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# ADJACENT GOVERNMENT

May 2015

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The road to a greener Europe



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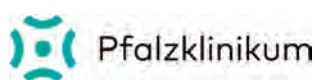
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Read more on pages 130 and 131.



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Varberg**

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# Foreword

**Markku Markkula**

**President**

**European Committee of the Regions**

Europe's economy is showing signs of recovery – 2.7m more people are in jobs since 2014. Nevertheless, last year a European Commission report shows that after a decade of convergence, disparity between member states and regions are on the rise. Unemployment in some regions is still unacceptably high which is why job creation is a priority for the European Committee of the Regions (CoR). Making EU funds work can make the difference in helping to reduce disillusionment towards the

Union. But to kick-start growth and give citizens the fresh start they deserve, cities and regions must become the driving force to creating a truly sustainable economy. We need more synergy and better integration of digital single market activities, the energy union and a human-centred urban agenda.

To achieve this we must make the most of EU investment. This is why the CoR welcomed the Commission's EU Investment Plan which will utilise EU funds to (hopefully) attract private investments totalling €315bn. However, whilst EU cohesion policy is designed to engage local players, the plan so far suffers from taking too much a top-down approach, that risks ignoring regional scale projects and lacks proper coordination with existing local economic policies. Soft components need to be integrated to the more traditional investments on infrastructure and housing. Collaboration and partnership between all EU institutions is therefore crucial and, as our recently launched partnership with the European Investment Bank shows, cities and regions must have their say as they understand their local economies and know which projects work best.

Europe needs to progress and move forward. Last years' European elections raised serious questions about the future direction of the EU and showed that the gap between Brussels and citizens is growing, which is why EU funds have to be delivered with citizens' at its core. From climate policy to the Energy Union to the industrial renaissance – all citizens must reap the benefits of EU investment. For rural and most isolated regions, this means strengthening a more innovative agricultural and fisheries policy. For cities this means a renewed sustainable urban agenda.

Investment alone cannot generate long-term sustainable jobs – it requires finding new innovative ways of working. To give Europe the competitive edge, regions must prioritise research and innovation whilst exploiting emerging opportunities in the market. Local and regional authorities are best placed to co-create new initiatives with research centres and



businesses by fostering an entrepreneurial mind-set and supporting start-ups. This is why working on breaking down silos and crossing borders is so critical. To co-create a new citizen-focused Europe we need to better collaborate, share experiences and knowledge which is why the Committee will push to strengthen cross-border partnerships.

We need to encourage the bottom-up movement. Boosting entrepreneurship, innovation and smart specialisation can reduce regional disparity and tackle unemployment. For this we need a simpler Europe that benefits citizens and businesses. EU legislation is criticised for sometimes making things worse rather than better. The Committee will work alongside the other EU institutions to find ways to improve law-making and engage in the REFIT programme creating leaner, simpler EU legislation. Cutting red tape will allow local economies to flourish and local governments to truly benefit from EU legislation through, for example, improvements to SME financing and innovative public procurement.

Our capacity to tackle key issues – such as economic growth, migration and energy efficiency – is crucial to addressing concerns about the direction and state of the European Union. Besides delivering on jobs and cohesion, the EU needs more democratic credibility and Europe's regionally and locally elected leaders – through the Committee – are best placed to demonstrate that the EU can work for its citizens. We need to show the EU is willing to change and place its citizens at its centre which is why during my Presidency I will enhance the Committee's role within the EU decision-making process. From upholding our commitments to climate change to delivering infrastructure to creating a competitive Europe, a new agenda for Europe must place subsidiarity – putting citizens first – at its heart. ■

**Markku Markkula**  
**President**

European Committee of the Regions

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# Introduction

**M**ay has been an interesting month for government. In the UK, David Cameron won an unexpected overall majority in the 2015 election leading himself and his chosen cabinet back to No10. As a result of the disappointing votes received for the Labour and Liberal Democrat parties, their leaders Nick Clegg, and Ed Miliband resigned. A major significance in the election was also the number of seats won by the SNP. Nicola Sturgeon swept the board in Scotland, winning a massive 56 out of 59 constituencies.

The result of the election could have a significant impact for the UK in Europe, with David Cameron promising a referendum by 2017.

In this May edition of Adjacent Government we give thought to the key policy areas in the forefront of people's minds throughout Europe. We kick off with a Foreword from Markku Markkula, the President of the European Committee of the Regions. In his introduction to the publication, he details how we must make the most of EU investment to further help the economic recovery.

Consideration is also given in this spring edition to science and research throughout Europe. How Horizon 2020 can make an impact, and the importance of excellence in research. In a special focus we highlight articles from Science Europe, ANR – The French National Research Agency, and Adjacent Government looks at the European Commissioner for Research, Science and Innovation's priorities for investment in these areas.

The health section is packed as always and includes an interview with Danilo LO FO Wong from the World Health Organization. The interview details the growing problems of antibiotic resistance and how it can be a silent killer. Andrew Miller MP, Chair of the Science and Technology Committee in the UK also gives thought to this important topic.

Security is an important aspect of any country, and in Adjacent Government, we shed light on the new technologies and developments that help keep Europe safe. CCTV is highlighted in an article from the British Security Industry Association (BSIA), and we also outline the growing trend of drones being used throughout UK airspace, with an interview from Gerry Corbett at the Civil Aviation Authority.

Topics also highlighted include: air quality; the Energy Union; agriculture investment; road safety; the digital agenda; and boosting trade growth.

As always I hope you find this edition of Adjacent Government thought provoking and useful, and welcome any feedback and article suggestions you may have. ■

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# The new look UK government

**In his first move since reclaiming Downing Street, David Cameron has announced who will stand beside him in the House of Commons. Here Adjacent Government's Amy Caddick outlines the new ministerial appointments for the Conservative government...**

**M**ay has been a roller coaster ride for politics. David Cameron won the battle for Number 10 with a majority, despite experts forecasting a hung parliament. It was followed by the greatest exodus of central political figures seen in decades. Nick Clegg, Ed Miliband, and Nigel Farage all announced they were stepping down within hours of one another, leaving the Liberal Democrats, Labour, and UKIP leaderless. Although Farage made an astounding comeback after his party refused his resignation. Who will replace Clegg and Milliband however, has yet to be decided by the individual parties, but all bets are on for who will take those coveted roles.

The Conservative win came with an opportunity to reshuffle the cabinet. The loss of coalition partner the Liberal Democrats has left a power void in a number

of high profile roles, none more so than Nick Clegg's coveted role of Deputy Prime Minister.

Among those who will maintain their position is George Osborne, who will remain Chancellor of the Exchequer. This news is hardly surprising, given the vital role he has played in delivering austerity and helping the Prime Minister to improve the economy. He will also take the role of First Secretary of State, giving him status as the most senior secretary of state. This had previously been given to William Hague.

The Home Office will also see no change to its leadership, with Theresa May set to remain as Home Secretary. May is also touted to be in the running for leader of the Conservative party after Cameron announced he would not seek a third term. However,





**Justine Greening –  
International Development  
secretary**

within hours of the election, May caused concern among privacy groups after stating she would increase state surveillance powers.

Other senior Conservatives to retain their positions include Philip Hammond, Michael Fallon, and Nicky Morgan, who will continue as Foreign Secretary, Secretary of State for Defence, and Secretary of State for Education and Minister for Women and Equalities, respectively. The Department for Welfare and Pensions will see also no change, with Iain Duncan Smith retaining his position, and Transport Secretary Patrick McLoughlin will also remain in his role. Liz Truss, who replaced the controversial Owen Paterson during the 2014 reshuffle, will also keep her role as Environment Secretary.

Other ministers who will stay in their current positions include Justine Greening, Secretary of State for International Development, Theresa Villiers, Secretary of State for Northern Ireland, and Jeremy Hunt, Secretary of State for Health. Matt Hancock will become Minister for the Cabinet Office and Paymaster General, while Greg Hands will take Danny Alexander's former position of Chief Secretary to the Treasury.

Former Chief Whip Michael Gove, who was relieved of his position as Education Secretary in the 2014 cabinet shuffle, is set to take a more senior role once again. He will become Lord Chancellor and the Secretary of State for Justice. He will replace Conservative Chris Grayling, who will become Lord President of the Council and Leader of the House of Commons. Mark Harper will replace Gove as Chief Whip.



**Michael Gove –  
Justice Secretary**

Among those benefiting from the new appointments is Energy Minister Amber Rudd, who will replace Lib Dem Ed Davey as Secretary of State for Energy and Climate Change. Rudd is an obvious choice to take over, given her history at DECC, but it is not yet known who will fill her former position. Priti Patel has also been appointed Minister of State for Employment and will attend Cabinet.

The Department for Business, Innovation and Skills will also see a change of leadership, as senior Lib Dem Vince Cable lost his position. He will be replaced by Sajid Javid, who moves from the Department for Culture, Media and Sport.

John Whittingdale, who had sat as chair of the parliamentary select committee for culture, will replace Javid. He will undoubtedly be a popular choice among the general public, as he expressed significant criticism of the BBC's license fee. It is likely, therefore, the new minister will push to abolish what he called an "unsustainable" fee that is "worse than the poll tax". On the other hand, this is not good news for the BBC, which relies on the revenue the 'TV tax' brings in.

Eric Pickles lost his position as Secretary of State for Communities and Local Government. The remit of the role includes planning. He will be replaced by Greg Clarke, former Universities Minister.

The Labour party is also undergoing its own shuffle after its defeat last week. Acting leader Harriet Harman has announced a number of changes after senior party members lost their seats.



**Theresa May – Home Office Secretary**

Education – Nicky Morgan

Leader of the House of Lords – Baroness Stowell

Business Innovation and Skills – Sajid Javid

Energy and Climate Change – Amber Rudd

Culture, Media and Sport – John Whittingdale

Environment, Food and Rural Affairs – Liz Truss

International Development – Justine Greening

Transport – Patrick McLoughlin

Communities and Local Government – Greg Clark

Northern Ireland Secretary – Theresa Villars

Wales Secretary – Stephen Crabb

Scotland Secretary – David Mundell

Chief Secretary to the Treasury – Greg Hands

Chief Whip – Mark Harper

Minister for Small Business – Anna Soubry

Minister for Employment – Priti Patel

Minister without Portfolio – Robert Halfon

Minister for the Cabinet Office – Matthew Hancock

Attorney General – Jeremy Wright

For more information regarding the new government, and their roles visit – [www.gov.uk](http://www.gov.uk) . ■

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Lord Charlie Falconer is set to replace Sadiq Khan as Shadow Justice Secretary, as Khan is said to have requested a return to the backbenches.

Chris Leslie will take Ed Balls' former role as Shadow Chancellor after he lost his seat in one of the more surprising outcomes of the election, while Hilary Benn will replace Douglas Alexander as Shadow Foreign Secretary. Shabana Mahmood will take Leslie's role as Shadow Chief Secretary to the Treasury.

Andy Burnham, Yvette Cooper, and Chuka Umunna, will also remain in their current positions as Shadow Health Secretary, Home Secretary, and Business Secretary, respectively.

A full list of the new Conservative government appointments are:

First Secretary of State and Chancellor of the Exchequer – George Osborne

Home Office – Theresa May

Foreign Secretary – Philip Hammond

Work and Pensions – Iain Duncan Smith

Defence – Michael Fallon

Health – Jeremy Hunt

Leader of the House of Commons – Chris Grayling

Justice – Michael Gove



# Investing in the future of research

**Adjacent Government highlights the work the Commissioner for Research, Innovation and Science, Carlos Moedas is doing to support investment for research and innovation...**

Research and innovation is an important part of economic recovery throughout Europe. Horizon 2020, the EU's research funding programme, is the biggest of its kind, with €800m available between the years 2014 to 2020.

Programmes for investment, such as Horizon 2020, are crucial to develop further research and innovation developments throughout Europe. The European Commission's Innovation Union Scoreboard 2015 revealed the EU's overall level of innovation has remained stable, but has shown little in the way of growth. Despite these unfortunate results there has been improvement in areas such as: human resources, business investments in research and development, and the quality of science. However, these are not enough to produce a stronger innovation performance.<sup>1</sup>

Sweden once again came out on top of the overall ranking as the innovation leader of Europe, closely followed by Denmark, Finland, and Germany. The UK ranked amongst some of the fastest growing innovators, which included Malta, Latvia, Bulgaria, and Ireland. Despite the number of countries growing in terms of investment in innovation, the EU is still outperformed by nations such as the US, Japan, and South Korea.

In order to determine better results, the European Commission believes investment and innovation go hand in hand. Commissioner for Research, Innovation and Science at the European Commission Carlos Moedas commented on the results. He said: "We need more investments to boost the EU's innovation performance. This should go hand in hand with better conditions and a single market for innovative products and services in Europe. We are working on this at EU

level and stand ready to help Member States implement the reforms to enhance the impact of their public investments."<sup>2</sup>

Moedas took over as the Commissioner for Research, Innovation and Science in November last year, and follows on from Maire Geoghegan-Quinn. Since taking his post Commissioner Moedas has made quite an impact. In a speech in April this year, he detailed how important funding is to fundamental science and research.<sup>3</sup>

"We must do everything within our power to preserve European funding to fundamental science and basic research, as a long-term investment in our competitive edge and future prosperity. That is why when many Member States were making cuts to their nations R&I funding, you fought to preserve the EU funding that would allow fundamental research to continue."

During the speech, which was given at the European University Association Annual Conference 2015, the Commissioner also detailed how the new European Fund for Strategic Investment puts research and innovation at the heart of its priorities. He went on to say:

"The new Fund puts research and innovation among its central priorities, with the aim of funding high risk, high reward projects that would not be funded by Horizon 2020: broadening the kind of projects we can support and injecting new life into Europe's investment innovation ecosystem.

"EFSI will not be for infrastructure projects alone. It will be for research and innovation projects, such as new research facilities, commercialisation activities and first of a kind technologies."



Carlos Moedas, the Commissioner for Research, Innovation and Science

Moedas also explained that he will be working alongside Commissioner Corina Cretu, who is responsible for Regional Policy. Together, the two commissioners will ensure the EU's vast Structural Fund supports more research and innovation projects at a regional level. Moedas also expressed his ongoing commitment to the Horizon 2020 project and explained that he had "no intention of changing that upward trend". He firmly believes these new measures will help to give a necessary boost to Europe's innovation ecosystem.

"By contributing to the European Fund for Strategic Investments; by making the most of Horizon 2020's innovative financing instruments, and by working with European Structural Funds, our aim is to bring more money to the European research and innovation community, not less," he added.

Speaking to the European University Association, Commissioner Moedas did not forget to express the importance of universities within the research and innovation sector. He described universities as a "vital link" in the chain, and that he understood how many Member States rely on EU grants to support their best researchers, and that "raising up our best talent is a necessary prerequisite for progress in the future."<sup>4</sup>

However, he did express concern regarding the low number of women that take science and research roles. Women's participations in research and innovation is

progressing, but much too slowly. Although there are now more women in science than there have ever been there are still great differences appearing between the careers of female and male scientists. Moedas believes that this points to a great pool of untapped talent.

"We need universities and research institutions to remove all possible bias preventing women and girls from realising their potential and enjoying successful careers to the highest ranks of academia.

"Pursuing gender equality in research and innovation is as much about research quality as it is about fairness. Diverse research teams produce better results. A further research, not only to see women take their rightful place, but to ensure Europe is the most attractive place in the world for mobile researchers."

The Commissioner ended his speech by saying he would like the wider research community to work towards a more open, collaborative, and interconnected way of conducting research. In order to address the great challenges we face in our lifetime he believes we need to realise science is increasingly driven by digital technologies and the globalisation of the research community.

"Throwing doors open, does not mean compromising on research quality. It means embracing with open arms, the wonders this new century has to offer." ■

<sup>1</sup> [http://europa.eu/rapid/press-release\\_IP-15-4927\\_en.htm](http://europa.eu/rapid/press-release_IP-15-4927_en.htm)

<sup>2</sup> Ibid

<sup>3</sup> [http://ec.europa.eu/commission/2014-2019/moedas/announcements/european-university-association-annual-conference-2015\\_en](http://ec.europa.eu/commission/2014-2019/moedas/announcements/european-university-association-annual-conference-2015_en)

<sup>4</sup> Ibid

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# The role of excellent science in an ERA of innovation

**Stephan Kuster, Head of Policy Affairs at Science Europe outlines the role scientific excellence plays in encouraging innovation throughout Europe...**

Science is surrounded by growing expectations linked to the innovation potential of scientific discoveries and new technologies. In Europe, stimulating innovation is widely regarded as the road to a sustainable recovery of its economies. The Europe 2020 strategy includes a 'flagship initiative' called 'Innovation Union', the aim of which is to stimulate research-based innovation. This initiative sets the completion of the European Research Area (ERA) as one of its goals. Horizon 2020, Europe's research programme, is also driven to a large extent by innovation goals. Why, then, should we care about fundamental research and scientific excellence?

The ability of an economy - be it a city, region, country, or continent - to lead and thrive rather than follow and survive in today's fast paced and ultra-competitive global environment depends on its capacity to maintain a healthy knowledge and innovation ecosystem. Within that environment, a

comparative advantage emerges from the ability and willingness to sustain the long-term supply of new knowledge into the ecosystem. In other words, at the heart of the competitiveness questions lies the vision and decision by policy makers to provide a crucial public good: supporting the environment needed to perform excellent fundamental research and the pathways from there to innovative products and applications.

**"The biggest advantage of ERA is that, if done properly, it allows the development of a research and innovation strategy based on the strengths of Europe, one of which is the diversity of the national research and development (R&D) systems."**

A healthy knowledge ecosystem requires funding and does not come for free. No public good does. The societal value delivered by public research systems in

terms of knowledge goes beyond what is tangible and readily measurable. This is because publicly-funded research often operates with a longer-term perspective and higher risk tolerance than privately-funded research.

Publicly-funded research is a primary supplier of 2 types of knowledge resources that are vital for innovation and are under-supplied by other sectors: fundamental new knowledge, in the form of original discovery and understanding; and the necessary structures for that knowledge to be produced and shared, such as trained and skilled researchers, laboratories, equipment and so on.

Giants like Google, Siemens, General Electric, Bayer, Apple or Phillips are part of an ecosystem that largely relies on publicly-funded research, infrastructures and human resources. Without the complex eco-system that is nourished by public research funding, such companies would lose the long-term supply of ingredients needed to transform new knowledge into products to put on the market. Technologies such as the ones found in smartphones and optical fibres are matured to fruition thanks to an intense interplay between public and private sector, and owe their existence to basic research that is more than a century old.

The lesson we draw is that, above and beyond short-term programming and objectives, European research policy – be it at national or EU level – needs to focus on creating and nourishing a vital tissue comprised of universities, researchers, trainers and infrastructures, so that our economies can engage in knowledge-intensive activities. As a result, public policy makers need to act with a systemic perspective, thinking long-term, and risking more, and for longer, than private initiative is willing to.

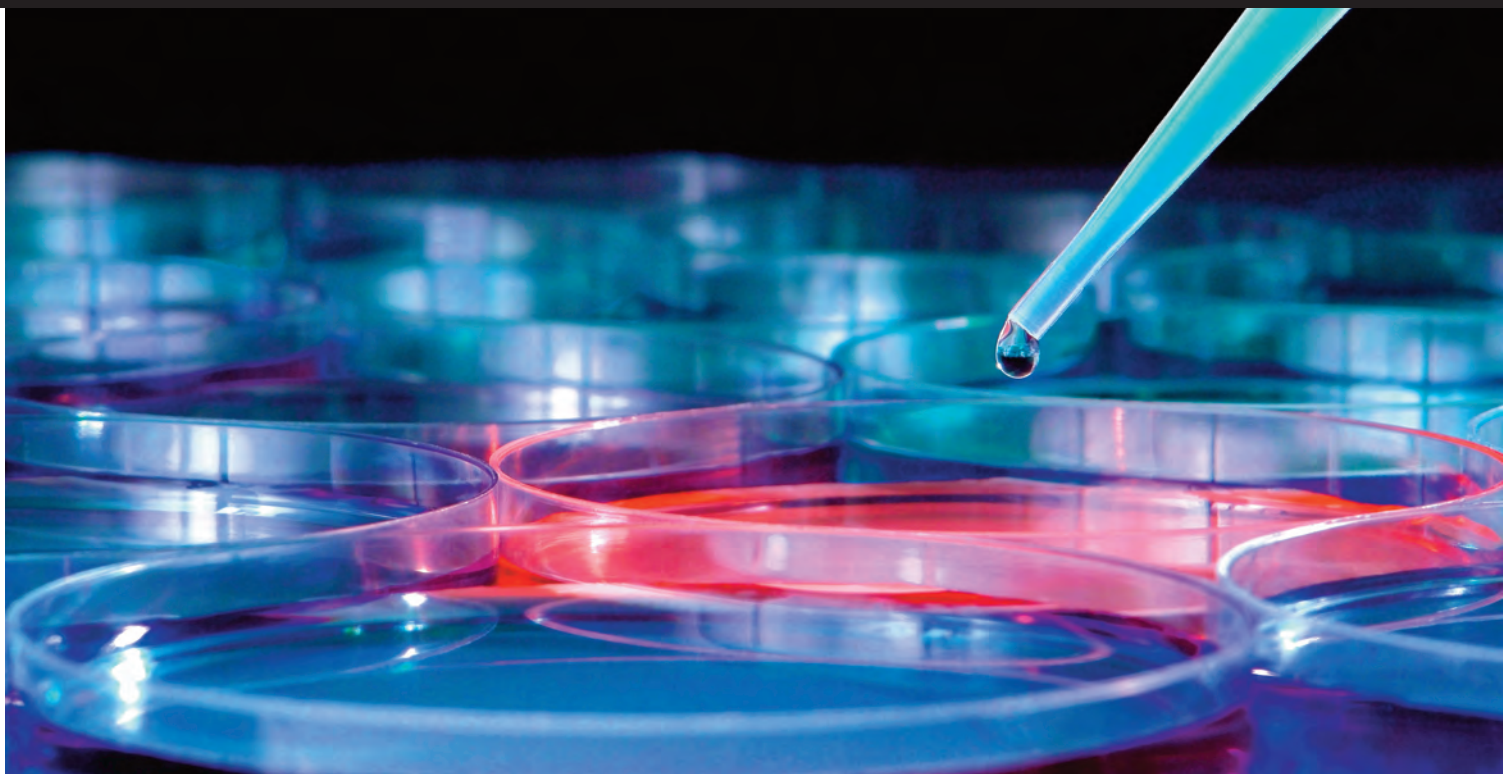
Two factors seem most important when it comes to doing this at European level: collaboration and co-ordination between the diverse policy stakeholders managing innovation-related policies; and the opening of pathways between research and innovation, which requires actions by all actors at both individual and organisational level. Given the complexity of research-based innovation, exploring these factors requires a multi-stakeholder dialogue.

In this sense, the European Union's ERA policy is a good idea. ERA policy is predominantly about the role of the national public science systems, and it complements the many European Union policies related to innovation. ERA aims at aligning national policies so as to allow for the free circulation of knowledge and researchers. The biggest advantage of ERA is that, if done properly, it allows the development of a research and innovation strategy based on the strengths of Europe, one of which is the diversity of the national research and development (R&D) systems. ERA is an opportunity to involve the relevant stakeholders and use the collective experience to design better policy. This, in true scientific fashion, is a sound methodology to develop an ERA that helps build and sustain the highest scientific capacity in Europe and close the gaps between regions currently performing at different levels, without compromising on excellence.

An important instrument for ERA is the Horizon 2020 Programme. Horizon 2020 was designed to bring clear added value to complement research efforts at a national level. This provides the means for fostering pan-European competition and collaboration that would not have the same impact without the framework programme. For instance in research endeavours, on a scale that is only possible to tackle collectively or in the promotion of researcher mobility where transnational approaches make sense. In this way Horizon 2020 helps to overcome fragmentation in Europe and contributes to the long-term investment in the knowledge economy. This impact is further increased outside by the leveraging effect Horizon 2020 has, and its complementarities and synergies with other programmes at European and national level. ■

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# ANR, an actor in building the European Research Area

**The French National Research Agency (ANR) outlines how they are committed to increasing the quality of science funding through European collaboration...**

In both basic and applied research fields, funding is becoming increasingly more competitive. As a project-based funding body, ANR – the French National Research Agency – is committed to increase the quality of science funding, through renewed funding instruments, restructured application processes and a drive toward European collaboration. Since its creation in 2005, the agency has undergone profound changes to transform and consolidate its position in the French research ecosystem and the European Research Area (ERA).

As it approaches its tenth anniversary, ANR is now well established on the European scene and acknowledged for the effectiveness of its actions, as witnessed by its presence in numerous European and global forums and its fruitful partnerships with the

main funding agencies abroad. From the moment it was created, ANR notably concentrated on rapidly integrating the European networks, thereby facilitating the cross-border collaborations of the French teams levered by project-based funding.

## **Coordinating national and European funding**

As a funding agency, one of the greatest challenges is how to articulate the different funding instruments that exist at the national and European levels. This is a reason why ANR has threaded together much of its Work Programme – ANR's roadmap for the year 2015 – with the funding programme Horizon 2020, and more broadly with the European policy agenda. Its programming is structured around major societal challenges that are common to the national and European societies.

ANR has set itself the priority of improving coordination between national and European funding schemes within the ERA. ANR's Work Programme is thus divided into 4 components, one of which is entirely dedicated to building the ERA and developing France's international attractiveness.

One of the main challenges facing ANR is to boost French participation in European calls for proposals, with a view to raising the visibility and profile of the country's research. The agency has just launched a brand new instrument entitled "Setting up European or International Scientific Networks". The aim is to encourage the formation of research networks that are well placed to respond to European funding programmes, thereby facilitating French researchers' access to these programmes – in which France's scientific community is currently under-represented. The call encourages French researchers to set up networks composed of national and foreign teams from the public or private sector that represent a wide range of skills and disciplines. The short-term goal of these networks should be to design and develop collaborative research projects involving the networks' members. These networks can cover any number of scientific disciplines related to a topic with recognised scientific, technological or societal impact.

### **Developing collaborative research in France and in Europe**

ANR's actions contribute to developing collaborative research by rallying scientific teams from all horizons around common S&T issues as well as around societal challenges.

By pooling the skills and resources of different teams, collaborative research reinforces the synergies between teams who would not habitually have worked together, and enables them to achieve more ambitious results which break away from the conventional paths. Collaborative projects give pride of place to scientific audacity and interdisciplinary to foster the development of emerging themes, disciplinary and transdisciplinary breakthroughs, new models and methods, or advances in theory to improve the position of French teams in European and international programmes.

Collaborative projects (whether academic, transnational or through academic-enterprise partnerships) represent the main mode of ANR funding and account for more than 75% of projects funded by the agency in 2014. 75% of the ANR transnational funded projects have built on European consortia.

...notably through the "Lead Agency" method.

Open, cross-border exchange of knowledge and discovery is at the heart of science. To facilitate science inside Europe, it is essential to provide researchers with opportunities to collaborate across national borders in order to form collaborative research projects fostering the exchange of ideas and scientific expertise. Supporting research projects conducted in different countries requires arrangements between the funding bodies concerning application, review and funding processes. Apart from specific transnational calls involving a unique application and review process, project partners must traditionally apply to their respective funding agency. Only if all agencies involved approve the application, then the transnational project can go ahead. This procedure means a "double jeopardy" for the applicants, as the national peer review procedures are carried out independently. This also implies a financial and administrative burden.

To make for simpler and speedier scientific collaborations, to create seamless research funding areas and thereby help build the ERA, ANR sets up bilateral collaborations with European funding agencies. It signs agreements that serve to facilitate collaboration between teams from different countries. They can concern targeted themes or be open to all the research themes funded by ANR. In this case each agency funds the teams from their respective country.

The "lead agency" procedure is undoubtedly the most advanced form of such inter-agency partnerships. It is based on transparency and mutual trust between the funding bodies: the lead agency takes responsibility for the receipt, the evaluation and the selection of projects for the countries involved. It therefore enables researchers to avoid "double jeopardy" in their co-operation through evaluation by a single lead



agency and contributes to reducing the administrative burden. In 2014, ANR decided to implement this procedure on a bilateral basis with the German Research Foundation (DFG), the Austrian Science Fund (FWF) and the Swiss National Science Foundation (SNSF). The scheme is also implemented with the FNR in Luxembourg.

### **Developing European cooperation through the EC instruments**

European cooperation allows for mutual enrichment and increased efficiency. By putting competition aside, we create an incentive environment for synergies, shared vision and joint strategy.

The European Commission (EC) has developed a series of instruments facilitating Pan-European collaborations: ERA-NETs and ERA-NETs Cofund, Joint Programming Initiatives (JPIs). In that context, funding agencies issue calls for transnational proposals that are clearly on the rise and that are expected to complement the Horizon 2020 calls. ANR is a driving force in these programmes. Through joint calls we promote the notion of excellence throughout Europe.

Within the scope of an ERA-NET Cofund for instance, the partner agencies launch a large-scale call for proposals bringing together at least 5 countries in a target field. These calls can only be launched if they create European added value and complement the Horizon 2020 calls from a thematic perspective. If this is the case, the Commission joins forces with the partner agencies and co-funds the research projects. ANR takes an active part in these networks, in fields such as biodiversity, environment, biology and health. The agency is the coordinator of the ERA-NET Cofund on rare diseases (E-Rare-3); this is overall the fifth ERA-NET coordinated by ANR.

Those instruments are also forums for discussions, joint analysis, networking and platforms to detect bottlenecks. We also meet with our European partners to define common priorities and coordinate our actions. The JPIs are inter-governmental initiatives supported by the EC. They are also a tool to promote evidence-based policy making and thus go beyond research itself. All of these activities contribute to a

greater coordination of the national research agendas, and beyond, they are pushing towards alignment of research programmes and greater integration. ANR is also a member of 8 of the 10 JPIs currently under way in Europe.

### **Responding together to major societal challenges**

The development of such multilateral partnerships is finally a unique way to respond to societal challenges together. Funding bodies pool resources and share research costs in research areas that strongly profit from coordination on a European scale.

**“By pooling the skills and resources of different teams, collaborative research reinforces the synergies between teams who would not habitually have worked together, and enables them to achieve more ambitious results which break away from the conventional paths.”**

Using the example of JPIs, the member bodies develop roadmaps and strategic research agendas on the major societal challenges: demographic change, Alzheimer's diseases, food security and climate change, antimicrobial resistance, etc., which in turn feed the European research programming and Horizon 2020.

Working together, they wish to optimise national research efforts and network the actors (research organisations and funding agencies) in order to respond as effectively as possible to the major societal challenges facing Europe as a whole. They aim at avoiding the fragmentation of research in Europe by combining and coordinating the efforts and setting up joint research programmes on issues that are of major importance for European societies and that the national programmes cannot address alone. ■

.....  
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# Roadmap for sustainable healthcare

**EU Commissioner for Health and Food Safety, Vytenis Andriukaitis details in a speech at the Conference of the European Steering Group on Sustainable Healthcare in March, his views on sustainable healthcare, and his aims to improve access to healthcare...**

I am very pleased to be here today to discuss a roadmap for sustainable healthcare. It is an ambitious and vital goal for European health systems, and ultimately for patients and citizens.

Today I would like to share with you my views on sustainable healthcare and the areas where the action at EU level can add real value.

As you may know, the new Commission entered office saying that we want to be “bigger and more ambition on big things and smaller and more modesty on small things”. Through its policies the EU has to bring real benefits to the citizens; taking account of modern technology, digital reality, reducing red-tape, simplifying.

Health is area of EU action that directly impacts our citizens and is a real concern for each of us every day.

There are many areas in health policy where the EU can and does make a difference. My vision for EU health policy can be summarised by the 3Ps: Prevention, Promotion, and Protection. Recently, thanks to some younger followers on social media, I have added a fourth ‘P’ – participation.

These elements are crucial towards maintaining and improving citizens’ health to benefit individuals, society and our economies.

Traditionally, investing in health has focused on care and cure. But we all know that most of the harm related to alcohol, tobacco or obesity is preventable.

Take chronic diseases, for example, it is the leading cause of mortality and morbidity in Europe. It has a huge impact on our health systems.



I would therefore focus more on health promotion and disease prevention, so that we pay less for treatment in years to come.

However, this potential can only be fully realised if effective action is taken to ensure the most efficient use of resources targets where investment is most needed.

I also want to improve health systems and access to health and make sure that more people can benefit from innovation.

When we think about the future of healthcare we immediately think of more technology, for example – eHealth, for example, patients should be sure that – if they have to see a doctor in another Member State or just in another hospital of his own country – doctors have access to their electronic patient records.

As we have heard here this morning, healthcare in the future will be more patient –centred. We should see:

- An increase in integration of care;
- More multidisciplinary teams;
- More outpatient care and,
- A rise in information technology usage.

But, above all other aspects, the future of healthcare will still depend on the basic features of today's health-care systems. In the future, we will still have to ask:

- Are patients able to have access to quality healthcare?
- Is healthcare improving the health and lives of citizens as far as possible?
- Are our health systems sustainable?

This is why, in April 2014, the previous Commission adopted a Communication on effective, accessible and resilient health systems.

The Communication aims to propose an EU agenda to support Member States with their actions own health systems. This agenda lists initiatives which can be taken or further developed to help Member States:

- Strengthen the effectiveness;
- Increase accessibility;
- And improve resilience of their health systems.

Let's look at these 3 factors in turn.

The first aspect we focus on is effectiveness – the concrete capacity of a health system to improve the health of the population it serves.

The challenge is to measure improvements in the health status that are due to the health system. In order to strengthen the effectiveness of health systems, the Commission will further work:

- On patient safety and quality of care;
- On integration of care, and
- On health systems performance assessment.

I will return to this point a little later.

The second important aspect of health systems is accessibility: the capacity of the health system to reach people. Access to healthcare is a multidimensional phenomenon. We can identify at least 4 dimensions:

- The share of the population that is covered;
- The basket of care;
- The affordability of care (co-payment, cost-sharing), and;
- The availability of care (in terms of distance from providers, waiting times).



Vytenis Andriukaitis, Commissioner for Health and Food Safety

A good planning of health workforce is essential to ensure access to care. We are giving the utmost importance to the quality and productivity of our health professionals and to the development of their skills.

The Cross-border Healthcare Directive may also play a role in supporting an EU-wide consensus on what we mean by accessible healthcare. This directive could lead to a greater clarity on national baskets of care or on what we understand by medically “undue delay”.

Measuring access to healthcare is no easy task. Available indicators allow for the measurement of self-perception of unmet needs for care but not for objective measurement of access.

In addition, indicators for coverage, waiting times and affordability are often either non-existent or inadequate. We are currently looking into the issue of

access to healthcare with a view to identifying possible areas for future work.

We are also considering supporting Member States in establishing an integrated EU health information system. The last aspect of health systems discussed in the Communication is resilience – the ability to adapt effectively to changing environments, tackling significant challenges with limited resources.

Member States’ future ability to provide high quality care to all will depend on making health systems more resilient – more capable of coping with the challenges that lie ahead.

And, this must be achieved while remaining cost-effective and fiscally sustainable. Clearly, innovation in health must be cost-effective. We attach great importance to increasing co-operation on Health Technology



Assessment as a tool to ensure the development of the best innovation and to avoid duplication of research.

Plus, the Commission and the Member States are taking forward work on exploiting eHealth to its full potential. While this is primarily a task for the Member States, the Communication highlights a number of initiatives through which the EU can support policy makers in the Member States.

The focus will be on methods and tools that will allow Member States to achieve greater effectiveness, accessibility and resilience from their health systems.

As promised, I return to the issue of health systems performance assessment. I am committed to working closely with Member States to help them improve the efficiency and sustainability of their health systems, so that they can provide all citizens with equitable access to care.

As you may know, President Junker invited me to draw lessons from recent experiences in health system performance assessment and to build up knowledge which can help make evidence-based policies at national and European level.

Of course, we are not starting from scratch. A reflection process with Member States on how to build together expertise on health system performance assessment has been undertaken.

As a result of this reflection, we agreed on some common priorities and principles which can be found in the Vilnius Declaration. I invite you to read this interesting document if you have not done so already.

We decided to work hand in hand to pursue a set of common goals. The first goal was to provide Member States with a forum within which they could;

- Exchange their experiences;

- Present their practises;
- Share success stories and failures; and last but not least;
- Learn from each other.

The second goal was to support national policy makers by identifying tools and methodologies to improve the assessment of their health systems. In pursuing these goals, we are also co-operating with international organisations established in this field such as the OECD and the World Health Organization.

Let me be clear – when we set up this new form of collaboration with Member States, we all agreed that we would not rank or grade health systems according to their performance.

Our guiding principle is to learn from each other – not to make lists of bad versus good countries. The expert group is working at full speed and I am confident that we will see the first outcome of its efforts before the end of this year.

Let me finish by expressing my sincere gratitude and appreciation for your excellent efforts in support of our shared goal to achieve true sustainable health systems in Europe. ■

This is a speech taken from the European Commission website – [http://ec.europa.eu/commission/2014-2019/andriukaitis/announcements/conference-european-steering-group-sustainable-healthcare\\_en](http://ec.europa.eu/commission/2014-2019/andriukaitis/announcements/conference-european-steering-group-sustainable-healthcare_en)

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- Euro Hepatitis Index 2012
- Euro Vision Scorecard 2013
- Euro Pancreatic Cancer Index 2014

#### Sweden, others

- Health Consumer Index Sweden 2004, 2005, 2006
- Diabetes Care Index Sweden 2006, 2007, 2008
- Breast Cancer Index Sweden 2006
- Vaccination Index Sweden 2007, 2008
- Renal Care Index Sweden 2007, 2008
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# Chromatin and epigenetic changes the immune response

**H**istone modifications and chromatin remodelling are involved in regulating the immune response to different pathogens. A proper immune response is essential in combating viruses, bacteria and parasites that are harmful for us. We have several lines of defence; from the physical barrier of the skin to specific cells in the body. The innate system is an early response and is composed of several cell types; monocytes, macrophages and natural killer cells (NK cells). These cells react unspecifically to infectious viruses, bacteria or parasites and present these agents to the adaptive immune cells. T-cells and B-cells comprise the adaptive immune system and these cells recognise specific antigens of the infectious agents. These cells constitute the memory, developing specific memory cells that can quickly be stimulated upon a further infection. Several studies have now shown that a memory exists in the absence of T-cells and B-cells, trained immunity, but the mechanisms behind are not fully understood<sup>1</sup>.

Several recent studies have shown that both the innate and the adaptive immune system change the epigenetic landscape in response to infections. The development of immune cells in the bone marrow involves a large epigenetic reprogramming. Depending on signal, the different cells in the immune cells develops and acquire the specific gene profile for the cell



lineage<sup>2, 3, 4, 5, 6</sup>. High through-put transcriptome analyses, performed together with ChIP seq of histone modifications<sup>7, 8</sup> and analyses of the global DNA methylation profile<sup>9, 10, 11</sup>, has shown that the change in gene expression follows changes in the epigenetic landscape in the different cell lineages. In particular, cell type specific transcription factors and signalling pathway factors are regulated by histone modifications and DNA methylation.

The further response of different immune cells to infections also involves transcriptional and epigenetic responses<sup>12, 13</sup>. In response to viral infections, not only genes regulating the immune response, such as cytokines and signalling factors, are modulated, but also genes involved in DNA methylation and histone modification changed, maybe to adjust cells to the new epigenetic state. Similar changes also occur upon the induction of inflammation processes in response

to infection, but also to non-infections stimuli, such as nutrients, stress and exercise. Inflammation is the host early response induced by innate immune cells, creating fever, swelling and pain. When the response goes wrong, inflammation can be harmful. Genes involved in the inflammatory response are particularly regulated and are marked by epigenetic mechanisms<sup>14</sup>.

The immune system protects us upon infections, but can also be the cause of diseases. Allergy is caused by the immune system overreacting and autoimmune diseases, such as rheumatism and MS, are caused by the immune cells starting to attack our own tissues. Autoimmunity together with chronic inflammatory response have now been linked to many diseases and disorders, and may be the underlying cause for yet many more.

The immune response differs slightly depending on the pathogen involved. Many pathogens have evolved ways to elude or inhibit the full response of the host. The immune system has particular difficulty when combating pathogens with a life cycle in several stages. One such pathogen is the Plasmodium parasite, which is the cause for malaria. Studies towards specific antigens produced by the parasite have been investigating specific responses. The biology of the mosquito<sup>15, 16</sup> has also been studied and the immune response elicited to understand to many ways the Plasmodium parasite affects its hosts. Malaria affects mainly children, those that survive are less susceptible as adults, but no real immunity is obtained. There are, however, differences in response between individuals as well as populations,

most likely caused by genetic factors. One ethnic group in Africa, the Fulani, which has been extensively studied because of the resistance to malaria. The immune response upon infection in the Fulani has been studied and compared with the response in various other neighbouring ethnic groups. These studies have mainly been SNP analyses, investigating variations in genes coding for factors in the immune response. One such example is the SNP study performed between them and the Dogon people in Mali that found genetic differences<sup>17</sup>. However, these studies have so far not been able to fully explain the differences in response between ethnic groups in the sub-Saharan region. The relative resistance found in the Fulani group could therefore be explained by other factors. Interestingly, it was shown that miRNA also involved in the response to malaria and most likely other parasites<sup>18</sup>. Hence, we are interested in studying the underlying cause for the difference in immune response on another level; in epigenetic factors, such as differences in DNA methylation and histone modification profiles as well as in non-coding RNA levels. A further phenomenon of certain complex pathogens that needs to be explained is the lack of real immunity. Immune tolerance could be part of it, but not fully explain the lack of immunity. The memory of the innate immune system, trained immunity<sup>1</sup>, could be involved in the finding that adult people living in exposed areas are less susceptible to malaria, a protection that is lost when leaving these areas.

To understand the human immune response to complex pathogens, and

how host and the pathogen interacts, can then shed light to other responses causing a variety of diseases, such as stress-induced immune responses, autoimmunity and chronic inflammation.

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# RNA in human disease diagnosis and therapy

Professor Michela Alessandra Denti of the Centre for Integrative Biology at the University of Trento, outlines the work of her laboratory on genetic diseases and cancers

The Laboratory of RNA Biology and Biotechnology at the Centre for Integrative Biology (CIBIO) of the University of Trento, Italy, is focusing on RNA to develop better diagnostic tools and therapeutics for a range of genetic diseases and cancers. The research projects developed in the laboratory also aim at unveiling new active roles for RNA molecules in the mechanisms underlying these diseases.

RNA impacts nearly every aspect of gene expression and it is now clear that a large portion of human genetic diseases are caused by mistakes in RNA metabolism. It has become progressively evident that RNA is not just a carrier of genetic information, but also a catalyst and a guide for sequence-specific recognition and processing of other RNA molecules.

The growing body of knowledge concerning RNAs is opening up exciting and unprecedented avenues for research: RNA molecules are today, at the same time, targets of therapeutic intervention, tools for functional studies and novel therapeutic molecules to treat human diseases.

Led by Prof Michela Alessandra Denti, the research in the RNA Biology and Biotechnology laboratory covers various diverse areas, and researchers focus on two main research interests.

## Modulating RNA splicing as a cure for inherited diseases

Firstly, the laboratory studies different ways of modulating 'RNA splicing', a process that all messenger RNAs (mRNAs) undergo in the cell. Several gene mutations, which cause different rare inherited diseases, affect the splicing of specific mRNAs. At variance with mainstream gene therapy approaches, which aim at replacing the mutated gene with a functional DNA copy of the gene itself, Denti and coworkers intend to correct the mRNA

transcribed from the mutated gene, through an approach called "exon skipping". By introducing small RNA molecules, they mask the mRNA to the attack of the splicing machinery, inducing it to jump certain portions of the mRNA, thus restoring the correct message. The team predicts that exon skipping holds a great deal of promise as a potential cure for genetic diseases, and several clinical trials have supported the notion that the technique could one day become commonplace.

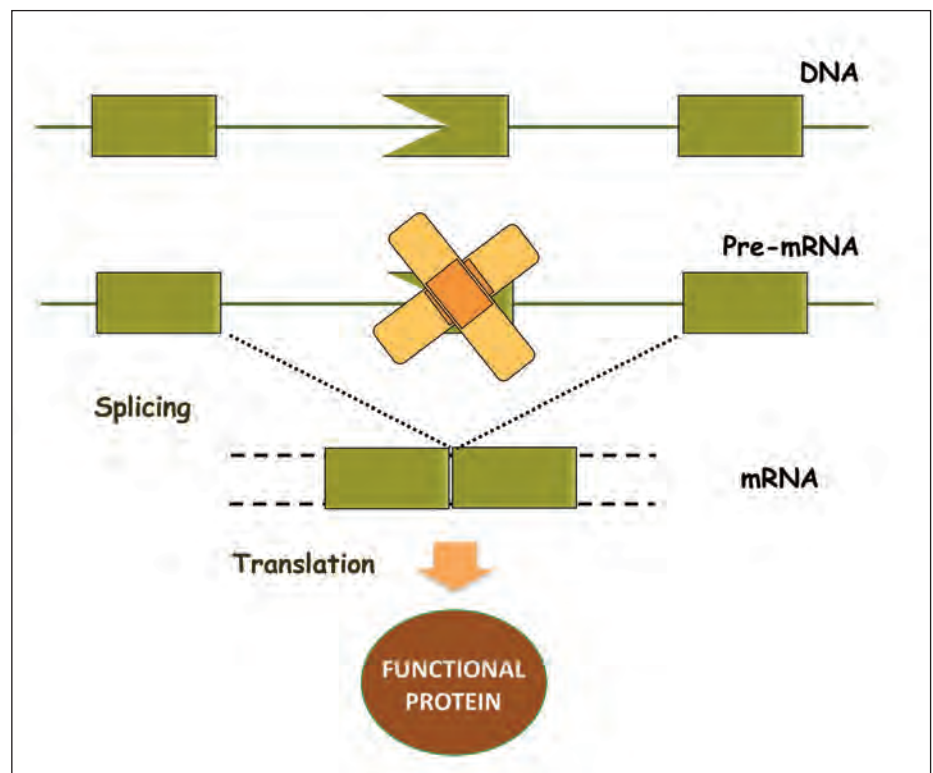


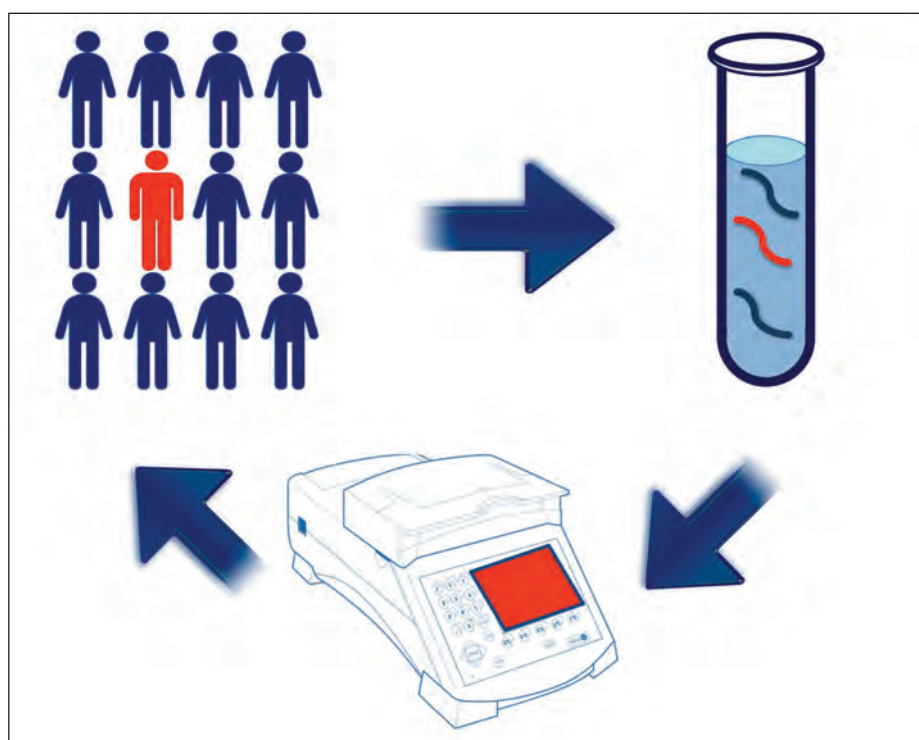
Figure 1. Exon skipping approaches to correct diseased genes: a molecular bandage for inherited diseases



The group is carrying out studies to develop a cure for a rare neurodegenerative disease: Frontotemporal Dementia with Parkinsonism linked to chromosome 17 (FTDP-17). FTDP-17 patients have single nucleotide mutations in the gene for protein tau, which induce the aberrant inclusion of an exon in tau mRNA, and ultimately cause the accumulation of this protein in neurons and consequently result in neuron's degeneration. Very recently, Denti and colleagues have been successful in inducing exon skipping and the correction of tau mRNA through the use small RNA molecules in cells. They are now working to show the efficacy of the approach in an animal model of the disease.

### MicroRNAs as biomarkers of cancer, cardiac and neurodegenerative diseases

A second line of research is aimed at studying some very small RNA molecules called microRNAs (miRNAs) that have only recently been discovered. Due to their size these RNA molecules were overlooked for a long time, but it has become clear in the last decade that thousands of them are encoded in the genomes of all organisms, and play a crucial role in cells, fine-tuning the production of proteins. The deregulation of miRNAs has been implicated in several diseases, and the laboratory is studying the potential for specific miRNA, to be used as a tool in the early and accurate diagnosis of cancers, cardiac diseases and neurodegenerative diseases. The advantage of using miRNAs as biomarkers lies in the ease with which they can be detected, and in their extreme specificity.



**Figure 2. MicroRNAs have been proposed as biomarkers for the diagnosis and prognosis of cancers and several other diseases**

In one project, the group focused on lung cancer, the leading cause of cancer mortality worldwide. As it is now possible to design therapies targeted towards specific forms of cancer, Denti and her colleagues were required to distinguish between squamous cell carcinomas (SCCs) and adenocarcinomas (ADCs). To do this, the researchers measured the quantities of miR-205 and miR-21 in cancer biopsies, and found that the results provided a useful marker for differentiating between SCCs and ADCs – an identification which is not always possible via traditional histochemical methods. Recently, the researchers have discovered that measuring other miRNAs could enable the differentiation between neuroendocrine tumours both from the other two lung tumour types, and amongst themselves.

The group is also working towards the identification of molecular mechanisms in which miRNAs play a key role, thus representing optimal targets for a therapeutic approach.



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# Nanoimaging to cure Alzheimer's disease

## Background to Alzheimer's disease

Alzheimer's disease (AD) is one of the most devastating neurodegenerative disorders affecting more than 25 million people worldwide which is the fifth leading cause of death for those aged 65 years and above. The disease typically starts with a difficulty to remember new information and as it advances, more severe symptoms such as disorientation, change the mood and behavior, confusions with time, events ending up with the difficulty of speaking, swallowing, walking and almost entire memory loss. The disease develops slowly with the average life span after diagnosis 4-6 years, although it can be as long as 20 years. There is no current cure for AD, but treatments of symptoms can slow the disease progressing thus improving the quality of life of AD patients.

## Model for the AD

The disease was named after a German physician Alois Alzheimer, who in 1906 linked the disease symptoms with the appearing of dense deposits (plaques) outside nerve cells. Additional evidence for the link of the AD symptoms with the brain morphological abnormalities were obtained in the 1960s, when the correlation between the cognitive decline and the number of plaques and tangles was found. The application of modern molecular biology techniques in the early 1980s led to the discovery that senile plaques are primarily composed

of the rather short amyloid beta protein (A $\beta$ ) with lengths of 40 and 42 amino acids. The *in vitro* experiments with proteins isolated from the brain or chemically synthesized revealed their ability to spontaneously assemble in large aggregates including fibrils found in amyloid plaques. These findings have led to the model of the AD development termed amyloid cascade hypothesis that is considered as the main model for AD. According to this model, assembly of A $\beta$  proteins in aggregates triggers the disease. Recent studies showed that oligomeric forms of A $\beta$  proteins rather than large insoluble aggregates including fibrils are the neurotoxic A $\beta$  species. The current model considers accumulation of A $\beta$  oligomers at the synapse as the critical stage of the AD neurodegeneration. The intraneuronal fibrils are formed by tau protein and this process is initiated by A $\beta$  oligomers triggering tau phosphorylation.

## A $\beta$ oligomers as therapeutic targets

These recent advances suggest that the treatments of AD should be associated with eliminating A $\beta$  oligomers from the brain. However, assignment to A $\beta$  oligomers of exclusively pathological role should be made with caution. A $\beta$  proteins are components of the synapse and the existence of cellular receptors for A $\beta$  oligomers points to their physiological role. Indeed, A $\beta$  proteins are present in brains of healthy people and at phys-

iological levels A $\beta$  proteins regulate synaptic function from the very beginning of the organism development. What happens with the age? Why do A $\beta$  proteins become associated with synaptic failure and lead to Alzheimer's disease pathology? These are fundamental questions and their answers require a thorough characterisation of A $\beta$  proteins in monomeric and oligomeric states.

## Nanoimaging and probing for A $\beta$ oligomers properties

Studies during the past decade identified structural dynamics of A $\beta$  protein termed misfolding as a factor leading to its ability to induce AD. In fact, similar misfolding property was found for other proteins responsible for the development of neurodegenerative disorders such as Parkinson's disease, Down's syndrome, and Huntington's disease. Despite the crucial importance of protein misfolding, factors that lead to protein misfolding and aggregation *in vitro* are poorly understood, not to mention the complexities involved in the formation of protein nanoassemblies with different morphologies. A better understanding of the molecular mechanisms of misfolding and aggregation will facilitate rational approaches to prevent protein misfolding and aggregation. Also, such knowledge in conjunction with molecular modeling will fundamentally advance our understanding of cellular nanomachines and their function at normal and the pathological conditions.



The problem in the lack of knowledge lies in the need of techniques required for amyloids characterisation. The real mechanisms of physiological systems and diseases are played out on a very transient level through highly dynamic molecular-scale interactions. A process that may appear simple by traditional techniques may actually have many steps and a variety of important intermediate states – each with its own unique dynamics. Intermediate states are stabilised by weak interactions that are typically transient and difficult to measure. However, they are key control mechanisms in several pathways. The nanotechnology has tools capable of probing the intermediate states of protein self-assembly process and studies with the use of such tools will fill this gap in the knowledge.

We have recently pioneered and developed advanced nanoimaging approaches that allow us to probe and characterise transient misfolded protein states. Importantly, we were able to characterise the amyloid dimer, which is the very first amyloid

oligomer. A critical factor in this advancement was the application of such a single-molecule probing technique as Atomic Force Microscopy (AFM) force spectroscopy. Dimers were found to be very stable, suggesting that, at appropriate conditions, further aggregation processes can use dimers as transient seeds. The significance of this findings is supported by the discovery of the Harvard University groups that A $\beta$  dimers were the predominate oligomeric species isolated from the brain of humans with AD and they are capable of causing neuritic degeneration. These studies were extended to other types of amyloidogenic proteins, so we hypothesize that assembly into dimers is the mechanism by which disease-prone, transient misfolded states of peptides and proteins are stabilised by several orders of magnitudes. Along with experimental studies, we applied Molecular Dynamics (MD) computational analysis to demonstrate the role of interpeptide interactions in the formation of misfolded states of peptides at the atomic level. Together,

these studies led us to the model of early stages of protein aggregation, in which interaction between monomers is the key to the formation of aggregation-prone misfolded states of proteins.

### Future prospects for AD treatments

The recent nanoimaging studies not only advanced our knowledge on the amyloids assembly, but established tools that will propel the development of novel diagnostic and therapeutic treatments of AD. Future characterisation of oligomers with these tools open realistic prospects for the development of efficient immunological preventive, diagnostic, and therapeutic strategies for AD, PD, and other neurodegenerative disorders.



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# Behavioral Vaccine to Prevent Teen Depression

**D**r. Benjamin W. Van Voorhees believes that adolescence offers the moment in development when young people can best learn resiliency and coping skills to prevent major depression through a primary care, Internet-based behavioral vaccine.

## Introduction of Current Study:

A primary care physician or nurse practitioner is likely to be the first health care provider to be aware of an adolescent beginning to show signs of depression. The problem is that there is no widely available, low cost, and culturally acceptable preventive approach that targets depression in primary care settings. In order to close this gap, he and his colleagues, including Dr. Tracy Gladstone, PhD, co-Principal Investigator and researchers Daniela DeFrino PhD(c), RN and Monika Marko MSS, are conducting an innovative Phase 3 trial to study the efficacy of CATCH-IT (Competent Adulthood Transition with Cognitive Behavioral Humanistic and Interpersonal Training). This is a primary care Internet-based depression prevention intervention being fielded in a two-site trial (Boston and Chicago) sponsored by the National Institute of Mental Health. It is a 5-year, two-site, multi-health care system randomised clinical trial comparing CATCH-IT to a general health education (HE) Internet intervention, called PATH (Promoting Adolescent Health).

The creation of CATCH-IT was heavily informed by research and theory. In order to meet teen's social media standards and create a singular experience, the active arm of the study incorporates character stories, peer videos, and design/picture elements into the intervention for the teen. The intervention also includes an Internet-based parent program integrating psycho-educational material about youth depression and role-playing video vignettes. A primary care provider motivational interview is used to engage both the youth and parent with the CATCH-IT program.

The PATH study will determine if a primary care Internet-based intervention that teaches adolescents coping skills to build resiliency can prevent the onset of depressive episodes in an intermediate to high risk, geographically representative sample of adolescents ages 13-18 years. Adolescents will get repeated mental health evaluations and be referred for treatment as needed. The PATH study will provide data on whether CATCH-IT does a better job of preventing depression than routine mental health care and health education that teens can find online.

## Mental Health Issues in Teens:

While there are differences between urban, suburban and rural populations, it remains true that the burden of depression affects not only the



**Dr. Benjamin Van Voorhees**

person with the illness, but also their families and friends. Major Depressive Disorder (MDD) not only causes significant morbidity and lost productivity, but it is also associated with an increased risk of suicide. The hope for prevention is based on the knowledge that patterns of coping are established in adolescence and young adulthood. Primary care providers can take advantage of a period of "plasticity" in the brain to make youths resilient against mental disorders. The first episode usually occurs in adolescence, often as early as age 15. The lifetime prevalence rate of depression by the end of adolescence is 25%. At any point in time, 3% to 8% of adolescents are affected by depression.



MDD is an illness that recurs throughout one's lifetime, with 40% of those with depression relapsing within 2 years of remission, and 75% relapsing within 5 years. Unfortunately, treatment alone will eliminate less than 20% of the disease burden for adolescents. Therefore, there are limits to the efficacy of existing interventions. Only 50-60% of adolescents treated with evidence-based psychosocial treatment (cognitive behavioral therapy and interpersonal therapy) and pharmacotherapy will show improvement. The longer the depressive episode lasts, the less likely it is that treatments will be helpful. Access to any type of intervention is often a major barrier, with 70% of depressed youth never receiving any treatment at all.

However, there is evidence that prevention of MDD works. Teaching coping methods, such as those used in this study, to adolescents who are at-risk tend to be more cost-effective and, certainly, are less disruptive. The overall goal is to change the way

doctors and nurse practitioners, particularly those in pediatrics, deal with mental illness by moving the focus, which is now heavily trained on treatment, to prevention.

#### **Dr. Van Voorhees' Background:**

His commitment throughout his career has been to provide effective, compassionate, and accessible healthcare for all children, especially those in urban areas. He lived in close quarters with other young adults during his time in the US Navy, and observed the effects that others' mood can have on a close group of people. Dr. Van Voorhees' interest in conducting research in creating a behavioral vaccine against the onset of depression has been afforded through his training and experience. He is primary author of more than forty peer reviewed publications, and served as a grant reviewer for the government of the Netherlands and the Robert Wood Johnson Foundation. He has also been a consultant to a variety of organisations seeking to develop

health messages and programs for diverse communities, including the University of Hong Kong and Wuhan University Medical School in Hubei, China. Additionally, he has completed multiple cross-sectional and longitudinal study analyses to evaluate both the influence of attitudes on health-care seeking behavior and factors predicting future depressive disorder. His research focuses on five core areas:

- Intervention development;
- Clinical epidemiology;
- Health services and attitudinal research;
- Community based clinical trials of primary care/Internet-based interventions, and;
- Reduction of health disparities through primary care based interventions.



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# Acute respiratory infections in Wales

Preliminary findings in a community surveillance program

## Influenza and other acute respiratory infections in the community

Although the majority of acute respiratory infection data comes from diagnostic testing of patients in secondary care; detection of influenza viruses and other acute respiratory infections in the community is increasingly important. Surveillance of influenza in the community has been ongoing in Wales for more than 20 years, and since 2005/6, virology surveillance has been a vital component.

Surveillance information for influenza-like illness (ILI) in the community in Wales is collected through the Welsh Sentinel GP Surveillance Scheme: which covers a total population of

363,059 across 42 primary care practices. The primary aims of the ILI sentinel GP surveillance scheme are to monitor the proportions of patients in the community presenting to their GP with ILI symptoms and to monitor community circulation of influenza viruses in Wales.

The information and samples submitted through the sentinel scheme has shown the widespread early circulation of influenza B during the 2012-13 influenza season<sup>1</sup> and also more recently demonstrate that *Mycoplasma pneumoniae* circulates in the community at a greater level than previously thought<sup>2</sup>. Respiratory pathogen surveillance beyond influenza in the community has demonstrated that the clinical presentation of many of the respiratory infections can be very





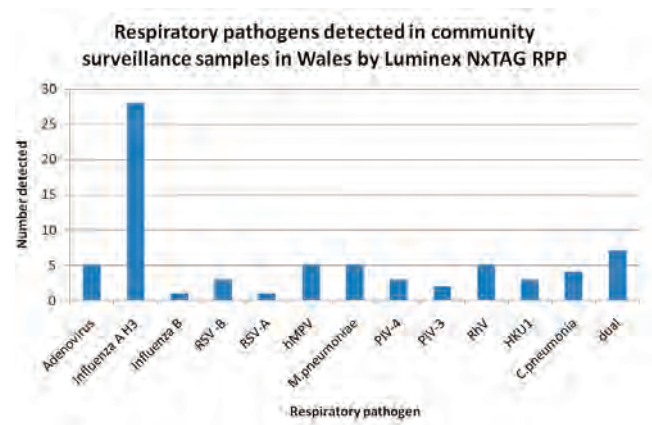
**Figure 1.** The Luminex NxTAG® Respiratory Pathogen Panel (RUO) process from nucleic acid extract to MAGPIX®.

**Preliminary findings:** The study began in December 2014 with a completion date of April 2016. Early data was promising, from December 2014 until March 2015, 106 samples were tested from the community with an overall positivity rate of (72/106) 68% (figure 2).

similar to influenza; even though most sentinel clinicians seem to exercise a conservative approach when sampling ILI patients.

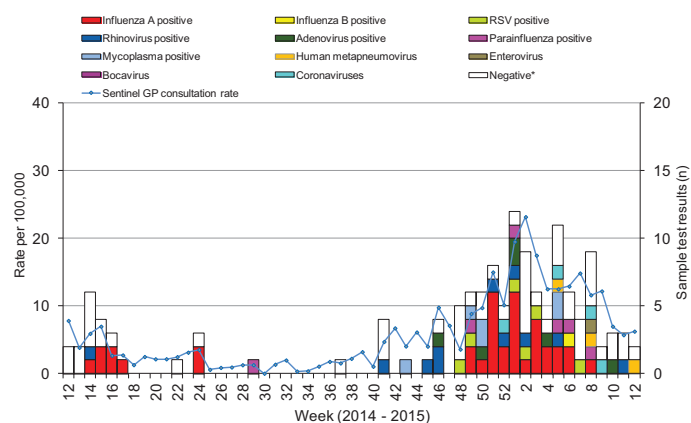
### Increasing the sensitivity of the Welsh community surveillance scheme

Often influenza is detected in hospitalised patients in advance of it being detected in the community; this suggests that current sampling approaches in the community are less than optimal to allow for early detection of influenza. To address this problem, a study was devised in Wales where a less specific, but more sensitive criteria for sampling for patients presenting with acute respiratory illness (ARI), was introduced to give an estimation of undetected influenza cases which present to primary care, not fitting the more conservative definition of ILI.

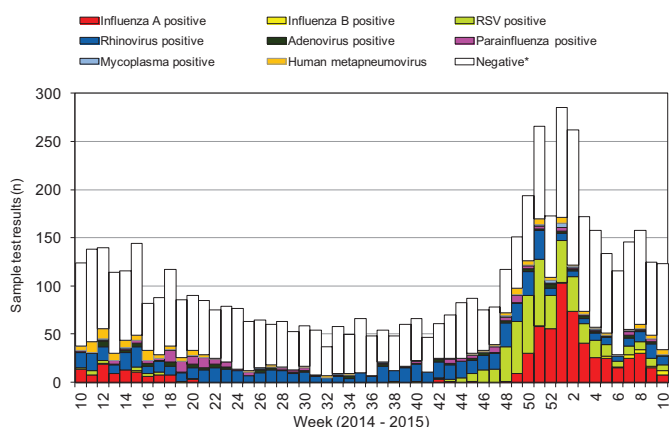


**Figure 2.** Range and number of respiratory pathogens detected in community surveillance samples (Dec 2014-Mar 2015)

Influenza A H3 viruses dominated the season and despite including a wide range of pathogens in a single tube, dual infections were uncommon (6/106). Overall, the community surveillance data correlated with that seen in the hospitalised cohort tested through the routine service (figures 3 and 4). Consequently the Luminex NxTAG Respiratory Pathogen Panel will continue to be used as an integral part of community surveillance in Wales.



\* Tested negative for influenza, adenovirus, rhinovirus, RSV, adenovirus, parainfluenza, mycoplasma, human metapneumovirus, enterovirus, bocavirus and coronaviruses.



Combined data for tests carried out in Public Health Wales Microbiology: Cardiff laboratory, provided by Public Health Wales Microbiology Cardiff Specialist Virology Centre.  
\* Tested negative for influenza, adenovirus, rhinovirus, RSV, adenovirus, parainfluenza, mycoplasma and human metapneumovirus

**Figure 3.** Samples submitted for virological testing by sentinel GPs as of 25/03/2015 by week of sample collection, week 12, 2014-week 12, 2015.

**Figure 4.** Samples submitted for virological testing for hospital patients and non-sentinel GPs as of 11/03/2015 by week of sample collection, week 10, 2014-week 10, 2015.

In summary, the simplicity of the assay process, coupled with the excellent preliminary results obtained for a wide pathogen target range (including the detection of enterovirus-D68) makes the Luminex NxTAG® Respiratory Pathogen Panel a realistic and exciting option for a diagnostic laboratory.

Additionally, by expanding the panel of targets being tested for in the community surveillance scheme insight into to how pathogens other than influenza might impact on influenza consultation rates as well as further elucidating what causes the wider burden of ARI in a primary care setting. Current surveillance protocols only allow for detection respiratory pathogens which cause patients to present to GPs with ILI. By widening the clinical symptom sampling frame the aim was for a better estimation of community rates of non-influenza causes of ARI.

## Study methods

The sampling method employed in Wales is unique in that predominantly dry respiratory swabs are collected from either the throat or nasopharynx and returned to the laboratory for direct testing in the molecular screen<sup>3</sup>. Currently, a panel of well optimised real-time PCR assays are utilised, made up of 6 duplex or triplex reactions per sample detecting Influenza A, B, RSV-A, RSV-B, human metapneumovirus, rhinovirus, the parainfluenza viruses types 1-4,

M. pneumoniae and adenovirus. Whilst this approach offers flexibility in terms of running specific assays during outbreaks, the set-up of the assays can be onerous for the user when large numbers of samples are received. Additionally, the panel does not include other respiratory pathogens such as the seasonal coronaviruses and a separate enterovirus assay has to be performed on those cases where a respiratory enterovirus such as EV-D68 is suspected<sup>4</sup>.

To expand the target panel without introducing new assays into the in-house repertoire, Luminex kindly agreed to supply early research use only (RUO) batches of the NxTAG® Respiratory Pathogen Panel (RUO) for the purposes of the study.

The major benefit of the NxTAG® Respiratory Pathogen Panel for the study was that as well as the targets included in the routine respiratory screen, additional targets including the seasonal coronaviruses (HKU1, 229E, NL63 and OC43), bocavirus, Chlamydia pneumoniae and Legionella pneumophila were also included.

Importantly, unlike the previous formats of Luminex molecular panels, the reagents are supplied in a freeze dried format to which 35µl of sample extract is added to reconstitute the reagents and beads (figure 1). Following a 2.05 hour amplification and hybridisation step on a thermocycler, the plate is then simply transferred to the MAGPIX® instrument for detection. The whole process from sample receipt to result is around 4.5 hours, meaning that up to 96 samples can be processed easily within a standard working day.

The study protocol was devised to run alongside, but separately from the routine respiratory diagnostic service. Once a week the data from both was correlated and analysis of respiratory pathogen circulation trends undertaken and published in the weekly online surveillance report.

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#### Catherine Moore PhD, Clinical Scientist at Public Health Wales

Public Health Wales has a clear remit to improve the health and well-being and reduce health inequalities for the people of Wales. We are a unique national NHS Trust delivering public health services to the public in Wales. We work closely with communities, the NHS, local authorities and other agencies including education, housing, police and fire and rescue services, the Welsh Assembly Government and the wider population of Wales.

Catherine has worked in the Cardiff laboratory of Public Health Wales for almost 20 years. After working as a Biomedical Scientist in virology for three years, she moved into the newly formed Molecular Diagnostics Unit in 2000 as a clinical scientist with a remit to develop and implement molecular diagnostic assays for virology. Catherine is now a Principal Clinical Scientist undertaking FRCPath with a specialist role in respiratory/CNS and emerging and re-emerging viral infections.



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# Principles of Pulmonary Ultrasound

Ultrasound deals with waves traveling through a medium at frequencies above the threshold of human hearing. More accurately, these waves are pressure waves produced by the ultrasound transducer that travel through a tissue medium. Typically, bedside ultrasound machines used for emergency department and critical care applications utilise frequencies between 2 to 14 megaHertz. Several probes are often available for selection, depending on the application or procedure performed. Two important properties of the ultrasound wave important to probe selection are frequency and wavelength. Wavelength is the distance between successive crests of the sound wave. Frequency is the number of occurrences of a repeating event (for ultrasound purposes, the sound wave

crest) over a unit of time. Frequency and wavelength are inversely related. The longer the wavelength, or greater the distance between the wave crests, the less frequent the crests occur over a unit of time. In other words, long wavelengths have low frequencies. Lungs are relatively superficial compared to intracavitary organs, so less distance is required to visualise the pleura. A higher frequency probe (5-14 MHz), with a shorter wavelength is required. In addition to ultrasound wave properties, the ultrasound transducer surface is also considered in probe selection for pulmonary ultrasound. Flat footprints of varying length and square or rectangular shape are available.

Various modes are utilised to visualise intrathoracic structures, including B



Virginia M Stewart

mode, M mode, and Doppler assessment. B-mode stands for “brightness” mode and presents a 2 dimensional display in varying shades of gray (Figure 1). M-mode stands for “motion” mode, and selects an “ice pick” single dimension sample from pixels of the B mode image (Figure 2). The horizontal axis represents time and the vertical axis represents the motion of reflecting echoes. Many machines simultaneously display B and M mode imaging. Doppler assessment is obtained either through continuous, pulse wave, or color flow mapping. Pulse wave Doppler uses a single crystal that transmits the ultrasound wave, then “listens” to receive the returning Doppler information. The returning pulse is a snapshot of the position of the reflecting surface position within the sample. A B mode image is displayed along with information about pleural movement in relation to

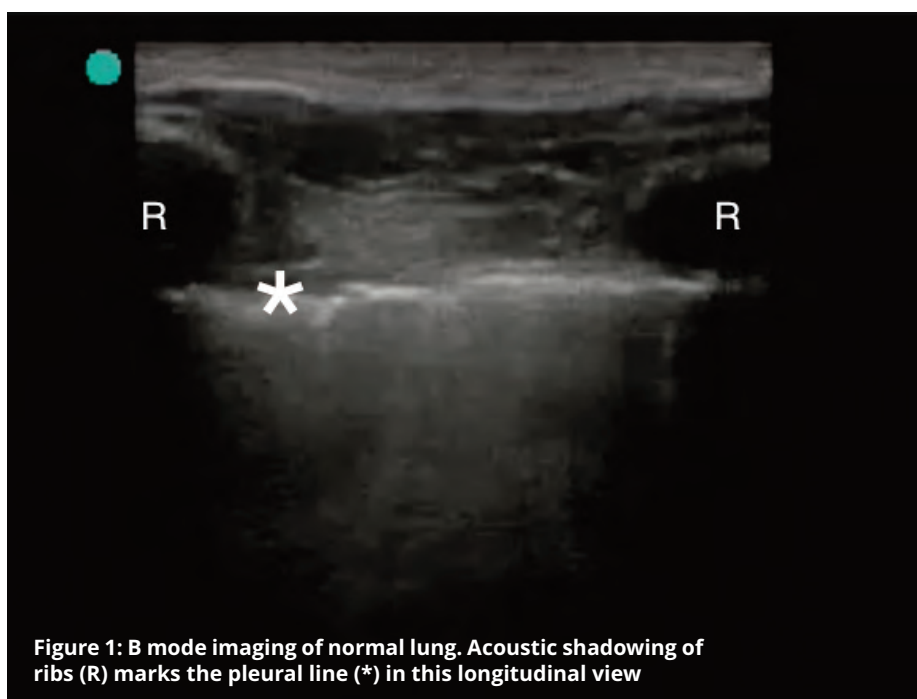


Figure 1: B mode imaging of normal lung. Acoustic shadowing of ribs (R) marks the pleural line (\*) in this longitudinal view

the transducer surface. Pulse wave Doppler information is displayed acoustically or is converted into color. A color map indicates flow direction with a red and blue scale, or simply the presence of movement, which is depicted as an orange scale. Figure 3 demonstrates power Doppler as it detects pleural movement (orange) relative to the transducer surface.

### Pulmonary Ultrasound Examination and Pathology

Air is a poor medium for ultrasound waves due to its low density and slow propagation velocity. Healthy lungs contain air, and are surrounded by the highly reflective bones of the ribs. Rather than visualising lungs directly, pulmonary ultrasound identifies various artifacts or detection of movement.

**“Two important properties of the ultrasound wave important to probe selection are frequency and wavelength.”**

In a longitudinal view, the acoustic shadowing of the ribs marks the space where the pleural line may be identified. In Figure 1, the acoustic shadow of the ribs (R) is created by the strongly reflective bony cortex, and marks the pleural line (asterix). Since bone reflects ultrasound waves, no signal is detected behind the bony cortex, creating shadowing.

Normal pleural movement demonstrates a “shimmer sign” with B mode imaging. Poor respiratory effort, operator experience or fatigue, and other factors may complicate the identification of a “shimmer sign”. M mode imaging uses a high frequency probe to depict lung movement. Using M mode, normal lung that is moving has a homogenous granular appearance under the brightly visualised pleura.

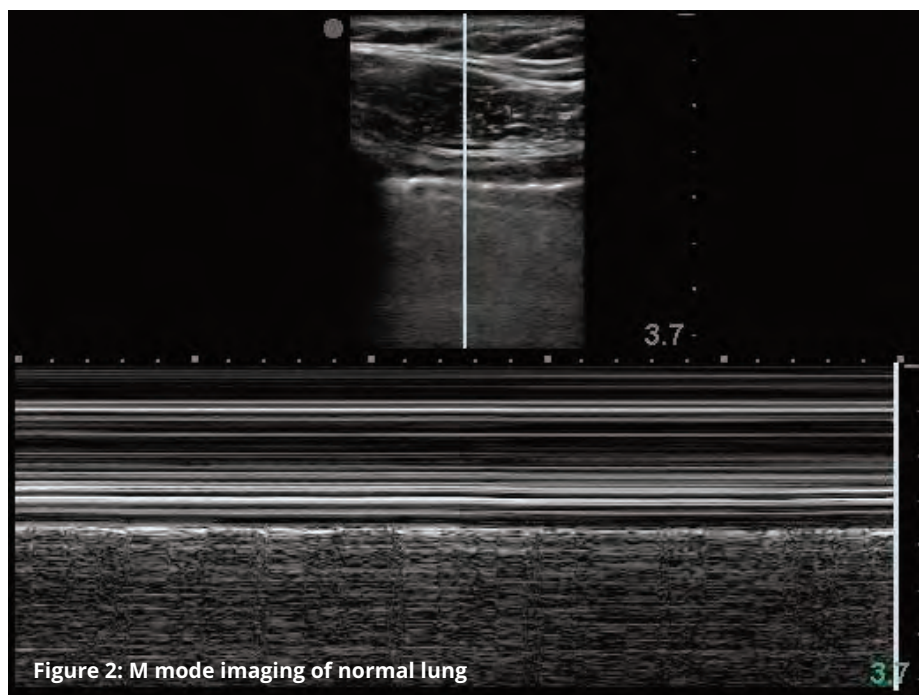


Figure 2: M mode imaging of normal lung

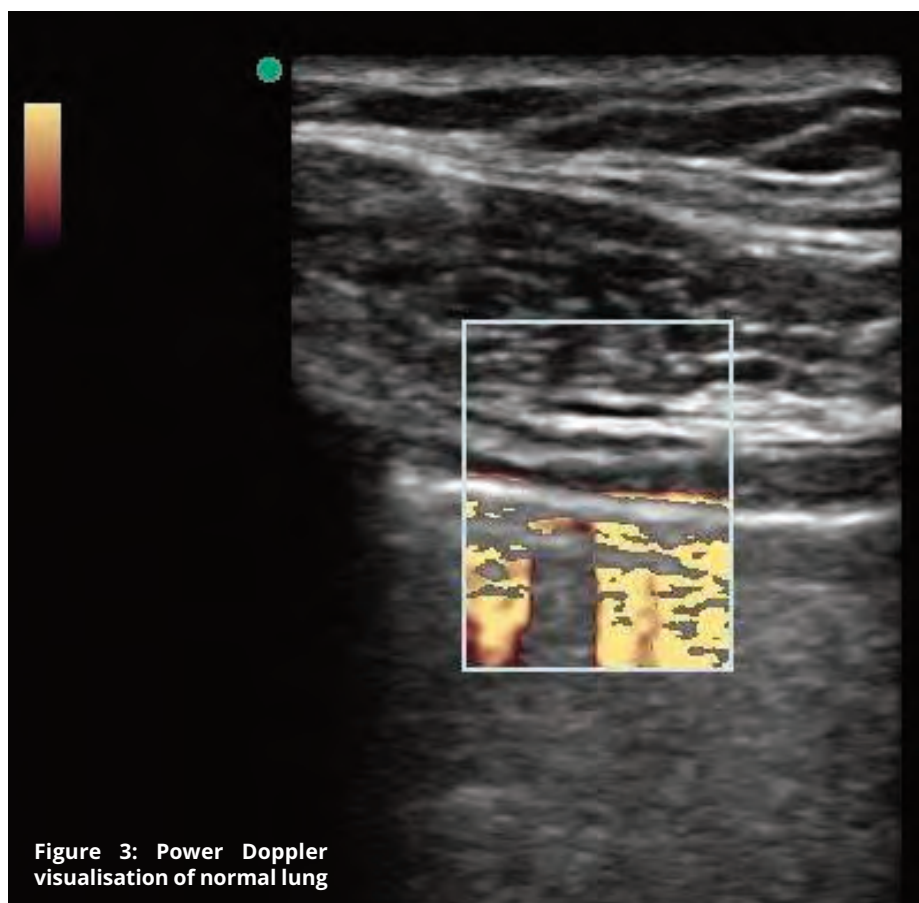
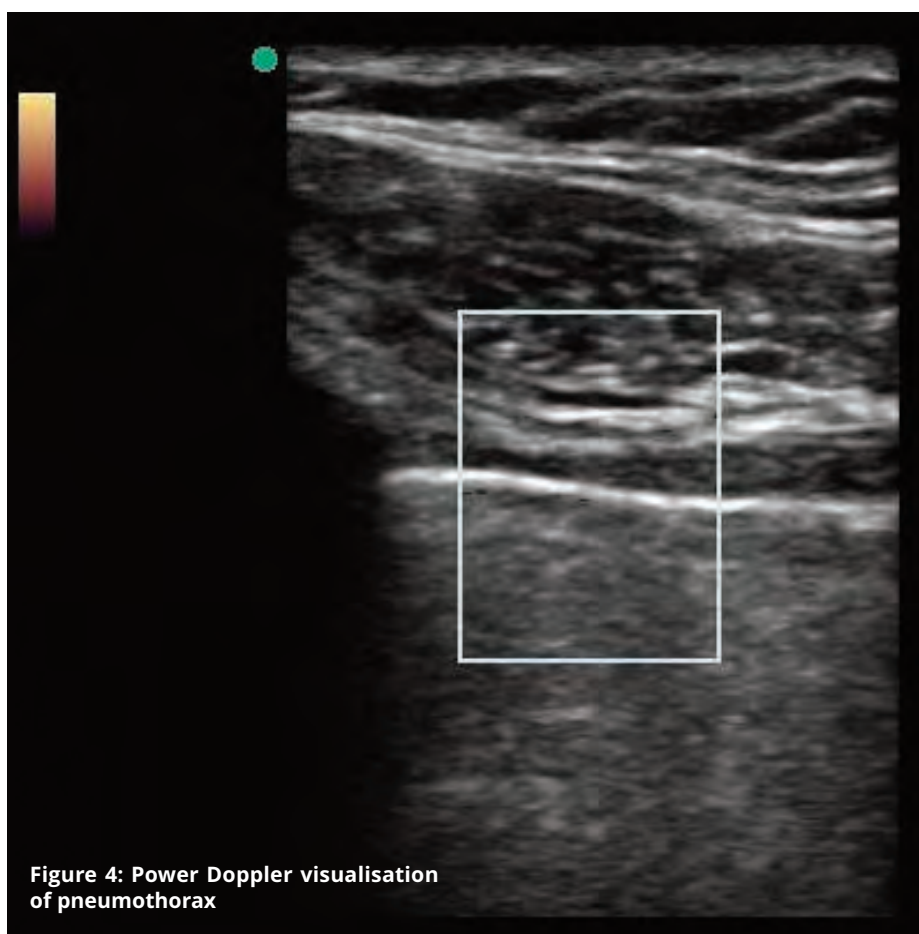


Figure 3: Power Doppler visualisation of normal lung

Figure 2 depicts this “seashore sign”, with the normal lung reminiscent of sand and approaching waves. The loss of granular appearing “sand” on the bottom half of the screen is indicative of pneumothorax.

Lung sliding is also detected by Doppler. Power Doppler (Figure 3) utilises an orange scale to detect movement relative to the transducer surface, which is more sensitive for movement as compared to the red



Lung that is compressed from pleural effusion, tumor, bronchial obstruction, or other atelectasis appears wedge shaped and brighter, or more echogenic. Pleural effusions and hemothorax are typically anechoic, or black, on ultrasound. Dynamic evaluation of the compressed lung demonstrates lung floating in an anechoic effusion. Interpleural distance of greater than 50mm at the lung base represents a pleural effusion of at least 800mL.<sup>6</sup> Figure 6 demonstrates a pleural effusion with compressed floating lung.

Several scanning protocols exist for pulmonary ultrasound. As a general rule of thumb, it is recommended to visualise more than one lung field, and over any area where there is clinical suspicion for pathology. The BRIPPED protocol is a screening tool for undifferentiated shortness of breath that may be performed with the patient in any position, and utilises high and lower frequency probes using a portable bedside ultrasound machine.

blue Color Doppler. A patient with a pneumothorax will not have lung sliding relative to the transducer surface, and no color will be detected in the sample selected (Figure 4).

B lines, also known as “comet tail” artifacts, represent the common border between the interlobular septa and the alveolar wall.<sup>1</sup> B line artifacts start from the pleural line, and are hyperechoic, or brighter than the surrounding field. Figure 5 demonstrates the vertical B lines and horizontal A lines parallel to and below the pleural line. A lines are the reverberation artifact of the pleural line. B lines move with lung sliding during respiration. In normal lung the B lines appear to “wipe” side to side over the stationary appearing A lines. The lack of B line movement also indicates pneumothorax.

B lines are key to identification of interstitial lung disease due to pulmonary fibrosis, pulmonary edema, acute respiratory distress syndrome, and other pathologies.<sup>2</sup> Due to the pleural traction created from underlying fibrotic lung and thickening of the interlobular septa, B lines appear at least 7mm apart in interstitial lung disease.<sup>3</sup> Ground glass appearing lung on chest tomography appear on ultrasound as B lines that are at least 3mm apart.<sup>4</sup>

The lack of B lines is seen in pulmonary consolidation due to the replacement of the alveolar air with fluid or blood. Consolidated lung may appear homogenous or heterogenous. Doppler evaluation of lung assists with evaluation of a vascular blood supply indicating lung cancer rather than an infectious etiology of consolidation.<sup>5</sup>

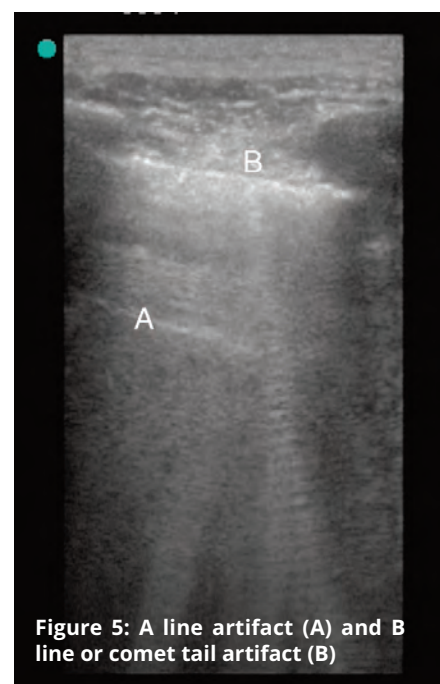


Figure 5: A line artifact (A) and B line or comet tail artifact (B)



### BRIPPED Protocol:

The BRIPPED scan is an effective screening tool for undifferentiated shortness of breath that evaluates pulmonary B-lines, Right ventricle size and strain, Inferior Vena Cava (IVC) collapsibility, Pleural and Pericardial Effusion, Pneumothorax, Ejection Fraction of the left ventricle, and lower extremity Deep Venous Thrombosis.

The BRIPPED protocol can be performed in its entirety from a head to toe approach, switching between high

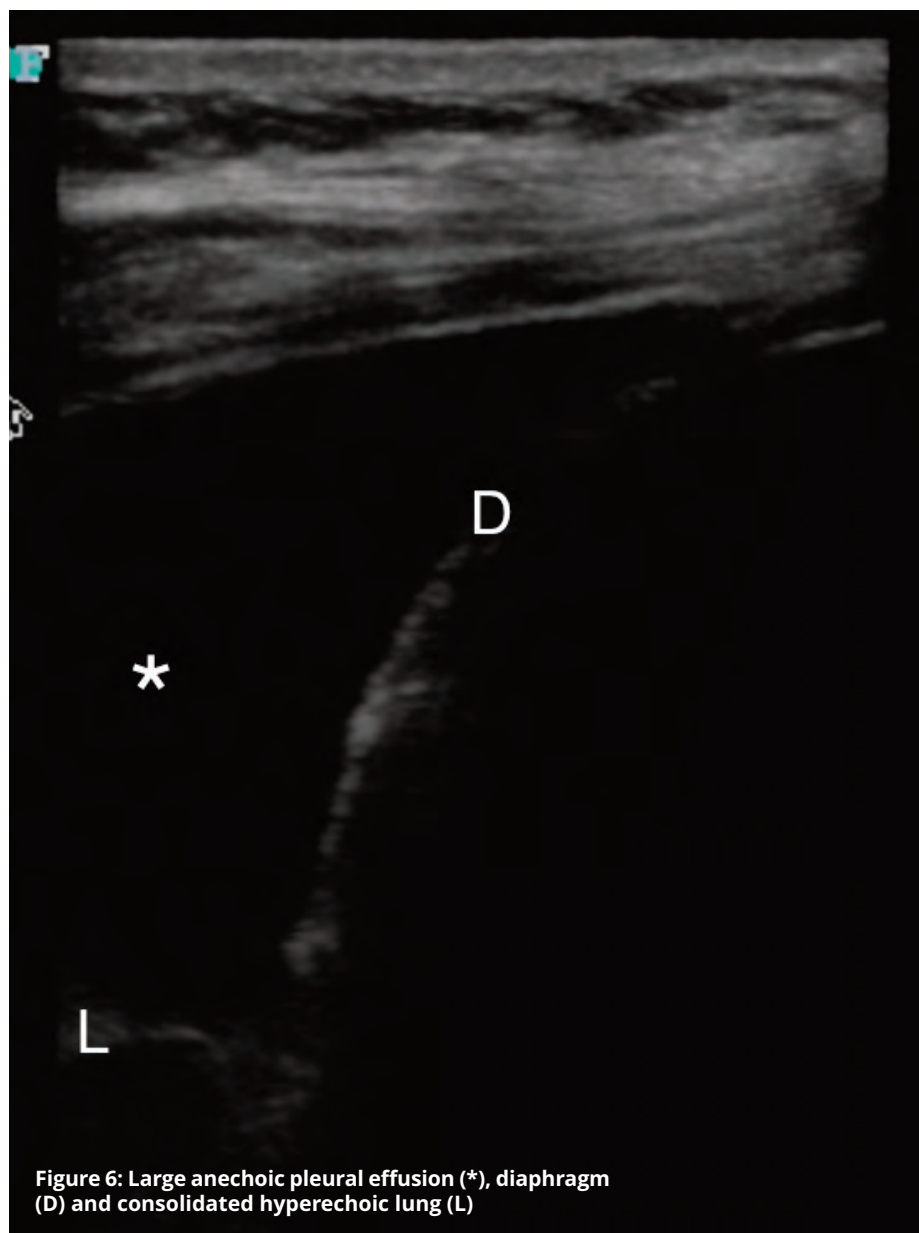
and low frequency transducers, or completing the exam with one transducer then switching to the next. An example of the latter would be to first use the low frequency probe to evaluate the parasternal long axis and apical 4 chamber, noting the presence or absence of pericardial effusion, ejection fraction, and RV strain. Then the long axis of the IVC is evaluated for dynamic collapsibility. Moving laterally, the costophrenic angles are evaluated bilaterally for pleural effusion. The probe is switched to the

high frequency probe to evaluate each lung apex at the mid clavicular line for the presence of pneumothorax and B lines. Lastly, the dynamic 2 point DVT screening is performed with compression ultrasound.

The BRIPPED protocol and other bedside ultrasound resources can be viewed here: [www.anatomyguy.com/b-ripp-ed-scan-for-evaluation-of-emergency-department-patients-with-shortness-of-breath/](http://www.anatomyguy.com/b-ripp-ed-scan-for-evaluation-of-emergency-department-patients-with-shortness-of-breath/)

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Figure 6: Large anechoic pleural effusion (\*), diaphragm (D) and consolidated hyperechoic lung (L)

# Dengue



In recent decades Dengue has become one of the most uncontrolled and neglected infectious diseases, especially in the tropical and sub-tropical regions of the world. It is believed that societal and ecological changes/movement during the World wars increased vector-borne diseases, and dengue hyperendemicity began in the Southeast Asian regions, thus triggering epidemics of dengue hemorrhagic fever (DHF).

Dengue viruses can be asymptomatic, or may also cause a wide spectrum of symptoms that can range from classic fever to plasma leakage, hemorrhaging, shock and even death.

The slow progress in vaccination and drug discovery is mainly because (i) the vaccine needs to be able to protect against all 4 DENV serotypes; (ii) of the lack of protective immune correlates; (iii) there is an absence of reliable animal models to represent dengue and (iv) the controversial and limited understanding of dengue pathogenesis.

Dengue diagnosis is not only important for clinical management of patients, but also for epidemiological

surveillance, outbreak intervention and vaccine development and monitoring. Due to the absence of pathognomonic clinical features that can distinguish dengue from other febrile illnesses, laboratory confirmation is an essential part of diagnosing dengue. Dengue diagnosis is divided into two main phases, the early phase and the late phase.

We have been actively involved in the development of diagnostic kits. An in-house method for the detection of dengue IgM via IgM capture ELISA, and a multiplex dengue viral RNA detection assays were developed and evaluated. We have also been involved in the evaluation projects of these kits conducted by the WHO. These evaluations revealed that the NS1 detection rate is inversely proportional while the IgM detection rate is directly proportional to the presence of IgG antibodies. This information helps in balancing the use of NS1 kits which are not entirely solely dependable as a single assay for the detection of dengue infection. Combining this assay with an IgM and/or IgG assay will increase the sensitivity of detection, especially in areas with a higher prevalence of

secondary dengue virus infections.

Newer technologies are being applied to fine-tune available diagnostic assays and also to design new ones that fit the ideal test concept. Although many tests and assays have been carried out, we are still striving to improve better diagnosis of dengue infection. Our laboratory thrives to develop and test for new avenues in streamlining dengue diagnosis.

These past few decades have seen a surge in dengue research – in trying to understand the disease, the cause and the trigger. Our lab has been part of the worldwide research embarking on finding the cause and correlates of severe dengue and the occurrence of asymptomatic dengue cases.

We investigated immune correlates in dengue severity which included HLA association with dengue susceptibility/protection, T cell responses of dengue infected patients, and cytokine profiling of dengue patients at different phases of illness.

With the understanding that the asymptomatic dengue cases should not be taken lightly, our lab has



'Fogging' to prevent spread of dengue fever

investigated the asymptomatic dengue cohort to search for predisposing markers that constitute protection, or lack of clinical manifestations in these individuals, using microarray and high throughput quantitative PCR to assess the molecular basis of the human genomics.

More recently, we have ventured into the field of endothelium dysfunction of infectious diseases. The hallmark of severe dengue is plasma leakage and hemorrhage. The 'organ' crucial for regulating electrolyte content of intra- and extravascular spaces is the endothelium layer. Many other viruses have been known to target the endothelium leading to enhanced permeability. This is why we are also investigating endothelium dysfunctions caused by other viruses including respiratory viruses, influenza virus, and neuroviruses. By gaining an understanding of the mechanism of endothelium dysfunction in infectious disease, we hope to move on to finding therapeutic strategies to prevent, limit, and reverse the disruption of the endothelial layer and thus minimise the severity of disease.

### Antimicrobial/Antiviral Drug Development

Pneumococcal diseases represent a global threat mainly affecting the elderly and children under the age of two – caused by *Streptococcus pneumoniae* or pneumococcus, a Gram-positive, alpha-hemolytic, aerotolerant anaerobic member of the genus *Streptococcus*. This pathogen was a major cause of pneumonia in the late 19th Century and represents one of the major etiological agents causing life-threatening diseases such as pneumonia, meningitis, and bacteremia. Although antimicrobial drugs such as penicillin have diminished the risk from pneumococcal disease, the proportion of strains that are resistant to antibiotics is steadily increasing.

Antimicrobial peptides (AMPs) represent an important part of the innate immune system and the primary role is to kill off invading pathogenic organisms. Our main focus is to design novel synthetic antimicrobial peptides (AMPs) as potential antimicrobial candidates against *Streptococcus pneumoniae*.

Currently, we have designed and tested a series of hybrid AMPs exhibiting strong antipneumococcal effects, of which DM3 possessed promising *in vitro* and *in vivo* antipneumococcal activities, this has now been patented. Based on this current experience, we have begun to investigate other hybrids generated based on Ranalexin and Indolicidin which showed potent antipneumococcal activity and the mechanisms of these AMPs are being evaluated alongside *in vivo* therapeutic efficacy.

### Funding Bodies:

University of Malaya (Postgraduate Research Fund, High Impact Research Grants), Ministry of Higher Learning (MOHE), Ministry of Science & Technology Malaysia (IRPA RM6, MOSTI RM9, Brain Gain Malaysia, ScienceFund, Scientific Advancement Grant Allocation (SAGA), Exploratory Research Grant Scheme (ERGS), Fundamental Research Grant Scheme (FRGS) and Malaysian Agricultural Research and Development Institute (MARDI) and TDR/WHO.

### Collaborators:

TDR/WHO, The John Hopkins University, Perdana University Graduate School of Medicine Malaysia, University of South Florida, Colorado State University, University of Tubingen, Institute for Medical Research Malaysia, Faculty of Biomedical Engineering University of Malaya, University Sains Malaysia and the University of Brunei.



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# Nutrition and prostate cancer

Prostate cancer will become an increasing burden on society

Prostate cancer is now the most common malignancy in Western men, accounting for 30% of newly diagnosed cancers, and it is the second leading cause of male cancer-related death. The burden of human suffering and the cost to society are expected to increase significantly in the coming decades due to increased life-expectancy. The Canadian Cancer Society reports that an estimated 23,600 men will be diagnosed with prostate cancer in 2014 and that 4000 men will die from the disease. This represents 10% of all cancer deaths in men. The US Cancer society estimates for 2015 are about 220,800 new prostate cancer cases and 27,540 deaths. Statistics for the European Union are similar overall but are very interesting in that they show a very wide regional difference in mortality rates. In Mediterranean countries prostate cancer mortality can account for as little as 4% of all cancer-related deaths in men whereas in Scandinavian countries it can be as high as 20%. This is where nutrition comes in to play. Poor diet has been consistently implicated as an important risk factor in prostate cancer.

## Eat your vegetables, they are good for you!

Every parent has said it and many a child has protested. Yet parents do know best; epidemiological studies across European and North American populations consistently associate high life-time vegetable consumption



Broccoli is an effective antiprostata cancer food

with reduced risk of developing cancer and this is particularly true for prostate cancer. Unfortunately, a generation of people has been raised on a high fat, carbohydrate and protein diet, low in fibre and plant-derived nutrients.

Prostate cancer develops slowly, with tumors that are already present in men below forty that grow to detectable size over a number of decades. These cancers usually start out as hormone-dependent tumors that respond to therapies that block androgen synthesis or androgen action, but progress to an androgen-independent state that is difficult to treat with conventional chemotherapeutic agents. These non-responsive tumors will eventually metastasize, resulting in death of the patient. This slow path to malignancy provides

valuable opportunities for effective chemopreventive dietary intervention. It is never too late to start eating healthy.

## Broccoli, diindolylmethane and death of the prostate cancer cell

My laboratory at the *INRS-Institut Armand-Frappier* is very interested in understanding how natural compounds can kill prostate cancer cells. These are studies of a fundamental nature and have focussed on compounds found in vegetables of the Brassica family, such as broccoli, cauliflower and Brussels' sprouts. They contain indole-3-carbinol, which in the stomach undergoes conversion to diindolylmethane (DIM). DIM is relatively non-toxic as it will kill prostate cancer cells at concentrations that do not affect normal prostate cells. In collaboration with professor Stephen



The pomegranate has been a symbol of wealth and prostate health since ancient times

Safe at Texas A&M University, we have been testing a number of synthetic derivatives of DIM (named ring-DIMs), which have shown increased anticancer activity compared to native DIM. It is relatively well known how DIM exerts its anticancer effects and we expected that the synthetic ring-DIMs would act similarly, just more potently. This was not the case. Probing deeper into the machinery of the prostate cancer cell we found that the increased potency of the ring-DIMs is likely because they act on additional molecular pathways in the prostate cancer cell to trigger its death. Significantly the ring-DIMs were effective against androgen-dependent as well as -independent prostate cancer cells. Tumor cells (and healthy cells for that matter) can die in several distinct ways, which include programmed cell death (apoptosis), uncontrolled cell death (necrosis) or by dissolving themselves into small components (autophagy). We found the ring-DIMs to trigger all three of these pathways. The question is: what is the trigger? We are currently trying to understand which molecular target or targets in

the prostate tumor cell are initially activated to trigger ring-DIM-mediated cell death. Our various experiments have led us to the mitochondria, the energy producers of the cell, which appear to rapidly lose their function. On a deeper level, it appears that our most potent ring-DIM activates a certain kinase (an enzyme responsible for transferring signals that result in a cellular response) that may be a direct target. We have published the results of these studies in the journal *Genes & Cancer*.

### Government policy and research funding

Governments can apply policies that stimulate the consumption of healthier foods (fresh produce, lean meats, cereals) and discourage that of highly processed and nutritionally questionable foods (fast food, foods with high sugar, fat and salt content). It can also improve the availability of fresh produce in remote areas, a problem that is very real in a country such as Canada, where a head of broccoli can cost upwards of \$8,- in Canadian dollars in isolated communities.. Also

necessary is improved and more diversified funding for research on the potential anticancer effects of natural compounds, as research on natural compounds is neglected in comparison with drug and clinical research. It is often argued that natural compounds are not as interesting because they are usually less potent and do not have a specific cellular target. Untrue, because we know that highly selective anticancer agents can result in tumor resistance, whereas natural compounds (usually present in complex mixtures in food) have multiple targets and therefore can act via a diversity of anticancer mechanisms to inhibit tumor growth, while making it harder for the tumor cells to adapt and develop resistance. Of course, we should see the consumption of natural compounds in the form of healthy foods mostly in a context of chemoprevention. A healthy diet nips cancerous cells in the bud before they can develop into full-blown tumors.

Bon appétit!

Dr Sanderson's research is funded by the Canadian Institutes of Health Research (CIHR) and the Natural Sciences and Engineering Research Council of Canada (NSERC).



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# The million dollar question in prostate cancer research

**Owen Sharp, CEO at Prostate Cancer UK sheds light on the important work that's being done to better diagnose and treat prostate cancer...**

**M**ost prostate cancers aren't a problem. In fact, for many the problems only come from diagnosing and treating them. These are the prostate cancers a surgeon once described as 'pussycats'. Most men in their 50s will have some cancerous cells in their prostates, and most of those will never need to know about them. They won't cause symptoms or problems, and won't grow any further.

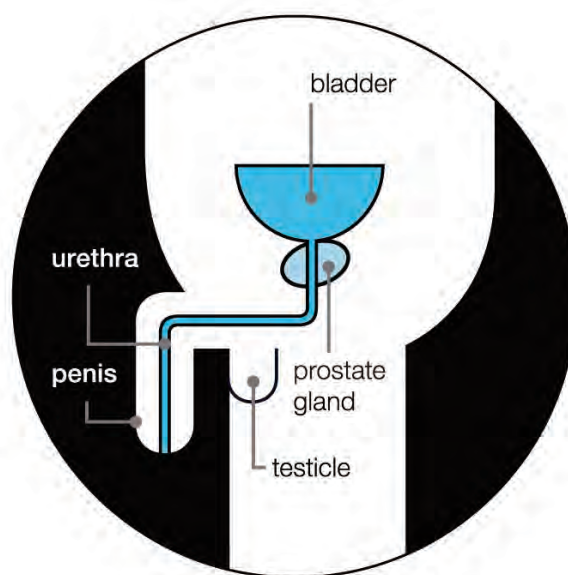
The trouble is that some of those men don't have pussycat cancers. They've got tigers; fast moving, aggressive, and often fatal. And those tigers kill one man every hour in the UK.

So arguably, the questions we need to answer to make a huge difference to the lives of men diagnosed with prostate cancer are: how can we tell the tigers from the pussycats? And, how can we take the claws (and teeth) out of the tigers, when we find them?

Usually, the answer lies in early detection and early treatment. That is absolutely true for prostate cancer too, but with a hefty caveat.

Early detection and treatment of the pussycat prostate cancers leaves men open to an unnecessary risk of infection from biopsy and of serious treatment side effects, like incontinence and erectile dysfunction. So to make a real difference to these men, we need to find a way to accurately assess their risk of having aggressive prostate cancer, and be able to tell them – with confidence – that they don't even need a biopsy, let alone radical treatment, if their risk is low.

There's a huge amount of work going on across the UK, much of which is supported by Prostate Cancer UK and our charity partner The Movember Foundation,



into understanding the genetic basis of prostate cancer risk, improving imaging techniques to reduce the need for biopsies, and discovering new biomarkers to identify aggressive disease, to name but a few. As well as developing a new tool to help men and GPs identify a man's personal risk of having aggressive prostate cancer. All these avenues of research have the same goal in mind: reduce over-treatment of the pussycat prostate cancers, and under-treatment of the tigers.

But what about the men with advanced prostate cancer who are already caught in the tigers' jaws? The key there, will be well designed clinical trials of 'smart' drugs. To make these drugs, we'll need to understand more about the ins and outs of each man's cancer; what his, and his cancer's, genetic make-up can tell us about which treatments will and won't work for him, and how long they'll work for. We also need to know more about how to use the drugs we've already got more efficiently. Research can help us there too, and again, that work is ongoing. For instance, only last





week, we heard that the world's largest ever prostate cancer clinical trial had reported a clear survival benefit in treating men with docetaxel chemotherapy, alongside hormone therapy from the point of diagnosis with metastatic prostate cancer, instead of just after hormone therapy fails.

**“Early detection and treatment of the pussycat prostate cancers leaves men open to an unnecessary risk of infection from biopsy and of serious treatment side effects, like incontinence and erectile dysfunction.”**

Yet science can only take us so far. We will always reach a point – as we have now with the recent trial results - where research identifies a new 'gold standard' to improve the lives of men with prostate cancer. Then the scientists have to pass the baton to those who have the keys to access.

That's why now, more than ever, it's important that we all, men; researchers; health professionals; health

providers and charities, work together to make sure that new technologies are made available quickly and universally across the UK.

Taming a tiger was never going to be an easy job. But it is possible. We're ready to be bold, and dynamic in pursuit of this ambitious goal. Are you ready to join us? ■



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# SKIN CANCER

Melanoma is  
Melanocytes are  
melanin, which is  
dominantly  
of the

## Euromelanoma and skin cancer prevention in Europe

**Veronique del Marmol European Chair and Alexander Stratigos Vice-Chair of Euromelanoma look at the growing burden of skin cancer in Europe, and the importance of making people aware of the risks...**

**S**kin cancer is the most common cancer in the world. It is usually caused by unprotected or excessive exposure to the sun's UV rays, which penetrate and damage the skin over time. Cancerous lesions are likely to appear in sites exposed to (UVA and UVB) the sun more often such as the face, neck, back and limbs. It is most common in people over the age of 50, but any age can be affected. The incidence rate for all forms of skin cancer is increasing, but it is recognised that non-melanoma skin cancers are still underreported in official statistics, masking the true scale of its prevalence. Skin cancer is one of the most treatable forms of cancer, with a very good recovery rate. However, public awareness of the symptoms of skin cancer is currently low, meaning opportunities

for vital early detection can be missed. 'Skin cancer' refers to several different forms of the condition, each of which has different symptoms, treatments and severity. Carcinoma, basal or squamous cell carcinoma, are the most frequent cancers, originating from the cell keratinocyte. The most aggressive and dangerous skin cancer, melanoma, originates from the melanocyte, the cell that is responsible for skin pigmentation. Every year, Melanoma is responsible for the death of 20 000 European citizens.

Fortunately, cancerous lesions can be identified with vigilance, allowing the cancer to be treated more effectively. These can be defined by change color, size or shape, appear different to the rest of nevi, are

asymmetrical or have uneven borders, are wider than 6mm, feel rough or scaly (sometimes you can feel a lesion before it becomes visible) are multi-coloured, are itchy, are bleeding or oozing, look pearly, or look like a wound that does not heal.

**“The most aggressive and dangerous skin cancer, melanoma, originates from the melanocyte, the cell that is responsible for skin pigmentation. Every year, Melanoma is responsible for the death of 20 000 European citizens.”**

### **Euromelanoma**

Euromelanoma exists to promote and share information on skin cancer prevention, early diagnosis and treatment. It is led by a network of European dermatologists who generously give up their time to serve this cause. This activity culminates in public screenings during an annual ‘Euromelanoma Screening Day’. In fact, Euromelanoma is active in 33 countries and to date, over 450,000 people have received free skin examinations. Every year a new campaign is created and this gives the opportunity for many countries to receive a free material and organise this event with a lower investment. The Euromelanoma campaigns are mainly supported by grants provided by the industry.

The activities of this pan-European campaign are focused on reaching 3 key audiences; the general public, the scientific community and European and national policy makers.

As education is able to improve early detection. The action of such campaign is particularly important for countries in the Eastern part of Europe, because the

most recent estimates of melanoma incidence and mortality reveal sharp differences between countries, possibly related to missed opportunities for early diagnosis and incomplete reporting of melanoma in Eastern Europe.

In the last years, Euromelanoma in collaboration with the European cancer leagues (ECL) and the European academy of Dermato-Venereology (EADV), host special events to ensure that the treatment of skin cancer is fully recognised and supported in healthcare systems and policies, but also highlights specific aspect of prevention such as skin cancer for outdoor workers and the legal aspect of sunbed use. These events have been organised by the European parliaments, with the involvements of MAC, the MEPs that are mobilised against Cancer. ■

.....  
**Veronique del Marmol**  
**European Chair**

**Alexander Stratigos**  
**Vice Chair**

Euromelanoma  
[www.euromelanoma.org](http://www.euromelanoma.org)



# Psychosocial impact of epilepsy

**Dr Anthanasios Covanis, President of the International Bureau for Epilepsy (IBE) details the psychosocial impact of epilepsy, and its challenges in day to day life...**

**E**pilepsy is one of the most common serious brain disorders that affects at least 65 million people worldwide in a variety of ways, and is expressed clinically by seizures of various severity and frequency. Almost 30% of people with epilepsy do not respond to the existing antiepileptic drugs and in low-and middle-income countries up to 80% do not receive any treatment at all. In any society, people with epilepsy who have seizures have an increased risk of injury, are stigmatised and discriminated from a range of areas including social activities, education, employment and insurance. In many countries, legislation issues, such as those applying to the right to have a license to drive where seizures are controlled, are not applied and frequently violated.

In contrast to many chronic illnesses, where the impact is experienced through its physical symptoms and its effect on psychosocial consequences, in epilepsy the physical manifestations are mostly transient and the psychosocial consequences grow with time and severely affect the function of people with epilepsy.

Various factors can adversely affect the lives of people with epilepsy, such as the direct and indirect effect of unpredictable seizures, the impact of treatment and the neuropsychological aspects of epilepsy (cognitive difficulties, memory complaints, depression, and psychosis), and the impact the social stigma and prejudice directed against the individual with epilepsy. Additional contributors affecting quality of life result from uncontrolled seizures, restrictions in driving, and human rights violation.

Health Related quality of life (HRQOL) is often referred to as the impact of disease and treatment on Quality of Life (QOL) or it may be described as the patient's

perception of disease impact on well-being, and is used as a subjective measure in population studies.

The psychosocial impact of epilepsy and seizures is related to QOL, psychosocial state, educational achievement, employment and marital status. Various risk factors related to unpredictable seizures have been identified to predispose to poor QOL such as stress in the individual and the family, restrictions of liberty, driving, problems in making friends, getting or retaining a job, poor access to education, the perception of epilepsy by the individual, sexual problems which differ between males and females who have epilepsy and, finally, the isolation and depression encountered by people with epilepsy. Epilepsy is more than seizures and all these factors make epilepsy a significant health and socio-economic burden.

In the past the sole measure of successful treatment of epilepsy was the degree of seizure control. During the last few decades various innovative tests have been developed in assessing the impact of physical function, health, social function and psychological state. While the concept of QOL is ambiguous, quality of life measures are used to value treatments of various conditions including epilepsy. However, modified measures that identify predictors that correlate to health-related quality of life, may better help to improve the quality of life of people with epilepsy by preventing them. Optimising QOL requires more than controlling seizures and multiple biological and social processes must be considered.

The International Bureau for Epilepsy, together with our medical counterpart organisation – the International League Against Epilepsy – are involved in a number of initiatives to improve the social and medical quality of



life of people with epilepsy and to raise awareness and understanding of the disease. These include the EU Resolution on Epilepsy, passed by the parliament in 2011 by one of the largest ever majorities of MEP signatures for a resolution. Since 2011 we have also celebrated an annual European Epilepsy Day that, just this year, has been developed to become an annual International Epilepsy Day. A longer-standing initiative has been our 3-way partnership with the WHO in the Global Campaign Against Epilepsy 'Out of the Shadows'. In January of this year, the WHO passed a Resolution on Epilepsy during its Executive Board Meeting and in late May this is due to have final ratification during the World Health Assembly at the United Nations in Geneva.

The International Bureau for Epilepsy and all stakeholders working in the field of epilepsy must join forces to develop supporting measures of acceptance,

self-reliance, self-respect, and the self-empowerment of people with epilepsy to obtain a place in the community equal to their abilities. We also need the continued support of national organisations, public health agencies, and special action groups to make epilepsy a top healthcare priority particularly in those low-and middle-income countries where reduction in the 80% treatment gap is vital. ■

.....  
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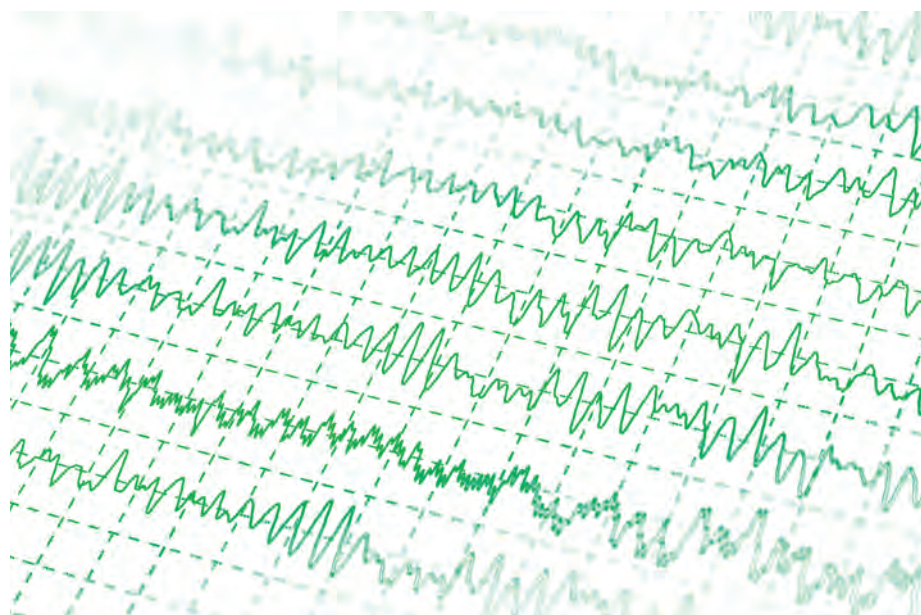
# EEG Gold Standard in Epilepsy Diagnostics

## Electroencephalography (EEG)

EEG visualises voltage differences recorded with electrodes located on the head. These very small (typ. 10-50  $\mu\text{V}$ ) voltage fluctuations result from ionic current flows within the brain. One of the key advantages of EEG recordings as compared to imaging techniques such as MRI (Magnetic Resonance Imaging) is the high temporal resolution of an EEG recording. This allows for detection of minute changes in brain activity within milliseconds. To increase spatial resolution a routine EEG recording uses 19 electrodes dispersed over the head.

## Routine EEG

A typical routine EEG is recorded with the patient's eyes closed with phases of open eyes to test the patient's EEG reactivity. The electrodes (typically AgAgCl cup or bridge electrodes) are located on the patient's head with a standardised layout called 10/20 system. The 10/20 system positioning of the electrodes assures for reproducibility and adaptation to individual head sizes. To detect epileptic seizures and other epileptic disorders typically two provocations methods "photic stimulation" and "hyperventilation" are used during a routine EEG recording. There exist certain kinds of epilepsies which may surface upon photic stimulation. That's why epileptics are not recommended to go to the disco, if they use stroboscopic light effects. If you breathe deeply for 2-3 minutes you may feel dizzy and an epileptic



person may develop a seizure which the routine EEG tries to demonstrate in a controlled manner.

## 24h EEG recording

To record an EEG over a period of 24 hours is recommended if the routine EEG did not deliver conclusive information regarding potential epileptic activity. In this application scenario the patient wears a compact device that records EEG activity over a prolonged time (typically 24 hours). The electrodes (preferred cup electrodes) are affixed to the head (e.g. with Collodion) and conductive electrode gel is injected through a hole in the electrode to assure electric conductivity between skin and electrode. The data are then read out and reviewed for epileptic activity (such as seizures or epileptic spike and wave discharges, etc.). The review of 24 hours of EEG

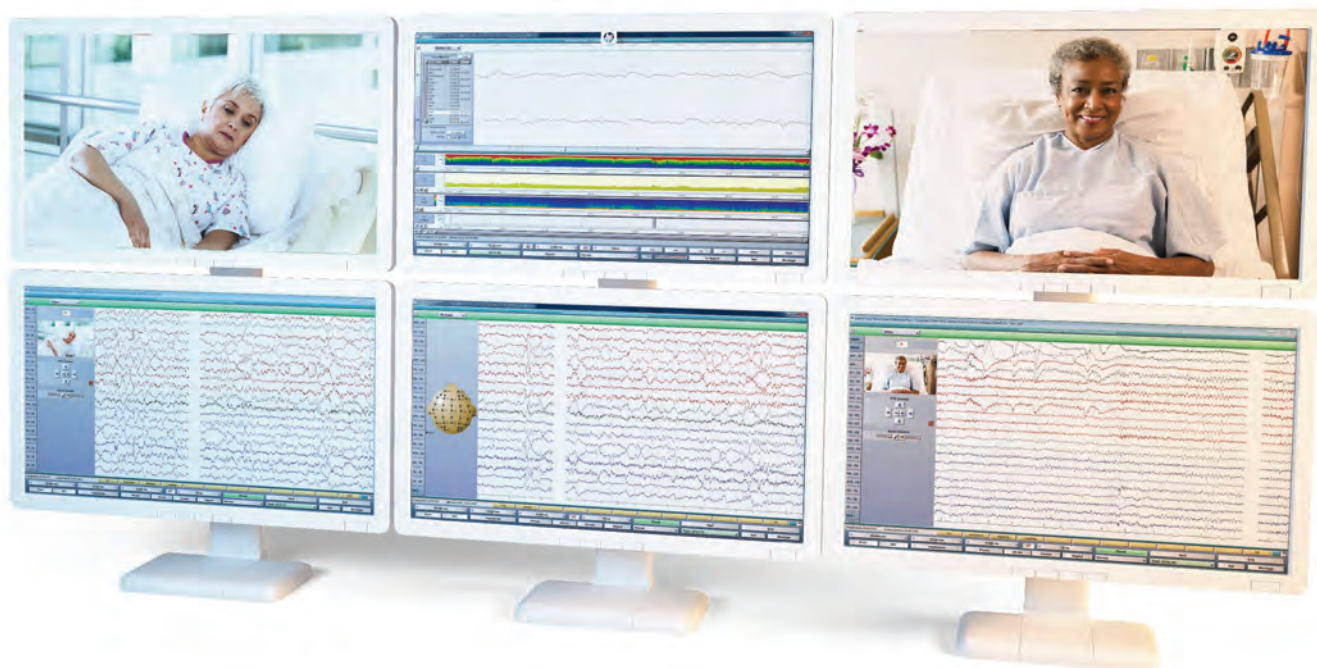
data can be quite time consuming and automatic computer based methods have become available to pre analyze the data for faster final test results.

**"One of the key advantages of EEG recordings as compared to imaging techniques such as MRI (Magnetic Resonance Imaging) is the high temporal resolution of an EEG recording."**

## Video-EEG

Epileptic activity in the brain may be accompanied by motor disturbances such as erratic limb movements and minute motor disturbances. To allow for a more detailed analysis of such periods it has become very helpful to record, in a time synchronised fashion, patient's activity along with the EEG. The video recording today will be a





digital recording allowing for easy computer based retrieval and storage. Zoom and cut features are helpful for analysis and archiving purposes. If two cameras are being used a total view and a detailed view (e.g. just the head) may be recorded, allowing for even better video analysis quality.

### Epilepsy Monitoring

One of the goals of Epilepsy Monitoring will be to find the best mix of medication to get the patient seizure free. In this setting the patients are admitted to the Epilepsy Monitoring Unit (EMU) for a prolonged period of Video-EEG recording in a safe and well controlled environment. If it turns out that a patient's epilepsy is resistant to any anti-epileptic medication resective surgery may be the last hope to become seizure free. In this case the medication will be reduced and seizures are provoked and recorded for detailed analysis. One of the targets is to find out whether the epileptic activity is of focal origin. If

this is the case and it can be well documented this will be the basis for a potential neurosurgical intervention.

### Electrocorticography (ECoG)

To localise focal activity the scalp recorded EEG will not suffice for neurosurgical intervention (cerebrospinal fluid and skull tend to smear surface recorded potentials). In this case strip and grid electrodes (sometimes also depth electrodes) implanted by neurosurgeons will be used to record electrical activity from the brain; a procedure referred to as Electrocorticography. This technique allows for better analysis of low voltage and high frequency electrical activities and since the strips and grids use smaller electrodes and have closer electrode spacing the spatial resolution is improved as compared to scalp derived recordings.

### Summary

Brain electrical activity can be recorded with surface electrodes and in special cases with subdural and

intracranial electrodes. The various EEG recording techniques presented in this paper are currently the best way to diagnose epileptic activity and also the best way to monitor therapy efficacy. Therefore the EEG can be considered as the gold standard in epilepsy diagnostics.

 **alpha trace**

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# Fighting back against antibiotic resistance

**Danilo Lo Fo Wong, Programme Manager on Antimicrobial Resistance at the World Health Organization (WHO) tells Editor Laura Evans that antibiotic resistance is a global problem and needs to be stopped now...**

**E**ach year it is estimated that around 25,000 people die of antibiotic resistant bacterial infections acquired in hospitals, throughout the European Union. However, across the wider European region, it is unknown how many people are affected but experts and signs suggest that the situation may be even worse.

The reckless use of antibiotics throughout these regions has left doctors and scientists fearing the spread of antibiotic resistant infections. Concerns stem from the fact that overuse could see a return to a pre-antibiotic era where simple infections do not respond to treatment and routine operations can become life-threatening.

However, Europe is fighting back and the World Health Organization (WHO) is helping with this. Danilo Lo Fo Wong, Programme Manager on Control of Antimicrobial Resistance (AMR) at the WHO Regional Office for Europe tells Editor Laura Evans how AMR is a global problem and one that many people are not aware of.

"Antibiotic resistance is a form of survival of the fittest. It is a natural phenomenon, which happens when you expose bacteria to antibiotics or drugs," explains Lo Fo Wong. "Normally antibiotics would kill the bacteria that cause the illness, but some of these bacteria are genetically different and may be able to survive the treatment."

"Globally, people agree that it is one of the major health threats we are facing today. This is because we are increasingly seeing people with bacterial infections that are resistant to more and more drugs. This means there are more people becoming increasingly difficult to treat."

One of the problems with regard to AMR is that many people are not aware it exists. Because it is not a disease, but a complication that arises from an infection, people can not see it, (making it difficult or impossible to treat). Lo Fo Wong explains it is very difficult to estimate how significant a problem AMR is in relation



to other health issues. This is due to the fact when a patient dies it is often difficult to discern whether it was due to the illness or the treatment failing.

“Intuitively I think many people would agree that it is a real threat. It is a threat here and now and the problem is increasing. Doctors will tell you the same thing – that they have to prescribe different antibiotics until they get the right one, as increasingly the drugs fail one after the other,” he says.

“It is a natural phenomenon. Bacteria multiply quickly and there are genetic diversities. Sometimes there is a different type of bacteria that is able to withstand the treatment. The infection then remains and can spread from one person to another.”

The problem is a global one, and it not just something that only affects Europe. As infections can spread from person to person, they can easily be transported to different countries. In low-income countries where drugs such as antibiotics are not readily available this can be an additional issue. However, the problem is no limited to these countries.

“Antibiotic resistance is not a disease. It is a complication of diseases, and one of the things that we know is that diseases travel, either through products or trade. So whatever happens in one country can affect another,” explains Lo Fo Wong.

“And of course in countries that are less resourceful the effects of treatment failure may be more devastating. When you have populations that are weak to begin with or where certain antibiotics are not available those are hit the hardest.

“It is certainly also an issue in high-income countries. The problem is many countries do not have regulation on the use of antibiotics.”



One of the reasons this problem exists could be the reliant nature we have on antibiotics and the assumption by the general public that they will treat all infections. Lo Fo Wong agrees this could be the case and that people are not always aware when they work or not.

“There is a lot of awareness that still needs to be raised among the general public,” he explains. “Sometimes patients put a lot of pressure on the doctor to prescribe them something. What usually happens is that patients go to a doctor who then does not prescribe anything but tells you to tough it out because really the antibiotics won’t work. People then have the opinion they are a bad doctor and go to another doctor.”



“European Antibiotic Awareness Day helps to raise awareness to this issue and focuses on the fact that if you have a common cold or flu, which is caused by a virus, you don’t need to use antibiotics.

“It is about trying to raise awareness and lower the expectation that antibiotics can cure everything because it is not the cure for everything.”

The WHO are trying to combat the problem by getting it on the global health agenda. As a slow developing medical disaster it is harder to bring to the front of people’s minds rather than something you can actually see the dramatic effects of, such as Ebola.

“Every year we have the World Health Assembly, which is where all 194 Member States come to Geneva and discuss health issues, focusing on what has been done and what needs to be done. This is an ideal audience to raise awareness, which is what we have been doing through special events like this one since the mid 80’s” says Lo Fo Wong.

“We have annual campaigns on hand hygiene on 5 May <sup>1</sup>, and we are collecting evidence to convince Member States, doctors, and pharmacies of the seriousness of the issue. We are also in a good position to collect best practice from one country and inform other countries there are solutions out there.”

WHO have been campaigning against this issue for many years and following World Health Day in 2011 it seems to have gathered global momentum. The slogan from that day reads “No action today, no cure tomorrow’. Following that campaign people started to see the urgency of the matter in terms of if we don’t take action today there will be no antibiotics to treat the future generations.

“In terms of action last year the World Health Assembly – where 194 Member States come together to discuss health issues – A number of countries proposed

a resolution, which included putting AMR back on the health agenda and calling for a Global Action Plan,” says Lo Fo Wong.

“The Member States asked WHO to draft this Action Plan, which will be presented during the next World Health Assembly this year. There have been action plans before, but the problem with previous ones is it put a lot of emphasis on what WHO should do and not what countries themselves should do.

“This is a global action plan, not a WHO action plan, with roles and responsibilities for Member States and other organisations, as well as more practical guidance on what needs to be done.”

As resistance continues to spread there is an urgent need for new antibiotics as well as better diagnostic tools. According to WHO, less than a handful of antibiotics are currently in the pipeline to combat antibiotic-resistant bacteria. Of course, we need to be smart about how we use these new antibiotics to avoid misuse happening again. Awareness campaigns such as European Antibiotic Awareness Day help to bring the issue to the forefront and will hopefully reduce the overuse of antibiotics, preventing this from being a future problem. ■

<sup>1</sup> <http://www.who.int/gpsc/5may/en/>

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# Drug Discovery Backwards?

It's not just human health that counts...

It's a fact that there has been slow-down in drug discovery and various reasons have been noted as contributors including an increasingly challenging regulatory environment, a lack of good druggable targets (all the easy ones having been done), increasingly challenging disease states associated with aging populations, a lack of good quality new chemical entities, and so on. Overall an intrinsically risky business has become riskier. It's entirely appropriate and understandable, therefore, that pharma companies should take serious steps to mitigate the risks and thereby increase profitability. My perception looking at several major pharma companies from the outside is that their response has been to put in place a system for drug discovery to which projects in that company must comply ticking the necessary boxes as they go. Usually this implies having a well-characterised pharmacological target (a receptor or enzyme) with an appropriate assay and then a sequential series of downstream assays in whole cells, serum, or blood before experiments are undertaken in animal models. That's a lot of work before you get to a proof of concept experiment in an animal model to show that your potential drug has a chance of working in the disease state for which it is intended.

In this situation, academic scientists can help in the early stages of drug discovery without compromising the rigour needed in a drug development programme and before the big financial commitments have to be made.

The pharmaceutical industry itself has made it clear for many years that despite its size it cannot do everything worth doing or interesting. It boils down simply to the academic sector fulfilling one of its prime roles, namely to create opportunity. This is where the title of this piece, Drug Discovery Backwards comes in; you can find something that works and then establish the underlying science. My point is that if you have discovered a group of compounds that really work from whatever source, they should be taken seriously as opportunities for new drugs.

This more open approach suits the academic environment and, of course, my own interests in heterocyclic chemistry which provides many of the compounds. A particular recent success of ours concerns immunomodulatory compounds that have efficacy in animal models of asthma, rheumatoid arthritis, lupus, and inflammatory bowel disease. You can read more about it in my web-book 'Chemistry, the Queen of Sciences' published by Adjacent Government. However it is proving difficult to find an industrial partner to take this work forward because, being a Drug Discovery Backwards project, it does not yet have all of the system components in place in order. For our projects and, I believe, for many other opportunities, we need better ways to match opportunity with development and route to market.

It's not just human health that's involved. In sub-Saharan Africa, for

example, many millions of people depend upon cattle for their livelihood. Too often, these animals are affected by the parasitic disease, trypanosomiasis, which leads to morbidity and mortality in the animals. There are old drugs to which the parasites are now showing resistance. With the help of colleagues at the University of Glasgow and the active participation of a company interested in animal health, we've been able to identify new compounds (heterocyclic compounds of course) with genuine potential to lead to new treatments. But we can't yet describe in detail the relevant biology and explain why the new compounds selectively kill the parasites and not normal animal cells. It's still Drug Discovery Backwards but now there's a company with vision alongside prepared to help us make the connections between the innovative basic science and the development of a medicine that could transform the economic situation in sub-Saharan Africa. That's well worth the effort.



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# Tackling antibiotic resistance

**Andrew Miller MP, Chair of the Science and Technology Committee sheds light on why the next government must make tackling antibiotic resistance a public health priority...**

**M**edicine could be 'cast back into the dark ages' by growing antibiotic resistance, David Cameron grimly warned last year. To see off the 'superbugs' the Prime Minister promised a review of the economics holding back research and development into new antibiotics. This is a welcome move, but the review will take almost 2 years to report back with recommendations before action is taken. Can we afford such a delay? The Science and Technology Committee, which I chaired until the dissolution of Parliament, examined the problem of antimicrobial resistance and found that Ministers could be doing much more right now to prevent the unnecessary prescribing of antibiotics across both health and veterinary services.

Whilst antibiotic resistance cannot be entirely prevented, it is a problem made worse by inappropriate use and poor stewardship of antibiotics in healthcare and farming. For too long, these drugs have been

used routinely by some as if they were cure-all miracle treatments. They are of course ineffective against viruses and other diseases that are not caused by bacteria and the unnecessary prescription of antibiotics has contributed to the acceleration of antibiotic resistance. We even heard stories of antibiotics prescribed by GPs simply to achieve a placebo effect or placate patients with distressing symptoms. In farming meanwhile, we suspect that antibiotics are being routinely used on healthy animals. Having said that, practices in other countries are sometimes even worse where valuable tools in the doctor's armoury are available over the counter thus increasing the likelihood of a resistance developing.

All levels of the NHS must be given clear responsibilities for stewardship of antibiotics and better monitoring and reporting put in place to bear down on unnecessary use of antibiotics. But fears were also raised during the inquiry that the massive restructuring of



the NHS may limit its ability to get to grips with growing antibiotic resistance in the short-term. The implementation of new structures and chains of command may exacerbate difficulties in limiting the unnecessary use of antibiotics. We recommended that the government outline, in its Action Plan for its Antimicrobial Resistance Strategy, how it will embed those responsibilities across all roles within the NHS and how compliance with its strategic goals will be monitored and reported. We also need to look carefully at how the pricing policy works with big pharma, this is an area within which we should incentivise research but be circumspect with prescribing.

There is circumstantial evidence that antimicrobial resistance can be transmitted from animal pathogens to human pathogens. The use of tetracycline antibiotics and penicillin in farming as growth promoters has been already banned and we were alarmed to learn that the total veterinary use of tetracycline's and penicillin type antibiotics has increased nearly tenfold and fivefold respectively. We have called on the government to take action to ensure the use of antibiotics in farm animals is strictly required for therapeutic use and that more research is carried out on the link between animal and human pathogens resistant to antibiotics.

Whilst efforts to protect existing antibiotics must remain a priority, policy must be evidence-based. There is a lack of data on the post-prescription behaviour of patients and we suggested that the government develops a system for monitoring this. What's more, we have little data about the environmental drivers of antimicrobial resistance and the potential for transmission of antimicrobial resistance between animal pathogens and human pathogens.

Worryingly Ministers are actually using this information gap to justify a lack of urgency. DEFRA Minister, George Eustice told us that "in the veterinary profession...there is less evidence of resistance developing". Taking comfort from "less evidence of resistance developing" in the absence of an adequate evidence base is disingenuous and verges on recklessness in my view.

We are not convinced that the department has made any real progress on plugging its antimicrobial resist-

ance evidence gap since our report in July last year, nor do we feel that it has a firm grasp on the extent of the work it has to do and the time it will take. Every year of delay takes us closer to a nightmare scenario where we are defenceless against common infections. What we really need from government right now is decisive and immediate action to prevent antibiotics from being given to people and animals who do not need them. Greater public awareness surrounding the necessity for better stewardship of antibiotics will be vital in achieving this and easing the pressure on practitioners to prescribe antibiotics. Ministers must set challenging targets for improvement of public awareness against which success may be measured and reported. We had good news earlier this year when a new class of antibiotic was discovered, that potentially provides more breathing room and, with better stewardship and improved incentives for drug development, we can tackle this problem. But urgent action is still required. I urge the next government to heed the warnings from Sally Davies and make antibiotic resistance a public health priority. ■



.....  
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# Advocacy and the Care Act 2014

**Des Robertson, Chief Officer at Advocacy in Somerset gives thought to the Care Act 2014 and its impact on advocates...**

**A**t the time of writing this article we stand on the cusp of the introduction of a powerful new piece of legislation in the form of the Care Act 2014 which has the potential for making a significant impact on the way that people are assessed and cared for by social care and health services. The ethos and philosophy that underpins this legislation is not new, its emphasis is on person-centred care and treatment and enhancing 'quality of life'. To those of us that work in the third sector, and particularly in advocacy, these notions are our raison d'être. Long have we worked and campaigned to ensure that statutory services respond to a person in terms of their needs and not in terms of what the service can offer.

While these notions have been embedded in previous policies, national service frameworks and the like, the Care Act positively demands a change in mindset so that the service user truly does sit at the centre of the care planning process. The difference this time is that, thanks to some successful lobbying by advocacy organisations during the development of the Care Act, this ethos is backed by a powerful mechanism to 'keep services honest' as it were, i.e. the statutory duty to involve an advocate when a person has 'substantial difficulty' in being involved in the process of assessment, planning and review and importantly during safeguarding investigations.

The reasons why services need this imperative are many and varied but it is interesting to reflect on the period we find ourselves in at this time. Particularly with regard to austerity measures and how these measures create huge tension between what is there in terms of ethos and intention and, what exists in terms of the ability to actualise the spirit of the legislation. It's not rocket science, austerity measures involve

cuts to budgets, which results in less staff or staff doing more for less which all creates a tension that mitigates against the fulfilment of the aim of the law.

On the ground we increasingly see social care and health staff being put under so much pressure that they become sick which reduces capacity even further. In order to assess, plan and review effectively time must be spent with people, time that many social workers don't have and there is no substitute for this. You only really get to know what a person needs when you take the time to find out. Much of this is also about a mindset which is not about money but there is no denying the economic pressures at this time and how they pull against the aspiration to work truly person-centred.

Advocates will be the safeguard here but it is essential that understanding of the advocacy role comes quickly. The advocate walks a tricky line between challenging services and enhancing their function. It is imperative that professionals assessing people for services embrace advocacy as a vital part of ensuring that the end product really does address a person's needs.



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# Tackling child mental health

**Dr Alistair Thomson, MindEd Consortium Executive and Fellow of the Royal College of Paediatrics and Child Health (RCPCH) details the importance of tackling the growing number of child mental health cases arising in the UK...**

**B**arely a day goes by without children and young people's mental health hitting the headlines. And all too often it is not for the right reasons.

Long waiting times, children being admitted due to inadequate community resources, children being placed in adult wards due to bed shortages and growing numbers of children being diagnosed with mental ill health to name just a few.

In recent months there have been reports of an increase in teenagers turning to self-harm with medications or implements. A study by Cardiff University <sup>1</sup> found that young people are using social media to share images of other people as well as themselves self-harming. The issue of self-harm was highlighted on a global scale in March as Zayn Malik of the popular pop group One Direction <sup>2</sup> announced his departure due to stress, resulting in thousands of 'One Directioners' taking to Twitter urging other fans to '#cut4zayn'.

The UK has one of the highest rates of self-harm in Europe. There has been a staggering 68% increase <sup>3</sup> in children and young people being admitted to hospital over the last ten years because of it. So what can we do to change this behaviour and ultimately reduce this statistic?

Educating children and young people early plays a vital role. That is why the Royal College of Paediatrics and Child Health (RCPCH) has called on all political parties to commit to making Personal, Social and Health Education (PSHE) lessons in all schools compulsory. It is a call which gained support from the Education Select Committee earlier this year as well as the Royal College of Nursing, the Faculty of Public Health, the Association of Directors of Public Health and the British Association for Sexual Health and HIV. The policy also received strong public support in a poll <sup>4</sup>

commissioned by the RCPCH in March this year – 82% of UK adults confirmed they would back such a measure.

## Working with professionals to improve children's mental health

However, it is not just through direct education of children and young people that children's mental health may be improved. Last year, the RCPCH, as host of a Consortium, was the venue for the launch of MindEd <sup>5</sup>. This e-learning resource is designed for anyone working with children and young people, (in particular those outside the health care professions), and aims to equip them with the skills needed to identify a young person at risk of developing a mental health problem at the earliest opportunity.

There are 850,000 children and young people with a mental health problem, yet 75% do not get the help they need. Part of the problem is that the people around them do not know what they need to look out for. A poll <sup>6</sup> commissioned by the MindEd Consortium last year highlighted this further. It found more than half of adults lacked the confidence to approach a child, or a parent of a child, whom they suspect to have a mental health problem, in case they are mistaken.

A year on, over 14,477 users have signed up across the professional spectrum, over 24,653 sessions of e-learning have been completed and a huge number of professional and voluntary bodies are weaving it into their CPD and training programs. But there is still a long way to go if we are to reach the 1 million adults who work with children and young people – a good place to start is in the classroom. For example, we know we have reached over 3,000 teachers and around 400 pre-school workers but with over 400,000 teachers in England alone, it is clear we've barely touched the tip of the iceberg.



We need to ensure those around children have the skills to spot the signs of a child in trouble. MindEd is a resource that is available now and will help do that. We have to ensure that schools – and others – know about it and use it.

### Supporting children early

Earlier this year, the Duchess of Cambridge added her voice to that of Royal Colleges, charities and campaign groups to raise awareness around children and young people's mental health. The Duchess supported charity 'Place2be's' launch of Children's Mental Health Week by releasing a video message <sup>7</sup> in which she talked about the number of young people struggling to cope with challenges of growing up in the world today: challenges like bullying, bereavement, domestic violence and family breakdown. She emphasised the need for early support for these children as many of these experiences can trigger mental health problems like self-harm, anxiety and depression.

Just 2 months after this message was released, the Department for Education has awarded the Consortium, again hosted by the RCPCH £560,000 <sup>8</sup> to continue the work of MindEd and develop a resource targeted at parents and carers. This will give them advice, information and guidance around children and young people's mental health. The e-learning will go live in 2016 and will address many of the issues the Duchess raised in her video message.

However, with increased mental health awareness comes an increased need for professional support. That puts pressure on an already stretched Child and Adolescent Mental Health Service (CAMHS) so it remains vital for Government to monitor and invest in this area.

### Investing at the right time and place

In the wake of the general election, we saw Coalition Government <sup>9</sup> commitments in England invest £1.25bn in mental health services, with £250m being targeted at children's mental health over a 5 year period. This was backed up with Future in Mind, which sets out a comprehensive strategy to promote, protect and improve children and young people's mental health and wellbeing. Great news for CAMHS but this money

must be spent in the right places – something the RCPCH has called on the next government to prioritise.

The RCPCH's 'Vision 2015' <sup>10</sup> document calls on all political parties to commit to run a regular B-CAMHS survey to identify the individual need for services around the country and to develop a mental health action plan to encourage early intervention. Only by doing this can we target those most in need and begin to transform negative headlines into positive stories.

Our message to policy makers is a clear one. To reach the thousands who turn to self-harm and others struggling with growing up in the world today, we must educate young people early, assist those caring for them to help them to the best of their abilities, and ensure additional support for CAMHS is targeted at those areas which need it the most. ■

<sup>1</sup> <http://www.bbc.co.uk/news/uk-wales-31878391>

<sup>2</sup> <http://www.dailymail.co.uk/tvshowbiz/article-3011449/Hysterical-One-Direction-fans-spark-concerns-self-harming-disturbing-hash-tag-trends-Twitter-Malik-quits-chart-topping-boyband.html>

<sup>3</sup> [http://www.youngminds.org.uk/training\\_services/policy/mental\\_health\\_statistics](http://www.youngminds.org.uk/training_services/policy/mental_health_statistics)

<sup>4</sup> <http://www.rcpch.ac.uk/news/nine-ten-britons-call-children%E2%80%99s-healthcare-be-priority-nhs>

<sup>5</sup> <https://www.minded.org.uk/>

<sup>6</sup> <http://www.rcpch.ac.uk/news/thousands-young-people-risk-%E2%80%98slipping-through-net%E2%80%99-due-adults%E2%80%99-lack-mental-health-awareness>

<sup>7</sup> <http://www.place2be.org.uk/our-story/news/hrh-the-duchess-of-cambridge-supports-uk%E2%80%99s-first-children%E2%80%99s-mental-health-week/>

<sup>8</sup> <http://www.rcpch.ac.uk/news/rcpch-wins-%C2%A3560000-support-childrens-mental-health>

<sup>9</sup> <http://www.rcpch.ac.uk/news/rcpch-responds-%C2%A3125b-boost-mental-health-services>

<sup>10</sup> [http://www.rcpch.ac.uk/system/files/protected/page/RCPCH%20Child%20Health%20Manifesto%20WEB\\_0.pdf](http://www.rcpch.ac.uk/system/files/protected/page/RCPCH%20Child%20Health%20Manifesto%20WEB_0.pdf)

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# Dementia – Living together

People with and without dementia share a common world. Yet, their daily lives are mostly separate. The challenge, however, is not to ignore the up to 1.5 million people suffering from dementia and their families in Germany, of which 80,000 are living in Rhineland-Palatinate. We have to understand them as a self-evident part of public life and should integrate them into the community.

This is especially necessary in view of the demographic change. Fortunately, we will all grow older in future. Thus, the number of people suffering from dementia will inevitably rise. The number of dementia cases is expected to double until 2050. Therefore, we have to ask ourselves how we can support and manage social participation for people with dementia and their families, and how we can succeed in living together as one society.

The “Forum for Dementia” is a common work group of the regional care conferences of the district of Südliche Weinstraße, and the city of Landau based on the care infrastructure planning of the government of Rhineland-Palatinate. The Forum is based on the Rhineland-Palatinate Dementia Campaign, which was started in March 2004 by the Minister-president of Rhineland-Palatinate and the Ministry of Labour, Social Affairs, Health, Family and Women under the “Menschen pflegen” (“Caring for



Partners of the dementia campaign in Rhineland-Palatinate that was started in 2004

people”) initiative and other partners. The campaign is implemented by the Landeszentrale für Gesundheitsförderung in Rheinland-Pfalz e.V. (Regional Center for Health Promotion in Rhineland-Palatinate).

The Forum was founded in 2008 during the regional care conference of the district of Südliche Weinstraße. In May 2010, the first common meeting with the members from Landau was held. Now, it is also part of the “Landes-Netzwerk Demenz” (Dementia Network in Rhineland-Palatinate), also initiated by the Minister-president of Rhineland-Palatinate.

The forum helps to inform the public and dilute fears regarding dementia. It aims to make consultation and health care structures more transparent and easily accessible for both the persons

concerned and their relatives. Thus, missing offers can be identified faster and initiated accordingly.

All the members of the “Forum for Dementia” work in areas entrusted with the care of people suffering from dementia. Among them are the Regional Center for Health Promotion in Rhineland-Palatinate as a supporting body, the local representatives of the district of Südliche Weinstraße, and the city of Landau as well as the Rhineland-Palatinate Alzheimer Society. Additionally, nursing homes for the elderly, care support centers, Pflzkl-nikum with its hospitals for gerontological psychiatry and neurology and the Pflzkl-nikum day-care center for the elderly can be named.

After the foundation of the “Forum for Dementia” the preparation of a guide



for the region was particularly important. This guide will raise awareness, inform about dementia and provide an overview of the existing out-patient, day-care and in-patient offers.

### **Dementia guide 2014**

Due to great demand, the Dementia Guide of the "Forum for Dementia", District of Südliche Weinstraße – City of Landau, is currently out of stock and being updated. New offers for ill citizens in the district and the city have been added, especially in the field of hourly-based care and day care.

At present, the Federal Government is launching a law on strengthening care. For January 2015 an adjustment of the long-term care benefits including increased payments is planned. Therefore the new edition of the guide will not be available prior to spring 2015.

### **Zoo project**

The Landau zoo project is probably a unique project in Germany. In in-patient facilities animals have become a familiar sight by now.

The positive response triggered off by animals is effectively used to heal or at least relieve symptoms.

Because of last year's favorable feedback the members of the "Forum for Dementia", District of Südliche Wein-

straße – City of Landau, and the Landau Zoo School want to organise more exciting afternoons in the Zoo for people with dementia and their relatives.

### **Symposium at Pfalzlinikum in 2015**

For the first time the "Forum for Dementia", together with the Pfalzlinikum – Service Provider for Mental Health, is planning to organise a symposium. During the all-day event interesting subjects about the care and support of people suffering from dementia primarily in old people's homes and hospitals will be covered. Apart from many other interesting speakers, Bettina Rudert and Bernd Kiefer will hold a 2-hour lecture on "The therapeutic table visit – the esteeming short-term activation as a method of prevention and escalation". These 2 lecturers are highly esteemed among experts.

With this symposium, professional care-givers living in the district of Südliche Weinstraße and the city of Landau are given the opportunity by the "Forum for Dementia" to undergo professional training not far away from home at Pfalzlinikum.

The symposium will take place on March 4, 2015. The detailed program will be announced in due time by public relations.

### **Pfalzlinikum – Service Provider for Mental Health**

Rudolf Lentz, Social Worker (MA) (Author), "Forum for Dementia", Clinic for Geriatric, Psychiatry, Psychotherapy and Psychosomatics

Dr. Markus Fani, Medical Director – Clinic for Geriatric Psychiatry, Psychotherapy and Psychosomatics

Sven Kaufmann, Head of Nursing Staff, Clinic for Geriatric Psychiatry, Psychotherapy and Psychosomatics

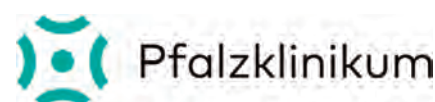
Rita Becker-Scharwatz, Director, Day Care Center "Living with Dementia", a Facility of "Care – Foster – Life – community-based services"

### **District Administration of Südliche Weinstraße**

Heike Neumann, Office for Health and Social Affairs

### **Municipal Administration of Landau**

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# Managing wounds as a team

**Professor Zena Moore, from the European Wound Management Association (EWMA) identifies the benefits of wound care teams for patients and healthcare professionals...**

**F**rom a wound care perspective, the growing prevalence and incidence of non-healing acute and chronic wounds is a worrying concern. Indeed, the incidence of wounds in the EU-27 is approximately 4 million, and furthermore 2 million patients acquire hospital acquired infections each year.<sup>1</sup> It is estimated that more than 23% of all hospital in-patients have a pressure ulcer and most pressure ulcers occur during hospitalisation for an acute episode of illness/injury.<sup>2</sup> The cost of just one problematic wound is between 6.650-10.000€ per patient, and the total cost of wound care accounts for 2-4 % of European health care budgets.<sup>3</sup> Further, 27-50% of acute hospital beds are likely to be occupied on any day by patients with a wound.<sup>3</sup>

One of the biggest challenges in wound care is the lack of united services aimed at addressing all the health care needs of individuals with wounds.<sup>4</sup> The WHO argues that professionals who actively bring

the skills of different individuals together, with the aim of clearly addressing the health care needs of patients and the community, will strengthen the health systems and lead to enhanced clinical and health related outcomes.<sup>5</sup>

However, despite some evidence<sup>6,7,8</sup> the use of focussed interdisciplinary wound care teams is lacking within the literature, with disparity existing as to what exactly the term “interdisciplinary” means, and who exactly is eligible to be a member of this care team.<sup>9</sup>

## Objective

The overarching objective of this project was to provide recommendations for implementing a team approach to wound care within all clinical settings and through this to develop a model for advocating the team approach toward decision makers in national government levels.

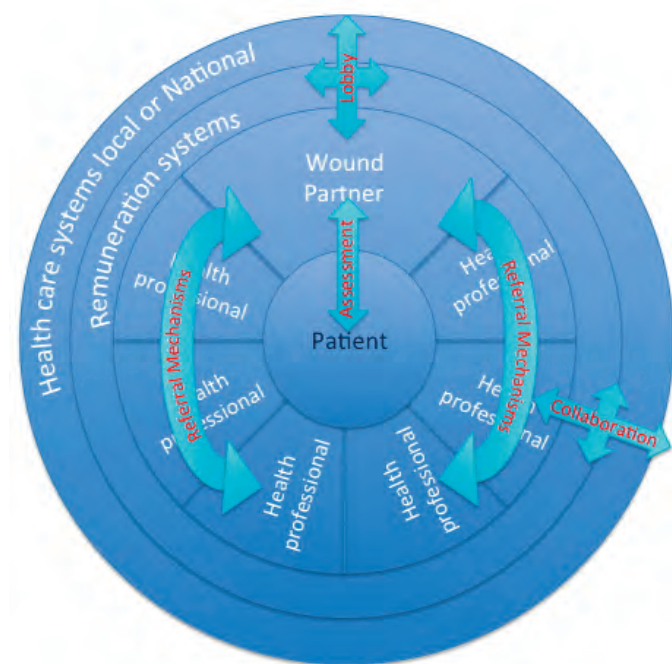


Figure 1 – Essential elements in an interdisciplinary wound care service

## What we found

A review and analysis of 18 years of literature related to managing wounds as a team reveals a consistently increasing evidence to support a team approach. When analysed according to wound types, literature related to diabetic foot ulcers comprises the largest body of knowledge, with many retrospective and prospective reviews of long term programs, all demonstrating a positive team effect. Outcomes related to leg ulcer team care is supported by the highest quality of evidence. Pressure ulcer team benefits are mostly supported by descriptive reports of program outcomes. The team effect on chronic wound care is supported by a systematic review with emerging additional literature describing positive effects from care delivered by teams in dedicated wound centres.

Outcome measures for all wound types are generally related to wound healing and amputation rates with some additional qualitative, quantitative and patient centred endpoints. All outcomes have been reported positively, with no reports of negative consequences of a team intervention. Furthermore, the use of a team approach has been demonstrated in all health-care settings across the continuum. Overall, study populations have been representative of the wound population at large. In addition, methodological

issues are reflective of the research limitations and challenges in wound research as an aggregate.

Additional research is needed to clearly demonstrate the effect of the team approach to wound healing, particularly relating to financial and clinical outcomes, owing to the current challenges regarding reduced health budgets. Patient sensitive outcome measures should also be investigated with specific focus on patient safety. Finally, exploration of the inter-professional educational opportunities in wound care will help differentiate the skill set required to maximise team function.

## Universal Model for the Team Approach to Wound Care<sup>10</sup>

It is obvious that a ‘one model fits all’ approach to building a team for the provision of wound care is unrealistic. Available resources, access to relevant expertise, remuneration provisions and patient populations will always be context specific. It is evident however that the inclusion of key elements within wound care services will foster collaborations between different health care professionals and keep the needs of the patient at the forefront. The elements are depicted in Figure 1 and described below.

The patient forms the focus of the care but relies on the expertise of a wound navigator to organise wound care service via established referral mechanisms. The wound navigator and other health professionals either collaborate to explore beneficial remuneration and health care systems and/or lobby to meet the needs of the patient.

In summary, we believe that effective management of wounds as a team requires the development of 5 essential elements:

- A patient focus using an advocate for the patient – wound navigator;
- Referral mechanisms that are responsive;
- Aggregation of assessment data to form a single plan;

- Appropriate remuneration systems;
- A health care system sensitive to team models.

Each element can be realised either via health care system reform or local collaboration. It has been suggested that clinicians interested in establishing wound team services begin at the local level by assuming the role of wound navigator. Interested clinicians could generate a list of local services, collaborate with identified services to develop referral mechanisms, aggregate assessment data collected by the services into a care plan, explore options for better utilisation of existing remuneration schemes to fund the identified patients need, and collect data that supports the benefits of the wound team approach highlighted in the literature. Over time the local initiatives suggested have the potential to grow into a 'groundswell' of evidence that can be used to lobby government to instigate needed health care reform.

## Conclusion

We advocate that the patient should be at the heart of all decision-making, as working with the Universal Model for the Team Approach to Wound Care, which begins with the needs of the patient. To facilitate this, we suggest the use of a wound navigator who acts as an advocate for the patient. ■

For more guidance on how to adopt this approach please refer to the original Position Document: Managing Wounds As a Team<sup>10</sup> which can be downloaded via [www.EWMA.org](http://ewma.org/english/publications/ewma-documents-and-articles/managing-wounds-as-a-team.html) using this link: <http://ewma.org/english/publications/ewma-documents-and-articles/managing-wounds-as-a-team.html>

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This article is based on the Position Document Managing Wounds as A Team initiated by the Association for the Advancement of Wound Care (AAWC-USA), the Australian Wound Management Association (AWMA) and the European Wound Management Association (EWMA) and realised in collaboration with The International Working Group on the Diabetic Foot (IWGDF). The overall aim of this Position Document was to provide a universal model for the adoption of a team approach to wound care.

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# ACHIEVING THE IMPOSSIBLE: 310 DAYS PRESSURE ULCER FREE

## The prevailing pressure ulcer crisis

Globally, **pressure ulcers affect 15.3% of patients**, across a variety of care settings<sup>1,2,3,4,5</sup>. 20-25% of beds are occupied each day by patients with pressure ulcers<sup>6</sup>. 60-80% of these are hospital acquired<sup>6</sup>. The cost to treat an individual ulcer ranges from £1,064-£1,551<sup>7</sup>. **Pressure ulcers cost the NHS an estimated £1.4bn-£2.1bn** annually (4% of total expenditure)<sup>7</sup>.

Mölnlycke Health Care through research and product development have introduced a solution proven to help reduce the risk and occurrence of avoidable pressure ulcers. Prof. Nick Santamaria's RCT shows a **76% fall in incidence of hospital acquired pressure ulcers when using dressing in prevention**<sup>8</sup>. Our dressing Mepilex® Border Sacrum has been demonstrated to impact four extrinsic factors that can contribute to developing pressure ulcers; these being to redistribute shear, redistribute pressure, reduce friction, and to maintain an optimal microclimate<sup>9,10,11</sup>.



University College London Hospital, Critical Care Unit have demonstrated a significant decrease in pressure ulcer incidence and prevalence.

The unit is a 35 bedded multi-specialty facility which accepts level 2-3 critically ill patients. The unit receives elective and emergency surgical admissions and emergency admissions via the wards and the accident & emergency department. The workforce comprises 200 whole-time equivalent nurses & nursing assistants, and a multi-disciplinary team of approximately 50.

Given the risk factors that most Critical Care Unit (CCU) patients present with, a rapid and immediate assessment of patient risk is required in order to ensure that these potential or actual risks are alleviated as far as possible.

After discussion amongst members of the multidisciplinary team at UCLH, it was agreed that given the need to reduce the number of pressure ulcers on their unit (19.9 acquired PUs per 1,000 in 2011)<sup>12</sup>, and various local and national quality drivers, they would explore a 'whole team' approach to pressure ulcer prevention, including the prophylactic use of dressings on sacrum and heels.

There were a number of outcomes that they wanted to achieve:

- **Eliminate all pressure ulcers on UCLH Critical Care Unit**
- **Embed a culture of candor and harm free care within the Multi-Disciplinary Team**
- **Embrace Quality Improvement methodology**
- **Improve and support teamwork and communication**
- **Improve the patient experience and outcomes**

UCLH set about achieving their outcomes by developing an all encompassing intervention protocol that demonstrated a shift in culture from cure to prevention. The nurses use their clinical judgment on a minute by minute basis to assess the level of risk. They discuss their mistakes, celebrate their successes and have introduced Bay Safety Huddles which encourage staff to question the needs and individual risks to each patient. The final piece to their intervention protocol was the prophylactic use of dressings.

A Mepilex® Border Sacrum Dressing is applied to all level 3 patients, high risk patients or anyone that is of concern. The dressing is peeled back once per shift and the sacrum inspected by two nurses, and the dressing changed as required.

These changes in practice helped pressure ulcer incidence in their critical care unit to decrease from 19.9 per 1,000 patient population to 0.84 per 1,000 patient population in 2014<sup>13</sup>. Incredibly, they went **310 days pressure ulcer free!**

**Watch this short video below, to hear from Elaine Thorpe, Critical Care Matron, University College London Hospital**



Mölnlycke Health Care is a global provider of healthcare solutions. We have two complementary areas of focus, Wound Care and Surgical Solutions, both which work in parallel to benefit patients and healthcare professionals alike. Mölnlycke Health Care has a history of developing innovative wound care dressings for nearly 70 years. Over that period our aim has been to improve the quality of life for millions of people.

We offer support to the health care sector in a variety of different ways; to name a few we aim to provide our customers with clinical education and resources, most

of our solutions come complete with a wide range of evidence, both clinical and value justification and we aim to support in controlling costs and meet financial objectives. We work with NHS Establishments individually and help them meet the challenges that they are facing so that the quality of care that a patient receives remains best in class.

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- <sup>13</sup> University College Hospital London, Pressure Ulcer Incidence, 2014



**Figure 1. Mepilex® Border Sacrum**

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# Working towards quality patient care

**Rachelle Kaye and Diane Whitehouse from the European Health Telematics Association (EHTEL) outline how effective organisation and leadership in telemedicine can benefit patients...**

**T**elemedicine has been hailed by the European Commission as one means of tackling the challenges to Europe's healthcare systems. It can help handle changing demographics, the growing prevalence of chronic diseases, shortages in human resources in healthcare, and increased demands from patients for more quality in the provision of healthcare services.<sup>1</sup> There is evidence that, when combined with proper organisation, leadership and skills, telemedicine and innovative Information and Communication Technologies (ICT) can provide significant benefit to individual patients. Telemedicine can support improvements in patients' health and quality of life, particularly for people with chronic diseases, by enabling safer monitoring at home and reducing hospital visits.<sup>2</sup>

## **EHTEL**

The European Health Telematics Association (EHTEL) is a pan-European multi-stakeholder forum, founded in 1999. It has a growing membership of more than 50 organisations. It is dedicated to the improvement of healthcare delivery through eHealth. EHTEL has put the promotion of telemedicine high on its agenda: the organisation is convinced that telemedicine can enable elderly and chronically ill people to live high-quality, independent lives in the community.

## **MOMENTUM**

As just one expression of this commitment, EHTEL has coordinated a Competitive and Innovation Programme thematic network project<sup>3</sup> called European MOMENTUM for Mainstreaming Telemedicine Deployment in Daily Practice, which was completed in February 2015.

MOMENTUM was carried out by a consortium of 20 organisations, including telemedicine associations

and competence centres from Denmark, Estonia, France, Germany, Greece, Israel, Netherlands, Norway, Poland, Spain, Sweden and the United Kingdom. Its member European stakeholder associations represented health professionals, health care organisations, health insurers, and technology vendors. MOMENTUM concentrated on addressing the needs of "telemedicine doers", people who are actively involved in deploying telemedicine. 'Doers' may be leaders in health or care authorities, hospital managers, public administrator's clinicians, entrepreneurs and business executives.

## **The blueprint**

MOMENTUM gives telemedicine users a blueprint for how to successfully scale up telemedicine projects. The blueprint shows how to deploy these initiatives as part of routine healthcare services. It is based on 18 critical success factors that were identified by analysing 30 telemedicine services. At its core, the MOMENTUM blueprint provides a set of guidelines and indicators. They are intended to help users to build their own telemedicine action plans so that they can deploy telehealth both in routine care and on a large scale.

## **Case studies**

Among the services analysed by MOMENTUM were the Maccabi Telemedicine Center for Chronic Patients (MOMA) in Israel. Maccabi has clearly shown that it has helped patients to cope with their disease better, reduced depression, improved healthy lifestyles, and reduced hospitalisations. Another example was the ITHACA Programme – 'Intervention of Treatment of Hypertension Arterial in Catalonia' – that provides telemedicine services for chronic hypertensive patients in the Catalan region. Both are established services that support routine care.



**MOMENTUM****CRITICAL SUCCESS FACTORS**

- Ensure cultural readiness for the telemedicine service;
- Come to a consensus on the advantages of telemedicine in meeting compelling need(s);
- Ensure leadership through a champion;
- Involve healthcare professionals and decision-makers;
- Put the patient at the centre of the service;
- Ensure that the technology is user-friendly;
- Pull together resources needed for deployment;
- Address the needs of the primary client(s);
- Prepare and implement a business plan;
- Prepare and implement a change management plan;
- Assess the conditions under which the service is legal;
- Guarantee the technology has the potential for scale-up;
- Identify and apply relevant legal and security guidelines;
- Involve legal and security experts;
- Ensure that telemedicine doers and users are “privacy aware”;
- Ensure that the appropriate information technology infrastructure and eHealth infrastructure are available;
- Put in place the technology and processes needed to monitor the service.

**Guidelines and workshop training**

To make the MOMENTUM guidelines even more practical and ready for use, they were combined with a Telemedicine Readiness Self-Assessment Tool (TREAT)<sup>4</sup>. The MOMENTUM-TREAT Toolkit is composed of the 18 Critical Success Factors. Each success factor is accompanied by performance indicators in the format of an online questionnaire. The indicators measure to what extent each success factor is present in a particular telemedicine setting. The results of the survey are processed electronically. They serve as the basis for a facilitated workshop, where all the key stakeholders in a telemedicine setting meet together. The activity is designed to help them achieve consensus on gaps, potential barriers, and an agreed action plan for deploying the telemedicine service. The MOMENTUM-TREAT toolkit has been successfully used in a United4Health<sup>5</sup> project setting in Kristiansand, Norway and, more recently, at a national level tackling telemedicine strategies in Scotland. ■

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<sup>3</sup> <http://ec.europa.eu/cip/>

<sup>4</sup> Developed as part of the Renewing for Health Project <http://www.renewinghealth.eu/en/home>

<sup>5</sup> <http://united4health.eu>



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# Main strategies in active and healthy ageing in Europe

## The importance of identifying the users groups and their profiling

**A**ctive and Healthy Ageing (AHA) is a main direction in the HORIZON2020. One of the basic tasks is to face the challenge of turning existing research efforts to reality for healthy and chronic diseased elderly people across Europe. Existing flexible ICT solutions could assist elderly users in organising, carrying out and completing daily tasks and functions having been part of their life for years and provide essential stability and adjustment factors for continuing to be and feel independent. Thus, within AHA we will need to develop all-around, personalised, multi-faceted existing ICT solutions and services addressing diverse daily activities (shopping, eating, physical activity, commuting, mental stimulation, communication, social interaction, etc.) to elderly users taking largely into account cognitive impairments and their carers living in their own home or in care centres.

### Current practices

As aforementioned, ICT solutions are existing applications and services which will be improved and most solutions are considered to be at technology readiness level 7 and above. Several solutions are already commercial or open source products and available for use and others were developed within the framework of European projects and are prototypes.

It is expected that we start from a relative mature level 5 (levels: 1-9) for the

majority of tools and we anticipate to reach a TRL of 7 more for around 75% of tools within the next 7 years.

It is clear that the needs and requirements for the addressed user groups at an early stage of developing chronic diseases or changing states in their organism functioning are essential and are a cornerstone within an extended and flexible evaluation framework.

For example in the case of cognitive impairment, the main user groups are:

#### 1. Mild Cognitive Impairment (MCI)

people are usually elderly who have lost cognitive functioning on at least one aspect, with no sign of dementia, and who still function in daily activities. People with MCI are estimated to account for 20% of the elderly over 65. ICT solutions as interventions might have more potential for people with mild cognitive impairment, as these are still in the early stages of forgetting and are still active, eager, and can learn new functionalities.

**2. Early stages of Dementia**, people have been diagnosed with dementia but they are still maintaining some aspects of their daily functions (early signs of dementia are apparent) and users have been diagnosed by specialists (i.e. neurologist, neuropsychologist) and might be under medication. The improvement in daily functioning is usually rather limited compared to

the deteriorating effects of the disease. Since early and moderate dementia users can still carry out certain activities with assistance.

**3. Cognitive impairment as a co-morbid condition**, users with other conditions and diseases with cognitive impairment as a co-condition is a common situation among the elderly. Increased medical co-morbidity is evident in elderly. High rates of medical co-morbidity are evident in elderly living at large urban areas due to low socio-economic status (SES) and poorer access to health services.

**4. Caregivers**, either formal (i.e. healthcare, social, etc.), or informal (i.e. family members and friends) that need to be empowered with knowledge and tools to support the elderly in their everyday life activities. Informal caregivers often struggle combining work and caring for their relatives, resulting in strains on their own health and coping mechanisms.

In addition, there are many **stakeholders** with an interest in, but not a direct involvement in day-to-day care provision. Some main stakeholders, are described briefly below:

**Regulatory authorities on local, national or international level**, regulating a wide range of aspects from device safety and essential performance, via legal, ethical and privacy related issues. This group

includes an Ethics Control Board with external expertise and representatives from all the pilot sites for ensuring applicable regulations are respected.

**User interest organisations** work to serve the interest of their members. This group involves care centres and organisations for elderly people and dementia centres with experience in working with and for users with cognitive decline.

**Standardisation bodies** are organisations that define how AAL care systems should work in a consistent manner (i.e. members of Continua Alliance). Furthermore, another important standardisation body is INFOTERM, aiming to promote and support standardisation actions in the AHA area.

**Public bodies, insurance companies and care organisations** are important as they define care standards offered and the reimbursement levels provided. We need to interface these stakeholders primarily via on-site care centers, outpatient clinics, hospitals, organisations, dementia research centers and their networks.

It is in the domain of consumers' study that the move away from the 'medicalisation' has been more radical with the introduction of the concept of **resilience** in opposition to that of frailty. The concept of resilience can be defined and measured along two dimensions: a) capacity to function in terms activities of daily life or of disability-free status; and b) Socio-Economic Status (SES), where we include not only more tangible dimensions (income, education attainment) but also social support and networks.

Using these two dimensions we can determine the taxonomy. We identify four archetypes (so in qualitative and ideographic fashion) that have different needs, should be the target of different interventions, and possibly of more granular monitoring indicators. For the sake of simplicity we describe the four segments considering the extreme (low/high) and neglecting the nuanced and intermediate situations.

**Dependent.** These are individuals with low SES and with poor health severely hampering the capacity to function. They may also suffer from isolation and lack of social support, which means little or no access even to informal care. They need public support for immediate care.

**Assisted.** These are individuals with good SES yet suffering from health related limitations. Since they can afford it, they are likely to seek quality of life improvements and can afford to buy care and other support, or can rely on social support and networks. They can potentially demand and pay for assisted living and other aides to independent life. They may be the target of some of the services that can be brought to market and can afford to pay for them.

**At risk.** These are individuals with low SES but holding onto normal life due to their good health status enabling resilience at least in one dimension. They are at risk in the sense that lack of SES resources may bring them easily in the condition of the dependent elderly, when and if, a health problem emerges and limits their functioning capacities. They may be the target of pre-empting public policies such as for instance health

awareness and prevention services or skills building measures

**Active elderly.** These are individuals with high resilience they are ageing well and actively and we could also call them the 'discerning old'. They are likely to seek quality of experience and demand for luxury goods and leisure such as smart homes.

Based on the above baseline for user profiling, the main innovation that is needed is to estimate the real life depiction of a large-scale effort to estimate the potentially positive effect of ICT solution on AHA such as in cognitive decline and multi-morbid elderly for statistically adequate number of users which reflect the diversity of real users with actual cognitive impairments for a long period of time. Ensuring the inclusion of significant indicators for assuring successful assessment and investigation of the Quality of Life indicators ensures the extrapolation of findings and the viable transfer of knowledge to business modelling and health service provision with measurable and generalisable indicators as ROI and SROI have been accepted to be.



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# Network Convergence

**Voice and data convergence, also known as Network Convergence refers to the provision of telephony, video and data communications services over a single network.**

Traditionally, for many decades, voice and data services have been provided by separate infrastructures both internally and externally to an organisation. Voice services were, and still are to a large extent provided by circuit switched technologies. This means that when a telephone call is made a circuit with dedicated bandwidth is opened between the source and destination of the call. This provides a very reliable connection, but it is inefficient in bandwidth usage (the circuit remains open even if there is silence on the call). Circuit switched networks are unsuitable for data communications because of the inefficiency, which is why packet switched technologies were developed starting in the 1960's to support computer to computer communications.

Historically, speech communication dominated business interactions, but today businesses and customers demand a plethora of different types of business to business and business to customer interactions including voice, email, SMS, web technologies. Sophisticated, high speed converged data networks have been developed to support these interactions.

## Technology and business drivers for network convergence

Technically, voice processing has become less of a challenge to support within modern data networks. The standardisation and wide spread adoption of the Session Initiation Protocol (SIP) has been key to enabling voice to be successfully integrated into data networks. However, the key inhibitor for voice integration into data networks in the early 2000's has been the lower reliability – or perceived reliability of data networks. Yes, it was technically feasible, but data networks were simply not as reliable as traditional circuit switched telephony.

So, it is the improvement in reliability of data networks in the last decade that has truly enabled network convergence to be a realistic goal for enterprises. The reliability of a network can be measured by:

- Quality of Service – Converged networks must have predictable delay, jitter and latency.
- High availability – Converged networks must target availability levels equivalent to ISDN systems which are exceptionally reliable.

**The business driver and the real prize for implementing a converged network is the cost savings of maintaining a single network infrastructure which support all media types.**

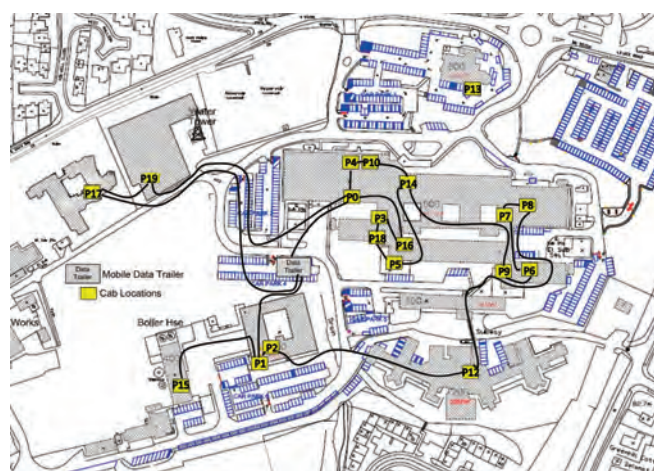
## Implementing converged networks

In a series of articles, we will explore various aspects of implementing a fully converged network by reference to an example of an acute NHS hospital trust making the transition towards convergence:

- Infrastructure resilience
- Converged network architecture
- IP telephony in the cloud
- Ultra high WAN resilience

### Infrastructure resilience

The trust's data infrastructure comprises a central data centre housing core network and server infrastructure with approximately 20 communications hubs around the hospital housing edge switching equipment and patch panels for connecting end user devices.



### Security and environment

Very often, especially in older buildings, data networks were not planned into the buildings from the start. Sometimes communication hubs can be found in cupboards, riser rooms, loft spaces and other locations which are not ideal for active equipment. It is usually expensive and impractical to move a communications room, but as a minimum, air conditioning and security must be addressed to provide a truly high availability converged network. Our upgrade program specified air conditioning with temperature and humidity monitoring as well as secure swipe card access for all communications hubs.

### Fibre resilience

Prior to the upgrade, each hub was connected back to the data centre via 1Gbit fibres. The trust had suffered some data outages when fibres were broken during refurbishment work as workers accidentally cut through unmarked fibre routes.

A new fibre infrastructure was specified and deployed using armoured 10Gbit fibre in a ring architecture so that each communications hub had 2 diverse routes back to the data centre (Fig x). This means that two fibre breaks are needed to isolate a communications hub and it has therefore dramatically reduced the possibility that a communications hub can become isolated by a fibre failure.

## Power resilience

Probably the most common cause of failure of a communications hub is loss of power. Although, in this case study, the entire hospital was backed up by generator, isolated fuse board failures were a significant cause of loss of service. This is an important point when comparing service levels for separate voice and data infrastructures. Typically, traditional voice services are provided directly from the data centre or telecommunications hub without the need for active hubs (that have risk of power failure) for distribution. In order to achieve equivalent resilience in a converged data network it is important to ensure there is resilient power supply at each active hub.

In our case study example, each hub was upgraded with power feeds from two separate distribution boards. In addition, two UPS units were installed in each hub and redundant power supplies fitted to all installed data switches.

## Security and environment

Very often, especially in older buildings, data networks were not planned into the build from the start. Sometimes communication hubs can be found in cupboards, riser rooms, loft spaces and other locations which are not ideal for active equipment. It is expensive to move a communications room, but as a minimum, air conditioning and security must be addressed to truly provide a high availability converged network. Our upgrade program specified air conditioning and secure swipe card access for all communications hubs.

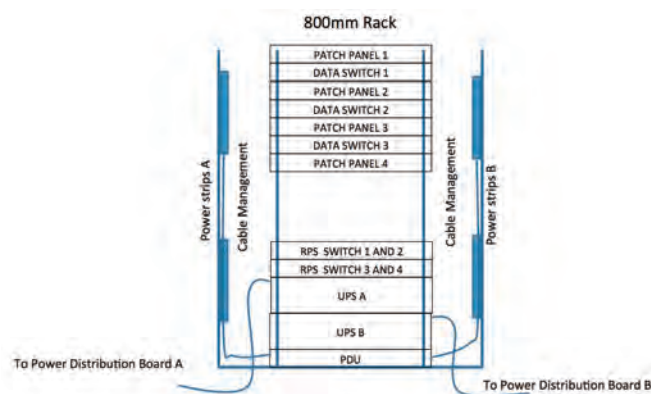
## Network monitoring

Usually, a large organisation will have an internal IT help desk which responds to calls from users regarding service disruption. However, it is possible to monitor converged networks very closely these days. In our case study example, we installed a network monitoring system to monitor vital signs not only in the data centre itself, but also in the every communication hub around the hospital trust. As a minimum, the following vital signs are monitored at each communications hub:

- Temperature/Humidity
- UPS health
- Dual 10Gbit fibre links back to data centre
- All data switches
- Data switch power supplies
- Wireless access points

When redundancy is built in to a network it is, in fact, essential to monitor both the primary and backup functions. If this is not done it is possible, for example, for a primary power supply to fail without any impact on service because the back power supply takes over. However, the loss of resilience must be detected by network monitoring and restored before the backup system fails.

The result of comprehensive service monitoring is that the IT department are usually aware of any service disruption before the first help desk call is received from an end user. This leads to faster time to fix and a better service to end users.



The figure above shows a standard communications hub rack layout fed from two separate power distribution boards, with dual UPS, data switches, RPS units to provide backup power to the data switches, patch panels and horizontal cable management panels and vertical cable management trays.

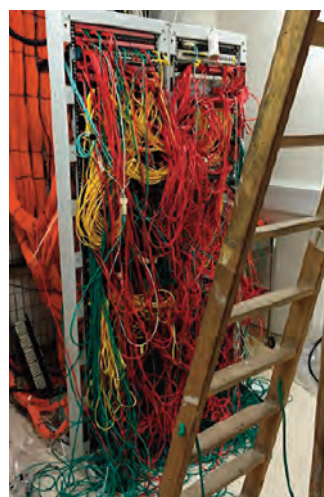
## Finally, please keep it tidy!

Day to day maintenance of a communications hub is kept much easier if short, colour coded patch cords are used to patch from data switches to patch panels. It is good to specify a different patch cord colour for each function. IT engineers can see at a glance what function each patch cord is performing. An example colour code is provided below:

Function	Patch cord colour
Data + IP voice	RED
Analogue Voice + Fax	GREEN
Wireless	BLUE
Medical/ Patient monitoring	ORANGE
Cameras and Access Control (security)	MAUVE
Third Party Equipment	GREY

Appropriate patch cable lengths should be used. Too often we see 3m patch cords where 0.25m will do. The two photographs below show a communications hub before and after the upgrade process. I hope the comparison speaks for itself!

## BEFORE



## AFTER



# Telehealth – empowering patients

**Nichola Arathon, Principal Programme Lead at NHS Dorset Clinical Commissioning Group describes how telehealth has the potential to transform healthcare...**

NHS England's ambition through the Technology Enabled Care Services (TECS) programme is to 'create the right commissioning environment that supports and encourages the innovative use of technology to improve health outcomes for patients with long term conditions and deliver more cost effective services'.

Technologies such as telehealth have the potential to transform the way people engage in and control their own healthcare, empowering them to manage it in a way that is right for them.

Telehealth helps to reduce non-elective/unplanned hospital admissions for patients, offer care closer to home and assist with directing clinical resources where they are most beneficial/required. Telehealth compliments other interventions provided by the patient's Key Health Worker (KHW) by remotely monitoring a daily or weekly sequence of questions relevant to the patient's condition alongside testing for vital signs such as Blood Pressure/Temperature/Pulse/Oxygen and Weight.

The aim is for patients and carers to feel empowered in managing their long term health condition, safe in the knowledge that their Key Health Worker is on hand to remotely review their results and act promptly as required. Ultimately, patients are able to recognise any deterioration in their condition and access medical help at the right time without the requirement for telehealth.

Telehealth for Dorset was launched in February 2012 with the purchase of 500 home pods; focusing primarily on patients who have Chronic Obstructive Pulmonary Disease (COPD) or Chronic Heart Failure (CHF).

An independent company is commissioned to provide the home equipment which includes installation into the patient's home and technical support plus development of key technical upgrades and protocols as requested by clinicians

Two members of staff are employed by the CCG to manage the project.

The majority (83%) of the 300 people currently using telehealth have Chronic Obstructive Pulmonary Disease (49%) or Chronic Heart Failure (34%).

48% of patients state their primary reason for using the telehealth system is for self-management and 15% for prevention of deterioration/admission to hospital and 7% for reassurance.

The largest numbers of referrals are made and supported by Community Matrons at 53%, Heart Failure Specialist Nurses and support workers at 20% and Practice Nurses at 11%.

To date, there have been close to 600 referrals with approximately 300 active patient users at any one time at an approximate cost of £700.00 per person on Telehealth.

From local evidence it can be seen that the provision of telehealth for this cohort of patients is highly cost effective with a saving of £1,300 per patient. This is on the basis that the product is not used indefinitely.

However, a patient who is able to self-manage is able to call for clinical help/advice in a more timely manner thereby avoiding hospital admission or if admitted, reducing the length of stay as demonstrated in a



review of the Dorset telehealth service which shows that in a cohort of 231 telehealth using patients with Chronic Obstructive Pulmonary Disease and/or Chronic Heart Failure:

- 80% of patients demonstrated a reduction or no change in hospital admissions, of these 43% demonstrated a reduction in hospital admissions;
- 81% of patients demonstrated a reduction or no change in their length of stay, of these 41% of patients demonstrated a reduction in length of stay.

These patients are better able to manage their health and thereby their personal care although this and the social care impact of telehealth hasn't been examined specifically within Dorset.

There is still a degree of scepticism amongst clinicians about the benefit of telehealth, particularly GPs and consultants. Managing patients on telehealth also absorbs nursing time, but for those clinicians who use it they feel that it allows them to support more people on their caseload.

**Heart Failure Specialist Nurse** – *‘Telehealth has freed up time for me to see new referrals quicker both at home and in the clinic setting, thus potentially improving patient care and reducing unnecessary admission to hospital.’*

**Practice Nurse** – *‘Telehealth equipment can have real benefits to patients and the health community as analysis of patients’ use of the health system before and after the installation of telehealth shows a significant reduction in the number of admissions and visits/calls from GPs and nurses.’*

Due to the poor take up and limited understanding of the service by clinicians there is considerable variation in the use of telehealth between our teams, primarily due to staff understanding the potential implications on service provision. However, the scale of the use in these patient groups (COPD and CHF) supports the need to move to embedding the service within providers.

**Patient A** – *‘I was diagnosed in 2001 with COPD, and was admitted to hospital quite often. Since having telehealth this is the first year I haven’t needed any admissions. I believe I am now meeting my goal, which was to gain a better understanding of my health and reduce admissions. I can control my health now and have clearly seen benefits and would certainly recommend it to others.’*

**Patient B** – *‘I have Chronic Heart Failure (CHF), and I have a triple heart bypass in 2000. I have been using telehealth for a couple of months after my Community Matron recommended it to me. I take my tests and send them to my Community Matron, and if she is ever concerned about the results she will call me, come visit me at home if needs be. If I am feeling unwell, I sometimes take extra tests for my peace of mind, as I do not have to send the results to my Matron. I would recommend it to others as it doesn’t just benefit me, it also benefits the Matrons to enable them to look after more patients.’*

The aim is to enable all localities to reach the top percentage of patients on Practice QOF registers locally achieved i.e. 4.3% of Chronic Obstructive Pulmonary Disease patients and 8.8% of Chronic Heart Failure patients.

However, the pod costs are such that telehealth does not represent a good financial return if people remain on it indefinitely with senior nurse support. There is a balance between creating a dependency and using telehealth as part of a nurse specialist toolkit and a proactive route to self-management. ■

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**Nichola Arathoon**

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Design and Delivery (East)**

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# New standards for children's unscheduled care

**Dr Stephanie Smith, Consultant Emergency Paediatrician and spokesperson for the Royal College of Paediatrics and Child Health (RCPCH) details the changes needed to children's healthcare...**

The NHS was dubbed the key issue in the General Election – with polls consistently revealing it was the top priority for voters <sup>1</sup>. A recent public poll <sup>2</sup> commissioned by the Royal College of Paediatrics and Child Health (RCPCH) showed that in terms of NHS priorities, care for children and young people and the elderly were equally important – and issues such as mental health, maternity care and urgent and emergency care should be high on the political agenda.

Amidst the political debates and disagreements around NHS funding, the integration of health and social care and potential health service reconfiguration, there is one thing that politicians agree on – the NHS is under considerable strain. No more so is this the case than in children's urgent and emergency care services.

The statistics make shocking reading. There has been an increase in the number of Emergency Department attendances and admissions amongst the UK population as a whole over the past 10 years, with more than a quarter of these admissions under 16's. It's not just the fact that numbers have increased that is worrying, it's the fact that as many as between 15% and 40% are presenting with minor illnesses that could be managed more effectively outside hospitals.

It seems that some patients are bypassing GPs and going straight to hospitals, when in fact GPs can answer many of the questions they have.

There needs to be fundamental change in the way in which services are set up – with fewer hospitals with more care delivered in the community, and better communication between primary and secondary care.

So why is it that attendances at Emergency Departments

are so high amongst children? And, if hospitals are often not the best place to be, why is it parents take their children there?

**“The statistics make shocking reading. There has been an increase in the number of Emergency Department attendances and admissions amongst the UK population as a whole over the past 10 years, with more than a quarter of these admissions under 16's.”**

There's no simple answer, but it's worth remembering that every attendance means that a parent or carer is worried about their child's health, and either unable or unsure about how to access what may be a more appropriate service. Part of the problem is that many other services are not available out of hours and so hospital is the only place to go. But also, parents may not be aware of where they can go for help, so we need to support them in navigating the various options so that children receive the best possible care by the right health profession in the right place and at the right time.

As well as supporting young people, parents, and carers to gain access to the most appropriate services, we need to accept that current services are not set up in the best way to deliver care effectively. There is too much emphasis on the hospital, and not enough made of community services and the links between GPs, pharmacists, community nurses and hospital doctors must be stronger.

The Royal College of Paediatrics and Child Health, Royal College of Nursing and Royal College of GP's new Facing the Future: Together for Child Health <sup>3</sup> standards set out 11 key standards to support primary care providers,



and particularly GPs, to care for children safely in the community and closer to home.

**“As well as supporting young people, parents, and carers to gain access to the most appropriate services, we need to accept that current services are not set up in the best way to deliver care effectively.”**

These include GPs having appropriate training in child health and having easy access to expert child health advice from paediatricians e.g. via a hotphone. In my own setting in Nottingham, we’ve found that at times when a paediatric consultant is available to support the GP’s management of a child and young person’s healthcare, GPs then feel empowered to manage many conditions without referral to hospital.

There should also be an expanded role for Community Children’s Nurses who can provide crucial support to general children’s services and offer advice for worried parents.

Some children will of course still need to be treated in hospital. Where this is the case, the standards focus on reducing the length of time they need to be in hospital, which then enables them to go home again as safely and as quickly as appropriate.

Many of these standards can’t be implemented by a single service and will require professionals to work together across paediatrics and general practice; primary and secondary care; community and hospitals, so that care is centered around the child and young person. We hope these standards will be embraced by practitioners and managers across the health system, because no child should be in hospital when care can be provided to an equivalent or better standard elsewhere.

#### **The 11 standards in facing the Future: Together for Child Health are:**

- GPs assessing or treating children with unscheduled care needs should have access to immediate telephone advice from a consultant paediatrician;



- Each acute general children's service should provide a consultant paediatrician-led rapid-access service so that any child referred for this service can be seen within 24 hours of the referral being made;
- There is a link consultant paediatrician for each local GP practice or group of GP practices;
- Each acute general children's service provides, as a minimum, 6 monthly education and knowledge exchange sessions with GPs and other healthcare professionals who work with children with unscheduled care needs;
- Each acute general children's service is supported by a community children's nursing service which operates 24 hours a day, 7 days a week, for advice and support, with visits as required depending on the needs of the children using the service;
- There is a link community children's nurse for each local GP practice or group of GP practices;
- When a child presents with unscheduled care needs, the discharge summary is sent electronically to their GP and other relevant healthcare professionals within 24 hours, and the information is given to the child and their parents and carers;
- Children presenting with unscheduled care needs and their parents and carers are provided, at the time of their discharge, with both verbal and written safety netting information, in a form that is accessible and that they understand;
- Healthcare professionals assessing or treating children with unscheduled care needs in any setting have access to the child's shared electronic healthcare record;

- Acute general children's services work together with local primary care and community services to develop care pathways for common acute conditions;
- There are documented, regular meetings attended by senior healthcare professionals from hospital, community and primary care services and representatives of children and their parents and carers to monitor, review and improve the effectiveness of local unscheduled care services.

A full report of the standards can be found here – <http://www.rcpch.ac.uk/sites/default/files/page/Facing%20the%20Future%20Together%20for%20Child%20Health%20final%20web%20version.pdf> ■

<sup>1</sup> <https://www.ipsos-mori.com/researchpublications/researcharchive/3554/NHS-continues-to-be-top-issue-for-British-voters.aspx>

<sup>2</sup> [http://www.comres.co.uk/wp-content/uploads/2015/03/Final-Results\\_RCPCH\\_Child-Health\\_Feb-2015.pdf](http://www.comres.co.uk/wp-content/uploads/2015/03/Final-Results_RCPCH_Child-Health_Feb-2015.pdf)

<sup>3</sup> <http://www.rcpch.ac.uk/facingthefuture>



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# Paediatric Rheumatology in 2015

**P**aediatric Rheumatology has become recognised within the last 20 years as a paediatric subspecialty. Previously the care of these patients was undertaken by interested adult rheumatologists. However, the National Service Framework for children recognised that children should be seen in child-friendly areas by staff trained to look after children. In the UK, there are not enough Paediatric Rheumatologists to see all of these patients, and many are still seen by adult rheumatologists, or are seen by non-specialists. This is no longer acceptable practice.



In the last 20 years arthritis treatments have emerged which have brought fundamental improvements to the outcomes of children. These improvements can be measured not only in the number of adults who are not consigned to life in a wheelchair, but less demonstrably the even greater numbers whose functionality has been maintained through their school days, enabling them to fulfil their potential in life. However, the distribution of areas of best practice is lamentably poor, creating an inequality of access to care. There is no overall grasp of the problems that the current lack of systems throws up. Specialist commissioning is, to a certain extent, addressing some of the issues, but is itself overwhelmed by the huge task it has been assigned.

As a paediatric subspecialty, Paediatric Rheumatology has 2 major drawbacks: paediatricians were not historically taught how to examine the muscu-

loskeletal system, and many of the emerging drug treatments are more familiar to oncologists or immunologists than to paediatricians. Therefore, paediatricians are often unfamiliar with the skills to look after these patients and do not have a ready source of training to close the skills gap. At the moment, there is no added incentive for District General Hospitals (DGH) to provide paediatric rheumatology clinics, and many paediatricians are unwilling to take on the responsibility of caring for these patients.

The conditions that paediatric rheumatologists look after are chronic conditions that are considered to be rare: the commonest of these is Juvenile Idiopathic Arthritis (JIA) with an incidence of 1 in a 1000 children. DGH Paediatricians who start to see children with arthritis are often surprised by the number of patients (80 to 100 per DGH) they see. These children need to be seen frequently within the first

year of their diagnosis (and when their arthritis flares), as well as every 3 months once their disease is under control to monitor their growth and ensure their joints are developing normally. Added to this cohort will be children with musculoskeletal aches and pains that mimic arthritis: most DGHs should be running a regular Paediatric Rheumatology clinic.

BSPAR (British Society for Paediatric and Adolescent Rheumatology), in conjunction with ARMA (The Arthritis and Musculoskeletal Alliance), have published Standards of Care for JIA which have been internationally recognised. These describe the support that children with arthritis need access to: this includes access to physiotherapists, specialist nurses and occupational therapists. Paediatric musculoskeletal physiotherapists are needed for children with musculoskeletal aches and pains, whether they are due to arthritis or the more



common biomechanical problems (such as a muscle imbalance). This care should be provided locally: at the moment, the specialist centres are trying to plug this gap and are being overwhelmed. Patients with difficulties in activities of daily living (due to disease or pain) should have the support of an occupational therapist to help with access to schooling or to help them maintain their independence at home. The patients with arthritis, and other inflammatory diseases requiring immunosuppressant medication, should have the support of a clinical nurse specialist to help them understand their disease, their medication and to oversee the monitoring of the medication.

At the moment, most of this care depends on Paediatric Rheumatology Centres that have developed in a haphazard way. Each centre has been built up by an interested doctor, with no regard to population numbers or geography. Each centre has developed its own model of care with varying levels of support local to the family. Not all patients have access to a specialist centre and these will often be looked after by adult rheumatologists.

This inequality in care leads to a wide variation in outcomes: research has shown that delay to diagnosis is a poor prognostic factor for good outcome in

many inflammatory diseases. Arthritis is often viewed as an unexciting condition which is not life-threatening. Children with inflammatory diseases are at risk of life-threatening events, which are often poorly recognised until too late. Paediatricians, quite rightly, set great store in whether a child looks well or not. Unfortunately, these children often look relatively well, with only the blood tests indicating the severity of their underlying condition, until they collapse and end up in intensive care. Though this only occurs in the smaller number of children with systemic illness (rather than illness restricted to just the joints), the early stages are eminently treatable. Even with children whose disease is restricted to just one joint, such as the knee, the joint damage caused by arthritis leads to an inability to walk, leg length discrepancy and secondary spinal deformity. Children with multiple joints affected used to end up severely disabled with stunted growth, often in wheelchairs and unable to lead independent lives.

The advent of better medication in the last 20 years (methotrexate and then biologic agents such as etanercept) has improved outcomes enormously by controlling inflammation and allowing normal growth and development to take place. Teams looking after these patients have seen a shift from

struggling to keep these patients moving despite their joint problems, to supporting patients to regain normal strength and to maintain full access to their education.

There is a financial as well as a human cost in failing to provide proper care in the early years of disease. Stinting on preventive treatment in early years multiplies exponentially the cost of support and care in the rest of life. Existing Paediatric Rheumatology Centres are all oversubscribed and specialist commissioning aside, there is no attempt by government or the NHS to address the lack of an overall strategy to save children from unnecessary lifelong hardship. Paediatric Rheumatology teams are keen to improve the care of the children, but lack the time to train local teams to set up, and maintain, appropriate care. The tools exist, but we are failing our children by not enabling them to be put to use.



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# The danger of the status quo

Why we need new interventions to battle mosquito-borne diseases

**M**osquitoes are the most dangerous creature in the world. They kill one person every 12 seconds and infect hundreds of millions of people each year with serious diseases. *Aedes aegypti* is a particularly harmful species because it mainly bites people and lives in and around homes. This makes it very effective at spreading diseases like dengue fever and chikungunya.

This non-native species originated in Africa and is now in more than 100 countries and is still spreading. There is no cure or available vaccine for either disease so the World Health Organization recommends controlling the mosquito itself.<sup>1</sup>

## Why is *Aedes aegypti* so hard to control?

Biting females hide in nooks and crannies around the home so they can stay close to their human meals. Insecticides need to touch these blood-feeding females to kill them, and it is remarkably difficult to reach all of those hiding places. This mosquito is also developing resistance to the chemicals used to kill it. So there is an 'arms race' to find, test and implement better mosquito control methods as quickly as possible to prevent the next epidemic.

Using currently available methods, mosquito control groups cannot reduce *Ae. aegypti* numbers low enough to prevent the spread of disease. World



leading mosquito control groups with fleets of planes and helicopters can only reduce *Ae. aegypti* by about 50%. With that many disease vectors still around, it is possible for dengue, chikungunya, Zika virus – anything that *Ae. aegypti* can carry – to be introduced at any time. This mosquito is a ticking time bomb.

Public health and mosquito control groups urgently need access to better tools to help them in their fight to protect people against the *Aedes aegypti* mosquito. This global health challenge is on such a large scale that progress will depend on the public, scientists, industry and governments working together towards solutions.

## New tools as the way forward

The battle against mosquito-borne diseases can be fought on multiple

fronts. Companies are racing to find working vaccines and to test them in clinical trials to determine whether they will work. But viruses mutate and new strains appear.

A compatible but different approach is to reduce the numbers of the mosquito spreading the disease below the transmission threshold<sup>2</sup>, so that whatever the virus does, there simply aren't enough mosquitoes around to spread it.

A new technology by Oxitec does exactly that by using genetically engineered mosquitoes to control their own species. Since trials started in 2009, Oxitec has reduced target *Ae. aegypti* populations by more than 90%. This is an unprecedented level of control and is a key reason why mosquito control groups around the

world are keen to evaluate it for use in their countries. Another reason is its light ecological footprint because it's a highly targeted control method that is non-toxic and pesticide-free.

### How genetically engineered mosquito control works

Oxitec mosquitoes are genetically engineered so their offspring die before they can reproduce and before they can become transmitters of disease. It's an approach similar to the Sterile Insect Technique (SIT) where male insects are sterilised by radiation and released to mate with pest females. With successive releases there are fewer offspring each generation and the pest population crashes. SIT has been used worldwide for more than 50 years and has been successful in tackling pests such as New World Screw Worm.<sup>3</sup>

The Oxitec mosquito is inspired by the SIT approach but doesn't rely on radiation, which can affect many genes and the insect's competitiveness. Instead, Oxitec uses one gene to induce 'sterility' and a colour marker gene for monitoring the results. Like SIT, this approach requires successive releases, but there are major environmental benefits such as the disappearance of the insects and their genes from the environment once releases are stopped. The approach is also species-specific, controlling only the non-native *Ae. aegypti*, so other native species can flourish.

### Evaluating new tools against the status quo

New tools need to be tested, and human health and environmental impacts are just as important to consider as developing a mosquito control solution that works. This means rigor-

ously evaluating new tools before implementation. The Oxitec mosquito has been scientifically evaluated with laboratory studies, cage studies, and then field studies of increasing size. Results of these evaluations are available in peer-reviewed scientific publications and regulatory documents online.<sup>4</sup>

In every country where Oxitec is invited to do a mosquito control project, there is a review process by independent experts in accordance with national legislations and regulations. These reviews evaluate the Oxitec mosquito for its safety and environmental impact and releases only go ahead once these experts are fully satisfied. Since 2009, mosquito trials have been completed in Cayman, Malaysia, Brazil and Panama, without adverse effects, and more projects are being planned.

The evaluation process for new control methods is vital to progress in the war against mosquitoes. An important consideration for such evaluations is weighing the potential risks of a new intervention against the risks of maintaining the status quo. Public health depends not only on protection from potential future problems but also from existing threats such as mosquitoes spreading disease.

### Investing in the future

In Brazil, the dengue burden is so great that they've called in the army to help educate people on how to fight the *Aedes aegypti* mosquito. Brazil has a lot of experience and expertise in tackling dengue and recognises the need for new approaches to complement and improve on current methods. This forward thinking has

led to the first municipal project of genetically engineered mosquito control following approval by the national biosafety group (CTNBio) for release of Oxitec mosquitoes throughout the country. The city leading the way is Piracicaba, in São Paulo state.<sup>5</sup>

The Oxitec mosquito and its lead inventor have also been nominated for a prestigious international award for this biotechnology breakthrough in battling disease-carrying mosquitoes.<sup>6</sup> The hope is to build on the success of the Oxitec mosquito to tackle the mosquitoes that transmit malaria next. Award nominee, Dr Luke Alphey, also hopes to inspire the next generation of scientists to carry on this important work, and join in the fight against vector-borne diseases.

1 World Health Organization Dengue and Severe Dengue Factsheet  
[www.who.int/mediacentre/factsheets/fs117/en/](http://www.who.int/mediacentre/factsheets/fs117/en/)

2 Focks et al. 2000. Transmission thresholds for dengue in terms of *Aedes aegypti* pupae per person with discussion of their utility in source reduction efforts. [www.ncbi.nlm.nih.gov/pubmed/10761719](http://www.ncbi.nlm.nih.gov/pubmed/10761719)

3 [www.oxitec.com/SIT](http://www.oxitec.com/SIT)

4 [www.oxitec.com/publications](http://www.oxitec.com/publications)

5 [www.cctv-america.com/2015/05/03/biotech-firm-experiments-with-mosquitoes-to-fight-dengue-fever-in-brazil](http://www.cctv-america.com/2015/05/03/biotech-firm-experiments-with-mosquitoes-to-fight-dengue-fever-in-brazil)

6 [www.epo.org/news-issues/press/releases/archive/2015/20150421a.html](http://www.epo.org/news-issues/press/releases/archive/2015/20150421a.html)



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# Donate cells – save lives

**Andrew Hadley, General Manager of Specialist Services Operations at NHS Blood and Transplant outlines the importance of stem cell donation in the UK...**

Stem cell (or bone marrow) donation can help save the lives of people suffering from blood borne cancers, anaemia or forms of bone marrow failure. The British Bone Marrow Registry (BBMR) is run by NHS Blood and Transplant and is made up of blood donors who are also willing to donate bone marrow or blood stem cells. The BBMR forms part of the Anthony Nolan and NHS Stem Cell Registry, along with the Anthony Nolan register and the Welsh Bone Marrow Donor register.

Patients suffering from leukaemia, thalassemia and sickle cell disease as well as other diseases of the immune system may need a bone marrow transplant to save their life. In about 30% of cases, a matched donor can be found from within the patient's family, such as a brother or sister. The other 70% of patients have to rely on a matched volunteer donor, identified through the BBMR.

The UK needs more stem cell donors, particularly young men under 30, as they make the best donors. Donors from black, Asian and minority ethnic (BAME) communities are particularly needed. Around 60% of people from BAME backgrounds needing a stem cell transplant will be able to find an acceptable (not perfect) match, compared to 96% of Caucasians. This highlights the need for people from ethnic communities to sign up.

While there are over 25 million potential donors worldwide listed by international stem cell registries, many patients are still unable to find a suitable match. This emphasises the complexity of Human Leukocyte Antigen (HLA) matching between patient and donors.

Our Histocompatibility & Immunogenetics team are the first in the UK to use "next generation sequencing"

to determine full-length unambiguous HLA types of donors as they join the BBMR. During February, 500 donors tissue typed by this method were added to the registry, with the plan to type an additional 10,000 donors by the end of 2015. This "allelic level typing" will reduce the time taken to confirm the HLA match between donor and patient from around 6 weeks to around 3. Allelic level typing is the highest level of HLA typing – it removes all the ambiguity associated with lower resolution typing, and provides improved information on donor selection without the need for additional donor typing.

**"While there are over 25 million potential donors worldwide listed by international stem cell registries, many patients are still unable to find a suitable match."**

Listing donors with full-length, allelic-level HLA typing is intended to lead to higher utilisation of donors joining the BBMR – with donors up to 7 times more likely to be selected for transplant, compared with the rest of the donor panel.

So we plan to continue to recruit and to HLA type donors to the highest level to give patients in need the best chance of a match. To do this we rely on funding from the government and this year the Department of Health has announced that we will share £3m with Anthony Nolan to continue work to support stem cell transplantation.

The money will allow more patients to benefit from lifesaving treatment through the allelic-level typing of young adult stem cell donors, including those from (BAME) populations and allow us to collect and bank high quality cord blood donations.





We are working towards an inventory of 20,000 cord blood donations by 2018, and to add 75,000 young male donors to the Anthony Nolan and NHS Stem Cell Registry by 2020.

Over the last 4 years we have reached a number of key milestones. More patients are receiving a potentially life saving stem cell transplant than ever before. In 2013/14, 258 additional patients received a stem cell transplant from an unrelated donor compared to 2010/11. This translates to an additional 130 lives saved each year. Over 60% of BAME patients are now able to find a well matched donor, which represents a significant improvement on the 40% figure cited by the UK Stem Cell Strategic Forum in 2010(1). UK sourced cord blood is increasingly meeting the needs of UK patients. In 2014, around 25% of UK cord blood transplants used donations from UK donors compared with just 10% in 2010.

To join the British Bone Marrow Registry, you must be a blood donor aged between 18 and 49. When you go to give blood, you will provide an extra sample during your donation which will be typed and tested. ■

[http://www.nhsbt.nhs.uk/download/uk\\_stem\\_cell\\_strategic\\_forum\\_report.pdf](http://www.nhsbt.nhs.uk/download/uk_stem_cell_strategic_forum_report.pdf)

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# Stem Cells and immunity

## Stem cells, Chromosomal instability and Cancer

Life expectancy in the western world has been on the rise, leading to an upshift in median age that will continue in the next decades<sup>1</sup>. As a consequence of population ageing, the incidence of ageing-related ailments has escalated; not only degenerative diseases such as Parkinson or Alzheimer, but also the number of people affected by cancers has risen drastically. Notwithstanding its impact on society, the underlying mechanisms are still not completely understood, translating into relatively coarse and unspecific cancer treatments. Only in the last few years has the treatment of some forms of cancer evolved into a more guided approach, and years of investigation will still be needed to design intelligent treatments for a wide variety of cancers.

### Stem cell biology of cancer

Stem cells have a central role in most if not all ageing-related ailments. In most of the diseases studied, the depletion of stem cells and reduction of their proliferative capacity seems to be the main cause of tissue degeneration. In cancer, however, excess growth is the central underlying mechanism. The role of stem cells in tissue homeostasis depends on the equilibrium between differentiation and self-renewal. Whereas stem cell differentiation into more specialised cell types is the mechanism that produces the somatic tissues, self-renewal assures the maintenance of an undifferentiated cell population that maintains a

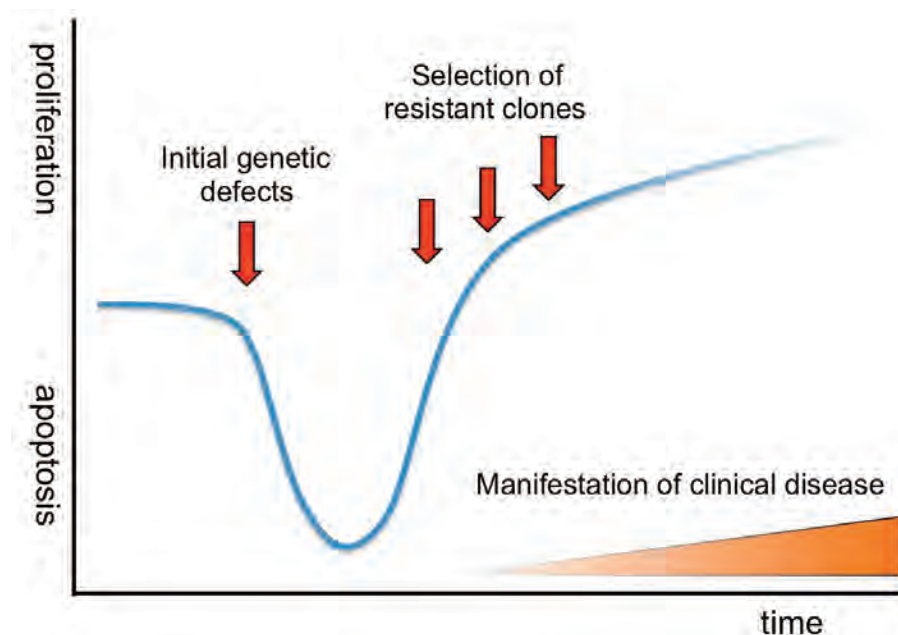


Figure 1. Stem cell depletion and cancer. Whereas the majority of ageing stem cells will enter senescence or apoptosis upon accumulation of genetic defects, a small proportion might survive and evolve into the rapidly dividing resistant population that causes cancer.

proliferative capacity. In cancer, the equilibrium between differentiation and self-renewal is disturbed, provoking the accumulation of a population of poorly differentiated but highly proliferative cells.

The identification of a stem cell population at the heart of tumor growth<sup>2</sup> comprises yet another link between ageing and cancer; the role of stem cells in cancer is just as important as in degenerative diseases. Whereas stem cell depletion and their uncontrolled growth appear unrelated phenomena, they are in fact closely related; whereas a proportion of stem cells are lost during ageing, the

surviving stem cells have an increased chance of chromosome alterations.

### Chromosomal Instability (CIN)

A key difference between healthy, normal stem cells and tumor cells is the acquisition of genomic alterations by the latter. Most carcinomas present some form of genetic instability, either as an accumulation of intragenic mutations or as a large-scale alterations – translocations, deletions and numerical changes – termed chromosomal instability (CIN). Although the hypothesis that CIN itself can cause cancer has taken a long time before being accepted, CIN is frequently detected in tumors before intragenic

mutations and thus comprises a driving force in carcinogenesis<sup>3</sup>. Current theories suggest that CIN can induce cellular transformation through gene dosage or gene translocation; the genome fragments gained or lost in CIN frequently contain hundreds of genes, each of which can affect a pathway regulation step. The extra copies of many genes in CIN cause a gross imbalance in cellular regulation, which easily spills over into other pathways including cell cycle control<sup>4</sup>. Pathway interconnectedness thus appears to be the Achilles' heel of genomic stability in mammals.

### Stem cells, CIN, and cancer therapy

Because of their unique role in tissue renewal, stem cells have a combination of characteristics that renders them susceptible to genetic damage, transformation, and tumor initiation. Stem cells not only undergo rapid growth and division, but also seem to be tolerant for gene dosage effects that would induce apoptosis in other cell types. Notwithstanding their resistance, cancer stem cell theory clearly indicates that this population must be targeted to treat carcinomas efficiently.

Traditional anticancer therapy depends on tumor cell eradication by cytotoxic drugs, through the induction of additional chromosome defects that lead to apoptosis or necrosis. Although the efficacy of the classical cancer treatments has advanced tremendously, they still suffer from side effects, such as the shutdown of stem cells in skin, intestine, and immune system. Thus, a drawback of many

chemotherapeutics is the low capacity to distinguish between cancer cells and rapidly dividing non-cancer cells. In addition, most of the chemotherapeutic compounds favor selection of resistant and aggressive cancer cells.

The last decade has seen the development of new therapies, aimed at a more specific elimination of cancer cells while reducing toxic effects. One phenomenon in particular, oncogene addiction, might yield novel targets for anticancer therapies<sup>5</sup>. In oncogene addiction, the cancer's need for survival leads to activation of the corresponding signal pathways, to an extent where cells become completely dependent. Oncogene addiction has been characterised in only a few types of cancer so far, but preliminary results are promising. Oncogene addiction seems to increase with tumor progression, so targeting survival pathways might be the way to treat advanced cancer, where classical therapies lose efficiency. For example, the high level expression of HER that characterises the most aggressive forms of breast cancer is exploited for treatment with the neutralising antibody Herceptin®, improving the prognosis of HER-positive tumors. Novel targets in signaling pathways must be seen as an addition to classical therapies for now, but further characterisation of pathways might help to treat a wide range of cancers. Especially the targets that overlap with stemness and differentiation are interesting, for the possibility to attack cancer stem cells.

### Concluding remarks

The fundamental way in which cancer is treated is just recently being mod-

ernised. New therapies will hopefully be able to discriminate better between cancer cells and healthy stem cells, and be tolerated better by the patient than current treatment schedules. The combination of data from stem cell biology, tumor evolution, and genetic analysis of patient material has greatly improved our understanding of cancer biology. Still, continued efforts are needed to use this knowledge for the benefit of cancer patients.

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# Musculoskeletal health: perspectives in an ageing society

**Dr Benjamin Ellis, Senior Clinical Policy Adviser at Arthritis Research UK, details the importance of good musculoskeletal health in an ageing population...**

Over the last century, life expectancy has steadily risen at an extraordinary rate. Yet though we live for longer, those additional years are often plagued by ill health. One particular area stands out as affecting quality of life more than any other – musculoskeletal health. Good musculoskeletal health means having the strength and coordination to do all the things we want to do without pain or stiffness. It means not living in fear of falling, and not having fragile bones that can easily break after a minor trip. It means people being able to look after themselves independently, and to keep doing the things they enjoy, such as walking, gardening or dancing. We all want to enjoy good musculoskeletal health. And yet so often it is illusive.

Musculoskeletal conditions are a major threat to good musculoskeletal health. These long-term disorders of the bones, joints, muscles and spine commonly cause pain, stiffness and a loss of mobility and dexterity. Pain and disability from these conditions ruins quality of life, robbing people of their independence and impairing their ability to participate in family, social and working life.

Musculoskeletal conditions fall into 3 groups, all of which are more common in older people. Conditions of musculoskeletal pain make up the first group, which includes osteoarthritis and back pain. Together these affect more than a quarter of people aged over 45 years. A second group is osteoporosis – weakened bone. Though osteoporosis is a painless condition, a minor trip or fall can result in a painful and disabling fragility fracture. Rarer conditions where the immune system attacks the body's tissues make up a third group which includes diseases such as rheumatoid arthritis.

Musculoskeletal conditions are an important component of multimorbidity in older people. Many of the risk factors are similar to other long-term conditions such as diabetes, heart disease and dementia. For example, obese people are around 4 times more likely to develop osteoarthritis of the knee, and obesity is an important risk factor for developing back pain. People who are physically inactive are more likely to develop musculoskeletal problems. Smoking is associated with rheumatoid arthritis, osteoporosis and back pain. People with musculoskeletal conditions such as osteoarthritis are less physically active – pain can limit people's ability to take the exercise they need to improve their health overall.

Mental health can also suffer because of these conditions. Nearly a quarter of older people with osteoarthritis report depressed mood and 1 in 6 people with rheumatoid arthritis has major depression. Nearly 7 out of 10 people report depressive symptoms when their arthritis pain is at its worst. Psychological distress and depression can also worsen pain, and make it harder for people to cope with their symptoms.

There is a huge impact from musculoskeletal conditions on health and care services, as well as on the wider economy. Each year in the UK, 1 in 5 of the population consults their general practitioner about a musculoskeletal health problem. The direct costs of health-care for these conditions make up the fourth-largest disease area, after cancer, cardiovascular disease and mental health. Substantial social care costs are attributable to loss of independence because of musculoskeletal conditions, for example due to the progressive pain and immobility of osteoarthritis, or the sudden, devastating impact of a fragility fracture: only half of those surviving a hip fracture are fully



independent a year on. Musculoskeletal conditions can also be a major barrier to workplace participation. Along with mental health problems, they are the leading cause of work days lost due to ill health and are a major call on disability benefits. People with osteoarthritis have lower income than others, and retire at a younger age. As statutory retirement ages rise, a higher proportion of the workforce will be affected and the economic impact is expected to rise.

There is a pressing need to challenge the myth that nothing can be done about musculoskeletal health. Something can be done at every age and at every stage. Regardless of age, people can reduce their risk of developing a musculoskeletal condition in the first place, and can substantially improve their symptoms if they have developed a musculoskeletal condition.

Strategies to reduce obesity in the first place will reduce prevalence of osteoarthritis. But people with osteoarthritis that lose weight can substantially reduce their symptoms and slow progression. The message is similar for physical activity. Many people wrongly believe that exercise causes arthritis, and that people with osteoarthritis or back pain should take it easy and avoid using painful joints. The truth is very different. Walking is simple, accessible and safe – reaching 6,000 steps per day protects against disability in people with or at risk of knee osteoarthritis. Even in later life, becoming physically active promotes healthy ageing, for example reducing by a third the chances of developing difficulty walking or having restriction

of daily living activities. One study found that older women who exercised regularly were a fifth less likely to be diagnosed with arthritis over a 6 year period. Another found that physically active women (for example, walking, bicycling, using stairs, and gardening) were a third less likely to need a hip replacement over the 11 years of the study.

Many are predicting a massive increase in musculoskeletal conditions in our ageing, increasingly obese and progressively physically inactive society. Yet this is not inevitable. In public messaging about reducing obesity and increasing physical activity, the public health community must raise awareness about the benefits to musculoskeletal health, reducing risk onset of musculoskeletal problems and reducing impact for those with symptoms. When modelling the benefits of interventions to tackle obesity and physical inactivity, policymakers should include the positive impact on musculoskeletal health. Finally, health and care systems should be geared towards supporting people with musculoskeletal conditions to maintain a healthy body weight and become more physically active, so that people have the same access to these interventions as to medications or surgery.

Much can be already be done to improve musculoskeletal health, now and for the future. By taking steps now, governments can help make sure that our ageing societies are pain free and independent, and that people are able to enjoy a good quality of life throughout their older years. ■

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# Therapies for weak muscles

It is estimated that ten percent of the costs of health care in Switzerland (or an equivalent of 500 billion Euros per annum in the EU) being associated with lost work is related to injury or dysfunction of the musculoskeletal system (Fig. 1). Surgical and subsequent rehabilitative interventions are important part of the therapy that re-establishes musculoskeletal function.

The Laboratory for Muscle Plasticity at Balgrist University Hospital aims to bring light into the underlying mechanisms in skeletal muscle with the goal of translating the findings into more effective clinical applications.

Skeletal muscle plays a major part in control of movement and posture and affects whole body metabolism through its effects on energy expenditure. Affections ranging from simple overuse injury to rupture of tendon and bones, or disease, lead to deconditioning of skeletal muscle as a result of inactivity and damage signals<sup>1</sup>. The consequent loss in muscle strength and fatigue resistance exerts a distinct negative impact on the quality of life and may render the affected individuals dependent. In these situations a surgical intervention and rehabilitation may be indicated, yet may come too late as irreversible changes may have resulted.

**Focus on muscle plasticity:** The laboratory for muscle plasticity investigates the mechanisms that underlie the conditioning of skeletal muscle structure and function during recovery

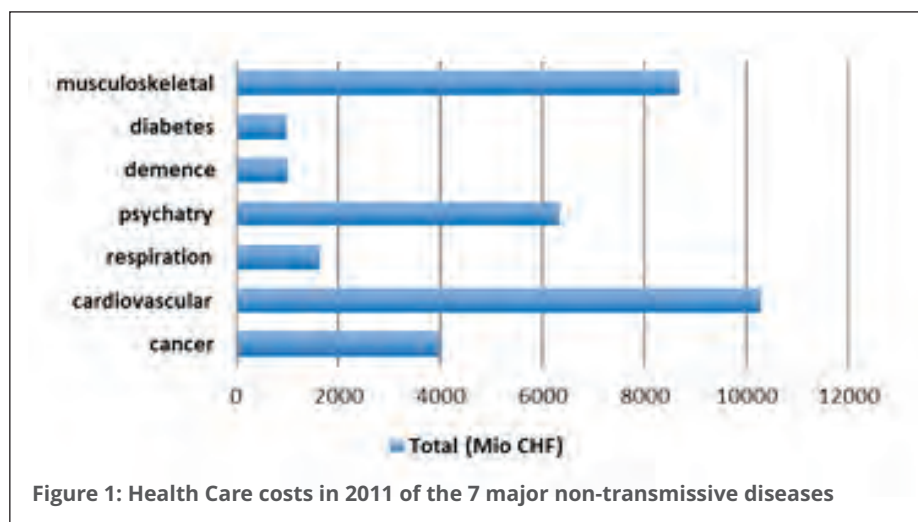


Figure 1: Health Care costs in 2011 of the 7 major non-transmissible diseases

from surgical interventions and rehabilitation. As shown through research on Sport Performance this process is driven by mechanical and metabolic stimuli. It is mediated through a gene response that instructs adjustments in muscle composition with the repeated impact of exercise during training. In consequence, force production and fatigue resistance of muscle may be improved or maintained.

On the opposite muscle's functional capacity is reduced in the absence of a physiological stimulus by a reduction in the size of muscle fibers and their content in mitochondria (Fig. 2).

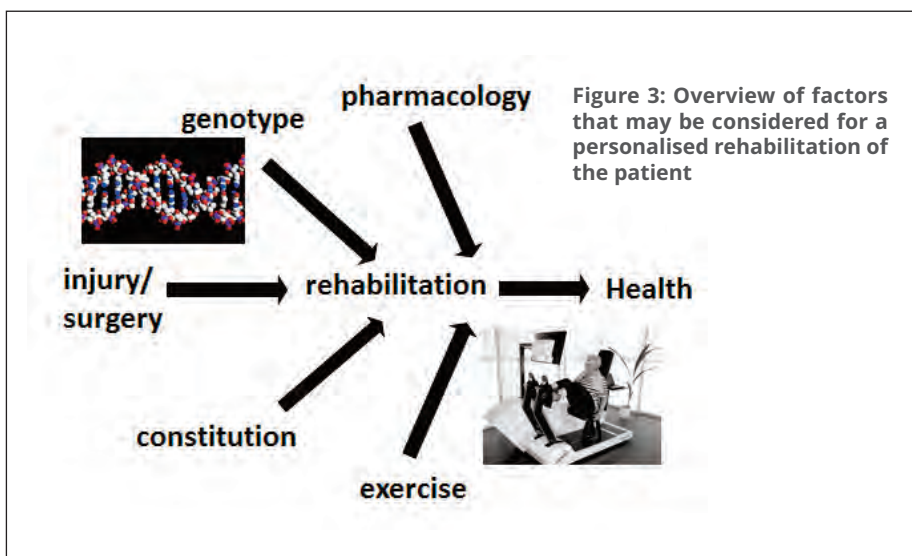
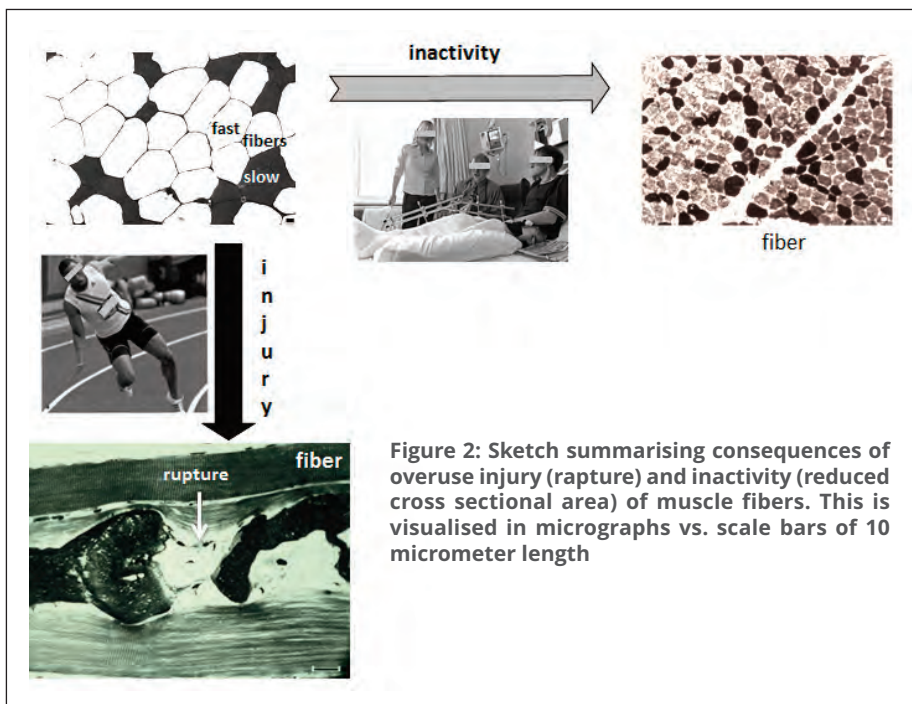
In fact, while the safety and effectiveness of physical factors for muscle conditioning are well established, the dose-effect relationship between exercise and muscle adaptation is often not fully respected in clinical practice. An example of this biological regulation is the important role of muscle contraction and loading in preserving muscle mass of the bedridden musculoskeletal patient after

surgery which otherwise loose muscle mass at a pronounce rate. Genetic factors (so called gene polymorphisms) importantly affect this adaptation<sup>2</sup>. This indicates that gene polymorphisms contribute to the inter-individual variability of the response to surgical interventions and rehabilitation.

**“The Laboratory for Muscle Plasticity at Balgrist University Hospital aims to bring light into the underlying mechanisms in skeletal muscle with the goal of translating the findings into more effective clinical applications.”**

**Research projects:** The emphasis of the research team lead by Prof. Martin Flück at Balgrist is put on major musculoskeletal affections that arise in the context of the Orthopedic Clinics at Balgrist Hospital. A special focus is put on resolving the contribution of gene polymorphisms to inter-individual differences in the healing of muscle with re-attachment of the ruptured rotator





cuff tendon, and the strengthening of skeletal muscle with rehabilitative exercise in patients.

The aim is to develop personalised forms of interventions that maximise muscle adaptation (Fig. 3). The latter approach is based on our previous work that points out the important exercise-intensity and exercise-type related influence of gene polymorphisms on the muscle response to the leisure type Sports activities <sup>3</sup>. This opens a venue to tailor the therapeutic

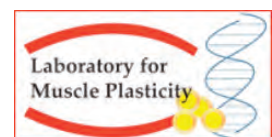
tically effective exercise intervention for patients which otherwise would demonstrate little plasticity to a generic exercise stimulus and for which pharmaceuticals alone do not work due to the importance of activity-induced muscle metabolism for muscle adaptations.

Patient-lead research: By the end of 2015 the laboratory will undertake a major step towards an expansion when it will move in brand new research facilities in what is to

become the Balgrist Campus (<http://www.balgristcampus.ch/en/>). A key ingredient of this research facility will be an open-space landscape where research and development into musculoskeletal medicine is integrated under one roof between clinicians, biologist, engineers, and industry. The facility is situated in the vicinity of the orthopedic hospital at Balgrist; thus providing a pipeline for a reality-driven approach that re-integrates questions from bedside to bench and returns to the patient. The laboratory for muscle plasticity is looking for potential partners that may want to exploit the research options presented in the future Campus in the frame of collaboration.

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# Muscling in on myopenia and myosteatorsis

**T**he relationship between body composition and risk of disease has become more clearly understood in recent years, as the technology available to non-invasively quantify components of body mass has improved. Image based approaches specifically and precisely quantify muscle and fat, while having the capacity to also reveal additional features such as excess inter and intra-myocellular lipid accumulation within muscle tissue. Low muscle mass (myopenia) and increased fat content of muscle (myosteatorsis) are known to relate to disease risk and outcome.

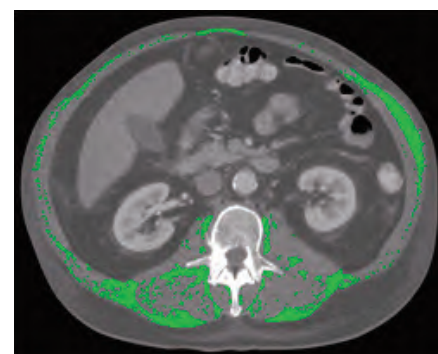
Muscle mass and strength are critical components for maintaining physical function, mobility and vitality. Loss of muscle mass occurs during aging but is also a feature of many chronic diseases. Individuals with severe muscle wasting may have difficulty performing daily tasks as well as disability, poor functional capacity and shorter survival contributing to high costs as a result of reduced quality of life, increased caregiver burden and health service utilisation. It has been revealed that low muscle mass is prevalent in every body size, not only in people who appear underweight, but also in those who are overweight or obese.

Muscle tissue normally contains only small amounts of fat not intended for long-term lipid storage, but rather as a short term energy source for skeletal muscle contraction. Myosteatorsis is characterised by excess deposition of

fat in the form of triglycerides into muscle is considered to be a pathological phenomenon. The more fat a muscle contains, the less dense it becomes, and low density muscle is poor quality muscle. Low muscle density has been described in conditions of aging, detraining, various types of muscle atrophy, insulin resistance, Type 2 diabetes and most recently, cancer.

Very little data exists to define the biological, biochemical and physiological features of human muscle that bears the features of myopenia and/or myosteatorsis. What is known reveals that poor prognosis and different types of morbidity are predicted by muscle loss and the presence of fat in muscle. Resistance exercise appears to combat muscle loss that occurs with aging whereas aerobic exercise modifies the fat content of muscle. Currently there are no drugs approved for muscle loss or myosteatorsis. Loss of muscle and low density muscle may share common pathways for development. Many underlying factors contribute to muscle loss including catabolic humoral mediators (i.e. pro-inflammatory cytokines), anabolic failure (i.e. insulin insensitivity) and activation of proteolytic systems.

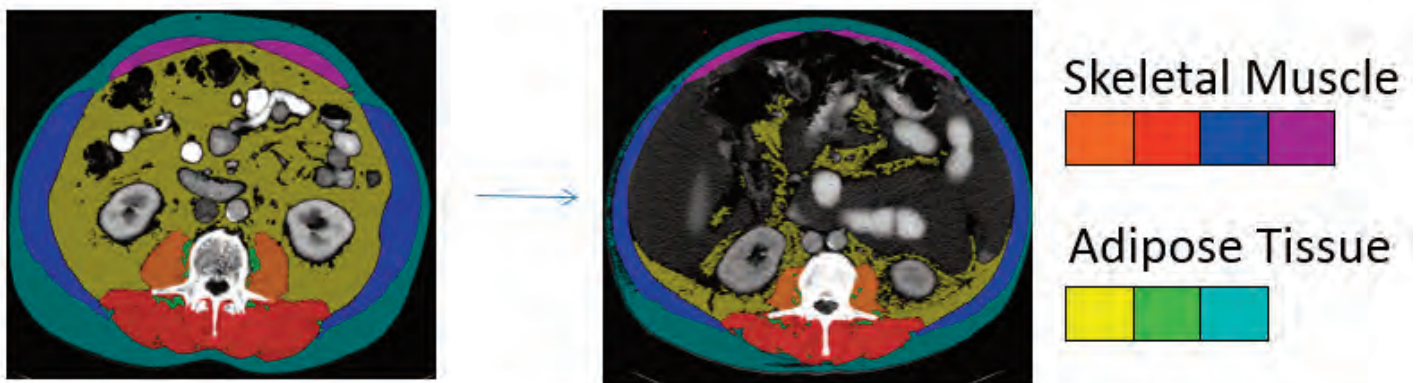
One nutrient that is showing promise to modify the amount and quality of fatty muscle are the long chain n-3 polyunsaturated fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). N-3 fatty acids



This slide shows a CT image from a cancer patient who underwent 16 weeks of first line platinum doublet chemotherapy for lung cancer. Only the intramuscular adipose tissue is shown in color

are essential nutrients that can only be obtained from the diet from cold water fatty fish and their oils (as well as supplements). N-3 fatty acids are found ubiquitously in cells and tissues throughout the body. Several benefits to muscle mass and function have been attributed to EPA and DHA. N-3 fatty acids are likely to affect more than one pathway, therefore, mechanisms may work collectively to improve muscle health by simultaneously targeting anabolic pathways, inhibiting catabolic pathways and improving energy utilisation in a parallel and complimentary way.

My research is currently focussed on understanding the underlying pathology contributing to muscle loss and myosteatorsis in people with cancer and further, how these pathologies can be modified from a nutrition vantage point. In cancer patients, both low muscle mass and muscle density are associated with poor



To quantify different tissues for body composition analysis using computed tomography imaging, a bony landmark is used to consistently measure the same region of the body across patients. The 3rd lumbar vertebrae is an established landmark in body composition analysis that correlates with amount of whole body muscle and fat. Each tissue attenuates radiation in a specific way which is recognised by a software program to enable skeletal muscles and different types of adipose tissues to be identified. Each tissue of interest is then color coded (see legend). When more than one CT image exists in the patient record, tissue changes over the trajectory of the disease can be determined. This image presents 2 scans taken approx 6 months apart at the same region within the same patient. The marked decline in muscle and adipose tissue is evident

outcomes and risk of death. Very little is known about these features in the muscle of cancer patients. Our research program relies on our capacity to collect human tissue during surgical procedures which can be subsequently analyzed for histological and biological features. Animal models, first verified for human relevance, are used to study mechanisms related to of n-3 fatty acids and other interventions that have a capacity to modify these pathologies.

**“Muscle mass and strength are critical components for maintaining physical function, mobility and vitality. Loss of muscle mass occurs during aging but is also a feature of many chronic diseases.”**

The ability to modify muscle wasting and intramuscular fat accumulation has a broad scope of application to

aging, diabetes, obesity and various forms of muscle atrophy, which share these common features. While treatment for these conditions remains limited, a number of mechanisms may contribute to the ability of n-3 PUFA to alter body composition, however, a more complete understanding of the features of the muscle characterised by wasting and fat infiltration is required.

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# Reviewing worldwide cancer research

**Dr Kate Allen, Executive Director of Science and Public Affairs at the World Cancer Research Fund UK outlines some findings from their worldwide research on liver cancer...**

**O**ur Continuous Update Project (CUP) on the links between diet, weight, physical activity and liver cancer <sup>1</sup>, released recently included some significant and interesting findings.

The research found strong evidence that:

- Three alcoholic drinks a day can cause liver cancer;
- Overweight and obesity can cause liver cancer; and
- Coffee is linked to a decreased risk of liver cancer.

It is the most comprehensive review to date of global research into the relationship between diet, weight, physical activity and liver cancer. Thirty-four studies were reviewed in the report covering 8.2 million people of whom more than 24,600 had liver cancer.

The findings were widely reported in the media and sparked some interesting debate.

Our finding on alcohol is particularly interesting. We found for the first time that at a certain threshold of

alcohol consumption the risk of liver cancer increases disproportionately. Below 45 grams of alcohol a day (that's up to 3 drinks or 6 units) there is very little change in cancer risk. But at around 45 grams of alcohol per day the evidence shows the increase in liver cancer risk becomes statistically significant. This means it is unlikely to be a chance finding. Chronic excessive alcohol consumption is known to cause significant acute liver damage resulting in hepatic fibrosis and eventual cirrhosis. The majority of liver cancer cases have underlying cirrhosis and the effect of alcohol on liver cancer is likely to be largely mediated through cirrhosis as an intermediate state. Higher alcohol consumption is also positively associated with a greater body fatness.

Since 2007 we have known that there is a link between alcohol and liver cancer. What is important about this latest CUP report is that it has identified a threshold. This is important because it advances what we know about the level of drinking that increases liver cancer risk. It adds to our knowledge of the links between diet, nutrition, physical activity and cancer, which is the aim of the CUP.

Liver became the 10th cancer to be strongly linked with overweight and obesity in the report. It joins a growing list of cancers that have been linked to weight by the CUP, with advanced prostate and ovarian cancers added last year. Post-menopausal breast, bowel, pancreatic, kidney, gallbladder, womb (endometrial) and oesophageal (adenocarcinoma) make up the other cancers strongly linked with overweight and obesity <sup>2</sup>.

The report uncovered 14 new or updated studies relating to the links between weight and liver cancer, giving a total of 15 studies. A meta-analysis of 12 of these studies showed a statistically significant 30% increased risk of liver cancer per 5 BMI units.

An important reason why more cancers are being added to the list of those associated with weight, is that the research is becoming more detailed. For example, a link between excess weight and advanced prostate cancer, uncovered in our report last year <sup>3</sup>, was found because studies had analysed data for advanced prostate cancer separately from those identified through screening for the disease.

Body fatness directly affects the levels of several circulating hormones in the body such as insulin, insulin-like growth factors and oestrogens, creating an environment that encourages the creation of cancerous cells. Body fatness is also known to stimulate the body's inflammatory response, which may contribute to the creation and progression of several cancers. In addition, body fatness is strongly associated with an increased risk of type 2 diabetes which, in turn, is associated with increased risk of a common type of liver cancer known as hepatocellular carcinoma. Obesity is a risk factor for non-alcoholic steatohepatitis (fatty liver) which may progress to cirrhosis and therefore an increased risk of developing liver cancer.

Around 61% of people in the UK are overweight or obese. Overweight and obesity is a public health issue not just in the UK, but around the world. We estimate that about 23,100 cases of liver cancer in the UK could be prevented each year if everyone kept a healthy weight.

The other significant finding in the research concerned coffee.

The CUP reports new, strong evidence that drinking coffee may decrease the risk of liver cancer. The research shows about a 14% decreased risk of liver cancer for each cup a day. However it is not possible to predict the exact risk for a specific number of cups of coffee.

**“Liver became the 10th cancer to be strongly linked with overweight and obesity in the report. It joins a growing list of cancers that have been linked to weight by the CUP, with advanced prostate and ovary cancers added last year.”**

There are many unanswered questions about coffee drinking and cancer risk. Although there's strong evidence that coffee may be beneficial, we don't fully understand why. We drink coffee in different ways and it could be how much is consumed that is important, how regularly, the type of coffee consumed or what is added to it that has an effect. The evidence just doesn't show the full picture yet, but it's an area of research we are interested in. ■

<sup>1</sup> <http://www.wcrf.org/int/research-we-fund/continuous-update-project-findings-reports/liver-cancer>

<sup>2</sup> <http://www.wcrf-uk.org/uk/preventing-cancer/lifestyle-statistics/body-fatness>

<sup>3</sup> <http://www.wcrf.org/int/research-we-fund/continuous-update-project-findings-reports/prostate-cancer>

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**Dr Kate Allen**

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World Cancer Research Fund UK

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# Obesity, fatty liver disease and liver cancer in Europe

**A**lterations in our way of living over the last decades, including high caloric intake (e.g. through high fructose and high fat diet) combined with a sedentary lifestyle, have augmented the incidence of overweight and metabolic syndrome, characterised by abdominal obesity, insulin resistance, hypertonia and dyslipidemia. This trend is observed not only in industrialised countries such as the United States of America or Europe but also step by step in developed as well as developing countries.

Overweight and metabolic syndrome lead to diseases of several kinds, including coronary heart diseases, Type 2 diabetes, and also cancer (e.g. liver, colorectal). Epidemiological data clearly indicate that overweight and metabolic syndrome are reaching pandemic dimensions in industrialised countries. Notably, it is suggested that newly developing countries – as a consequence of industrialisation and adaptation of their lifestyle – will also experience a steep increase in overweight and metabolic syndrome-triggered diseases. In the past ten years, the rate of obesity has doubled in adults and tripled in children in the USA. A similar trend has also been observed in Europe.

The liver – which is the most important metabolic organ – is strongly affected by a chronic state of overweight and metabolic syndrome. Non-alcoholic fatty liver disease (NAFLD),



the most frequent liver disease worldwide, is a clinical manifestation of overweight and metabolic syndrome. NAFLD is a chronic disease that can last several decades, characterised by predominant macrovesicular steatosis of the liver. Although the prevalence of NAFLD is increasing globally, epidemiology and demographic characteristics of NAFLD vary worldwide. It is becoming increasingly clear that a number of pathways are involved in the pathogenesis of NAFLD and NASH and its progression to advanced stages of liver disease. These pathways may be diverse in different cohorts of patients suffering from the condition, and understanding which pathways play a role in its development will be critical before launching treatment modalities.

A significant number of NAFLD patients develop nonalcoholic steatohepatitis (NASH), fibrosis and consequently hepatocellular carcinoma (HCC). In recent years, obesity, leading to metabolic syndrome, steatosis and steatohepatitis, has attracted increased attention due to an increased HCC incidence in the US and Europe. In line with this, the most common etiology for HCC in industrialised countries has recently switched from chronic viral infections (e.g. hepatitis B and hepatitis C virus) to obesity, making HCC the most rapidly increasing type of cancer in the US, with a similar trend observed in Europe. Today we lack a detailed understanding of how chronic steatosis develops into NASH and what factors control its transition from NASH to HCC. At the same time, no



therapeutics exist to efficiently treat NASH, and treatment options for the therapy of late stage HCC are limited and prolong the lifespan of patients for between three to six months.

**“In the past ten years, the rate of obesity has doubled in adults and tripled in children in the USA. A similar trend has also been observed in Europe.”**

In laboratory mice, NASH can be induced by several different diets, such as a methionine/choline-deficient (MCD) or choline-deficient diet (CD) but not by a high-fat diet (HFD) alone. However, C57BL/6 mice fed with MCD or CD do not develop obesity or metabolic syndrome, and the diet has to be discontinued after a few months due to weight loss (up to 40%) or occasional cachexia. Hence, these approaches do not recapitulate NASH and its consequences (e.g. transition to HCC) in humans, and appropriate mouse models for genetically and mechanistically dissecting NAFLD-induced NASH and NASH-triggered HCC development have been thus far lacking.

Deficiency in the essential nutrient choline was described in NAFLD patients to exacerbate NAFLD and NASH. Moreover, humans with inadequate choline uptake were shown to have defects in hepatic lipoprotein secretion, oxidative damage caused by mitochondrial dysfunction and ER stress.

Based on the clinical observations of choline deficiency to exacerbate NAFLD

and NASH patients, we have recently combined choline deficiency with a high fat diet (CD-HFD) as a chronic diet for laboratory mice, which may lead to metabolic syndrome, steatosis, liver damage and NASH, thus delivering the ‘second hit’ that promotes dietary-induced liver carcinogenesis – similar to the human situation. This approach has enabled us to establish a chronic mouse model of NASH and metabolic syndrome, triggering subsequent HCC in a wild-type C57BL/6 mouse, in the absence of chemical carcinogens or genetic mutations predisposing to NASH or HCC development (Wolf et al., Cancer Cell, 2014). CD-HFD-treated mice display obesity, overweight, insulin resistance, liver damage and fibrosis and hepatic mitochondrial damage, dyslipidemia and NASH, as observed in human patients. HCC developed 12 months post-CD-HFD start and resembled histologically, genetically and morphologically human HCC. Interestingly, by using this novel model we could show that adaptive immune cells (e.g. cytotoxic T-cells as well as natural killer T cells) greatly contribute to the diet-induced liver pathology. Consequently, we also analyzed NASH patients and patients suffering from other liver diseases with concomitant lipid deposition diseases (e.g. chronic HCV infection) and could find the same activated immune cells in livers of NASH patients, as well as the same cytokines, which we identified to be causally linked to NASH and HCC disease development.

We thus believe that our mouse model recapitulates several pathophysiological aspects of human NASH and enables us to study its develop-

ment and transition to HCC. In the future, the link between activated T-cells in the liver and their crosstalk to hepatocytes could give us important insights into how we can generate novel therapeutics for treating NASH as well as NASH-induced HCC in industrialised countries.

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# Understanding coronary artery disease in postmenopausal ladies

**Dr Stefano Savonitto, Director of Cardiology at Manzoni Hospital sheds light on the risk of heart disease in women...**

**W**hen thinking about their health, women are especially concerned of cancer. However, the most frequent cause of death among women is heart disease, and especially coronary artery disease. The number of women dying of heart disease has surpassed the number of men in Europe. What is still a negative peculiarity of male destiny is the higher risk of premature cardiac death (that is before the age of 65), since women are probably protected by oestrogen before the age of menopause. After that age, the risk of cardiac events, especially myocardial infarction, but also stroke, among women gradually equalises men's risk to become more prevalent after the age of 75. A single, but important, epidemiological study carried out in the Netherlands involving more than 12 thousand post-menopausal women, followed for up to 20 years in a breast cancer program, showed that each year's delay in menopause is associated with a 2% reduction in cardiovascular mortality. This reduction in risk with later menopause seems to be particularly important in the early post-menopausal years, to disappear after the age of 80.

Therefore, understanding the development of heart disease after the natural cessation of oestrogen protection might disclose potential means of protecting women from their first disabling disease. Particularly considering that, as shown by the United States heart and stroke statistics, life expectancy is 30 years for postmenopausal women, and 20 years after the age of 65.

The protecting role of oestrogen against heart attacks is incompletely known, but seems to be multifactorial. A first piece of the puzzle might be that oestrogen causes a reduction in serum lipid concentration, a well-known risk factor for atherosclerosis which,

however, may be efficiently reduced by the currently available cholesterol lowering drugs, such as the statins and the even more powerful agents under development. A more recent observation is the association of early menopause with a higher risk of developing diabetes mellitus, another powerful atherogenetic risk factor. Oestrogen also has direct effects on the vasculature, by promoting vasodilatation, and regulating the growth of vascular cells (Figure 1).

However, the evidence that oestrogen replacement therapy may affect the progression of coronary disease after menopause is incomplete, and most studies have used a combination of oestrogen and progestin, more generally referred to as hormone replacement therapy (HRT). Observational studies consistently indicate that HRT is associated with a lower risk of coronary heart disease. Initial and large randomised trials have shown a null effect although most women in these trials were older than 60 and more than 10 years postmenopausal. Subsequent studies and meta-analyses indicate that cardiovascular and total mortality are reduced when HRT is initiated in women aged less than 60 or within 10 years of menopause. In a recent large randomised study from Denmark, more than 1000 women with recent menopause were treated using HRT (or left untreated in the control group) for up to 10 years and followed up for up to 16 years: HRT has significantly reduced the risk of mortality, myocardial infarction, or heart failure, as compared to a control group left without HRT. In this study, there was no excess risk of cancer or stroke, a potential "side effect" of HRT.

Besides these trials on potential preventive treatments, knowledge of the evolution of coronary disease after menopause is scanty. Whereas at a younger age women

# Pathophysiology of coronary heart disease in women

## Female sex hormones



### Macrovascular changes



- Smaller and less compliant arteries
- Plaque erosion
- Less critical stenoses of coronary arteries

### Microvascular changes



- Endothelial dysfunction
- Smooth muscle cell spasm

### Haemostasis changes



- Increased platelet reactivity
- Hypercoagulable states

Figure 1

have less coronary obstructive disease as compared to men, even in the cases with acute myocardial infarction, the prevalence of obstructive disease increases with age and as time passes after menopause. In Lecco, a multicenter study is being coordinated, involving 800 patients with acute myocardial infarction at 8 Italian centers, in order to assess by quantitative angiographic methods whether the age of menopause has any impact on the severity of coronary artery disease in the postmenopausal years. Prior data on this same issue seems to suggest that the impact of menopausal age, if any, is limited to the early postmenopausal years of women with very early menopause (before the age of 45). Should the data suggest that early menopause is associated with more severe and diffuse coronary disease, an impulse to either prolong the effect of estrogen after menopause or, alternatively,

to treat more aggressively the concurrent atherosclerotic risk factors in women with early menopause would be warranted. Besides the atherosclerotic mechanisms, the recent OCTAVIA multicenter study using optical computerised tomography (OCT) in age and sex matched myocardial infarction patients showed that the final mechanisms of infarction are very similar in women and men. This data find correspondence in clinical practice. ■

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# Tackling diabetes in Europe

**Jill Farrington from the World Health Organization (WHO) details the importance of raising awareness of diabetes throughout Europe...**

**H**ow much of a problem is diabetes throughout Europe? The number of people with diabetes (prevalence) can be hard to measure at national and European levels because many countries do not have diabetic registers or surveys or, where they do exist, they are incomplete. The World Health Organization (WHO) estimated that just over 8% of European adults had diabetes mellitus in 2014, with rates slightly higher for men than women, and wide differences between countries: the proportion of adults estimated to have diabetes can range from just over 5% in Belgium or Denmark to almost threefold that level in Azerbaijan or Turkmenistan at 15%<sup>1</sup>. The International Diabetes Federation expects numbers to continue to rise, reaching 70 million in the next 20 years<sup>2</sup>. To put this in perspective, that would mean more than 1 in 10 Europeans suffering diabetes by 2035.

Why are numbers rising? There are a number of types of diabetes mellitus but the most common, which is Type 2 diabetes, is closely associated with overweight and obesity. Obesity levels have more than tripled in some countries since the 1980s and now over 50% of the adult population in Europe is overweight, with at least half of these obese. Unhealthy diets and a lack of physical activity, attributed in part to social and environmental changes, are helping to drive the trends.

Major health challenges come with diabetes. Diabetes mellitus is not only a long-term condition that can lead to a shorter life and disability; it is a chronic, complex, metabolic disorder that increases the risk of damage to eyes, kidneys, nerves, heart and blood vessels. Apart from the toll on individuals and their families, and the personal and social consequences,

diabetes is also a financial burden for them and for health systems, with high costs associated with medications and hospitalisation for complications.

**“Diabetes mellitus is not only a long-term condition that can lead to a shorter life and disability; it is a chronic, complex, metabolic disorder that increases the risk of damage to eyes, kidneys, nerves, heart and blood vessels.”**

The good news is that diabetes can be prevented – and good care and education for people with diabetes can reduce the risk of complications. A healthier lifestyle can help prevent people from developing the condition in the first place, and intensive support can assist prevention for those most at risk. For those already with the disease, given its long-term nature, care needs to be centred around the person with diabetes with continuity and integration of care across different providers. The ability of individuals to manage their own condition supported by family or carers needs to be facilitated for example through structured education and personalised care planning. Primary care and nurses play important roles in this and can contribute to better patient outcomes. Patient education and intensive support for women with diabetes before and during pregnancy can lead to better outcomes for mother and baby. Early detection and treatment of diabetic eye damage can prevent blindness, and foot care can prevent amputations. Leading causes of death for people with diabetes are heart attacks and strokes so cardiovascular risk needs to be assessed and managed with advice to stop smoking, avoid harmful use of alcohol, eat healthily, be physically active, and maintain a healthy weight and use of medication as required.

Through its Global Action Plan for the Prevention and Control of Non-communicable Diseases (NCDs), endorsed at World Health Assembly in 2013, the World Health Organization is promoting policy options that can help attain by 2025 the targets of a 0% rise in obesity and diabetes by 2025, and 25% reduction in premature mortality from the 4 main NCDs which include diabetes. Many countries have in place a national plan or programme for diabetes prevention and control but problems with funding, quality of care, monitoring and evaluation may hinder implementation. The St Vincent Declaration of 1989 placed an emphasis on evidence-based treatment, equity of access, and strong partnerships in care for people with diabetes. While there is still some way to go in making this a reality for all in Europe, the Global NCD Action Plan provides opportunity for renewed focus. ■

<sup>1</sup> Age-standardised prevalence for diabetes in adults aged 18 years and over. Global Health Observatory, WHO, 2014  
<sup>2</sup> Diabetes in Europe: Policy Puzzle. The state we are in. IDF, 2015

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# Challenging the Diabetes Treatment Convention

**D**iabetes treatment costs in all developed countries have increased year on year for the past 20 years. Similarly the incidence of diabetes, predominantly type 2 diabetes, has risen year on year so that in Europe a quarter of the adult population have diabetes and rates are predicted to rise to the rate in the United States where one third of the adult population have type 2 diabetes.

In 2012 the direct costs of diabetes in the UK was estimated at £13.75 billion, but this is not the total cost since it does not take count of loss of earnings from inability to work, cost of early death, carer costs and transport costs. The £13.75 billion healthcare costs are mainly composed of treatment of concomitant disease and inpatient costs as a result of secondary complications. These secondary complications include adult onset blindness, cardiovascular disease, kidney damage, microvascular disease and neuropathy, often leading to amputation of lower limbs.

Given these ever increasing costs, one might expect that there would be serious attempts to prevent these complications by developing new strategies of early detection and treatments designed to address the pathophysiology of the disease. In fact primary treatment of type 2 diabetes has not changed in 40 years. The two classes of drugs given initially to type 2 diabetics are sulphonylureas and



the biguanide metformin. Metformin addresses one aspect of the pathophysiology in that it reduces glucose output from the liver but it does not stop the progression of the disease. Sulphonylurea drugs produce an initial significant reduction in the blood glucose concentration in many patients. However, the effects are short-term and there is a strong belief that sulphonylureas produce their initial benefit at the expense of a rapid decline in the ability of the pancreatic islet cells to produce insulin. Thus, although sulphonylurea drugs are cheap, they might actually increase the cost of diabetes treatment in the longer term.

Current therapeutic strategy follows the horse has bolted maxim. First there is no attempt to identify pre-diabetic patients, who if identified and provided with drug treatment plus

dietary advice might never develop diabetes. Second, diabetes is typically found by the GP following a consultation for another problem so that typically a person could have had diabetes for 10 years pre-diagnosis. The reason being in its early stage diabetes is a silent disease but secondary complications could be developing. Thirdly, many diabetics do not have a blood glucose home monitor and even if they do, blood glucose is only measured once or twice a week. Modern equipment for measuring glucose together with a mobile phone app to transmit the data to a doctor or diabetic nurse could put the patient in charge of their disease and would potentially result in better dietary compliance. Fourthly, current treatment is based on giving the cheapest monotherapy and when that fails adding a second drug and when that fails adding a different drug until





ultimately the patient requires insulin. De Fronzo in his Banting lecture to the American Diabetes Association proposed a different way. He said treatment needed to commence early and be based on the pathophysiology of the disease. The main factors involved in diabetes are:

- Increased glucose output from the liver even after a meal when the liver should be taking up glucose;
- Increased resistance to the patients' own insulin resulting in reduced glucose uptake by skeletal muscle;
- Increased release of fatty acids from the fat tissue;
- Impaired insulin secretion with ultimately a failure to produce insulin.

De Fronzo argued that the prime objective of diabetes treatment should be preservation of pancreatic islet cell function. This requires durable control of the blood glucose concentration rather than short-term fixes. De Fronzo recommended that a combi-

nation of metformin (to reduced glucose output from the liver), a thiazolidinedione insulin sensitiser (to improve insulin sensitivity, reduce fatty acid release and preserve islet cell function) and a GLP-1 mimetic (to increase insulin secretion in a glucose dependent manner – no hypoglycaemia – and to increase insulin synthesis and islet cell neogenesis) would produce durable blood glucose control and preservation of islets. Of course, increasing the level of diagnosis of diabetes and providing such a drug treatment would increase costs. However, the primary drug bill for type 2 diabetes is only 6% of the healthcare costs. Since the current treatment paradigm is so clearly failing and in 10 years time some one third of the total healthcare budget would need to be spent on treating diabetic complications, new modes of treatment must be tried.

The drugs in the De Fronzo paradigm are better than the existing treatment regime but it is not ideal. First it is three drugs. One is an injectable and both metformin and the thiazolidine-

dione insulin sensitiser have some side-effect issues in some patients. Thus, there is a need for new classes of drugs that are designed to address the pathophysiological paradigm.

**"In 2012 the direct costs of diabetes in the UK was estimated at £13.75 billion, but this is not the total cost since it does not take count of loss of earnings from inability to work, cost of early death, carer costs and transport costs."**

The Buckingham Institute of Translational Medicine is working with academic and industrial partners to address this by providing *in vitro* and *in vivo* pre-clinical testing facilities. In addition, it has a research programme to identify edible plant extracts that will mimic the effects of the various drugs in the De Fronzo paradigm.



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# Medical imaging – revolutionising healthcare

**Professor Alison Murray, Director of the Aberdeen Biomedical Imaging Centre, University of Aberdeen, explains how medical imaging has transformed healthcare over the years...**

**M**odern imaging is an essential part of healthcare and has come a long way since the discovery of X-rays in 1895 by Wilhelm Roentgen. Developments by researchers – many of them physicists and engineers in the UK – have resulted in imaging capabilities that we now take for granted, such as catheter angiography, ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI) and molecular imaging modalities in Nuclear Medicine and Positron Emission Tomography (PET). Imaging experts and equipment now form an essential component of all hospitals. Clinical radiology departments provide imaging for patients from emergency to routine out-patients, from conception to death. Imaging biomarkers of disease and response to treatment are highly effective in clinical trials of novel drugs and allow significant reduction in numbers studied. Clinical imaging also extends to national screening programmes, such as the use of X-ray mammography for breast cancer screening.

For much of the 20th century plain X-rays and modification of this technique by the introduction of contrast, such as barium or iodinated contrast materials for gastrointestinal studies or myelography, were the mainstay of radiological practice. In 1953 the Swedish radiologist Seldinger introduced safe catheter arteriography<sup>1</sup> which has revolutionised interventional radiology and cardiology, allowing placement of arterial stents and occlusion of cerebral aneurysms.

In 1958 the Scottish obstetrician and gynaecologist Ian Donald developed ultrasound, using sound waves to image the fetus during pregnancy,<sup>2</sup> and laying the foundations for modern antenatal care and the use of abdominal US for characterising abdominal masses.

The development of computed axial tomography (or CAT scanning) by Sir Godfrey Hounsfield in 1973<sup>3</sup>, supported by EMI funding as a result of the success of the Beatles, was a major advance that allowed us, for the first time, to see inside the head. Soon CT scanners were available in all major hospitals – completely revolutionising the lives of neurosurgeons (for whose benefit the images were displayed as though looked down on from above), radiologists and most importantly patients – who were now spared the barbarism of air-encephalography. Although limited to axial imaging for around 20 years, CT became and remains the mainstay of stroke treatment planning, cancer diagnosis and staging, trauma investigation and much more. CT took another leap forward with the development of slip ring technology in Erlangen (Siemens AG) in 1990, which allowed acquisition of a helical volume of data that could be reconstructed in any plane<sup>4</sup> – paving the way for CT angiography and 3D reconstructions. Methods that are now routinely used for pre-operative planning and follow-up.

Nuclear magnetic resonance (as MRI was first known) had been used for scientific analyses for some time but simultaneous ground-breaking research in brain imaging in Nottingham<sup>5</sup> and body imaging in Aberdeen<sup>6</sup> resulted in the first brain and body images of patients that would truly revolutionise medical imaging. Early work led to the development of gradient coils to allow slice selection and faster “spin-warp” imaging sequences (it was no secret that many early MRI physicists were “Trekkies”)<sup>7</sup>. Today patients benefit from faster, quieter, higher (both temporal and spatial) resolution images acquired at progressively higher field strength. These allow, not only beautiful anatomical depiction but functional quantitation of perfusion, neuronal activation, structural integrity, spectroscopy and MR

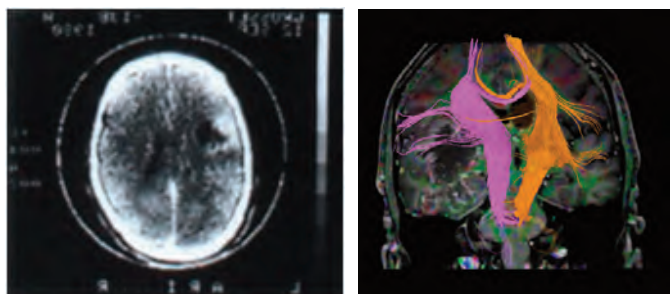


Figure 1 (left): Early Aberdeen axial T1 weighted MRI of patient with a left frontal high grade glioma.

Figure 2 (right): Coronal T1 weighted MRI at 3T following gadolinium, with superimposition of fibre tracking reconstructions from diffusion tensor imaging. These demonstrate that the tumour is displacing but not destroying the white matter tracts between the cortex and spinal cord (pink coloured areas)

Radiological images are all stored, transferred and reported from picture archiving and communication systems (PACS). In Scotland we are fortunate to have a single system, allowing images acquired on a patient in Inverness to be seen by an expert in Edinburgh, before a decision is made to transfer the patient. PACS now constitutes a vast database of clinically relevant images and using best practice for anonymisation and safe data linkage developed with the Farr Institute, researchers are developing methods to exploit these data to answer clinically important questions relevant to the NHS. The combination of imaging data with genomic and life-course data in future will be extremely powerful and provides new opportunities and challenges for healthcare. ■

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angiography, and provide exquisite structural and functional depiction of disease and its consequences, without ionising radiation. MRI has protean clinical applications and, importantly avoids radiation in imaging children and in second and third trimesters of pregnancy.

Nuclear medicine imaging using radioisotopes, such as radioiodine, has been available since the 1940s. However, the use of <sup>99m</sup>Tc, with its half-life of 6.5 hours, made labelling of many more useful molecules possible allowing, for example isotope bone scintigraphy – used for staging and monitoring response to the treatment of breast, prostate and other cancer patients. PET scanners use completely different hardware that relies on co-incidence detection of the simultaneously emitted photons following annihilation of a positron with an electron. PET is the most sensitive molecular imaging technique that, following production of hybrid PET-CT scanners, has revolutionised diagnosis and staging of many cancer patients and has been shown to be cost-effective <sup>4,8</sup>.

New methods of imaging continue to be developed. Fast-field cycling MRI, by varying the strength of the magnetic field during the scan, allows extraction of new tissue information <sup>9</sup> that has the promise to provide better information about breast cancer and new information in dementia-related neurodegenerative diseases. Micro-US takes the diagnostic and therapeutic potential of US and miniaturises this to make it available at the end of a biopsy needle <sup>10</sup>.



# Experimental PET Imaging Laboratory (EPIL)

The research goal of the Experimental PET Imaging Laboratory has been to develop untested new ideas for diagnostic and therapeutic approaches to enhance usability of PET imaging. The first clinical studies using positron emission techniques were done in 1952 by Gordon Brownell to localise brain tumors. The success of these studies led to wide use of positron emission imaging as a diagnostic tool for tumors and abscesses in different parts of the body in following 20 years when only film-based X-ray imaging was another option. Brownell conducted more than 6000 clinical patient studies before computer-tomographic (CT)-imaging came to the clinical use. Independently of CT-development Brownell's team developed software for 3-dimensional imaging and turned positron emission imaging to tomographic positron imaging (PET) by 1971. After that came a long silent period for PET imaging. The roadblock for clinical use of PET has been high cost and slow compensation policy of the healthcare stakeholders. PET is an expensive study compared to CT or magnetic resonance imaging since in addition to the imaging procedure it needs radiopharmaceutical agent what is often individually prepared for the study. After [ $^{18}\text{F}$ ]fluorodeoxy glucose ([ $^{18}\text{F}$ ]FDG) and its distribution were developed PET imaging obtained significant clinical role in oncological diagnosis and evaluation of therapeutic response leading to the concept of FDG-PET.

PET imaging is extraordinary well suited to study cellular function *in vivo* because a wide variety of agents can be made to target specific molecular sites within the body. Furthermore, PET can detect minute quantities of these agents. Therefore, the development of new imaging agents is an important aspect of the work. Even the major part of the work at the EPIL has focused on neurological diseases and especially glutamate functioning the developed techniques can be utilised to many other disorders including cancer.

There is considerable experimental evidence that metabotropic glutamate receptors (mGluRs) are involved in the regulation of synaptic transmission in the cerebroneurvous system. However, the lack of specific markers has limited the precise characterisation of individual mGluRs and hampered progress in identifying the physiological and pathological roles of mGluRs. As an outcome of the pioneering work at the EPIL there is now several PET imaging ligands for mGluR1, mGluR2/3, mGluR4 and mGluR5.

The developed PET imaging ligands and techniques can be used to investigate neurodegeneration like Parkinson's, Huntington's and Alzheimer's disease, fragile X syndrome, amyotrophic lateral sclerosis, schizophrenia, anxiety, epilepsy, pain, obesity, etc. Even these diseases and conditions are different they are dependent on glutamatergic neurotransmission. The



Gordon Brownell looking at a PET image of the heart

results obtained in the preclinical studies need to be translated to human studies to maximise the benefits of the research and it requires appropriate funding from different stakeholders like healthcare providers, drug companies, governments etc, what is presently a missing link.

Presently, at the time of the precision medicine PET has an important role in research and clinical use to point the target for therapeutic approaches as well as to determine the drug dosing and efficacy of the treatment.

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# Tumour therapy: Making the right choice

**The European Association for Nuclear Medicine explains how nuclear imaging techniques help tailor treatments and match the individual cancer patient's needs...**

**F**or tumour patients the timely choice of the appropriate therapy is of vital importance. Nuclear medical methods such as PET (positron emission tomography) allow not only for targeting the tumour but also for assessing the treatment outcome soon after therapy onset. This enables doctors to change treatment if necessary and adapt it to the specific conditions and needs of their patients, says Professor Stefano Fanti, expert at the European Association of Nuclear Medicine (EANM).

**“The most tested tracer used for PET is FDG (2'-[(18)F]-fluoro-2'-deoxy-D-glucose), a radioactive glucose analogue. But currently a number of other radioactive tracers to assess therapy response are being studied, among them labelled Choline, which can be used in prostate cancer that is not suitable for FDG.”**

Over the past years the number of patients with solid tumours such as cancer of the colon, the breast or the lungs has increased. This is due to a variety of reasons, among them a raised life expectancy as well as the exposition to new risk factors, for example a wider diffusion of smoking among females. Furthermore, cancer is earlier being detected than it used to be, thanks to refined imaging procedures that are already used for screening.

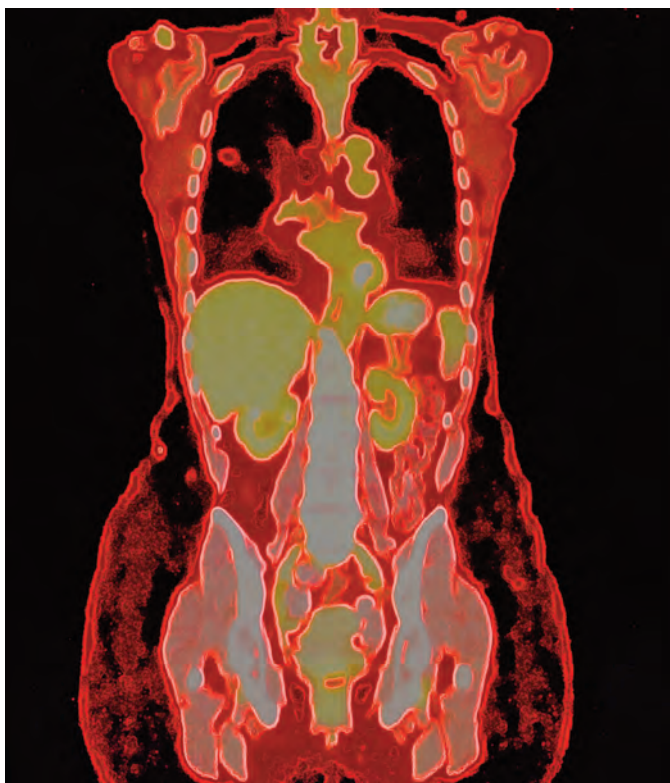
“In the past, enormous public and private investments have been made in order to reduce cancer incidence and mortality. Despite some improvements over the last 10 years, the overall outcome of the “war against cancer” has been disappointing. Among the reasons for this is limited success in our inability to determine, whether the therapeutic target is reached and possibly

cured by the drug that is being applied. A further important issue is our limited ability to correctly assess response to treatment early after the start of therapy, which would allow for more individualised treatment approaches,” says EANM expert Prof. Stefano Fanti (University of Bologna).

## **A new weapon against cancer**

This is where the combination of the 2 imaging techniques PET (positron emission tomography) and CT (computed tomography) comes into play. While CT uses X-rays to deliver cross-sectional anatomical images, PET spots cancerous cells by making visible their metabolism through tracers (radioactively labelled substances the patient is injected with).

In the last 15 years PET/CT has been successfully employed to assess how patients respond to chemo and radiotherapy. Before treatment starts, patients undergo a PET examination in order to evaluate the malignancy and the extent of the tumour by measuring the tissue's uptake of the radioactive tracer in relation to the administered dose and the body weight. After chemo or radiotherapy, or a combination of both, a second PET examination is performed in order to evaluate the treatment outcome. The amount of tracer substance that can still be visualised now informs on how much the metabolic activity of the tumour as well as the extent of the cancerous areas have been reduced. Even a complete normalisation is not rare. However, even in such cases, where the therapy has been entirely successful this is not always accompanied by a complete disappearance of the tissue mass which may persist as a fibrotic area still detectable through morphological imaging modalities such as CT. This is why these conventional imaging techniques, although very



accurate in staging, have a low specificity in the assessment of therapy response in oncology. By contrast, PET allows to safely and precisely assess the efficacy of chemotherapeutic or radio therapeutic treatment in a non-invasive manner.

“A PET response to therapy is of clinical impact because it is related to prognosis and to subsequent clinical and therapeutically individualised choices. This approach was proved to work in several solid tumours such as gynaecological cancers, breast cancer, brain malignancies, lung cancer, head and neck cancer, pancreatic cancer, oesophageal cancer, soft tissues sarcomas, neuroendocrine tumours, colorectal and anal cancer. Even in certain kinds of lymphatic cancer at the advanced stages PET provides better diagnostic and prognostic results,” says Prof. Fanti’s colleague Dr. Cristina Nanni.

The most tested tracer used for PET is FDG (2'-[(18)F]-fluoro-2'-deoxy-D-glucose), a radioactive glucose analogue. But currently a number of other radioactive

tracers to assess therapy response are being studied, among them labelled Choline, which can be used in prostate cancer that is not suitable for FDG.

### **New avenues for tumour treatment**

The high sensitivity of PET/CT in therapy assessment has allowed oncologists and nuclear medicine doctors to further exploit its potential for the patients' benefit. By applying PET/CT early after therapy onset – for example after 2 or 3 cycles of chemotherapy – they could show that a decrease in metabolic activity in responding tumours occurs very soon after therapy onset even if the mass is unchanged in size and shape.

This has important consequences. A non-responder patient can be identified very soon after therapy, so that non-effective chemotherapy can be immediately stopped, reducing adverse side effects through inefficient toxicity and enabling an early salvage approach, for example by shifting to a different drug or to radiotherapy. Due to this, PET/CT lays the ground for therapies that are tailored to the individual patient: The data provided allow for the selection of the most efficient drug while at the same time avoiding useless toxicity, thus supporting personalised therapeutically choices.

For further information from EANM, please also visit [www.facebook.com/officialEANM](http://www.facebook.com/officialEANM).

For an animated introduction to nuclear medicine, please visit the website [www.whatisnuclearmedicine.com](http://www.whatisnuclearmedicine.com). ■

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# Highlighting the best of Irish research

**Adjacent Government highlights how funding for research in Ireland is enabling the country to tackle some major societal challenges including healthcare...**

Ireland has a wealth of knowledge and skills when it comes to research. The country has risen in the world research rankings from 36th in 2003 to 20th in 2010. With the help of funding organisations such as Science Foundation Ireland (SFI), the Irish Research Council, and Enterprise Ireland the country is starting to show itself as one of the leaders of research excellence in Europe.

In order to give a much needed boost to research in the country, the Irish government has provided funding for a number of new initiatives, all of which have been launched in the last 12 months. Ireland has set its sights on €1.25m of European funding for research under the Horizon 2020 programme, and these initiatives aim to help the Irish research community prepare ideas and projects for competition at a European level.

Announcing 'New Horizons' <sup>1</sup>, one of the funding initiatives launched by the Irish Research Council, the Minister for Skills, Research and Innovation Damien English commented on their importance.

He said: "Ireland has punched above its weight in the first round of results from Horizon 2020, based on the quality of our researchers and their research proposals. The Irish Research Council New Horizons funding will provide opportunities for the research community to maintain this momentum in what is an incredibly competitive European environment.

"Our success in Horizon 2020 will play an important part in showing that Ireland is a hub for excellent research and innovation."

Investment can play a key role in boosting research. In April this year the Irish government also announced over €30m of research funding for 23 major projects <sup>2</sup>. Government backing such as this is key for Ireland to develop research & development and become a global leader in the field.

The investment will be delivered by the Department of Jobs, Enterprise & Innovation through the Science Foundation Ireland (SFI) Investigators Programme. During a 4 to 5 year period, the programme will

provide 23 research projects with funding ranging between €500,000 to €2.3m. Over 100 researchers will be involved.

“This funding provides assistance to individual researchers to advance their investigations and address key research questions in sectors such as energy, medicine, food and nutrition, technology and agriculture” said English.

“It allows researchers to further their careers and build partnerships with leading industry partners who also benefit from access to some of the leading academic talent on this island. This investigations Programme is an important contributor to Ireland’s credentials as a research leader in a number of sectors.”

Health research is vital to treat and prevent many of the national health challenges faced throughout Europe. In December last year, €1.9m<sup>3</sup> of funding was also announced in a partnership between SFI and pharmaceutical company Pfizer. The funding will encourage new bio therapeutic research in Ireland and deliver important potential discoveries in the areas of immunology and rare diseases.

Professor Martin Steinhoff, Director of UCS Charles Institute of Dermatology and Charles Clinic, is one of 5 researchers from 4 academic institutions in Ireland to receive some of the funding. Through his research, Professor Steinhoff hopes to investigate severe skin diseases caused by inflammation and develop a new therapy that targets immune response.

Professor Mark Ferguson, Director of Science Foundation Ireland and Chief Scientific Adviser to the government of Ireland commented on the funding. He said: “At the heart of the SFI’s Agenda 2020 strategy is the funding of excellent scientific research that may impact both society and the economy.

“Innovative partnerships between industry and academia are crucial if we are to continue to share knowledge that could lead to the development of new medical breakthroughs.”

Horizon 2020 is crucial to Ireland’s success. In the first 9 months of the EU’s flagship research programme,

Ireland’s researchers and companies successfully won a total €97m of funding.

Further cementing their place alongside research leaders, the country has also moved up one place on the 2015 Innovation Union Scoreboard – from 9th in 2014 to 8th place. The Scoreboard<sup>4</sup> provides a comparative assessment of the research and innovation performance of EU Member States. Out of the 8 dimensions that make up the European Commission’s Innovation Union Scoreboard, Ireland is ranked first in 2 of them: Innovators and Economic Effects. English welcomed the news, stating: “This is the second year in a row in which Ireland’s ranking has improved, up from 9th in 2004, and 10th in 2013. In June 2013, the government set a range of system level targets in the context of implementation of research prioritisation and one of these targets was to move to 8th place in the innovation Union Scoreboard by 2017.” He concluded: “I am confident that, based on the pipeline activity, we will surpass our targets of €100m for the first year of the Programme. There are many more opportunities where innovative firms, including SMEs can exploit Horizon 2020.

“I want to encourage more industry participation. Success brings not only financial rewards, but also a change to collaborate with the best and brightest in Europe.” ■

<sup>1</sup> <http://research.ie/scheme/new-horizons-research-project-scheme-now-open>

<sup>2</sup> <http://www.sfi.ie/news-resources/press-releases/minister-english-announces-over-€2%82%AC30-million-sfi-investment-in-scientific-research.html>

<sup>3</sup> <http://www.ucd.ie/charles/news/december2014/title,225505,en.html>

<sup>4</sup> [http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015\\_en.pdf](http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015_en.pdf)

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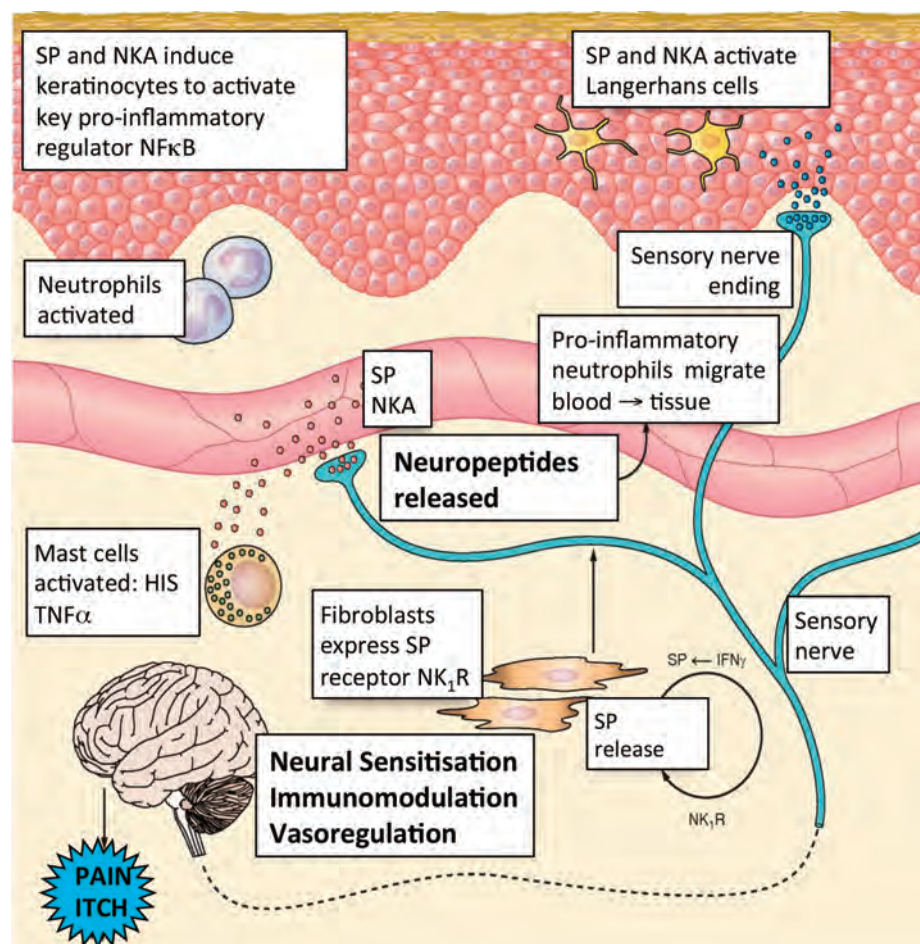
# Systems medicine approaches in dermatology

Although a small field in medicine, dermatological diseases are very frequent and span a wide range of illnesses such as allergies, inflammation (e.g. atopic dermatitis, psoriasis), autoimmune diseases or malignancies (e.g. melanoma). Thus, translational dermatological research is an important, innovative field for future basic and clinical research for many diseases in which treatment is still an unmet medical need.

## Skin conditions under investigation

The major areas of dermatology under investigation at the Charles Institute are atopic dermatitis, rosacea, itch and other inflammatory skin conditions (Director: Professor Martin Steinhoff, Professor Frank Powell), cell signalling (Professor Cormac Taylor), wound healing and epidermolysis bullosa (Dr Wenxin Wang) and melanoma genetics (Dr Simon Furney). These areas are explored using a wide range of innovative techniques: disease models, 3D skin models, proteomics, genomics, metabolomics, cell signalling, immunology, systems biology, and state-of-the-art imaging.

Itch serves as a self-protective system under normal conditions, but chronic itch can have a debilitating impact on quality of life. Chronic itch can be caused by skin conditions such as atopic dermatitis (eczema) and contact dermatitis, or after zoster (shingles), by systemic disorders or certain medications. Terminally ill cancer patients, for example, often experience such severe itch in response to morphine



**Figure 1: Neuroimmune communication in itch: Sensory nerves releasing neuropeptides substance P (SP) and neurokinin A (NKA) in the skin, activating NFκB, histamine (HIS) and other molecules which regulate inflammation and itch. Adapted from Steinhoff et al., *Physiological Reviews*, 2014**

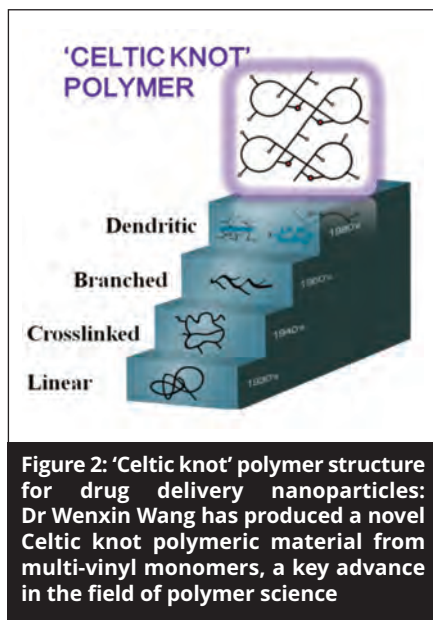
that many choose to live in pain rather than take the medication. Steinhoff's laboratory is discovering more about the mechanisms of itch (Fig. 1). A large part of their work focuses on endothelin-1, and they have shown that it is possible to turn the dial up or down on the level of itch by targeting this pathway.

Epidermolysis bullosa is a family of genetic skin diseases characterised by skin fragility, resulting in blisters, chronic wounds, scarring and skin

cancer. In an effort to find a cure to this devastating disease, the Wang team has developed a non-viral, polymer-based vector carrying normal collagen type VII expression to cells in which it is missing. Unlike most genetic therapies, this is designed to be applied directly to the skin.

Wang's laboratory designs and builds polymers with a variety of defined shapes illustrated in Fig. 2 which can be specifically tailored to suit the application. This distinctive combina-





tion of chemical and biological expertise offers promising prospects for application to many areas of bioscience, including drug delivery, immunology and the development of vaccines, biodetection and biosensor, antimicrobials and antiviral agents.

Another target group of patients in Wang's sights is people with diabetes. Over time, diabetes can damage the nerves and circulation of the lower limbs, and if wounds form they can be very hard to heal and in severe cases the person may need an amputation. The Wang group has been looking at the specific needs of diabetic wounds and has developed a tailored biomaterial that could be used in dressings to carry therapeutic agents such as stem cells and growth factors.

Rosacea is a chronic inflammatory skin disorder with symptoms of dry, sensitive facial skin that commonly affects middle-aged people, with a

particularly high incidence among people of Celtic extraction. As an example of modern translational research, Steinhoff's recent findings gave new insights into the pathophysiology of rosacea, which is so far incompletely understood. Using a combination of transcriptomics and immunohistochemistry, his group elucidated for the first time the complex pathways of genes involved in this condition (Journal of Investigative Dermatology 2015). Another approach led by Prof. Frank Powell focuses on deciphering the role of the Demodex mite, a microscopic organism associated with the inflammatory lesions which affect rosacea patients.

### Translational research

At the UCD Charles Institute of Dermatology, the vision is to establish a centre of excellence for translational dermatology research in Ireland, working with colleagues in dermatology clinics at UCD's affiliated hospitals. The goal is to understand the pathophysiology of skin diseases in a translational fashion. The outstanding infrastructure with patient care clinics, clinical trial units, and a new €20m research centre for over 70 scientists provides a unique opportunity to comprehensively study the pathophysiology of various skin diseases, develop new treatments and perform innovative clinical trials for patients with treatment-resistant skin diseases.

### Funding

Avon; Bayer; Bristol Myers-Squibb; Chugai; City of Dublin Skin and Cancer Hospital Charity; DEBRA International;

Galderma; German Research Foundation; Leo Foundation; L'Oreal; Maruho; National Institutes of Health (NIH); Pfizer; Salix; Science Foundation Ireland; Tigercat; Toray; Vertex.

### Director biography

Professor Martin Steinhoff is a clinical dermatologist as well as a basic scientist with 20 years' experience in translational dermatological research. He is a trained dermatologist, allergist and phlebologist with specific interests in neuroimmunology, inflammatory skin diseases and systems medicine. After his appointment as associate professor in Germany (2005-2008), he worked at the University of California, San Francisco, as full professor (2009-2013) with NIH-funded research. Steinhoff began his position as professorial chair of dermatology and director of the UCD Charles Institute of Dermatology in January 2014.



### Prof Martin Steinhoff

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# Can e-cigs increase your odds of quitting?

New studies highlight the danger posed by the Tobacco Products Directive

Two new studies into the use of e-cigs, and successful smoking cessation have recently been published. The first<sup>1</sup> looked at e-cigarettes as a category, and found that daily use of an e-cig was linked to a significant increase in likelihood of making an attempt to quit smoking compared with non-users (65%vs 44%) – BUT not to an increased success rate, although 14% had managed to cut their cigarette consumption by more than half (compared with 6% of non-users), increasing the odds of a successful quit attempt in the future.

The second study<sup>2</sup> looked at both the frequency and type (cigalike vs tank system) of electronic cigarette being used. 11% of daily cigalike users, and 9% of non-daily tank users had stopped smoking, compared with 13% of non-e-cig users. This indicates that daily cigalike use had no real effect, and non-daily tank use reduced rates of quitting. However, daily tank users had a 28% success rate in moving away from smoked tobacco.

There are a number of caveats with these data: the demographics of the tank users tended to be quite different, which is likely to have an effect. Older people were more likely to use tank systems, and this may reflect a greater intention to quit in this group. Another pre-determinant was lower education, but since this is a traditionally high smoking prevalence group, this is itself good news, and may be an indi-

cation that this success was motivated more by financial than health reasons.

The low rates among cigalike users may be a reflection of the use of e-cigs as a solution to restrictions on indoor smoking, and that many of this group therefore have no intention of quitting.

Cigalikes are also often less effective at delivering nicotine, although there is considerable heterogeneity, and it would be unfair to class them all this way. Another factor it is important to bear in mind is that this study was mainly conducted in 2013, and so features comparatively old products, in the rapidly evolving e-cig market. Finally, the significant loss to follow-up means that the sample size is fairly small, and this limits the extent to which the study can be considered robust, and generalizable to the population as a whole.

So how is this relevant to the Tobacco Products Directive<sup>3</sup> (TPD)? The TPD is, not to put too fine a point on it, a bit hostile towards refillable tanks systems, and the liquid used to refill them. Of particular note in the e-cig section (Title III, Article 20) are subsections (a), (b) and (g) of paragraph 3. These require Member States to ensure that:

“(a) nicotine-containing liquid is only placed on the market in dedicated refill containers not exceeding a volume of 10 ml, in disposable electronic cigarettes or in single use

cartridges and that the cartridges or tanks do not exceed a volume of 2 ml”

“(b) the nicotine-containing liquid does not contain nicotine in excess of 20 mg/ml”

“(g) electronic cigarettes and refill containers are child- and tamper-proof, are protected against breakage and leakage and have a mechanism that ensures refilling without leakage”

Why is this such a problem? Here are some design features of recent tank systems, and the issues associated with them:

- Capacity of over 2ml, so as to reduce the frequency with which they need refilling. This is explicitly prohibited by the Directive;
- Material often glass, so as to reduce the potential for leaching from polymer/plastic materials. Unlikely to be considered ‘protected against breakage’;
- Often have a selection of types available, to allow user customisation (usually in the form of different replacement coils, with different resistances available). This is likely to fall foul of the “tamper proof” requirement, and will make it more difficult to meet the notification, and consistent dose, requirements;

And the big one (last, but very far from least).



- Have a variety of refill methods, which generally involves unscrewing part of the system, so that liquid can be refilled from a fairly standard soft bottle, with a fine delivery tip.

This is a problem because, as part of this Directive, the European Commission are delegated with responsibility for “technical standards for the refill mechanism provided for in paragraph 3(g)”. The Commission have delegated yet further to a contractor, with the current estimate for publication being quarter 2, 2016<sup>4</sup>. Since this proposed mechanism does not currently exist, it is not used in any current products, and so **all refillable tank products currently available will be prohibited**.

Even worse is that the deadline for placing a product on the market without having to notify 6 months in advance (another of the TPD provisions, from Article 20, this time in para 2) is 20 May, 2016. Since the (as yet theoretical) mechanism’s technical specification will not be available until just before or potentially after this deadline, it cannot be introduced to the market before this deadline. This means that any necessary re-design,

prototyping, as well as all the required product testing will have to be concluded by no later than 20 November 2016. Why November? Because 6 months after this date, 20 May 2017, all products that do not comply with the TPD have to be removed from the market by Member States (as set out in article 30 of the TPD). If this deadline is not met, come May 2017, the only products available on the market will be those that are not refillable.

There are other possibilities, too: there are no comparable leak-free refill mechanisms for viscous liquids on the scale required. The tank system is limited to a volume, rather than a capacity, of 2ml, about 0.5ml of which is usually occupied by the atomising element already, so this may not actually be technically feasible to achieve at all.

Come May 2017, it’s going to be much easier to place the comparatively ineffective cigalikes on the market than the tank systems that, according to the studies, are most likely to enable people to completely switch away from smoked tobacco. To put it mildly, this does not seem likely to

have a beneficial effect on public health. It’s also likely to destroy the vast majority of the e-cig industry, and favour those with the biggest budget – most probably handing what little remains to the tobacco industry. It’s hard to conceive of any reason why this is a good thing, either.

1 <http://onlinelibrary.wiley.com/doi/10.1111/add.12917/abstract>

2 <http://ntr.oxfordjournals.org/content/early/2015/04/20/ntr.ntv078>

3 [http://ec.europa.eu/health/tobacco/docs/dir\\_201440\\_en.pdf](http://ec.europa.eu/health/tobacco/docs/dir_201440_en.pdf)

4 [http://ec.europa.eu/health/tobacco/docs/implementation\\_plan\\_en.pdf](http://ec.europa.eu/health/tobacco/docs/implementation_plan_en.pdf)



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# European cohesion policy: a must for local government?

**Annemarie Jorritsma, President of the Council of Municipalities and Regions and Mayor of Almere in the Netherlands, details the importance of cohesion policy being developed for and by local and regional governments...**

Whether we like it or not, 40% of EU funds are invested, through different means, in our territories: regions, cities and municipalities. Besides, regular studies show that more or less 60% of the decisions taken by local government are directly or indirectly influenced by European legislation. In this context, there is no doubt, our municipalities, cities and regions are key players for economic development and growth. At a moment when Europe is searching for ways to sustain new development models, local and regional governments will be at the heart of such a shift.

In that sense, the cohesion policy, which is the EU's main investment policy with the stated aim of supporting job creation, competitiveness, and economic growth throughout our territories, represents one of the most concrete and best examples of Europe's engagement with our fellow citizens and territories. Given the current context this is essential today.

The economic and financial crisis, the effects of which have been felt since 2008, continues to have a huge impact on our towns, cities and regions: local finances are consistently under pressure, many municipalities and regions are facing reduced transfers from the central government. Furthermore public sector revenues are constantly falling as a consequence of the contraction of economic activity. This situation is leading to a serious reduction of investment at local and regional level, which in turn has a negative impact on the local economy and employment.

In this context, how can local and regional governments provide 500 million Europeans with high-quality health care services, education facilities, public transportation or aid to SMEs? Here EU cohesion policy has a starring

role to play. This is what I would like to stress as the President of the Council of European Municipalities and Regions (CEMR), which is the broadest European association of local and regional governments. Through its 60 national associations of local government from 41 European countries, CEMR represents more than 150 000 municipalities, cities and regions, including 100 000 in the European Union.

## **Cohesion policy must be developed for and by local government and its representatives associations**

The European Commissioner in charge of cohesion policy, Corina Crețu recently said: "The bottom-up approach in policy making needs to be complemented by a top-down drive". There are no magical solutions to ensure that this happens in reality. We, local and regional governments through our representative associations, alongside the Commission need to work hand in hand.

It would not be fair of me to say that the Commission has made no effort to involve municipalities and regions. It was indeed during the preparation of the current cohesion policy programming period (2014-2020) that the Commission officially and, for the first time, included municipalities, cities and regions in deciding how to spend €352bn of EU funds. This development marks a huge achievement.

But there is still room for improvement. According to a study published by CEMR and its member associations, although central governments have a legal obligation to closely cooperate with local government; only 4 of the 18 countries studied kept them fully involved.

Cooperation with local and regional governments is



also key to the success of European Commission President Juncker's €315bn investment package. This is the message we want to send across, loud and clear: The failure of previous development strategies clearly showed that such an ambitious project can only succeed if local government is fully involved from the beginning.

### **Cohesion policy invests in the low-carbon economy**

Any cooperation with the European Commission should be extended to all EU policies that directly or indirectly affect our cities, towns and regions.

It is worth saying that about 80% of energy consumption and CO<sub>2</sub> emissions in today's Europe are associated with urban activity. It is obvious therefore, that local and regional governments have much to say when addressing Europe's objectives on energy efficiency and the environment.

Aware of such responsibility, over 6.000 municipalities and regions throughout Europe joined forces through the Covenant of Mayors, in which CEMR is partner, to reduce their greenhouse gas emissions by at least 20% by 2020.

It is clear to us, the solutions to climate change are first and foremost local. This is why we will actively engage our members, alongside our global organisation – United Cities and Local Government – at the United Nations summit on climate to be held in Paris at the end of 2015.

The international summit will end up in a new set of goals on climate to be achieved and local and regional governments will engage in this process. In that sense, I must say that the EU €38bn investment to support the EU's transition to a low-carbon economy is a timely initiative that we should definitely use to enhance local energy production, bring down energy bills, address fuel dependence, increase energy efficiency and raise the share of renewables.

The cohesion policy is about empowering municipalities and cities of all type - small, medium-sized and large cities - and regions regardless of their nature, whether urban or rural. Meeting their needs while taking into account their specificities can only be achieved by working in partnership with them and their representative associations. ■



### **Annemarie Jorritsma**

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# Dhaka, The Productive City

The capital of Bangladesh, Dhaka, is often reminded as a poor, busy and polluted city in the heart of an often-flooded country. For a long time it was a quiet town, without any turbulence until recently some tension emerged. Deeper causes are not yet revealed but could have something to do with the high densities, increasing shortages of food, limited access to water and religion. With 170 million people in Bangladesh and 15 million in Dhaka only, the productivity of the country needs to be increased in order to be able to feed everyone and to become less dependent on aid from foreign countries. One way of increasing productivity is to grow food where it is consumed: in the city.

## Food security

Looking at Dhaka from a food perspective many of its problems come together. The main issue is how to feed the rapidly growing population. In first instance this is a quantitative matter. Where can areas be found that are, together, big enough to produce enough. Secondly it is a qualitative problem. Many fertile grounds have recently been built upon and forced out of production. Thirdly it is a matter of connections and distances. The distance between agricultural fields and city consumers increases, a problem that is exaggerated due to the vulnerability of the infrastructural system. The fourth underlying problem is the availability of water, both in qualitative terms of good water as in quantity, i.e. is there enough water in periods when it is needed? These problems are altogether

amplified as result of climate change. With a summer that is getting longer and longer, shifting rain periods, just outside the growing season and erratic rainfall, causing floods puts increasing pressure on the harvest itself. The absence of suitable land for growing food, the difficult distribution system, traffic congestion, water-quality and – management and increasing pressure due to climate change multiple and interdependent problems hit the city. In this complexity of problems only integrated solutions offer a way forward. How can we provide a productive ground for solving the multiplicity of problems in Dhaka?

**“With 170 million people in Bangladesh and 15 million in Dhaka only, the productivity of the country needs to be increased in order to be able to feed everyone and to become less dependent on aid from foreign countries. One way of increasing productivity is to grow food where it is consumed: in the city.”**

## Methodology

As a first step we conducted an intensive integrated design week for Dhaka.

The advantage of a design intensive is all information needs to be brought to the table at the same time (integration of information and solutions), and the pressure cooker of having to develop design propositions within a week for such a complex task prevents lengthy debates about details and challenges minds to identify the linkages and

benefits of solutions for multiples problems. The set-up of the week was chosen as a design charrette (Roggema, 2013). The week starts with several introduction lectures briefing the students about Bangladesh and Dhaka specifically, about designing for a sustainable city and the program for the week. During the whole week local Dhaka knowledge is available in person as a question booth, but also as reviewer of proposals and shared commissioner of the assignments. Most of the work is carried out in groups. First the participants are divided over groups according themes of water, energy, food, traffic and metabolism. They needed to come up with systemic solutions for the entire city. After this the groups were mixed in order to bring together knowledge and understanding about each of the themes in five spatial strips, horizontal cuts in the city, which together formed a whole. The task here was to integrate the systemic solutions for the five themes to one coherent story for each of the strips. After each of these tasks the solutions were shared through intermediate presentations. The final stage of the design week concerned the detailed design for crucial points in each of the strips. This could be a certain energy solution, a detail of a neighbourhood or a market place. The week was completed with a final presentation in which each of the groups presented their entire story, from the entire city level until the detail they'd designed for a specific place. This approach put a lot of emphasis on collaboration skills of the participants and also to turn fresh





**Figure 1. Connecting the strips**

information immediately into visual representation. The design and drawing work and visualisation techniques are an important part of the intensive design week, and as such require substantial time.

## Results

The results of this intensive way of

working are collected at three spatial scales: the whole city of Dhaka, the intermediate scale of precincts and the local level of specific detail locations.

At first the problems at the entire city level are mostly systemic by nature. For instance there is too much water being used which is also polluted and

gets even more polluted after use and is discharged as waste water in the river system. Or energy resources are used that pollute the city and increasing use leads to more pollution, the traffic and use of electronics is only growing hence the output of the energy system is ever increasing air pollution. Additionally, these systems are interrelated and connected with each other in the urban metabolism model, in which the city is seen as an integrated system in which all kinds of resources are processed, leading to outputs such as waste, but also new knowledge and welfare for its inhabitants. The aim of the urban metabolism model is to reduce the use of resources, process them smart and reuse as much as possible, and reduce the waste streams, while increasing the quality of life. For the energy, water, food and transport system Dhaka has been systemically redesigned during the Design Week. This has led to the proposal of new urban rivers, energy cascades, separation of traffic according to speed, a monorail system and floating markets and lonely farmers (growing food on their own rooftops). Through connecting places where food grows by water or road and provide clean water, spaces where food can be produced increase the amount of food produced in the city, it is closer to the consumers and can be transported easily.

At the intermediate level the entire city system solutions are connected to localised precincts. Dhaka was divided in five horizontal 'strips' for design reasons. In each strip a specific



**Figure 2. Guiding image with additional water body and production of fish and vegetables**  
(impression: Wytze Hoekstra & Stephanie Mullaart)

connection between infrastructure, housing, water management, energy-supply and food production is designed. The northernmost strip is connecting neighbourhoods with each other through a new green infrastructure in which water will be stored and food can be produced. It forms the cement between the residential areas. The second northern strip creates a central green water space in which a newly reconstructed river on two levels produces fish and contains also energy producing cascades, while

the surrounding green provides space for growing vegetables and fruit. From these places the produce is easily transported to crossroads in the precincts, where local markets take care of further distribution. In the central strip new waterways collect rainwater to be used to grow food, which is brought to food hubs in the food-corridor connecting the places where the food is sold in the multi-layered market, with a fish factory and a green food roof on top. The fore southern strip emphasises the

operation of energy cascades, which are small elevation differences where water flows downwards. Each of the steps in the cascade is provided with its own typical food production in a sawah-like system. The southernmost strip of the city centre proposes to connect hubs with transport, water and food from north to south and from east to west, collecting rainwater along the way and storing it in two big storage ponds. The connection of the western pond with the existing river, creates a natural island in the old river.



When the five strips are reconnected again (Figure 1) the City of Dhaka forms a hybrid design system in which elements of the strips are connected to the bigger picture. The interesting finding is that the diversity of the strips can still form one hybrid whole, in which the basic system operate in a much more sustainable way together than currently. The potential of food production, estimated at the whole city level is elaborated in five different ways and underpinned by the design exercises at the precinct level.

At the local level finally, concrete designs are created for solutions in different fields such as water, or energy or food, made specific for the place, but still integrated with the other themes and connected to the higher levels. Ideas for sustainable living, a regenerative landscape with water storage and food production (Figure 2), a water-energy cascade, a recycle river, an elevated traffic system as a riksja highway and a diversity of hubs have been designed at this level. They all illustrate the integration of topics and the sustainability the solutions can offer at the lowest scale. Each of the detail designs give insight in the productivity of the specific area and adds up to a productive Dhaka.

### A Productive Dhaka

The example to redesign Dhaka in a intensive design week has several advantages. With the right scope it enhances the amount of food that can be grown in the city and thus raises the productivity of the city. Secondly it illustrates that productivity/food pro-

duction can be used as a mechanism to leverage other thematic solutions, for instance increase of renewable energy supply, an advanced infrastructure system, and cleaner water. The solutions brought forward in a week have an originality that can only be reached without too much knowledge about the site. There are always enough reasons for not proposing innovations and when these are known during the design process, innovative designs are hard to get. The flipside of this is that some solutions might be a little out of scope. Therefore, a follow-up after this week is required during which governmental authorities, together with entrepreneurs, NGO's and residents can elaborate the suggested solutions, especially at precinct level and for crucial locations in the city.

**“The aim of the urban metabolism model is to reduce the use of resources, process them smart and reuse as much as possible, and reduce the waste streams, while increasing the quality of life.”**

The approach used for Dhaka must be seen as a first step towards integration of policy and improvement of sustainability for the inhabitants of the city. The results of the Intensive Design Week show a range of innovative ideas, spatial solutions that generally solve more problems than the one it was invented for, and integrate not only themes and topics, but also time horizons, spatial scales and people. In this perspective it is a first step in a

longer pathway to come. But it is also a necessary step as current policy development often gets stuck in the daily routines of impossibilities and constraints. Therefore this first step is cheap in organising, but valuable in its impact and can be very useful for many other cities around the globe.

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# Urban Development for the highest level of quality of life

**Andreas Trisko and Katharina Söpper from the Municipal Department of Urban Development and Planning, City of Vienna shed light on the Urban Development Plan Vienna 2025...**

Vienna's Urban Development Plan 2025 (UDP 2025) was adopted in June 2014 and is the 4th development plan since 1985. The key question is, how does the municipality plan aim on keeping its high quality of life, by using less resources, saving free space and being a smart city? The UDP 2025 answers this question by using "True Urban Spirit", which displays the commitment of the city to being livable for everyone. Nowadays Vienna can look back on being the most livable city in the world, several times in a row.<sup>1</sup>

This fact displays that Vienna already is very attractive for existing as well as new residents. After gaining more than 200.000 new residents in the last 15 years, statistical predictions expect 2 million inhabitants for 2029 (2014: 1.8 million inhabitants).

Living space was provided by the development of new areas, but as well in the existing city by reusing empty housing space. Urban development areas will provide new housing space in the upcoming decade. Current and future residents will benefit from the further development of the city, from new living and working spaces as well as from new and improved infrastructures.

The UDP 2025 illustrates principles along them the City of Vienna will develop the city during the next decade. All initiatives and measures are strategic and lay the first step for practical projects. Further thematic goals are discussed on the next level of the strategic framework, in so called thematic concepts. These concepts deepen the content of the UDP 2025 and fill the general framework with more detailed strategies on particular topics. Already published are thematic concepts on mobility, free and green spaces as well as on high-rise buildings. Thematic concepts on open space, industrial

zones and energy-spatial-planning are in preparation.

In addition to the urban development goals, Vienna's further development is guided by another strategic guideline, also published in 2014. The Smart City Wien Framework Strategy describes targets and steps along the way to become a smart city, not only in the urban planning field<sup>2</sup>. Resources and innovations as well as a social perspective on quality of life are the core of the strategy. The UDP 2025 follows the Smart City goals and brings them to life in the urban planning field. This is true for example by the establishment of multimodal transportation modes, energy-spatial-planning or in making the densely build city greener.

## **Vienna: building the future – Vienna: reaching beyond its borders – Vienna: networking the city**

These are the titles of the 3 chapters that display the key topics of Vienna's urban strategy, giving attention to the existing city, new urban developments, the metropolitan network, green and open spaces and mobility. A short overview is given below, and further information can be found in the UDP 2025 publication<sup>3</sup>.

Expected urban growth brings the need of 120,000 new housing units up to 2025. In addition to housing space, new green spaces in the dense existing city as well as in new development zones need to be constructed. Moreover, new and variegated working places have to be built. Vienna follows the rule inner city growth instead of urban sprawl. Therefore, integrated brownfields (for example abandoned railway stations) will be transformed in well connected, integrated urban quarters. Mixed use of high quality green and open space, and good public transportation connections shape new development areas, as well as the rebuilding and enhancement of existing quarters.

Offering appropriate locations and working conditions for all economic activities is very important for a metropolitan city like Vienna. Safeguarding and managing of land reserves for industrial enterprises is a big issue of the UDP 2025. Moreover, Vienna is securing space for small enterprises and businesses by providing improved conditions for the entrepreneurial use of suitable spaces, for example, ground-floor spaces or old commercial properties.

Vienna is more strongly linked to its surrounding areas than ever before. The public instruments and processes for interregional co-operation must be accelerated, intensified and refined. These efforts can build on existing practices, but the methods and strategies of regional co-operation together with the neighbouring cities and municipalities in the metropolitan region have to reach further than they used to in the past.

The city of Vienna is committed to a mobility policy that is environmentally friendly, economically viable and socially fair. The central target of Vienna's mobility policy can be summed up in "80:20" – by 2025, Vienna's residents will make 80% of their journeys by public transport, by bike or on foot (2012: 73%) and only 20% by car (2012: 27%). In order to achieve this, Vienna is actively promoting eco-friendly means of transport.

With a network of attractive paths that connect green spaces and recreation areas Vienna is improving the offer of open spaces in the city's inner districts. Moreover, Vienna is developing a package of measures for more quality, the better conservation of resources and more efficiency in the design of open space.

### **Possibilities by cooperation – UDP 2025 as strategic framework**

Besides content based targets, the UDP 2025 also provides new ways of implementation and explains how to shape the city in partnership. The city of Vienna aims to use collaborative urban development and therefore looks for strong partners to help further develop the city. Hereby the city administration will become a manager of urban development. Flexible procedures replace rigid regulations. New ways of collaboration with different stakeholders enable new

chances in the development of the city. Public interest targets are stated as guidelines, while bringing them to life, the city needs support by strong non-administrative partners.

Not only will the future urban planning be collaborative, also the formulation of the UDP 2025 was carried out in a dialogue oriented way. The communication concept during the formulation phase of the urban development plan made different input possible, gained in cooperative workshops, discussions and information exchange. These different ways allowed a broad debate on the further development of the city. Input was for example provided by urban planners, local district officials, neighboring municipalities, business stakeholder, nonprofit organisations, citizens and international experts.

Although, the new urban development plan is mandatory for city politics and city administration only, the city of Vienna is willing to implement new projects with dedicated partners. Urban development should be governed smart and calls for everyone who has "True Urban Spirit". ■

<sup>1</sup> [www.wien.gv.at/english/politics/international/competition/mercer-study.html](http://www.wien.gv.at/english/politics/international/competition/mercer-study.html)

<sup>2</sup> [www.smartcity.wien.gv.at/site/en](http://www.smartcity.wien.gv.at/site/en)

<sup>3</sup> [www.wien.gv.at/english/urbandevelopment/](http://www.wien.gv.at/english/urbandevelopment/)

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## Green growth the Nordic way

**Michael Funch, Senior Communications Adviser at the Nordic Council of Ministers details how the Nordic cooperation addresses the green economy challenge...**

**T**he challenge involved in developing a green economy is common to governments all over the world. In the Nordic region, there is a long standing tradition for working together on major social and economic challenges. This also goes for green growth and circular economy. One recent example is the Nordic Built Cities Challenge, which aims to contribute to creating liveable, smart and sustainable cities all over the globe. The Nordic Council of Ministers also has a new initiative coming up, profiling the Nordic region in the run up to COP21.

Green growth and bio economy have been 2 of the main focus areas for Nordic cooperation in recent years. As the seat of official cooperation between the five Nordic countries – Denmark, Finland, Iceland, Norway and Sweden – the Nordic Council of Ministers has initiated a number of projects to further a more sustainable development both regionally and globally.

The Nordic Prime Ministers in 2011 launched a new initiative to deepen the cooperation on selected areas

within green growth. This includes areas under the headline of circular economy such as textile and plastic recycling, food waste and bio refineries. It also includes work on eco-design and a better market surveillance for energy saving products, as well as a focus on new standards for renovation of houses and sustainable building.

On top of this, the Nordic Council of Ministers for Business has now launched a brand new initiative called Nordic Built Cities. Run by Nordic Innovation – the business and innovation institution of the Nordic Council of Ministers – Nordic Built Cities sets out to unleash creative energies across borders to create more sustainable, liveable and smarter urban environments, both in the Nordic countries, but later on also globally.

### **Nordic Built Cities – caring for the future of urban development**

The Nordic countries have a long and time honoured tradition when it comes to holistic city planning and innovative architecture. From the modernist classics of



Alvar Aalto over the playful Sydney Opera House by Jørn Utzon to the ground breaking work by Bjarke Ingels, the Nordics have always had a sense for creating houses and cities fit to live in –often with a creative twist.

The Nordic Built Charter that was introduced in 2013 was an attempt by the Nordic Council of Ministers to rally stakeholders in the region around a set of principles to guide future construction and refurbishment of sustainable buildings. Most of the major players in the construction business have signed the Charter, along with trade unions and interest organisations across the region, not to forget many cities and municipalities.

Now Nordic Built Cities takes this a step further by launching the Nordic Built Cities Challenge – an open, needs-driven competition based on the Nordic Built Charter, aimed at developing and visualising Nordic innovative solutions for liveable, smart and sustainable cities.

One part of the Nordic Built Cities initiative is a competition inviting cities and building owners throughout the Nordic region to bring forth the challenges they are facing when trying to develop sustainable urban environments. Subsequently, construction companies or other actors are invited to come up with solutions to these challenges.

The other part of the initiative is a translation of this process into more export oriented solutions. Thus the ambition of the Nordic Built Cities Challenge is to develop tangible and scalable solutions to urban challenges and support joint Nordic export promotion of these solutions – contributing to liveable, smart and sustainable cities all over the globe.

## New Nordic Climate Solutions

The Nordic countries have been very important players in the UN climate negotiations through the last decades and although the COP15 in Copenhagen in 2009 was not the success the organisers had hoped for, the Nordics remain committed to the climate agenda.

In the run up to COP21 in Paris in December, plans are in the making to present the best of green solutions

from the Nordic countries at various venues. The focus will be on World Efficiency, a pre-COP21 event in Paris in October. But the UN summit on the new sustainable development goals is also in play, as well as the climate talks in Bonn in June.

This is all part of a new strategy for profiling and positioning the Nordic region, a strategy that in many ways builds on and enhances the effort to showcase green solutions and green growth “the Nordic Way”.

The strategy builds on a set of values deemed to be typical of, although not exclusive to, the Nordic countries. This includes sustainable management of the environment and development of natural resources along with new ways of thinking, focusing on creativity and innovations. Trust, openness, the proximity of the common man to those in power as well as the conviction about the equal value of all people are other less tangible values involved.

Hopefully these values and this Nordic perspective will guide Nordic action in the field of green growth in the years to come. Initiatives like Nordic Built is at least one good example of how they can be carried out in real life. ■

The Nordic Council of Ministers is the official cooperation between the Nordic governments. Nordic co-operation is one of the world’s most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland, and Åland. The NCM secretariat is based in Copenhagen, with a number of institutions and offices throughout the Nordic-Baltic region.

For more information on green growth projects from the Nordic Council of Ministers see [www.nordicway.org](http://www.nordicway.org). For more info on Nordic Built Cities see [www.nordicbuilt.org](http://www.nordicbuilt.org).

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# European Green Cities

Creating cities of the future...

European Green Cities, EGCN comprises 85 members from 14 countries, working with innovation projects, implementation of best practice in planning and building projects, education and, last but not least, dissemination.

We send out a newsletter with an update on European research and development projects, and, two to three times a year, we send out a magazine with results from EU projects and others. Our actual activities involve arranging seminars and webinars.

On the EGCN website ([www.european greencities.com](http://www.european greencities.com)) you will find information on the network's EU projects – building up a knowledge database for members so that they can save time and effort in finding the latest news.

Our members aim to support each other in progressing sustainable development and sustainable projects. The EU has the large programmes Intelligent Energy Europe and now Horizon 2020, which have the means to support progressive development. We participate in and disseminate the results of projects within these programmes.

We want to use the results of these much more actively for concrete planning and building, and as a basis for new projects.

Two examples are Green Solar Cities, a CONCERTO project with great results, and AFTER – about commissioning. You can download magazines inform-



ing you about the projects on our website.

You can also use EGCN as your personal network of city guides, helping you to arrange and manage contact with actors at the sustainable 'scenes' in the member cities.

Join EGCN and use the organisation to get wiser on the sustainable cities and buildings in Europe, to exchange experiences with others working in the same field, to educate, and to make use of us as a platform for the dissemination of your projects.

Membership is not free, but it is affordable and has a lot of advantages. Contact us and hear all about it.

## Green Solar Cities leading on to Nordic Built Active Roofs and Facades in Sustainable Renovation

The main aim of the Green Solar Cities book which was published by Eartscan by Routledge in January 2015, is to provide people with a vision of how cities and buildings of the future can be implemented with high energy quality, with an optimised energy supply which, to a high extent, is based on renewable energy, and with an equal focus on how to secure best practice by introducing a clear policy for performance documentation. This can be done by looking at experiences showing where the risks of bad performance results lie in practice.

So the basic idea of the book is to present examples from practice, including experiences from the EU-CONCERTO Green Solar Cities project (2007-2013), to show that the idea of making low energy building is about introducing a quality agenda for buildings. Without this approach, buildings and large renovation projects will be built in the traditional manner, which



To order the Green Solar Cities book, please click on the link:  
[www.routledge.com/books/details/9780415731195/](http://www.routledge.com/books/details/9780415731195/)

means that they will leak, be full of thermal bridges and have a poor indoor comfort. The 'passive house' movement in the 1990s, mainly in Germany and Austria, demonstrated that high quality constructions without thermal bridges and air leakages, combined with heat recovery of the ventilated air, resulted in buildings with almost no need for heating.

When the passive house results were first discussed in Denmark after 2000, the ambition was to go in the opposite direction and mainly work with natural ventilation. And since many architects were used to this, the new passive house agenda was difficult to understand: "Does that mean we will have to introduce mechanical ventilation again?"

This was actually the case. However, like introducing passive house qualities to the constructions, it was very important to communicate that a high quality version of mechanical ventilation was needed. In other words: the efficiency of the heat recovery should be high and the electricity use for the fans should be low.

However, due to a lack of clear standards of documenting these things in practice, it has unfortunately proved very difficult to control this.

The experience is that it is very difficult to ensure that a mechanical ventilation system actually has a low electricity use, unless you can ensure a direct survey of this with the users and building owners.

This sets a good background for securing the next step of low energy buildings – buildings with easy access to all basic energy uses on a direct online basis. This is possible for different electricity and heating uses, as well as for basic comfort indicators like indoor temperature and humidity, CO<sub>2</sub> level and even daylight. The latest Wi-Fi technologies make it possible to obtain proof of an overall energy quality, documenting that users get what they have paid for.

In the Green Solar Cities book there is a focus on this and how this can be done as part of an Active House approach ([www.activehouse.info](http://www.activehouse.info)), and there is a presentation of the Nordic Built Charter which together with Active House is forming the background of the new Nordic Built project, Active Roofs and Facades in Sustainable Renovation, which is also detailed in the book.

Here partners from all the 5 Nordic countries are cooperating and there are actual demonstration projects in both Denmark and Sweden as well as full-scale testing in all countries.

## European Green Cities

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# Finding a planning framework to support communities

**Cllr Ken Browse, Chair of the National Association of Local Councils outlines concerns arising from the NPPF and why we need a planning framework for communities...**

Undoubtedly the coalition government sees the reform of the planning system as a key driver of economic growth. In other words 'reducing all that red tape and bureaucracy' from previous planning policies, which according to the government hampered development and therefore stifled the economy.

So the present National Planning Policy Framework (NPPF) in a 'bonfire of guidance' reduces it from 1,000 pages to just 50. But once the framework went live in March 2012, the serious business of planning began. The country needs a huge effort at a local level to get plans in place that properly reflect the integration of social, economic and environmental goals, and protect places people value.

So what does NALC think the impact of the NPPF has been on local (parish and town) councils and communities?

Firstly, NALC is a key supporter of neighbourhood planning which revolutionised the way local councils and communities can shape and design the future of their places.

We also support the broad thrust of the NPPF, in that the rationalisation of government planning policy statements and guidance notes to form a single consolidated document is in principle a good idea, and we think this should render the process of understanding planning simpler and more open.

However, NALC believes the NPPF has not functioned effectively in many parished areas since its introduction. We remain concerned about the ability of planning authorities to determine planning applications that

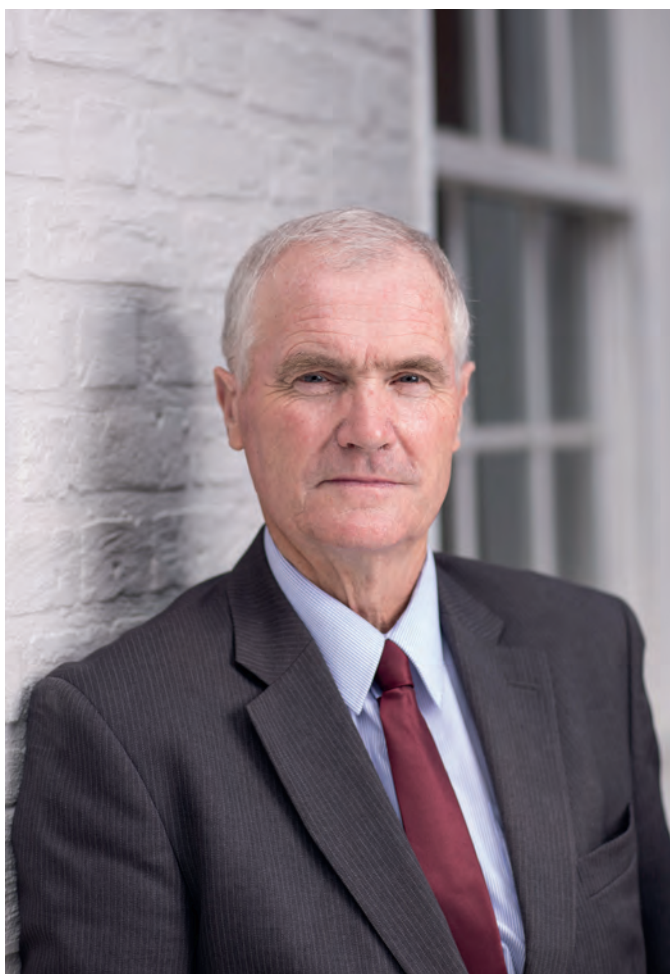
reflect the opinion of local councils without fear of developers winning applications on appeal, and planning authorities being awarded considerable costs against them.

**"We strongly encourage local councils and neighbourhood forums that have an adopted neighbourhood plan to request from their local planning authorities a share of infrastructure proceeds from Section 106 agreements or the Community Infrastructure Levy."**

Furthermore, we think there is too much focus on meeting housing targets and not enough focus on the quality of developments or on the mix of housing. It should be made mandatory to consult and engage with local councils in advance of submitting an energy-related planning application.

Local planning authorities should be particularly mindful of the need to support infrastructure requirements identified in adopted neighbourhood plans. We strongly encourage local councils and neighbourhood forums that have an adopted neighbourhood plan to request from their local planning authorities a share of infrastructure proceeds from Section 106 agreements or the Community Infrastructure Levy. We encourage local planning authorities to give full consideration to such requests.

We recommend that the government revoke its decision to limit to 5 the number of planning obligations that can contribute to a single piece of infrastructure until the proposed 2015 review of the Community Infrastructure Levy has taken place. In the meantime, local authorities should have a free choice



Cllr Ken Browse, Chair, National Association of Local Councils

between the use of the Community Infrastructure Levy and Section 106 agreements for the funding of infrastructure.

We call on local government (including local councils), the property industries and the voluntary sector to work together to produce a new 'planning users concordat' setting out the respective responsibilities of each group.

Regarding the operational impact of the NPPF on town centres – the original document stated being concerned with the views of communities – our experience is that developers have been delivering as little community infrastructure as they can, and we remain concerned that there is no actual sanction or community recourse.

Developers in town centres need to better consider the impact of their plans on communities, to understand the demography, infrastructure, amenities and workings of town centres. House builders need to model communities on the people living where development is taking place to test the impact of their plans and intentions. It seems that not enough of this activity has been happening on the ground by developers.

Our view on the operational impact of the NPPF on energy (non-major infrastructure) planning in parished areas, is it should be a mandatory requirement for the applicant to consult with all locally affected parishes/wards in advance of submitting a planning application, particularly in the case of wind turbines because the impact is far reaching.

We see the NPPF as a real test of the government's credentials, in that national targets of development and house building continually ride roughshod over the needs and demands of local communities and councils. We believe that the government should be putting more pressure on local planning authorities to protect their communities against the threat of undesirable development by moving quickly to get an adopted local plan in place that fits alongside communities' neighbourhood plans. ■



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New Station

New

# Reinventing the City Building on Creativity

Creativity, innovation and a strong focus on sustainable and attractive growth are at the very heart of the vision for the City of Varberg to become the Swedish West Coast's Creative Hot Spot by 2025. The municipality is growing quickly and has a population of more than 60,000 residents, mainly due to its location between two expanding regions – Göteborg (the West Sweden region) and Malmö (the Öresund region). Varberg is a stronghold for culture and tourism, and is especially renowned for its 13th Century fortress, long stretches of beautiful beaches and inland deciduous woodland with plenty of small lakes. It is also well known among surfers from all across northern Europe as one of the best places in Scandinavia for all kinds of surfing.

The City of Varberg is focusing strongly on sustainable development and has been acknowledged for its success in bridging the gap between public service and the diverse interests of various partners in society (e.g. commerce, business, industry, development, conservation, culture, etc.). The municipality has a sharp focus on the way ahead, and a portfolio full of solid strategies. In our vision for the future, the City of

Varberg has unique opportunities and we are acting on them. We are building a city converging around means of public transportation in a rapidly expanding region. The railroad, which has long created a barrier between the seaside and the city centre, will now be relocated into a tunnel underneath the city. To expand on this opportunity we are moving the harbour in order to further free up land for letting the city reclaim its position as a seaside town. In total, the project will result in more than 500,000 m<sup>2</sup> of land for development of our future city front. For people living, working or visiting the city of Varberg, the change will dramatically increase the freedom to experience the coastline. More places of residency, places for eating and meeting, places to shop and work, etc. – comes as a bonus.

In our vision for Varberg 2025 we are striving to be at the forefront of supporting social and cultural aspects of sustainability. The municipality is localised in the middle of a strong academic region. The University of Göteborg and Chalmers University of Technology, the University of Lund and Malmö, the University of Borås and the University of Halmstad are all located well within



An aerial photograph of the Varberg cityfront and harbor. The image shows a large industrial area with a pier and several boats docked. In the background, there are residential buildings and a park area. A large green arrow points from the top left towards the harbor. A green box with white text is overlaid on the bottom left of the image.

# v Cityfront

comfortable commuting distance from Varberg. This is of great importance for our local business climate and for our young. We are focused on consolidating the relationship with our academic allies even stronger, strengthening the position of our own Campus Varberg. The same is true for cultural institutions. For our growth it is key to attract enterprises and institutions that share our idea of building a more sustainable future, in the heart of a progressive region. This means that we are especially on the lookout for academic and cultural institutions, and enterprises with profiles that fit our idea of a modern sustainable city and trying to attract them into investing in Varberg.

It is often stated that the place, and the people and lifestyle associated with it, is everything. If this is true, then the City of Varberg has everything to offer.

**Come to Varberg.** Share our vision.



**The City of  
Varberg**

[www.varberg.se](http://www.varberg.se)



# What is regeneration about now?

**Elizabeth Wrigley, Director at Core Connections gives thought to what regeneration means for towns, cities and rural areas...**

The word regeneration has for many decades signified reinventing uses for interesting industrial structures, bringing life back to abandoned docks, manufacturing areas and canal sides, and creating new lifestyles such as loft living and waterfront development. Most regeneration has taken place in the inner areas of the larger cities. Some amazing new quarters have emerged, such as around the canal in Birmingham and along Regents Canal in London behind Kings Cross.

Rural landscapes can also be the subject of regeneration projects. The climate change resilience programmes will in many cases require urban and rural areas to be considered together, to arrange rainfall catchment management and to enable food to be grown.

Whilst 'regeneration' has meant bringing new and funky enterprises to towns, and housing them in interesting old buildings, there were some similar projects in small towns and countryside areas. A concert hall and studios in Snape Maltings are in the midst of reed marshes, and riverside projects reinvent the centres of small towns such as Stroud and the waterfront at Kings Lynn. In

Stowmarket the Museum for East Anglian Life reuses a formal historic house and park in the centre of town and the John Peel Centre is housed in a disused Corn Exchange: both are cultural projects to interpret aspects of recent past life in rural Suffolk.

With the need to reinvent uses for high street shops, some are becoming start up business locations for small artistic enterprises. A study of London's suburban high streets in 2013 by the Bartlett School UCL suggested that whilst many people do not visit their local high streets to shop, they visit specialist businesses and also to meet friends. It is the quality of its open spaces and the convergence of several walking routes that makes a place a centre.

New Towns and Garden Cities are also being regenerated. In Milton Keynes the town centre regeneration is taking the form of adding buildings and changing car-dominated boulevards into people friendly places, and improving links to the rail station. Similar, if on a much smaller scale, is the recent town centre revitalisation in Letchworth Garden City, where the cinema has been renewed, a college opened and the Spirella



corset-making factory is reinvented as a hub for many businesses, plus a café and conference centre.

### Using assets in the community for regeneration

Milton Keynes Council has observed that some towns and cities have under used and wasted land assets, as well as areas of social exclusion. Regeneration for Milton Keynes is “the process of redeveloping that land and revitalising the area by attracting economic investment and new employment and creating a much improved living environment.”

The introduction of renewable energy in Burlington in Vermont is an interesting form of regeneration. Coal power is being changed to biomass power, reusing trees that have fallen throughout the forests in the town’s hinterland and across the highways, often as a result of storms. The town will also introduce hydropower, solar PV and wind energy, so their regeneration policy covers a range of renewable energy options.

### Regeneration using a public private partnership

Burlington is also a pioneer as it operates a City Centre Tax Increment Financing scheme to “build a walkable downtown core”. The city bought land from developers for a park to provide future residents with natural areas. Shown as such in the TIF District Plan, the park could be funded from the TIF if the community votes in favour. Public participation was in February 2015, with several options available on a web site. A hands-on workshop, a “walkshop” through the area, collected thoughts for opportunities within this natural space.

In Los Angeles an 11 acre landfill site is designated as an ‘ecotown’ where communities will plant up and manage the site. Called Korea Town, it also has a local participation process, and is committed to economic, social, cultural and ecological dimensions of sustainability.

### Working with artists

Rail stations have been a focus around which much urban renaissance has spun its webs. In several rail station projects the local communities want to try to

make the places more interesting, characterful and to reflect the local area. Projects in stations such as Hackney, Kings Cross, and Peckham seek to create somewhere a little unusual, celebrating these specific stations as the places that the local residents and businesses use regularly. Using artists for example to introduce glass in imaginative ways, mixing uses, creating business space right next to the station hub are all aspects of the new regeneration scene.

### The new types of open space

The High Line in New York is perhaps the most well known example of a redundant rail line becoming a landscaped park, but in Paris there is a similar project called the Promenade Plantee: it offers a tranquil greenspace like the High Line.

Lurie Gardens in Chicago is a new park, featuring a very large green roof mostly made of polystyrene materials as it has to be light: it covers a car park and rail lines. The area offers a sanctuary in the space between the very dense city centre and the edge of the lake, and is next to Grant Park, the lakeside area, “forever open, clear and free”. Lurie Gardens follows the tradition of Chicago’s motto City in the Garden. Lurie Gardens has an endowment to cover its maintenance.

The examples above have common aspects: they are about the high quality of planting, and feature trees, shrubs and bulbs. Contact with nature is sought in cities as well as in the countryside and this is a feature of our new regeneration programmes. ■



.....  
**Elizabeth Wrigley**  
**Director**

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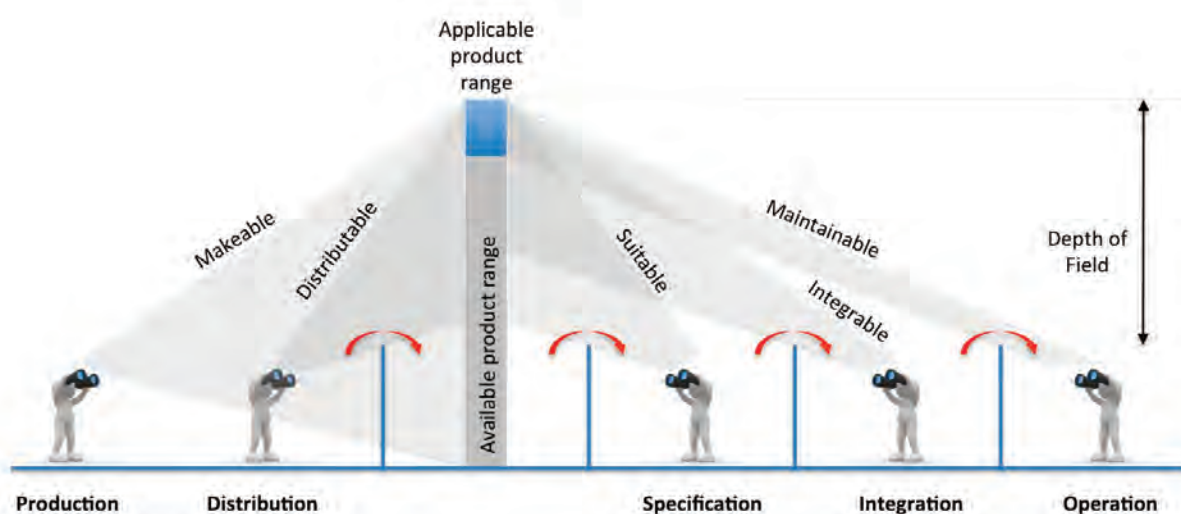
## The BIM menu of information

**Steve Thompson, Chair of BIM4M2 and Market Manager for Construction and Infrastructure at Tata Steel discusses the game-changing potential in efficiency improvements that BIM offers, but says it will only be deliverable consistently with clear definitions of what information is required and a menu of information for a project team to select from...**

**T**he recent BIM4M2 survey of manufacturers highlighted a number of things, one of which was that manufacturers are often asked for BIM objects or 'all of your BIM', without it being clear what information is really being asked for. To use the well-known quote from Theodore Levitt, "People don't want to buy a quarter-inch drill. They want a quarter-inch hole!" When someone asks for a BIM object or 'all of your BIM', what they really need is information in a digital, exchangeable format that supports their project activities. There are significant efficiencies that can be gained within the supply chain if we all work together to ask and answer the right questions.

Beyond the commonly accepted information requirements to enable exchange such as IFC and COBie, the information necessary to meet these requirements can vary significantly, and can have a huge impact on the results. If too much information is included for the sake of covering the bases, this can provide unnecessary constraints on the supply chain, but also miss the opportunity to get the most suitable products and solutions into the project efficiently.

Looking at the first sketch to illustrate the point, a manufacturer may have a range of available products to suit a generic application. The specifiers may look



### 1: Over-constrained depth of field – information thrown over the wall

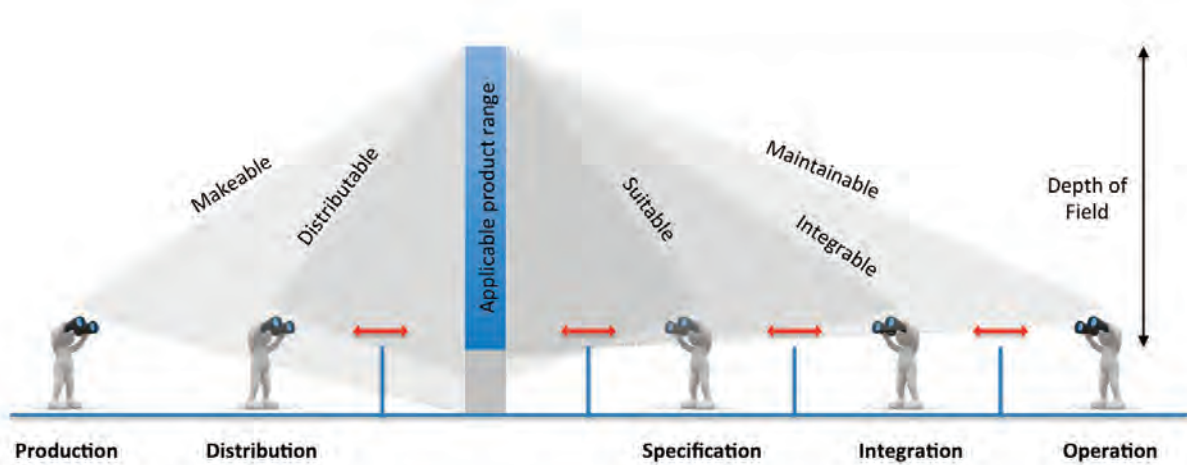
at the range of products and identify those that are suitable for the project they are working on, and specify a range to work from. The contractor may then look at what he can deliver at an acceptable cost and timescale that falls within the range identified by the specifiers. The asset owner and FM organisation are likely to have a set of criteria for ongoing maintenance and renewing of the products, but that view may only include a small range of products already selected. In other words, the proportion of products within a range that meet all those requirements is unlikely to be a large proportion of the full product range as a result of over-constraint. This can be the story if information is thrown over the wall between players, or BIM objects passed between stakeholders without a clear definition of what information is required.

**“If too much information is included for the sake of covering the bases, this can provide unnecessary constraints on the supply chain, but also miss the opportunity to get the most suitable products and solutions into the project efficiently.”**

It's important to understand the impact of exchange of information on the supply of construction products, not just on their specification and installation. How does

a product get from its specification and production through to its integration within a built asset? What complicates the issue further is that the distributor of the products may look at that original range of products and decide that he can only deliver a proportion of those products to a project based on his view of timescales, costs, etc.

So how do we increase the likelihood of delivering the right products and information to suit everyone's needs? We need to increase the depth of field (distance between the nearest and farthest objects in a scene that appears clear) and field of view (the extent of the observable world seen from a given viewpoint). We need to define information requirements based on purpose, not just by product type and generic application, and ensure these requirements are clearly shared through two-way communication between players if we are to benefit from some of the available efficiencies in the supply chain. These include reducing delivery times by providing information on clear decisions that impact on the supply of products, followed by early supplier awareness of product decisions. If people want a quarter-inch hole, let's understand that's what they want and make sure that's what we help deliver; not just focus on delivering a drill without understanding which drill bit we need for the job in hand.



## 2: Clearly defined information requirements – communication across the wall

I'm hopeful that the BIM Toolkit will help us achieve this, supported by the further development and application of PDTs (Product Data Templates), enabling each of the players within an asset's and product's lifecycle to increase the depth of field and define information requirements. It's important that we don't overload models with unnecessary information and constraints, but that instead we make information available for project teams to use where appropriate. For this we can learn from the concept of Product Lifecycle Management (PLM) used in the manufacturing and other sectors, and looking forward to Level 3 and Digital Built Britain, real-time analytics will make the potential opportunities for improved efficiencies much more transparent. For example, supply chain partners may be assessed based on their performance, measured throughout a number of projects instead of data being exchanged and validated only at key project stages.

**"It's important that we don't overload models with unnecessary information and constraints, but that instead we make information available for project teams to use where appropriate."**

So to summarise, BIM is a process which offers game-changing potential in efficiency improvements,

but these will only be deliverable consistently with clear definitions of what information is required at a project and discipline level (including product supply), and by enabling project teams to select relevant information to answer those requirements, nothing more and nothing less; that is the concept behind PDTs, a menu of information for a project team to select from. ■

**BIM4M2**

.....  
**Steve Thompson RIBA**  
**Chair**

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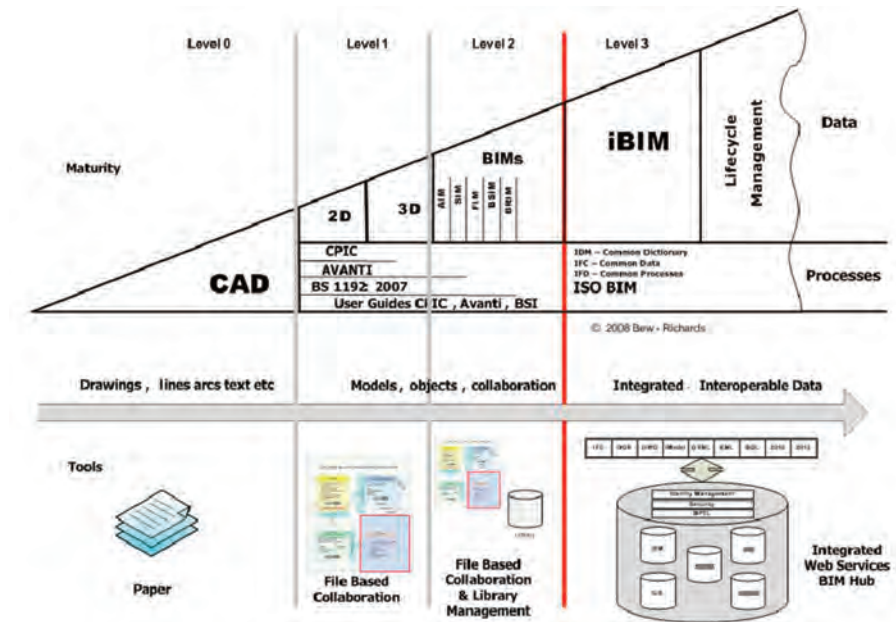
# Delivering a new Data Rich environment

The concept of BIM is remarkably straight forward; build a 3D model of what you plan to construct, review and check the model to make sure it works in a virtual environment and then construct it. In addition, this new found medium of communication extends to facilitate the downstream operation and management of the asset by providing access to essential information at the point of use.

For all parties, improved communication, surety of the outcome through 3D, 4D and 5D processes, a single source of truth in the information which can then be shared with all, the opportunity for offsite manufacture and pre-fabrication and the ability to recognise what needs to be done in maintenance before you get to the job site can easily be recognised from many everyday experiences to be a simpler and more efficient way to work.

Our opportunity through BIM remains; to **reduce the waste in what we do by rationalising the process of achieving the outcome**, as well as finding new opportunity from a better understanding and alignment of the end product with the initial requirements. This ideal remains at the heart of the BIM journey.

Many saw the opportunity, but it commendably took Government to lead the charge and their action has now delivered the well-known route map and ingredients necessary to reach the first milestone, level 2 BIM by 2016. As we enter 2015 and see the



Extract from Bew-Richards 2008

scale of change taking place around us it is clear that this journey is well underway. In many areas of the industry there are significant gains being made coupled with extended enthusiasm of the opportunity in front of us to re-engineer our industry, level 2 BIM is only the start of the end game.

For anyone who has grown up in construction the opportunity is significant, even obvious, and inevitably game changing but it does:

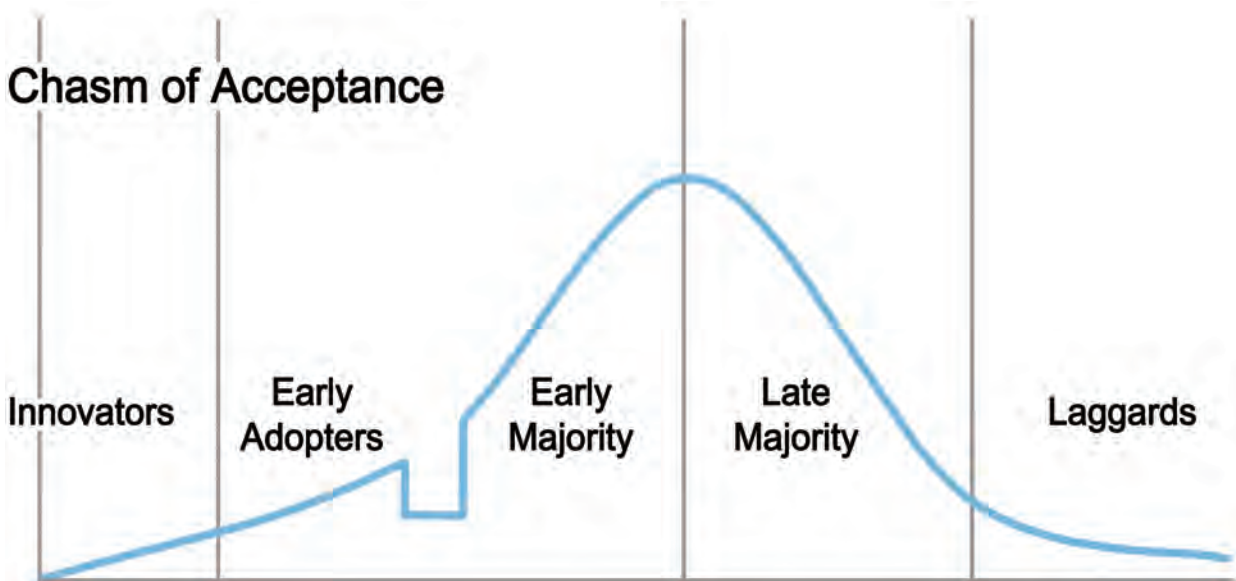
- Involve technology – to fundamentally **enable the opportunity**.
- Cause us to change our processes – to **realise the opportunity** and, most importantly of all
- Involve the engagement of people – to **embrace and deliver** a new outcome.

If only it were that simple, given the variety and complexity of the procure-

ment routes we use to deliver our asset base it is not difficult to appreciate the complexity this simplicity needs to fit within.

Needless to say these changes should not be restricted to visual representation alone. Leveraging the intelligence of the objects that we use to create the 3D virtual model allows us to count, measure, attach information and link to associated data which ultimately leads **BIM to participate in the "internet of things"**.

With all this information connected through a virtual model of our assets in which information and knowledge can be displayed in many different forms to support our decision making we start to replicate the simplicity and access we now see in many aspects of everyday life, some refer to this "gamification".



Whilst the use of technology and the internet have become part of our everyday lives it has also become an influencing factor in the way that we work. BIM and the Cloud are starting to do the same, but there is a way to go until we repeat the same physical and behavioural impact that has happened in our daily lives. What we know is that the change is inevitable, is getting faster and as we cross the chasm of acceptance to new ways of working the inevitable split between leaders, followers and the undecided will be quickly swept through by the pace of change and the scale of the outcomes.

So what needs to change to this people, process and technology infusion to reach the sweet spot of real success and make this happen?

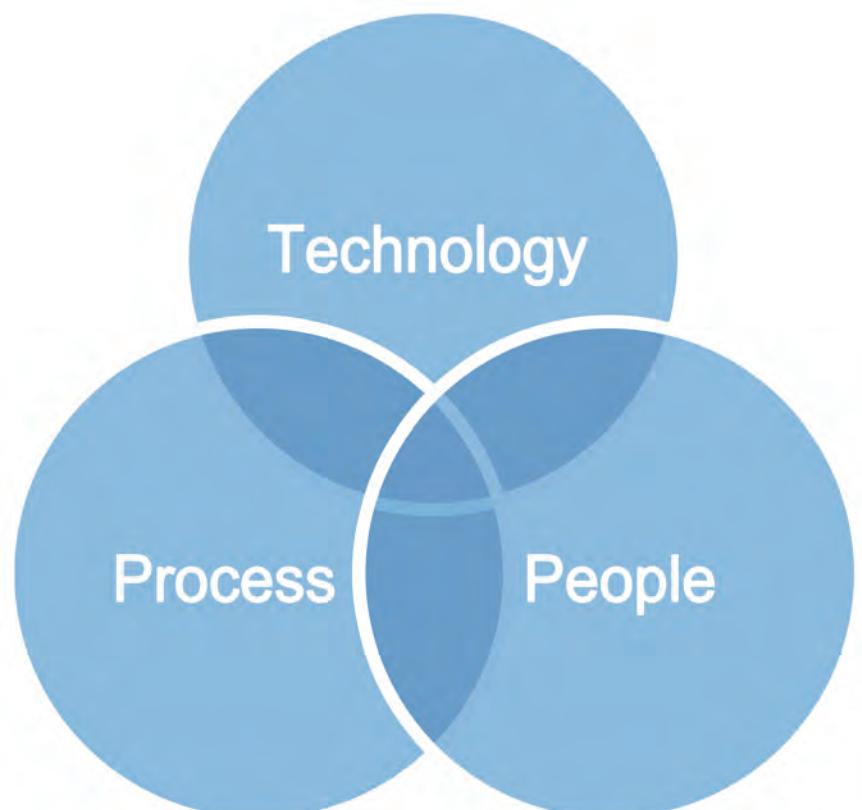
We know **real success will need to come from open easy sharing of transferrable information**. At Clearbox we believe the initial stepping stone comes from how easily we can access and manage the information to allow our teams to work together, this is the true simplicity of the common data environment (CDE) referred to in PAS 1192 Pt2.

### What are Clearbox doing to support this transformation?

At Clearbox we see this issue wrapped up in **the difference between a model centric approach to BIM and a data centric approach**. Ultimately our issue is to ensure that our ease of sharing and access to common data is delivered through a visual interface that allows us to see the outcomes we need at the required level of definition to suit the type of device we are using.

For us, **simplicity in the architecture of the product is key**.

When we search on Google Earth we don't load the detailed the model of the world as a multitude of small models the world is loaded at a level of detail and information pertinent to the view we need and the view is then refined and the data we have access to updated as we proceed. When we access a retail website, on our smart-



phone the view is tailored to suit the device and the information we need, and while that view is rarely fully customisable it is inevitably likely to be pre-customised to suit the view we require while providing access to other information should we need more.

The better the suitability of the view to the information we need the more likely we are to have success and want to continue to use the website. Just look at the speed of adoption and growth of Google Earth, the iPad, and Amazon and the simplicity of their user interface to recall just what the last 10 years have shown us.

In all these successes we see that the **management of the data** is the mechanism to control the visual interface. While we at Clearbox have made best use of existing industry tools our opportunity to step up our offering for users has been rate limited by the products currently on the market. Needless to say, in a space where the technology and its simplicity are key to the wider use and adoption of BIM, we have long recognised that we require a simpler, faster, more robust

and scalable viewer that connects to the data environment contained in our core product BIMXtra.

We have also recognised that such a viewer needs to be supported by the data as opposed to being completely standalone in order to manage very large projects. Previously we have used a well-known viewer to enable users to access data and information in the visual environment. This is no longer sufficient to meet the needs and in order to future-proof the technology solution and deliver a better experience across common market information standards we have now built an exciting new viewer, based around the type of technology that powers gaming, while providing the simplicity of the interfaces and access arrangements we see in everyday life.

Our approach is to make best use of and connect to, best in class tools, wherever they exist, and where they don't, develop our own to allow the sharing of intelligent data and information based around industry standards. This is a fast evolving environment but we know from the

world around us that **data is the new oil**, and that a data centric approach to managing BIM is critical to the simplicity, scalability and future-proofing of our BIM solutions, **just look at the road map... level 3 is next.**

Graeme Forbes is the Managing Director of Clearbox a specialist digital information solution provider that is focussed on bringing game changing solutions to the construction industry and other asset intensive industries based around BIM based processes.

Access to Clearbox website can be found at [www.clearboxbim.com](http://www.clearboxbim.com)



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# The NBS BIM Toolkit evolution

**Stephen Hamil, Director of Design and Innovation at the NBS, outlines how the NBS BIM Toolkit has been received around the country and what happens next...**

**B**ack in 2010, I remember listening to Paul Morrell, the then chief construction adviser, present the government's Construction Strategy and being inspired by the radical vision of the part Building Information Modelling (BIM) would play in transforming the construction industry.

To think that now, nearly four years on, NBS is in a position to complete Level 2 BIM, and in advance of the government's 2016 deadline for its use on public sector projects, is very exciting.

Launched on 8th April to great response and engagement, The NBS BIM Toolkit public beta is a web-based resource, tailor-made to guide users through the construction process. At the heart of the project is a standardised and digitally-enabled classification system coupled with a level-of-definition reference library and digital plan of work tool.

Combined, these have the power to transform the delivery of construction projects for all disciplines and across all scales of projects; from large infrastructure schemes to small, domestic scale works.

Given the confusion that still remains over what Level 2 BIM actually means or constitutes, the completion of such a defining suite of documents is critical to further BIM adoption and the enhanced building design and delivery this will bring.

The NBS-led team has been working hard to ensure the BIM Toolkit is easy to use and offers step-by-step support to define, manage and verify responsibility for information development and delivery at each stage of the asset lifecycle.

Whilst the NBS BIM Toolkit is being delivered by NBS in conjunction with colleagues from BIM Academy, BDP, Laing O'Rourke, Mott MacDonald, Microsoft, Newcastle University and RICS, its development has benefitted from input from a wide range of construction industry professionals.

The project team has consulted with architects, clients, contractors, engineers, manufacturers and facility managers, and over the last few months the NBS BIM Toolkit has been taken on the road around the UK in association with the UK Government's BIM Task Group's BIM Hubs.

In addition to demonstrations at major industry events such as Ecobuild, these free events have provided construction professionals in all regions of the UK with an early opportunity to preview and comment on the Toolkit.

Feedback has been invaluable and a number of recurring themes have emerged. For example, it is clear that Level 2 BIM is not just about design but managing the entire information set. Yes, graphical representations of doors or boilers are important, but equally so is the documentation of a solid brief, the clear allocation of tasks and responsibilities and any results of the consultation process.

The importance of the early stages (0 & 1) in the new plan of work has also been made clear; making sure you are thinking strategically before thinking about the products.

Above all though, these various events have made the team more certain than ever that the Toolkit has the

very real potential to transform the procurement of buildings and infrastructure by defining and testing the BIM data required at each stage of the project.

**“Whilst the NBS BIM Toolkit is being delivered by NBS in conjunction with colleagues from BIM Academy, BDP, Laing O’Rourke, Mott MacDonald, Microsoft, Newcastle University and RICS, its development has benefitted from input from a wide range of construction industry professionals.”**

In addition to a wealth of technical content, users are able to access a support area which includes a series of articles providing expert advice on a range of relevant subjects such as; the concept behind Level 2 BIM, the levels of definition for construction objects and how to develop employer’s information requirements.

Free-to-use, the NBS BIM Toolkit empowers all parts of the construction industry.

Clients and managers of assets are able to comprehensively define information requirements to ensure their needs are met and better project outcomes are guaranteed.

Design and construction teams are able to assemble a team with clearly assigned roles and responsibilities to work collaboratively on their Level 2 BIM projects.

Finally, manufacturers are able to provide digital information quickly and easily to specifiers on thousands of construction projects.

In summary, by proving the answer to achieving Level 2 BIM, the Toolkit will immediately start solving some of the problems the construction industry has struggled to overcome by moving it from an analogue system of working into a digital world.

It will also ensure that the UK construction industry capitalises on the clarity of its public sector vision for BIM. A unique vision that is increasingly being followed by the private sector and a digital approach that will put the UK in a position of worldwide leadership. ■

To create your first BIM Toolkit project, go to <https://toolkit.thenbs.com/>.



.....  
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# THERMAL comfort

## The fabric of thermal comfort.

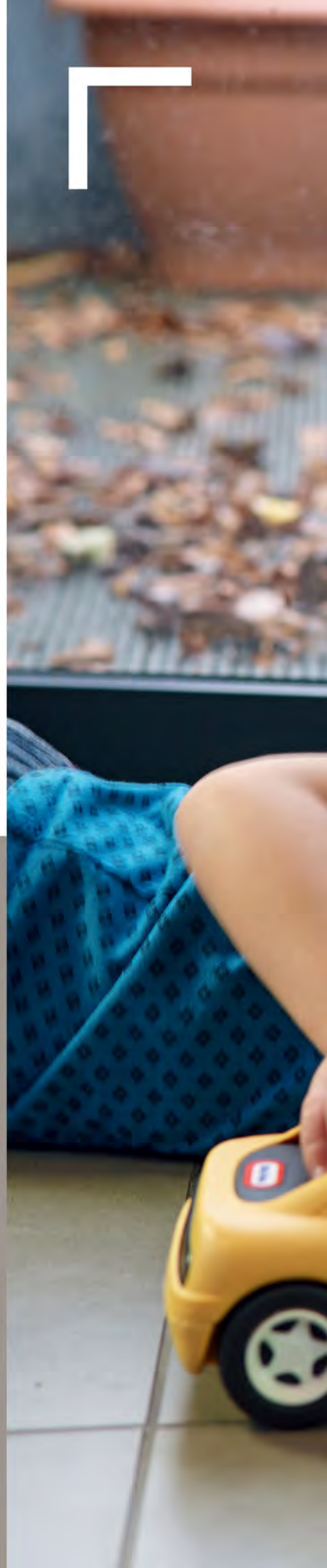
When we typically spend 90% of our time indoors or in vehicles, it's fair to say that the buildings we live, work or play in every day, have a significant impact on our comfort, health and wellbeing.

Saint-Gobain, the world leader in the sustainable habitat and construction markets, has identified five key elements that contribute to our comfort levels indoors; visual, indoor air quality, audio, economic and thermal quality. Through years of research and development of these qualities, Saint-Gobain has created and recently launched My Comfort – the Multi-Comfort building concept which delivers benefits for the environment as well as occupant wellbeing.

Stacey Temprell, Residential Sector Director at Saint-Gobain, explains how thermal comfort in buildings affects health and wellbeing, the first article in a series examining each element of comfort.

Buildings should provide us with a comfortable, healthy habitat in which to be successful, efficient and safe as we set about our daily routines. Our newly launched multi-comfort building concept, My Comfort, combines the highest level of thermal performance with excellent acoustics, visual comfort, superb indoor air quality and outstanding energy efficiency.

My Comfort is designed to deliver comfort for everyone – in any type of building. Reduced energy usage and lower ongoing operational and maintenance costs mean you can actually save money, while enjoying all the additional long-term benefits of a future-proofed, sustainable building that gives you improved comfort, health and wellbeing.





**WE TYPICALLY SPEND 90%  
OF OUR TIME INDOORS  
OR IN VEHICLES**





## All-round comfort, at any time

Within a building, various conditions are required to enable people to be comfortable, and to be able to efficiently and effectively perform tasks relevant to the space.

The four factors of thermal, audio, visual and indoor air comfort are powerful tools for designing happy, healthy, energy efficient buildings that deliver considerable economic benefit as well as all-round positive wellbeing effects for occupants.

According to the World Health Organisation (WHO), health is a state of complete physical, mental and social wellbeing, and recent research has shown that comfort levels in buildings can greatly increase health and productivity.

When designing and constructing buildings, a holistic approach is the best way to guarantee user comfort. The Multi-Comfort concept and 'My Comfort' starts from the central premise that all buildings can be designed to:

- Provide the highest levels of all-round comfort for their users;
- Genuinely and positively contribute to our health and wellbeing;
- Deliver the highest levels of efficiency for their owners – saving home owners and bill payers money on energy;
- Achieve the Passivhaus standard of energy efficiency.

We rarely consider whether a building really meets our needs, unless it suddenly isn't working for us or it makes us feel uncomfortable. How many of us have been in a restaurant where it's hard to hear our conversation? Or have been disrupted by the noise of neighbours either at home, or work? Or have been in a meeting room at work where the light quality is so poor it's hard to work? How many of us have been at our children's schools, and have thought how the rooms echo and the impact this could have on our children's learning? It's when we notice these sorts of things that we begin to question just how comfortable our buildings are.

## Thermal Impact

Thermal comfort is what we experience when the body functions well, with a core temperature of around 37°C and skin temperature of 32–33°C. Thermal comfort achieves the right mixture of temperature, humidity, radiant temperature and ventilation, yet this can alter according to individual needs. Everyone has slightly different criteria for thermal comfort, so a building must allow you to adapt its conditions to your particular requirements and achieve this level in every room.

Multi-Comfort is based on Passivhaus design principles, with buildings using very little energy for heating and cooling. Like Passivhaus buildings, Multi-Comfort buildings achieve a 75% reduction in space heating requirements in comparison to current standard practice in new-build homes and provide the same level of thermal comfort.

Good insulation is crucial to maintaining consistent levels of thermal comfort, but ventilation is just as important, so that when any excess warm air leaves the building, it doesn't disrupt the consistent temperature. For example, glass in windows can either let sun radiation enter the building or block it depending on the season, and can also conserve or evacuate heat according to the kind of coating or film on the glass. Air-tightness membranes and vapour control membranes will allow internal humidity to exit the building while preventing the humidity from the outside entering, preserving the insulation.

There is overwhelming evidence to support the effects that improved thermal quality has on increasing comfort and wellbeing. Here are just a few of the studies' findings:

- Data indicates that around 90% of hospital wards are of a type that is prone to overheating, and the ability to control temperatures is often limited<sup>1</sup>. Seminal research in 2003 identified 15 studies linking improved ventilation with up to 11% gains in productivity, as a result of dedicated delivery of fresh air to the workstation and reduced levels of pollutants<sup>2</sup>.
- Exposure to extreme heat is already a health issue. Currently, one-fifth of homes in England could experience overheating even in a cool summer<sup>3</sup>. Flats, which are generally more at risk of overheating than houses, now make up 40% of new dwellings compared to 15% in 1996. Urban greenspace, which helps to mitigate the urban heat island effect, has declined by 7% since 2001. In the UK, excess deaths from high temperatures are projected to triple to 7,000 per year on average by the 2050's as a result of climate change and a growing and ageing population.
- A cold home is bad for your health and increases the risks of cardiovascular, respiratory and rheumatoid diseases as well as worsening mental health. Cold homes are a significant contributor to the level of excess winter deaths in the UK every year. In 2009-10, there were an estimated 25,400 excess winter deaths, over 21% are attributable to the coldest quarter of homes<sup>4</sup>.

There are many elements of comfort that must be considered to boost occupants' health and wellbeing. It is true that a little more financial investment in infrastructure is needed than current Building Regulation levels to achieve such effective housing, however investment will provide economic efficiencies for the long term. By providing buildings with the lowest primary energy demand, running costs can be greatly reduced, such as heating and water bills, alongside lower maintenance costs for the owner.

At Saint-Gobain, we believe that sustainable habitat is within our reach, and by providing sustainable products and solutions, this vision can be made a reality.

Read more about Multi-Comfort here: [www.multicomfort.co.uk](http://www.multicomfort.co.uk)

To find out more about Saint-Gobain, visit [www.saint-gobain.co.uk](http://www.saint-gobain.co.uk). Like the Facebook page and Tweet @SaintGobainUK







## BIM: the story so far

**Anthony Burd, Head of Market Development and Stephanie Kosandiak, Lead Programme Manager for Construction at BSI, outline the growing BIM landscape...**

The architecture, engineering and construction (AEC) industry previously relied on CAD and marked-up drawings to build. With the need to improve efficiency and reduce costs across the process, BIM software has filled the gap and shown that it can do both. The creation of a virtual 3D map (embedded with all the relevant data) of a building using digital technology, means that an accurate model can be constructed. This has major uses for everyone involved from the planning, design, construction and facility management aspects of the build, where all elements can be integrated and viewed by the architects, engineers and constructors.

Building in a simulated environment means that unforeseen issues can be corrected before any physical work can begin. As traditional methods have dominated the AEC industry for such a long time, this shift in process requires a shift in perception and working too. This includes a move towards a faster pace of working especially as BIM acts as a traceable database for the project. Therefore, all the associated costs of every design change can be tracked in real time. Stakeholders do not need to wait as long as they once had to, to see the implemented changes and can see what the final project will look like with demos and walkthroughs.



BIM is effectively changing the face of construction and is recognised not just by industry but also government as a key tool. As older methods eventually become obsolete, the AEC industry will have to adapt. In anticipation of the importance of BIM, BSI has developed a full BIM suite of standards to support the use of BIM.

### The key BIM standards

**BS 1192:2007** *Collaborative production of architectural, engineering and construction information. Code of practice.* The standard establishes the methodology for managing the production, distribution and quality of construction information, including that generated by CAD systems, using a disciplined process for collaboration and a specified naming policy.

**PAS 1192-2:2013** *Specification for information management for the capital/delivery phase of construction projects using building information modelling.* The requirements within PAS 1192-2 build on the existing code of practice for the collaborative production of architectural, engineering and construction information, defined within BS 1192:2007. It focuses specifically on project delivery, where the majority of graphical data, non-graphical data and documents, known collectively as the Project Information Model (PIM), are accumulated from design and construction activities.

**PAS 1192-3** is the partner to **PAS 1192-2**, and focuses on the operational phase of assets irrespective of whether these were commissioned through direct capital works, acquired through transfer of ownership or already existed in an asset portfolio. Like PAS 1192-2, PAS 1192-3 applies to both building and infrastructure assets.

**BS 1192-4:2014** *Collaborative production of information Part 4: Fulfilling employers information exchange requirements using COBie – Code of practice COBie (Construction Operations Building Information Exchange),* is required on all government construction projects where information must flow into portfolio, asset planning and facility maintenance tools. BS 1192-4 provides users with recommendations on how to use COBie to structure information required for the operation of an asset or facility during the construction process, supporting the processes outlined in PAS 1192-2 and PAS 1192-3.

**BS 7000-4:2013** *Design Management Systems: Guide to managing design in construction.* This BIS funded revision has been radically updated to take into account the development of BIM within the construction industry. It replaces **BS 7000-4:1996**.

**BS 8541** Series of Library Objects for architecture, engineering and construction – provides construction product manufacturers and suppliers with guidance on how to provide product information for inclusion in Building Information Models. It comprises **BS 8541-1:2012** *Identification and classification*, **BS 8541-3:2012** *Shape and measurement* and **BS 8541-4:2012** *Attributes for specification and assessment*.

### Upcoming BIM standards

There are several standards that work in synergy with the **BS 1192** suite of standards. The key ones expected in 2015 are: **BS 8541-5** and **BS 8541-6**. As BIM Level 2 becomes more widely adopted in the UK, BSI is adding 2 new British Standards to the BS 8541 Library Object series in early 2015. They provide best practice recommendations on how to develop library objects for assemblies and product and facility declarations.

- **BS 8541-5** *Library objects for architecture, engineering and construction: Assemblies* (on the sharing of sub-models representing combinations of components and spaces covering naming, classification and nesting) and;
- **BS 8541-6** *Library Objects for architecture, engineering and construction: Product and facility declarations – Code of practice* (on the sharing of data expected from product declarations, labelling and environmental tables).

Lead Technical author, Nick Nisbet, explains, “Repeatable rooms and prefabricated modules, on the one hand, and the Construction Products Regulation and energy performance reporting on the other, are issues of growing importance in the construction sector. These codes of practice build on the earlier parts of the series to help the industry achieve higher quality and accuracy when exchanging product (and facility) information.”

**BS 8536:2010** *Facility Management briefing is being revised as Facility Management briefing for design and construction – Code of practice*, to take into account current industry best practices in briefing and the emergence of the soft landings process and BIM. The revised standard will give recommendations for design and construction to ensure that design takes account of the expected performance of the asset/facility in use over its planned operational life.

**BS 8536:2015** will introduce the integration of the principles of the soft landings process, combined with effective information management and the requirements for post-occupancy evaluation (POE) to strengthen the link between asset/facility owners, operators, and their facility managers and the design and construction team to assure performance of the design and the operational asset/facility in all aspects.

The standard cross-references information requirements associated with the mandated documents for BIM Level 2 PAS 1192-2, PAS 1192-3 and BS 1192-4 and is expected to publish in July 2015.

**BS 8536:2015** is intended for use by individuals and organisations preparing or contributing to design, construction and operations, in both the public and private sectors, including owners refurbishing an existing asset/facility, organisations procuring a new asset/facility and the designers, constructors, subcontractors, operators, operations teams, facility managers and other specialists engaged in such activities.

**PAS 1192-5.** The UK BIM Task Group's "Security Working Group" announced late last year at "ICE BIM 2014: Business as Usual" Conference in London that "PAS 1192-5: Specification for security-minded building information management, digital built environments and smart asset management", is currently in development.

The PAS will outline a risk assessment process to determine the sensitivity of information already held, or which will be acquired during the course of a project, and identify appropriate, proportionate security requirements for BIM collaboration which

should be applied during all phases of the lifecycle of an asset, i.e. concept, design, construction, operation and disposal. It will then address the steps required to assist in creating and cultivating an appropriate security mind-set, and the secure culture necessary to enable business to unlock new and more efficient processes and collaborative ways of working.

The intended audience for this PAS includes organisations and individuals responsible for the procurement, design, construction, delivery, operation and maintenance of buildings and infrastructure assets. Although specifically targeted at the use of Level 2 BIM, the requirements will provide a foundation to support the evolution of future digital built environments and will contribute to smart asset management.

The standard is expected to publish later this year. ■



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**Anthony Burd**  
**Head of Market Development**

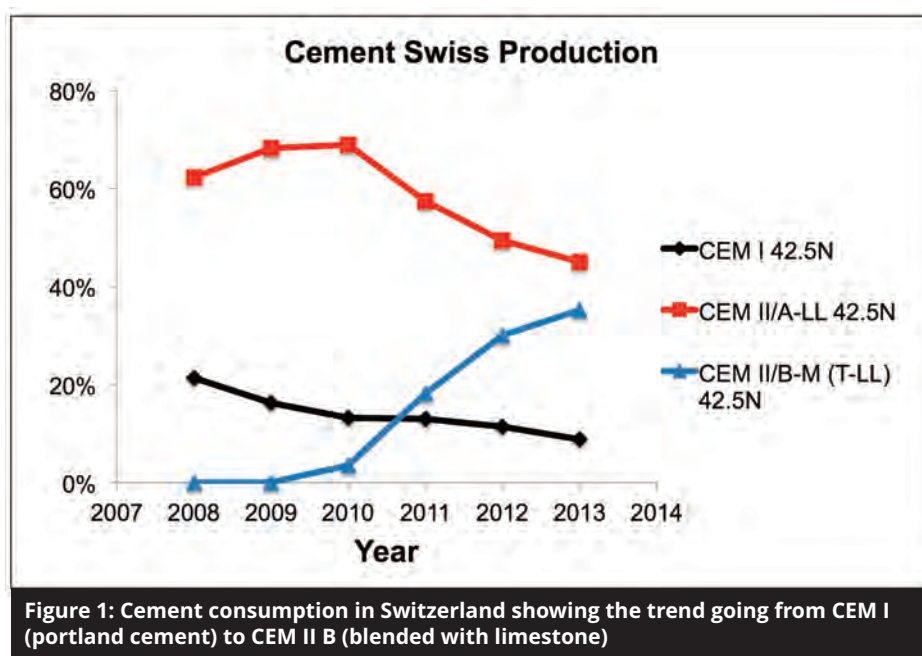
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# Durability challenges for new and existing reinforced concrete structures

Concrete and reinforced/pre-stressed concrete is and will be the main construction material for civil engineering infrastructure. Much more than in the past this construction technology faces challenges that have been discussed at the International RILEM workshop held at ETH Zurich in Switzerland on 17-18 April 2012<sup>1</sup>.

For new structures that will be built in industrialised and emerging countries to expand the civil engineering infrastructure, the challenge is to achieve long service life, practical, cost-effective solutions with materials having a reduced environmental footprint. To achieve this, the cement industry made great efforts in substituting clinker (responsible for a large part of the CO<sub>2</sub> emissions) with supplementary cementitious materials (SCM). This substitution is reflected in the decreasing amount of Portland cement (CEM I) and the increase of blended cements (CEM II) worldwide (figure 1). These modern binder systems containing limestone, fly-ash, oil burnt shale etc. in a complex blend are getting included (thus allowed) by more and more standardisation bodies such as the European Cement Standards EN 197-1 and their national companions. The standards include specifications on the proportions in which they are to be combined, as well as the mechanical, physical and chemical requirements for both the products and their constituents. These blends are suitable for achieving strength similar to Portland cement, thus can be used to build concrete structures.



From the point of view of the end user (engineer, owner of the structure, society) that the final product uses concrete made of cement is more important. Performance based concrete standards such as the European concrete standard EN 206-1 have thus

emerged that relate concrete durability to different types of exposure. Concrete for a bridge in the Swiss mountains (figure 2) exposed to a severe climate and de-icing salts (exposure condition XD3) must be of much higher quality compared to

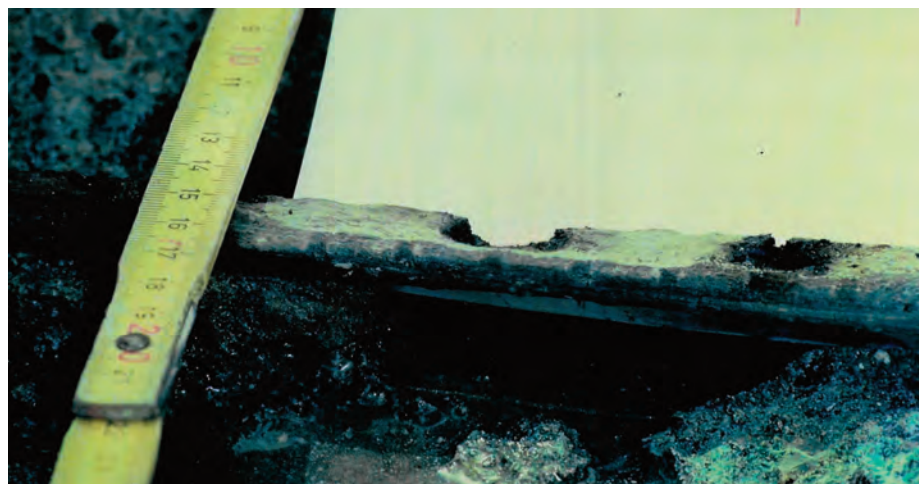


**Figure 2: Typical highway bridge in the Swiss Mountains with severe exposure to de-icing salts in the winter**



concrete inside a building (XC1). The term “quality of concrete” includes the care with which it is executed but also its composition – thus water to cement ratio and the cement type. Whereas long experience is available with concrete structures made with Portland cement (CEM I), new blended cements have a much shorter track-record. In addition, due to the reduced clinker content, the pH of the pore solution will be lower and questions arise regarding the corrosion protection of the steel<sup>2</sup>, thus the durability of these new structures both regarding the resistance against carbonation and against chloride-induced corrosion.

The civil engineering industry is currently, in many industrialised countries, in a transition phase from building new constructions to maintaining the large stock of valuable assets. This is reflected (as an example valid for other industrialised countries) in the increasing costs for maintenance of the Swiss national highway system (figure 3) compared to the costs for building new structures. These reinforced concrete structures are aging and very often show premature deterioration due to corrosion of the reinforcement. For existing infrastructure the challenge is



**Figure 4: Localized chloride induced corrosion of the reinforcement showing that no rust is formed**

thus extending the service life with a minimum of intervention, costs and traffic delay. Bridge management systems based on the results of inspection of the structures are crucial. Today visual inspection is common – once a sign of distress (cracks, rust) is detected maintenance action is decided (reactive strategy). In this way damage, especially chloride-induced corrosion of the reinforcement (figure 4) is detected only in a very late stage and maintenance costs are very high. An improved pro-active maintenance strategy requires a step forward, changing from visual inspection towards more refined techniques for inspection and

condition assessment, e.g. robotic inspection and corrosion surveys. This is particularly important for RC structures exposed to chloride ions (sea-water, de-icing salts) as internally ongoing corrosion of the reinforcement will manifest only in a very late stage at the surface.

The topics addressed here will be further focussed on in future issues of Adjacent Government.

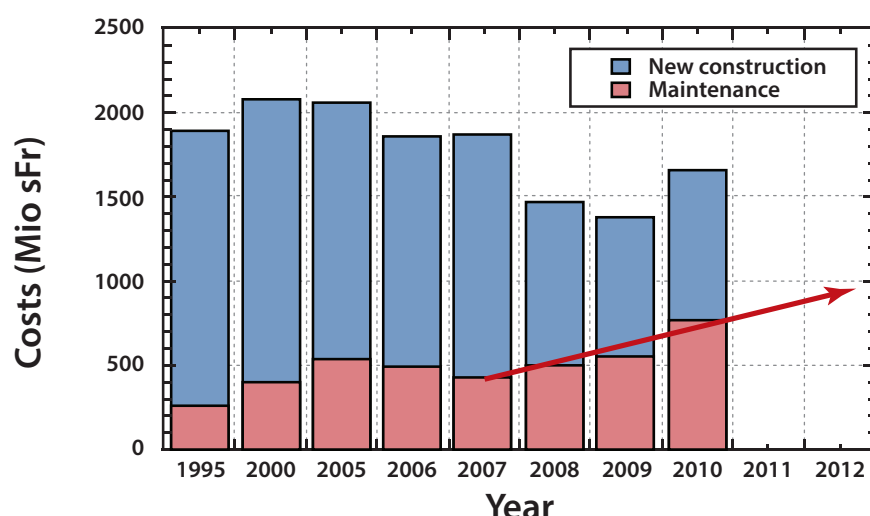
<sup>1</sup> U. Angst, R.D. Hooton, J. Marchand, C.L. Page, R.J. Flatt, B. Elsener, C. Gehlen and J. Gulikers, *Materials and Corrosion* 63 (2012) No. 12

<sup>2</sup> L. Bertolini, B. Elsener, E. Redaelli, P. Pedersen, R. Polder, *Corrosion of Steel in Concrete – Prevention, Diagnosis, Repair*, WILEY VCH second edition (2013)

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**Figure 3: Increasing costs for repair and maintenance of the ageing infrastructure – example Swiss Highway System**

# Time to address the skills shortage

**Julia Evans, Chief Executive at BSRIA examines the current construction skills shortage and urges action to help promote the industry as an attractive career path...**

**A**s the influence of the recession begins to fade and the construction industry sees a return to growth, all the things that beset us, such as having too many staff, are now reversing and the hunt for talent is on.

Recent figures from the CITB report that 200,000 more workers will be needed in the construction industry by 2020. The Royal Academy of Engineering reported in 2012, during a period of recession, the need for the UK to increase the number of science, technology and maths (STEM) graduates by 100,000 each year just to maintain the status quo. So where are all these people going to come from?

Total construction employment is expected to hit 2.74 million by 2019 which is slightly less than the number employed pre-recession in 2008 when 2.86 million were employed. So what has happened to all the people that used to work in construction, and are they likely to return?

We have only to cast our minds back to the height of the recession and the precipitate loss of many workers, including apprentices who were part way through their courses, to understand that poor practice in difficult times has done the industry few favours.

Nevertheless, handling the recruitment of new staff is an issue that can no longer be ignored. So how can companies now seeking that elusive new colleague do their best to persuade the next generation that the construction industry is a good viable long term career move?

The National Union of Students has set up a commission to examine the Future of Work. The NUS



Julia Evans, Chief Executive at BSRIA

went out to ask 4000 students and recent graduates about their view of the world of work. It revealed some salutary and concerning findings.

About a third were pessimistic about the job market which is an irony given the situation of impending skill shortages. Respondents saw employers to be at the heart of the issue (not government) and particularly



apprenticeships are open to those who 'get the grades' (Labour), suggests that those for whom vocational training is a more appropriate avenue to pursue than A levels or a degree, may find themselves shut out of the course which will lead them to a sound career. Similarly, current government proposals (Tory and LibDem) about change to apprenticeship schemes contain plans to change the point at which employer funding becomes available. This is proposed to alter from the beginning to the end of a course. Whilst this change is not so much of a problem for larger employers, for many SME employers (which are where many apprentices receive their training) the impact that this change will have on cash flow may be unsupportable leading to reductions in apprenticeship numbers.

So where does all this leave us? Employers are clearly in the driving seat as far as young people go so let's not wait for government to lead. If we want to attract the best talent we need to look to our methods of recruitment, our promotion of the changing nature of construction industry, packages of benefits and the scope of training to ensure we give ourselves the best chance of getting the right people into our businesses. We need to consider party policy and vote accordingly. But most of all we need to get on with addressing this issue now and grasp the situation. After all, compared with the experiences of the recession, this is a good problem to have. ■

highlighted issues of low pay and no pay (as in internships) being key. The other important factor was the 'catch 22' conundrum of employers wanting work experience; half of the respondents asked saw that absence of experience was a huge barrier to employment. And yet, as we know, whilst there are many excellent work experience schemes available, the majority of employers do not offer this kind of opportunity.

Although the young people surveyed by the NUS didn't see government as being the driver for change, many employers do. May 2015 sees our opportunity to choose the next government. All the main political parties have education and training as a key plank in their manifestos. Central to education policy is the approach taken to apprentices – always a part of the foundation of construction employment.

Policies do not differ greatly between the parties in this regard. All see apprenticeships as being a key part of future economic success. However, apprenticeships are now becoming a key issue with debate around gross numbers, levels of investment and interestingly, even producing a whiff of elitism.

Whilst no one would argue against the drive to improve overall educational standards, the idea that



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# Major FM Companies are Achieving BAFE Registration

The public sector continues to make wider use of outsourcing and Facility Management for their fire protection and there is growing awareness among Facilities managers that their responsibilities for fire protection are significant. However it can be difficult to ensure that external providers of fire safety services are capable and competent. As a result more and more of the major FM companies are achieving third party certification with BAFE.

BAFE also monitors all public sector tenders for fire protection services to encourage specifiers and purchasing bodies to use third party certificated companies. So to compete for these valuable contracts providers need to be able to demonstrate their competence.

This is not a question of recommending one company over another, as there is now such a wide range of companies available who are certificated across the UK, but it is a matter of refining choices for end users.

BAFE is the independent third party certification registration body for the fire protection industry. We develop schemes for UKAS accredited certification bodies to assess companies to recognised standards. BAFE supports specifiers and property managers to ensure that they get quality fire protection to match their risks. There are now over 1200 companies registered to BAFE schemes.

The Regulatory Reform (Fire Safety)

Order 2005 and the equivalent legislation in Scotland and Northern Ireland, places specific duties on the 'responsible person' or 'duty holder' and DCLG states in its guidance documents (section 8):

"Third-party certification schemes for fire protection products and related services are an effective means of providing the fullest possible assurances, offering a level of quality, reliability and safety that non-certificated products may lack."

## SO YOU NEED BAFE...

If you are looking for the **Maintenance of portable extinguishers**, look for Companies accredited to BAFE Scheme SP101/ST104. Companies have to be annually certificated to ISO9001 and all technicians are regularly assessed to BAFE standards. Over 1250 Technicians are now BAFE registered which ensures that they are properly trained and keep up to date.

For **Fire Alarm systems**, Companies should hold BAFE SP203-1 scheme approval for design, installation, commissioning and maintenance modules. This is the key measure of competence for quality fire alarm companies and there are over 770 companies in the scheme. This scheme also requires that only properly certificated product is used in the installation.

Our **Emergency Lighting** scheme (SP203-4) is also modular and sets out staff competence, equipment and quality criteria to be met.

BAFE has also developed a scheme for Companies who carry out **Fire Risk Assessments** (SP205). The scheme certifies the competence of the individual assessors as well as the quality requirements for the organisation. A competent fire risk assessment is the basis for all fire protection and is the key requirement of national legislation. There are a growing number of companies registering to the scheme, throughout the UK. If you provide FM services for clients or within your own company, you have an important responsibility to understand and implement fire protection requirements.

Becoming one of the more than 1200 BAFE registered companies ensures that a provider has taken important steps to ensuring that their services will be delivered to national, independently certificated standards. Using a BAFE registered company is the way to ensure that you receive a competent service.



**Stephen Adams**  
Chief Executive  
BAFE

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# Don't gamble with your fire risk assessment!...

**If you are responsible for a business premises, the law requires that you have a fire risk assessment. To find competent providers, you need BAFE.**

Under the provisions of the Regulatory Reform (Fire Safety) Order 2005, the Duty Holder or Responsible Person for a building is required to make a Fire Risk assessment to clarify the fire precautions necessary to ensure the safety of staff, customers and property.

At present there are no adequate means to ensure the competence and reliability of a company commissioned to carry this out.

BAFE scheme SP205 has been developed specifically to address this situation, and will provide reassurance to the Responsible Person that they are doing everything possible to meet their obligations.

**So don't leave everything to chance. Make sure that your suppliers are registered with BAFE.**



**[www.bafe.org.uk](http://www.bafe.org.uk)**

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**Promoting Quality in Fire Safety**

# CDM2015 and domestic projects

**James Ritchie of The Association for Project Safety answers the questions most raised about the new CDM Regulations with regard to domestic projects...**

**T**he phone line has been red hot since the beginning of the year. Everyone wants to know the implications of the new CDM Regulations; what they mean for their projects, clients, designers and contractors. "Can I be a Principal Designer?" "My client wants to appoint me to carry on giving him advice on his construction projects – is that allowed?" "How strict is the Principal Designer duty to ensure designers comply with the regulations?" "What is going to happen on domestic projects?" "What if my domestic client appoints all the contractors separately?"

CDM2015 is aimed at small and domestic projects – the very area where most construction accidents and incidents are occurring – and many of the calls are from architects who do nothing but domestic projects.

## **So what do Domestic Clients Need to do?**

CDM2015 understands that most domestic clients will not be familiar with design or construction projects or associated legislation. If someone is about to alter or extend their house or buildings, thinking of putting up a new one or demolishing an existing one, then the Construction (Design and Management) Regulations 2015 (CDM2015) place a number of specific duties on them as a construction Client.

The aim of the CDM2015 Regulations is to make health and safety an essential and integral part of the planning and management of projects and to make sure that everyone works together to reduce the risk to the health or safety of those who work on the structure, who may be affected by these works, or who will use it once it's completed. A domestic client is someone who has construction work done on their own home, or the home of a family member which is not in connection with a business. Unlike CDM2007, domestic clients have duties under CDM2015.

The extent of these duties varies with the type of project involved. On projects that are likely to involve more than one contractor, the domestic client is required to appoint a Principal Designer before significant detailed design work starts so that they can advise and assist the client with their health and safety duties and plan, manage, monitor and co-ordinate the health & safety of the pre-construction phase of the project. The Principal Designer is a designer (architect, building surveyor or engineer for example) who can demonstrate to the client that they have knowledge, skill and experience of CDM2015 and understand the process of design risk management.

When clients are talking to a designer or designers about their project they should check that the designer has the capability and experience to do the work. A designer might be a member of one of the following professional bodies – ARB, RIBA, RIAS, CIAT, RICS, IStructE etc. and, in order to carry out the Principal Designer role, should have an accreditation in construction health and safety risk management (Registered membership of APS for example) or can provide evidence of having undertaken appropriate training on CDM2015.

The Regulations recognise that Clients hold the power to influence and control the designers and contractors they engage or appoint on a project, and therefore that the ultimate responsibility for the achievement of a safe and healthy project is in your hands as much as theirs.

The Regulations are about making sure that there is:

- Early appointment or engagement of capable key people or organisations that have sufficient skills, knowledge, experience and resources;



- A realistic project programme which gives enough time for planning and programming as well as carrying out the work itself;
- Early identification and reduction of construction risks and proper management of those that remain, so that construction is safe and does not damage the health of workers or others;
- Co-operation between all involved in a project and effective coordination regarding Health and Safety issues;
- Adequate welfare facilities provided from the start and throughout the construction phase; and that
- Appropriate information is made available to the right people at the right time so that work can be carried out safely and without risk to health.

However, it is very important that the amount of effort devoted to managing health and safety is kept appropriate and proportionate to the complexity of the project and level of risks. It is particularly important to be aware of, and avoid, unnecessary paperwork. Most domestic work should be relatively simple and therefore require minimal paperwork.

### **What type of domestic project is being planned?**

Irrespective of size or duration, the CDM2015 regulations separate construction projects into two types – dependent on how many contractors will be involved in the project.

The two types are:

**Projects with only one contractor** – where the project will only require one contractor working on the site. An example of this might be an electrician rewiring the house or a plumber installing a replacement boiler, when no other trades are required to do any work. Where the project only involves one contractor, the client duties specified in CDM2015 Regulation 4(1) to (7) and Regulation 6, must be carried out by the contractor. The contractor needs to undertake these duties in addition to their own duties as a contractor.

When clients are selecting a contractor, they should ensure that the contractor is aware of the client duties under CDM2015 as well as their own contractor duties. Clients are advised to ask for examples of how the contractor has done this on previous projects.

**Projects that are likely to involve more than one contractor** – this will be the majority of projects. For example, if the work will require a bricklayer, electrician, plumber, roofer and plasterer, then that is five contractors.

If it is likely that the project will require more than one contractor, then the client must appoint a designer with control over the pre-construction phase as Principal Designer and a contractor with control over the construction phase as Principal Contractor. These appointments must be made as soon as practicable and before the construction phase begins. If the client fails to make these appointments, then the designer in control of the pre-construction phase is deemed to be the Principal Designer and the contractor in control of the construction phase is deemed to be the Principal Contractor.

If the client is in doubt, they should assume that the project will require more than one contractor. The appointed designer or contractor should be able to help clients decide or alternatively clients can contact the free Public CDM Helpline as a source of independent advice on 0333 088 2015. ■



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# From Bradley Curve to Cultural Safety™ Map

Many people will be aware of the Bradley Curve and the three phases of Dependence, Independence and Interdependence. Beyond that however, fewer will know about the how critical workforce behaviours to each of the phases and fewer still how it was derived. That apart there is still the question of what does it mean for the day-to-day management of safety and the development of your safety culture? This article provides answers to those questions and looks at a modern approach to Safety Culture assessment and development.

At first sight the 'Curve' is presented as a tri-state model rather than a continuum so the name seems rather anomalous. So let's examine that. The underlying principle is that Culture is something that changes slowly; there's no switch that can be thrown overnight to move from one state to another. It's notoriously difficult to measure things that move slowly and even worse trying to tie down the intangible so how best to quantify a culture and know how to improve it? If it's a long journey then perhaps we need a map as well as a model.

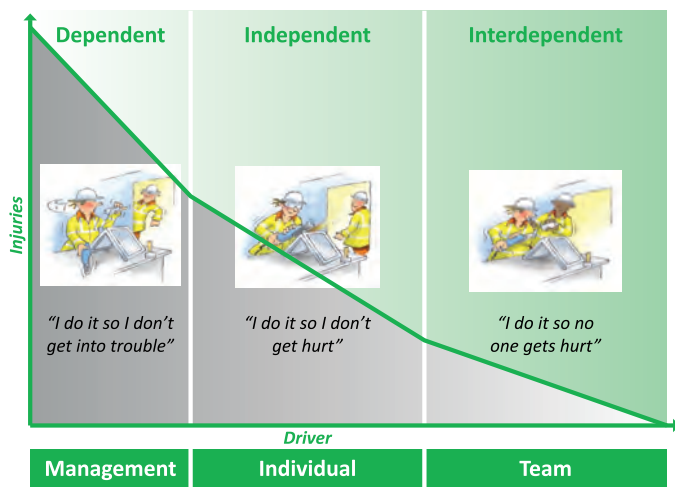


Figure 1 The Bradley "Curve"

Sociologists and Anthropologists tend to define a culture as consisting of four elements, Belief Systems, such as a religion; and 'Rituals' – frequently performed behaviours often associated with a ceremony or right of passage designed for a particular purpose Language and 'Artefacts' as beloved of Time Team and archaeologists. Put simply go somewhere where any one of the four are significantly different and you have a different Culture.

So it can be seen that Behaviours which the Bradley curve focuses on are only part of a Culture and need to be associated with Beliefs, objects & places and how those are talked about.

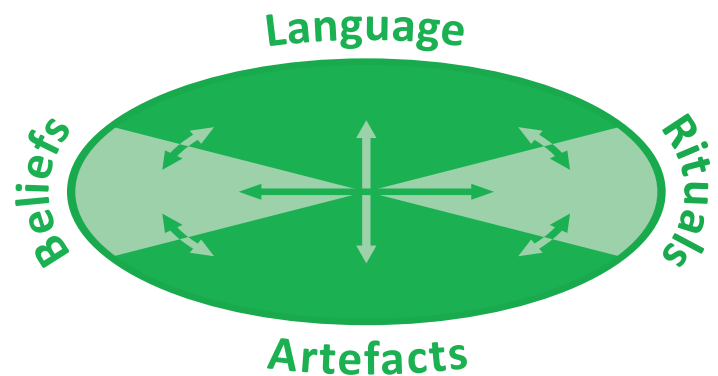


Figure 2 The Cultural Safety™ Model

It's surprisingly easy to translate this neatly into the workplace. Our tribe is our Company, the beliefs are the Values & Mission Statements; the Rituals are the formal Method Statements & Procedures (and the informal undocumented ones!); the artefacts are the logos, workwear, tools of the trade, site layouts and crucially the documentation & reports used to control and manage a classic safety system; How they are written, style and tone as well as when they are read and discussed, is the language element.

The interrelation of Behaviours to Beliefs, Artefacts & Language would indicate that there's more to developing a stronger safety culture than the Bradley curve alone would indicate.

As you unpack the essential elements of the Bradley curve it comes down to just two basic things: Teamwork and Ownership.

An easy way to determine the degree to which ownership has been assimilated by the workforce what you are looking for is the degree to which people believe that Safety is done:

- **TO** the workforce so they are being policed (Barely on the Scale!) or
- **FOR** the workforce by managers or safety staff so they don't need to worry about it (Dependent), or
- **BY** the workforce looking out for themselves (Independent) or
- **BY** everyone for mutual benefit (Interdependent).

So what the Bradley curve mainly measures is how much ownership of the Safety system has been taken up by the front-line workforce and how much people look out for others as well as themselves. To some extent it does look at their beliefs (or motives) since in some implementations this is judged by looking for specific behaviours.

So far so good, but is that enough for a robust general purpose tool?

The answer is probably not. One issue is the tone and style. What the Bradley curve uses to define progress are terms which all contain the concept of dependence and a focus on front-line behaviours. As with a lot of classic Health and Safety is about 'eliminating the negative'. What the psychologists have shown in many spheres is that, in the words of the song, 'Accentuating the Positive' is far more effective.

Another potential weakness in using the Bradley Curve terminology is that it is widely acknowledged that people do not normally turn up for work expecting to get hurt. This would indicate that the starting point on the Bradley curve should be the Independent state as people do have a natural tendency to look after their own welfare. Dependence should be seen a backward step!

Whilst Bradley defines just 3 phases most models in commercial have five levels to describe safety culture development. Furthermore teamwork & concern for others have been championed not just in safety but also in quality and environmental management – there are other dimensions to a safety culture that give a far wider and more subtle perspective.

The ideal would seem to be a model which reflects the four elements of a culture, since that's essentially what we're trying to assess, and draws out the ownership and teamwork elements which makes Bradley an appealing, if simplistic, model.

These were the design criteria for the Roscoe-Bizzell model which RyderMarshSharman are now using. The Model looks for evidence of the development of the 4 elements of culture by examining ownership plus other key factors. These are then combined and you see distinct pattern emerging.

For example by pulling together the groups of factors which define an area of interest. For example looking at the Extent, Efficacy and Accuracy factors of the artefacts of the formal safety management system gives an idea of fitness for purpose and often opportunities for incremental improvements can be identified here. It's also crucial to see if "over dependence" has set in and the organisation has become "System obsessed" rather than genuinely concerned for the workforce.

Looking at how productivity and safety are really valued relative to each other is key to understanding the true beliefs

driving the culture and in turn is the best indication of how far the enablers of a strong safety culture have developed. Looking at the individual and co-operative Behaviours exhibited will complete the whole picture of the culture.

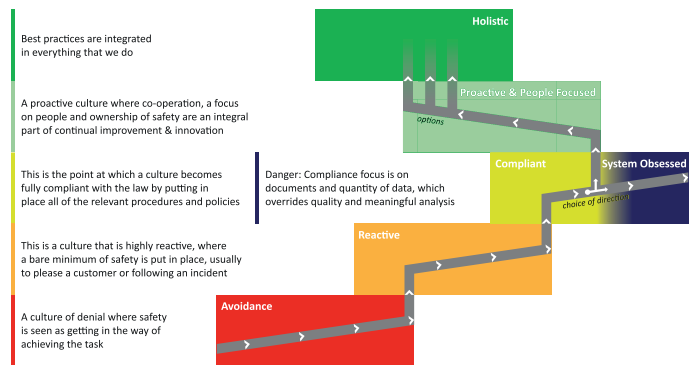


Figure 3 The Cultural Safety™ Map

This modular approach makes for a flexible, practical to administer and useful tool with which one can both get a snapshot of the present and use to pinpoint ideas for how the strategic improvements can be identified, prioritised, planned and implemented.

Taking a view beyond psychology alone makes it the first truly Cultural model and the focus on the key discriminators makes it practical and robust. The combination of simple administration and sophisticated analysis possibilities makes Cultural Safety™ a powerful tool which eclipses the single-focused survey instruments.



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# Addressing EU water challenges

**Pavel Misiga, Head of the Water Unit at the European Commission's Environment DG, outlines how the EU Water Framework Directive can help to ensure clean water in sufficient quantities for people and nature...**

The main aim of EU water policy is to ensure that throughout Europe a sufficient quantity of good quality water is available for people's needs, the economy and for the environment. Since the 1970s, through a variety of measures, the EU has worked hard to create an effective and coherent water policy.

**“Higher water temperatures and changes in extremes, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution.”**

The EU Water Framework Directive (WFD), adopted in 2000, takes a pioneering approach to protecting water based on natural geographical and hydrological formations: river basins. Integrated river basin management adopts a holistic approach to protecting the whole body of water, its source, tributaries, and river mouth. The Directive requires Member States to draw up river basin management plans to safeguard each of the 110 river basin districts, 40 of which are international and cross borders, covering about 60% of EU territory. It is implemented through 6 year recurring cycles, the first of which covers the period 2009-2015.

The overall aim of the WFD is to achieve 'good status' for all EU waters, including fresh, transitional (river mouths) and coastal waters by 2015. 'Good status' means both 'good ecological status' and 'good chemical status'. But in spite of improvements in recent years, achieving this goal is still some way off with only 53% of surface water bodies at present in good ecological state.

European Water policy has improved water protection. Problems of quantity and quality are being addressed.

As a result most Europeans can safely drink tap water and swim in thousands of coastal areas, rivers and lakes across the EU.

However, progress is still too slow and Member States need to step up actions to preserve water resources. The Commission's 4th WFD implementation report published on 9 March 2015<sup>1</sup> sets out a series of recommendations for the way forward. At the 4th European Water Conference held in Brussels on 23-24 March 2015<sup>2</sup>, Karmenu Vella, EU Commissioner for the Environment, Maritime Affairs and Fisheries conveyed the report's key recommendations for Member States.

- First and foremost, it is necessary to improve the monitoring of water status;
- Diffuse pollution from agriculture is a significant pressure which affects 90% of river basins in the EU. Stricter controls should be imposed, in particular with regard to the use of agricultural chemicals such as fertiliser and pesticides, in order to tackle this pressing problem;
- Industrial pollution needs to be better controlled by adjusting permits to reflect the achievement of the water policy objectives;
- Water bodies have been negatively affected by too many changes to their shape and flow due to, for example, flood protection, hydropower development, navigation, etc. Removing or mitigating these man-made pressures is necessary to restore the aquatic environment and its ecosystems;
- Water scarcity remains an issue, and not just in the South. Water abstraction needs to be controlled in

order to achieve a good balance between availability and use. In this context in particular, more attention must be paid to the principle of cost recovery by applying, for example, water pricing or other ways to incentivise an efficient use of water;

- Greater uptake of under-used EU funds was also recommended.

### **How does climate change impact the quality of water?**

In the coming decades, climate change will pose a major challenge for water management across the EU. Higher water temperatures and changes in extremes, including floods and droughts, are projected to affect water quality and exacerbate many forms of water pollution.

Droughts and increased water scarcity are expected to affect larger areas of Europe thereby reducing water availability, especially in the summer season.<sup>3</sup> On the other hand heavy downpours can increase the amount of runoff into rivers and lakes, washing sediment, nutrients, pollutants and other materials into water supplies. These effects can reduce the quality of water and can damage the infrastructure that we use to transport and deliver water.<sup>4</sup>

Under the WFD, EU Water Directors adopted in December 2009 a Guidance document on adaptation to climate change in water management<sup>5</sup> to ensure that the River Basin Management Plans are climate-proofed. In addition, the 2007 Floods Directive adopts a proactive approach, requiring Member States to develop flood risk management plans by 2015, in coordination with the next cycle of River Basin Management Plans (2016-2021).

In this context, Natural water retention measures (NWRMs)<sup>6</sup> are an important tool as they can help reducing flood risk while improving water quality. NWRMs, such as floodplains, river or wetland restoration, rely on nature to regulate the flow and transport of water so as to smooth peaks and moderate the consequences of extreme weather events. They are already being implemented or planned in several EU

river basins and the EC encourages their broader take up.

### **How do new technologies help with water management?**

In 2012, the Commission launched the European Innovation Partnership on Water (EIP Water)<sup>7</sup>, designed to encourage private investment and get good ideas on the market. The Partnership is expected to mirror the innovation needs of EU water policy implementation and facilitate the development of innovative solutions to address major European and global water challenges.

The Partnership brings together actors from sectors including the water industry, SMEs, the research community, local governments, major water users and finance. It helps develop networks and action groups that work on innovative solutions which are then spread including by means of web platforms. Currently action groups are working on issues such as water monitoring, smart water networks, water re-use, aquifer recharge, etc. ■

<sup>1</sup> [http://ec.europa.eu/environment/water/water-framework/impl\\_reports.htm#fourth](http://ec.europa.eu/environment/water/water-framework/impl_reports.htm#fourth)

<sup>2</sup> [http://ec.europa.eu/environment/water/2015conference/index\\_en.htm](http://ec.europa.eu/environment/water/2015conference/index_en.htm)

<sup>3</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0672>

<sup>4</sup> <http://ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf>

<sup>5</sup> [https://circabc.europa.eu/sd/a/a88369ef-df4d-43b1-8c8c-306ac7c2d6e1/Guidance%20document%20n%2024%20-%20River%20Basin%20Management%20in%20a%20Changing%20Climate\\_FINAL.pdf](https://circabc.europa.eu/sd/a/a88369ef-df4d-43b1-8c8c-306ac7c2d6e1/Guidance%20document%20n%2024%20-%20River%20Basin%20Management%20in%20a%20Changing%20Climate_FINAL.pdf)

<sup>6</sup> [https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures\\_Final.pdf](https://circabc.europa.eu/sd/a/2457165b-3f12-4935-819a-c40324d22ad3/Policy%20Document%20on%20Natural%20Water%20Retention%20Measures_Final.pdf)

<sup>7</sup> <http://ec.europa.eu/environment/water/innovationpartnership/>

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[www.ec.europa.eu/dgs/environment/index\\_en.htm](http://www.ec.europa.eu/dgs/environment/index_en.htm)

# Groundwater modeling

**G**roundwater is surrounded by an aura of mystery. People associate groundwater to dangerous subterranean rivers, which only water witches can unveil, or to earthquakes triggered by fluid injection into deep rock. As a subject deserving attention, it remains largely unknown. Yet, most fresh water around is underground (the other great reserve is frozen far away in Antarctica and Greenland). Therefore, many daily processes require groundwater: rivers flow continuously because they are fed by aquifers; groundwater is the sole source of moisture during droughts, thus providing robustness and resilience to aquatic ecosystems; groundwater remains the safest source of drinking water because pathogens are virtually immobile in porous media. Still, aquifers are subject to increasing pressure by humans: too much water is pumped in some aquifers, which causes rivers and wetlands to dry; too much water is added from irrigation return flow in others, which causes soil salinization; pollutants are often disposed of in the soil and eventually reach groundwater, which becomes polluted. In short, like so many other natural elements, groundwater is being stressed beyond its natural recovery capacity. Understanding the way human impacts affect aquifers is essential for a healthy planet. This is precisely the ultimate goal of groundwater modeling at the GHS (Groundwater Hydrology Group) at Barcelona.

The GHS is a research group comprising geologists, geochemists, physicists, chemists and engineers from CSIC

(Spanish research council) and UPC (Technical University of Catalonia, CSIC acknowledges the group at UPC as an "Associate Unit"). The GHS performs laboratory, field and numerical modeling research in groundwater. Research is largely driven by applied problems (polluted aquifers restoration, acid mine drainage, seawater intrusion, CO<sub>2</sub> storage, urban aquifers, geothermal developments, etc.). However, applications often lead to basic questions about established understanding and tools, so that GHS also performs basic research. Following are four representative examples.

## Artificial recharge

Aquifers are replenished by rainfall recharge. The process is slow (0.1 m per year can be considered a reference value). This may not suffice in heavily pumped aquifers. Artificial recharge is a technique that consists of increasing natural recharge by injecting water in wells, or infiltrating it through basins. Even though the surface of these basins may be small, the recharge rate is large (1 m per day can be considered a reference value), which compensates their size. Artificial recharge is also beneficial for water quality (decrease of turbidity, pathogens, nitrogen, phosphates, metals, and dissolved organic carbon). Moreover, subsoil processes may remove organic contaminants, which drives a great scientific effort because many are not eliminated by conventional water treatments. The passage of water through the soil-aquifer system during artificial recharge may represent an alternative or comple-

mentary treatment for their removal.

As a general rule, the fate of organic compounds within the aquifer depends on lithology, hydraulic and textural properties of the soil, temperature, physico-chemical properties of the specific compound, and microbial environment. But the predominant redox state of the aquifer was the most significant one. Since certain pollutants are preferably removed under some particular redox conditions, such conditions could be promoted in artificial recharge practices. Even more important, if different compounds are degraded under different redox environments, a water mass undergoing a sequence of redox states should have most of its initial contaminants eliminated.

To test this conjecture, we developed a methodology to perform microcosm experiments to analyse the fate of organic micropollutants. Different anaerobic redox conditions were promoted and sustained in each set of microcosms by adding adequate quantities of electron donors and acceptors (For instance, to ensure nitrate reducing conditions, we added a high concentration of nitrate and some acetate). The evolution of the experiments is complex and numerical modelling, including major and trace solutes and dissolution/precipitation of solid phases, proved necessary for understanding the processes. The results confirm that micropollutants that are not removed under aerobic conditions tend to be removed under (often highly) reducing redox condi-



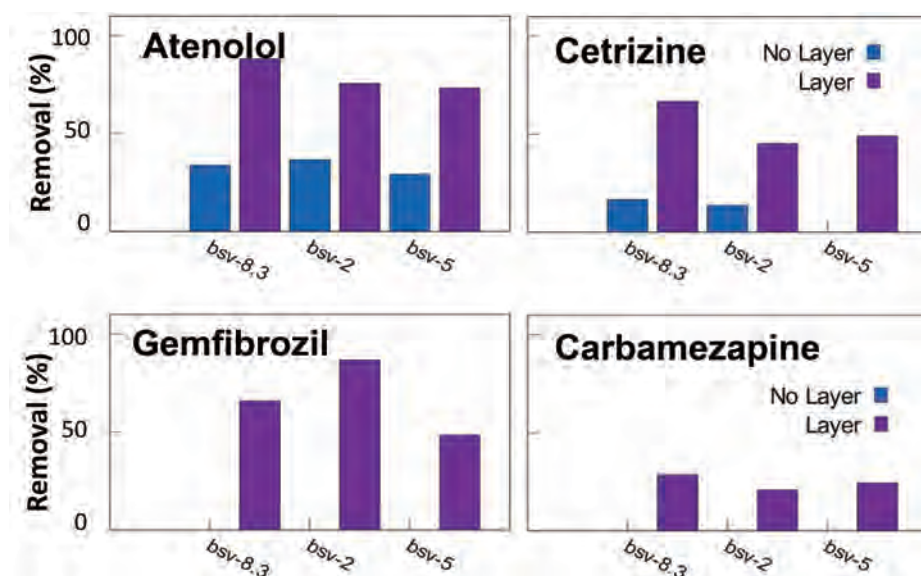


Figure 1: Removal of four emerging contaminants at the Artificial Recharge facility of Sant Vicenç del Horts (near Barcelona), showing that removal was greatly enhanced after installing the reactive barrier

tions. This suggests that aquifers may constitute a potentially efficient complementary water treatment, especially if reducing redox conditions are promoted during recharge and long enough residence times are ensured.

We tested the concept using our experience in permeable reactive barriers by adding a reactive layer to the infiltration basin of Sant Vicenç dels Horts near Barcelona. This layer consisted of: vegetable compost to promote reducing conditions and provide sorption sites for neutral compounds (some 49% in volume), sand to ensure structural integrity and high permeability (50%), and clay (1%) to promote sorption of cationic compounds. Removal of emerging contaminants after artificial recharge through the soil and only 2-7 days residence in the aquifer was greatly enhanced after construction of the reactive layer (Figure 1). More importantly, from a practical point of view, the basin has operated without clogging and maintaining reducing conditions for over two years, which we attribute to the

growth of plants that contribute to a beautiful view. It is reasonable to hope that this type of basin will become standard for renaturalisation of treated water and that the concept of promoting reducing conditions to enhance removal of recalcitrant contaminants can be used to alleviate generalised aquifer pollution by manure and other fertiliser application in agriculture.

#### Urban groundwater:

Urban groundwater is relevant because sustainability calls for use of local resources and urban groundwater represents an easily accessible and inexpensive source of water. Unfortunately, urban groundwater may be polluted by losses from the sewage system, which is leading to abandonment of groundwater pumping in many cities. This causes groundwater levels to rise, flooding and damaging underground urban structures. Controlling heads rise may demand groundwater pumping. As it turns out, this water is usually acceptable for most uses from the chemical and

microbiological points of view. Still, widespread use of urban groundwater requires guaranteeing long term quality, which in turn requires understanding the processes affecting the quantity and quality of urban groundwater. Specifically, sustainability requires quantifying recharge and the various sources involved.

The sources of and pathways for groundwater recharge in urban areas are more numerous and complex than in rural environments. Some direct rainfall recharge is lost because of impervious urban surfaces, but additional recharge can occur from storm drainage systems. Moreover, evapo-transpiration is significantly reduced, which together with losses from supply and sewage networks, contributes to large urban recharge. At GHS, we developed a methodology for identifying the relative contribution of waters with different chemical signatures (losses from water supply and sewage networks, infiltration from surface runoff and other water bodies, lateral aquifers inflows ...) by means of solute mass balances. Using this methodology, we found that the main contributors to total recharge in Barcelona are (Figure 2): water supply network losses (22%), sewage network losses (30%), rainfall, concentrated in the non-urbanised areas (17%), runoff infiltration (20%), and Besòs River (11%).

Since waste water is one of the main sources of urban recharge, concerns about urban groundwater quality are well founded. Yet, urban groundwater is quite good. A significant portion of GHS work has been devoted to understanding contaminant removal processes and conditions. We have found that again most contaminants

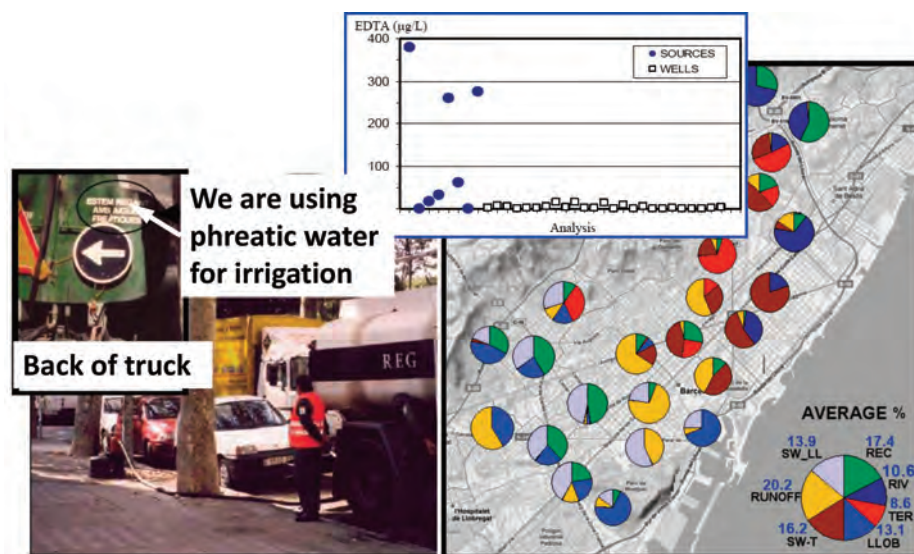


Figure 2: Right, mixing ratios of the various types of recharge water computed in Barcelona groundwater. Even though significant portions of sewage water are present in GW, most organic compounds have been largely removed (see, e.g., above, EDTA concentration in recharge sources and wells). Left, the good quality of Barcelona ground water and the need to lower water levels has prompted the development of a “phreatic water distribution network”

degrade as a result of the varying redox conditions and significantly long residence times. The implication is that good quality can generally be assured if water is pumped at depth, although reducing conditions may mobilise some contaminants. Therefore, actual use of urban ground water requires specific studies to ascertain local conditions and may need aeration (e.g., stripping).

The conditions prevailing under Barcelona are such that water quality is sufficiently good for most uses and a “phreatic water distribution network” has been developed for secondary uses, such as gardens irrigation, fire-fighting, or street cleaning (Figure 2).

An anecdotic, yet illustrative, finding was the identification of drugs of abuse in Barcelona aquifers from losses in the sewage system. Results are interesting on two accounts. First, the dominant drug in rich neighbour-

hoods is cocaine. In less affluent neighbourhoods, the dominant drug is the much cheaper ecstasy. While this may sound alarming, the fact is that they are found everywhere. Besos river water, which receives effluents from waste water treatment plants, contains many more drugs and in much higher concentrations than urban ground water. In fact, using the mixing ratios shown in Figure 2 and the concentrations of drugs in end members, we could reconstruct the concentrations that should have been expected if removal processes had not occurred. These are some 5-10 times larger than the ones observed, demonstrating again that organic compounds are largely removed in urban ground water.

#### Soil salinization:

Salinization refers to the precipitation of salts in the soil surface and root zone. These salts are highly soluble, so that the activity of water is greatly

reduced, hindering uptake by plants and causing significant losses in agricultural production. The problem is global: nearly 50% of irrigated lands in arid and semi-arid regions, 30% overall, suffer some degree of salinization.

Salinization is generally viewed as involving two processes: (1) salty water is brought to the surface by capillarity; (2) evaporation increases salinity and eventually causes salts to precipitate forming a crust. Actually, the process is complicated by the fact that the drop in water activity reduces evaporation. In fact, as activity equals the relative humidity of the air, a reduced activity implies that vapour will tend to flow towards salinized areas (osmotic effect).

We performed column evaporation tests to understand how deep salinization penetrates, where evaporation takes place or whether salinization is a surface process or can also occur at depth. We placed sand and silt columns with varying concentrations under a lamp, and monitored the weight loss by evaporation and the time evolution of temperature, salinity and water content versus depth. These variables are interesting, but do not suffice for a characterisation of actual processes, which requires detailed modelling.

We found two surprising results. First, evaporation causes vapour pressure to increase at the evaporation front, which is very narrow, so that vapour flows not only upwards, as expected, but also downwards. Second, downwards flux condensates below the evaporation front, causing dilution. As a result, ironically, water below the evaporation front is less saline than

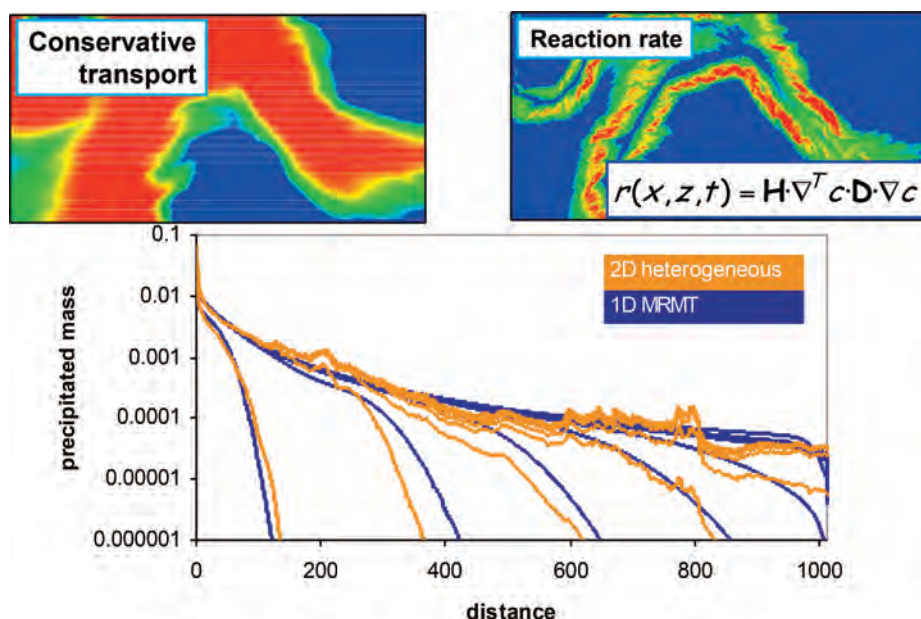


Figure 3: Above, pictures of a conservative tracer concentration and reaction rate for mineral precipitation driven by mixing. Below, comparison of cumulative, vertically integrated mass of precipitated mineral versus distance for several times in the heterogeneous domain (above) and using a homogeneous effective equation

the incoming one. The mechanism displays positive feedbacks, as condensation will be most intense in areas of highest salinity, thus diluting saline water that may have infiltrated.

Implications for salt management are clear. Salinization occurs solely at the surface and may be controlled by reducing evaporation (e.g. by soil mulching) or by forcing it to occur far from the root zone (e.g. by drip irrigation). The important point, however, is that, accepting that salinization is an essentially surface process, suggests remediation methods.

### Transport:

Solute transport is the phenomenon that explains how dissolved substances are transported by any flowing fluid. It is represented by the Advection Dispersion Equation (ADE), which includes the two most important transport processes: advection (dragging of solutes by the fluid) and

dispersion (spreading of the solutes due to chaotic fluctuations in fluid velocity). Hydrologist and many others (the ADE is identical for all fluids) have found since long ago that the ADE displays numerous limitations. In particular, the ADE equates spreading and mixing, which is unfortunate because they are different processes: spreading controls the size of the region potentially polluted and mixing controls reaction rates and thus the fate of pollutants. It is clear that an alternative equation is needed.

To this end, we performed detailed simulations of transport through heterogeneous media (it is widely accepted that problems with the ADE are caused by heterogeneity). For an initial pulse line injection, we found that heterogeneity induces anomalous temporal scaling of the mixing rate. This effect is particularly relevant for reactive transport. We also found that mixing is never complete, that

concentration will always display heterogeneity structures, whose size grows subdiffusively. More importantly, we found that spreading is most naturally represented by acknowledging that transport is markovian if represented by a continuous time random walk in which sequential steps are not characterised by fixed time steps (as in traditional random walks), but by fixed spatial jumps.

This latter development has naturally led to non-local in time equations for solute transport, which had been introduced with various rationales by several authors. This can be viewed as adding diffusion into immobile regions as an additional transport mechanism. A very hopeful result along this line is shown in figure 3, which shows that reactive transport through a highly heterogeneous porous medium is closely reproduced by a homogeneous non-local in time transport equation. While the issue is far from closed, this result makes us feel convinced that an effective transport equation that captures small scale heterogeneity dynamics will eventually be found.



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# Water in the city

**With population growth, urbanisation and economic development, the demand for freshwater in urban areas are increasing throughout Europe. At the same time, climate change and pollution are also affecting the availability of water for city residents, as discussed here by The European Environment Agency...**

In July 2011 intense rains left parts of Copenhagen flooded <sup>1</sup>. The urban drainage systems could not handle the amount of water that came down in intensities up to 135 mm in 2 hours. Copenhagen's water problems did not end there. Shortly after the floods, large parts of the city were affected for weeks by contaminants in the drinking water in connection with water main repairs. Similar types of water-related problems occur in other cities.

More than three quarters of European citizens live in urban areas and rely on clean water in cities. Approximately one fifth of the total freshwater abstracted in Europe supplies public water systems – water that is directed to households, small businesses, hotels, offices, hospitals, schools and some industries.

Ensuring a steady supply of clean water to the public is not a simple task. The water system needs to consider many factors including population and household size, changes in the physical characteristics of land surfaces, consumer behaviour, economic sector demands (such as tourist activities), the water's chemical composition and the logistics of water storage and transport. It also has to factor in the challenges from climate change that can include unexpected flooding, heat waves and periods of water scarcity.

To prevent urban water crises, we need to manage water resources effectively at every stage: from the supply of clean water to its different uses by the consumers. This could involve reducing consumption as well as finding new ways of collecting and using water. Water management should also be better integrated

within wider urban management while taking into account characteristics of the local environment.

## Paying for the water we use

Advances in technology and new pricing systems alone have already been proven to significantly reduce the amount of water used by households, which is typically 60-80% of the public water supply across Europe. Technological improvements to domestic appliances such as washing machines and dishwashers, for example, have helped reduce water use without requiring a change in behaviour or an awareness of water issues.

More significant improvements are also possible with changes to the use of water for personal hygiene, which currently accounts for 60% of water use in households. Cistern replacement devices in toilets, for example, provide a cheap and simple way to reduce the water used by one litre per flush <sup>2</sup>. Minor adjustments to shower systems, such as by aerating the water flow, can also result in water savings. As set out in the EU Water Framework Directive <sup>3</sup>, linking the price of water to the volume of water consumed can provide an incentive for a more sustainable use of water. In England and Wales, people living in metered properties use on average 13 % less water than those in unmetered homes.

## Re-using rain and greywater

Only 20% of water used by the sectors receiving a public water supply is actually consumed. The other 80% is returned to the environment, primarily as treated wastewater. Concreted and sealed surfaces in

cities typically direct the rainfall to the sewer networks where it is merged with wastewater. This prevents the rainfall from infiltrating the soil and forming part of our groundwater storage that can benefit us at a later date. Rain runoff and wastewater often pass through water treatment plants before being returned to rivers, usually far away from the cities. With some changes to urban water systems, both rain water and less polluted wastewater could be returned to the city's water users.

One of these changes is the reuse of greywater. Greywater refers to all household wastewater that is not from toilets, such as wastewater from baths, showers, washbasins and the kitchen. This water can be treated directly on site or left untreated for use with less than drinking water quality for e.g. flushing toilets.

Cities could also harvest rainwater by collecting rainwater flowing from a roof or driveway in a receiving container and this water could be used for non-potable activities such as toilet flushing, washing cars or gardening. It could also be led directly to a ground water recharge. Such systems can be installed in households or businesses and will not require changes in consumption habits from the water users. There are, however, more steps that can be taken to improve the supply of water before it reaches domestic premises.

Keeping the water in the city by allowing the water to infiltrate the soil and accumulate in water bodies provides many benefits, including offering recreational space to local residents and creating a cooling effect during heat waves.

### Reducing loss

The loss of water through leakages can be considerable; in Croatia nearly 40% of the total water supply is lost in the water transportation network. Leakages can be prevented through maintenance and water network renewal, and also through the use of new technologies. Such technologies may involve sensors that recognise and locate the noise from a

leak or devices that use radio signals to detect the presence of flowing water. With the application of these technologies, public water systems no longer need to face the extra burden of water loss through leakages when fulfilling water demands with limited supplies. Renewing the water networks, however, could require significant infrastructure investments.

### Time for action

Achieving a more sustainable use of urban public water supplies requires not only the implementation of measures such as those outlined above, but also raising public awareness on water conservation issues.

Various means are available to inform domestic, business and tourist water consumers, including websites, school education programmes, local authority leaflets and mass media. The eco-labelling of appliances and eco-certification of hotels, for example, can also play an important role in raising awareness by helping consumers make informed choices about water efficiency and conservation.

A truly sustainable use of our fresh water resources cannot be achieved without additional improvements to the sustainability of urban water use. ■

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<sup>1</sup> <http://www.eea.europa.eu/articles/water-in-the-city/publications/urban-adaptation-to-climate-change>

<sup>2</sup> <http://www.eea.europa.eu/articles/water-in-the-city/publications/towards-efficient-use-of-water>

<sup>3</sup> [http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)

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# An innovative technology for industrial wastewater reuse

Water is one of the most important natural resources on Earth. It is not only fundamental to life but also essential to wealth of countries contributing to all aspects of personal welfare and economic life. However, global drivers such as climate change, population growth and improving living standards increases pressure on water resources. This is particularly the case in developing and fast growing countries where rapid industrialisation increases demand for water with clear effects on supply of safe drinking water and access to adequate sanitation services for the population. Consequently, there is an emerging gap between safe freshwater availability and water demand. To ensure sustainability of water resources, major efforts must be made by governments and industries. Implementation of governance policies must be undertaken. Various water initiatives are actually considered by governments, including water footprinting, business risk assessment frameworks, reporting and disclosure protocols, as well as standards and certification frameworks. From the industry side, such policies will force them to review their actual management practices and develop new approaches and strategies.

The pulp and paper industry is a major user of water. It ranks third in the world, after the metals and the chemical industries in terms of freshwater consumption. Economic issues combined with strict environmental

regulations are the driving forces for water reduction use at paper mills. Although they have for a long time now implemented measures to reuse process waters, there is still room to improve water and energy savings through further reduction of freshwater consumption. However, advanced wastewater treatment methodologies will be mandatory.

**“To ensure sustainability of water resources, major efforts must be made by governments and industries.”**

We are actually conducting studies to develop a multifunctional adsorbent filter media using electrospun nanofibres for the removal of contaminants from aqueous solutions. The main features of the device is that it is a non-woven three dimensional porous mats made of randomly laid nanofibres in the size range of 3 nm to 5 µm produced by electrospinning which provide a physical, sized-based separation mechanism for the filtration of contaminants. Polymeric nanofibres with very small diameter have unique properties, such as high specific surface area and surface functionalities. It is possible to make nanofibrous media with low basis weight, high permeability and small pore size that should overcome common technical problems encountered with most usual processes used for water treatment, namely packed bed adsorption column and membrane filtration. Such a device should be able to generate low pres-

sure drop, high adsorption capacity and low fouling behaviour. Actually we are investigating Chitosan for nanofibre production. Chitosan is attractive since it has a strong chelation potential for heavy metals due to the presence of amine and hydroxyl groups on the surface that are involved in the adsorption process. Chitosan is a biodegradable, natural, and non-toxic polymer derived from chitin which is readily available at a very cheap cost, since it is essentially a waste product from the fishing and marine industries. The device will also be used to test wastewaters from the mining industry and municipal wastewaters targeting emerging contaminants released by chemical and pharmaceutical industries.



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# Environmental benefits of re-using rainwater

**Water UK explains the environmental as well as money saving benefits of recycling and re-using rainwater...**

**I**t might seem difficult to believe but it was only 3 years ago that parts of Britain were starting to recover from 2 years of extremely low rainfall, followed by intense storms and wet weather. Dry, cold, wet, hot - the meteorological rollercoaster ride of the past 3 or 4 years has been exceptional.

These are impacts of climate change and we must take action now so we can avoid potentially catastrophic situations in the future where for example, we experience water shortages followed by extreme flooding.

Storing rainwater better when it falls, and using it more efficiently is essential. The South-East of England is already densely populated and there is little, if no room

to create new reservoirs. These also cost huge amounts of money to build, so we need to look at cheaper and better ways.

With this in mind, water re-use and rainwater harvesting is one of our options. This can be anything, from keeping a water butt in your back garden for watering your plants, to having water treatment equipment and systems in individual homes or industrial sites.

In the UK, we use around 150 litres a day of water and about 50 of these litres is used for flushing the loo. By recycling 'greywater' from showers and basins through retreating it on site, customers could save water and therefore potentially save money on their bills in the



Domestic water recycling or reuse schemes will most likely be costly at first. This is especially the case with retro-fitting homes and buildings for example, with a greywater reuse scheme. The hope is that new homes will have water re-use systems built-in from the beginning, but again so far the costs have proven to be a barrier.

**“Some households use up to 15 litres a day for gardening – another good example of where water and money could be saved.”**

long-term Some households use up to 15 litres a day for gardening – another good example of where water and money could be saved.

There are also many environmental benefits of re-using water. This would stop us from having to take so much water from sources such as underground aquifers, rivers, lakes and canals. The effects of over-abstraction include disrupting eco-systems in rivers and waters and affects fish and other wildlife. Over-abstraction of aquifers can cause water tables underground to sink further which in turn makes it costlier to pump the water up.

But despite the many benefits, water re-use and recycle schemes have not yet taken off in the UK. Water UK, with the Environment Agency, Defra, and the University of Brighton, have been working together to understand and hopefully remove the barriers to allow greater take up of water efficiency measures. We know that:

- Codes and standards sometimes prevent greater use of these schemes rather than encourage them;
- The technology can be difficult to maintain or costly in terms of energy use;
- People are not yet convinced that recycled water can be used and that there are very high quality standards to be met.

But there are some examples of where large-scale schemes are being put in place. Cambridge University is building a site to accommodate 2000 post-graduate students, with academic and commercial research buildings, community facilities including retail units, a community centre and primary school. The site includes a series of lagoons and swales and will be the UK's largest rain-water recycling system. It will enable rainwater to be collected, stored and treated, before it is pumped back into the homes on the site for non-potable water uses such as irrigation and toilet flushing.

It may be that re-use and harvesting schemes will have only a small part to play in reducing overall water consumption. But nevertheless it's important that innovation is supported and developers are given more encouragement and incentives to consider re-use schemes on new sites. ■

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Water UK  
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# Air pollution in Europe – an overview

**Gautham Gnanajothi, Senior Industry Analyst & Team Leader – Energy & Environment at Frost & Sullivan highlights the impact of air pollution throughout Europe...**

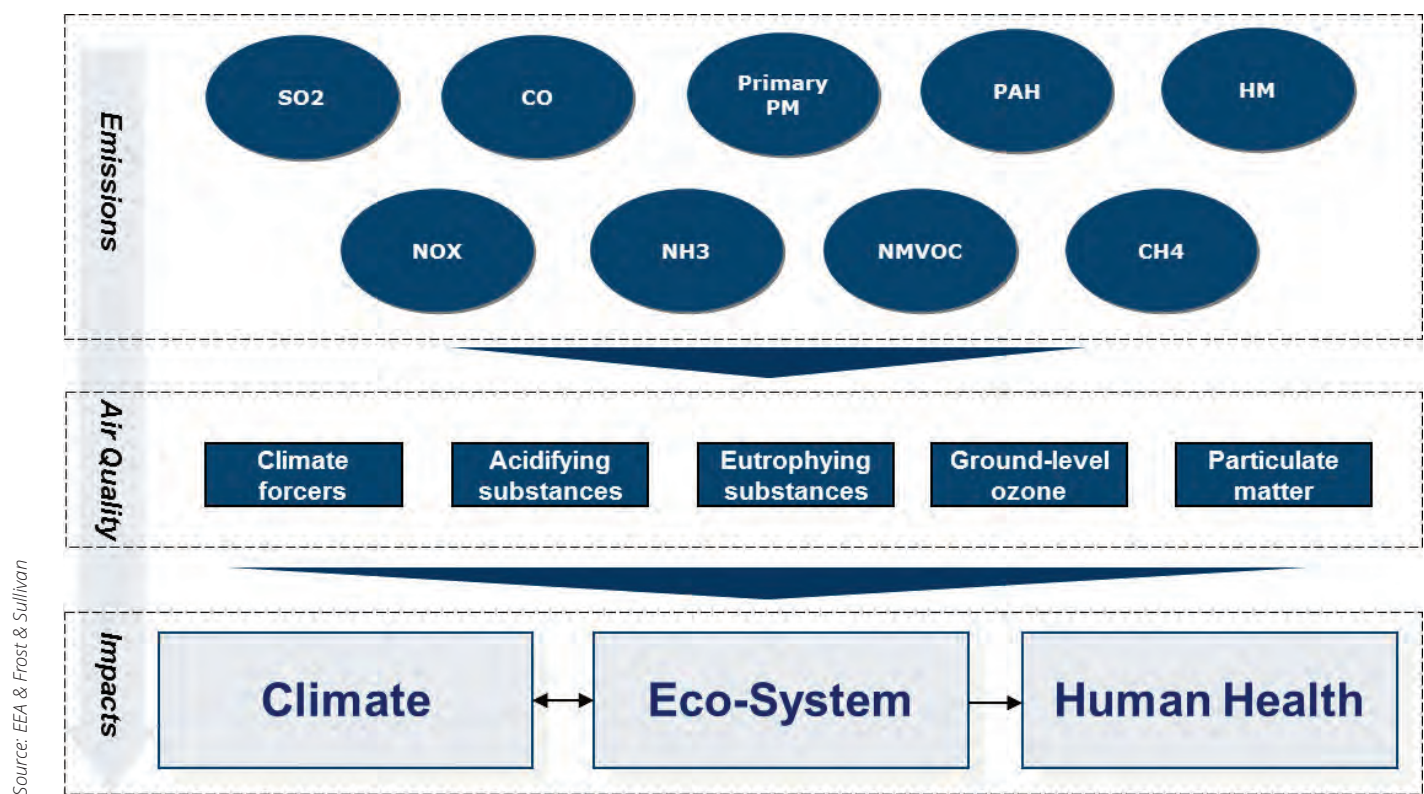
Looking at air pollution in Europe from a surface level, it gives us an impression that air quality standards have been significantly improving over the past decades and have reached safe levels that are acceptable. There are however 2 angles to this when we dig deep. Air quality data show that emission of air pollutants did decline substantially over the past 10 years. However, the real question remains, is it safe enough? The simple answer to this question is No. Studies from European Environment Agency (EEA) show that several countries in Europe still exceed one or more of their emission limits, especially in the 3 major pollutant categories which are known to significantly affect human health – particulate matter (PM), nitrogen dioxide and ground level ozone. Data collected from official monitoring stations across Europe indicate that for certain pollutants, over 95% of the population living in cities are still exposed to unsafe levels.

## Pollutant types and sources

The intensity of air pollution across Europe varies depending on the type of pollutants and their emission levels. Key sources of air pollution causing the most damage in Europe are industry and transportation. Other important sources also include agriculture, waste management and households. Currently the most serious air pollutant in Europe is particulate matter (PM<sub>10/2.5</sub>), which is a mixture of solid and liquid particles suspended in the air which has both physical and chemical characteristics. Sulfates, nitrates, ammonium and other inorganic ions include some of the common chemical constituents of PM. Vast majority of air pollution-caused premature deaths in Europe during the recent years were caused by long term exposure to PM. Studies by EEA also reveal that short episodes of exposure to high levels of ground level ozone also caused a significant number of deaths in the same period. There are 2



## Air Pollution and Potential Impacts



Note: SO<sub>2</sub> – sulphur dioxide, CO – carbon monoxide, PAH – Polycyclic aromatic hydrocarbons, HM – Heavy metals, NOX – Nitrogen oxides, NH<sub>3</sub> – Ammonia, NMVOC – Non-methane volatile organic compounds, CH<sub>4</sub> – Methane

sources of PM, man-made (anthropogenic), where the sources are transportation, energy production in industries and house hold, other industrial activities etc. Whereas, the non-anthropogenic PM is formed as a result of atmospheric transformation of gaseous pollutants, (such as nitrogen oxides).

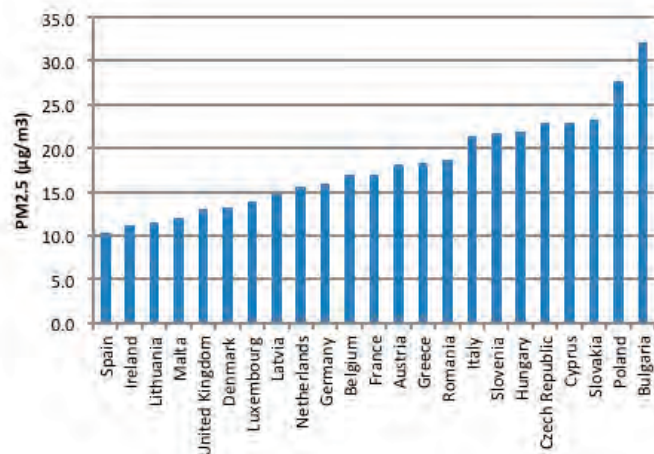
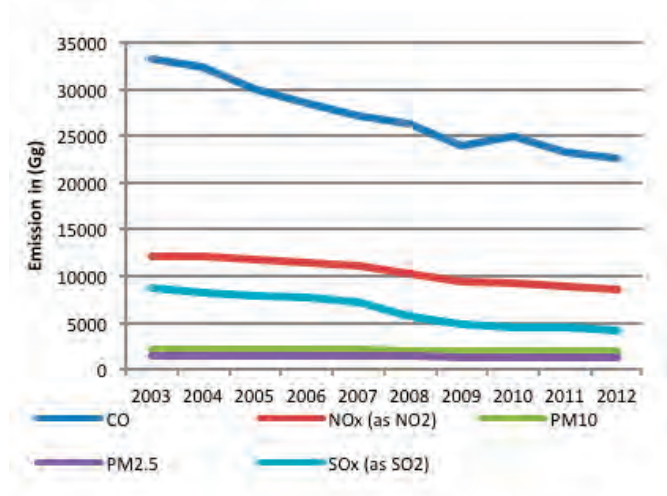
On a positive note, most pollutants including PM and ozone have slightly declined over the past 10 years. However, the concern remains on a few pollutants that have not been declining at an anticipated rate. Nitrogen dioxide (NO<sub>2</sub>) is one of the prime examples, the reason being its primary source – motor vehicle emissions. The other example is benzo pyrene (BaP), which saw the most increase among all pollutants over the past decade, increasing by over a fifth between 2003 and 2013; exposing nearly 9 out of 10 people living in urban areas in 2012 at levels above WHO reference.

### Associated economic costs and regional overview

Health and environmental costs incurred by economies due to air pollution and greenhouse gases in 2012 is estimated to be between €59 and €189 bn. The same during the period 2008 – 2012 was estimated to be between €329bn up to €1,053bn. The good news is, the damage costs have been declining year-on-year during this period. This is because of the lower emissions by industries, driven by legislations, improving plant efficiencies, and a decline in industrial activity due to the economic slowdown across Europe. A staggering 96% of these costs were caused by industries (energy 67%, production process 17%, and manufacturing combustion 12%). More interestingly, 50% of the total damage costs were a result of emission caused by 1% of the total industries. Germany was the biggest contributor for costs, accounting for €38.2bn, followed by the UK with €25.9bn. Poland,

## Key Pollutant Trends, 2003 - 2012

### PM2.5 concentration, Three Year Average 2010 - 2012



Source: EEA &amp; Frost &amp; Sullivan

France and Italy took the next 3 spots in the table with €24.8, €14.3 and €13.8bn respectively. Among the 30 most damaging industrial facilities in Europe, 8 were located in Germany, 6 in Poland, 4 in Romania, and 3 in Bulgaria. Comparing the relative air pollution damage caused by countries to their national economic output, the worst offenders are Bulgaria, Romania, Estonia and Poland.

### Control strategies and technological advancements

Control strategies for air pollution can be looked at from 2 perspectives; one is particulate control which includes fairly common technologies such as cyclones, electrostatic precipitators, air filters, and wet/dry scrubbers. The other is control methods for gasses, like adsorption towers and catalytic combustion. There has been some technological advancement in the control of air pollution on a pollutant level. For instance in SO<sub>2</sub> control, there have been developments in the flue gas desulfurisation processes, resulting in higher control. Similarly in NO<sub>2</sub> control, there have been advancements in the selective non-catalytic reduction (SNCR) technology (employing advanced combustion modification techniques), boosting the ability to reduce NO<sub>2</sub> levels to 80% compared to 50% – 70% levels achieved by the conventional systems. Apart from this, there have also been significant strides in terms of technological advancements in the indoor air

quality (AIQ). The EU-funded “IAQSENSE” project is a great example of this. It is an ongoing project (2013 – 2016) that aims to develop new nanotechnology-based sensor systems to monitor the composition of IAQ. The project is based on 3 patented technologies, including “Surface Ion Mobility Dynamics” and “Biomolecule Detection”.

### Road ahead

Given that these advancements and legislations are implemented effectively, there is a high probability for average air pollution to significantly decline over the next decade. On the other hand, in practical terms, studies and reports by EEA suggest that exposure of PM exceeding EU standards will still be significant on a large portion of the European population by 2030. Especially in South Poland, Czech Republic, Slovakia, Northern Italy, and Bulgaria. ■

.....  
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# ADVANCED PURIFICATION SOLUTIONS

## INFUSER INTRODUCTION

Atmospheric gases and light are responsible for protecting all living organisms on the Earth's surface. It is the right composition of gas and light that protects and maintains a clean environment in our oceans and in the air we breathe. INFUSER's science is entirely focused around accelerating those natural processes in a controlled environment, capturing the pollution before it escapes into the atmosphere with devastating results for the environment.

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99% of all pollution consists of hydrocarbons. When hydrocarbon gasses are emitted and eventually reach the atmosphere they start reacting with naturally occurring compounds to form particles in a process triggered by sunlight and gasses. The particles eventually fall to the ground with the rain as pollution, and the air is clean once again. INFUSER's photochemical air purification technology accelerates this natural process by 100,000 times in the CLIMATIC® system preventing the gasses from escaping into the atmosphere.

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The first treatment phase entirely disinfects the air and surfaces in the room (up to 99.9999%), killing all organisms including bacteria, viruses, mould and fungi.

The second treatment phase removes any gas residues and aerosol particles. Now the room is entirely decontaminated and safe to enter again – free from bacteria, viruses, fungi, odour, residual chemicals and harmful particles.



# Using geological data to answer environmental questions

**Kate Royse Director for Environmental Modelling at the British Geological Survey details how the types of geological data are changing in response to policy makers needing to answer ever more complex environmental questions...**

**P**olicy and decision makers today need geoscientists to answer what appear on the surface to be simple questions. Will we have enough drinking water in 50 to 100 years' time? How will changes in climate affect the frequency and magnitude of landslides? How vulnerable are our coastal communities? How resilient is our critical infrastructure from natural disasters? The geoscience community are finding that, in order to answer these 'what if' questions, we need to be able to improve our predictive modelling capabilities and work in partnership with many organisations in order to understand how the atmosphere, surface and subsurface behave under changing conditions. Put simply the environment is just too complex for us to reason through the needs of policy without models and data.

What does that mean in terms of the types of data and geospatial information that the British Geological Survey will be collecting in the future? In essence the Survey is going to be moving from concentrating on the solid subsurface to monitoring processes below the ground in real time (such as understanding how water moves through rocks). This will necessitate not just the instrumentation of subsurface boreholes but also the use of satellite measurements and real-time monitoring of natural hazards. The drive for this monitoring is to enable us to model, predict and mitigate the impacts of environmental change. To do this effectively we will need to look at novel ways to visualise and communicate our data to non-specialist users and combine our geological data with data from other sectors. Making use of mobile platforms and open data will provide us with many opportunities to achieve this, as well as some significant challenges.

We are going to see a huge increase in the amount of

data that we will need to ingest and process. Big data will soon be the norm in the geoscience community as it is in the atmospheric sciences; the key challenge will be to be able to improve how we capture, ingest and model this data so that we are not drowned in a data deluge. Crucial to this will be the development of new technologies and architectures designed to extract value from large volumes of disparate data by enabling high velocity capture, discovery and or analysis. Currently the vast majority of data being generated is unstructured which means that more often than not we know very little about the data we are capturing unless it is somehow characterised or tagged. Meta-data is not a new concept within the data information community but it is something that will need to become more prevalent if we are to make data useful i.e. 'smart'. Therefore the capacity for big data to change how we do research will be down to our ability to make data smarter.

Data based policy making has necessitated the need for decision makers to be able to argue their case to a much more data orientated public. To unleash the full impact of geoscience data to this community we not only need to model data, we also need to improve how we visualise data. Current advances in data interoperability are resulting in improvements in visualising time series, point cloud and satellite data which are all essential for better modelling and manipulation of large-scale environmental datasets. 4D visualisations in real time will allow us to harness the potential of geospatial data to become much more predictive, improving our forecasting and scenario planning. Within the geoscience community the visualisation of geospatial data has so far been flat; in 2 dimensions, this is all about to change with a push to build whole earth models i.e. to integrate the subsurface with the surface.



We are already seeing a growing interest to include subsurface data within BIM systems and integrating subsurface and surface infrastructure within smart cities. In the next 5 years the ability of technology to visualise seamlessly the flow of geospatial data and information from the surface to the subsurface will open up possibilities for managing the life cycle of buildings and infrastructure, as well as monitoring and responding to the effects of environmental change and natural hazards within a virtual environment. This will enable scientists to engage more effectively with policy makers, responders and the general public, to provide effective and intelligent solutions to a wide range of problems and challenges.

The British Geological Survey will in the next 5 years, through the application of multi-disciplinary knowledge, instrumenting the earth and the development of integrated environmental models, be able to not only explain and explore but also predict the Earth's response to natural and human induced environmental change. By combining data, models and visualisation

techniques in an integrated, flexible and reusable manner we will improve our understanding of how geological processes act in real time. We will use this to develop decision support systems and products that will better inform policy decisions and communicate environmental problems and solutions to society at large. ■



**British  
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

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# Understanding modern volcanology in Europe

**Mike Burton, Professor of Volcanology at the School of Earth, Atmospheric and Environmental Science, University of Manchester explains the importance of research into European volcanoes to understand their behaviour...**

European volcanology began with the observations of Pliny the Younger, who recorded the geological events leading up to and including the AD79 eruption of Mt. Vesuvius, Italy. Since then, the study of volcanoes has developed from a largely qualitative science, exemplified by observations of the same volcano by Sir William Hamilton in the 18th century, to a gradually more quantitative, empirical study, beginning perhaps with the volcanic gas measurements of Robert Bunsen in 1845. Modern volcanology in Europe is conducted using multi-disciplinary experimental, modelling and empirical techniques. I write this whilst on Stromboli volcano, Italy, during a field campaign with a group of 40 scientists from across Europe and the USA, using simultaneous high-speed imaging, gas and seismic instruments to better understand the processes driving periodic explosive activity from this volcano. Deepening our understanding of

such processes is the key to better forecasting when, how and how long eruptions will occur. Unfortunately, such secrets are not given up easily by volcanoes, whose behaviour is often dictated by the dynamics of magma deep below the surface. For example, multiple lines of evidence suggest that the strongest eruptions of Stromboli, which produce a distinctive blonde pumice, are created by the ascent of magma from 10 km depth, in just a few hours, or even minutes. However, the trigger which creates these large explosions are still unclear, making them very challenging to predict.

This highlights a feature of volcanological research: it is motivated both by a desire to understand the natural world, and in addition by the need to protect populations living in the shadow of volcanoes, and provide useful information to disaster managers in

case of an eruption. This latter activity of applied volcanology is exemplified by volcano observatories, which monitor the signals produced by active volcanoes and assess risk scenarios for future eruptive crises. Observatories are the interface between pure volcano research, which focusses on processes and new empirical methods, and practical, applied volcanology, which has the aim of producing reliable, timely and useful information for policy makers.

There are multiple volcano observatories in European territories. In Italy, large observatories, run by the Istituto Nazionale di Geofisica e Vulcanologia <sup>1</sup> monitor volcanic islands around Italy's coast, as well as the large volcanic systems of Etna, Vesuvius and Campi Flegrei. These latter 2 volcanoes are close to the large populations living in and around Naples, and so the risk they pose is high, producing a major challenge to decision makers and volcanologists. Volcanoes on the French Caribbean islands of Martinique and Guadeloupe are monitored by the Institut de Physique du Globe de Paris <sup>2</sup>. The volcano Mt. Pelée on Martinique last erupted in 1902, producing high temperature, high velocity, low density clouds of suspended volcanic rock particles called pyroclastic flows, which devastated the population of the city of St. Pierre, killing almost the entire population of 30,000 people, whilst leaving buildings mostly intact. In 1976 mild explosive activity at La Grande Soufrière on the volcanic island of Guadeloupe produced sufficient concerns that a larger eruption might be imminent to evacuate the island as a preventative measure. The larger eruption did not occur, and so populations were allowed to return, but the episode was marked by public disagreement between scientists on the potential risks posed by the reactivation, and the necessity of the evacuation. This highlighted the need for scientific consensus in crises, which can be more readily achieved using probabilistic approaches.

The eruption of Soufriere Hills volcano in Montserrat, British West Indies, began in 1995 and posed a major challenge to both the local and British governments. The volcano produced pyroclastic flows with run-out distances of several kilometres, necessitating

evacuation of surrounding areas, including the main town of Plymouth, which was mostly destroyed by pyroclastic flows in the following years. Scientists from the Montserrat Volcano Observatory assisted local government in the definition of exclusion areas, which extended far from the volcanic centre, to the frustration of populations who had property in the excluded areas. This experience highlighted the importance of the public communication of volcanic risk, a subject which integrates the social and geological sciences, and which is the focus of much research in the UK.

The recent ash-rich eruption of Eyjafjallajökull, Iceland in 2010 produced the temporary closure of air-space over much of Europe, at an economic cost of approximately €1.3bn. The eruption highlighted how the combination of increasing population density and reliance on air transport in a globalised economy has dramatically increased society's vulnerability to volcanic eruptions. The need for reliable information during such crises is paramount, but as well as empirical data collection robust interpretative models of magma dynamics are needed to provide probabilistic forecasts to policy makers. The development of improved measurement techniques and models requires experimental approaches to investigate processes and signals under controlled conditions. European volcanology is therefore dependent on research on the triumvirate of measurements, experiments and modelling, and such work will be an ever-increasing priority in the future, as the populations vulnerable to eruptions from volcanoes both near and far continue to grow. ■

<sup>1</sup> <http://www.ingv.it/it/>

<sup>2</sup> <http://www.ipgp.fr/fr>

.....  
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# Volcanology and Geothermal Research

Volcanoes and geothermal and mineral resources – Exploring subsurface geology

Most of the economic and energy resources are found in the subsurface. Exploration in the search of water reservoirs, hydrocarbons, mineral deposits, and geothermal underground resources is therefore of greatest societal relevance. The knowledge of the existing resources in the subsurface and their potential exploitation is based on the characterisation of rocks and fluids, and their properties. This task is commonly carried out by indirect geophysical methods or by direct in situ observations and measurements by means of drilling and downhole logging tools, which provide in situ rock properties and images, up to several kilometres depth.

Volcanoes are one of the main geological systems hosting economic and energetic reservoirs. Volcanoes are the main source of geothermal energy.



Compared to the normal geothermal gradient of about 25°C per km of depth in most of the World, when magma (i.e.: molten rock generated at the Earth interior) enters the crust, for example, as a shallow intrusion beneath a volcano, this normal gradient is perturbed locally as temperature rises around the intrusion. The extent and duration of such a thermal anomaly depends mostly on the temperature and volume of the intruded melt. The presence of hot magmas below the surface of active volcanic regions offers the prospect of harnessing a huge amount of geothermal energy. The geothermal energy is a renewal resource, as it exploits the abundant Earth's interior heat and water, which once used and cooled, is then piped back to the reservoir. Having the use of this natural energy source has

important implications for preserving the environment.

When exploring the subsoil for geothermal or mineral resources through boreholes, geophysical logging tools are used to obtain in situ oriented images and measurements at depth, from few meters to several thousand meters. Complete sets of different physical properties and borehole wall oriented images are obtained with downhole logging tools equipped with sensors, that provide the evidence to construct a detailed picture of the subsurface rocks and fluids.

Boreholes are frequently equipped with monitoring sensors to obtain a continuous record of ongoing processes in the subsurface, such as fluids flow (water, hydrocarbons,



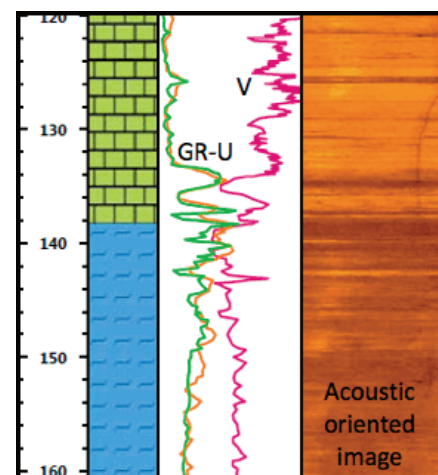


gases) and migration and also seismicity and deformation and temperature changes, among other. The boreholes then become subsurface monitoring labs and are specially critical in places where active subsurface processes are relevant, either for economic resources or, to mitigate natural hazards for the population safety. This type of research is carried out at the downhole research lab facilities at the ICTJA used for long term and continuous monitoring experiments. This facility is equipped with a complete system of geophysical logging tools, and borehole monitoring data loggers in the frame of ongoing research projects.

The characterisation of the reservoirs in the subsurface results not only in an improved subsurface resources evaluation, but also on the knowledge of the existence of faults, fractures and other potential sources of geotechnical and natural hazards. The detailed picture of tectonic, structural and geotechnical properties and characterisation of rocks and fluids in the subsurface can help to minimise potential hazards and risks. Geological, geophysical and geochemical information on the subsurface is used to obtain reliable 3D simulation and visualisation models for the exploration and improve the efficiency of both exploration and exploitation strategies with a significant costs reduction.

At the Institute of Earth Sciences Jaume Almera, CSIC, of Barcelona, Spain, the Group of Subsurface geology and downhole measurements, lead by Dr. María José Jurado, in collaboration with the group of Volcanology (GVB-CSIC) lead by Prof. Joan Martí, addresses different aspects of the subsurface structure and resources, including active faults and processes, hazard assessment and characterisation of subsurface fluids and petrophysics and resources. Their work on subsurface geology and active subsurface processes aims at improving the imaging of the earth's subsurface dynamics. Thus, helping to understand the distribution of minerals and fluids, geothermal reservoirs, as a way to define better exploration and exploitations guidelines.

Research on energy and mineral deposits related to active and past volcanic systems, are required to improve and standardise the geophysical, geological and geochemical technologies needed to characterise and monitor subsurface geological reservoirs, in order to minimise the exploration and exploitation costs by reducing the drilling uncertainties. A better characterisation of such reservoirs imply the systematic application of drillhole geophysical logging techniques during and after drilling, which will help to correlate and constrain existing data from surface geology



**Complete logging operations with slimhole logging equipment in open hole included acoustic and optical imaging, spectral natural gamma ray, full wave acoustic logging, magnetic susceptibility and hydrochemical-temperature logs Through casing (PVC casing) measurements included spectral gamma ray logging, full wave sonic and acoustic televiewer**

and geophysical exploration, and combine all the available information in order to obtain reliable 3D simulation and visualisation models. These should help to improve the efficiency of exploration and exploitation strategies significantly reducing their costs.



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# Volcanic and geothermal systems on Earth

The Institute of Earth's Sciences and Nordic Volcanic Institute, University of Iceland

The ultimate energy source of the Earth's interior or heat comes from the early days of the planetary formation and decaying of radioactive matter. If today's society could be able to harvest this energy in an economic way, our future energy prospective would be bright. From the deep interior to the surface the energy needs to be transported through the Earth's crust. The most effective mechanism is through volcanic and geothermal systems, whereas molten rock and hydrothermal fluids are convection from depth to surface.

Volcanic and geothermal fluids play a major role in the transport of energy

from depth to surface; they are the highways of energy transport. Our understanding of volcanic and geothermal systems is important for our future. They could provide the major future energy source though harvesting the thermal energy of Earth. They are also among the major natural hazards of our environment resulting in volcanic eruptions, earthquakes and tsunamis.

In order to move forward with the energy harvesting of our Earth's interior system and predicting possible natural hazards it is crucial to know their detailed nature. These include:

- Earth's crust processes

- Magma and fluid geochemistry and geophysics

- Environmental effects.

## **The Institute of Earth's Sciences (IES), University of Iceland and Nordic Volcanic Institute**

The IES, University of Iceland (<http://earthice.hi.is>) is a research institute with major scientific themes of:

- Understanding volcanoes
- Environmental and climate
- Crustal processes.





It hosts the Nordic Volcanic Institute (NordVulk) (<http://nordvulk.hi.is>) that is a leading Nordic research center within the field of volcanology.

**“Our understanding of volcanic and geothermal systems is important for our future.”**

The institutes (IES and NordVulk) provide research facilities for about 30 senior researchers and about 50 post-doctoral and graduate students. It has an international research environment with one of its major tasks training new generation of scientists within the field of Earth's sciences. A large part of the research at IES and NordVulk is financed through national and international research funds and training networks.

Among the major fields of study at IES and NordVulk are:

- Volcanic hazards
- Physical volcanology
- Petrology and geochemistry of magmatic rocks
- Crustal geophysics
- Geochemistry of volcanic and geothermal fluids
- Ice/water-magma interaction and subglacial volcanism
- Environmental effects of volcanic eruption and geothermal energy utilisation.

The institutes played a major role during the Eyjafjallajökull Eruption in 2010 that brought most European aviation to halt and also during the Bárðarbunga eruption in 2014-15, the largest eruption in Europe in ~250 years, with daily SO<sub>2</sub> gas emissions four times greater than the EU total. Also, researchers at IES and NordVulk play a leading role in a joint European program for future volcanic hazard predictions within the Futurevolc project (<http://futurevolc.hi.is>). Researchers at IES and NordVulk have played a major role in understanding volcanic geothermal systems and geothermal energy utilization, for example the Geysir Research Group (<http://geysir.hi.is>) making Iceland among the leading nations in harvesting the ultimate energy source of the Earth's interior.

### Future perspective

Future research at The Institute of Earth's Sciences and Nordic Volcanic Institute, University:

- Understanding volcanoes and predicting major volcanic hazards
- Geothermal Energy of the future
- Training the next generations of researchers.



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Image: © Sebastian Gerland, Norsk Polarinstitutt

# The Arctic: A global climate “canary in a coal mine”

**Dr. Jan-Gunnar Winther, Director of the Norwegian Polar Institute, explains how a dramatically warming Arctic heralds global changes to come...**

**I**t is a documented fact that no region of the planet is experiencing more dramatic climate change than the Arctic. In recent years, this has resulted in melting glaciers, rapid ecosystem changes, diminishing sea ice, and changes in atmospheric circulation and ocean properties. The Arctic is undergoing changes unknown to have occurred during the last 1450 years and probably longer (IPCC, 2013). Climate models project that the most pronounced warming in the future will happen in the Arctic. In a business-as-usual scenario temperatures may increase by 8-10°C in the Arctic. Even half of such a rise in temperature will fundamentally change this region as we know it today.

The mean temperature in Arctic Longyearbyen in the Norwegian Svalbard Archipelago during January-March in 2015 was about 6 degrees warmer than normal for this time of year. Although, this not in itself evidence of human-induced climate change, it is in line with what climate models project as normal conditions in the future. Svalbard is on the verge of “a novel climate”, characterised by winters without very low temperatures (above -20°C) and summers with extended growth seasons (above 5°C). Because of these changes, invasive species are threatening the native species that are adapted to a colder climate. However, the largest risk to the terrestrial environment is currently



Image: © Geir Wing Gabrielsen, Norsk Polarinstitutt

caused by species increasing in number, such as the destructive impacts of native geese on vegetation. The impact caused by goose abundance is mainly due to management outside of the Arctic, as reported in “The state of the Norwegian Arctic” (MOSJ 2014). The report states that climate change in the Arctic is the main pressure likely to cause major state changes in Svalbard’s terrestrial ecosystems.

The Earth’s regions are connected by circulation in the atmospheric, ocean, climate and weather patterns. Arctic climate change therefore has profound global consequences and has an impact on global conditions such as sea level rise, ocean acidification, permafrost thawing (which releases greenhouse gases) and changing weather patterns, such as the monsoon. Arctic climate change is therefore arguably relevant to the weather and climate in far-away countries like India.

Much is yet unknown to us, as the Arctic is a hostile place in winter, when it is cold and the sun disappears for several months. We do know, however, that the sea ice is diminishing at an accelerating rate in extent and thickness. Scientists from 10 countries are carrying out a wide range of research projects. The aim is to increase our knowledge of the upper ocean–sea inter-

action, atmospheric forcing, sea ice and snow mass balance and biogeochemical sea ice interactions. This knowledge will be used to improve projections made by climate models. What is happening in the Arctic gives a warning of change which may occur in the rest of the world.

Although the development is disturbing, climate change also provides some advantages. Increased biomass production in northern waters may become an important resource for the world’s ever-increasing need for food and proteins. Furthermore, the Arctic’s special role in global change makes it a potential laboratory for developing new green technology and new solutions that can be introduced globally, under the idea that “What works in the Arctic will work elsewhere”. ■

.....  
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**EUROACADEMY'S RECTOR**, since its inception, is Jüri Martin, Academician of the Estonian Academy of Sciences, DSc. The vice-rector is Peeter Karing, DSc.



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# Investing in the future of agriculture

**Phil Hogan, Commissioner for Agriculture and Rural Development at the European Commission details the importance of investment and innovation in agriculture...**

**A**griculture is humankind's primary occupation – the only economic activity which can be truly said to nourish the world.

The principle of food security needs to be a top priority for policymakers. However, while the challenges of enhanced food security and reduced food waste are not new, it is opportune for all actors – as guardians of the agricultural sector – to renew our commitment to these principles, and resolve to widen and deepen our structures for cooperation.

Europe has a deep well of experience in shared agricultural governance. We have reformed our Common Agricultural Policy, which operates in the 28 member states of the EU and its 500 million citizens, to be more dynamic and market oriented.

As a result we have seen considerable investment and innovation flowing into agri-businesses. Our goal

is to consistently and sustainably produce high quality product for consumers the world over.

We believe this makes sense, and that our policies will deliver food security, incentivise waste reduction, nurture the environment, but also – crucially – demonstrate that working in agriculture can be good business, particularly for younger people.

Giving farmers the freedom to participate in the global market will serve all these goals. Let me be clear: the subsidies and protectionism of another era are gone, and we must all adapt to the 21st Century accordingly, and with confidence.

Nonetheless, targeted measures can incentivise farmers to play their part in our shared ambitions. Intelligent policy and sound governance can be real catalysts for change. Together, we must develop sustainable food systems and focus the international

debate on increasing productivity, while continuing to address climate change and the sustainable management of natural resources.

We must promote a knowledge-based agriculture, strengthening research and innovation, and bridging the communication gap between farmers, researchers and agri-business. By transmitting research outcomes to farmers, and incentivising them to participate in the right research projects, we unleash their potential to drive the changes we are discussing here today.

Agriculture has always been an innovative sector, but the global food imperatives are now of such a magnitude that we need to innovate more, and innovate faster, if we are to achieve our goals. Agriculture must continue to become more productive and more efficient.

We must therefore continue to strengthen the Agriculture Market Information System and enhance the contribution of the annual Meeting of the Agriculture Chief Scientists, through the framework of the G20.

We must broaden the burden of food waste reduction to include the manufacturing, retail and consumer levels. Indeed, the main players in these sectors must begin to take a greater degree of responsibility in this shared challenge, and I encourage them to engage constructively in the coming months.

We must likewise focus on reducing on-farm and post-harvest losses for farmers.

Finally – and crucially – we must create the enabling environment to bring the private sector fully into this equation: productivity and sustainability cannot be achieved without investment. This means developing appropriate and accessible financial instruments on multiple levels, to provide farmers with the finance to support the significant on-farm investment required to facilitate these changes. This is a model we are currently pursuing with vigour and determination in the European Union.



Phil Hogan, Commissioner for Agriculture and Regional Development at the European Commission

Our fundamental shared challenge is this: how can we increase production while respecting our natural resources and reducing waste – how can we produce more, using less?

The EU “farm family” has 28 members, with differing needs and expectations, and we have learned many lessons during our shared journey towards a modern agricultural policy. We are willing, and committed, to sharing this bank of knowledge with our global partners.

In Europe, we consider our farmers to be custodians of the soil. As policymakers, our aim is to give them the tools and supports to produce more food – efficiently, productively, and sustainably.

Let us therefore resolve to work together, in every possible forum, with every willing partner, to provide the global leadership needed.

Europe stands ready to play its part. ■

.....  
**Phil Hogan**

**Commissioner for Agriculture and  
Rural Development**

European Commission

[http://ec.europa.eu/commission/2014-2019/hogan\\_en](http://ec.europa.eu/commission/2014-2019/hogan_en)



# Plant pathology specialist

Integrated methods of crop management...

**B**ob Harveson was hired in July 1999 as assistant professor and extension plant pathology specialist with the University of Nebraska's Panhandle Research and Extension Center, located in Scottsbluff, NE. He rose through the ranks becoming a full professor in 2009. He has a joint appointment (50% research and 50% extension) with responsibility for specialty crop diseases with an emphasis on sugar beet root rots, bacterial diseases of dry-edible beans, and sunflower diseases. He also has current projects ongoing involving several pulse crops (chickpeas and dry yellow peas), potatoes, corn, and wheat.

He has employed field disease surveys and disease diagnostics to successfully establish his extension and research program. The diagnostic lab at Scottsbluff has processed approximately 25,000 total (plant and soil) samples since 2000 for disease identification. This has provided a desired service for growers and consultants while also generating income for technical support. The resulting information obtained has then been disseminated in both research and extension-oriented publications. He has further used this information to identify and highlight important problems, providing preliminary data for new proposals that attempt to address these emerging disease issues.

An early accomplishment was identifying and determining that

*Aphanomyces* root rot was a previously unknown component of a root disease complex in sugar beets (with rhizomania, *Rhizoctonia* root rot, and others). His lab is now focusing on integrated methods of management for this complex including biological, cultural, chemical, and predictive.

One of the innovative predictive techniques developed for addressing these root rots is a pre-plant soil assay, and implemented as a tool to estimate the potential for experiencing root disease problems in grower fields the following season. This test uses sugar beet seedlings as bait to identify root pathogens (primarily *Rhizoctonia solani* and *Aphanomyces cochlioides*) present in soil samples to be planted to sugar beets the following year. The infected seedlings appearing in soil samples effectively predict the threat to field infections because the same pathogens also cause root rots later. These results were compared with yield data obtained after the season from the same fields. The most important finding was a strong negative relationship between pre-plant test values and ultimate yield parameters. This validated the use of this test as a practical predictive tool for estimating potential problems due to root diseases, thus allowing growers the opportunity to proactively make management decisions before the problem occurs during the following season. Since 2003, more than 2600 samples have been tested, each



Robert M. Harveson, Ph.D.

sample representing a distinct field, across the sugar beet-growing areas of Nebraska, Colorado, Wyoming and Montana.

**"The diagnostic lab at Scottsbluff has processed approximately 25,000 total (plant and soil) samples since 2000 for disease identification."**

The Harveson lab has also been studying the re-emergence of bacterial wilt of dry beans, caused by *Curtobacterium flaccumfaciens* pv. *flaccumfaciens* for more than 10 years. This was an endemic disease in this region, disappearing by the early 1980s, before reappearing again in dry bean crops in the mid-2000s. This work has uncovered a high degree of variability within the pathogen, illustrated by the discovery of a fourth



Symptoms of the bacterial wilt disease of dry beans

pathogen color variant (pink) near Scottsbluff, never before reported from any other location (previous research had identified isolates producing yellow, orange, and purple pigments). They have additionally revealed the pathogen's ability to survive in other crops grown in rotation with dry beans in western Nebraska. Approximately two dozen wilt isolates pathogenic to bean that were found in surveys occurring in mixed infections with other common bacterial diseases of sunflower, alfalfa, soybean, wheat, and corn, altering the paradigm for the value of crop rotation. He has further continued working with the University of Nebraska's bean breeder, Carlos Urrea, to develop locally-adapted dry bean cultivars with better disease resistance via the screening *Phaseolus* germplasm sources against multiple isolates of the bean pathogen.

The sunflower work began in 2008 with a comprehensive survey of the most prevalent diseases in Nebraska and other regions of the central high plains of the U.S. One of the more significant finds was the identification of

the early stages of sunflower rust for the first time from naturally-occurring field infections in volunteers and wild species. This demonstrated that the pathogen overwintered in this area, explaining the implications for subsequent early disease development in commercial sunflower crops. In collaboration with Sam Markell (North Dakota State University), research at multiple geographically distant sites has disclosed the optimal time period for applications of fungicides for managing the rust disease within the Great Plains. A similar project, additionally including Febina Mathew (South Dakota State University), is currently ongoing to identify the best time for making fungicide applications, integrated with host genetic resistance, for controlling another serious yield-limiting disease, *Phomopsis* stem canker.

These research and extension efforts have helped establish Harveson as a national and international authority on sugar beet, dry bean, and sunflower diseases. This is further illustrated by his continuing role as an editor for

multiple publishing sources, and as an author of 500 publications ranging from book chapters and refereed journal articles to extension and newspaper articles. He has served as associate and senior editor of American Phytopathology Society's (APS) applied research journal, *Plant Disease*. He is currently a senior editor with APS Press and has also served as editor and/or author of numerous chapters for APS Press publications "Compendium of Beet Diseases" and "Compendium of Bean Diseases". He also is co-editor (with S. Markell) of the new "Compendium of Sunflower Diseases", currently in review. These publications are the most visible and widely purchased from APS Press, and are worldwide in scope, readership, and author participation.

Finally, he has recently authored a new book to be available in June 2015, (also published by APS Press), entitled "The Bacterium of Many Colors" that focuses on the historical significance of specific selected plant diseases and what lessons we have learned as a result of their study.

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# Physiology of animal growth, development and reproduction

A significant part of fundamental research in the Kielanowski Institute of Animal Physiology and Nutrition Polish Academy of Sciences in Jablonna

## Central regulatory mechanisms

A number of experimental techniques have been developed in the Kielanowski Institute of Animal Physiology and Nutrition in Jablonna (Poland) that make it possible to conduct experiments in vivo at the level of the central nervous system (CNS). The stereotactic equipment conforming to the atlases of the rat and sheep brains enables precise implantation of cannulas into the brain ventricles or chosen hypothalamic nuclei. Currently conducted studies address a wide range of topics especially related to different hypothalamic-pituitary axes.

One of the investigations is focusing on the relationship between the functional state of GnRH neurons in the hypothalamus and the expression of genes in gonadotrophs in the anterior lobe of the pituitary gland. Analysis is based on changes in the activity of intracellular systems responsible for regulating the expression of genes determining the activity of promoters of gonadotropin subunits and of the gonadotrope GnRH receptor gene.

A further area of study deals with the characteristics of the Cu-GnRH complex activity. This unique analogue of GnRH is characterised by specific parameters of intracellular activity, including increased resistance to enzymatic degradation, as well as the ability to activate different signalling pathways in pituitary gonadotrophs.

Due to potential use of the Cu-GnRH complex in treatment of GnRH-gonadotropin dysfunctions, it is particularly important to conduct a comprehensive study of this molecule's activity in gonadotrophs.

Other research addresses the effect of immunological stress caused by bacterial and viral infections on the function of the GnRH/LH gonadotrope axis. Consequences of stress of this type include disorders of the ovulatory cycle, or even complete infertility. The focus of these studies is elucidation of the interactions between the reproductive and immune systems, which are specific for each level of the hypothalamus-pituitary-gonadal axis. The results of these studies suggest that the hypothalamus – a structure integrating the functioning of the nervous, hormonal and immune system – plays a key role in the inhibitory action of immunological stress on reproductive function. During inflammation various mediators like interleukins and cytokines are activated in the CNS. These factors evoke changes in the secretion of GnRH/LH either directly via their own receptors or indirectly through intermediate regulatory neurons.

Another investigation studies the central mechanisms regulating the secretory activity of the pituitary during lactation. The development of the maternal behaviour, production

and secretion of milk, reduction of responsiveness to stress, and the inhibition of reproductive activity are some of the hormonally regulated aspects of the adaptation of a lactating female. Our key achievement in understanding the regulation of these processes was the identification of salsolinol (a derivative of dopamine) in the sheep hypothalamus and determination of changes in its secretion in response to suckling. Using the sheep model we showed that salsolinol has stimulatory properties in relation to prolactin and oxytocin, hormones strictly related to lactation. It is suggested that salsolinol may be an important terminal element in the sucking stimulus, encouraging the release of prolactin and oxytocin and making it possible to sustain increased secretion of both hormones during lactation. The latest data also shows that salsolinol participates in inhibiting the reaction of the corticotropic system to stressors, which would associate this molecule with the mechanism responsible for reducing the sensitivity of lactating mothers to stress.

## Gastrointestinal tract development in neonates

Only a few centres specialise in the study of the development of the structure and function of the gastrointestinal tract in new-born animals. Studies in new-born pigs have an impact not only on progress in these animals breeding, but to a large extent can be





**Intestinal motility measured in piglets by the telemetric method**

transferred to the man. Especially the early-born piglets may be regarded as the only model for premature babies.

Studies on the maturation and functioning of the gastrointestinal tract in new-born piglets focus on bioactive colostrum and milk compounds, i.e. hormones, growth factors and cytokines, which may affect gut maturation as well as motor functions of the small intestines on both in vitro and in vivo models. Our researchers established the unique animal model that enables nursing and rearing of neonatal piglets in controlled laboratory conditions. They have shown that leptin, ghrelin and obestatin – gastrointestinal peptides involved in energy expenditure – are also present in colostrum and milk, and, when given orally to suckling animals, they significantly influence intestinal maturation. Interestingly, enteral administration of leptin and ghrelin regulates the process of autophagy in the small intestine epithelium. Autophagy is a cellular process that breaks down cellular components to promote cellular survival during starvation by maintaining energy levels. It is suggested

that leptin/ghrelin control of autophagy is the effect of physiological control of energy balance at the epithelial cell level.

The last decade brought much evidence that a neonate pig is the best model for studying the physiology and pathophysiology of the gastrointestinal tract in the human neonate. Various aspects of intestinal motor function appear to be the most critical problems, resulting in feeding intolerance in low-birthweight infants. The motility of the small intestine is considerably less organised in premature infants than in term infants. This is caused by an intrinsic immaturity of the enteric nervous system that delays transit, causing subsequent bacterial overgrowth and distension from gases that are the by-products of fermentation.

The research group from the KIAP&N has recently been interested in nutritional programming, a phenomenon based on epidemiological and animal model studies which have shown that development and growth during the early life period is markedly influenced

by maternal health and diet composition. Maternal diet influences the metabolic status and plays a crucial role in the development of metabolic functions in offspring and their risk of metabolic diseases in adulthood. Our team investigates the role of maternal high-fat diet on the development of the gastrointestinal tract in offspring and the ability of obestatin to influence gut maturation and reverse maternal programming. The project includes studies on human and animal models. The preliminary results show that obestatin expression differs according to the mother's diet, and enteral administration of this peptide significantly influences the intestinal contractility. As the project researchers are also members of the Polish Foundation of the Bank of Milk, they hope that studies on obestatin's role in neonates and also observations on its fluctuations in mother's milk and its availability for neonates will aid in choosing the proper milk, derived from the right donor mother, for feeding pre-term babies



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# Investing in a sustainable future

**Nick von Westenholz, CEO of The Crop Protection Association outlines the importance of investment in innovation in the agriculture sector to support sustainable food production...**

**P**roducing enough food for a growing global population is one of the major challenges we all face over the coming years. The crop protection industry prides itself on our commitment to technological innovation to help meet that challenge, investing nearly £4bn per annum globally to develop innovative solutions that support safe and sustainable food production.

The process leading to the authorisation of a new crop protection product is complex, costly and lengthy; on average it takes 10 years and costs £160m to bring a pesticide to market.

Crop protection products are some of the most thoroughly tested and regulated chemicals in the world. Like other chemical, medical or veterinary products, pesticides can pose risks if not used properly.

Their registration and use are therefore strictly regulated and controlled. The process for bringing new chemicals to the market involves, research, development (R&D) and registration.

As an industry, we strive to ensure that our products are safe for consumers and the environment whilst delivering effective protection. However, in a competitive market, companies will only continue to fund R&D if they are assured of a stable regulatory framework. The effects of overly precautionary regulation at the EU level are starting to be felt. Since 2001 UK farmers have lost more than half of the active substances approved for use in the EU, and a recent report <sup>1</sup> by the Andersons centre found that the 250 actives still available for UK use could be cut by at least a quarter under existing legislation. Numbers could half if further precautionary approaches are adopted.



**Nick von Westenholz,**  
**CEO of The Crop**  
**Protection Association**

This downward trend is the result of a regulatory system that places hazard rather than risk at the centre of its decisions and which creates uncertainty by allowing political considerations to circumvent the approvals process – as we saw with the neonicotinoid moratorium.

The uncertainty of EU regulation discourages long term investment by pesticide manufacturers in Europe. This stifles innovation and has led to a reduction in the share of global crop protection R&D investment in products targeted at the EU market, from 33.3% in the 1980s to 7.7% today.

The Healthy Harvest <sup>2</sup> campaign which we have launched in partnership with the National Farmers Union and Agricultural Industries Confederation, seeks to reverse these trends by calling for a change of approach in crop protection regulation to ensure that we have a crop protection toolbox capable of delivering short and long term sustainable solutions.

Hopefully European policy-makers will now realise how imperative it is to make a proper assessment of risk and impact when they take decisions affecting food production, and to make sure they foster rather than stifle innovation. If not, we fear that farmers and growers will no longer benefit from increasingly targeted and effective crop protection products as industry continues to divert investment away from Europe.

As an industry we would like to see the UK government demonstrate its commitment to innovation through better regulation. There is serious concern across many industry sectors, covering a range of technologies, about approaches to regulation that rely on risk avoidance rather than risk management. The 2013 Agri-Tech strategy was an encouraging start, showing that government recognises the importance of supporting an innovative high-tech agricultural sector. Given the long term nature of crop protection, and other agricultural R&D it is essential that this strategy is maintained under the future government. Innovation is by definition a risk-taking activity, but one that stimulates economic growth, creates jobs and provides solutions to the major challenges facing society. As far as food security goes, it is innovation that will allow us both to protect the environment and to improve productivity over the coming decades.

The UK government must not only place innovation at the heart of its food and wider industrial strategies, but also lead the way in Europe, demonstrating a progressive and enlightened leadership among other member states in taking a proportional approach to risk – one that protects consumers and the environment and also fosters innovation. ■

<sup>1</sup> [www.cropprotection.org.uk/media/89364/andersons\\_final\\_report.pdf](http://www.cropprotection.org.uk/media/89364/andersons_final_report.pdf)

<sup>2</sup> [www.nfuonline.com/healthyharvest\\_final\\_digital/](http://www.nfuonline.com/healthyharvest_final_digital/)



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# United Nations University Fisheries Training Programme

Building capacity in aquaculture research and development

Established in 1998, the UNU-FTP addresses major challenges to the sustainable development of fisheries and aquaculture in developing countries through institutional and individual capacity building. The UNU-FTP runs a six month post-graduate training in Iceland for practicing professionals and delivers short courses in developing countries in partnership with local institutions. The training offered by the UNU-FTP is designed to meet the needs of individual participants and their institutions and is well suited to fulfil capacity building components of development projects.

**“Over 90% of all fish produced in aquaculture comes from developing countries, and each faces distinct challenges.”**

Over 300 professionals from 50 countries have completed the six month programme in Iceland. One area of focus for UNU-FTP is sustainable aquaculture, which is taught at Holar College University in northern Iceland. 26 fellows have completed this line of specialisation, roughly 20 more have done research related to aquaculture through the lens of policy and planning, management of fisheries companies and quality management of fish handling and processing. Individual research projects have grappled with a range of issues facing aquaculture development across the globe,



Short courses in partner countries have been a substantial part of the activities of the UNU-FTP since 2004. In Vietnam, the UNU-FTP has together with Network of Aquaculture Centres in Asia-Pacific (NACA) and the University of Nha Trang developed two regional courses, on profitability analysis, broodstock management. Courses have also been run in partnership with universities in Uganda, Mozambique and Namibia

including assessment of profitability, evaluation and formulation of policy, experiments with new species, and formulating new sources of protein for fish feed. Taken together, these research projects strengthen our understanding of both the path that led to modern aquaculture and the challenges it will face in the future.

Since the mid-1980s global catches of fish have stagnated at around 90 million tons annually. At the same time demand for seafood has increased rapidly due to increased human population and the growing global

middle class's taste for healthy fish. Aquaculture is the fastest growing food sector in the world, producing 50% of all fish for human consumption in 2012, according to the FAO. Most countries have aquaculture growth high on their development agenda.

## **Feed, seed and scale of operation: pressing issues in global aquaculture**

Over 90% of all fish produced in aquaculture comes from developing countries, and each faces distinct challenges. Most of the production in



China are carp species, which are low in the food chain and of relatively low value. Rapid economic development in China and many other Asian countries has increased demand of high valued fish, which continues to lead to the culture of new species, which is another challenge facing aquaculture.

**“Since the mid-1980s global catches of fish have stagnated at around 90 million tons annually.”**

Sub Saharan Africa produces less than 1% of total global aquaculture despite decades of investment by development agencies in the sector. Costs can make or break aquaculture farms. Feed constitutes more than 50% of the variable cost in fish farming. Research in alternative protein sources for fish meal and improvements in fish feed formulation are important areas of

research. Marketing and geographic placement of farms are also key components to success in aquaculture, as the cost and security of deliveries depend on logistics and the closeness of markets.

Economies of scale are particularly important in the sustainability of aquaculture enterprises, and more so as operations become more intensive and require greater investment. In Asia, the formation of clusters has to some extent had a scaling effect but this is not a common model in Africa.

**Hólar University College:** Hólar is a small community in the northern part of Iceland with a strong cultural heritage relating to higher education. The objective of the Department of Aquaculture is an international centre for research, instruction, and continuing education in aquatic biology, aqua-

culture, and fish biology. For more information, visit <http://www.holar.is/en/english>.



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# THE EVOLUTION OF YIELD IN CORN

*Dr. Ronnie Heiniger  
North Carolina State University*

## Why is Corn Yield so Important?

The key to feeding a growing world with less demand on scarce resources and lower environmental impacts lies in increasing yield. Research has shown that increasing corn yield results in better efficiencies in nutrient and water use thanks to the fact that corn plants that yield more also have bigger root systems and more effective leaf area. The challenge for corn producers is to find management practices that allow them to maximize yield given the soil and environmental constraints they are operating with. Among the many management options that corn producers have what practices will provide the best return on investment in terms of increasing yield with the lowest cost and risk. This publication discusses some of the key principles and practices corn growers should consider when seeking to increase yield in corn.

## It is All About Intercepting Light

At the most basic level corn is a starch factory that depends in turning light energy into starch. Therefore the most critical practice in managing for higher yield is maximizing light interception. There are three management practices that can be used to increase light interception. These are growing longer season hybrids, increasing seeding rate and plant population, and decreasing row spacing. Of these three the most effective practice is increasing seeding rate and plant population. While growing hybrids that require a longer growing period increases the amount of light intercepted it also increases water requirements and does not improve root mass or leaf efficiency. Using narrow rows only increases light interception for a short period of time. In contrast high plant populations increase light interception across the entire growing period, result in improved efficiency in light interception, and along with other key management practices increase root mass in the field. Figure 1 shows the impact of increasing plant density on the morphology of corn plants. As plant population increases the corn

plant grows taller resulting in more effective placement of leaf area to intercept sunlight. This results in optimum yield potential. However, there is a limit to this response. As plant density increases so does the need for water and nutrients. When the demand for water and nutrients exceeds the ability of the environment to provide these to the plant the corn plant responds by reducing its height and yield potential is reduced. Note that in Figure 1 there is a narrow range of plant densities over which the plant reaches maximum height and productivity. Corn producers must precisely match plant population to the environment of the field.



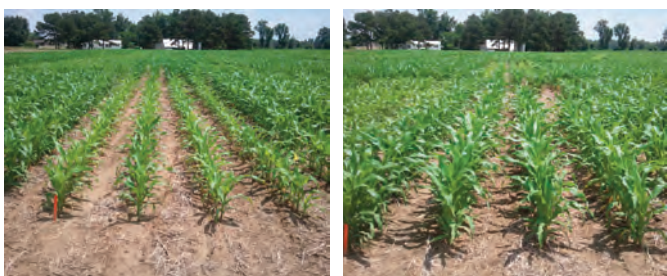
*Figure 1. Change in plant density from 29,343 plants ha<sup>-1</sup> on the left to 107,593 plants ha<sup>-1</sup> on the right.*

## Supporting Plant Density with the Right Management Practices

As is apparent in Figure 1 planting at a higher seeding rate is not the only step producers should use to achieve higher yield. Higher plant densities result in individual plants that have smaller root systems and thinner stalks.



These negative effects must be compensated for. There are two key practices that must be used in a systems approach along with higher seeding rates to make higher corn yield possible. These two key practices are starter fertilizer and multiple applications of nitrogen. The root is the first plant part to be developed in the growth cycle of the corn plant. The faster the corn plant grows from germination to flowering the more root mass will be produced. Since the root system is the key to better nutrient and water use efficiency this is a critical component of a high yield corn plant. Starter fertilizer which contains small amounts of nitrogen and phosphorus increases the early growth of the corn plant (Figure 2). Research shows that increasing early growth by using starter fertilizer results in a plant with more root mass and thicker stalks overcoming the negative effects of higher plant populations.



*Figure 2. No planting or starter fertilizer was used on the four-row plot on the left while 22.5 L ha<sup>-1</sup> of 11-37-0 was applied in a 2 x 2 band at planting to the four-row plot on the right.*

Likewise, a corn plant depends on nitrogen to maintain leaf chlorophyll levels and efficient conversion of light into starch. Unfortunately, most growers only apply nitrogen at the beginning of the season or, at most, twice at planting and again at canopy closure. Since nitrogen is mobile in the soil and subject to loss these applications often don't cover the full season nitrogen demands of the plant (Figure 3). Growers often apply more nitrogen than the plant actually needs to cover the fact that some nitrogen will be lost by the time the plant reaches the reproductive stages. A better system for producing high yield corn is to apply small amounts of nitrogen throughout the season. This approach allows growers to just meet the needs of the plant at a given time resulting in little or no waste while ensuring optimum growth and

yield. Furthermore, nitrogen rates can be adjusted as the growing season progresses to match changes in weather (particularly rainfall) resulting in maximum nitrogen use efficiency.



*Figure 3. Nitrogen was applied at four different times during the growth cycle of the corn plant to the four-row plot on the right while nitrogen was only applied at planting to the four-row plot on the left.*

### **In Summary – A High Yield Corn System**

Capturing more light while increasing root mass and light use efficiency requires a systems approach to corn production. The future of high-yield corn production lies in precisely matching plant population with the environment of the field and then supporting that population with starter fertilizer and regular feeding with small amounts of nitrogen. This approach has the potential to increase yield resulting in less demand on land resources. Research at the Vernon G. James Research and Extension Center at North Carolina State University over the past three years documents that this systems approach consistently produced maximum corn yield ranging from 21.1 to 23.7 mt ha<sup>-1</sup>. Only by using a systems approach can growers increase water and nutrient use efficiency in corn production resulting in better utilization of scarce resources and improving the amount of carbon fixed in a corn field resulting in less climate impacts.



# A disaster waiting to happen – or a solution for the future?

**Suzanne Sharrock, Director of Global Programmes at the Botanic Gardens Conservation International (BGCI) discusses the impact of climate change on plants...**

**T**here is unequivocal evidence that the Earth's climate is warming at an unprecedented rate. Recent reports show that the Earth has warmed by about 0.74°C in the last 100 years, and global mean temperatures are projected to increase further by 2100 (IPCC, 2013).

Plants, being major regulators of global climate, are of particular importance. The uptake of carbon dioxide, one of the principle greenhouse gases, during photosynthesis, is the major pathway by which carbon is removed from the atmosphere and made available to animals and humans for growth and development. Forests are especially important in this regard, acting as major carbon sinks by soaking up carbon dioxide and storing it as biomass. Conversely, the ongoing destruction of tropical rainforests is a major source of carbon emissions.

Plant diversity underpins all terrestrial ecosystems and these provide the fundamental life-support systems upon which all life depends. Ecosystems are composed of species assemblages and individual species within ecosystems will react differently to changing climatic conditions. Some species will remain where they are and adapt, others will move to new locations and some will become extinct. Changes in species composition may result in the collapse of ecosystems and the loss of important ecosystem services, such as the provision of.

But it is not just ecosystem services that will be affected by loss of plant diversity. Plants are the basis of global food production, with over 7,000 species being used as a source of nutrition around the world. The negative impacts of climate change on agriculture include reductions in yield, shifting crop growing

zones and increased pests and diseases. Such effects are predicted to be greatest in regions such as sub-Saharan Africa and South Asia – regions where populations are already growing rapidly and poverty is rife. Studies have shown for example, that since 1980, global maize and wheat production have declined by 3.8% and 5.5%, respectively, in relation to a ‘non-warmed’ world scenario (Lobell et al., 2011).

It is also noteworthy that 80% of the world’s population rely on traditional medicine for their primary healthcare, much of which originates from plants. Overharvesting of medicinal plants is already putting many valuable species at risk, and climate change will exacerbate the problem. Today, some 25% of the world’s known 370,000 plant species are thought to be under threat of extinction. Models of future plant distributions indicate that a temperature rise of 2-3°C over the next hundred years could result in as many as half of the world’s plants being at risk (Hawkins et al, 2008).

Most plant species will be threatened by climate change because they cannot naturally shift their geographical ranges fast enough to keep up with current and projected rates of change. However species such as alpine and island species, which have ‘nowhere to go’ are considered to be particularly endangered.

Despite the gloomy predictions, we do not believe plant extinction is inevitable. Many species can be conserved through seed banking and through establishing living collections in protected environments, such as in botanic gardens and arboreta. Large collections already exist and although much more needs to be done, work is ongoing. ‘Climate smart’ agriculture is being promoted, with strategies including planting different varieties of crops, integrating different species on the farm, combining mixed crop and live-stock systems, diversifying sources of food, adopting landscape approaches, and restoring degraded ecosystems. Diverse ecosystems are most resilient in the face of climate change, so management practices are increasingly acknowledging the need to maintain high levels of diversity in the landscape. Systems are also being developed to ensure sustainable levels

of harvesting of plants from the wild, with a new certification scheme ‘FairWild’ promoting this approach.

A combination of conservation and sustainable management of resources will help both mitigate the effects of climate change and allow adaptation in the face of change. However such methods require skills and expertise, which are in short supply, as well as financial support. Plants are often the ‘poor relation’ when it comes to conservation funding – for example in the USA, 60% of the species listed by the Endangered Species Act are plants, and yet they receive only 5% of funding available for conservation (Negrón-Ortiz, 2014). There is a great need to raise awareness of the importance of plants and role they play in supporting human livelihoods. There is much uncertainty about how climate change will unfold and what the response of species and habitats will be, but such uncertainty must not prevent us from taking action now. Conserving plant diversity will help in the maintenance of carbon sinks and will ensure options for future plant use under different climatic conditions. The richness of our lives in the future depends on how we act and what we conserve today. ■

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# Climate change and the impacts on forest trees

The Intergovernmental Panel for Climate Change (IPCC) identifies climate change as one of the most serious global challenges to ecosystems and societies. A crucial feature is the rise in mean ambient temperature. Models predict that in the next few decades temperatures could increase by 2-4°C, exceeding what most forest ecosystems would be able to handle. IPCC and the International Union of Forest Research Organizations (IUFRO) project that as a result forest distribution and species composition will drastically change. This is a worrying prospect, as the importance of forests can hardly be overestimated. In North-Europe, forests cover as much as 55-75% of the land, 50% of which is coniferous, 25% is broad leaved, and 25% mixed. These forests are not only reservoirs of biodiversity, providing crucial wildlife habitats, they also represent substantial economic value, and provide societal, health and recreational benefits. Moreover, they mitigate climate change by storing carbon dioxide and holding water.

## Warming affects forests

Elevated levels of carbon dioxide, a significant driver of temperature increase, might initially benefit temperate and boreal forests, but eventually alter their geographical location and compromise species diversity. Projections indicate that temperate forests will migrate northwards and invade the boreal zone,



thereby reducing the competitiveness of boreal species. Because climate change will outpace the natural migration rate of many tree species, the more aggressive, adaptable and fast-growing species will become dominant in the newly established areas.

## Instability reduces tree survival

Global warming will not only raise the mean annual temperature but also give rise to weather instability, characterised by unusual fluctuations in humidity and temperature. Some areas will become drier and hotter, resulting in draughts, while other areas will experience increased precipitation and waterlogging. The frequency of storms and pest outbreaks will increase,

resulting in die-off and decay of many trees. Although currently temperate forests are carbon sinks, increased migration-related forest destruction and warming-induced conversion of organic soil matter could turn forests into carbon dioxide sources. A different and potentially serious effect of weather instabilities is that they compromise the ancient and fine-tuned interplay of trees with the environment to which they are adapted. Fine-tuning is crucial for survival, as it allows trees to maximise their short growth period as well as timely preparation for winter. That climate change might compromise this fine-tuned relationship has received little attention in climate models. Our investigations focus on how photoperiod- and temperature-

driven signaling events schedule growth and survival strategies. Understanding how trees regulate their seasonal cycle in response to a changing environment will help to prognose and mitigate the effects of climate change.

**“A crucial feature is the rise in mean ambient temperature. Models predict that in the next few decades temperatures could increase by 2-4°C, exceeding what most forest ecosystems would be able to handle.”**

### Seeing light and sensing cold

Deciduous trees use their responsiveness to the day-night cycle to foretell the arrival of winter. They utilise photosensitive pigments in their leaves that give input to a genetically controlled clock. When a critical shortening of the light period is registered, the clock sends a signal to the growing points to trigger preparations for winter. Each local tree population (ecotype) has its own ‘daylength set value’ at which it responds, giving it just enough time to prepare for winter in their local environment. When the signal arrives, the growing point ceases apical elongation and switches from leaf to bud scale production. Inside the bud, a dwarfed shoot system emerges that arrests growth and establishes dormancy when the bud is completed. Essentially, the bud is a survival package that allows a rapid start in spring. Winter buds are crucial to survival and longevity, and without them temperate and boreal forests would not exist. Dormancy not only arrests growth, it also primes the bud

for freezing-tolerance to protect cells during winter. Our work established that growth arrest is governed by genes that block communication between cells in the growing point, transforming a functionally integrated cell society into a collection of isolated individuals. At the same time, other genes are expressed that direct cellular physiology towards a freezing-tolerant state. The chill of the approaching winter has 2 effects: it breaks dormancy by re-opening the communication channels and reversing the capacity of cells for networking, and it further deepens tolerance to freezing. The result is that the arrested system is now highly freezing tolerant, but poised for rapid growth once temperatures rise in spring. Thus, interestingly, Northern trees have turned the pre-winter chill from foe to friend.

### Compromised fine-tuning

The mechanisms that fine-tune the growth and survival strategies function well in the stable climate in which trees evolved. However, the unusual weather fluctuations projected by climate change models may seriously compromise the environmental scheduling of these strategies. Longer warm spells in mid-winter can awake non-dormant buds and remove freezing-tolerance, thus leaving them unprotected from returning frost. This could result in considerable damage to both wild and domesticated tree species. We therefore urgently need to improve our understanding of the survival strategies forest trees rely on, the degree of resilience they confer, and if they can be modified to better fit changing conditions. It requires coordinated efforts of cross-disciplinary

teams to integrate knowledge – from genes to cells, trees and forest ecosystems. Presently, we know too little of how individual forest trees will cope under a changing climate, and how their distribution and survival will be affected. Fortunately, there is a growing awareness among policy makers, the public, forest owners and forest-based industries of the urgency of these problems. Norway actively supports forest research, but to obtain an integrated view of climate change impact we urgently need to strengthen investigations that elucidate the genetic and cellular mechanisms that trees use to fine-tune their relation to the environment.



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# Why we need an Energy Union

**Miguel Arias Cañete, European Commissioner for Climate Action and Energy gives an overview of why an Energy Union is integral to the EU...**

**D**ivide et impera. Divide and rule. As simple as it may sound, this maxim summarises the key strategic approach of the most eminent leaders and statesmen throughout history. The idea that lies behind this approach is that single nations have weaker bargaining and negotiating power than nations that coordinate and work together. That is exactly what happened during the last energy crisis in Europe. If we are to have a better position to negotiate energy deals in the international market, we need to decrease our dependence from external suppliers and increase our interdependence as European allies. Now is the moment to do it, the moment to achieve the Energy Union.

In order to build it, we have to work on 3 different ideas. Firstly, we have to deal with the challenge of

Energy Security. Gas sales, as we have seen lately, are not treated as mere commercial matters, and some suppliers use them as weapons for political leverage. If we want to put an end to the politicisation of commerce and to stop jeopardising the supply for our companies and the wellbeing of our citizens, we need to diversify the sources of our imports. We should strengthen our ties with firm and trusted friends like Norway or Ukraine, but also undertake new commercial relationships with countries like Turkey or Algeria.

Secondly, we have to develop a truly integrated Internal Energy Market. The EU was founded on 4 basic freedoms: the freedom of goods, services, capital and people to move freely across the Union's internal borders. Why should energy be excluded from these freedoms? If highways do not end at





national borders I cannot think of a reason why electricity cables should. If we achieve a unified market with interconnected grids, the energy companies would be more competitive and citizens would enjoy more affordable prices, saving up to €40bn a year.

Thirdly, we have to improve the efficiency of our energy. The EU is already a world leader in energy efficiency, but I think that we can do much more. Now that we have proven that economic growth and energy consumption are decoupled, we should step up our initiatives in this direction. At the consumer level, for example, our approach for improving the energy efficiency of buildings has resulted certainly successful, and new dwellings now consume 40% less than dwellings built 20 years ago. Along the same lines, at the industrial level we have developed equally successful actions and the energy intensity of our industries has improved by 19%. We have to understand that energy efficiency is one of the most cost effective means to reduce greenhouse gas

emissions, something particularly positive after the EU has publicly stated its commitment to achieve a 40% reduction by 2030. Without a doubt, a win-win way to fight climate change.

The Energy Union is an ambitious project that will change the face of energy in Europe. Today we have the opportunity to make our energy more affordable, more competitive, more secure and more respectful with the environment, and we cannot miss it. It is the time to take a stand against the strategy of divide and rule and to adopt a new strategy, the strategy of unite and win. ■

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**Miguel Arias Cañete**  
**Commissioner for Climate Action and Energy**  
 European Commission  
[http://ec.europa.eu/commission/2014-2019/arias-canete\\_en](http://ec.europa.eu/commission/2014-2019/arias-canete_en)



## CO<sub>2</sub> unbalances Earth's energy

**T**he natural history of Earth has been one of fire and ice. Fire was early and ice later. Indeed, ice ages have been distinctive occurrences in Earth's history. During the last minor ice age some 20,000 years ago, due to lower sea levels, *Homo sapiens* crossed newly formed land bridges between Siberia and Alaska and also Europe and the British Isles. Ice, however, is not likely going to form an integral part of Earth's continuing history. Rapid warming is occurring over the entire Earth. The polar ice caps are melting, glaciers are receding and permafrost is disappearing. All of these events are unambiguously linked to an increase in the amount of carbon dioxide in the atmosphere and this increase is distinctly caused by relying on burning fossil fuels for energy for the last 150 years.

Until recently, the CO<sub>2</sub> level in Earth's atmosphere had never been higher than 300 parts per million (ppm). Over the last 1000 years it has varied only slightly around an average of 275 ppm. This resulted in the existence of relatively constant global weather patterns during which humanity blossomed and spread across the globe. Now, however, this is changing. Having done our expansion during favorable conditions, we are unprepared for the massive global troubles that await us in the not too distant future.

Earth's warming is being caused by an energy imbalance. Earth is now receiving more energy than it is able to emit. While the Sun is the primary source of energy (ultraviolet radiation) input, Earth's radiant energy (infrared radiation) is different. Instead of being

emitted into space, infrared radiation can be absorbed by molecules such as CO<sub>2</sub> to increase their vibrations and rotations. Before these "excited" molecules can re-emit this excess energy and fall back into their normal states, thousands of molecular collisions each second end up transferring kinetic energy to molecules of oxygen and nitrogen in the air. The air heats up. Some of that heat is transferred to Earth's surface. These are not hypothetical assumptions; they are unsailable chemical and physical facts.

To see the profound effect CO<sub>2</sub> is capable of having, consider increasing CO<sub>2</sub> just 2 ppm in a year. We know from accurate measurements that CO<sub>2</sub> increased from 398 ppm in 2013 to 400 ppm in 2014. We also know from 50 years of precise measurements that



CO<sub>2</sub> has not only maintained this steady increase year after year, but its rate of increase is increasing. Taking into account known parameters for Earth's energy emissions as a function of wavelength, and knowing with high reliability the amount of energy CO<sub>2</sub> can absorb as a function of wavelength, scientists can calculate with a fair degree of accuracy the amount of energy absorbed by 2 ppm of CO<sub>2</sub> increase each year. The answer is 380 billion megawatt-hours. This is the amount of energy that just a 2 ppm increase in CO<sub>2</sub> returns to Earth over what CO<sub>2</sub> returned to Earth last year. Put into more earthly relevance, this increase in energy per year is enough to melt about 15 times the amount of ice that disappeared in the Arctic last year.

**“The effects of such warming have never been experienced by humans. One of the consequences of ice melting is a rise in ocean levels. This is already occurring.”**

Earth's energy imbalance is large and is getting bigger each year because CO<sub>2</sub> continues its unaltered climb. Climate specialists have estimated that Earth's average temperature will rise to +2°C over its pre-industrial level by 2035 (450 ppm CO<sub>2</sub>) and to +3°C (550 ppm CO<sub>2</sub>) by 2100.

The effects of such warming have never been experienced by humans. One of the consequences of ice melting is a rise in ocean levels. This is already occurring. Adding all of the Arctic and Greenland ice to the seas, and accounting for the large thermal expansion of water, will raise the sea level by 20 feet and all of the ice in

Antarctica will raise it a further 200 feet. This will be catastrophic for people living near the sea. It is estimated that over 100 million people live within 3 feet of sea level. The massive exodus of these people will create incredible challenges for the whole world. Furthermore, weather patterns will change with some areas getting more rain and some drought conditions. The severity of storms will increase, with concomitant dislocation of people and with food, water, and health supply disruption. Reliable agricultural production will be adversely affected. The list goes on.

The global community has been slow to act to avoid this happening. We have had Summits where nations have tried to commit to CO<sub>2</sub> emission reduction targets and then we have spent years spouting excuses for not meeting them. Some nations are making more progress than others, but the chief obstacles to reducing CO<sub>2</sub> are the desire to maintain economic growth in industrialised nations and second and third world nations wanting to achieve the same standard of living. Energy for this growth is a prime need and, unless things change radically, it will come from burning fossil fuels. We like our prosperity and we are loath to erode even a minor part of it. But to avert a warming of calamitous proportions, something has to be done, and quickly.

There is a half-baked scheme being discussed about putting millions of small mirrors in orbit to curtail energy input from the sun. This would, some argue, cool the world while we continue our growth. Proponents do not adequately discuss the probability that the sky would no longer be blue

or the disaster of overcooling should a large volcano erupt. Once engineered, such a “solution” would not be able to be de-engineered. Alternatively, carbon cap and trade schemes and/or carbon taxation are being discussed. Each of these schemes has its own set of advantages and disadvantages. What is most obvious to most informed people is that our society has to stop using fossil fuels. That means we must invent ways to use renewable clean energy sources. Such work takes money and time, both of which are not easily available without a considerable and urgent change in our political, social, and economic will.

Nations are now preparing for a CLIMATE CHANGE Summit in Paris in December of 2015. Citizens of all countries must inform their political leaders that we will not accept their continued failure to act as a coordinated global civilisation. They must know we will be watching. They must know we are passionate about making sure that Earth is sustained for future generations to live with dignity and hope.

**BRConard Consulting, Incorporated**  
metals • environment • health • toxicology

**Bruce Conard**  
**President**

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# Reliable clean energy solutions for real world applications

The Kliux Project Engineering Team will design a fully customized energy solution to meet your exact needs, assessing key elements of your project:

1. Energy consumptions needs
2. Availability of wind and solar resources at installation point
3. Area and surface characteristics of installation site
4. Availability of financial incentives for renewable energy projects
5. Onsite configuration of equipment
6. Cost amortization analysis
7. Flexible payments terms - up to 100% financing may be available

## Rural Tourism

Cabins, hostels and country houses with access to the grid or within a backup generator, coastal hotel, spas.

## Public Sector

Urban planning roads, pedestrian walks and bike lanes, squares and parks, intelligent networks for towns, villages, neighborhoods.

## Private Residences

Partial or total supply of housing energy needs, community of property owners, common areas (elevator, lighting, pool), picnic areas and wine cellars.

## Rooftop Mounted

Residential buildings, industrial warehouses, shopping centers.

## Sports Facilities

Yacht club and lighthouses, yacht and boats, golf courses.

## Agriculture

Wineries, wells, pumping stations, farms and dairies.

## Mountain and Forest

Mountain lodges. Fire watchtowers. Ski resorts.

## Benefits of Installing a Kliux System:

### SAVE FROM DAY ONE

Independence from the electricity grid. No impact from future increases in the price of gas oil. Decreased O&M cost.



### NOISELESS

Virtually no noise, which makes it suitable for installations in any environment.

### REMOTE MONITORING

Through our remote consumption monitoring system you will have access to generation and control data at any time and from most of today's mobile devices.



### ENVIRONMENTALLY FRIENDLY

Prevents birds from getting near and is respectful of other wildlife. Resistant to extreme environments and weather conditions.





# Vertical Axis Wind Turbine

## Kliux Zebra

### Maximum generation without noise

#### UNIQUE DESIGN

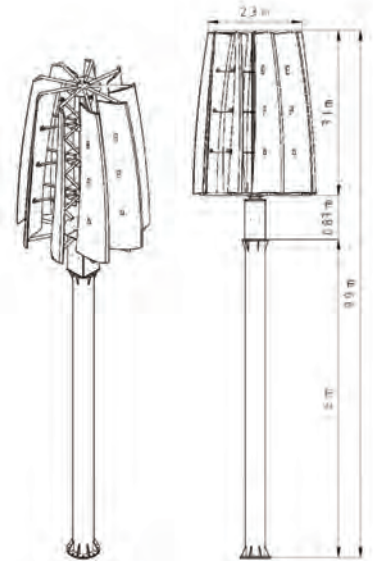
- Designed to maximize energy output in urban, inhabited areas.
- First vertical-axis wind turbine with a 9 alpha blade in a Savonius type rotor (drag) made of expanded polyurethane supplied by Bayer MaterialScience.
- Designed and made in Spain.

#### PRODUCT ADVANTAGES

- No startup system needed.
- Minimal maintenance.
- Noiseless.
- Aesthetic visual Integration in urban and rural locations.
- Birdfriendly.

#### APPLICATIONS

- Power generation system best suited for private residences, public areas, rural tourism, sports venues, schools, universities, public parks, industrial areas, farms, water pumping stations and roads.
- Blades provide an excellent platform for branding and advertising.



#### WIND TURBINE ASSEMBLY COMPONENTS

Vertical axis wind turbine (VAWT) Kliux Zebra.  
 Gear box. Three-phase Permanent Magnet Generator.  
 Steel mast with anti-corrosion painting protection.  
 Wind inverter: Windzet.SP.4 3400, 4kW, 230Vac, 50/60.Hz (Zigor). Grid Connection.  
 GSM/Ethernet Communications module (optional).  
 Weather station (optional).  
 Voltage dischargers.

#### WIND TURBINE DIMENSIONS AND WEIGHTS

Rotor + Generator and transmission's weight: 375,00 kg.  
 Mast Weight: starting at 351 kg.  
 Rotor's diameter: 1,6 - 2,2 m.  
 Rotor's / Transmission's height: 3,1 m / 0,83 m.  
 Mast height: starting at 6 m.

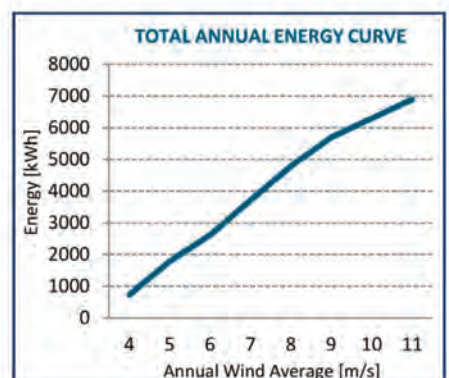
#### WIND TURBINE YIELDS

Nominal power: 1.800 W.  
 Start up speed: 3 m/s.  
 Maximum rotation speed: 70 RPM.  
 RPM limited by inverter power curve and generator resistance.  
 Noise at 10 m distance: 32'6 dBA.  
 Durability: 25 years.

#### ADDITIONAL INFORMATION

Blades' material: Expanded polyurethane from Bayer MaterialScience.  
 Rated output voltage: 230 Vac. ( $\pm 15\%$ ).  
 Certifications: ISO: 9001, 14001 y CE.  
 Certifications in progress: IEC 61400 -2/-11/-12, AWEA 9.1, BWEA 2009 Standard.

MEDIA VIENTO (m/s)	ENERGÍA ANUAL GENERADA (kWh)
4	736
5	1.789
6	2.616
7	3.717
8	4.793
9	5.693
10	6.296
11	6.892



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**KLIUX**  
energies

# Distributed Energy Storage – Power to the people

The compulsion for energy security and the end of cheap oil are decisively adding to climate change concerns to finally boost a long overdue re-evolution towards a new and sustainable model of generation, management, storage and consumption of energy. Recent efforts to tap unconventional oil and gas will soon pass into history as attempts to scoop out the final remains of an obsolete model. Regardless of how long this final stage will hinder our transition, we will finally have to shift from a society of “energy gatherers” (collecting fossils for fuel) to one of “energy farmers”, making use of energy vectors such as electricity, 3G biofuels, hydrogen or other synthetic fuels.

Energy storage will play a central role in this upcoming model. As it will also distributed generation, energy efficiency and conservation, information and communication technologies (ICTs), all of them leveraging each other in smart grids (Figure 1).

Research on materials and devices for energy storage and conversion is precisely what we do at the NEO-Energy Lab. From batteries to supercapacitors, from hybrid nanocomposite materials to nanofluids, from papers to patents and to the public.

Our group is part of the Catalan Institute of Nanoscience and Nanotechnology, ICN2 (CSIC-CERCA), which in turn is located at the UAB Campus, near

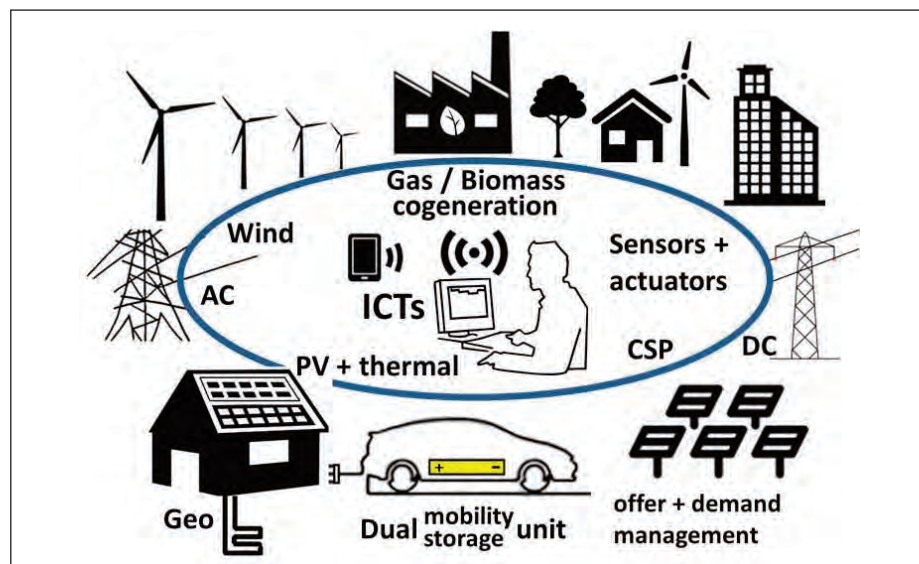
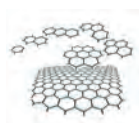


Figure 1. Distributed generation and storage made possible by smart grids (smart policy makers also needed)

Barcelona, Spain. A Research & Development Hub and Heaven where CSIC is implementing a new and improved management model. A perfect place to do research and discover...what we have discovered:



## New industrial methods for the preparation of

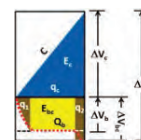
### high-quality graphene

Forget about the purest square centimeter of graphene. We are not into making the oxidised stuff. We make it big and we make it good.



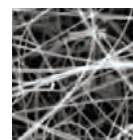
## Nanofluids are HOT

Heat Transfer Fluids (HTFs) have shown they are great at transferring heat at low temperatures. We want them working at high temperatures for boosting thermal solar energy.



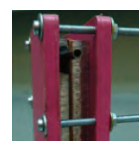
## Hybrid Supercapacitors made of hybrid electrodes for energy storage

We work on batteries (great energy, poor power), we work on supercapacitors (great power, poor energy). We also work on hybridising them to get the best of both worlds.



## Micro-Supercapacitors with Silicon NanoWires

A collaborative European project (NEST; Nanowire Energy Storage) integrating knowledge, integrating Europe.



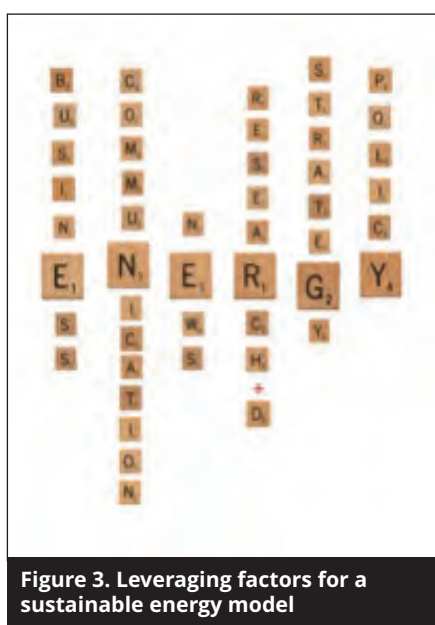
## Radically new and better flow cell concepts

The idea is storing fluids with high energy density in large tanks externally to the electrochemical





**Figure 2. Create, apply and disseminate Science. Those are our humbly ambitious rules**



**Figure 3. Leveraging factors for a sustainable energy model**

reactor that we call battery. This type of liquid storage is bound to obliterate the word “intermittent” out of renewable energies and even end up fuelling our future electric cars.

All of these research lines, and technologies, could end up having some impact on the integration of distributed storage and renewable energies with those baby grids now beginning to grow.

That will not only depend on the success of scientists, many other factors and players come into action to make a sustainable energy model possible (Figure 3). Policy is not the least

important. It represents one of the many leverage factors that could help science and technology. Thus, in the context of our present evolution towards a more sustainable energy model, policy must be a primary driver to correct market barriers and even plain failures, the most striking of which are non-internalised costs of conventional technologies. But watch out, policy can also play a detrimental role.

Regressive policies like the ones recently implemented in Spain will not stop but will retard the development of clean energies. At most, these arbitrary decrees could take Spain out of the list of leading renewable energy countries. Energy policy should be consistent, coherent with the pursuing of overall social benefit and lasting. Otherwise we run the risk of suffering drawbacks like fishy regulations penalising the use of PV solar for self-consumption in Spain. A reminder that what we could call nutcracker leverage is also possible.

Some recent relevant publications:

- Hybrid Energy Storage. The merging of battery and supercapacitor chemistries. D. P. Dubal, O. Ayyad, V. Ruiz, and P. Gomez-Romero\* Chemical Society Reviews, 2015, 44, 1777.
- Pedro Gómez-Romero, Deepak P. Dubal, David Aradilla, Gerard Bidan. Electrode material comprising silicon nanowires covered

by MnO<sub>2</sub> nanoflakes and salt-doped ionic liquid electrolytes for energy storage device. European Patent 1515831. 9-03-2015.

- Stable graphene–polyoxometalate nanomaterials for application in hybrid supercapacitors J. Suárez-Guevara, V. Ruiz, P. Gomez-Romero\*, Phys.Chem.Chem.Phys. 2014,16(38), 20411.
- Development of hybrid materials based on sponge supported reduced graphene oxide and transition metal hydroxides for hybrid energy storage devices D.P. Dubal\*, R.Holze, P.Gomez-Romero\*. Scientific Reports (Nature pub. Group) 2014, 4: 7349

Patent “Graphene-based electroactive nanofluids as liquid electrodes in flow cells” P201530693, 20 May 2015

Prof. Dr. Pedro GOMEZ-ROMERO, FRS (born in Almansa, Spain) B.Sc. Ms.Sc. U. Valencia, Spain, PhD in Chemistry with Distinction, Georgetown University, Washington D.C., USA, 1987. Visiting Scientist at the National Renewable Energy Laboratory, Golden, CO, USA, (NATO Senior Fellow sabbatical appointment 1998-1999. Author of 10<sup>2</sup> (i.e. ten to the second power) scientific publications and author of two award-winning popular science books. NEO-Energy Group Leader. Researcher ID: B-7855-2008.

All figures © Pedro Gomez-Romero



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[www.cienciateca.com](http://www.cienciateca.com)

# E3-Modelling research finds first-mover advantage for the European Union as frontrunner in climate action

In Paris, delegates from the 196 UN parties will meet in December 2015 to negotiate a global climate agreement. Countries accounting for roughly a quarter of global emissions met the March deadline to provide targets for curbing Greenhouse Gas Emissions (GHG) while at the same time some of the leading economies have missed the deadline, including Canada, Australia and notably China, lowering expectations for a universal climate agreement by December. However China signed an agreement with the USA on coordinating climate mitigation strategy. In contrast, the EU submitted ambitious emission reduction goals for 2030 well within a decarbonisation pathway.

The stakes are high, as the world is at present on a path to possible above 4°C global warming by 2100. Hitherto preventive action – including efforts to build a carbon market or to subsidise renewables – has been confined to the developed world and is largely insufficient. The European Union is clearly a frontrunner but many question the macroeconomic and industrial adverse effects of unilateral action.

E3-Modelling, based on modelling services to clients such as European Commission, Governments and business stakeholders, published research showing that in contrast with skepticism the EU's economic and industrial benefits can be effectively reaped from pioneering climate action.

## Abatement of GHG emissions & carbon leakage

As stated on numerous occasions by the President of E3-Modelling Prof. P. Capros, “the basis for the deep decarbonisation of the global economy rests in efficient and equitable effort sharing. Lack of consensus on an international agreement for reducing Greenhouse Gas Emissions eventually leads to asymmetric climate policies which not only increase the cost of reducing emissions, but also dent the effectiveness of climate policy, through carbon leakage<sup>1</sup>.” In particular, studies performed by E3-Modelling staff conclude that an international concerted action to reduce GHG emissions at safe levels by 2050, would require 1.5% of global GDP. In the case where only OECD countries embark in GHG mitigation, the carbon leakage rate is estimated to be close to 25%. If China participates to the abatement effort of OECD countries then carbon leakage rate can be reduced to 3%, underlying the importance of allying developed and emerging economies in pursuing GHG emission reduction policies.

## EU as a first mover

Europe has long been a leader in pursuing a global climate deal, and has early outlined – with support from our economic and energy modelling research (PRIMES and GEM-E3 models) – a robust set of targets for drastically curbing the region's emissions by 2030. Indeed, the

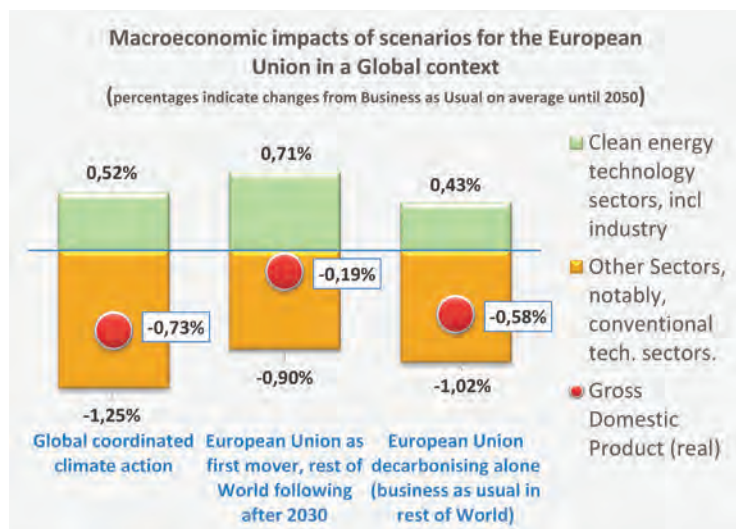
Conference of Parties (COP21) submission of EU countries' targets has formally put forward a binding, economy-wide target of cutting the region's GHG emissions by at least 40% below 1990 levels by 2030. The EU COP21 submission has been largely based on modelling work undertaken by E3-Modelling staff, with the use of two highly sophisticated and well established in the European context models: the PRIMES energy market model and the GEM-E3 computable General Equilibrium Model.

The EU can be considered as a first mover in global GHG mitigation. The net impact on EU economy is uncertain as early movers incur costs, but may also benefit from gaining a cost comparative advantage on producing low carbon technologies; the costs depend on the loss in competitiveness that leads to a decrease of their shares in global markets. A recent study performed by E3-Modelling shows that the net potential gain to EU from undertaking a first mover action can be up to 0.54% of its GDP.

## Modelling tools operated by E3-Modelling

The main energy-environmental-economic modelling work of E3-Modelling rests upon a series of highly sophisticated in-house models:

PRIMES, a workhorse energy market model developed and maintained for



all individual European countries and the internal electricity and gas markets is a sophisticated market-oriented engineering-economic model with modular structure by sector, with high sectorial resolution including for transport sector. The model has been extensively used in assessing the 20-20-20 energy and climate policy package, the EU's decarbonisation Roadmaps and the recent climate and energy policies for 2030.

In contrast with optimisation models, PRIMES is an agent and market oriented model aiming at representing the reality of actors' behaviors and their interplay in markets, for energy commodities and for the emission allowances (EU ETS). PRIMES is rich in engineering information and includes detailed representation of energy and transport infrastructure. Its sub-models cover power market operation in high resolution, investment and design, gas market strategic analysis, energy efficiency in houses and buildings, industrial energy use and cogeneration, district heating, biomass/waste sector and new technologies including bio-energy, renewables, smart grids, power-to-gas, power-to-liquid and synthetic fuels, as well as storage. The Energy Roadmap publications and the Eurelectric Power Choices scenarios, carried out using PRIMES illustrate the capabilities

of the model in simulating deep restructuring of energy systems in demand and supply sectors, the dynamics of investment and equipment turnover in all sectors, while projecting impacts on markets (incl. EU ETS), commodity prices and costs by agent.

The GEM-E3 general equilibrium macro-economic model is a sophisticated multi-sector and multi-country model used for economic impact assessment and macroeconomic studies. GEM-E3 fully linked with the energy model PRIMES analyse closed-loop energy-economy-environment assessments. The world energy projections, with focus on hydrocarbon world markets, is handled by E3-Modelling using the PROMETHEUS stochastic world energy model. GEM-E3 has been the model of choice for numerous country-specific macro-economic studies for a variety of cases, including Romania, Switzerland, North Africa countries, and others.

### Modelling of Energy Economy and Environment

The researchers of E3-Modelling have provided scientific support and policy advice for the European Commission on many occasions including most recently the 2030 Energy and Climate Communication (January 2014), but have also provided support to the

German Ministry of Economic Affairs and Energy in the run-up to the agreement. They also regularly provide support to the Belgian Government, as well as to numerous non-governmental groups such as Eurelectric, AEGPL, EUROGAS. E3-Modelling participates in international cooperative projects such as the EMF and partners with renowned world institutes such as MIT, IIASA, PIK, FEEM, etc. in order to validate and enhance its modelling tools and regularly publishes its findings in international peer-reviewed journals.

At E3-Modelling, our aim is to communicate to policy makers and stakeholders around the world the quality output of leading scientific research in the areas of energy and the environment, helping them take informed decisions when formulating their optimal pathways towards a low carbon economy.

E3-Modelling is a spin-off company based on research activities performed at the National Technical University of Athens.

More information about E3-Modelling can be found at [www.e3modelling.gr](http://www.e3modelling.gr)

1 The part of emissions reductions in abating countries that may be offset by an increase of the emissions in non-abating countries

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# Success story on mineral carbonation of CO<sub>2</sub>

Pushing academic research towards industrial scale through advanced modelling and piloting

At Aalto University's Department of Energy Technology, Professor Mika Järvinen's Energy Engineering and Environmental Protection research group is conducting pioneering research on biomass combustion, carbon (CO<sub>2</sub>) capture and storage (CCS) by mineral carbonation, circulating fluidised bed gasification of waste, and advanced modelling of industrial processes, mainly for energy and metallurgical applications. To foster good industrial collaboration, the group carries out laboratory, pilot and full-scale research to avoid problems in scale-up and provide sustainable and economically feasible solutions for companies.

In 2011 the Aalto University Foundation, together with Abo Akademi University and SSAB (formerly Ruukki) Raahe Works, successfully secured a patent for a technique that produces precipitated calcium carbonate (PCC) from alkaline by-products. This CCS approach aims to reduce CO<sub>2</sub> emissions by using alkaline industrial waste materials and flue gas rich in CO<sub>2</sub> to produce a valuable PCC that is marketable to paper, pharmaceutical or plastics industries, (see the above figure 1). The conventional production of this PCC requires limestone to be mined, transported and subjected to a very energy intensive calcination processes that also emits CO<sub>2</sub>. However, by substituting limestone with industrial Ca-rich wastes (e.g. steel slag) our

method reduces waste, saves energy and reduces CO<sub>2</sub> emissions.

Almost 1500 Mt of steel is manufactured globally every year producing 2700 Mt CO<sub>2</sub> corresponding 6.7% of anthropogenic emissions. In addition to the direct and indirect emissions of CO<sub>2</sub>, the production of steel also annually generates about 400 Mt of a solid by-product known as slag. Slag is formed from species in pig iron such as Si, Mn, Mg, some Fe and also valuable Cr that are oxidised during steelmaking. One major component in slag formation is CaO that is fed to the top of the slag to remove silicon and sulfur and improve flowability. CaO is produced in the lime kiln by heating the lime stone up to 1100 °C.

There are several different types of slag produced at different stages of the steelmaking process. Basic oxygen steel converter slag is very well suited for a Slag2PCC process as it contains a large amount of free calcium that can be effectively extracted, with annual slag availability being 135 Mt. Steelmaking slag finds applications in road construction as well as the cement industry, however, about 13% is unusable for these purposes and is generally landfilled. Figure 2 presents the simplified principle of our Slag2PCC process implemented to steelmaking.

Steelmaking requires calcium oxide CaO that is produced from CaCO<sub>3</sub>. In

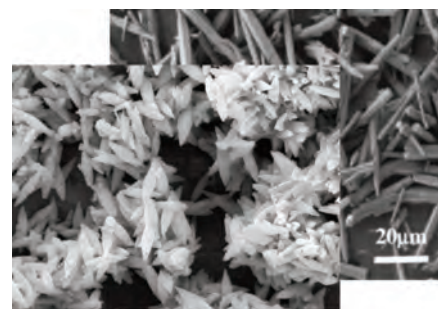


Figure 1

our process, a water solution of an ammonium salt is used to extract calcium from the steelmaking slag. The resulting Ca-rich solution is bubbled with CO<sub>2</sub> gas which reacts to form PCC, precipitated calcium carbonate.

The quality of synthetic PCC generally surpasses that of even the highest quality natural ground PCC as the process can be tailored and controlled to produce a wide variety of PCC products with very high purity and different crystal properties. For this reason PCC can be sold at a higher price. The global consumption of PCC increased from 10 Mt in 2004 to 14 Mt in 2011 and is expected to continue to grow. There are many requirements for the PCC properties including particle size, purity, brightness and crystal morphology, and these vary depending on the application.

## Current research challenges and main developments

There could be a significant surplus of PCC available if all steel converter slag production in the world would be utilised by our process. As one exam-

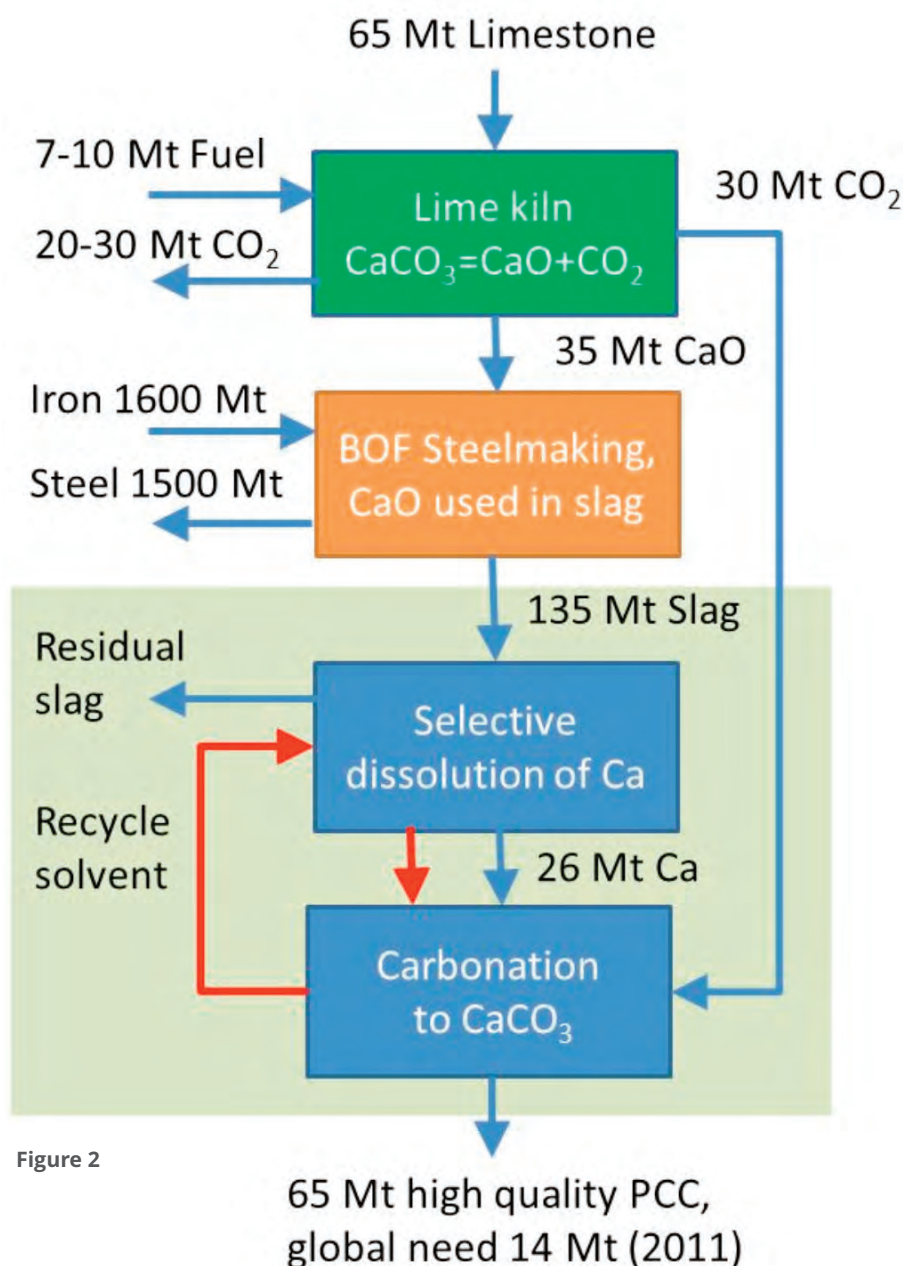


Figure 2

ple, our synthetic PCC could partly replace the limestone used in the production of steel, reducing the need for mining. PCC could be sold at a higher price as a commodity chemical to several other industries. We are also able to bind most CO<sub>2</sub> emissions, 30 Mt, related to calcium treatment in the steel mill. If the lime kiln is heated by biofuels, the process would be mostly CO<sub>2</sub> neutral. The global annual emissions from the blast furnace in

iron making are in the order of 2600 Mt, being far too large for Slag2PCC process to be applicable. The slag from blast furnace is also not suitable for our process and is already mainly used the cement industry. The biggest benefit from our process is in the reduced need of virgin lime stone required for steel converters.

The feasibility of PCC production from steel making slag has been success-

fully demonstrated by our pilot plant, launched in 2014, both on batch and continuous modes. We can successfully produce high quality PCC of rhombohedral calcite and aragonite of various sizes. We have recently published results showing that by applying ultrasonic extraction, extraction efficiency can be significantly increased (Said et al. Enhancement of calcium dissolution from steel slag by ultrasound, Chemical Engineering and Processing 89 (2015) 1–8). We are also currently working on developing alternative PCC products based on the particular advantages of the Slag2PCC process for potential high value niche applications. Recovery of the ammonium salt solvent and effectiveness of the filtering are still critical aspects of the process and how to best achieve this at minimal energy cost is a major challenge.



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# Energy challenges and the production of electricity from waste heat

The Nobel Peace Prize 2007 was awarded jointly to Intergovernmental Panel on Climate Change (IPCC) and Albert Arnold (Al) Gore Jr. "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change".

The prediction of climate changes induced by CO<sub>2</sub> emission into the air is as scary as the book of revelation: "The seventh angel poured out his bowl into the air,... then there came flashes of lightning, rumblings, peals of thunder and a severe earthquake... Every island fled away...From the sky huge hailstones, each weighing about a hundred pounds, fell on people."<sup>1</sup>

The human conscience is enhancing in a new direction: all of us need to face the same global problem, the human-induced climate change. We realized that we are the threat for our own planet as a consequence of lack of knowledge. But in a near future the consequences will originate from a lack of reaction; an inertia lead in secret by the "ego" of most people. I can detect that in my-self, this "ego" is seeking comfort, recognition, and power. If I can feel it at my level, how much more is the temptation of that ego at high political levels?

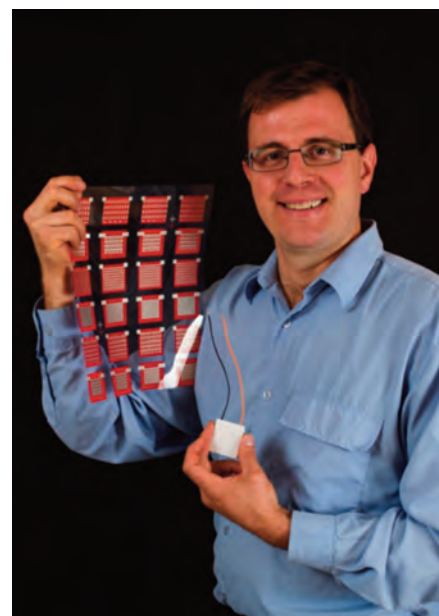
Thanks to Nobel prize's impact, everybody knows that burning fossil energy leads to climate change via CO<sub>2</sub> emission<sup>2</sup>. What is the status of our energy portfolio? The world energy consumption is about 15TW. 87% of that energy

is coming from fossil energy sources (coal, oil, gas), 6% from hydroelectricity, 6% from nuclear power plants, and only 1% from green energy sources. The good news is that there are enough green energy sources to replace totally the fossil energies and cover all our needs in the future. Indeed, the sun is by far the largest source with  $1 \times 10^5$  TW of radiation reaching the earth surface. So, in theory we could stop the CO<sub>2</sub> emission without stopping the development of our society.

But the real challenge is in the rapid implementation of green energy sources to stop the global temperature rises of 1-2 °C per 30 years<sup>3</sup>. Few people really appreciate the magnitude of the problem we need to face. We are about 7 billions of inhabitants on earth and the expected population in 30 years is about 10 billions<sup>3</sup>. With an average power consumption of 3kW/person, the expected world power consumption should increase from 15TW in 2013 to 24TW in 2050.

What does it imply to produce an extra 9TW in practice? 9TW is equivalent to 9000GW. What would mean 9TW in term of nuclear power? One nuclear reactor generates about 1GW, so it means we would need to fabricate 9000 nuclear reactors in the coming 30 years. This corresponds to 1 reactor every day for 30 years! Of course, a mass implementation of nuclear power would create a major issue with the radioactive waste.

What about photovoltaics, i.e. solar cells? Those electronic devices trans-



Xavier Crispin holding a prototype for a printed thermoelectric generator

form the solar radiation into electricity with efficiency about 20%. The sun is irradiating the surface of the earth with a power per area of 1000 W/m<sup>2</sup> during half day. So, the surface area that needs to be covered with solar panels to produce 9TW is 90 000 km<sup>2</sup>. For the sake of comparison, this corresponds to three times the surface area of Belgium. To make that possible, a solar cell stripe of 100 m wide and 82 km long should be manufactured and installed every day for 30 years.

Note however that this scenario is still conservative since today's 15TW consumption would remain mostly from fossil energy sources. In other words, the CO<sub>2</sub> production rate would not decrease and the global warming would not be stopped. But these simple illustrations on the additional 9TW needed clearly reveal that a drastic implementation of green energy technologies is



crucial and a true challenge. Technology wise, it would require extremely low-cost manufacturing technologies and conversion devices composed of materials with atomic elements of high natural abundance. Due to the complex political and economical situations, Europe is not ready to take drastic measure to tackle this problem despite our full dependence on Russian gas. Noteworthy, there are other possible energy scenarios for the future. Indeed, gas is to Russia as sun is to Africa. The other communist power, China, is aggressive and realizes that the many resources including solar radiation are in Africa. China is giving present to countries like Burundi, constructing road in the capital for “free”. But “there is nothing like a free lunch”.... Despite previous tensions between Africa and Europe, the African population (not the politicians) is really welcoming ideas see the European coming back with fair deals and promote the development of their countries as brothers. Beside awareness of political investments, Europe has maybe little gas and sun, but it has brains. Exploratory research has still a major role to play and many exciting initiatives are emerging, for instance using printing technologies for creating large area solar cells.

Finally, another key eye-opening fact is how the energy is actually converted. Using fossil energy sources, nuclear power or even solar radiation, the energy conversion to other more practical energy forms (such as electricity) is mostly realized via thermal energy with a mean efficiency of about 40% or less<sup>4</sup>. Hence, 60% or more of all energy sources is lost in heat! The major part of the thermal energy produced is rejected in the atmosphere and oceans as waste heat. Hot gases ( $T > 600^{\circ}\text{C}$ ) can typically produce electricity via heat engine (thermodynamic cycle), however

it becomes less economically advantageous for hot gases and warm fluids in the low and medium ( $20^{\circ}\text{C} < T < 600^{\circ}\text{C}$ ) temperature ranges. Thermoelectric generators (TEGs) are explored as a potential technology to transform part of this waste heat and natural heat source in the  $20\text{--}600^{\circ}\text{C}$  into electricity. If via these TEGs, which are semiconducting devices, we could recover a mere 1% of the primary energy contained in coal, natural gas, oil, and nuclear energy that we consume in the UE-27, we would get 191 TWh/y of electricity<sup>5</sup>. Also, if one could improve by 1% the efficiency of all engines thanks to TEGs implemented in vehicles, the  $\text{CO}_2$  emission would reduce by 42 millions tons  $\text{CO}_2/\text{year}$ <sup>6</sup>. Those numbers imply a massive implementation of TEG co-generators in Europe. A massive implementation of TEGs put requirements on the thermoelectric (TE) materials and thermoelectric generators. TE materials must be: efficient, stable, environmentally friendly, composed of elements abundant in nature, and synthesized with a scalable method. Also, low-cost manufacturing process of the TEGs must be addressed. Nowadays manufacturing constitutes 50% of the cost for a TEG. At the moment, such materials and manufacturing method do not exist and constitute the main bottle neck for using this technology.

In my project entitled “Organic Thermoelectric Generators” financed by the European Research Council, my team at the Laboratory for Organic Electronics of Linköping University (Sweden) is developing plastics that conduct electricity. We are optimizing their thermoelectric properties and demonstrated that thin films of conducting polymers possess efficiency for heat-to-electricity conversion about five times less than the best inorganic thermoelectric materials based on non-abundant element: bismuth and telluride<sup>7</sup>. It took

us few more years to understand the reason and discovered that those samples are the first semimetallic polymers<sup>8</sup>. The beauty of using polymers compared to inorganic materials is that can be processed from solution and do not require high temperature sintering. Today, many challenges remain to create a viable technology and we still do not know the exact potential of this new class of thermoelectric materials. We are working closely with the research institute ACREO, a key player in printed electronics ([www.printed-electronicsarena.com](http://www.printed-electronicsarena.com)), and hope to be able in few years to replicate micro-thermoelectric generators on large areas with low-cost printing techniques. This is just our tiny contribution in the hope for a green world.

1 The holy bible, Revelation 16: 17-21

2 Global Climate Change Impacts in the United States . Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA. ([www.epa.gov/climatechange/images/science/ScenarioTempGraph-large.jpg](http://www.epa.gov/climatechange/images/science/ScenarioTempGraph-large.jpg))

3 US Census Bureau, International data Base ([www.census.gov/population/international/data/idb/worldpopgraph.php](http://www.census.gov/population/international/data/idb/worldpopgraph.php))

4 Bernard Durand, “Energie et Environnement” (ISBN : 978-2-7598-0001-8).

5 <http://www.eea.europa.eu/data-and-maps/figures/primary-energy-consumption-by-fuel-1>

6 “EU energy and transport in figures” (ISSN 1725-1095).

7 O. Bubnova et al., Nature Materials 10, 429 (2011).

8 O. Bubnova et al., Nature Materials 13, 190 (2014).



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# BFS blue Enterprises technology

When removing CO<sub>2</sub> is not longer a problem and becomes an opportunity...

According to the recent Fifth Assessment Synthesis Report presented in Copenhagen by the Intergovernmental Panel on Climate Change (IPCC) to face the irreversible effects of climate change greenhouse gas emissions need to fall as much as 70% around the world by 2050, and to zero by 2100. Implementing such reductions poses substantial technological, economic, social, and institutional challenges. In this context BFS blue Enterprises has developed a unique technology to capture, neutralise and transform industrial CO<sub>2</sub> emissions into products with applications in a range of markets including energy, pharmaceuticals, nutrition, cosmetics, and biotechnology. Using a sophisticated technology to accelerate the power of nature, BFS hopes to provide a feasible mitigation pathway for the CO<sub>2</sub> emissions.

## The problem

Because of the human cycles of production and consumption, our food, energy and environment are intricately linked. With the consistent global development of the past century, it is increasingly difficult to satisfy our world with sufficient food and energy. Meeting these demands has a direct impact on the environment, especially through the emission of greenhouse gases, particularly atmospheric CO<sub>2</sub>, which is currently at an unprecedentedly high concentration of nearly 400 ppm (September 2013).



Figure 1. BFS' tested and certified (SGS) Industrial plant that absorbs CO<sub>2</sub> emitted from an adjacent cement factory. Plant Tour: <https://www.youtube.com/watch?v=v33kNULlvs>

According to the global scientific and environmental community (UN, NASA, IPCC, EPA, etc), if current emission rates continue, we will soon reach a point of no return: irreparable damage resulting in a lack of potable water, changes in food production conditions and increased mortality rates from natural disasters such as floods, storms, and droughts. Climate change is not merely an environmental issue; it has deep economic and social implications. Though many of these natural phenomena have already been documented, energy from fossil fuels has allowed for most of society's modern comforts, making it difficult to implement changes in behaviour.

According to the International Energy Agency, \$1 trillion is roughly the amount of investment needed worldwide each

year for the next 36 years to stave off the worst effects of global warming and keep the Earth habitable.

## When CO<sub>2</sub> becomes an opportunity

BFS technology presents some of the answer to the big problems we have represented so far with much lower investment.

BFS technology presents a unique technology (3rd Cycle of CO<sub>2</sub>) to accelerate CO<sub>2</sub> reduction based on Carbon, Capture, Conversion and Neutralisation (C3N). C3N is an alternative, or in some cases complementary, to the CCS technology. In BFS technology CO<sub>2</sub> is captured, but instead of being buried, this is used to feed marine phytoplankton (the building blocks of life) that capture the CO<sub>2</sub> via photo-

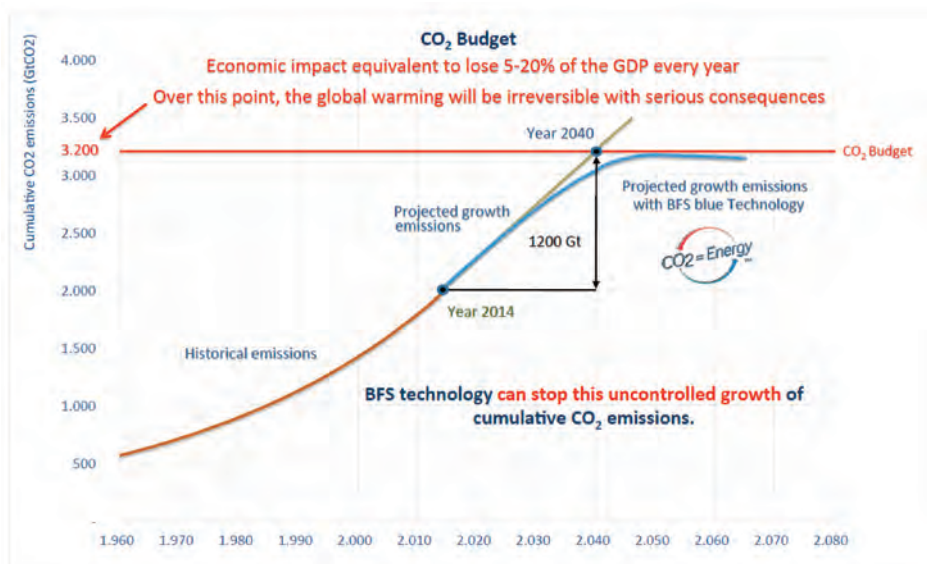


Figure 2. Worldwide CO<sub>2</sub> Budget. Potentiality of BFS blue Technology to capture and neutralize the CO<sub>2</sub> emissions

synthesis and transform it into value-able bioproducts with applications in a range of markets including energy, pharmaceuticals, nutrition, cosmetics, and biotechnology:

- Food. Some other products can be essential for food.
- High value products (Omega 3, antioxidants, vitamins, sitosterols, polysaccharides, natural colorants, etc.) from a commercial point of view.
- True alternative to fossil fuel; storable, high-density energy to be used even to get all the derivate products that currently are obtained from fossil oils (plastics, paints, chemicals, etc).

With patented technology, BFS Blue Enterprises cultivates these marine phytoplankton on an industrial scale with a fully-automatised, aseptic process to ensure high-quality, homogenous production throughout the year. Because of the modular nature of the plant (seen in Figure 1), production is divided into sectors to produce different products, making BFS technology highly adaptable to market demand.

### 0 CO<sub>2</sub> emissions are possible maintaining our lifestyle

Reducing imminent climate change is in our hands, but the solutions proposed to date will supposedly change our current lifestyle and infrastructure; is this one so great as to make it as difficult for states to agree to a joint action investment?

Nevertheless, BFS Blue technology proposes to maintain our current energy model **without changing our current lifestyle or infrastructure**, with a much lower investment. For example, in order to reduce 100% of the emissions coming from the combustion of crude oil in EU, an annual investment of 38,3 B€/year, around 0,4% of the GDP every year up to 2050 is needed; from this point on, no additional investment would be needed anymore, and the plant would generate a revenue of 544 B€ per year.

There are also some figures, not related to the climate change, that allow us to understand that the real magnitud of the investment is not so high as it seems:

- Mobile apps sector has revenues of more than 38 B€/year.

- 1,7 T€ is the annual worldwide budget for military expenditure.

- Development of the F-35 Joint Strike Fighter has a total cost of about \$1.5 trillion over the course of 50 years, or \$29 billion per year.

Mankind should react whatever the cost implied in mitigating the climate change, but with the combination of innovative technologies, it can be done without drastic changes and expenses; in fact, the plant not only has the ability of capturing CO<sub>2</sub>, but generating revenues with the production of high value products. Never CO<sub>2</sub> was such a good business.

### Conclusions

It's important to comment that the potential of the technology goes beyond European Union, or to reducing the CO<sub>2</sub> coming from crude oil emissions. In figure 2, we can see an example of the worldwide CO<sub>2</sub> budget (before the non reversible global warming) and the effect of BFS blue technology in a global project.

**BFS** blue

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# A New Catalyst for an Ancient Bulk Chemical

A research group at DTU Chemistry shows, that zeolite recrystallization allows synthesis of extremely efficient gold nanoparticle catalysts

**T**his latest research from DTU Chemistry could revive one of the oldest processes in the chemical industry, namely production of acetaldehyde from ethanol. This principle has the potential to apply to a range of new catalysts.

A group of researchers at DTU Chemistry and at the Max-Planck-Institute für Kohlenforschung has managed to oxidize ethanol effectively and selectively into acetaldehyde by use of a novel type of zeolite catalyst with encapsulated gold nanoparticles.

"This is likely to be a favourable, green alternative to the so-called Wacker process, which dominates the world's current production of acetaldehyde. And hopefully this is just the beginning. This type of catalyst will in principle apply to a range of other reactions," says Associate Professor Søren Kegnæs from DTU Chemistry. DTU has patented the new type of catalysts, and Søren Kegnæs and his group hope that industry will be interested in cooperation on this.

## Gold nano-particles

While most other attempts to encapsulate metal nanoparticles in zeolites have relied on expensive additives and complex procedures, this new approach is both simple and effective. Crystals of the zeolite silicalite-1 are modified by recrystallization, which creates intra-particle voids and mesopores. The recrystallization is

performed in the presence base and a surfactant, which protects the outer surface of the crystals. Since the zeolite crystals are porous, the base will penetrate into the crystals and begin to dissolve them from within. The trick is to stop the process at the right time, when the inner voids have the optimal size. The voids will then be filled with a precursor solution containing a metal salt. The confined space provides ideal conditions for preparation of small and disperse gold nanoparticles inside the zeolite crystals.

## A clever way to use bio-ethanol

To prove their creation of efficient catalysts, the researchers chose to catalyze oxidation of ethanol into acetaldehyde.

"We chose the ethanol process, because bio-ethanol receives large attention these years, since it is a renewable resource," Associate Professor Søren Kegnæs explains.

"If you want to use ethanol as fuel you need to get rid of the water content, which will cost you a rather high amount of energy. It would thus be interesting to find an alternative use of the bio-ethanol in which a high content of water is not a problem. This is the case for the production of acetaldehyde," notes Søren Kegnæs.

"Also, this revival of ethanol as source for production of acetaldehyde has some benefits in comparison with the

use of ethylene, since ethylene is produced from crude oil which is a non-renewable resource."

The results are published in *Angewandte Chemie, Oxidation of Bioethanol using Zeolite-Encapsulated Gold Nanoparticles*.

## International cooperation

Associate Professor Søren Kegnæs emphasizes the cooperation on this project between DTU Chemistry and the Max-Planck-Institute which was made possible by a grant from the Danish Council for Independent Research (FTP).

"The cooperation takes place in a very open atmosphere, with a high degree of sharing ideas and having students visit for shorter or longer periods of time."

**DTU Chemistry**  
Department of Chemistry

**Søren Kegnæs**

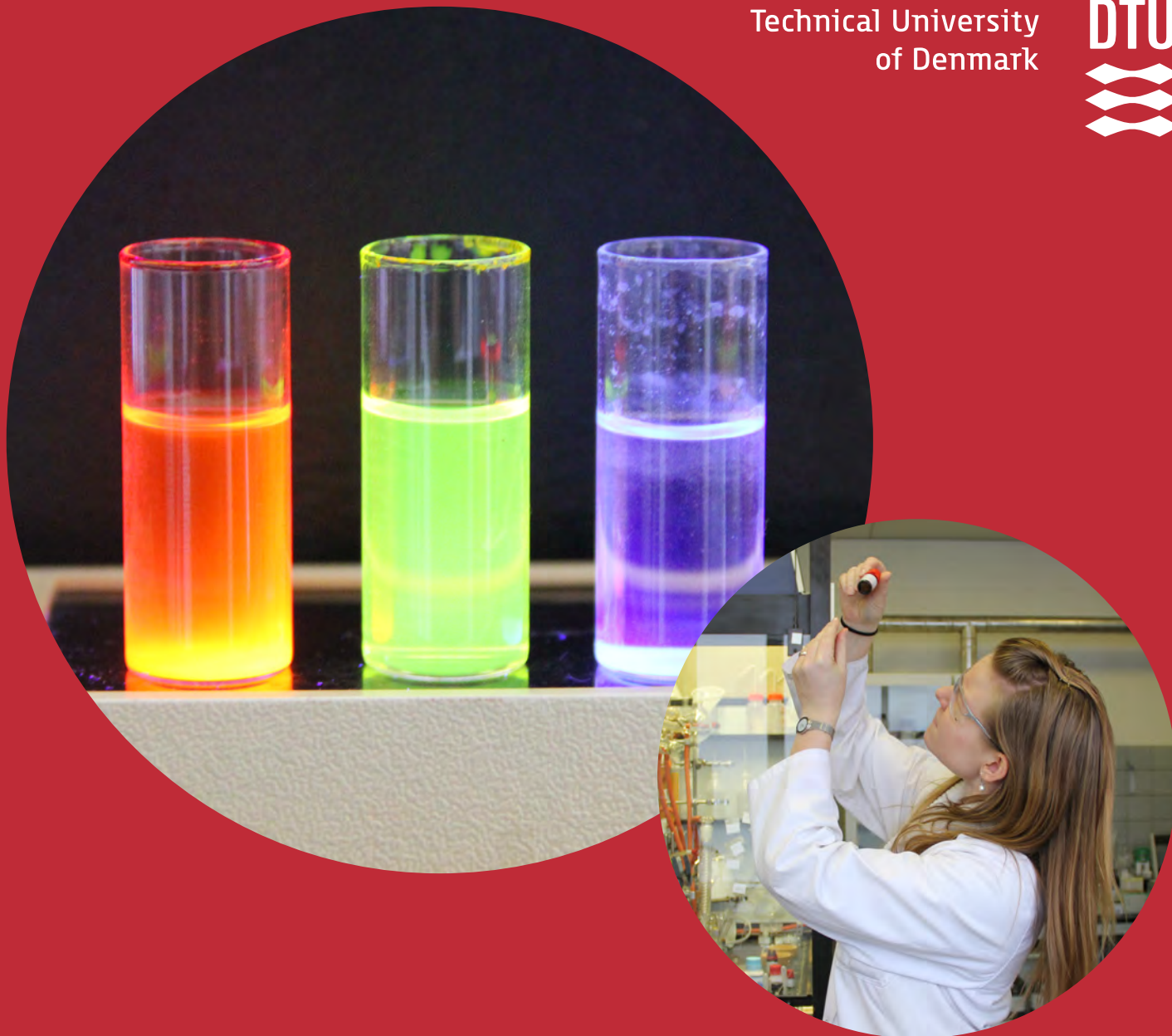
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Technical University of Denmark

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**Read more: [www.dtu.dk](http://www.dtu.dk)**

# Thermal Energy Storage at the University of Lleida

In 1999, the research group GREA at the University of Lleida already saw the importance of thermal energy storage (known as TES) in today's energy systems. The main advantages of TES are a reduction of energy costs, a reduction of energy consumption, an increased flexibility of operation, a reduction of initial and maintenance costs, and an improvement of indoor air quality in buildings. Although energy storage is already acknowledged for its potential by policy makers, TES is still disregarded. Thermal storage may be stored by elevating the temperature of a substance, by changing the phase of a substance (such as melting ice at 0°C), or with the use of the energy involved in chemical reactions.

TES, therefore can be applied in the grid, in the industry, in buildings, and in our cities. At the University of Lleida, several applications have been demonstrated, and are shown here. One of them is the use in buildings to reduce their energy demand, demonstrating that TES is one of the tools to be used, together with the use of renewable energies and consumer



Pilot plant available at the University of Lleida to test TES up to 400°C

behaviour. GREA has a unique demonstration pilot plant, where cubicles of adequate size have been monitored over 10 years.

Another key installation is the one where industry applications are developed, such as use of TES in solar power plants, recovery of waste heat from the industry by implementing TES, or the use of industrial by-products as storage materials.



Pilot plant available at the University of Lleida, where TES is tested together with other energy efficiency technologies (good insulation, solar energy, heat pumps, etc.)



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# Energy at the heart of the Union

**Ulla Sirkeinen, Member of the European Economic and Social Committee's (EESC) Employers Group gives opinion on EU Energy challenges, and the potential of current policy...**

In many ways, European energy policies, which are a shared responsibility between the Member States and the EU, have been successful. Targets for decreasing greenhouse gas emissions and increasing the use of renewable energy sources by 2020 will be met ahead of time and energy efficiency seems to be almost on target. Markets have been opened up and consumer choice increased.

Still, in practice, energy issues have been dominated by national interests and approaches. EU legislation has not been fully implemented and a properly functioning internal market has not been achieved. At EU and national levels, policies on different aspects of energy have been fragmented and often unbalanced. There is widespread concern about overregulation and interference in too many aspects of the energy economy.

Recently, new energy challenges have been brought to the fore. Concerns about security of energy supply have become acute in some Member States. Consumers, especially the vulnerable, have been suffering from increased energy costs in the face of the economic downturn. Industry is struggling to be competitive faced with lower energy prices in competing regions.

In spite of great success in the field of renewable energy, Europe is in danger of losing its frontrunner position. More renewable energy sources are needed to decrease external dependence and emissions. It is already obvious that, in order to function, an electricity system with bigger shares of intermittent renewables requires a market that goes beyond national borders.

It seems that the potential of the current policy approaches has reached its limits in achieving the

energy policy goals of sustainability, security of supply and competitiveness.

**Key EU action**

Facing these challenges, it was necessary for the new Commission to make energy policy one of its 10 priority areas. The vision and roadmap presented in the “Communication on a framework strategy for a resilient energy union with a forward-looking climate change policy” is hopefully convincing to the Member States, Parliament and stakeholders.

However, a clearer message is required on what European citizens and business will gain from the energy union, to ensure the broad support needed.

**Top priorities among many**

The most urgent priority should be action on the cost of energy for citizens and businesses. Citizens are feeling more and more alienated from the EU and when they are now hit by the economic slowdown, their main energy concern is undoubtedly costs. The same is true for businesses and their workers competing on international markets. As the increases in retail energy prices – in particular for electricity – are mainly due to political decisions, correction of this can rightfully be expected.

Closer cooperation and the exchange of information between Member States is necessary in a market – gas or other – where they are faced with a dominant supplier or a cartel. Cooperation should, however, not hinder the functioning of the market.

Updating electricity and gas networks is of key importance for the realisation of the energy union. The need for more interconnection capacity is in many cases obvious, even pressing. It is astonishing that in so many cases the 10% target is so far from being reached. Efforts to shorten approval procedures are most necessary and welcome.

Energy efficiency offers enormous opportunities and requires a wide variety of smart initiatives. Most of the work has to be done nationally and locally. Particularly in the building and transport sectors, energy efficiency potential is considerable. In the future,

efficiency measures and demand-side responses should compete on equal terms in the energy market.

With regard to the decarbonisation of the economy, the COP-21 meeting in Paris is absolutely crucial to achieving sufficient legally binding commitments globally. The problem of carbon leakage must be taken seriously by the EU in the event that Paris does not deliver a proper level playing field.

It is important to ensure that the EU is the world leader on renewable energy. The measures taken have to respect competition and market rules, be market based and avoid increasing end user prices.

EU competitiveness is, however, not only about being best at energy and climate related technologies. It is just as much – or even more – about dealing with energy as a production input as efficiently and sustainably as possible, better than the competitors. This is a broader and securer way to ensure growth and more jobs in Europe.

**Better governance is a must**

Better coherence between different aspects of energy policy as well as between the Member States must be ensured in the future. Action by the Commission is clearly needed to achieve this. The EESC is pleased to see that its initiative for an energy dialogue with stakeholders has been taken on board by the Commission. A detailed action plan on this is now expected. ■

Ulla is also an EESC rapporteur on “Energy Union strategic framework” (TEN/570 opinion)



**European Economic and Social Committee**

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**Member of the Employers’ Group**

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# Investing in climate action

**Vice-President of the European Investment Bank, Jonathan Taylor speaks to Editor Laura Evans about their commitment to climate finance and supporting projects that help make cities more resilient to climate change...**

Climate change is one of the biggest challenges of our lifetime. As the fight to tackle the issue grows, so does the need for investment in order to prevent further damage. Extreme weather events are already being felt worldwide, causing major damage to cities and environments.

One of the many ways to help fight the devastating impact of climate change is reducing carbon emissions. This could be done by using more sustainable forms of energy and transport. The majority of energy we use at the moment comes from burning fossil fuels, which create two thirds of the world's greenhouse gasses. Changing the way we create energy could be the key to creating a greener future.

The European Investment Bank (EIB) is the world's largest multilateral lender by volume, with loans totalling €76bn in 2014. Support for climate related investment and renewable energy is a key priority for the EIB.

Last year alone the Bank invested €19bn for climate action projects. This included renewable energy, energy efficiency, sustainable transport, and climate friendly research and development. Over the last 5 years alone they have provided more than €90bn investment towards reducing carbon emissions and adapting infrastructure to a changing climate.

Vice-President of the EIB, Jonathan Taylor, explains to Editor Laura Evans the role of his organisation and the importance of sustainability.

"As the EU bank, we support climate finance to help build a more sustainable future. We finance investment projects within and outside Europe, which help reduce greenhouse gases and make our society more resilient to climate impacts," Taylor says.

"The European Union has very clear policies in regards to climate change, and how individual member states should contribute to the overall global targets.



“It is important that we make our own contribution to that. Around 25% of all our lending goes to climate related projects and we ensure environmental standards are adhered to in all the projects we finance.”

The EIB supports climate action through a wide range of projects. Their €19bn investment last year included €2.29bn for energy efficiency, and €5.93bn for renewable energy. This included wind energy, solar power, and biofuel projects. The largest area of lending in the renewable energy sector was wind energy at €2.04bn in 2014.

“Energy is a key area, and we have a very clear strategy, and not just from a climate point of view,” continues Taylor. “Energy is also important in terms of security. There is a general objective of encouraging investment in more energy efficiency and diversity in energy.

“Lending to energy efficiency projects by the Bank in 2014 represented our largest ever annual engagement in the sector, with €2.297bn provided for projects in Italy, Spain, India and elsewhere.

“Over the next few years the EIB expects to continue to play a strong role in supporting investment in renewable energy,” says Taylor.

As the world’s largest lender for investment in renewable energy, the EIB in recent years has supported more mature technologies, such as onshore wind, geothermal energy and solid biomass.

“Renewable energy lending in 2014 included €1.377bn for offshore wind farms and €666m for onshore wind projects. In countries such as France, Spain, Morocco, and South Africa support for concentrated solar power and photovoltaic solar power generation projects totalled €530m.

“Across the EU and elsewhere around the world, renewable energy is now established as an essential part of power production,” he added. “With renewable energy expected to become the second largest source of power.”

Some of the projects that are supported and invested in by the Bank not only help reduce the impact of

climate change, but can also help in other areas. For example, retrofitting and upgrading energy efficiency in homes can create jobs as well as reducing energy bills, as Taylor explains:

“The more efficiently we can help people use energy the better it is in terms of their bank balances,” he says.

“For example, upgrading former council housing to make them more energy efficient will help to not only reduce customers’ bills, but also create health benefits and jobs for people carrying out the work.

“The growth of the onshore and offshore wind industry is also helping to create jobs. Companies that were linked to the coal mines in the north east, now have a key role in the offshore wind energy, and this is a crucial element of our investments.”

Over the next 3 years the EIB is expected to lend around €71bn each year, although they do not have any national or sector specific targets. Taylor confirmed the Bank will continue with its 25% commitment to support climate related investments.

However, how this financial support is used will depend on individual projects and their economic viability. The work of the EIB however is only a small part of the picture in terms of climate action.

“There is a lot more to be done,” says Taylor. “We’re doing enough as far as what we do, but that’s only a small part of the overall picture.

“If you look at numbers from the UN which suggest that you need a minimum of another \$100bn of investment annually to properly get anywhere in terms of combating the effects of climate change, particularly in developing countries, then a lot more needs to be done.” ■

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# Towards miniature electron accelerators for a wide range of applications

Particle accelerators have already become useful, and in many cases an indispensable tool in many applications, such as medical treatments (radiotherapy, production of isotopes for PET), industry (material irradiation and sterilisation, industrial radiography) and safety control (cargo inspection).

More than 90% of accelerators in operation nowadays are machines, producing beams of electrons, protons or ions of low and medium energy (up to 50 MeV). The accelerated particle beams are used either directly or for the generation of the bremsstrahlung radiation, namely soft or hard X-rays.

The new growing trend in accelerator technologies is the design and construction of compact electron accelerators, with low power consumption and relatively low costs, whose output beams meet tight requirements determined by the specific application. In addition they must fulfill very stringent limits on the level of the scattered radiation. The most appropriate types of machines are electron linear accelerators (linacs), or electron machines with beam recirculation, like a race-track microtron (RTM).

An example of a compact RTM is a 12 MeV electron accelerator (see the internal part of the accelerator head in Fig. 1). This is under construction at the Microtron laboratory of the Institute of Energy Technologies (INTE) of the Technical University of Catalonia (Barcelona), in collaboration with the Skobeltsyn Institute of Nuclear Physics

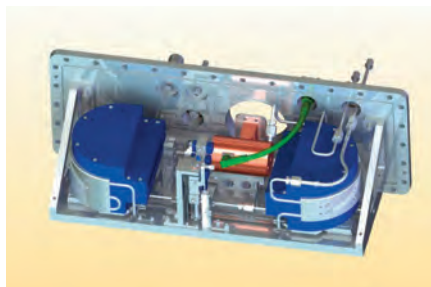


Fig. 1



Fig. 2

(SINP, Moscow) and CIEMAT research center (Madrid). Its main envisaged application is cancer treatment by means of the Intraoperative Radiation Therapy. Due to its principle of operation, the RTM can produce a beam with low energy dispersion and good control of the current and dose. The output beam energies are 6, 8, 10 and 12 MeV, and the change of energy is achieved by simply extracting the beam from a corresponding orbit. In the bending, focusing and extraction magnets of this machine, permanent magnet material as a source of the magnetic field is used. This innovation

makes it possible to place the magnets inside the vacuum chamber thus reducing the dimensions of the accelerator head and dispense with the need for magnet powering. However the magnets must be manufactured and initially tuned with quite high precision. The required technology and tuning methods have been already developed and tested at the SINP.

Another example is a linac for industrial radiography and cargo inspection, designed and built at the SINP in collaboration with industrial partners (Fig. 2). It allows for continuous regulation of the beam energy (from 3 MeV to 8 MeV) and dose, and includes a local shielding with the attenuation coefficient  $10^4$ . Another feature is a vacuum sealed design, which means vacuum pumps are not necessary. These and other novel technical solutions make this linac a reliable machine already ordered by a few industrial companies.

In this article a collaboration of Dr. V. Shvedunov (SINP) and A. Sánchez (INTE) are highly appreciated.



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# **ELECTRIC POWER FOR THE FUTURE**

**At the Norwegian University  
of Science and Technology**



The Department of Electric Power Engineering is among the international leaders for teaching and research within its field. Strong-point areas include energy technology, energy consumption and energy planning.

The Department contributes to research and teaching at graduate (Master's) and doctoral (PhD) levels within its field. As a result, it makes a significant contribution to developing new methods and new technology for efficient and environmentally friendly energy systems.

The Department has a key role in the development of the interdisciplinary Energy and Environment engineering programme at the Norwegian University of Science and Technology. The Department with partners have made this into a high quality professional programme that is tailored to the needs of Norwegian energy utilities and industry.

A major research objective is the further development of environmentally friendly electrical energy technology.

The Department has a range of up-grading and post-graduate courses that cover the key disciplines. These courses are used for systematic staff updating by both energy supply companies and industry.



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# Saving money through energy efficiency

**Gregor Paterson-Jones, Managing Director of Energy Efficiency at the Green Investment Bank (GIB) details how a street lighting revolution could save local authorities millions of pounds...**

The orange glow from their sodium-vapour bulbs is as much a part of the urban landscape as cracked pavements and pot-holed roads. Yet Britain's streetlights cost £300m a year to switch on and off each night.

Street lights soak up an average of 30% of a local council's energy bill, with nearly a third of that light escaping up into space rather than being directed down onto the pavements, roads and car parks where it's actually needed.

Street lighting might not seem the most interesting topic, but in this age of tight budgets and low carbon that we're living through, it's become an ever-more important subject. No matter which party or parties form the next UK government after May's General Election, the amount of money available to local authorities each year in their budgets is going to continue to be under huge pressure.

That's why it's so important for councillors and their officials to get to grips now with spending on street lighting, which can free up cash for other essential services, saving money for council tax payers and cutting our country's greenhouse gas emissions at the same time. One of the best ways of tackling the issue is to switch from using traditional sodium and other inefficient bulbs in our street lamps to the latest generation of light-emitting diodes (LEDs).

Back in the 1980s, LEDs only ever seemed to be used for the "on" light on our hi-fi sets. But since then the cost of producing them has tumbled and now they're everywhere, from the headlamps in our cars to the screens on our televisions.



Gregor Paterson-Jones,  
Managing Director of Energy Efficiency

By switching all of the UK's street lamps from inefficient bulbs to LEDs, councils could cut their collective electricity bill from over £300m a year to near £100m. At the moment, less than 10% of Britain's 7.4 million street lamps use LEDs, but making the switch could cut councils' recurring electricity bills by between 50 and 70%.



GIB has spoken to more than 100 local authorities from throughout the UK over the past year and one of the barriers is the high cost of replacing bulbs with LEDs. But the GIB Green Loan can help councils to spread that cost over up to 25 years. The financial modelling GIB undertakes with each council allows individual loans to be tailored, shaping them to the forecast long-term savings and realising cash savings immediately to help council budgets.

The first local authority to make use of the GIB's Green Loan is Glasgow City Council, which worked with GIB to begin replacing 10,000 lamps along its main arterial roads, with phase 2 of the project looking at replacing a further 60,000 street lamps and their columns.

Standard bulbs also only last for about 15,000 hours, while LEDs can offer 100,000 hours of light, saving time and money when it comes to replacing broken or damaged lamps. All of these advantages mean that local authorities could pay off their initial investment in LEDs in less than 10 years.

But with council budgets under pressure, where is the cash going to come from to pay for the switch from traditional bulbs to LEDs? To get the most out of the new lamps, experts have said that central management systems should also be installed, allowing for remote dimming and monitoring of lights, but at an extra cost.

To help councils pay for their new street lights, the Green Investment Bank (GIB) – the investment vehicle launched by the UK government in October 2012 to use £3.8bn of public funds to kick-start renewable energy projects, energy-from-waste schemes and other programmes designed to reduce the UK's greenhouse gas emissions while also growing the economy – has launched its Green Loan for local authorities.

These low-cost loans give local authorities the chance to “spend to save”, borrowing the money up front to meet the initial outlay and then paying back the capital costs from the money saved on their electricity bills.

The Scottish Futures Trust (SFT), a Scottish government body set up in 2008 to advise public sector organisations on their infrastructure projects, has both produced toolkits for councils on LED projects and is running workshops to assist local authorities in developing such schemes. This has since been adopted by the UK government's Department of Energy & Climate Change (DECC) to cover the rest of the UK.

GIB estimates that switching all of the UK's street lights from bulbs to LEDs could prevent c.475,000 tonnes of the carbon found in carbon dioxide gas from being emitted into the atmosphere, the equivalent of more than 200,000 cars off the road. With compelling financial and environmental figures and GIB's Green Loan offer, let's hope that more councils will be making the switch up and down the country. ■

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# Effective competition to improve quality

Driving change in the electrical distribution network...

Ofgem's recent findings in its review into the electricity connections market<sup>1</sup> published on 21st January 2015, recognised that "Effective competition will help improve the quality of service that customers receive and reduce the cost of connection. Competition can also encourage innovation in the type of services on offer. A well-functioning market for connections to the distribution network should benefit us all – connections that are timely and cost effective help the economy to grow and help to decarbonise the energy we use."

One of the key drivers for change within the UK will be the delivery of a fully open and competitive market place for provision of electrical connections to distribution networks owned and operated by the incumbent Distribution Network Owners (DNO's).

Whilst it is accepted some progress has been achieved, there is still a long way to go. There are many outstanding issues, such as streamlined processes targeting at minimising times not working to maximum durations accessing DNO records systems to enable self-service and self-approval processes. With these arrangements in place, it would provide an open competitive market place aimed at meeting the end customers' needs in a time frame they desire.

From Power On's position, there is a

need to swiftly manage transition of the ability to service our customers' needs with the minimum of DNO engagement.

The proposed national Code of Practice (COP) which is currently being discussed between Ofgem, and the DNO's with consultation with ICP's and IDNO's, if successfully adopted and implemented, will support a truly open and competitive marketplace where quality of service and cost efficiencies can be derived.

The COP will hopefully provide a standard methodology across the UK for enabling connections to be undertaken with minimal involvement or intervention of the DNO. It is hoped that the COP will cover each of the following areas:

- The Customer Awareness of Competitive Alternatives
- Emergency Service for IDNO networks
- Unmetered supply inventories
- ICP to be in control of delivery of the connection
- Contestability of Disconnections on Brown Field Sites, Diversions and Service Alterations
- Construction, Adoption and Connection Agreements
- Land rights process and performance

- Competition in Part Funded Schemes
- Governance

**"...Power On Connections customers have access to specialist expertise and decades of industry experience in traditional and next generation utility infrastructure including gas, electricity, water, superfast fibre and community-based district energy."**

As the UK's No 1 Independent Connections Provider, we have the accredited capabilities and competencies as required by the DNO's to operate and subject to independent audit undertaken by Lloyd's through the National Electricity Registration Scheme. However, despite this routine demonstration of competence, we are still subject to further DNO approval, site audit and review.

Every Power On employee interfaces on a daily basis with the bureaucratic processes which have evolved from the DNO's from enquiry through to the adoption of the assets. Fortunately, throughout the past ten years of engagement, we have developed the knowledge and capability to successfully get through these barriers, but are still at times disadvantaged by the draconian application of maximum times for responses and endless gates of approval and double checking.



Naturally, we are the leading advocates of change and we have leadership roles on all the national debating platforms for Competition in Connections. We are strongly supported by our Sister company, GTC, who are the largest Independent Distribution Network Owner and Operator in the UK to try to drive this requirement forward, which we all believe will deliver improved customer service, shorter delivery times and a more cost effective solution for electrical connections.

Through our sister company, See the Light have developed a relationship with Sky to offer their services across our 300Mb fibre optic network, providing our customers with unrivalled quality service and speed. As well as clean and foul water service connections through our Water business, further complementing our unique utility service provision are our Sustainable energy experts, Metropolitan,

who offer a range of district heating and energy schemes.

We all operate under the same group Brookfield Utilities UK, the leading independent provider of last-mile networks with over 30,000 discrete networks serving over 1.5 million utility connections throughout mainland UK. This means that Power On Connections customers have access to specialist expertise and decades of industry experience in traditional and next generation utility infrastructure including gas, electricity, water, superfast fibre and community-based district energy.

Whilst Power On Connections' core business centers on delivering complex electricity solutions, the company has the power behind it to provide multi-utility infrastructure to every development and being part of a big family in Brookfield Utilities UK has many advantages for our customers. We are able to offer all the traditional

as well as next-generation utility infrastructure solutions through just one partner which gives the best possible customer experience. Utilities are time critical in every development project and that kind of continuity and delivery can and does make a vital difference.

<sup>1</sup> [www.ofgem.gov.uk/ofgem-publications/92527/connections-competitionreviewfindings-pdf](http://www.ofgem.gov.uk/ofgem-publications/92527/connections-competitionreviewfindings-pdf)

**POWER ON**  
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# 2015 – A decisive year for CCS

**Judith Shapiro, Policy and Communications Manager at The Carbon Capture & Storage Association explains why 2015 could be a very important year for CCS...**

The UK 2015 General Election has now concluded, with a much clearer result than anyone had predicted. A Conservative majority government could have a number of interesting implications for the energy industry – and therefore CCS. Looking back over the last 5 years, the coalition achieved a number of important successes; the first and arguably the most important is the implementation of the Electricity Market Reform (EMR) framework – setting in place the mechanism to reward all forms of low-carbon electricity generation. The coalition also committed £1 billion to the current CCS Commercialisation Programme (competition) and together with EMR, we are now undoubtedly in a much stronger position, in terms of financial support for CCS, than we have ever been in the UK. The government has also made several announcements regarding CCS research – including an extra £2.5m to encourage development of CO<sub>2</sub> storage in the North Sea and a £4.2m grant for industrial research and feasibility work at Summit Power Group's Captain Clean Energy Project in Scotland.

Globally, CCS is progressing well - October last year saw the unveiling of SaskPower's Boundary Dam Project in Canada: the first commercial-scale project in the world combining post-combustion CCS with coal-fired power generation. The project aims to capture 1 million tonnes of CO<sub>2</sub> per year – the equivalent of taking more than 250,000 cars off the road – and will make an invaluable contribution to demonstrating the technical, environmental and economic case for CCS. Overall, there are now 22 large-scale CCS projects in construction or operation worldwide – a 50% increase since 2011.

As yet, we don't have a commercial-scale CCS project operating in the UK. If the UK is to catch up with other countries such as Canada, we need to get moving on CCS – and fast. First and foremost, the single most important action on CCS for the new government is to

get both projects in the competition over the finish line – i.e. positive Final Investment Decisions.

Equally as important is the debate around follow-on projects – how many and by when. 2030 is the magical date when it is envisaged that all low-carbon technologies will be able to compete in technology-neutral auctions – based on costs alone. For CCS to reach this point and play a key role in meeting the UK's climate change targets, the Energy Technologies Institute have recently estimated that we will need around 10 GW of installed CCS capacity by 2030 – or approximately 14 projects. The ETI present 3 different scenarios for reaching this 10 GW figure, however all of the scenarios depend on at least 3 follow-on projects reaching Final Investment Decision by 2020 and in operation by 2025. A delay to the follow-on projects would jeopardise delivery of CCS at scale by 2030, with severe consequences for costs and meeting climate change targets.

Last year, the Intergovernmental Panel on Climate Change (IPCC) published its 'Climate Change 2014: Synthesis Report' in which CCS was identified as the essential low-carbon technology needed to help cost-effectively reduce global carbon dioxide emissions. The report found that without CCS the total cost of limiting CO<sub>2</sub> emissions could increase by 138%.

The next 12-18 months will be crucial for CCS and decisions taken by the new government will determine whether or not the UK has the foundations for a successful CCS industry. ■

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# Biomass to energy in Finland

**Mika Järvinen Associate Professor at the Department of Energy Technology at Aalto University details how new technologies can further increase biomass potential...**

**R**educing fossil CO<sub>2</sub> emissions in our energy systems has driven research to new ways of biomass conversion to form methane and bio-oil. Up to now, the technologies applied, gasification<sup>1</sup> and fast pyrolysis<sup>2</sup> are close to being commercial technologies as applied in 3 recently commissioned plants.

As an example Fortum Oy operates an integrated fast pyrolysis plant in Joensuu (Finland) producing 50000kt of bio-oil per year which is combusted in adjusted oil burners for power and heat production. In its GoBIGas plant Göteborg Energi (Gothenburg, Sweden) produces 160 GWh per year of bio-methane which is fed in the local gas distribution network. Lahti Energia (Finland) gasifies pre-sorted solid waste (solid recovered fuel, SRF) to yield a gas which is combusted to generate power and heat with an efficiency of 88%.

However, utilisation of solid waste and very wet biomass fuels for efficient energy conversion to high-grade fuels still bears challenges, but research in advanced technologies is ongoing.

The gasification of solid waste is very challenging as waste streams contain high amounts of ash, alkali, chlorine and heavy metals. Circulating fluidised bed (CFB) reactors are a promising conversion technology due to their high fuel-flexibility. Although in operation, gas cleaning before combustion in the waste gasification plant in Lahti still poses a challenge, resulting in considerable maintenance costs and plant availability issues. This situation could be alleviated by improving the conversion of solid waste into a cleaner gas product by optimising operational parameters. Related research is conducted at Aalto University in a newly deployed test rig. Although still challenging, CFB gasification of waste has shown to be a highly efficient and clean pathway to recover energy from waste.

Another challenge imposed by biomass fuels is the often high moisture; 40-60% for vegetational biomass and up to 95% for aqueous biomass such as sewage sludge and algae. Making them suitable for conventional gasification or combustion requires extensive drying which can account for up to 30% of the energy contained in the biomass which deteriorates the process efficiency.

Hydrothermal processes, in which the biomass' water content is used as a reaction facilitator, are currently investigated. Among those, supercritical water gasification shows promising results for processes in which very moist biomass is converted into chemical fuels such as bio-methane or hydrogen. Water becomes supercritical at pressures and temperatures above 220 bars and 370 °C, respectively. At which, water's physical properties combine an advantageous mix of vapour and liquid ones and allow more efficient gasification. Experimental results obtained in cooperation between Aalto University and Åbo Akademi show that wet biomass can be gasified in supercritical water at high temperatures into high-grade syngas (mainly H<sub>2</sub> and CH<sub>4</sub>) without significant contaminants. ■

<sup>1</sup> Gasification is the partial combustion of a fuel at high temperatures in an oxygen-poor atmosphere. Organic compounds are broken down to form mainly hydrogen, methane, carbon monoxide and dioxide.

<sup>2</sup> Fast pyrolysis is the decomposition in an oxygen-free environment at temperatures of approximately 500°C. The main product is a complex liquid mixture of higher hydrocarbons.

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# Hydropower – revolutionising electricity generation

**Simon Hamlyn, Chief Executive Officer at The British Hydropower Association sheds light on how hydropower could play an essential role in reducing carbon emissions...**

**T**he British Hydropower Association [BHA], was established in 1995 and has over 180 members. It is a trade membership association solely representing the interests of the UK hydropower industry – from micro to large scale – and its associated stakeholders in the wider community, in the UK and overseas.

Hydropower, which over 150 years ago revolutionised electricity generation in the UK, is a flexible technology that has improved and been refined over many years. Its site specific features make it highly innovatory in application which makes use of a wide range of resource available, large or small, pumped storage or run-of-river, tidal range, canals or even water treatment works.

The first water turbines were built in the mid 1800's and they have been developing ever since. Turbine efficiencies are rarely below 80% which is about double that of a steam turbine. The cost per kW of clean energy is the lowest of all renewable technologies over the full lifetime of the scheme and there are 7,400 [BIS 2025] people directly employed in the UK hydropower industry.

Hydropower currently produces around 20% of the world's electricity and 90% of the world's renewable power.

Most of the hydropower in the UK has been developed but recent resource studies have indicated that as much again of undeveloped potential is still viable. At present 30% to 40% of the UK's renewable generation is provided by hydropower, whilst globally, 17% of energy is supplied – and will continue to be supplied – from hydropower sources.

As an established technology, hydropower offers long term generation beyond the subsidy period and hydropower schemes have an 80-year life compared to 25 years for wind, solar PV and AD; 35 years for nuclear.

On average 70% of the cost of a new UK hydropower scheme is in civil construction which is procured locally. The majority of new small schemes are in remote rural areas, providing valuable energy and income in a way which is environmentally sensitive, and has strong community support and involvement.

Hydropower is an important and valuable contributor to the UK renewables mix and to achieving the UK's low carbon targets. It offers a unique and attractive combination of low lifetime cost and a local/UK based supply chain.

The Department of Energy and Climate Change (DECC) is undertaking a review of the Feed-in-Tariff (FiT) scheme – the subsidy mechanism for renewable technologies, which will report during 2015. The BHA has been inputting into this process to try and ensure that by working constructively, DECC can deliver an effective and affordable scheme that provides future support for the sector.

The overriding problem facing the hydropower sector is how government is reducing the level of the Feed-in-Tariff (FiT), in a way that is unduly severe and detrimental to future growth.

At the moment, once all the paperwork is gathered for a proposed scheme, the subsidy is applied for and usually granted by DECC. However even though the subsidy is “pre-accredited” and the plant may never

be built, DECC still counts the number of megawatts expected to be produced and reduces next year's FiTs accordingly.

In 2013, 75 megawatts were pre-accredited – which is about 5 times the amount of schemes built in a typical year. Yet as DECC counts the number of megawatts that is actually produced it resulted in a 20% cut in subsidy last year.

**“Hydropower is an important and valuable contributor to the UK renewables mix and to achieving the UK's low carbon targets. It offers a unique and attractive combination of low lifetime cost and a local/UK based supply chain.”**

Last year 90 megawatts were pre-accredited – about 6 times what is normally produced in a year, causing a 20% cut in subsidy this year.

The BHA agrees that the FiT has been good for hydropower. Before FiTs was introduced, c2-3 MW of small-scale hydropower was connected per annum. Since the FiT was introduced in 2010-2014, c65MW of new hydropower has been connected.

However government support for small-scale hydropower in the UK is essential, otherwise even with all the associated benefits both environmentally and economically, small scale hydropower development in the UK will effectively cease.

The rapid speed at which government has allowed the FiT to be degressed has caused a dramatic decline in new hydropower projects. This is a totally unanticipated result of linking the pre-accredited schemes, rather than just those that have been deployed, with the degression mechanism.

A great number of concerns have been raised with DECC about the current FiT structure and the BHA are keen to assist government in ensuring the review is completed in a timely and effective manner, and avoids any unforeseen consequences for the hydropower sector.

There are several important changes to the current FiT scheme that the BHA has requested government to consider in their review, which include;

- A revision of tariff levels to stimulate further hydropower development;
- De-coupling the degression and pre-accreditation mechanism;
- A revised degression mechanism that creates a 'glide path' rather than the current 'sharp steps' approach;
- The introduction of a grace period for grid connection delays where the project would have connected on time but for delays that are not the developer's fault;
- Extending the pre-accreditation 'window' to allow time to reach financial close. With delays of 3-4 months – sometimes longer – in granting preliminary accreditation, the current system is not delivering the length of guarantee that was the original policy intention.

Some of these changes are urgent, and require a fast-track review in order to prevent unintended but grave harm to the sector. The BHA, other renewables organisations and their members, strive to ensure that the potential and associated economic benefits of hydropower are fully realised. However it is essential that there is genuine government understanding of the current issues and a willingness to provide the support required to secure the future of the industry.

Let's not forget that hydropower is the world's leading renewable energy source and the oldest method of harnessing clean power – the first watermills were used over 2,000 years ago, so now is not the time to confine such a legacy to the renewables scrap heap. ■

.....  
**Simon Hamlyn**  
**Chief Executive Officer**  
 British Hydropower Association  
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# Hydropower vs ecology

Society's conflicting demands for more renewable hydropower and improving the ecological status of European lakes and rivers: Is it possible to meet both requirements?

The water management authorities face a contradicting dilemma in EU directives regulating the management of water resources in Norway and Europe. The European Water Framework Directive (EU WFD) and the Nature Diversity Act seek to preserve and improve the ecological status of lakes and rivers, whereas the European Renewable Directive and the el-certificate market promote increased production of renewable energy to reduce greenhouse gas emissions.

Norway has the potential to export renewable and flexible hydropower energy, and to serve as a "green battery" for Europe, but the above-mentioned market drivers and environmental considerations call for knowledge based and applied solutions that optimise the trade-off between renewable energy production and the preservation of local environmental conditions, and multiple user interests in existing and planned hydropower projects.

## The RIVERCONN research project

The research project "Hydropower and Connectivity in Inland Rivers" – RIVERCONN, funded by the Norwegian Research Council, aims to provide new knowledge of the ecological requirements of migratory fish species in inland rivers in Norway. The key species are the salmonids European grayling (*Thymallus thymallus*) and brown trout (*Salmo trutta*). The E.

grayling are declining in numbers across Europe and are even redlisted by some countries. Many grayling populations in Norway are still viable, but several new hydropower projects give rise to a growing concern amongst fishermen as well as environmental management authorities. Hydropower dams have already fragmented many river systems in Norway, and they represent barriers or hindrances for migratory fish species. In the Glomma river, which is the largest river in Norway, 12 hydropower dams are established in the main river. These obstacles and river development raises an important question for both the hydropower companies and the water management authorities: What is the ecological significance of preserving migratory life histories? Is the preservation of a variety of naturally evolved life histories relevant to the EU WFD?

## Why stress fish migrations and life histories?

Fish migrations are adaptations that allow fish to utilise several habitats to optimise survival, growth and reproduction, i.e. obtain greater net benefits and thus lifetime reproductive output. Hence, human actions that reduce or prevent fish migrations, reduce habitat quality and water flows are expected to cause reduced individual and population fitness. As a consequence, this may lead to declining populations and poor resilience capacity. Mitigation measures have primarily

focused on the stocking of hatchery reared fish to sustain and support sport fishery in regulated inland rivers in Norway, and partly on safeguarding upstream migration past hydropower dams. However, the obvious requirements for wild fish to perform return migrations past hydropower installations have by far been neglected. The EU WFD focuses on improving the ecological status of lakes and rivers, and one of its main goals is to restore the ecological connectivity of fragmented river systems. The Norwegian water management authorities have clearly stated that stocking hatchery-reared fish does not improve the ecological status of degraded water localities. Hence, it is urgent to develop new measures that safeguard natural recruitment and production of wild fish populations.

Traditional mitigation measures in fragmented rivers, such as the stocking and construction of fishways, need to be evaluated in light of new knowledge and legislative recommendations regarding their ecological effects. Fishways in European rivers have rarely been evaluated for functionality, and dysfunctional passage routes may cause high mortality and traceable evolutionary responses in wild fish populations. The scientific literature also reports an increasing body of studies showing that compensatory fish stocking programs may have limited positive or even detrimental effects on wild fish populations.

## **Suspension of compensatory stocking of brown trout in large river in Norway**

In 1991, the environment authorities ordered the hydropower companies in the Glomma to release more than 50,000 two-year old hatchery-produced brown trout annually. The main goal of the stocking program was to maintain the important sport fishery in the river. However, relatively few resources were allocated to evaluate the effects of the program, which is also due to common practice. Fish stocking is a relatively inexpensive and simple measure to mitigate the negative consequences of hydropower development. However, the authorities and fishermen experienced a lack of success. The artificial produced brown trout had higher mortality and grew slower than wild fish. Few cases of large and attractive stocked fish in the catches of anglers were reported. In 2010, NINA implemented boat electrofishing as a new survey method in large rivers like Glomma, and the results showed that few stocked trout survived their first winter in the wild (NINA Report 1056). A big proportion were eaten by the piscivorous northern pike, and 80% of pike diet constituted more than 80% hatchery-reared trout in some reservoirs during the weeks after release. At the same time, boat electrofishing surveys gained new knowledge about the wild populations of grayling and trout, and NINA concluded that their population status should be improved despite the hydropower production. In addition, one could not exclude that the fish stocking could have a negative effect, e.g. because of undetectable outcome from competition for food and shelter, on the wild fish populations. In 2014, the water management authorities decided to revoke the stocking program.

The decision was made without major protests from municipalities or fishermen. For many anglers, both locals and visitors, wild fish are increasingly more sought after compared to stocked trout.

## **Is it possible to improve the ecological status in regulated rivers?**

Society has decided to produce renewable hydropower in Glomma, and undamming the river is not yet considered a relevant question in Norway. The concept of environmental design seeks to optimise the trade-off between continued hydropower production and environmental considerations and preservation, e.g. how to safeguard migrations or habitat requirements of fish without losing too much hydropower. This is a research-demanding challenge, but NINA and partners in the "Centre of Environmental Design of Renewable Energy" ([www.cedren.no](http://www.cedren.no)) have developed this concept in regulated salmon rivers in Norway. Our advice to the water management authorities in Glomma is to start the process to develop this concept also for fish species like the European grayling and brown trout. To succeed with the concept of environmental design, we first have to reveal the ecological bottlenecks necessary to improve the ecological status of grayling and trout, and thereafter work out the most effective mitigation measures. Some emphasis should be placed upon threshold values for spillwater release necessary to maintain ecological connectivity. The results from the RIVERCONN-project imply that it will be mandatory to pay much effort into improving facilities for safeguarding two-way fish migrations past many hydropower dams in the future.

In conclusion: It is beyond doubt that hydropower developments generally have a negative impact on river ecosystems, but there is a great potential to reduce negative effects using environmental design to reveal ecological bottlenecks and work out goal-oriented mitigation measures. This will demand a more proactive approach applying dose-response trials designed by fish ecologists, hydropower companies and water management authorities in Norway. Supplementary stocking of hatchery-produced fish in the Glomma river is a past regime, and we should probably realise that preserving wild fish and ecological functionality after hydropower development in complex river systems like Glomma are far more demanding and expensive than continuing the supplementary stocking program. But on the other hand it will be more effective and the ecological status will be improved according to EU WFD.



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# A fuel poverty crises – why only infrastructure will do

**Bryn Kewley, Campaigner at the Energy Bill Revolution explores the facts behind our fuel poverty crises and calls on the next government to make home energy efficiency a national infrastructure spending priority...**

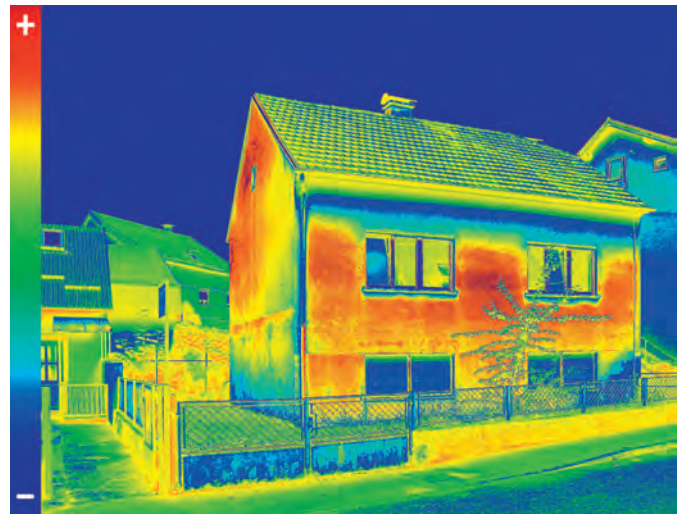
Shortly after the 7th May one man will hold the keys to No.10 Downing Street. The question is whether any of the contenders to be Prime Minister have a solution to one of the biggest threats to the UK's most vulnerable people.

Fuel poverty in the UK is at crisis levels. According to one European survey, only Estonia has a worse record. We're not talking about an extra sniffle or a few cold toes. The harsh reality is that thousands of people die every winter because they simply can't afford to turn on their heating. The UK has almost 30,000 Excess Winter Deaths a year on average with 30% of these attributable to cold homes. This is far more than in Scandinavian countries which have much colder winters. The stark truth is that cold homes cause more deaths in the UK than road traffic accidents, alcohol or drug abuse.

Two million children are also growing up cold in the UK. They face twice the likelihood of contracting respiratory diseases like asthma, are more susceptible to multiple mental health issues and will probably suffer a lower educational attainment than their peers in warmer homes.

The primary cause of this crisis is the fact the UK still has some of the least efficient housing in Europe. The UK has toyed with more energy efficiency policies than any other country in the world, but lessons have not been learned and they are failing.

Over the last 2 years the number of energy efficiency measures being installed in UK homes has fallen by 80%. It's been an energy policy car crash. The new flagship energy efficiency loan programme, the Green Deal, has led to only 5,000 homes being

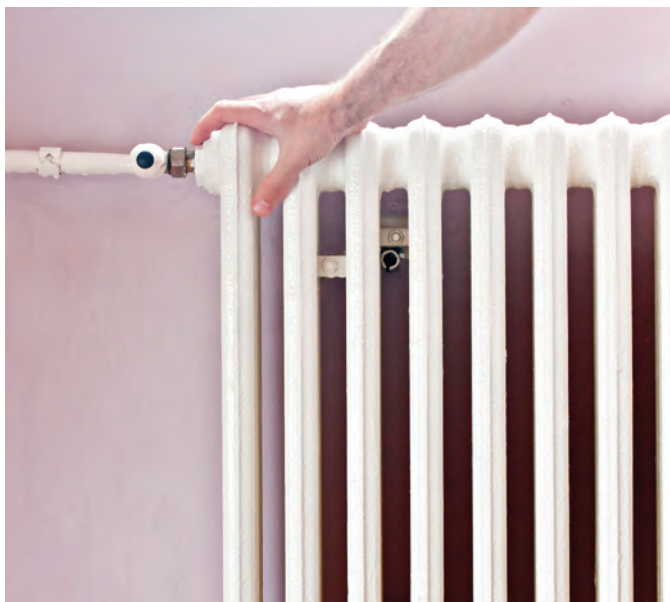


retrofitted since the start of 2013. It was supposed to be taken up by at least 100,000 households in the first year. But the interest rates are too high and the offer too complicated.

The heavy lifting has been left to the Energy Companies Obligation, a levy on energy bills to subsidise energy efficiency measures in UK homes. But in the wake of high energy bills the levy has been cut back and the targets reduced. This has left fuel poor households without almost any major insulation support during the last winter. This is a winter in which the Association for the Conservation of Energy estimates 13,000 people died because they lived in cold homes.

Not all countries have chosen this path of low ambition on energy efficiency. The Swedes build and retrofit their homes to a high standard of energy efficiency. The gas they use to heat their homes costs more than ours; yet because they live in such well insulated and efficient homes they have proportionally half as many people in fuel poverty.





The findings show that every £1 invested by the Treasury would see £3.20 returned in GDP, another £1.27 returned to HMT in tax and a further 42p saved by the NHS. This programme would completely pay for itself within 8 years. Importantly, its economic benefits are so great it would be classified as a high value infrastructure investment. And of course it would end the UK cold home crisis.

The key message from this ground-breaking research is that home energy efficiency investment is spectacularly good value for money. It appears that this value has been badly underestimated by economic ministries across Europe until now. Whole house retrofits to make our homes super energy efficient are one of the best investments a country can make.

The Energy Bill Revolution is a major alliance campaign in the UK to turn things around. The alliance of 200 charities, businesses and unions is calling for a stable, secure and long term revenue stream to retrofit UK homes to a high energy efficiency standard. The solution is to make home energy efficiency a national infrastructure spending priority. If energy efficiency is going to be the first fuel, it needs investment.

**“The harsh reality is that thousands of people die every winter because they simply can’t afford to turn on their heating. The UK has almost 30,000 Excess Winter Deaths a year on average with 30% of these attributable to cold homes.”**

Over the next 5 years alone, the UK government plans to spend over £100bn of public money on infrastructure projects such as road and rail. But despite the fact buildings are infrastructure, not one penny of this budget is yet pledged to retrofit homes.

This is a huge missed opportunity, the economic returns are vast. Cambridge Econometrics, one of the most respected economic institutes in the UK, took the Energy Bill Revolution plan to retrofit all UK homes and calculated the macro economic and fiscal impacts. The programme includes grants for all low income homes and 0% loans for everyone else.

We now wait to see whether the UK’s political parties will take up the mantle to make home energy efficiency a UK infrastructure investment priority. Imagine standing on the doorstep and being able to state that your party, will invest in a massive energy efficiency programme than can save households over £400 every year, boosting the economy and ending fuel poverty.

It’s not just a solution to fuel poverty. It’s a vote winner. ■



.....  
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A photograph of a woman and two children looking at a tablet together. The woman is in the center, smiling, and the children are on either side of her, looking at the screen. The background is slightly blurred, showing what appears to be a kitchen or living area.

# Why not pre-pay?

**We pre-pay for our petrol, we pre-pay for our food and many of us pre-pay for our mobile phones – so why does pre-paying for energy have such a bad rap?**

Utilita want to lift the stigma from prepayment energy – the vast majority of the UK population pay for their gas and electricity via direct debit, waiting for a bill every month which arrives after the energy has been used, making it very difficult to see what is being spent until a huge bill has been ‘racked-up’. Maybe this payment method is convenient but it also comes with its fair share of frustrations if the direct debits don’t go to plan.

**We believe prepayment will find its place in a new energy-smart country.**

Smart metering, as with Internet shopping for retail, has the potential to change the market and customers’ experience of it, particularly in the case of prepayment energy. 13% of people in the UK use prepayment meters to pay for their energy and this number is expected to rise, furthermore a disproportionate number of prepayment meter users are on low incomes.

The first thing we need to destroy is the antiquated view of prepayment meters – if you’re forced to go into a shop to top-up a key, before returning to your home to plug-in and transfer your credit onto your meter (which may often be placed out of easy reach), then you’re with the wrong supplier. The prepayment energy service has evolved, it’s come a long way and it’s time to see its potential and look past its perceived reputation.

As part of a recent Consumer Focus (now Citizens Advice) study on prepayment smart metering in the UK, it was found that many felt there was an information gap related to smart prepayment options: “Technical solutions for smart prepayment are not as common as those for the post-paid sector; therefore, fewer reference models exist that can be drawn upon to help deliver benefit to the customer segment.”\*

Installing free, prepayment smart metering systems in the homes of every customer as part of our ‘Smart Energy’ service, we have over the past seven years learned first-hand what this market demographic need, but equally how it could be benefitting a much wider group.

**Prepayment smart energy has the potential to address many of the issues that those using a traditional prepayment meter face.**

The challenges associated with prepayment and lack of agreed solutions, mean that few suppliers are trialling pre-pay at scale, with the resulting impact that the more challenging pre-pay issues are not being identified or resolutions sufficiently prioritised. Therefore it is anticipated that pre-pay customers, as a customer group, will be the last to benefit from the smart meter rollout.



## So what are the benefits?

### A competitive prepayment tariff

The bedrock of our service is in offering a competitive tariff and developing user-friendly ways to 'pay-as-you-go'. Specifically tailored to the needs of the prepayment market, we understand that people are being penalised on price when opting for a prepayment energy service over a traditional credit meter. We constantly monitor our rates across the nation to ensure our supply of energy is competitively priced and as low as wholesale and distribution costs will allow.

### Control

A 'hands-on' pre-pay service – one that customers can easily understand and use to their advantage. We provide every customer with a free smart meter display allowing them to view their credit balance and usage in real-time; this helps them to budget for their energy at every step.

### No more loss of supply

We understand a factor contributing to the stigma around prepayment energy is the fear that customers could lose supply easily compared with a meter

in credit mode. To combat this, we give every customer access to 'Emergency' and 'Friendly Credit', ensuring they do not lose power during evenings, weekends and bank holidays. The last thing we want is a household left without power and have developed an infrastructure to avoid this where possible.

### Ease of use

Trekking to the shop with a plug-in key to top-up a prepayment supply is archaic and offers the user little flexibility. We offer convenient payment methods such as online and SMS top-up options which meet the demands of modern life.

### Responsive aftercare

We hold extended hours in which customers can reach a knowledgeable Care Team Advisor; we pride ourselves on offering comprehensive aftercare. The 'Big Six' aren't built to cater for this demand, with the infrastructure of larger companies based upon serving credit users alone.

There are over 4.5 million households in the UK on a prepayment supply but the energy market is still dominated by the 'Big Six'. Utilita are pleased to be offering a service tailored to the needs of this market - with over a decade of prepayment experience and over 200,000 prepayment customers, we believe in the future of prepayment energy and the benefits it can, and will, deliver.

\*<http://www.consumerfocus.org.uk/files/2013/03/Smart-Metering-Prepayment-in-Great-Britain.pdf> (Consumer Focus now Citizens Advice)



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Local residents at the launch of Warm Up Bristol

## Warm Up Bristol: City-wide energy efficiency

**A part of Bristol's status as 2015 European Green Capital involves becoming the UK's most energy efficient major city. Here, the Council outline their Warm Up Bristol initiative targeting poorly insulated and energy inefficient homes...**

**B**ristol has some of the oldest housing stock in Europe and each year in the city around £108m is spent on heating homes, a third of which could be saved if all houses were insulated in line with current building standards. That's the equivalent of the UK average annual heating bill for 140,000 houses.

In response to this issue, Bristol City Council recently launched Warm Up Bristol, an initiative offering up to 45 different home improvement measures, designed to make houses across the city warmer, cosier and more energy efficient.

The programme kicked off in October 2014 and will run for 4 years during which time the team aim to fit 30,000 measures across Bristol to help citizens save money and energy.

It's not a one-size fits all solution and measures available range from solid wall insulation to draught proofing, double glazing and new boilers, depending on the best solution for a property. The ambition is to offer something for everyone and advisers from the council's delivery partner, Climate Energy, will be visiting every home in the city over the period to tell people about the scheme.

At the heart of Warm Up Bristol is a community-led approach. To get the initiative off the ground and engage people from the grass-roots up, Bristol City Council has been working with local community energy groups such as the Bristol Energy Network and Easton Energy Group. These groups have been helping to spread the word about the scheme and effectively 'warm up' areas before advisers go around speaking to people – and this approach is working well.

Mareike Schmidt, Service Manager of the council's Energy Service, said: "We're running the most ambitious energy efficiency scheme in the country in Bristol as we want to help people improve their homes.

"It's not just about energy efficiency and carbon savings, but rather the benefit of living in a cosy home. We want to give people one less thing to worry about and with energy bills continuing to rise, insulating your home is one way to counter rising costs in the long-term."

To make the benefits of installing energy efficiency measures more palpable, the team has opened a Warm Up Bristol show home in Easton, which is open to the public 3 days a week. It's complete with an energy-themed mural on the outside so it's easily identifiable and is staffed by the volunteers from Easton Energy Group who are on hand to tell people about the scheme and what's on offer.

Mareike continued: "One of the barriers to people insulating their homes is that it can be quite intangible and hard to imagine what solid wall insulation and other energy efficiency measures look like in practice. The show home helps us overcome these issues as people can come and take a look around and speak to a local community group about the scheme if they want to find out more.

"As well as local community energy groups, we've been working with Streets Alive which is a local charity who organise street parties to engage people. We want to make insulation fun and engage people in any way we can as it's a hugely important scheme to the city."

The show home is fully equipped with external and internal wall insulation, underfloor insulation, loft insulation, new double-glazed windows, a humidity sensitive ventilation system, new gas condensing boiler and water saving features as well as rain water which is used to feed the garden.

Around the corner in Easton, the Demonstrator Streets can be found. These are the homes of people who won a competition to have solid wall insulation fitted on their homes. The competition was organised

by Bristol City Council to build a buzz around Warm Up Bristol ahead of launch and it was hugely successful as over 100 people entered in Easton alone.

In the context of Bristol's European Green Capital year, energy is one of the key themes and Warm Up Bristol is central to this. Delivering the programme will help the city reach its ambitious carbon reduction targets, whilst also helping Bristol along the way to becoming the UK's most energy efficient major city. Warm Up Bristol is also supporting jobs in the industry with local SMEs doing the majority of the installations.

Mayor of Bristol, George Ferguson, has been championing the scheme from the offset. He said: "Warm Up Bristol gives a huge opportunity for us to address householders' energy needs and costs. We are working with local communities with the ambition to engage residents right across the city. Real change comes from the community and I'd like to personally encourage all to grasp the nettle.

"This is a cause that is central to our Green Capital status and will lay a vital part of the foundations for Bristol to be the most sustainable city in years to come."

Funding for Warm Up Bristol has come largely from the European Investment Bank under the European Local Energy Assistance ELENA programme, as well as Energy Company Obligation funding provided by EDF Energy, and £7.2m from the Department of Energy and Climate Change – the largest funding pot allocated to any local authority. There is special funding available for landlords with the lowest energy efficiency rated properties, as well as funding for what's known as 'Green Deal Communities' in Bristol who have particularly hard to treat properties. ■

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[www.warmupbristol.co.uk](http://www.warmupbristol.co.uk)  
[www.bristol.gov.uk](http://www.bristol.gov.uk)  
[www.twitter.com/BristolCouncil](https://twitter.com/BristolCouncil)

# Delivering affordable and renewable energy in Cheshire

**Councillor Michael Jones, Leader of Cheshire East Council explains how geothermal energy will help to secure the Borough's economic future...**

**T**he British Geological Survey has identified Cheshire East as one of only 6 areas in the UK with the potential to generate huge amounts of energy from deep geothermal heat.

So it is only right that Cheshire East Council is at the forefront of discussions with potential partners to develop ways to turn this potential into a source of long-term, renewable energy.

It is estimated that geothermal reserves in the Cheshire Basin hold around 4.6 million gigawatt hours (GWh) of zero-carbon, low-cost energy, more than 6 times the national heat demand of Britain.

There could be potential to generate 100 gigawatt hours a year within a 2.5km radius of Leighton West in Crewe, which has been identified as an ideal site to bring hot water to the surface.

To give an idea of the scale of this energy source, it is enough to provide every UK resident with a daily shower for 142 years.

Geothermal energy is a key project in the Council's recently published Energy Framework, which will contribute to its vision of delivering affordable, renewable and decentralised energy and creating new energy businesses.

The benefits to residents will be competitive energy prices from renewable sources and a resilient, low-carbon, decentralised energy network.

The prize is huge and so is the up-front cost. The first phase of the geothermal project will require a £37m investment to drill down 4.5km to the hot water.

This money would come from private sector investment, revenue from heat sales and renewable heat incentive funding.

Despite the scale of the challenge, there has been a lot of interest from a range of international companies including the utility market, the geothermal development sector and from institutional investors.

**"Geothermal energy is a key project in the Council's recently published Energy Framework, which will contribute to its vision of delivering affordable, renewable and decentralised energy and creating new energy businesses."**

We are excited by the level of market interest and this has encouraged us to look in more detail at the feasibility of this project.

We have signed a partnership agreement with Keele University, just over the border in Staffordshire, to carry out major research backed by an £88,000 government grant.

The Council is contributing to a Natural Environmental Research Council-funded PhD studentship at Keele which will enable a talented graduate to analyse Cheshire East's geothermal potential and work out the best way to release the energy.

This work – alongside other projects in our Energy Framework – puts Cheshire East at the forefront of research into new sources of renewable, low-cost energy.

With the help of a grant from the Department for Energy and Climate Change (DECC), we are carrying





out a feasibility study into how we can attract private sector investment into district heating schemes in urban areas of Crewe. We are also looking at other projects to tackle energy poverty in rural areas.

The geothermal project is only one part of our efforts to innovate. The way forward is through low-carbon technologies, local energy solutions and self-sufficiency.

Our approach demonstrates the flexibility, innovation and teamwork that we are bringing to bear in order to realise our ambitions.

I am determined to eradicate fuel poverty within the borough and this is not just a vague policy objective. We have taken concrete steps to achieve it by becoming the first local authority to become a direct supplier of gas and electricity to the public since the markets were nationalised in 1947.

With our partners OVO Energy, we launched Fairerpower, a domestic energy supplier, in March

this year. Within 3 weeks we had signed up 1,000 customers and saved them an average of £250 each.

Energy is a fundamental need, essential for the welfare of our residents and for the success of our economy.

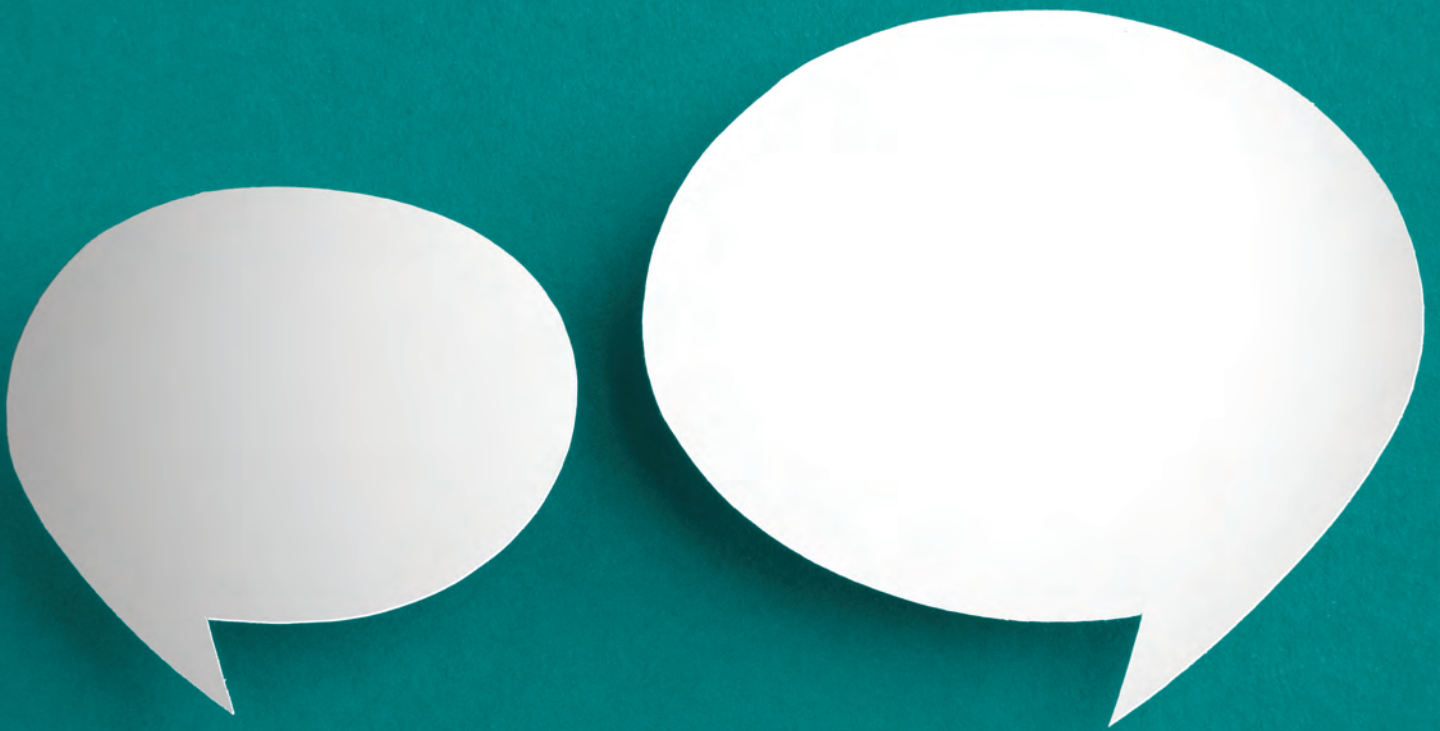
I believe that the approach we are taking in Cheshire East is the right one. By taking a lead and bringing in partners who can move these projects forward, we will make a huge contribution towards securing the economic future of the Borough's residents and businesses. ■

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**Councillor Michael Jones**

**Leader**

Cheshire East Council

[www.cheshireeast.gov.uk](http://www.cheshireeast.gov.uk)



# YOUR OPINION MATTERS

Whether you agree, disagree, or have another viewpoint with any news and features on our website, we want to hear from you.

Leaving a comment on any item on our website is easy, so please engage and join the debate today.



# The importance of adequate rail infrastructure financing

**Libor Lochman, Britta Schreiner and Hans Besser from CER – the Voice of European Railways, emphasise the importance of infrastructure investment throughout Europe...**

**M**obility is vital for the European Union's internal market, for the quality of life of Europe's citizens, and for society as a whole.

Effective mobility requires a modern, efficient and multimodal infrastructure network, where transport modes are properly interconnected, and each mode is able to perform where it is most efficient. Such a system will transport people and goods at the lowest possible cost, with the highest efficiency and with the least emissions.

Investing in transport infrastructure is also essential for economic growth, and the creation of wealth and jobs. In 2011 the transport sector in 28 EU Member States directly employed 1.6 million people and generated €1.3tn in turnover<sup>1</sup>, or 10.2% of GDP. A recent study conducted by research company Ecorys<sup>2</sup> suggests that the impact on indirect employment in the rail sector is substantial: employing 1 person in the rail sector will lead to the creation of 1 other job in a related sector, such as manufacturing.

## Defining Europe's transport needs

Given the importance of the transport sector for economic growth, the European Commission set ambitious targets in the 2011 Transport White Paper, in particular for the rail sector:

- A shift of 30% of road freight over 300 kilometres to rail or inland waterways by 2030 and more than 50% by 2050;
- A tripling of the length of the existing high-speed rail network;
- A fully functional EU-wide multimodal TEN-T core network;
- The connection of all core network airports to the rail network by 2050.

In addition, the Europe 2020 Strategy, the EU's agenda for growth and jobs for the current decade, imposes challenging climate change and energy targets on all parts of the economy, including transport: a 20% reduction of greenhouse gas emissions compared to 1990, raising the share of EU energy consumption from renewables to 20%, and a 20% improvement in energy efficiency.

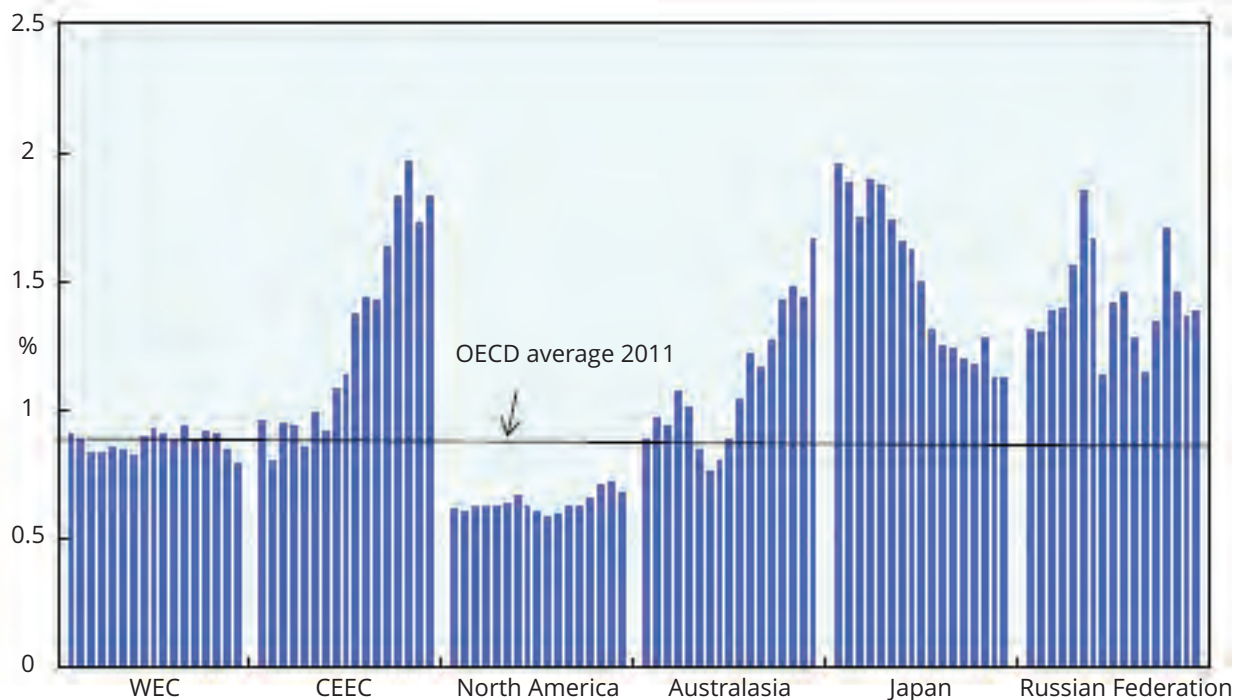
## The missing gap

These ambitious goals for a competitive and resource-efficient transport system require substantial financial resources. Significantly more than the €1.5tn identified by the European Commission in the 2011 Transport White Paper will be needed between 2010 and 2030 in order to create a well-performing and environmentally sustainable transport network in Europe.

Despite different financing models, all European infrastructure managers struggle with the same common challenge of having to maintain their standards of quality and performance, while facing increasing expenditures on maintenance and upgrades resulting from an aging rail infrastructure.

At the same time, slow economic growth, a growing unemployment rate and an ageing population have put enormous pressures on national governments in Europe to finance transport infrastructure. Data from the International Transport Forum (ITF)<sup>3</sup> shows that the share of government spending on transport infrastructure is falling. The percentage of GDP spent on inland transport infrastructure in Western Europe fell from 1.5% in 1975, to 1.0% in 1982, to 0.8% in 2011. In





Source: International Transport Forum at the OECD.

Investment in inland transport infrastructure between 1995 and 2010 (as a percentage of GDP, at current prices and exchange rates)

Central and Eastern European countries (CEECs), it rose from 1.0% in 1995 to its peak of 2.0% in 2009, after which it dropped to 1.8% in 2011. Instead of serving as a catalyst, transport infrastructure investment has been trailing behind the growth of the economy.

## Consequences of underinvestment

Poorly maintained infrastructure and deferred renewals and/or upgrades will lead to speed restrictions and delays. In the long term, a growing maintenance backlog and deferred investments will have serious cost and planning implications on the management of the rail infrastructure. It creates uncertainty and may lead to the closure of lines. A loss of competitiveness with respect to other modes will be inevitable.

A typical example of insufficient rail infrastructure financing can be found in South-East Europe. Due to a lack of financing, the rail infrastructure network over there has been running deficits in maintaining their network for many years. As a result there are thousands of permanent speed restrictions; additionally, numerous tracks had to be closed.

## Current action to improve rail financing

Member states, European institutions and the rail sector have to work together to find solutions for

ensuring adequate, efficient, appropriate and reliable long-term funding for the rail transport system. The European Union supports these efforts with different financial and political programmes.

One important example of this is the newly adopted Trans-European Transport Network (TEN-T) Regulation and its accompanying financing tool, the Connecting Europe Facility (CEF). Under the CEF, €26.3bn will be made available for financing transport infrastructure projects for the period 2014-2020, with a focus on improving technical standards, removing bottlenecks, missing links, and projects of European added-value. The majority of the funding will be reserved for rail and inland waterway projects. The Connecting Europe Facility is therefore an important step towards a sustainable transport network.

Another policy instrument which can lead to significant benefits in terms of rail infrastructure financing is the introduction of multi-annual contracts. Multi-annual contracts (MACs) between governments and infrastructure managers improve the predictability, efficiency and transparency of the use of funds for the construction, maintenance and renewal of infrastructure. In this type of contract, governments commit to pay a certain sum to the infrastructure manager each year

for investments in infrastructure, in return for which the infrastructure manager commits to a series of quality and efficiency obligations. Multi-annual contracts thus facilitate a shift from compensation for expenditures to performance-related payments.

Directive 2012/34/EC reinforces the application of such contractual agreements in member states, and specifies the scope, structure and performance targets to be implemented by 16 June 2015. Such contracts force both parties to take a long-term view, and to develop maintenance plans on the basis of future demand and the infrastructure manager's business plan, leading to better cost control and reduced unit costs.

Finally, together with the European Investment Bank, the European Commission is currently exploring innovative financing solutions, including the possibility of attracting private investors for funding rail infrastructure projects. Financial markets could fill the financing gap as long as rail projects can generate a positive rate of return on the investments.

### What still needs to be done

The adequate financing of rail infrastructure is a necessary but not sufficient condition for the development of a modern and efficient rail system. Also necessary are fair and balanced framework conditions for all transport modes. Member states can introduce policy measures intended to change the behaviour of all players involved. Price signals play a crucial role in influencing traffic and travel behaviour in the transport system.

The introduction of a user-based financing system is one example of a government-driven policy measure for financing the wear and tear of transport infrastructure. Such systems are used by governments in many European countries to finance maintenance and renewal expenses of motorways. Contrary to the rail sector, where track access charges are obligatory under EU law, user charges in other transport modes are non-compulsory. As a consequence, their use varies strongly between countries, leading to price distortions between modes and between member states. User charges can also be a tool for financing new infrastructure where there is high traffic demand with a high revenue stream, allowing user charges to remain at the level which the market can bear.

Another policy measure is the internalisation of external costs. Fully applying charges for external costs can generate revenues for member states and ensure financing for new transport infrastructure. Switzerland is a good example of the application of the polluter pays principle. The 57km-long new Gotthard Base Tunnel beneath the Swiss Alps is due to open in 2016/2017. The construction of the railway tunnel is funded by the Swiss public transport fund, which is fed mainly by the kilometre-based heavy vehicle fee (HVF) payable by all trucks over 3.5 tonnes using the Swiss roads. Calculated on the basis of total weight, emission level and kilometres driven, the aim of the HVF is to internalise the external costs of trucks, therefore applying the polluter-pays principle, and encourage more freight onto rail. In this respect, the EU is unfortunately still trailing behind their Swiss neighbour.

### Conclusion

To sum up, the rail sector is ready to make its contribution to the customers and the environment, but can only do so if these basic principles for infrastructure financing are applied by all transport modes in a fair competitive environment. ■

<sup>1</sup> EU Transport in Figures, EU Statistical Pocketbook 2014

<sup>2</sup> The Economic Footprint of Railway Transport in Europe, Ecorys, October 2014

<sup>3</sup> Spending on Transport Infrastructure 1995-2011, International Transport Forum, 2013



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# Asset Management, how do we manage Asset Debts?

**A**sset Management under ISO 55000 is generating the highest value over the lifetime of the Assets, often decisions are made to postpone or reduce regular maintenance, this article describes the consequences and why not executing regular maintenance is not a saving but creates an Asset Debt.

It is a paradigm shift to move from maintenance management thinking to Asset Management. First what do we expect from our Assets, that is often not only a financial result, operating in a safe and healthy environment and delivering the products or services on time are key ingredients of the Assets Value. However financial results for companies do count and are important, especially when there is an economic downturn. Also for public companies the short term results are much more important than longer-term results, generating short-term thinking, which is a contradiction of true Asset Management.

## How is this attitude affecting our Asset Management?

Many companies are under financial pressure and are looking for quick savings, with little or no (measurable) consequences. Maintenance is an easy target, first and for all because financial people often lack the technical insight to understand why maintenance practices take place and the maintenance people are often not fully educated to demonstrate the (long) term financial results of their activities. This results in the maintenance budget under unequal pressure,

leaving the maintenance manager to cope with the consequences. What are his challenges?

Our Assets need to produce against the agreed deliverables, in a safe and healthy and environmental friendly way against minimal cost. However if we have to go below the minimal cost the maintenance/asset manager do have the challenge to make the right decision. Health and Safety are non negotiable nor reducing the amount of services/products. Hence the only variable is the Asset Lifetime. This doesn't show an immediate negative result, but it reduces the company's value and it increases the risk of failure before the natural end of life of the Asset.

When maintenance is postponed, wear occurs and we are creating "Asset Debt". Our Asset was expecting care that it didn't receive and wears out quicker than expected. Even worse it gets when necessary replacements are not executed in the required time. The risk of failure increases and an emergency repair may be necessary. Often this is financially not visible in a system that is in common use by maintenance/asset management and the finance department. Especially the immediate positive result for the finance department wins the battle what to do.

## Lets look at an example.

We have an Asset worth US\$ 100,000, with an agreed life of 25 years. The

annual write off in a linear model is US\$ 4,000/year. The company is best in class and operates its Assets with a 2% maintenance budget. This results in a maintenance cost of US\$ 2,000/year. Total annual costs are US\$ 6.000. After 5 years the maintenance department is pressed to reduce their maintenance cost by 10%. This results in an annual cost of US\$ 5,800. The organisation doesn't see the negative effects of the reduced lifetime. However over time the lack of maintenance is becoming to show results and the lifetime is unknowingly reduced by 3 years.

One of the aspects of Asset Management is managing the cost over the lifetime of the Asset. Under normal conditions the cost would be  $25 * \text{US\$ } 6.000 = \text{US\$ } 150.000$ . With the reduced maintenance budget the cost over the lifetime is  $5 * \text{US\$ } 6.000 + 17 * (\text{US\$ } 1.800 + \text{US\$ } 4.545,45) + 5 * \text{US\$ } 545,45 = \text{US\$ } 140.600$ . Running the Asset for 22 years against the normal cost would have resulted in a total cost for 22 years of US\$ 132,000. We see an additional cost of US\$ 8,600 or a cost increase over the lifetime of the Asset of 6,5%, where the organisation was expecting a reduction 3,3%.

Now we have a catch, when the machine is at the end of its life a renewal needs to take place. First there are the acquisition cost, the implementation cost and then the new Asset should operate at similar financial conditions as before. This is a too hypothetical situation to assess.





The only conclusion we can draw is that reducing maintenance is generating an Asset Debt with a potential substantial higher cost for the organisation than executing the proper maintenance program. A lack of visibility in cost and risk during the lifetime of the Asset will lead to decisions that cut corners and cost the organisation overtime a significant additional fee.

This doesn't mean that maintenance can't be optimised. There are many ways and methods to optimise maintenance. The big challenge is to optimise maintenance looking forward to the remaining life of the Asset and to take in account all elements that would contribute to the value = revenue – cost of the Asset. Maintenance as integrated part of Asset Management should be valued against the direct measurable cost, known and calculated risk and known and calculated life of the Asset. A change in maintenance that increases risk or decreases the expected life of the Asset has potentially major financial consequences for organisations and should be assessed as such. An integrated approach is recommended.

The Rail Industry is becoming well aware of Asset Management and

many Rail companies, both in Infrastructure and Rolling Stock have Asset Management programs. The programs are first to educate their staff and second to implement a strategy following the ISO 55000 guidelines or adopting ISO 55000 as a whole.

This adoption of the vision or the standard as a whole will create more visibility of the consequences of Asset Debt. Asset Risk needs to be taken in account against all its functions. Asset Life should be visible against the known programs and a change in managing the Asset should result in visible Asset Debt. This is possible by budgeting over the lifetime of the Asset. Not executed maintenance, hence an optical saving, should be set off against an Asset Debt minimal equal of the saving and possibly substantially higher with the increased risk and decreased lifetime.

In the Rail industry with Assets lasting for very long periods the positive consequences from this mind-set will be significant. Not only within the Rail organisation but also with the Regulator. We have spoken with several (rail) regulators in Europe and governments responsible for the public (rail) transport. They all welcome the transparency

of the required activities and long-term consequences of those activities.

In many countries we have a significant backlog in maintenance in the Rail Industry. Jernbaneverket in Norway presented at the Scandinavian Rail Development conference in Oslo in April a plan to eliminate their backlog. This courageous plan is expecting to last until 2030 and at very significant cost. Jernbaneverket is to be complimented that both the organisation and the government have realised the required maintenance to keep the network operating at the minimal required levels. They are biting the bullet and invest in not only develop new networks, but maintain the existing network to comply with the standards of health, safety, service AND Asset Management.

Other countries with backlog in maintenance in the rail industry are raising questions when suddenly the network doesn't seem to be as reliable as been expected for years or more failures, delays and even derailments take place.

Asset Debt is key to create visibility for the right Asset Management.



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# On the way to a future-oriented railway system

**Wim Fabries, European Rail Traffic Management System (ERTMS) Programme Director at the Ministry of Infrastructure and the Environment in the Netherlands, explains how a system could improve railways in the country...**

**T**he Netherlands has one of the busiest railway networks in the world. The quality and safety of its railways are good, but could be improved. For this reason, the Dutch government has the ambition to raise the quality of the country's railways. An important means to achieving this is the introduction of ERTMS (European Rail Traffic Management System). Through ERTMS, the aim is to raise safety to a higher level and move forward in the areas of reliability, speed, capacity and cross-border rail traffic. The Netherlands has reserved €2.57bn for the introduction of ERTMS, which will be introduced between 2016 and 2028 on EU freight lines, and on the busiest railway routes.

The Netherlands has more than 7,000 kilometres of railway tracks. Around 6,000 trains travel on these tracks each day, carrying more than 1.2 million people. Every day, 350 freight trains bring 115,000 tons of goods to their destinations. Trains are a sustainable means that can handle massive streams of transport while taking up a minimum of space. Our efforts are aimed at improving the quality of the railways so that rail transport is and continues to be an attractive option for both passengers and freight carriers.

To achieve this, the Dutch government chose a new train protection and control system: ERTMS (level 2). The current train protection system functions well, but the electromechanical technology on which it is based is outdated and the system hails from a time when fewer trains ran than at present.

Because of its modern ICT technology, ERTMS is more "fit for the future".

## **What is ERTMS?**

ERTMS consists of a system in the train and a system in the rail infrastructure. The 2 systems communicate with each other by means of wireless communication (at level 2 or higher). This enables continuous contact between an individual train, the track on which it is running and central traffic control. Via a GSM-Rail radio connection, information on the rail route (stating whether a train may continue on or should stop) and on the maximum speed, is transmitted to the train and shown on a monitor screen in the train's cab.

In the current system, train traffic is controlled through signals placed along the tracks. These signals are no longer necessary with ERTMS level 2.

## **What benefits does ERTMS provide?**

In a train with ERTMS, the operator sees all information directly on the screen in his cab, such as the maximum speed on that route and whether the track ahead is clear. What happens when the train operator fails to respond on time? In such a case, the system automatically intervenes.

ERTMS can also contribute to the reliability, speed and capacity on the tracks. This was shown by analyses conducted between 2012 and 2014. The system allows trains to follow one another at a shorter distance. The travel time of trains on some routes also becomes shorter. This enables a better utilisation of the track, shorter travel times for passengers and better adherence to the train schedule.

Cross-border train traffic is also getting a boost. ERTMS is becoming the standard throughout Europe

on international corridors. Because train protection in Europe corresponds between countries, trains can more easily travel from country to country without changing safety systems. This reduces delays at the border.

### How do we work together?

An important feature of ERTMS is the fact that the train and rail infrastructure communicate with one another. This is why the programme is being fully adopted by the government and railway sector. This collaboration is essential for success. We approach ERTMS as a single integrated system that should work both in the train and on the tracks.

For the implementation of ERTMS, we are therefore working in a new manner: as a single programme team with employees from the railway infrastructure manager ProRail, the main rail operator Nederlandse Spoorwegen (Dutch Railways), and the Ministry of Infrastructure and the Environment. Together, they will set up the tendering, contracting strategy and the training of operators, rail service managers and maintenance personnel.

We are investing heavily in garnering political and social support, not only because the railways belong to everyone, but also to ensure that all bases are covered and to avoid the plague of tunnel vision when getting the job done. Stakeholders such as regional and freight carriers, consumer organisations, labour unions, and regional government are heavily consulted.

Moreover, ERTMS is being installed on existing railway lines, which is a challenge because the trains must continue to run during the renovation. This is why we are expressly involving consumer organisations and trade unions, as well as suppliers, engineering firms and building contractors.

The goal is to be able to take decisions in 2016 that form the start of the actual call for tenders. This will



be a big step towards ensuring a robust, safe and reliable railway system. Because 176 years after the first train run over our rails, the railways have become an integral part of our country. Trains are essential for our society and our economy. This is why ERTMS is much more than a train protection system; it heralds the switch to a high-quality railway system that is ready for the future. ■

.....  
**Wim Fabries**

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Ministry of Infrastructure and the Environment –  
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# Promoting vehicle safety standards

**Antonio Avenoso, Executive Director at the European Transport Safety Council outlines how new vehicle safety standards can have a positive impact on all our lives...**

**E**very week in Europe, on average, 500 people die on our roads. Since 2001, more than half a million have lost their lives. And yet, the political response to the daily tragedy of those killed by speeding or drunk drivers is very often lacklustre, to put it mildly.

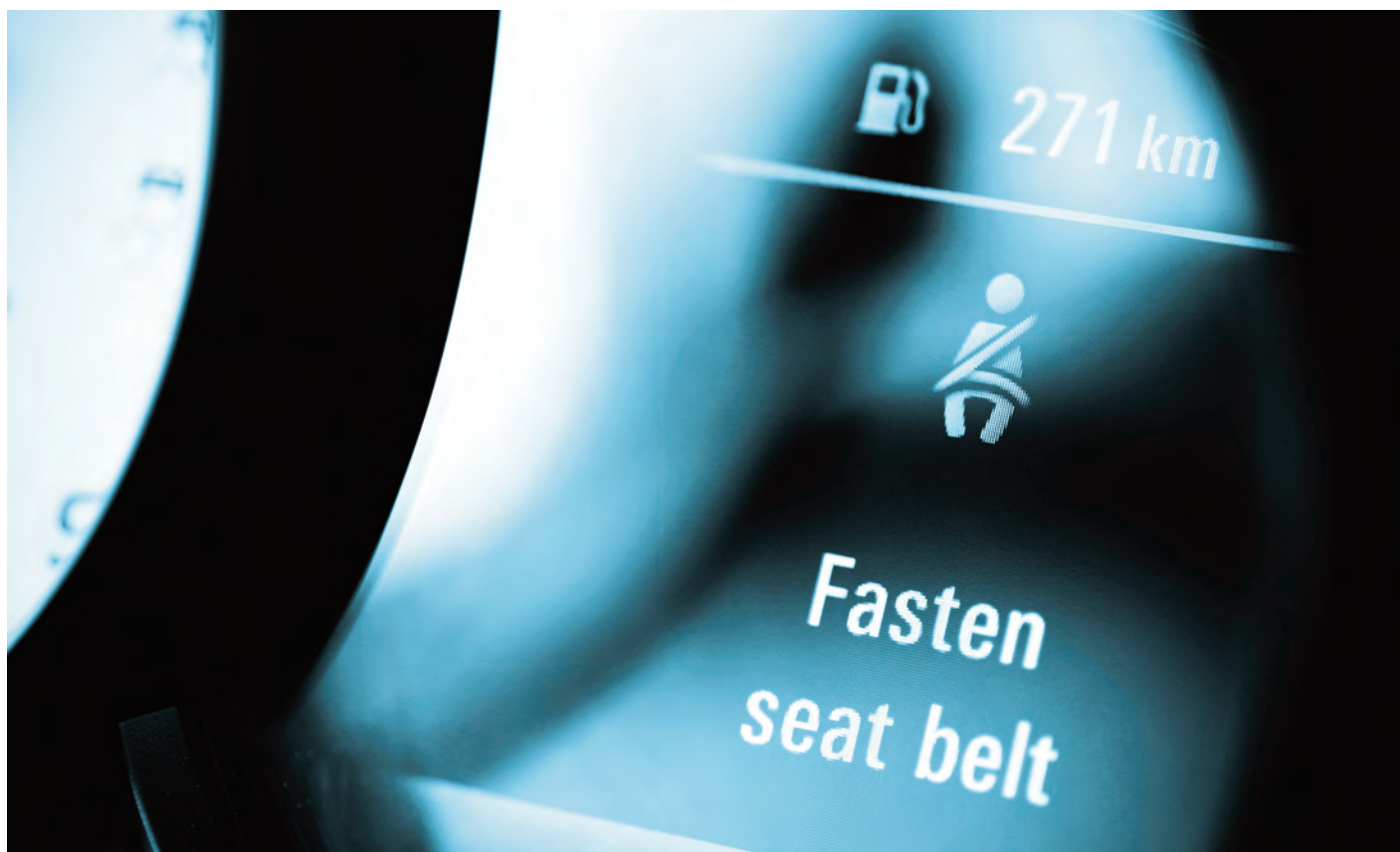
This year Europe has an opportunity to put this crucial issue back at the top of the political agenda and show an increasingly sceptical public that the EU is capable of doing things that have a positive impact on all our lives.

Right now, the European Commission is reviewing the rules which govern the safety requirements of new cars, vans, lorries and busses. Last time these rules were updated, in 2009, several very important technologies were made compulsory including 'Electronic Stability Control (ESC)' and seat-belt reminders (for driver seats). Over time they will save thousands of lives. But most people in Europe don't realise that these features are no longer expensive optional extras thanks to EU law.

So there is now a huge opportunity to improve safety further and, at the same time, show that the EU is capable of doing things that have a positive impact on the lives of everyone in Europe.

In the view of our experts, the most important new technology to be included now concerns speed which is still the single biggest contributory factor in fatal road crashes.

Intelligent Speed Assistance (ISA) uses a GPS-linked database of speed limits, which can be combined with cameras that read road signs, to inform drivers about speed limits and help them to stick to them with tactile feedback (added resistance on the accelerator pedal). This system, which would always be overridable, should be fitted as standard. It would not just limit the top speed on motorways (buses and lorries already have mandatory devices that do this), but would also help keep drivers within the speed limits in urban areas, where they come into contact, and kill and injure, many



pedestrians and cyclists. A recent YouGov survey in the UK found that two-thirds of British adults support this system being mandatory for professional vehicles, including vans.

**“Intelligent Speed Assistance (ISA) uses a GPS-linked database of speed limits, which can be combined with cameras that read road signs, to inform drivers about speed limits and help them to stick to them with tactile feedback (added resistance on the accelerator pedal).”**

We would also like to see Automated Emergency Braking (AEB) systems on all new cars and vans, it is already mandatory on lorries and buses. The latest systems are able to detect not just cars, but also pedestrians and cyclists and apply the brakes automatically and safely.

Seatbelt reminders, currently only mandatory for drivers, should also be extended to cover all passenger seats in the front or back.

These 3 technologies are already available on the market, but usually as options, not as standard.

Finally, the EU needs to do more to stop drink driving, particularly amongst repeat offenders and by professional drivers. We would like the EU to develop a standardised technology for connecting alcohol interlocks, which prevent a drink driver from starting his/her engine. We also believe that there is a strong economic and social case for fitting the devices as standard on certain categories of professional vehicles such as school buses, this is already the case in France and Finland.

We hope that the European Commission see the potential not just for saving lives, but also for showing the public that the EU can have a positive impact on an issue that affects every single one of us, every single day. ■

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# Cost effective solutions in difficult times

Speedar Limited is committed to providing cost effective solutions for the measurement of speed in campaigns to increase road and site safety

Speedar Limited was formed out of Ottery Electronics in 2004, encapsulating the wealth of experience gained by Ottery Electronics staff over a period of 30 years. A designer and manufacturer of speed measurement systems for Evaluation, Education and Enforcement in traffic applications, its core business has historically been in the field of hand held and tripod mounted radar units and Vascar systems. Speedar Limited are the only United Kingdom manufacturer of hand held radar equipment and hold United Kingdom Home Office approval for our Speedar range of equipment.

Speedar products have an enviable reputation worldwide and have been exported to over thirty countries in Europe, USA, Australia, Middle East and the Far East.

Speedar products have been sold to a high number of U.K. Police Forces, and Local Authorities in the United Kingdom as well as NATO forces. It has an increasing presence in the industrial market and can count some of the major corporations among its customers. In addition a recalibration and repair service as provided.

With the commitment by U.K. Government and Local Authorities to make the UK roads safer and reduce the incidents of death and injury, they have funded the provision of equipment to create community



speed watch groups. These groups provide a valuable contribution by monitoring motorists' speed through the villages.

Speedar Limited have supplied hand held radar units and associated training to several speed watch groups. The Speedar range has the advantage of being very robust, easy to use and considerably cheaper than Laser units. This makes it a cost effective choice for Speed watch groups.

A small but flexible company it has some notable achievements:

- **first** to use direction sensing Doppler radar.
- **first** to produce a cordless hand held radar.

- **first** UK designer of the VASCAR system.
- **first** standalone Laser Jammer Detector.

Speedar has a policy of continued product development and continually looks for new products in the fight to make roads safer.

## Construction and Industry

Recognising the increasing Health and Safety requirements on Industrial and Construction sites Speedar Limited has developed its highly successful SpeedVision range. The new SpeedVision SV3R is a standalone unattended unit that can be tripod, post or wall mounted and battery or mains powered. This enables the effective monitoring and recording





of speed violations whilst not endangering operatives standing roadside to operate the equipment. Recording of violations is to a CF card from which photographs with overlaid data can be produced using dedicated software. This has completed tests and literature will be available shortly.

For larger site applications, Speedar Limited is now developing a network version with speed cameras relaying data back to a central control room.

### **Police 'In Car' system**

Speedar has also produced a new range of Vascar systems.

Vascar is a tried and tested method of speed measurement, computing distance and time to measure the average speed over a minimum distance.

This has the advantage of measuring the average speed rather than the 'spot' speed as measured by radar or laser. It also has the advantages of not being able to be detected or jammed.

Now, in line with the modern demand for Video evidence, the new Speedar range of Vascar includes video recording and display, with the Vascar information superimposed on the video.

Integrated with any in-car existing computer system they have the facility to enable the screen to be used as a normal pc display for ANPR and/or Sat. Nav. programs.

The hand held controller is equipped with positive 'feel' switches and audible indication that the switch has

been activated. These systems are designed for easy retrofit into existing vehicles, expanding the functionality and extending the life of existing equipment, thus eliminating the need to change whole systems. Furthermore the Vascar system can easily be removed and transferred when the vehicle is replaced.

Some clever design features and sourcing of quality components ensure that this unit meets the stringent requirements of the UK Home Office HOSDB/CAST specification. These systems have now completed U.K. Police trials, test house testing and have been submitted to the Home Office CAST department for final approval.

The objective of the new Vascar systems is not only to provide a means of speed measurement but also to provide a cost effective solution.

***SPEEDAR***  
*SPEED MEASUREMENT SYSTEMS*

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# Maximising the impact – lowering the risk

**Chris Morriss, Team Leader – Cyber Assurance at the Defence Science and Technology Laboratory (Dstl) details the role of government science and technology, and Cyber Capability...**

The Defence, Science and Technology Laboratory (Dstl) provides cyber advice to the UK government informing both military and civilian domains of potential vulnerabilities and risks. One of Dstl's most recent initiatives, working with both the Ministry of Defence and wider government, is the Cyber Vulnerabilities Investigation (CVI) project.

The aim of the CVI project is to work with those responsible in government to help transition the management of cyber risk into one of business as usual against a backdrop of continually changing technology and threats. There are many enterprise risks in any business, whether that business is defending the realm or providing essential services through Critical National Infrastructure (CNI). This is particularly important for a number of government departments as they have responsibilities to work with selected CNI industry areas.

## Cyber Risk

Cyber is not a risk traditionally captured in an organisation's risk register. There is a strong possibility that nobody will be responsible or accountable within the business governance framework for making sure cyber assets are suitably considered from a protection and resilience perspective. Cyber systems are of course prevalent in all businesses, large and small, and often represent the backbone of operations. Remove the backbone and the organisation will retain little capacity to operate sustainably, if at all. This increasingly becomes a concern as major military systems and operators of CNI adopt a more automated approach due to technology upgrades, efficiency savings and regulatory requirements.

Dstl has a broad and deep science and technology portfolio. It has developed the capability to co-ordinate advice, support and bring rigour and clarity to customers with fit for purpose advice. Dstl is one of a number of organisations in government working together to support a collaborative approach to providing impartial advice to support the National Cyber Security Programme (NCSP). Dstl knows that within the UK supplier base there are commercial entities that can also help provide advice and it actively seeks to leverage these to support this work.

**“Cyber systems are of course prevalent in all businesses, large and small, and often represent the backbone of operations.”**

## Dynamic Domain

The cyber domain is fast moving, evolving and refreshing its technology capability on a regular basis. Visibility of its operation is largely hidden within computing devices and cables (or over the air e.g. Wi-Fi) and it often cares little about geography. Hence, consideration of how to protect the electronic borders or gateways within CNI as well as the devices and software within it are all key considerations. Both information technology networks (IT) and operational technology networks (OT) are areas of cyber risk and should be considered and sponsored appropriately and regularly.

The work that Dstl has been carrying out has identified, at a very high level, that there are 2 elements to mitigating cyber risk. The first of these is the traditional consideration of appropriate technical solutions and assurance. Operating systems such as Windows XP



are no longer supported, so any new vulnerability is unlikely to be patched. These types of issues exist for computing hosts, servers and industrial computing solutions such as programmable logic controllers. The second element is governance, with many organisations not funded for even the most basic situational awareness tools such as network monitoring.

Western industry is a financial construct. As such it will typically invest only as much as it needs to conduct business as usual. This includes investment in cyber solutions. Under static and controlled conditions this would be fine. Unfortunately, the cyber domain is not static, has few borders and can suffer from inside and outside threats, both deliberate and undeliberate (introducing malware as part of uncontrolled media for example) or clicking on a phishing email.

So there are governance challenges regarding investment in cyber risk mitigation from the perspective of protecting against domain threats, staff education (at all levels of a business), cyber policy and control and

audit of devices. Many businesses are now recognising cyber risk and investing appropriately. Dstl has seen a spectrum of maturity in many CNI sectors and is confident that with buy in at the right level, the majority of the risks can be mitigated.

The UK government has a part to play here too. Traditionally, advice to industry has been provided from disparate sources. This is changing rapidly with cyber initiatives such as Dstl's CVI project supporting lead government departments to provide a focal point for industry guidance. ■

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**Team Leader – Cyber Assurance**

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# ABBS Active Mine Protection System Testing Completed Successfully

Global Acceleration Completely Eliminated by Novel Rocket Motor System...

**M**ines and IED's have become the weapon of choice for any terrorist or insurgent organization worldwide and over 70 countries currently suffer from the problem with vehicles regularly being destroyed and people being killed and injured.

To counter those threats ABBS has developed sophisticated Active Mine Protection Systems including novel Linear Rocket Motors (LRM's) which counteract the mine blast forces and prevent it being blown in the air.

The LRM's generate the total impulse required to hold the vehicle down against the mine blast lifting forces and prevent its acceleration upwards. If the mine blast is within the system design specification, the upwards movement of the vehicle will be

completely prevented, so the occupants will not be subjected to any significant G forces, and will not suffer any significant G-related injuries.

The ABBS rocket motors are sufficiently small and light that they can be located easily in many different locations on the vehicles and their Linear configuration provides footprint areas large enough to allow mounting on un-reinforced areas of a standard ballistic steel body.

It is therefore now possible for armoured vehicle OEM's and the military vehicle specifiers to consider multiplying their vehicle mine blast specifications by a factor of 2, 3 or even 4 without adding huge amounts of weight to keep the global acceleration threat within limits. The ABBS rocket motors provide 'artificial weight'

at just the right time, and for the correct duration to counteract the forces generated by the relatively large IED's that are currently prevalent in many conflict areas around the world. A single VGAM motor 1 m long will briefly produce over 50,000kg thrust, so four on a 10 tonne vehicle will make it weight 210 tonnes for just the right period of time required to fully counteract the mine blast forces.

**"...ABBS has developed sophisticated Active Mine Protection Systems which counteract the mine blast forces and prevent it being blown in the air."**

The ABBS AMPS technology is now ready for testing on customers vehicles.



February 2015. Demonstration of ABBS Vehicle Global Acceleration Mitigation system completely eliminating the global acceleration of the vehicle. Vehicle doesn't move at all while the Linear Rocket Motor (LRM) is firing, there is slight spring re-bounce afterwards motor burnout occurs at about 30ms into the sequence. Without the LRM firing the rear of the vehicle is blown about 1m in the air, as shown below



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# Assessing the impact of CCTV

**James Kelly, Chief Executive at the British Security Industry Association (BSIA) outlines why CCTV remains a crucial pillar to public safety and highlights the importance of implementing standards across the sector as a whole...**

**W**ith between 4 million and 5.9 million CCTV surveillance cameras in the UK alone, the CCTV industry, both in the UK and globally, is one of the largest sectors within the security landscape. The application of CCTV is wide-ranging and, as such, is constantly changing and improving in order to keep up with the requirements of modern day society.

It is not just understandable to question the function of CCTV cameras in the UK in order to ensure that cameras are being utilised correctly for their intended purpose – it is essential.

## Crime detection

In terms of crime detection, CCTV cameras are unrivalled in their ability to gather real time intelligence instantly throughout a designated area – not only facilitating speedy responses from the police, but securing much needed convictions in court. Similarly, CCTV cameras in the UK also serve to save money for the public purse; in court criminals are much more likely to plead guilty when faced by the undeniable evidence of being caught on camera.

According to Hugh Marriage, former Home Office Crime Reduction Officer for the south-east of England, “A court hearing with a guilty verdict saves around £3,000 to £5,000 and CCTV pictures mean there has been an enormous increase in guilty verdicts.”<sup>1</sup> Indeed, in 2010 alone, the Met Police stated that 1 in 6 crimes are solved thanks to CCTV solutions.

While CCTV cameras have the ability to aid convictions in this way, it is important that they are installed and maintained properly in order to ensure that they are not badly positioned, out of focus, broken, or simply outdated and providing poor quality images. As

Professor Laycock from the Jill Dando Institute of Crime Science at University College London comments, “It depends on what cameras are being used for and if they are maintained properly.”<sup>2</sup>

## The importance of Standards

Speaking in more detail about the current CCTV standards climate, Simon Adcock, Chairman of the BSIA's CCTV section commented, “In 2012, the Protection of Freedoms Act<sup>3</sup> formalised the government's intention to drive CCTV best practice forward.

“The CCTV Code of Practice<sup>4</sup> – made up of 12 guiding principles – aimed to define best practice in a way wherein public protection was paramount. While the Code of Practice was undoubtedly a ‘step in the right direction’, it is flawed.

“Presently, the Code of Practice only extends to publicly-owned systems. However, the private sector is a key player in the CCTV arena; only 1 out of every 70 CCTV cameras in use are publicly owned, according to BSIA research released last year. The majority of CCTV cameras in the UK are privately owned and, as such, do not fall under the remit of the current code of practice dictated by government.

“Logically, the next step for the current CCTV Code of Practice is the application of its 12 guiding principles to cover privately-owned systems. Not only do they form the majority of CCTV coverage in the UK, they are also responsible for providing significant evidence to Police.”

## Promoting Community Safety

As Simon highlights, research conducted by the BSIA in 2013 suggested that only 1 out of every 70 CCTV

cameras is owned by public bodies. Despite this, both publically and privately owned cameras have the potential to promote community safety. For example, CCTV operators often contact medical services if they see people in the street suffering from illness or injury, as a result of criminal activity or otherwise. In fact, Squires (2000)<sup>5</sup> found that police are called on average 10 to 20 times for every 700 hours of observation.

Given the lack of resources available to the police, achieving these levels of detection would be impossible through patrolling alone. Aside from the fact this would require considerably more manpower; most members of the public would agree that CCTV cameras are preferable to an increased police presence, which could appear overbearing. In fact, one particular study (Brown<sup>6</sup>) found that police commanders believed that assaults on police had been reduced due to cameras allowing them to determine the appropriate level of response to an incident – either by sending more officers where necessary, or by limiting the number of officers to a minor incident to avoid inadvertently inflaming the situation.

Beyond crime, cameras can be used for other purposes to help the public, such as aiding in the search for lost children, monitoring traffic flow and providing updates or to determine if alarms have been activated unnecessarily. Camera footage can also help identify potential witnesses who might not otherwise realise that they could be vital to an investigation.

### The surveillance state myth

To conclude, despite a certain level of scaremongering from the press, the strong CCTV presence in the UK should not be viewed negatively. Indeed the significant number of CCTV cameras in operation are privately owned, rather than state owned. Despite this, communication between CCTV control room staff and



the police presents major benefits for law abiding citizens in terms of ensuring their safety on a day to day basis, as well as presenting assurance that in the event of them falling victim to opportunist criminals, the likelihood of those responsible being convicted is much more likely. Looking to the future, it is crucial that adequate standards are adopted across the entire CCTV sector in order to cement these benefits.

The British Security Industry Association is the trade association for the private security industry in the UK. Our members provide over 70% of UK security products and services and adhere to strict quality standards. ■

For more information, visit the BSIA's website at [www.bsia.co.uk](http://www.bsia.co.uk).

<sup>1</sup> <http://news.bbc.co.uk/1/hi/uk/2071496.stm>

<sup>2</sup> *ibid*

<sup>3</sup> <http://www.legislation.gov.uk/ukpga/2012/9/contents/enacted>

<sup>4</sup> <https://ico.org.uk/media/for-organisations/documents/1542/cctv-code-of-practice.pdf>

<sup>5</sup> [http://www.petersquires.net/wp-content/uploads/2013/02/CCTV\\_and\\_crime\\_reduction\\_in\\_Crawley.pdf](http://www.petersquires.net/wp-content/uploads/2013/02/CCTV_and_crime_reduction_in_Crawley.pdf)

<sup>6</sup> [http://www.popcenter.org/responses/video\\_surveillance/pdfs/brown\\_1995\\_full.pdf](http://www.popcenter.org/responses/video_surveillance/pdfs/brown_1995_full.pdf)

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# Standing up to terrorism and organised crime

**Matthew Finn, Managing Director at AUGMENTIQ discusses the importance of building Europe's capability to fight terrorism and serious transnational organised crime...**

For the better part of a decade the European Union (EU) has been struggling to create a new legal basis to protect its 500 million citizens, while respecting their fundamental right to privacy and the principle of free movement within Europe.

The issue at stake is, or rather was: "to use or not to use sensitive personal data for counter terrorism and serious transnational organised crime". The data in question is Passenger Name Record data, or PNR – essentially the booking information created each time a passenger books a flight.

**"The PIU must have a clear vision and a well-defined set of strategic aims. These will need the support of senior officials from all government departments that have a stake in seeing the PIU succeed for the benefit of the country's national security."**

The recent attacks in Paris altered the landscape and transformed how European policy-makers view the demands of security in the context of personal privacy. The issue is no longer whether to use this data (that decision has been taken), the issue now is 'how' to use it – for what purpose, for how long, by whom, what constitutes conspiracy to commit an act of terrorism and what defines serious transnational organised crime?

## **Creating the legal basis**

In February this year, Timothy Kirkhope, the lead Member of the European Parliament dealing with this issue, tabled the latest draft for what will become the EU PNR Directive. In the weeks that followed,

policy-makers from each of bloc's 28 Member States evaluated the draft and came up with some 800 amendments to shape the final version to be laid before Parliament, negotiated, agreed and ultimately adopted by the European Council. Despite the scale of the task, EU Member States remain confident the new legal basis will be in place by the end of 2015.

## **The journey from policy to operations**

As anyone working in this arena knows well: policy is one thing; operations another. Once the legal basis is in place, it will be down to each Member State to develop capabilities to acquire large volumes of PNR data, almost certainly including intra-EU flights, identify risks, target threats and ensure multiple actors on the ground, (e.g. police, counter-terrorism, customs, border control), are aligned, aware of their individual responsibilities and properly supported to conduct joint operations.

Arguably, acquiring the data and building a system to do something with it is the easier task. There are nonetheless inherent complexities in acquiring the right data in the right format at the right time, and having the right tools and skills in place to analyse patterns, behaviours and relationships that could reveal potential terrorist or criminal activity.

The harder task will be to bring multiple agencies together under one roof: create an environment that builds on the best practices of each, but leaves behind the cultures and practices that limit or inhibit working together as a high-performing team using an array of talents from multiple government departments. The Passenger Information Unit will be an entirely new environment, requiring new leadership, new thinking,

new skills and a mature approach to learning and improving performance over time.

### **Building capability**

A typical and understandable response to the challenge is for governments to focus on the technology needed to build these capabilities. Indeed, technology will be a critically important component. However, there are invaluable lessons that can be learned beforehand, particularly from countries outside the EU in Asia and the Middle East, where a number of governments have experience of working with systems involving the real-time risk assessment of passenger data.

**“A typical and understandable response to the challenge is for governments to focus on the technology needed to build these capabilities. Indeed, technology will be a critically important component.”**

Several EU Member States have already identified an existing agency or department to lead the Passenger Information Unit (PIU). Others are still considering the possibility of creating an entirely new entity. Yet whichever department is ultimately accountable for the PIU, many other government departments will want to shape the thinking around what it can achieve, how it will be organised and how they can share information, ideas, skills and talents to ensure it delivers the right outcomes in the national interest, not just departmental targets.

The PIU must have a clear vision and a well-defined set of strategic aims. These will need the support of senior officials from all government departments that have a stake in seeing the PIU succeed for the benefit of the country's national security.

### **From initiation to optimisation**

The PIU's vision and aims will set the parameters to inform how the unit is designed and managed. It will be important, particularly for ministers and the general public, to have a realistic understanding of what the unit can achieve by when.

On its first day of operation, systems, business processes, budgets and resources will be vague, 'works in progress' or altogether missing. As the unit

matures, processes will be defined, systems will become operational and the knowledge and confidence of using passenger data for risk assessment much greater. This maturity will enable the unit's capabilities and effectiveness to increase and allow the leadership team to focus on optimisation to drive more and better outcomes. With the right approach and support, the PIU can mature quickly and ultimately become one of the nation's most valued assets in the fight against terrorism and organised crime.

### **The way forward**

By late Summer 2015, we will have a clear idea of what the EU PNR Directive looks like and the legal basis that will enshrine each Member State's acquisition and processing of passenger data. Assuming there are no further delays in the legislative process, 28 Member States will have a green light to establish a Passenger Information Unit at the end of 2015. This means the next 6 months present a valuable opportunity for Member States to advance the thinking process and deepen their understanding of their strategic aims, draw lessons from other countries' experiences outside the EU, and work on some of the additional challenges they face in bringing together multiple government departments, creating new business processes, designing and interfacing new systems with existing ones (including systems such as those hosted at EU-LISA and INTERPOL) and developing new ways of working with data and intelligence. This will be vital to help Europe stand up to the growing threat of terrorism and organised crime that affects our societies, our economies and our European way of life. ■

About the author: Matthew Finn is the Chair of Smart Borders and Managing Director of AUGMENTIQ, a consultancy practice working internationally with government and industry to inspire new thinking, drive change and transform operations in homeland security.

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# Realising the potential of drones

**Gerry Corbett, UAS Programme Lead at the Civil Aviation Authority (CAA), tells Editor Laura Evans about the latest technology craze to hit our airspace – drones...**

Technology is beginning to dominate our existence, with the use of smart phones, smart cameras, and even smart TVs. The latest gadget on the market are Drones. These small unmanned aircraft, also known as UAS, can be traced back over many decades through remote control 'model' aircraft and also through military uses, such as target drones and, more recently, as reconnaissance vehicles.

However, today these drones are not just used by the military but by organisations and companies such as Google and the BBC. The majority of drones in use are smaller types to film aerial shots for documentaries, films or for aerial surveys, but an increasing number are now being used for recreational purposes. At a conference in December last year, Gerry Corbett, UAS Programme Lead at the Civil Aviation Authority (CAA), expressed his disappointment at the lack of operators and developers coming forward to test larger unmanned aircraft systems in UK airspace.

Here, he tells Editor Laura Evans about the type of drones we are seeing in UK airspace and the challenges in regulating them.

"We are seeing a lot more coming into use. However, they are nearly all small ones," explains Corbett. "What I mean by small are the types similar in size to radio controlled model aircraft, all of which weigh less than about 20kg. There's not much coming along in terms of what you'd equate more to a 'traditional' manned aircraft.

"Improvements in technology and a reduction in price means there has been a big explosion at the smaller end of the scale in the leisure and recreational market. At the same time we have seen a steady

increase in the number of applications to use them for work purposes, and it's only in the last year or so that people have started using them for recreational photography.

"In terms of the larger models, the sector hasn't come on as much," he adds. "The industry needs to develop the technology that would allow larger systems operate beyond visual line of sight. I also think that industry is still looking for suitable non-military applications."

**"The regulations are all designed with safety in mind, either public safety or safety to other aircraft," explains Corbett. "Regulations regarding smaller aircraft might need some revision. The cameras are smaller since we first wrote the regulations."**

The Civil Aviation Authority (CAA) is the statutory organisation that oversees and regulates all aspects of civil aviation in the UK. They are responsible for enhancing aviation performance security and improving environmental performance through more efficient use of airspace. The CAA regulates approximately 19,000 aircraft registered in the UK. However, as Corbett explains regulating the smaller drones can be tricky due to the vast amount that are sold.

"In general terms the legislation is identical to what you use for manned aircraft," he says. "My message has often been – they may be unmanned, but they are still aircraft, and they still have to fit in with the rest of the UK airspace users.

"It is difficult to actively police the operations of the smaller ones; we can't go out and 'approve' every single flight, nor should we have to. It is generally





dealt with by default. We work with the police to identify when unmanned aircraft are being misused, as it is more of a nuisance issue.

“Certainly for the smaller models our main priority is to deal with aviation safety, in terms of other aircraft rather than the risk to the public.”

The CAA has recently suggested that current regulations may need revising. Corbett said with technology evolving so quickly and the way the drones are used changing constantly the regulations will need to be amended to make sure that they are still relevant.

“The regulations are all designed with safety in mind, either public safety or safety to other aircraft,” explains Corbett. “Regulations regarding smaller aircraft might

need some revision. The cameras are smaller since we first wrote the regulations. Therefore, the aircraft have become smaller too and, one could argue, as a result they present much less of a safety risk.

“I will say certainly that for the small drones our main priority is to deal with aviation safety. A drone hitting a manned aircraft could be catastrophic. People thoughtlessly flying at heights where they can no longer see their drones are of particular concern to us at the moment; by wilfully flying out of your sight, you have no way of seeing, or avoiding, other aircraft and so the risk of a collision is much greater.”

Drones can pose a substantial risk to the general public too. While anyone can own one of these new gadgets there are still some very specific regulations

in place when flying them as, even though they may be thought of as toys, they must still be used in a responsible manner.

Safety is the CAA's key priority when it comes to regulating these small unmanned aircraft. Regulations<sup>1</sup> state that when flying the smaller remote control models they must remain within your sight at all times. The owner is not permitted to fly the UA within 50m of a person, vehicle or building, and must keep a greater distance away from large groups of people or congested areas. In January 2010, the CAA introduced new regulations that require operators of small unmanned aircraft used for aerial work purposes or equipped for data acquisition and/or surveillance to obtain permission before commencing a flight.

"Aviation regulations are contained in something called the Air Navigation Order," explains Corbett. "There are specific articles in the Order that refer to small unmanned aircraft – which is anything of 20kg or less. In addition, other articles deal with endangerment and cover reckless or negligent use – in simple terms, we expect people to operate responsibly, and to respect the safety of other people. Obviously, we are most particularly concerned about drone users endangering another aircraft.

"We also have a guidance document called CAP722 which is the UK's document on how to deal with and fly unmanned aircraft according to the law.

"Drones bigger than 20kg are required to comply with progressively more detailed regulations and safety requirements. When you get beyond 150kg drones will normally come under the European Regulations and under the European Aviation Safety Agency."

"We advise people to prove to us the unmanned aircraft is safe to use. Rules and regulations are there for a reason. From our point of view at the CAA it's all about safety."

It remains to be seen if these unmanned aircraft will become more extensively used on a much bigger scale. Corbett believes due to the benefits they can

offer there will be an uptake in the number of smaller models in use.

"The small ones are certainly being used more widely for things such as aerial photography," he says. "The ability to fly gives you a better, or a different, view of things. Certainly there are numerous television shots that have been achieved with unmanned aircraft.

"With the larger unmanned aircraft the benefits are that the endurance limitations of a human pilot within an aircraft are removed, therefore flight for much longer periods over several days, or even months, are possible.

"The main challenge with the larger aircraft is proving beyond doubt that they are safe to fly," he adds. "In other words are they airworthy enough and how do you avoid collisions with other aircraft? Collision avoidance is one of the major hurdles the sector has to tackle. In that respect, the full potential of unmanned aircraft is still to be realised." ■

<sup>1</sup> <http://www.caa.co.uk/docs/1995/CAP%201202UAVsafetyrules.pdf>

<sup>2</sup> <http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=415>



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# The security impact of drones

**Dr Chris Wyatt, Research Fellow at the School of Government and Society at the University of Birmingham discusses a recent report that looks at the challenges and opportunities drones could bring the UK...**

**W**ith the introduction of new, modern technologies, the question is often asked of their benefits weighed against the costs if deployment and use. Drones, or Remotely Piloted Aircraft (RPA) are no different and the last few years have seen an intense debate on the merits of their use.

The sixth University of Birmingham Policy Commission was established to address the issue of Remotely Piloted Aircraft (RPA) and their benefits for security within the UK and potentially worldwide. Under the Chairmanship of Sir David Omand, the Commission launched its report at the Royal United Services Institute in October 2014.

The report concluded that RPA technology, both civil and military, under proper legal regulation, can continue to deliver 'significant benefits' for the UK's national security policy and economy in the coming decades.

The Commission took the view that, for these gains to be realised fully, the UK government, and especially

the Ministry of Defence (MoD), should do more to reach out to the public over what the Commission sees as the globally inevitable use of drones in armed conflict and in domestic surveillance.

RPA use will become an integral part of Britain's aerospace capability, providing both advanced surveillance and precision weapons delivery. They can support UK forces deployed overseas, as in Afghanistan, or help prevent mass atrocities, as with the British government's decision to deploy the RAF Reaper fleet against the Islamic State (ISIS).

The report examined the distinctive and unavoidable choices for the United Kingdom over a crucial emerging technology and set out the under-appreciated legal distinctions between British practice and the US government's cross-border counter-terrorism strikes which dominate and distort public debate.

However, there are challenges regarding the use of RPA. These consist of 3 main obstacles affecting the



UK government's use of drones that must be overcome: gaining public understanding and acceptance of the legal and ethical soundness of the practice; allaying fears over the potential development of Lethal Autonomous Weapons Systems (LAWS); and safeguarding British airspace and the privacy of British citizens if drones are to be increasingly used for domestic surveillance and security.

The Commission concluded that the current and emerging generation of RPA pose no greater ethical challenges than those already involved in decisions to use any other type of UK military asset. The report showed clearly that the UK has operated its armed Reapers in Afghanistan according to the same exceptionally strict Rules of Engagement (no weapon should be discharged unless there is 'zero expectation of civilian casualties') that it applies to manned aircraft.

But the Commission added its voice to the wider coalition of international opinion that warns against the development of 'killer robots' – or, to use the emerging international legal terminology, Lethal Autonomous Weapons Systems (LAWS). The report concluded that it will not be possible to develop autonomous weapons that can meet the core legal obligation under international humanitarian law to distinguish between combatants and civilians.

In the face of these advantages and disadvantages, what were the aims of the report, and what conclusions did it come to?

The twin objectives of the Policy Commission were to improve the quality of debate and make recommendations. Specifically, the Commission assessed that:

- Future RPA, both ISR (intelligence, surveillance and reconnaissance) and armed, based upon a legally sound mandate, should continue to make a positive contribution to UK national security;
- Careful decisions on the deployment and specific use of drones need to be made on a case-by-case basis at a senior level of command;
- There is no convincing ethical objection to acquiring RPA, while the ethical acceptability of their armed use is dependent on context and control. Indeed, it

may be positively ethically desirable to use them rather than other kinds of firepower which are less capable of avoiding civilian casualties and which expose UK military personnel to avoidable risk;

- The MoD must do more to reassure the public that RPA will continue to be subject to the same strict rules as other weapons systems and to overcome pervasive confusion between RAF practice and the US use of armed drones beyond legally accepted theatres;
- Whatever decisions are taken by the British government, the threat to deployed UK forces and UK interests from RPA operated by hostile groups and states must be expected to increase;
- The Commission supports the UK government's decision not to develop LAWS and urges it to take a leading role in securing an international framework for their control;
- New integrated policies are required to regulate RPA in civil airspace in the UK and on the rules that should apply to their use by police and security authorities for surveillance purposes. The Home Office should lead on drawing up a code of practice and addressing public privacy issues.

All this underlines the need for the UK to embrace new technology, such as RPA, in order to create better defence and security systems under an accountable framework.

While the debate on the use of RPA continues, the report of the Birmingham Policy Commission has made a major contribution to that discussion – a legacy that the project team will continue to fulfil. ■

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# Cutting to the chase

**Antoon Burgers, Program Manager – Special Tactics Equipment at Holmatro details how hydraulics offer extra strength for special tactics operations...**

Speed is essential in special tactics operations. You do not want to waste time in getting to your subjects, with the risk of having them destroy evidence, or even escaping. However, SWAT teams and Special Operations Forces these days encounter more and more reinforcements on doors, windows, fences, etc. They find themselves faced with re-bars, padlocks and chains of hardened steel, which cannot be swiftly and easily removed. And these materials are not only found when breaching and entering a building, but also when removing objects in the street for security reasons, or when cutting free activists who have chained themselves to an object.

When encountering these obstacles, special tactics teams tend to fall back on conventional tools like grinders, bolt cutters, rams, sledge hammers or hooligan tools, but often not with the desired result. Why? The material is too hard and cannot be broken, it takes too long to open the object or the tools simply make too much noise, warning possible criminals inside. These conventional tools may also endanger the safety of the person that has to be cut loose. You need a tool that is safe and easy to use, can cut through the hardest and toughest materials and offers you the possibility of silent operation.

## Hydraulic force

The strength that is required to cut hard and solid materials can be supplied by hydraulics. This technology has been used for years in creating rescue equipment. Now a special materials cutter has been developed for special tactics operations. Because this tool is powered by high pressure hydraulics it can generate a high cutting force (up to 193 kN/19.7 t). Combined with a special blade and jaw design the special materials cutter can cut through extremely tough and hardened material, even up to 60HRc. Regular cutters cannot cut these materials, or only



while suffering severe blade damage. As the blades of the special material cutter are designed with hardened steel inlays they will not damage quickly, but can be easily replaced if needed.

Since the special materials cutter is powered by hydraulics and has a high cutting force it is fast to operate, saving precious time. Another advantage is that it can be used with a hydraulic hand pump, making it suitable for silent operations. The compact design of the special materials cutter allows you to use it in confined spaces. Its adjustable and rotating handle gives you the possibility to cut in various angles when the cutting area is difficult to access.

Ultimately, this tool allows you to speed up your special tactics operations safely and silently. ■

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# Compact & portable hydraulic power for tactical cutting and spreading

**H**olmatro introduces a new generation of ultra-lightweight combi tools for cutting and spreading applications during special tactics operations. Weighing only 8.1 to 9.2 kg and with very compact dimensions, these tools are easy to carry, handle and add to your existing kit. Developed in cooperation with Special Operations Forces (SOF), they also meet specific requirements such as low visibility and quiet operation.

- Up to 457 kN / 46.6 t spreading force
- Up to 206 kN/ 21.0 t cutting force
- Up to 431 mm spreading distance

## Various models

The new series include self-contained combi tools with an integrated hand pump and models that are operated by a separate hand pump. Depending on the nature of your operation you can choose between two versions: Short armed models (H)CT 5111 ST if you need a higher spreading force, and long armed models (H)CT 5117 ST if a higher spreading distance is more important.

## Benefits

The hand-operated combi tools have 360° rotatable pump and carrying handles which can be locked in multiple positions. This enables you to use



them at almost any angle. Both handles are also foldable for extra compactness. Thanks to their small dimensions and low weights you can even take these tools with you during airborne operations.

All new combi tool models are rapidly deployable, suitable for under water use and designed for police and military special operations units.

## About Holmatro

Holmatro develops, manufactures and services high-pressure hydraulic industrial, rescue and special tactics equipment for professional users worldwide. Our Special Tactics product range includes breaching, cutting, spreading and lifting equipment to suit a wide variety of applications. Designed for use by SWAT teams, other police units and Special Operations

Forces these products share characteristics like low visibility, quick & quiet operation and optimal portability. More information can be found on [www.holmatro.com/en/special-tactics](http://www.holmatro.com/en/special-tactics)



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# Patient or paraphernalia?

After more than 60 years, there is still room for improvement when it comes to medical evacuation, suggests Olav Kaarstein, president of NODIN Aviation

**M**EDEVAC – bringing doctors to patients, patient to doctor or patient to or between hospitals – is said to have its origins in 1915 when a French modified plane moved Serbian or Albanian patients. The British performed their first recorded aeromed in 1917 with a De Havilland biplane flying a Camel Corps Soldier to hospital in Turkey. At the end of World War II the US Army started developing this life-saving service when establishing tented field hospitals close to the theatre and using helicopters and ambulances to transport wounded soldiers.

In the past four decades the focus of MEDEVAC has increased as a result of nations being engaged in conflicts far away from their own countries, an increasing number of terrorist actions and large nature catastrophes. With

an almost ever-present press transmitting images of people in distress or of the seriously wounded or even deceased into our living rooms, it is vital for nations to have satisfactory routines, procedures and equipment to assure soldiers and citizens that they are able to take care of their own people when wounded abroad, and bring them home for treatment and recovery.

After more than 60 years of developing routines and procedures of MEDEVAC, both within each nation and within coalitions, one would assume that terms and abbreviations as well as equipment interfaces are harmonised between nations to assure interoperability, flexibility and cross training.

A lot has been done in the past 25 years to achieve this. NATO has devel-

oped Standards for equipment as well as terminology; several yearly conferences – both military and civilian organised – contribute to the transfer of knowledge and experience between services and nations. Nevertheless, most nations still have huge areas of improvement before perfection. Why?

**“...it is vital for nations to have satisfactory routines, procedures and equipment to assure soldiers and citizens that they are able to take care of their own people when wounded abroad, and bring them home for treatment and recovery.”**

There is off course no simple answer to this question, and perfection may never be achieved, but my observations can be summarised by two headings:

- Medical Routines and Equipment
- Standardisation and harmonisation between services and nations

## Medical Routines and Equipment

Medical advancement in treatment resulting from experience or from new technology and equipment often causes changes in routines. New threats in the field often results in new products. How can nations assure that such changes do not cause the chain of evacuation to be hampered? Does a nation's eagerness to use national





companies for developing equipment in fact reduce the possibilities of operability between nations? Do initiatives need to be channeled to central level to assure that local benefit also serves the interest of the total system?

### **Standardisation and harmonisation between services and nations**

While trying to assure interoperability of services as well as national forces, we know that it is impossible to meet all interests. For example, the infantry soldiers want superlight, compact stretchers. For the vehicle operator it is vital that the stretcher fits into the actual stretcher support in the vehicle. The helicopter or aircraft-operator needs a stretcher approved for aerial evacuation, while the wounded soldier has the best chances of survival and least pain if he is brought throughout the chain of evacuation on the same stretcher. Very often the result is different stretchers in different services, which arguably does not serve the patient.

Can the industry contribute in the process of harmonising, first of all equipment, and assist armed forces in

developing and maintaining flexible solutions with high capacity across services and nations?

I am confident they can, as there is a significant level of expertise and knowledge in the industry as well as in the Medical Services. I suggest that this knowledge can catalyse the best solution for the customer and the industry can further improve their services to their customers by:

- Developing collaboration between companies to extend competence and capacity;
- Participating in arenas where the customers share their experience in field;
- Knowing, understanding and being loyal to applicable standards when designing solutions;



- Focus on the patient and the medics, not the equipment, when developing innovative design solutions.

What can the customers do to make the suppliers better prepared to develop solutions, products and services that meet the needs of the patients? I would suggest:

- Improve the arenas where users share their experience in patient evacuation;
- Allow and encourage informal discussions between users and industry, enabling industry to fully understand the need;
- Describe the issue and/or the need, not the solution. The best solutions may not yet have been invented.

There is a significant effort in many nations to improve their CASEVAC and MEDEVAC capability and if these activities are fairly coordinated the international community will see a huge increase in the total capacity to bring injured people out of disaster areas.



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# A new ecosystem for learning

**Alastair Creelman, an e-learning Specialist from Linnaeus University, Sweden discusses the benefits of universities embracing new changes in learning...**

**T**he worldwide demand for higher education is exploding and projections show an increase from 100 million today to 250 million by 2025. The traditional university system simply cannot cope with this expansion and unless we start building new major universities every day for the foreseeable future, we will need to completely revise the provision of higher education. The demand for higher education among working professionals is growing rapidly and is overtaking the demand from the traditional 18-23 year old target group, which could even shrink as more young people opt out of often over-priced higher education. Whether they like it or not universities are facing a completely new market in the next 10 years. The traditional campus model certainly won't disappear but there are strong signs that the concept of a university education preparing you for a career is becoming less valid. In addition, there is a massive demand for lifelong learning opportunities from

people who have no university background but have gained equivalent skills outside the formal system.

The new learners are not able to uproot themselves to move to the university, or commute to campus classes since most of them will be studying while working full-time. They will be more skills-focused than younger students with no work experience and they may not see the point of many traditional academic concepts. The gold standard of the 3/4 year degree may not be relevant for tomorrow's professionals and traditional examination forms will be increasingly questioned in favour of various forms of skills assessment. Of course many universities already offer an extensive range of online courses and even degrees with many national open universities in the forefront, but with a few exceptions most institutions still see traditional campus education as core business and professional development and lifelong learning



**Alastair Creelman**  
**E-learning specialist**

as a sideline at best. Higher education is also highly selective with millions of potential students being rejected every year. Where do you go if you can't get into university and should higher education be a privilege or a right?

The European Commission's High-Level Group on the modernisation of higher education published last year, a welcome report (New modes of learning and teaching in universities <sup>1</sup>, European Commission 2014). They offer a number of recommendations for the improvement of teaching technologies and practices and stress the need for government authorities to stimulate and foster educational change rather than the present practice of delegating responsibility to grassroots initiatives alone. They call on all member states to draw up strategies to support universities in this major change in focus as well as stressing the need for coordinated teacher development and support. In addition they stress the need for quality assurance in online learning and the open availability of educational resources.

One promising avenue that is gaining ground is that of competency based degrees. Professionals can integrate their university education with work and gain credits from real projects in the workplace. Attendance on campus is the exception rather than the rule and there is close cooperation between university and employers. More importantly students can gain credits for skills they already have by providing the university with a portfolio of previous experience and certificates from employers. In this way experienced professionals can progress quickly through the degree programme and they can convert solid professional experience into credible credentials.

The present flora of non-formal and informal learning opportunities like MOOCs (Massive Open Online Courses), open educational resources and skills-based learning initiatives is leading us into a new educational ecosystem. Although there will still be a demand for the traditional university package deal, more and more people are acquiring skills through practical experience, non-traditional open education and in-house corporate training and need to get formal recognition for their skills. There are already universities (eg. OER university partnership <sup>2</sup> who are willing to award credits and even full degrees to students who can present verifiable evidence of prior learning, even for students who have never studied a single course at that institution. This creates new paths to learning where the university campus is no longer the only option and where online learning will be the driving force. However it is vital that higher education recognises and embraces these changes. Recognition of prior learning is likely to become the key to this new ecosystem and this is the area I expect to see growing strongly in the coming years. ■

Alastair Creelman is an e-learning specialist at Linnaeus University, Kalmar, Sweden with particular interest in open education (including OER, MOOCs), social media in education and quality in e-learning. He has extensive teaching experience in schools, adult education, corporate training and higher education in the UK, Sweden and Finland. He has lead and participated in numerous national and international e-learning projects as well as being programme chair of several international conferences. He was board member and vice president of EFQUEL (European Foundation for Quality in E-learning) from 2012 till 2014.

<sup>1</sup> [http://ec.europa.eu/education/library/reports/modernisation-universities\\_en.pdf](http://ec.europa.eu/education/library/reports/modernisation-universities_en.pdf)

<sup>2</sup> <http://oeru.org/>

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# Automotive Software Engineering

The automotive industry is one of Europe's driving economic forces. A huge variety of cars from premium cars, to e-mobile and low cost cars are developed and sold. Unseen, deep down into numerous electronic control units (ECU) engine control functions, comfort functions, driving assistance functions as well as security functions are implemented. In fact, this means programmed on a variety of processors, namely micro-controllers.

## The amazing variety of functions implemented in software

In the automotive domain raises the need for specialised design methodologies. With automotive software engineering (ASE) a new design methodology has been founded, so fundamental that we set up a complete master program on this topic. Challenges in ASE are to handle efficient interaction with the sensoric connected to the peripherals, guarantee real time requirements and separate hardware basis from software implementation. Last is crucial due to the huge variety of product versions, e.g. identic functions for different model lines implemented on different hardware platforms.

All hardware dependencies increase costs in terms of system complexity, testability and portability. We have evaluated the well-known AUTOSAR approach. This separates three levels: RTE, BasisSW and the microcontroller

core. This approach allows the separation of hardware and software, not only in the final design stage but also in the development state. Unfortunately, the separation levels increase complexity of virtual and final test processes. We developed a test method adapted to the level approach for so called built-in-self-test.

**“With automotive software engineering (ASE) a new design methodology has been founded, so fundamental that we set up a complete master program on this topic.”**

A test module which has access to all levels individually is inserted into the design. Thus, communication can be tested for all levels separately and correct functionality can be proved. Extending our approach we added a module to detect in detail the timing for individual communication. Thus over all communication time can be quantised as well as the delay introduced by each level. Finally, our test module can be exchanged by a monitoring module. In the same way, critical system parameters can be evaluated and monitored. This allows us to integrate health monitoring within the automotive application. In the development of our test and monitoring approach for automotive software systems students from the automotive software engineering master program are involved.



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# Food: the building blocks of society

**Richard Watts, Senior Catering Mark Manager at The Soil Association, asks how we can improve food in public places...**

Looking back over the last 6 years, The Soil Association's Food for Life Catering Mark has come a long way, and is already having a huge impact in transforming food service. For those who don't already know, the Catering Mark is an independent endorsement that caterers are taking steps to improve their food, through meeting standards on nutrition, freshness, sustainability and animal welfare. It is changing catering – providing more fresh, nutritious, environmentally sustainable, British meals to public sectors across the UK every day. In an industry previously driven by cost the focus is now shifting towards quality and local procurement; we are reconnecting with our food.

Catering Mark holders are assessed against a published set of standards and achieve either bronze, silver or gold accreditation based on the food that they are serving. Through the Catering Mark food providers are incentivised to move from bronze to silver and gold, where spend on UK, locally sourced, free range, LEAF marque certified, Freedom Food, MSC, Fairtrade and organic ingredients is recognised and rewarded.

Just before Christmas 2014 The Soil Association celebrated a landmark achievement, with 1 million Catering Mark meals being served every workday in schools, universities, nurseries, workplaces, hospitals, care homes and restaurants across the UK <sup>1</sup>.

The scheme has received praise from high places; Prue Leith recognised its impact in hospitals whilst Jamie Oliver has also shown his support: "Reaching 1 million daily Catering Mark meals is a hugely positive sign that the food industry recognises the importance of having clarity around food standards. With a third of our daily calories eaten outside the



**Richard Watts,  
Senior Catering  
Mark Manager at  
The Soil Association**

home, it's more important than ever that we all understand what we're consuming, and the Catering Mark is a really easy way to signpost this, and a brilliant framework for organisations to work towards."

It's not just caterers who are seeing the benefit of the Food for Life Catering Mark, the Department for Education (DfE) has given the Catering Mark a key role in delivering the government's School Food Plan as part of the Food for Life Partnership, and in helping caterers increase school meal take-up. School food standards now encourage the use of 'fresh, local, sustainably sourced food' – and the Catering Mark has been recognised as a way to help caterers demonstrate that these standards are being met.

The Catering Mark has also been cited in NHS England's 2014/15 guidance for commissioners and



providers and procurers. Catering Mark holders are recognised within the Plan as being well-placed to score good or excellent against the Plan's 'Balanced Scorecard' criteria.

The Catering Mark also provides a significant boost to the British farming industry, with over £40m spent on British ingredients each year. Figures show the growing demand for healthier, sustainable food in the UK food sector – the annual wholesale value of MSC certified fish sold into the Catering Mark supply each year is nearly £4m. Collectively, Catering Mark holders annually spend over £7m on organic ingredients, nearly £4m on free range and Freedom Food-certified meat and over £1.2m on LEAF marque certified products<sup>2</sup>. To link caterers with suitable suppliers for their Catering Mark meals The Soil Association has also developed the Supplier Scheme, helping caterers find suitable ingredients but also finding new routes to market for suppliers and food producers.

The Catering Mark was conceived in 2009 so hitting the 1 million meals mark is a huge accolade in a short amount of time. There is still more to be done: we need to ensure that the next government continues to support public food procurement and the local community. There are significant evidence-based local economic benefits from the Catering Mark that are in line with the Public Services (Social Value) Act 2012, showing a return of over £3 for every £1 invested locally in a Catering Mark menu.

A lot has changed for food served outside of the home in just 6 years and the best bit is, the changes that have already happened have created momentum and awareness. We need to ride the wave and make sure we increase the impact of the Catering Mark even further. ■

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**Richard Watts**

**Senior Manager – Catering Mark**

The Soil Association

[www.soilassociation.org](http://www.soilassociation.org)

care providers as a way to support hospitals to raise food standards. This means that GP commissioners can choose to link up to 2% of a hospital's budget to an achievement of better hospital food via a CQUIN goal (commissioning for quality and innovation), with the Catering Mark cited as a benchmark for improvement.

It goes further: the government's Plan for Public Procurement addresses wider aspects of quality within food and catering – such as ethical, environmental and social considerations. Based on the government Buying Standards for food and nutrition, the Plan seeks to achieve consistent standards for all food procured by central government departments, as well as providing best practice recommendations for food

# Making education central to rehabilitation

**Rod Clark, Chief Executive of the Prisoners' Education Trust details how education in prisons can help to aid rehabilitation...**

I was recently asked by a prisoner, why bother with education? His question is unfortunately not uncommon, given many prisoners' negative associations with school. 47% of prisoners say they have no qualifications, compared with 15% of the UK population, and almost half were excluded from school. <sup>1</sup> In response, I quoted our alumnus Francis Osei-Appiah, a father who left prison after serving a 9 year sentence with a degree, who says 'education set me free'. After working in social care management, he now runs his own charity which aims to stop young people from becoming involved in crime. <sup>2</sup>

In 2004 Francis benefitted from our Access to Learning programme. This core part of our work gives approximately 2,000 prisoners per year an opportunity to study distance learning courses in subjects and levels not otherwise available in prisons, such as GCSEs, diplomas and A-levels. As well as funding such courses, we offer career advice and art and hobby materials. In our 25 year history, we have helped prisoners across England and Wales study over 30,000 courses. We are now in touch with many of those people we've helped over the years, who, like Francis now dedicate their lives to reducing crime.

Unfortunately they are the exception rather than the norm. In the UK, 45.2% of adults are reconvicted within 1 year of being released, and crime committed by repeat offending costs taxpayers up to £13bn per year. <sup>3</sup> Government analysis of our charity's work shows the reoffending rate of people we've helped was over a quarter lower than similar offenders; but for this to help even more prisoners the state provision needs to provide more effective support. <sup>4</sup>

Ofsted Inspections found that more than half of prisons

inspected in 2013/14 (58%) were judged as 'requires improvement' or 'inadequate' for learning and skills provision. <sup>5</sup> An inquiry by the Parliamentary Justice Committee <sup>6</sup> found that over the past year, access to education and training had 'plummeted' and that staff shortages meant prisoners couldn't be escorted to activities. In 2 prisons, learners had to choose between having showers and making phone calls or going to class. This is unacceptable, especially as we know learning in prison works. It is imperative that men and women in prison are provided with alternatives to crime. Education, training and employment offers such opportunities, and our work in policy and practice supports those aims.

We believe education should be central to the rehabilitation of prisoners. As such, over the past year PET has carried out an action-research project alongside Cambridge University, working in 8 prisons to evaluate whether a learning-focused approach can change culture, for the better. As part of this project, which was funded by the National Offender Management Service, we trained staff to work effectively with prisoners and empower them to have a say in what, where, when and how they can learn. The Rehabilitative Cultures project was embraced by staff and prisoners, who came up with innovative ideas and plans to make improvements in each of their prisons. One has established a student council to give prisoner learners a forum to make suggestions or raise issues with staff, while another has rebranded its education department as a 'college' to foster an adult learning environment and attract more learners. Given many prisoners' previous experiences they are resistant to attending prison classes, but with encouragement and inspiration from their peers they are much more likely to engage. When they realise they are capable, they can begin to





enjoy learning, to continue developing, to plan for their futures and also share their skills with fellow prisoners or their own children.

Despite the cutbacks and challenges in prisons over the past year, innovation exists too. In prisons across the country, inmates are already helping staff by assisting teachers in classrooms and mentoring those who cannot read. If prisoners begin making a positive contribution to society in this way while they are still in prison, they will be better equipped to continue to continue doing so when they leave.

Such altruism not only helps our communities but gives ex-prisoners a chance to put into practice new skills they've developed in prison by volunteering, pursuing further education or going to work. This also helps them develop an identity that isn't solely characterised by the crime they once committed but on what they are doing or working towards now. Through studying in prison, individuals become students rather than just prisoners and on the outside, continuing to develop professional identities and shedding negative labels is one of the most crucial ways for people to desist from committing crime.

As the new UK government settles into office post-election, ministers must do what works to reduce crime, and that includes prioritising learning in the regime and culture of prisons. To help the Ministry of Justice and Department for Business Innovation and Skills to do this effectively, PET has consulted with 23 organisations as part of the Prisoner Learning Alliance to offer solutions, summarised in our report Smart

Rehabilitation<sup>7</sup>. As the current Skills Funding Agency contracts come up for renewal this summer, we have produced a further briefing, The Future of Prison Education Contracts<sup>8</sup>, using our vast shared expertise to inform the incoming government on how to make smarter use of resources and seize this timely opportunity to improve the quality of education in prisons.

### About PET

Since 1989, Prisoners' Education Trust (PET) has supported prisoners to engage in rehabilitation through learning. The charity does this by providing advice and funding for approximately 2,000 people per year for distance learning courses in subjects and levels not generally available in prisons. PET also carries out research, informed by prisoner learners, to improve prison education policies.

In 2012 PET launched the Prisoner Learning Alliance to work together with 22 other expert organisations to champion learning for people in prison. ■

<sup>1</sup> MoJ Surveying Prisoner Crime Reduction (SPCR), Hopkins, 2012

<sup>2</sup> <http://www.prisonerseducation.org.uk/stories/francis-osei-appiah-education-will-set-you-free>

<sup>3</sup> Table 19a, Ministry of Justice (2014) Proven re-offending statistics quarterly, April 2011 to March 2012, London: Ministry of Justice, and Table 7a, Ministry of Justice (2013) Proven re-offending statistics quarterly January 2011 - December 2011, London: Ministry of Justice

<sup>4</sup> MoJ Justice Data Lab, Re-Offending Analysis, Prisoners' Education Trust, 2014

<sup>5</sup> Ofsted Annual Report, Further Education and Skills, 2013/14

<sup>6</sup> <http://www.parliament.uk/business/committees/committees-a-z/commons-select/justice-committee/news/report-prisons-planning-and-policies/>

<sup>7</sup> <https://s3-eu-west-1.amazonaws.com/fbclientprisoners/Documents/PLA%20Smart%20Rehabilitation%20Report%20FINAL.pdf>

<sup>8</sup> <https://fbclientprisoners.s3.amazonaws.com/PLA/The%20Future%20of%20Prison%20Education%20Contracts.pdf>

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**Rod Clark**

**Chief Executive**

Prisoners' Education Trust

[www.prisonerseducation.org.uk](http://www.prisonerseducation.org.uk)

[www.twitter.com/PrisonersEd](https://twitter.com/PrisonersEd)



# The Digital Economy

**Günther H. Oettinger, European Commissioner for Digital Economy & Society details the importance of a digital economy and sustainable online services...**

**T**here are few business sectors emerging as fast as the digital economy. Just a year ago almost no one has ever heard of the taxi company Uber or the hotel substitute service Air B'n'B but now almost everyone knows about these 2 online services. Greater efficiency, the ability to adapt more quickly to the needs and wishes of consumers, and the absence of almost any additional costs when connecting to new customers are the decisive market advantages of this new model. Digital services, once established, are unstoppable – even if you wanted to. But it is possible to influence their development to ensure their sustainability. To seize the chance to influence the digital newcomers of tomorrow, Europe and Germany will have to play a far more active role. We have to improve and develop Europe's domestic digital society. If we fail to do so, progress will happen abroad and we have to deal with inventions and developments tailored to the needs of others, without necessarily taking into account our needs, perspectives and wishes.

If Europe wishes to influence these developments and ensure online services in Europe remain sustainable, it needs an active policy – a digital agenda. The need for innovative digital services to fit into legal frameworks and to pay taxes is self-evident.

From the European point of view the 2 following aspects are of major importance.

First, we have to make sure that anyone, old or young, employed or not, has the chance to benefit from the digital evolution. This requires competitive internet connections to be available regardless of where a person might be and for digital skills to be as commonly held as the skills of reading and writing.

Without access to a fast enough internet connection, a huge number of European citizens are and will continue to be unable to access the full benefits of digitalisation and will remain unable to profit from them. As a result we are willing to spend a share of

the Commission's newly introduced €315bn Investment Plan on schemes to extend broadband access. Several quality standards, such as a minimum internet speed, will be implemented as well.

The other vital requirement is to ensure Europe's citizens acquire adequate and sophisticated digital skills. This is not only important for citizens and consumers, for whom a basic digital knowledge is a must if they are to participate in today's digital world, but also from the point of view of businesses. They need workers to show a level of practical knowledge whilst also employing digital professionals with specialised knowledge if they are to succeed over the longer-term in the global market.

These points in particular need a lot of attention from the European Union. While the demand for digital professionals is rising faster and faster, the number of entrants into this profession continues to stagnate. Despite the fact that Germany has over the past few years been the positive exception with regard to this problem, its future demographic hurdles mean it must not lose its focus on digital development.

Secondly, there is an urgent need to complete the Single Market in the digital economy. It is no longer acceptable that, despite more than 20 years of the Single Market, European citizens must still navigate a multitude of websites with a view to order goods, simply because many websites refuse to deliver to customers living in another EU Member State.

The creation of a real and efficient Single Market in the digital economy is of major importance for both businesses as well as our own competitiveness in the global market as well.

Without a completed Single Market in the digital economy, the success of many newly invented technologies will be greatly muted. The remote supervision by medical staff of a patient with heart disease who is on holiday in a foreign country remains a luxury because of exorbitant roaming fees; a remote monitoring system for fixed industrial machines and facilities can only broadcast with unacceptably long delays over foreign networks; and cloud computing providers are forced to open data centres in each and every one of the European

Union's 28 Member States so to ensure they abide by each country's privacy laws – these are just 3 examples of how innovations are slowed down and will continue to be slowed down without a competitive Single Market in the digital economy.

The long established manufacturing sector, which even today is still the main pillar of the European as well as German economy, has a central interest in upcoming digital technologies too. The European Union has recognised the importance of the industrial sector and seeks to increase this sector's share of the gross value added to the economy up to 20%. This can only work by using and implementing new technologies, not by returning to old fashioned ones. 3D printers are one impressive example of how digital technologies may help manufacturing businesses enter their own renaissance. Implementing new technologies has even a higher importance for middle class people: only 14% members of the middle class sell goods on the internet and even a lower percentage sell to an international market. Middle class people have a high potential to profit from the internet by reaching new markets and make savings in production and other processes. Because of this, under the name "ICT Innovation for Manufacturing SMEs" we encourage projects teaching digital skills to participating enterprises.

If we can achieve a real, working Single Market in the digital economy by extending broadband coverage and ensuring people possess the digital skills needed to navigate the modern world, all of us in Europe will profit from the "industrial internet", the next step in the digital revolution, perhaps even to a greater extent than we have already profited from the development of the digital internet before.

The "Digital Economy" and "Industry" are no longer opposing terms. Today they are compatible. Tomorrow they will be inseparable. ■

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**Günther H. Oettinger**  
**European Commissioner for**  
**Digital Economy & Society**

The European Commission

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# Personal data: why ethical management matters?

Communication in general and marketing in particular went through colossal changes along deep and fast technological evolutions which have completely reshaped our world. Those waves have changed the way we communicate but also the way we consume. The consumer wants to play an active role, he wants to ask questions, to get answers, to give opinions. The digital world has forced communication to become interactive. Consume is not synonym to have anymore, consume is now be-have.

Through the millions on digital and social media, it's also true that the consumer wants to be perceived as unique. Brands have decided to put him in the centre of their strategy and to provide him with two important elements: personalised communication and real-time experience, both enhancing the relation consumer can have with brand. And this can only be based on data.

The added value of data is confirmed by the work done by the European Commission. "We need a digital European market which allows new business models to flourish, start-ups to grow and industry to innovate and compete on a global scale" stated Vice President Ansip for the digital single market. The Digital Single Market will only reached its full potential if based on a strong but balanced Data Protection Regulation.

Data protection must act as a water filter, catching harmful particles with-

out blocking the flow in order to deliver purified water to the individual.

The text is getting closer to an adoption, however, many voices have raised concerns that the discussions have derailed from protecting individual from misuse of data, to a solution which limits usage of data altogether. Such an approach seems hardly compatible with the promises of the digital single market. The future rules must remain principle based, technology neutral and be complemented by effective self-regulation developed by European trade organisation. Industry self-regulation is the right tool to use, flexible and adapted to the industry. Already supported by the European Commission, codes of conduct will bridge general and legalistic principles with the real daily life of data processing, providing full set of rules and guidance adapted to each specific sector and situation.

Going even further than mere compliance to the future rules, organisations, nowadays, have learned the hard way that customer trust is key to economic development. We've all seen in the press the potential of damages mismanagement of data and lack of respect of consumer's privacy can do. Ethical personal data management becomes a key competitive advantage in a world where everyone is processing personal data.

Willing to address both challenges, legal compliance and ethical management, at the same time, FEDMA, with



its unique experience of having a code of conduct approved by data protection regulators, has developed a Charter on Ethical Personal Data Management. This Charter will be the corner stone of the new self-regulation programme. With the necessary engagement of the industry and the renewed support of the regulators, the solution found with and for the entire European industry will unleash the potential of data while maintaining individual's trust.



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# ETHICAL PERSONAL DATA MANAGEMENT CHARTER



We are  
Data-Driven  
Marketing !



This Charter provides five key principles for ethical management of personal data for the data-driven marketing industry. These principles originate from legislation and from the FEDMA codes of conduct. Details and exact provisions of the FEDMA codes of conduct are available on the FEDMA website.

Data-Driven Marketing is an industry which uses data to effectively match customers and prospect's needs with relevant brand offers. Data-Driven Marketing industry main objective is to establish and maintain a personalised and interactive relationship between organisations and customers and prospects.

**With this Charter, the industry's objective is to ensure customers and prospects interests are respected by organisations:**

- Customers and prospects are expected to have a positive and engaging marketing relationship with an organisation.
- Customers and prospects are expected to feel valued, respected and receive commercial communication that the organisation considers as relevant to them.
- Customers and prospects, when participating in a dialogue with organisations, are expected to be able to express their preferences in receiving commercial communication through different communication channels used by the organisation.
- Organisations are expected to provide customers and prospects with understandable information. Special care is expected to be given when commercial communications are aimed at children.

## PRINCIPLES:

### 1 BE HONEST AND FAIR

- > Organisations are expected to be honest and fair and offer a clear customer journey.
- > Organisations are expected to be clear with customers and prospects about why they collect data and how they intend to use it for marketing purposes.

### 2 RESPECT INDIVIDUALS

- > Organisations must act in accordance with all legal requirements relevant to the processing of personal data

applicable to marketing activities; the processing must be based on a legal ground and provide the individuals with the rights they are legally entitled to, such as the right to object.

- > Organisations are expected to avoid irresponsible commercial communication.

### 3 BE DILIGENT WITH PERSONAL DATA

- > Organisations are expected to always treat customer and prospect data with the utmost care and respect.
- > Organisations are expected to take reasonable steps (such as by validation when necessary) to ensure that customer and prospect data are accurate and kept up to date.

### 4 EMPOWER THE CUSTOMER WITH CHOICE

- > Customers and prospects should have access to organisations' privacy policies providing an explanation relating to the processing of personal data for marketing purposes and their contact details enabling customers and prospects to interact with the organisation.
- > Organisations are expected, where possible, to give customers and prospects the possibility to express their preferences in receiving commercial communication through the different communication channels used by the organisation, and respect these. This can be done through the use of preference services lists (such as Robinson lists) where available.

### 5 BE ACCOUNTABLE

- > Organisations must ensure that they employ appropriate security measures when processing customer and prospect data, taking into consideration the sensitivity of the data and technological state of the art.
- > Organisations must take responsibility for the processing of customer and prospect data in-house. When the data processing is partly or fully outsourced to a data processor, both the controller and the data processor should be responsible for ensuring that all the applicable legal provisions relating to such processing are complied with unless a legal provision is explicitly assigned to either the controller or the processor.

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# MK:Smart Project – Smart city

**Dr Paul Sant, Associate Dean at The University of Bedfordshire details how Milton Keynes is striving to become one of the UK leaders in smart cities...**

According to a recent report by Centre for Cities, Milton Keynes is the UK's number one city for jobs growth. Not only that, it is also home to the MK:Smart project <sup>1</sup> – a £16m Higher Education Funding Council for England (HEFCE) Catalyst project that focuses on the development of technology to help Milton Keynes overcome the potential barriers to growth.

**“The MK:Smart project aims to improve the lives of citizens in Milton Keynes, as well as supporting the growth and development of businesses within Milton Keynes.”**

The project, led by the Open University, and with partners from across the Higher Education, public and commercial sectors, including the University of Bedfordshire (thorough University Campus Milton Keynes) has received £8m of funding from HEFCE, with the remaining £8m consisting of matched funding by partners. It promises to utilise technological capability, including the rapidly expanding Internet of Things (IoT), to deliver solutions that will allow Milton Keynes to continue to grow, and be one of the UK leaders in smart cities.

The IoT and connected devices landscape have the potential to address some of the societal challenges facing cities, both today and in the future. These include areas such as utilities (energy and water) and transport systems. They also have the potential to allow us to utilise vast data sources in order to inform health initiatives (for example, how to deal with an ageing population) as well as helping to inform policy makers who are responsible for city wide decisions.

Milton Keynes is a relatively new city, having been set up as a New Town in 1967. Today it has a population

of approximately 260,000, with a predicted population growth of 20% by 2026 (300,000). To achieve this growth there is a need to provide services such as energy, water and transport that will allow Milton Keynes (MK) to prosper, and remain an attractive place to live, as well as a thriving business environment.

Milton Keynes needs to address challenges to 3 key areas: transport, energy and water. It is predicted that traffic on the roads will increase by up to 60%, and traditional engineering solutions can only address 50% of this increase in traffic. The MK:Smart project is therefore looking to see how the IoT and smart technology can help to 'bridge the gap'.

In terms of demand for utilities (energy and water) the project is looking at how the predicted population increase in MK can be accommodated within existing energy and water consumption limits (i.e. with a 0% increase). Again, the project is looking to see how energy and water management systems can benefit from smart sensor technology in order to help support this objective.

At the heart of these developments is the desire for collaboration with business. In this respect, the University of Bedfordshire team are engaging with small-to-medium enterprises (SMEs) in MK in order to stimulate innovations that will feed directly into the MK:Smart project, and deliver solutions that will limit the impact on current and future citizens.

At the centre of the project is the so-called MK Data Hub, a computer architecture that is designed to collect data from various IoT and sensor networks, and allow businesses, the local council and its citizens to see the impact that the project is having, as well as



being able to use the data to meet the cities smart and future city objectives.

The MK Data Hub, which is housed at the University of Bedfordshire's Milton Keynes Campus is a test-bed for innovation relating to the MK:Smart project. It will collect data sets from across the city, and make use of a wealth of open data as well as information from the MK:Smart project in order to help achieve the projects' objectives, which include engagement with SMEs, job creation, and citizen engagement.

The MK:Smart project aims to improve the lives of citizens in Milton Keynes, as well as supporting the growth and development of businesses within Milton Keynes. With this in mind, work is well underway with respect to engaging the citizens of Milton Keynes. Working with Community Action MK, and SME based in Milton Keynes (Graymatter) and the team working on citizen engagement, a series of workshops aimed at gathering ideas from local citizens, relating to how smart cities work and function, have already been held. A citizen engagement platform is being developed which includes the opportunity for citizens to work with SMEs in order to bring their ideas to fruition.

On the business engagement front, University Campus Milton Keynes, including personnel from the University Of Bedfordshire Business School, have been engaging with businesses to see how they can bring innovation and business (technical and commercial) knowledge to bear within the project. This includes colleagues from the Big Data team from within the University's Business and Management Research Institute (BMRI) and members of staff from the Institute in Research in Applicable Computing (IRAC), who are working closely with SMEs

to develop solutions to some of the challenges that present themselves in the smart city arena.

MK:Smart is an important project for Milton Keynes, but it is not the only one. Milton Keynes is home to the Transport Systems Catapult, the UK's innovation centre for intelligent mobility, funded by the UK's innovation agency, Innovate UK. Late 2015 should see the introduction of driverless pods (LUTZ pathfinder project) ferrying people from the station to MKs central shopping area. In addition, Milton Keynes, as part of a UK consortium, recently won a multi-million grant (Innovate UK) called 'UK Autodrive' which may see more mainstream driverless vehicles on UK roads. Future city thinking will be at the core of this feasibility study, and will address not only technical aspects but also behavioural and societal impacts.

Aside from driverless cars, Milton Keynes is also part of a trial on smart bins (commercial), smart parking trials, a Low Power Wide Area Network (connecting the city, and enabling devices to communicate across a network) and a host of other smart city initiatives.

In summary, the Internet of Things, connectivity and smart cities are all things that Milton Keynes is a part of, and demonstrates the vibrancy of activity that is taking place. ■

<sup>1</sup> <http://www.mksmart.org>

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**Dr Paul Sant**  
**Associate Dean**

The University of Bedfordshire  
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# How to Print Smart

**G**overnment organisations are continuing to feel the squeeze of austerity. So how can departments make further spending reductions over and above what they have already achieved?

It's a tough ask, yet while operational overheads were usually the first area to be scrutinised and where possible minimised – there is still one area of everyday business activity that many departments have not yet considered: the printing and management of documents.

So there is a clear need for government departments to drive efficiencies. Reducing their document output spend offers them the potential to make significant savings. But how can they start to take control of their document output and manage their spend more closely? Often government organisations are unclear where to start. However, OKI can implement a range of strategies and products to help them address these issues.

At the heart of these services are OKI's smart managed document solutions – an integrated suite of software, technologies and tools to improve print and document workflow, management and security within an organisation. Through the use of these, OKI is able to extend document processes, ensuring a fully-integrated and optimised solution.

These solutions can be divided into five key areas:

- **Capture and distribution** – focuses on the digitisation of documents, converting to paperless workflows



with instant electronic access and routing by adding metadata;

- **Document and content management** – facilitates access and retrieval of data to improve collaboration and response times;
- **Security and output** – enables costs control and full visibility of print and copy usage;
- **Mobility** – enables printing from any device;
- **Device and contract management** – tracks device usage remotely.

OKI can help ensure the right printers are being used for the right job and to design a long-term print solution tailored to a customer's needs. It can also highlight previously unseen overheads such as the cost of man-hours spent supporting disparate systems so further savings can be made.

The whole analysis process is designed to enhance printer usage and create a more efficient managed print strategy. By using high-quality in-house solutions, government organisations will see an immediate impact both on the overall cost of their printing and their levels of wastage.

The approach also establishes best practices such as setting double-sided and mono printing as default options, which together reduce paper costs – and establishing some best practice rules, such as never printing emails simply to read them.

By deploying Managed Document Solutions, government departments ensure they work with just one contract for all their document output and management needs including purchasing printers, buying supplies or requesting maintenance. As a result, it is easier to monitor on-going costs; reduce capital investment and control budgets.

Any technical support a department may need to ensure its printers are up and running at all times can also be quickly delivered. Ensuring print operations and maintenance run smoothly, frees up the time of internal staff allowing them to focus on core tasks and work more productively.

Managed Document Solutions is all about flexibility and OKI can deliver a fully integrated and optimised solution that meets the specific needs of any government organisation, whether this is through capture and distribution, document and content management, security and output, mobility or device and contract management.

As part of a managed document solutions approach, OKI will initiate a process of consultation and analysis, through which it will identify specific operational needs and recommend a flexible solution to optimise print and document output. This will have full visibility and provide the opportunity to reduce costs, while delivering workflow efficiencies and saving time and money.

The continual management, review and implementation process ensures that the client's document workflow processes adapt and keep pace with changes across the organisation while delivering the anticipated cost savings.

### Moving to the Solutions

As part of the managed document solutions approach, replacing multiple desktop printers and scanners with a smaller number of networked multi-function printers can cut energy consumption and costs for any government organisation. Departments can make use of the new OKI MC700 and MB700 Series multifunction printers, for example, to move from a manual paper-based workflow into a digital workflow.

The MC700/MB700 Series provide additional levels of productivity to government departments through sXP (smart Extendable Platform), an embedded open platform offering enhanced workflow integration and document management, across the business. The new range of mono and colour MFPs provide additional flexibility, allowing organisations to select the model and options specific to their operational needs, for optimum print effectiveness.

Improving the way documents are handled, managed and processed will

deliver significant efficiencies and cost savings to government organisations concerned, ensuring their print capability fully supports their broader objectives.

In addition, the MC700/MB700 Series helps deliver enhanced control for government departments by including software for effective device management tasks such as remote diagnostics and document output controls including print tracking and authentication.

Again, as part of a managed document solutions approach, these multifunction printers also deliver advanced security features, including secure PIN printing, data encryption and disk wiping and a secure print with card release option. This represents a key benefit for any government organisation, giving them the peace of mind of knowing that they can have their document output and management needs at their fingertips without worrying that sensitive documents will get into the wrong hands.

### Going Green

A managed document solutions approach also drives greener, more environmentally friendly printing. OKI devices are all designed with a compact footprint to save on space and are based on robust and reliable LED technology for consistent quality and performance.

According to the Carbon Trust, printers can consume 30-40 per cent of their peak power when idling between printing and standby mode. However, with the right technology it becomes easy to reduce energy consumption.

Today, OKI ensures all its printers have 'Deep Sleep' mode cutting power

consumption to the minimum. OKI printers also offer 'Auto-Power Off' technology, which automatically turns off the printer after extended periods of non-usage.

Given that many government departments are facing an increasing number of departmental spending cuts and as such, are looking for ways in which to work more efficiently, OKI's approach to cost effective and green printing is of particular importance. Partnering with a professional vendor like OKI, government organisations can be assured document output will be managed in the most efficient and green manner – all key for departments looking to work more resourcefully.

With a focus on driving efficiency and maintaining control of printing, a managed document solutions approach will streamline processes and by doing this save time, costs and energy, all key benefits for any government organisation battling against the cuts.

For further information about OKI's products and services, please visit the OKI website, [www.oki.co.uk](http://www.oki.co.uk).



**Rob Brown**

**OKI business manager for  
managed document services**

Ok Systems UK Ltd

[www.oki.co.uk](http://www.oki.co.uk)

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# Smart cities standards, the story so far

**Saviour Alfino Smart Cities Standards Strategy Project Manager at BSI discusses how standards are shaping the future city landscape...**

There are many reasons to support the case of the smart city, be that creating a 'greener' environment, with improved use of shared resources and greater efficiency. Or simply accommodating the needs of a world which demands better services and facilities for its growing populations. With these goals in mind the need for an intelligent use and sharing of existing data and resource within a city, through radical, new and innovative means, was needed. For this to work successfully a common language had to be set out through the development of smart cities guidance.

The UK leads the world in shaping business standards and to make the most of the global opportunities from smart cities, experts representing all stakeholders played their role in structuring their knowledge. As such BSI, the UK's National Standards Body has been involved in a number of smart cities standards initiatives in the last 3 years with the core aim being to help accelerate the progress of the smart cities market. By addressing a number of key market barriers through the creation of leadership guides, management frameworks and other type of standards and activities, it has been able to pave the way for work in this arena.

So what are the key barriers to shaping the smart cities market? The centralised nature of public sector spending in the UK impacts negatively on the influence UK cities have in creating ambitious business cases that drive the smart city agenda forward. In addition, there is a need for building an ecosystem to share and build new service models using data, hence issues around data sharing become key in order to enable interoperability and break down market islands. In view of these and many other barriers, a number of

key initiatives have been launched. BSI's smart cities standards work provides a foundation of knowledge to help establish a common vision for smart cities.

The first stage of work has focused on establishing a common understanding of the benefits of smart cities and the approaches that can be taken to improve city performance. Specific projects include:

- Establishing common terminology for smart cities, promoting a shared understanding of concepts;
- Preparing smart city planning guidelines to set out how major new residential, retail and business developments can support the wider plans of that city to become smarter;
- Providing a decision-making framework for smart city leaders, setting out how to deliver a smart city project.

The latest addition to the portfolio is a guide PD 8100 Smart Cities overview – Guide which provides an overview description of a smart city, hence providing a basis for communicating the benefits of smart cities to key decision makers. In addition, this guide provides a number of tools for decision makers such as a smart city process framework and a capability assessment/gap analysis diagnostic tool to help cities in the development and implementation of a roadmap towards becoming smarter.

As an integral part of the second stage of this programme, BSI and the Future Cities Catapult have joined forces and created the Cities Standards Institute (CSI). The CSI board is composed of some of the largest UK cities and a number of key industry players that came together to explore market barriers even further.



Two immediate challenges have been identified by the CSI board and consequently 2 further initiatives have been launched:

### **A decision-making framework**

This is required to outline good practice in a number of areas when it comes to data sharing and interoperability. This management framework will address issues such as privacy, security, integrity, provenance, availability, quality and format of data. It aims to support data sharing in cities and between cities and the establishment of data sharing agreements, particularly where data is being shared by multiple organisations at once. Missing data or misinterpretation of data can lead to the wrong actions being taken by city decision-makers. A decision-making framework for sharing data can help ensure that they have the best overall data on which to base decisions.

### **Leadership guide**

This is also being considered to address the issue around developing sound smart cities business cases. It will focus on assessing existing business models and the suitability of alternative business models that could help drive the smart cities agenda forward. For instance, collaborative procurement models will be explored. This aims to help cities to benefit from new technology in commissioning new projects and exploit opportunities where the procurement process can

support a smart city agenda. In addition, considerations when planning and preparing smart city business cases will be explored (audience, defining projects, criteria measures, solutions, costs, benefits and risks), together with guidance on securing funding for smart city initiatives. Targeted mainly at business decision-makers in cities, and also of interest to local authority procurement officers, suppliers of products and services to cities, city funders and citizens.

As the price of digital technologies fall, market forces will drive their adoption to make infrastructure and city services more efficient. However, there is a need to shape the market to make sure the right conditions are created for innovation through citizen/community and business engagement. In order to achieve this objective, the CSI board will address market barriers as the need arises and ensure the right engagement is in place with UK government forums, European and international activities. ■

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**Saviour Alfino**

**Smart Cities Standards Strategy Project Manager**

BSI

[www.bsigroup.com](http://www.bsigroup.com)

[www.twitter.com/BSIStandards](https://twitter.com/BSIStandards)

# Digital skills are key to the future of Europe

**Ulla Tørnæs, MEP at the European Parliament explains why young Europeans need to have the necessary skills to embrace a digital future...**

**T**o ensure the future prosperity of Europe, it is of utmost importance to focus on digitalisation. We need to make sure that young Europeans have the necessary skills to embrace the digital future, underlining that this primarily is a task to be dealt with by the member states. The main task for the EU politicians, however, is to make sure that Europe is ready to make the most of the digital future by making sure to create the best possible legal framework to endorse digitalisation and take advantage of it.

Around the world, young people are practicing their digital skills in order to ride the wave of digitalisation. Many regions in the world are very much ahead of Europe when it comes to digital skills among young people. Many regions are also ahead with regards to how much business life is taking advantage of the many new possibilities the digital age offers. Digitalisation and the technological progress we have experienced over the past 20 years has been a true game-changer in the way we interact, how we live our lives and how we do business worldwide. And we must act on that.

The basic factor for Europe as a region in order to succeed in the digital age is to have a population which masters the skills needed. This requires that member states set clear priorities in order to train the population in the relevant skills. It is primarily through practice of such skills are obtained and a high level of competence is reached.

I therefore hope that member states – even though many are struggling to recover from the economic and financial crisis – will give priority to offering the best possible tools to young students to practice on. The digitalisation is one of the ways out of the crisis. It is very important, that we do not neglect preparing



**Ulla Tørnæs**  
**MEP (ALDE)**

the next generation for the digital future therefore we cannot expect young people to have great digital skills, if the equipment is outdated. We risk losing competitiveness in Europe if we do not put this question very high on the agenda. But at the end of the day, this is a member state competence to decide how schools and centers for education must act. It is not for the EU to outline the detailed priorities on how many computers the local schools should buy etc.

Even though the competence lays at member state level, the EU has a role to play when it comes to focusing on the “the big picture” and to create the best possible framework. The most important job for us as EU politicians is to pave the way for a successful digitalisation of Europe, so we are able to compete with other regions of the world. Our job is to design the legal framework that makes it possible to connect Europe digitally and make the framework as easy as possible to understand and use. This is an important factor to help Europeans break the barrier of doing business outside their own country. For instance, we need to get rid of the high roaming prices in order to make it cheaper and easier for business travelers to do their job when travelling over Europe. We also





need to design smooth rules for the digital single market, which endorses commerce across European borders. All of these examples are things that would foster growth and a high degree of competitiveness.

**“The most important job for us as EU politicians is to pave the way for a successful digitalisation of Europe, so we are able to compete with other regions of the world. Our job is to design the legal framework that makes it possible to connect Europe digitally and make the framework as easy as possible to understand and use.”**

It is absolutely imperative, that we do our utmost to create a good digital infrastructure and secure open and equal access to the internet. This is the basis for entrepreneurs to sell products and thereby promote growth, jobs and European prosperity. However, a first step is to make sure that Europeans can access the internet. Sadly many parts of Europe are not online and that is a challenge for our continent.

The fact that many European companies are outsourcing their digital services to other parts of the world, underlines the necessity of creating the best possible structures for doing business in Europe. We need to give digital start-ups in Europe special attention by creating a harmonised, clear and stable legislative environment.

In the EU, at national, regional and local level, we must think digitally if Europe is to achieve its goals of future prosperity for our businesses and citizens. ■

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# Boosting trade growth worldwide

**In an interview with Adjacent Government, Keith Rockwell from the World Trade Organization explains how they help countries to expand trade and boost economic growth worldwide...**

**T**rading between countries is vital in order to create stable relationships worldwide and to boost the economy. Trade can be driven by a number of factors and can play an important part in creating employment opportunities. Successful trade can provide economic stability for countries that are still recovering from the recession, which had a detrimental effect on many countries, not least those in Europe. This was due to the amount of small economically active countries that trade amongst themselves.

The World Trade Organisation (WTO) works with countries to boost further trade growth by settling disputes and by negotiating international rules to reduce barriers that obstruct trade. As an intergovernmental organisation, the WTO provides a forum for its 160 Member governments to discuss trade issues, examine trade policies and seek to resolve differences in a transparent and open forum. In an interview with Editor Laura Evans, the Director – Information and External Affairs Division at the WTO, Keith Rockwell, explains the importance of trade growth and what the organisation does to help support it.

“The most important thing to understand is that trade is a subset of overall economic activity. When there is greater economic growth there tends to be greater trade. It used to be that the trade expansion was 2 to 3 times greater than overall economic expansion, but that’s proving to be less the case since the financial crisis in 2008/2009,” says Rockwell.

“What we are seeing clearly is a slowdown in the expansion of trade, which is again largely due to the fact that we have not had great economic expansion, and



that is particularly true in Europe, which has a disproportionate weight when it comes to trade activity.”

Trade expansion happens when consumers buy more goods – imported goods and domestically produced goods. Trade growth can certainly help with economic recovery and plays a vital role in helping countries to get themselves out of poverty.

Rockwell continues: “When we had the crisis in Asia in the late 90s, it was trade that actually helped propel these countries out of the recession.

“We have seen this also, for example, in China. Their rise from quite a poor country to a middle ranking country in terms of the raw numbers was very impressive. They are now the second largest economy and the largest trading country in the world.

“They have lifted about 500 million people from poverty, and trade has been a very important reason why that has happened.”

Although China has been successful in its trading endeavours, there are still some countries where the system could be improved. Developing countries, for example, don't have the capacity to trade.

Rockwell explains why: "There are a number of reasons why trade can be stymied – in some cases it can be because of trade restrictions, like tariffs or quotas, or other types of restrictive measures.

"The principle reason many countries, particularly in sub-Saharan Africa for example, have not participated in the trading system to the extent they would like has to do with their overall capacity to trade.

"The productive capacity – whether it is communications or energy – is hampered by under developed networks, and that makes it more difficult for them to participate in global trade."

The WTO can help developing countries, in Africa and elsewhere, by reducing trade barriers and assisting them in their efforts to participate effectively in the negotiation of new agreements. Since the WTO was established in 1995 they have helped bring in 30 or so countries as members. They also oversee a programme called Aid for Trade, which helps the least developed countries.

The initiative assists governments in developing countries to develop their potential to make trade an important tool for development.

"This is something that the World Bank, the international Monetary Fund, the UN Development agencies, and the regional development bank, have all participated in.

"It is a means of trying to coordinate our aid programmes so that the funds go where they are needed, preventing duplication of effort. About \$40bn has been committed every year for the past 8 or so years to the initiative."

At the moment Rockwell explains that overall growth is down. It usually stands at about 6% or more per

year, but in the last 3 years it has been around 3 or 4%. There is still more to do in order to help boost it. He suggests one of the ways to do this is to address restrictions.

"This is a key element and the way to do that is to negotiate trade agreements. Another important element to that is to improve the productive capacity in developing countries so they can participate.

"In those countries what you have is consumers that are often quite poor and you need to find markets that have consumers with more money to spend. These are in the developed countries – so that is an important way to help with development and poverty alleviation.

"We hope this year that we can get a road map for concluding the long running Doha round of trade negotiations. This would certainly have an impact on trade and encourage investment in many places.

Rockwell concludes: "Many of the trade barriers we see today adversely affect developing countries. So we think it would be important to address these through this agreement, which is really oriented towards development and developing countries. We think that would be a great way to celebrate 20 years." ■



WORLD TRADE  
ORGANIZATION

.....  
**Keith Rockwell**  
**Director, Information and External Relations**  
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# Smart procurement at the centre

**David Noble, Group CEO, CIPS sheds light on procurement in the public sector...**

Supply chains lie at the heart of any good operation and this is no less true for the public sector, focussed on good services for the citizen and more value out of the public purse.

In the aftermath of the recession and in the continued age of austerity, local, regional and national governments have a responsibility to strategically align their spending to reduce the number of scandals around poor spending and achieve long-term measurable impacts and results. The public sector as a whole is effectively 'UK plc', and working together to collaborate and achieve not only the expected cost savings, but adding true value for their citizens should be the main driver.

By nature of its sheer size and buying capability, the public sector has massive leverage in the marketplace. By taking a collaborative approach to purchasing, there is strength in numbers but the sector often falls short of the mark as an ineffective and weak buyer. Though public buying cannot always enjoy the same freedoms as the private sector, suppliers find it easier to negotiate a good deal, for them and not for the buyer.

It takes a total re-think of how public sector buying is approached. There is some evidence that central government has taken this seriously, taking action and getting some excellent results in efficiency savings. But this means not taking the usual route of just beating down suppliers to cut costs. But, looking at creative and intelligent ways of considering whether your usual supplies are really what you need and whether your current suppliers are fit for purpose.

Taking a strategic approach is vital and this is not something that can or should be outsourced. It should



David Noble, Chief Executive at CIPS

remain an in-house function, aligned to departmental goals, looking both upstream and downstream at targets and need. Outsourcing can sometimes bring short-term gains, but the costs can sometimes be too high. A loss of control and misaligned long-term goals can be costly.

Though policies and procedures are vital in the procurement process, a strict adherence to procedures and the 'letter of the law' will completely stymie getting the real value the public sector seeks. For example, the tender process is weighed down by detailed procedures which can discourage good relationships with suppliers. Sticking to the rules may give you the best price each time, but constantly changing suppliers as they compete on price will not bring that long-term value. Recognising the changing



nature of the needs in the supply chain is more likely to bring good results.

Perhaps one of the biggest issues in public sector procurement is that a large proportion of spend is not under the control of procurement professionals at all. Non-procurement staff in the public sector hold billions of pounds' worth of spend and have little or no exposure to training or good procurement practice. This wouldn't happen in the private sector, so why the public sector should expose itself to the dangers of poor practice, let alone malpractice, is something to be questioned.

Central government has sought to introduce a commercial aspect to public sector purchasing through the introduction of commercial officers, but the direction of travel is just the same even if the job titles are different. Having trained and talented professionals in place will make all the difference to public sector buying. CIPS is working with a number of government agencies to ensure targeted training and qualifications help support the needs of the sector and its challenges as a new government takes the reins.

The need to have backing from ministers and top civil servants to create an environment where smart purchasing is recognised as a vital strategic function will go a long way to make these changes happen. But that takes some work to re-negotiate and re-engineer old processes and ways of working. ■

About the Chartered Institute of Procurement & Supply:

The Chartered Institute of Procurement & Supply (CIPS) is the leading international body representing purchasing and supply management professionals. It is the worldwide centre of excellence on purchasing and supply management issues. CIPS has a global community of 114,000 in 150 different countries, including senior business people, high-ranking civil servants and leading academics. The activities of purchasing and supply chain professionals have a major impact on the profitability and efficiency of all types of organisation and CIPS offers corporate solutions packages to improve business profitability. [www.cips.org](http://www.cips.org)

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**David Noble**

**Group CEO**

CIPS

<http://www.cips.org/>

# Competency Based QCF Procurement Qualifications

Following a collaboration between Awarding Organisations, Gateway Qualifications and ABC Awards, together with members of the Procurement & Supply Chain Management Association (PSCMA), the relevant Sector Skills Council and Employers, a comprehensive suite of “competency based” QCF procurement qualifications have been developed to replace the suite of “old” Supply Chain Management (SCM) NVQs.

## What is involved in achieving a QCF Procurement Qualification?

The Procurement Diplomas are “competency” based meaning that students not only have to prove their knowledge and understanding, but also have to demonstrate the application of knowledge in the workplace by carrying out the practical activities contained within the “units of competence” included in the procurement qualifications. This is achieved by putting a portfolio together using outputs of work e.g. tender docs, emails, contract docs, spreadsheets etc...The qualifications are very practical as the individual is expected to demonstrate their procurement skills and their procurement organisation will be effectively benchmarked against the qualifications which represent the latest procurement/supply chain practice. If there are any gaps in systems and procedures, the qualifications will highlight these. These qualifications can also be used as an effective personal development tool i.e. by selecting optional units for activities which may be currently outside the student’s current role with the organisation providing the appropriate

Qualification Level Comparison Table:			
Level (QCF)	Level Equivalency	Exam Qualification	Non Exam Qualification
6	Degree	CIPS Professional Diploma in Procurement and Supply	Level 6 Diploma in Procurement (QCF)
5	HND	CIPS Advanced Diploma in Procurement and Supply	Level 5 Diploma in Procurement (QCF)
4	HNC	CIPS Diploma in Procurement and Supply	Level 4 Diploma in Procurement (QCF)
3	A level	CIPS Certificate in Procurement and Supply Operations	Level 3 Diploma in Procurement (QCF)

**CIPS’ qualifications have been listed above purely for comparative purposes only. There are other similar academic qualifications available**

opportunities for them to gain the required experience to prove their competency for these units.

## Who are these qualifications suitable for?

These work-based qualifications are suitable for procurement/supply chain practitioners who wish to prove their competency and demonstrate the application of knowledge and understanding in the workplace instead of perhaps taking knowledge based exams only. These qualifications have the support of major UK employers both in the Public and Private Sector and provide a significant amount of knowledge, understanding and skills development that underpins occupa-

tional competence in the Procurement and Supply Chain Sector.

## Which level is suitable for me?

There are no specific entry requirements for these qualifications, but learners should be in a suitable job role to enable them to prove their competency at the appropriate level.

As a guide, the following QCF levels and job roles will apply:

**Level 3** – These qualifications are suitable for trainee buyers just starting their career in a procurement and supply environment, or for a purchasing/procurement assistant. They would also suit learners with delegated pro-



curement responsibilities who work outside of a formal procurement and supply environment.

**Level 4 and 5\*** – These qualifications may be suitable for learners in the following job roles:

- Buyer
- Procurement/Purchasing Executive
- Procurement Specialist
- Contract Officer
- Supply Chain/Inventory/Logistics Analyst
- Supply Chain/Inventory/Logistics Planner
- Assistant Category Manager
- Category Specialist
- Contracts Engineer
- Procurement Officer
- Supplier Relationship Specialist

\*More experienced learners should be able to commence at the higher level.

**Level 6** – These qualifications may be suitable for learners in the following job roles:

- Strategic /Senior /Purchasing or Procurement Manager
- Head of Commercial Services
- Supply Chain Manager
- Head of Logistics/Transport
- Operations Manager
- Senior Procurement Advisor
- Head of Procurement/Purchasing
- Senior Procurement Specialist
- Senior Buyer/Category Manager

### What about Professional Accreditation?

Levels (NQF) 4 or 5 of the former Supply Chain Management NVQs, together with appropriate experience, used to be accepted for full membership of the Chartered Institute of Procurement and Supply (MCIPS). There has been a “competency route” to MCIPS available until now for over 15 years. It is disap-

Qualification Title	Membership Grade
Level 4 Diploma in Procurement (QCF)	Associate (ASCM)
Level 5 Diploma in Procurement (QCF)	Professional (PSCM)
Level 6 Diploma in Procurement (QCF)	Expert (ESCM)

pointing, therefore, that following a so called “mapping” exercise to compare their academic qualifications with the QCF Procurement Diplomas, CIPS have decided not to accept these NVQ replacements for membership. Their decision has effectively disenfranchise many procurement practitioners who are unable for various reasons to take their examination route to obtain full membership.

However, the Institute of Supply Chain Management (IoSCM) will accept the new QCF Procurement Diplomas for the membership grades as shown in the table above.

For further information, see [www.ioscm.com](http://www.ioscm.com)

The International Institute for Advanced Purchasing & Supply (IIAPS) has confirmed that “after reviewing the comprehensive and extensive materials” submitted to them “someone with the Level 6 Diploma in Procurement (QCF) (assuming they have over three years work related experience) will satisfy the IIAPS entry requirements for participation on the International Green Belt in Advanced Purchasing and Supply Programme. See [www.iiaps.org](http://www.iiaps.org) for further information.

Whilst professional accreditation is desirable it should not be seen as essential as it is the level of qualification

achieved that is relevant. A commitment to continuous professional development (CPD) is now the norm for most people contemplating advancement of their career. It is essential, therefore, that both employers and employees alike choose educational pathways that best suit the individual and also the wider training and development objectives of the organisation. For many individuals and employers work based qualifications offer the ideal solution owing to their flexibility and practical nature which not only confirms knowledge and understanding but also the practical application of procurement skills.

For further information: [www.qube.uk.com/qcf-procurement-qualifications](http://www.qube.uk.com/qcf-procurement-qualifications)



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# Smart budgeting – smart councils

**Maia Beresford and Claire Mansfield from the New Local Government Network (NLGN) shed light on how some councils are embracing new ways of budgeting...**

**W**hen you think of public service innovation, you might think of fluorescent post-it notes, Lego, and innovation ‘labs’ where passionate hipsters dash about formulating ideas to join-up services around citizens’ needs. You might think of digital technology – iPad apps and running your life through your phone. What you almost certainly won’t think of is spreadsheets and budget books.

But the process of budget setting is the foundation of all good innovation.

Traditionally, budgeting in English councils has been incremental. In the context of austerity, this means using previous years’ budgets as a starting point, and ‘salami slicing’: setting an amount each department needs to reduce its budget by compared to the previous year, and tasking each department with going through line by line to see what can be lost. While councils might have strategic plans relating to ‘prevention’, ‘personalisation’ and ‘integration’ – this innovative intent is often lost in this incremental budgeting process which focuses on siloed and short-termist cuts.

But the tide is starting to turn. In NLGN’s recent report ‘Smart Budgeting’ we outlined how some councils are embracing new ways of budgeting which support rather than stifle more transformative and invest-to-save practice. These new budgeting activities involve shifting the focus to outcomes rather than outputs, using and integrating both financial and non-financial evidence when making decisions, and building long term planning for prevention into the budget process.

A good example of this in practice is the London Borough of Lambeth. In 2014 they decided to move from a standard incremental and siloed approach,

and instead reorganised their spending around 3 key outcomes. Each outcome was managed by a panel, comprising relevant officers and politicians from across council teams, which was tasked with generating new approaches to delivery and backing them up with a business case which fed into the final budget. Whilst outcomes were only aligned with the revenue budget at first, after the second year the council have been considering outcomes in relation to wider resources including its capital programme, the spending of key partners, and community assets.

Far from being stuffy people with calculators setting arbitrary savings targets, finance departments in councils like Lambeth are not just supporting transformation, but spearheading it: they are taking the lead in bringing together staff and service users from across their councils to come up with better ways of doing things, and working with them to slot new plans into a more holistic budget.

There are big central government issues that need addressing in order to fully enable transformative budgeting. Councils need greater flexibility and ability to integrate their budgets with other public service providers, and more certainty over funding in the medium to long term. Some of this was addressed in the Election 2015 manifestos, but we will want to see real changes as early as possible in the term of any new government.

But even without fundamental change in these areas, there is much that councils can do and are doing.

Granted, these are early days. All our case study areas have issues to iron out, and are still experimenting and adapting their approaches accordingly. Additionally



their practice is far from the norm. But what is reassuring is these councils' commitment to change and other areas' willingness to try new approaches. Over 80% of the councils we surveyed were open to experimenting, and given the high level of interest our report has had since publication, we expect to increasingly see forward thinking councils adopting these processes.

**“Councils need greater flexibility and ability to integrate their budgets with other public service providers, and more certainty over funding in the medium to long term.”**

This has come none too soon. It has been estimated that councils will face a £12.4bn spending gap by the end of the decade. With reductions in funding, the alternative is hollowed out services which fail to deliver benefits to their residents and councils facing increased levels of need. To put it simply, without embracing these new approaches, local authorities

are facing 21st century problems with a 20th century approach to budgeting. We commend councils to embrace a change.

*Maia Beresford and Claire Mansfield are authors of NLGN's report 'Smart Budgeting: Integrating Financial and Strategic Planning for Outcomes'. ■*

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# The “place” in economic development

In view of the significant transformation towards a knowledge-based economy which is taking place, as investment and people are now more mobile than ever before, so does the consideration of the quality of a place also become much more important.

The most important component of this transformation is a much greater reliance on intellectual capital and its application, based on significant advances in communication and other technologies and the management of data. The importance of place and place-making is that it plays a much more significant role in current decisions affecting business growth and development than ever before. Quality places retain and attract skilled and talented people. Talented people like places with natural, community, social, leisure, creative and cultural activities for themselves and their families. Combining this with effective professional networks, access to resources and opportunities is even more attractive to the entrepreneur inclined to exploit intellectual capital. Investment decisions are made by people in terms of their time, talent or money based upon an assessment of the anticipated benefit or return. Investment decisions are also made by institutions and businesses according to their own interests and balance sheet objectives, but even these interests are increasingly being directly influenced by place.

Determining what to focus on starts with identifying what key assets, services and growth opportunities the location provides which will shape the

desired economic opportunities but also day-to-day life. There is a series of challenging questions to be answered – for example, are the various forms of infrastructure adequate or a real factor in supporting a competitive commercial environment? Are the basic and hopefully higher-level elements of living in, working in and developing the various aspects of the intended local community firmly established? If the attraction of specific high-level talent is important, is there evidence of an enviable quality of life comparable to recognised successful locations? If not, why would someone consider investing their time, knowledge and expertise, or money (including persuading others) in your location with the associated risks connected with each of the shortcomings? Why would anyone wish to invest in a place that cannot demonstrate a will to invest in itself?

There are well-founded challenges to the perceived wisdom that consideration by investors should be to the South East first before anywhere else

in the UK. In terms of the knowledge economy, are smaller and medium sized cities better placed to rise to these challenges?

Ideally, an economically successful city-based economy comprises the following easily identifiable key characteristics:

- a diverse industry base including distinctive specialist niches;
- one or more high-level research and education-based institutions that have a mutually beneficial relationship with businesses;
- strong communications infrastructure;
- a variety of good transport links with and to other cities, with multi-modal options;
- public – and private-sector institutions working together;
- strategies to ensure that all communities benefit from the economic success;
- high levels of economic success and knowledge-based activity.

To illustrate this discussion, the wider Exeter economy has much of this



approach already established. There are other similar-sized cities that justify the proposition. Exeter's economic performance before, during and now amid the signs of post recession is of a place-making approach with credible examples of success. Some aspects are in need of further investment, and its most recently approved economic development strategy certainly embraces this approach as fundamental to making its transition to a knowledge economy. Following this approach has resulted in independent studies identifying the city as outperforming larger cities within the UK and confirming its beneficial regional economic impact. The creation of high-value employment opportunities, attracting and retaining highly skilled workers and graduates and capitalising on existing strengths and assets, is especially important as the city continues to strengthen its economy. Encouragingly, Exeter is outperforming the South West of England in terms of the percentage increase in qualifications among workers in the area in the past 10 years.

There are key drivers to establishing a successful knowledge economy, inextricably linked to place-making, on which the new economic development strategy for Exeter is based:

- having the architecture and accommodation that businesses and workers require;
- building on what's there – recognising the city's existing strengths and weaknesses and playing to these;
- 'smart specialisation' – focusing on the range of economic specialisms for which there are credible opportunities, for example, in Exeter's case, in sectors related to big data,

climate change mitigation, health, water science and agri-tech;

- attracting and retaining high-skill organisations – organisations that rely on productivity through high-quality jobs and highly skilled people;
- an acclaimed education sector – linking closely with the city and businesses;
- distinctive 'knowledge city' offer – for businesses and people who are considering investing, working and living in the city, supported by a diverse cultural offer;
- maintaining and improving strong connectivity within and outside the city economic area with major economic hubs;
- strong leadership – around an economic vision supported by proactive networks and partnerships;
- a business-friendly and pro-growth local administration.

Proactive support is important to create the right environment to attract and retain talent, entrepreneurship and technology transfer to those smaller and medium-sized places which can offer as much of a complete if not more affordable package to secure growth in investment and employment away from the massive metropolitan areas. It's about focusing on the value-for-money return that such locations really do offer.

The term 'growth hub' is being used to describe a number of different initiatives more recently, drawing on government funding obtained through a series of competitive bidding rounds providing hundreds of millions of pounds under the Regional Growth Fund, European Regional Development Fund and others. Funding has been made available for extensive

programmes of initiatives supporting infrastructure improvements, sector-specific projects and individual company growth plans, with job creation as the required objective and measure of success. What will distinguish them will be how integrated the initiatives are in supporting the approach, set out above, to create the place for successful investment and growth, not piecemeal developments focussed, for example, mainly on infrastructure. There are excellent examples of combined housing, employment site, education and skill-based programmes under the banner of the Growth Point support which have set the standard for joined-up economic development programmes around the country.

For examples of how Exeter is pursuing its growth agenda, see [www.exeter.gov.uk/index.aspx?articleid=13847](http://www.exeter.gov.uk/index.aspx?articleid=13847), or follow the quick response (QR) code below:



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# Lessons learned from private/public sector partnerships

Louise Fullwood, Partner at Pinsent Masons LLP details the seven features of highly effective public – private sector joint ventures...

The past few years have seen a range of successful transactions whereby the assets of a public sector “business” have been transferred to a new company often referred to as a ‘Newco’ jointly owned by a private sector partner (who will operate the new business) and the original public sector owner. This piece reflects on some of the practicalities and lessons learned from our experience in advising on many such projects and some aspects which might come as a surprise to teams running such projects for the first time:

**Preparation** – when advising public sector clients considering, or in the early stages of one of these projects we strongly recommend thorough preparation to get the business in the best state possible for the new venture. Often this stage can turn up a number of red flag issues which can be resolved fairly quickly. This is infinitely preferable to such issues only coming to light through bidder due diligence – which can alarm the bidder and require consideration and resolution during a period when time may be limited and the team is busy on the wider project– and possibly lowering value or causing the bidder to demand warranties or indemnities.

**Personnel** – The sheer size and multi-disciplinary nature of the team needed to complete the transaction is not always initially appreciated. The public sector team responsible for the deal will be multi-faceted, including specialists from commercial directorates, HR, procurement and finance. Legal advice may be provided by in-house teams or from the Treasury Solicitor’s team (who are likely to have a number of specialists to advise on discrete areas such as Pensions, Employment and State Aid). Experienced external legal and financial advisers will also be needed on

both sides. In addition, due to the nature of central government, personnel may often move into different roles in the course of a long term project and so there can often be a fair amount of churn.

**Planning** – the public sector tends to be good at planning out projects such as these, setting timelines and meeting schedules. Private sector partners can sometimes find this somewhat inflexible, but overall this tends to help keep the project progressing and help ensure that the (generally larger) public sector team are available for meetings.

**Process** – for a private sector team who are working on a transaction of this nature for the first time there can be a number of features which make this type of project very different from a standard private sector deal. For example, the process of outline and final business cases, approvals needed by Treasury and Cabinet Office, Ministerial Statements and Select Committee hearings, Gateway Review and involvement of the Shareholder Executive. These can seem to add extra administration and delay but are a necessary part of a well governed process with a clear audit trail and strong justification.

**Politics** (in the broadest sense of the word) – one of the reasons for the formal processes noted above is the wider responsibility which the public sector body has in relation to the transaction and the treatment of publicly owned assets. Therefore, as well as purely commercial considerations, there will be a broader set of sensitivities around any project, for example how it might impact on UK jobs and scientific expertise or how continuity of supply of products or services previously provided by the Newco may be affected. Since the criticism of the QinetiQ deal for underselling





assets, there is natural caution about ensuring value for money but equally, stories around wider impacts are ones which make the news stories and can affect whether a project is perceived as a success.

**Public to Private** – as a public sector business becomes a private sector body, there will be a number of practical aspects to address around changes in ways of operation, applicable legislation and regulatory requirements. These need to be anticipated and prepared for – for example whilst the business could freely use Crown copyright whilst a Crown body, once it becomes a private sector organisation (even if jointly owned by government) it will require assignment or licensing of such Crown copyright - which is likely to underpin all areas of its operation. If operating under licences from regulatory bodies then these may need to be reapplied for in respect of the new entity.

**Paper** – a clear and fair suite of legal documentation required to capture the deal and provide a solid basis for the joint venture (including asset transfers; subscription and shareholder agreements; service and supply agreements, leases and licences) is vital and so is having a positive negotiation process which sets the basis for the ongoing relationship. ■

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# How should employers manage performance?

**Jill Coyne, Senior Guidance Manager at Acas details how performance management is an essential tool for organisations...**

**P**erformance management is an important tool in developing and maintaining good employment relations in all sizes and types of organisations. It allows the organisation to plan effectively by setting realistic goals linked to individual objectives and, when done properly, enables employees to understand how their day to day work fits into the wider organisational aims. This can contribute to engaging staff more successfully with their work, increasing their contributions and encouraging greater loyalty to the organisation.

For many organisations it can represent a big culture change with all staff taking responsibility for the continuous improvement of business processes and for their own skills, behaviour and contributions. However it doesn't have to involve a complex system of monitoring and recording, rather it is better to adopt a simple process that fits in with the day to day running of your organisation.

## **The challenges of performance management**

In order for a performance management system to be effective it's necessary to engage with senior members of the organisation and get their support. At the same time it's equally important to involve the workforce, and their representatives (if they have any), in the development of a system. Without the support of staff and senior managers it's likely a performance management system will fail.

Linked to gaining this support is an effective and transparent communications strategy. Share the detail of the system from an early stage to allow staff to become familiar with it and promote a long lead in to the launch to ensure there are no surprises.

Once a performance management system is put in place it will highlight good performance but it will also reveal poor performances and these will have to be addressed. This is not easy for most people and it's important to prepare line managers so they can manage poor performance properly.

When linked to pay and reward performance management becomes a more engaging issue for both employees and managers. It makes the system more meaningful if it directly effects pay, often encouraging stronger performances. However, it can be divisive if team work is a key factor and it may focus employees on short-term goals rather than long-term organisational strategies.

## **Developing an effective performance management system**

A good performance management system should:

- Be developed in partnership with employees or their representatives; giving ownership to staff;
- Be applied fairly across all staff; from the youngest to the oldest, the most junior to the most senior, the worst performing to the best performing;
- Communicate key changes and messages transparently;
- Include training for staff and managers so they can use the system properly. Staff need to understand what is expected of them and managers need to learn how to deal with performance issues;
- Link organisational, team and individual objectives;



- Focus on the whole performance; don't just look at what employees produce (outputs) but also how they produce it (behaviours);
- Include a Development Plan so employees can develop skills and knowledge necessary for the job and future progression;
- Be written down. Develop a formal performance management process and form, and don't forget to keep records of objectives, meetings, progress and reviews.

There are a number of different approaches to performance management so it is important to develop a system that suits the culture of your organisation. During this development regular, open communication with employees is critical, this will also help to secure its successful implementation.

But remember, there are limits to what performance management can achieve alone – you need to recruit

the right people and have realistic individual and organisational goals for the system to succeed. ■

#### Acas Resources

Advice and guidance – [www.acas.org.uk/performance](http://www.acas.org.uk/performance)

Performance management e-learning  
[www.acas.org.uk/elearning](http://www.acas.org.uk/elearning)

Performance management training  
[www.acas.org.uk/pmevents](http://www.acas.org.uk/pmevents)

.....  
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# Improving performance and agility

## The role of business processes

All businesses, in whatever the state of development and maturity will use business processes to deliver services and goods to their customers. These processes evolve over time as companies and public bodies become more mature, complex with embedded fixes for problems in the past and are conducted with implicit rules by front line staff. In the case of public bodies they are constantly impacted by changes in government policy also.

Documenting processes is seen as a painful process, because it takes a long time, involves a wide variety of staff and requires a number of tools to document the outcomes. Businesses are driven to provide this documentation for certification, supporting work instructions and training materials and in some sectors this documentation is a differentiator for winning contracts or demonstrating good public services. However senior management still consider this activity low added value.

In manufacturing it has long been recognised that viewing, reviewing and streamlining processes is the key to improving quality, customer service and reducing costs. A number of key tools and techniques have been developed around this requirement, such as TQM, Six Sigma and the 5S for example. Manufacturing processes tend to be very visible and as a result can be more easily visualised and subsequently transferred into words and diagrams. Also use of visual aids

and problem solving techniques is well understood.

Applying these sort of techniques to public bodies and back office functions, such as finance or HR, and creative functions such as engineering or project management is much more difficult. So how do we raise the value of documenting business processes in the mind of senior executives, make the exercise more fulfilling for those engaged in it and speed up the process of documentation and review?

*A fault in the interpretation of observations, seen everywhere, is to suppose that every event (defect, mistake, accident) is attributable to someone (usually the one closest at hand), or is related to some special event. The fact is that most troubles with service and production lie in the system and not the people.*  
**Dr. W. Edwards Deming**

### Why and what is Modelling?

So why should business managers be interested in process modelling? 'Surely this is only relevant for certifying our operations?' It is fact that most errors and inefficiencies are due to the way work is performed rather than due to the person performing it. By mapping and documenting the business process it is possible to analyse where improvements can be made, identify the correct balance of work and where to apply controls. It is

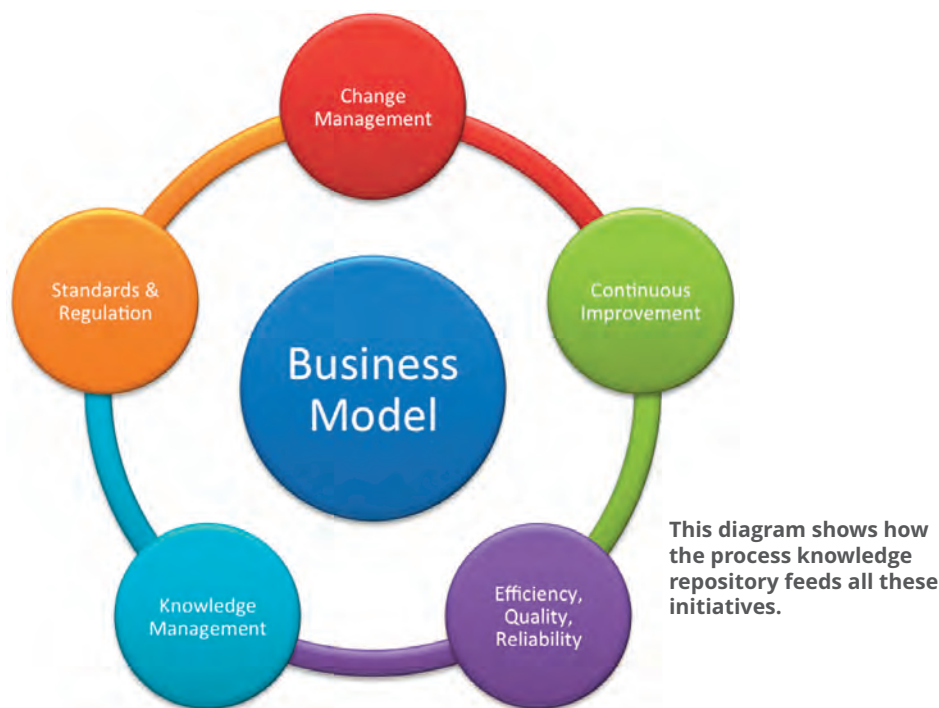
also a fact that the longer the time it has been since businesses have been reviewed, the less streamlined and poor performing they are.

*Service companies go from an EBITDA of 1.3% to 37%\* as they become process-driven.*  
**SPI Services Maturity Model 2013**

The statistics are that after 18 months there is 25% waste introduced into a process and within 5 years this has grown to 70%.

So how would each management level within a business use a process map? They all need different views of the business and a flat single level flow chart of the end to end business process will not provide this. For example the C band executives will require a very high level overview of the entire business showing how the Core business processes deliver the business and how they contribute to the strategy. If the Balanced Scorecard is used to articulate the strategy, then this will require targets to be set for the key business processes.

Middle management will require a more detailed drill down showing handovers between functions and how the cross-functional needs of business delivery to customers can be in conflict with departmental objectives or how poor handovers can



affect downstream performance. They also need to understand how business policy as applied to their processes impacts performance.

Front Line staff require a fully detailed step-by-step, model of the process, showing the tasks, who does the work and how it should be done and how to get to work instructions, particularly for more periodic processes that are not day to day activities.

### Making the Business Process Model the Centre of Day-to-Day Business

Once the business model is complete, it should be deployed for access by the entire business. By deploying the model to all staff a number of objectives can be achieved including knowledge transfer, continuous process improvement and increased business agility. The key to success will be the reuse of that work. There are many opportunities to do this namely:

- Organisational design, such as introducing new departments.
- Due diligence over mergers and acquisitions.

- Setting realistic process performance measures.
- Identifying role requirements, supporting competency definition and resource planning.
- Supporting business improvement initiatives and the application of technology.
- Supporting internal audits for security and segregation of duties, and quality certification such as ISO.
- Training of staff who are new hires or promotions.

This represents a significant benefit to the business and therefore should not be missed. The key to ensuring this, is gaining ownership of the model within the senior executive and functional departmental management and demonstrating immediate benefit.

Gaining ownership will only be achieved by proving the benefit of the approach to those asked to own both processes and outcomes. For process owners to effectively use the business process model on a day-to-day basis, they will need demonstrable benefits of its effectiveness. By designing processes within the model business managers

can apply time and cost so that the cost of delivery can be assessed; this might be related to rework loops and the benefit of avoiding them or skill of the person undertaking the activity. If the model is aligned to business KPI's realistic targets can be set to drive improvements and the removal of 'waste'; providing the source for 'lean' initiatives.

Managers must be trained in how to use the model to successfully facilitate process review and internal organisational redesign, i.e. such as moving jobs between incumbents and removing jobs through the application of technology.

Making the model central to training and induction is much easier; by using the model as a 'how to' guide for each business role, enabling access through the companies intranet leading to more in depth materials such as written work instructions or SOP's, or videos of the same. Rapid analysis of roles and job scope is aided by the 'where used' report applied to the business role.



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## MOVING ON FROM WHISTLEBLOWING

*“Everyone in the NHS needs to support staff so they have the courage to do the right thing when they have concerns about patient safety. We need to get away from a culture of blame, and the fear that it generates, to one which celebrates openness and commitment to safety and improvement.”*

*Sir Robert Francis QC*

The Whistleblowing issue is both complex and distracting; unleashing in its wake adverse publicity and high emotion. Endless hours are spent debating what causes someone to Whistleblow in the first place and it takes months or, in some cases, years to sort things out when they do.

Whilst this article touches especially on the NHS, the lessons and remedies apply equally well across the Public Sector. Our aim is to introduce a powerful strategy that removes the need for Whistleblowing by allowing all organisations to create the culture of openness and commitment as indicated by Sir Robert Francis.

### OK, BUT WHAT'S SO WRONG WITH WHISTLEBLOWING ANYWAY?

I've been taken to task on this many times with people saying 'it's a professional duty' and 'there should be more of it!' But I would like to suggest that there are 3 things wrong with Whistleblowing:

- Timing
- Locus of Control
- Breach of Trust

### TIMING

There's one thing glaringly wrong with Whistleblowing: **It's too late!**

Whistleblowing is post event and whatever was being done, or not done, at the time is in the past and can't be changed. An error in the NHS can be a matter of life and death and every bit as serious as a failing in any other industry. But a genuine opportunity for change is also being missed:

- A Never error was made when it could have been prevented;
- The level of care persisted where it could have been challenged;
- Trust was damaged where it could have been preserved and enhanced.

### LOCUS OF CONTROL

The business community is completely fixated in wanting to know how they're doing. From Friends and Family to telephone follow-ups, on-line feedback requests and prizes to be won for entering a 'review'! It doesn't matter who or what you think of – restaurants, banks, councils, phones, car insurance, the local flower shop, where you had your car serviced...they're all at it!

The Public Sector has always been a trail blazer in its search for quality assurance – except in its response to whistleblowing. So what's the difference between feedback and whistleblowing? I would like to suggest the answer is down to who's in charge!

With Friends and Family, the NHS is in charge of collecting, collating and responding to the information. Control is **Internal**. In a Whistleblowing case, the Whistleblower has the power, often catching the organisation on the back foot with the focus on containing damage. By this time, all hope of control is long gone and the information is most usually **External!**



But the information may well have been valid and crucial to be acted upon – **at the time**. [Ref point 1]. What's needed is a way of eliciting the information in a controlled and timely manner.

### BREACH OF TRUST

Pivotal to removing the need for Whistleblowing is the quality of the relationship between a manager and their team – and that is down to mutual Trust and Respect.

i.e. A manager needs to trust and respect their staff and give clear indication that information provided by them is valuable – and staff need to trust and respect their manager and be confident that something will be done with any information provided. But that's not always the case.

It's often been mooted that the easiest way to create Trust is to 'do what you said you were going to do' [or does that just make you reliable?]. But for a manager, Trust relies on 3 things: **Credibility, Consistency, and Connection**.

The trouble is that Whistleblowing muddies the water in all 3 areas; often causing not only a loss of trust between the manager and the person speaking out but also the manager, the wider team and sometimes the Public Sector itself.

The good news is that Trust can be repaired and the fastest way is by building **Connection**, establishing **Credibility** and being **Consistent** in all interactions with the team.

### DELIVERING CULTURE CHANGE

Our approach is quite simple: give managers the skills to create the sort of environment where staff can contribute by speaking up, capture the information and do something with it.

**My Contribution** is a strategy and an anonymous online application that welcomes Contribution by inviting feedback – positive and negative – on team wellbeing, patient care and the manager's performance in relation to building trust.

Reports are highly visual and easy to understand. The information is collated across the organisation and can be used as a management development aid as well as collecting invaluable data.

This is not the place for detailed technical specs. Suffice to say that the best way to understand any application is to use it yourself. If you are interested, all we need are a few details and we will send you an **expanded document and a link** to the demonstration.

**Click here** to submit your details.

### ACTION TIME

Maybe it's time to grasp the nettle and investigate a new way of re-building our Public Sector as we all want it to be. If you do, you will find us easy to work with and, as always, attentive to providing excellent value.

Please remember to check your inbox if you request the expanded document and link, and I am always delighted to receive your questions and comments.

Thank you for reading this article.



WELLBEING  
DYNAMICS

# The future of public services: how to manage change effectively

**Change can be integral to an organisation or business, here Barry Pirie, President of the PPMA outlines the key points when integrating and managing changes...**

Improving the delivery of public services has always been critical for any public sector organisation which wants to remain relevant and valued by the citizens it serves.

But for all that we are used to changing what we do and how we do it, the financial austerity of the last 5 years has forced the public sector to think about the way it approaches change in an entirely different way.

Gone is the luxury of making steady incremental changes to public services: budget cuts have created an imperative to think and act quickly to reinvent how we work.

What this means is that the ability to deliver change effectively and continuously is now a core capability at the heart of any public sector organisation.

In my experience of managing change, I typically come across 2 constants: the fact that there are always those that resist it and the turbulence that change causes within organisations.

The key to managing change effectively is very much down to minimising both of these. Achieving that is nearly entirely down to having an effective framework for communication and being clear about what lies ahead.

For me an effective framework for communication has 4 cornerstones.

The first is framing the objective of the changes planned. This has to be done with clarity, so that people understand why it is happening and what the desired outcomes are. Without this, people will just



**Barry Pirie**  
**President**

see change as something which is pointless and not related to the needs of the organisation.

The second is creating the opportunity for dialogue. This is important because it stops people feeling they are powerless and that change is being done to them, whether they like it or not. What's more people may also feel they have better ideas than the ones proposed by the organisation which you won't hear if you don't listen.

The third to focus on is in clarifying what change means to individuals and teams. A frequent cause of friction is the fear of the future born out of 3 factors: people being scared they will have to do things they don't feel capable of or may not want to do; fear of losing a job and fear of losing power or control over what they do. It is vital to be honest about what the future looks like and what's in it for each person or group.

Lastly, you need to paint a picture of the support they will have as they go through the change process. Many people faced by change will already feel overloaded with what they are doing already and feel like they lack the resources to do things differently.



When it comes to talking about what lies ahead, it is critical that leaders across the public sector ensure that people at every level have an unequivocal understanding of what the future looks like for our organisations.

This means explaining the end of the monolithic public sector organisation as the single 'owner' of a specific service and the need to work collaboratively with partners from charities, the private sector and blue light services to support our communities.

It also means articulating the need to behave differently and develop new skills for the new working environment which will emerge. This will not just be about working in virtual teams and using technology to do their jobs, but also the increasing role technology will have in the development and deployment of services.

In this context, the change facing managers and leaders is particularly important. They must be able to develop a culture which supports changing models for service delivery and must be ready to take responsibility for outcomes, not processes, focusing on simplicity, accessibility and transparency in the work they do.

Lastly, organisations as a whole need to understand how changing models for service delivery in the public sector will require new skills.

This means people who are responsive, flexible, efficient, focused on productivity and open to change.

Change management will necessarily involve insight around the skills gaps which exist today in these areas and how they will be bridged in the future. The danger as this happens is that we lose engaged and skilled people who wrongly assume they may not have a role in the future.

While there will be a need to bring in people with new and different skills into organisations, the diverse and talented workforce we have already in the public sector is critical to our future. ■

.....  
**Barry Pirie**

**President**

PPMA

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# Measuring Great Leadership

Is it possible to measure the value effective leadership adds to public organisations?

Without a robust method of measuring value, organisations are at risk of creating a disinterest surrounding leadership development at times when investment is key to success.

This year Jack Zenger and Joe Folkman, Leadership Development experts in the private sector, made the assertion that great leaders can double profits. By using five hundred thousand 360-degree feedback instruments pertaining to approximately fifty thousand managers, Zenger and Folkman matched up the exceptional leaders with the exceptionally profitable companies and discovered a striking correlation.

This research is intriguing because it attempts to identify, on a major scale, the specific value that leadership has on private sector organisations. Previously, evidence of this value relies on anecdotal examples of big companies with influential “poster-child” leaders.

But what of the value added to public sector organisations? Mark Moore’s seminal text *Creating Public Value* aims to explain what public sector leaders should do to enhance value in public sector organisations. Moore defines public value as: “A framework that helps us connect what we believe is valuable...and requires public resources, with improved ways of understanding what our ‘publics’ value and how we connect to them”. Notice two distinct facets to ‘value’: 1)

what ‘we’ value 2) what ‘our publics’ value. Whereas the private sector operates in terms of market forces – companies are rewarded for producing enough goods and services at the right price, and penalised if they do not – the public sector is affected by a diverse range of social, political and economic forces. Public sector leaders must negotiate this interplay in order to create change and secure value for the organisations and our citizens.

Through theoretical study, this article will show that effective leadership can be measured through the tracking of public value creation and transformation of our public services.

## Is it possible to have a single public value?

If the overarching goal is to assess leadership via the measurement of public value, it is mandatory to identify a robust public value framework. Moore’s public value concept emphasises that non-elected public servants should defend and develop their services threefold: by delivering actual services; achieving social outcomes; and by maintaining trust and legitimacy of the agency. This third point, a relatively novel suggestion, creates a difficulty in that trust and legitimacy is reliant upon fluctuating and often contradictory demands. Public sector leaders must acknowledge that, in our age of democratic pluralism, individuals do not have particularly stable preferences.

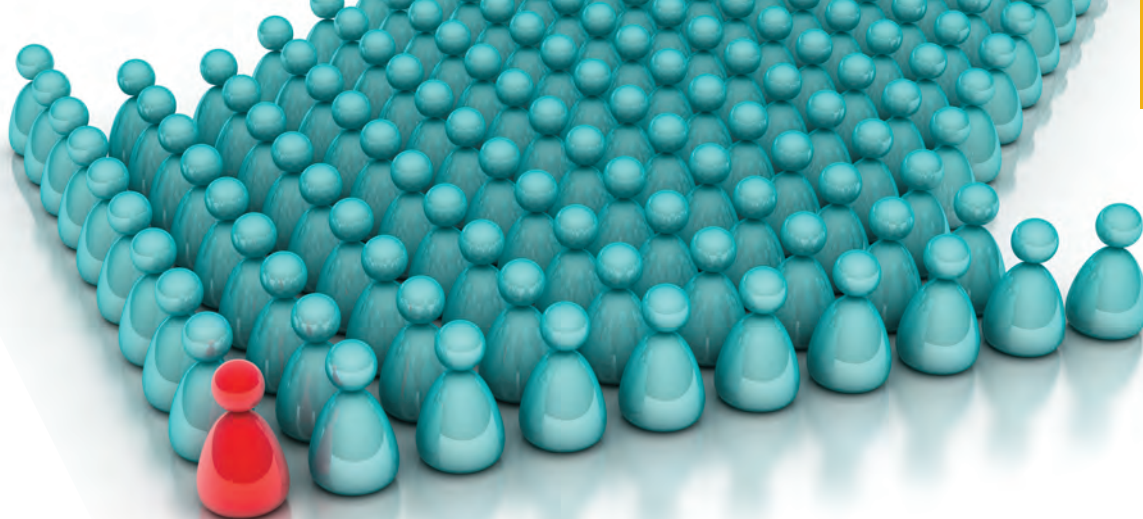
To maintain trust and defend legitimacy, organisations, and the leaders at their helms, cannot expect to work towards one definable notion of value. Successful public sector organisations thrive through the reconciling of fundamental contradictions in the mind-sets of not only their publics but also the organisations themselves. Cameron and Quinn (1999) concluded that the best organisations do well by attending to four “competing values”:

- Creation – in direct contrast to the constriction of bureaucracy, innovation is encouraged;
- Collaboration – through internal networks, such as mentors or facilitators;
- Control – managing the internal hierarchy;
- Competition – producers and directors negotiating the market.

If we are to illuminate the ways in which great leadership adds value to an organisation, it is necessary to demystify the complex notion of multiple public values. This competing values approach (named The Competing Values Framework, CVF) is a way in which the issue of an unachievable single public value can be tackled, by providing a framework to negotiate both internal and external factors.

## Where does real change occur?

All leadership and organisational development programmes attempt to



create change. In turn, change needs to be tracked in order to identify in what ways a programme has been successful.

There are three areas that change occurs: the individual; organisational; and the community. None of these areas are mutually exclusive but a web of interrelationships. The direct effects of leadership and organisational development interventions are commonly found in the individual domain, for example enhanced motivation, self-confidence and new relationships. On an organisational level, improved results can be attributed to greater leadership capability and, on a community level, transformational leaders have the ability to spread their influence through a wider social and professional network.

In a similar tripartite fashion, the outcomes of leadership development programmes can be episodic, developmental or transformative. Typically, programmes will aspire to achieve the transformational level – wherein real change occurs. In order to have an intelligent inquiry into measuring the effects of leadership and development, it is necessary to identify on what level change occurs, and frame this in terms of which of the three domains in which it occurs. Then, by setting this against the Competing Values Framework as a way of penetrating the difficult issue of what public value is,

it becomes possible to lead a highly directed investigation into how successful a programme has been in enhancing leadership.

### How can leadership be measured?

Effective evaluation of leadership development programmes is difficult because the outcomes are often perceived as intangibles (i.e. improved leadership capability). However emphasis on the above framework demonstrates the potential to dissolve this perception of intangibility. Crucially, the theory behind this approach builds on existing research and real-world evidence.

The measurement approach involves the use of both qualitative and quantitative results, as recent research has shown that skewing can occur when relying too heavily on one or the other. (We suggest using the Kirkpatrick model of training evaluation in order to achieve a fully considered result). Through the use of self-assessment by participants with degree-of-change ratings (Wall and Kelsey found that DoC ratings were more accurate than pre and post-test ratings), focus groups, competency assessments and 360-degree surveys the qualitative element of the results will be recorded. This, triangulated with quantitative, service-delivery results (for example, a service-delivery result in the health-care sector is the number of patients

seen) provides a robust method for assessing impact. Further, organisations may set their goals prior to the programme start, and cross-reference these post-intervention.

The best leaders create more profit (Zenger, Folkman) and the most successful organisations are effective in all four CVF areas (Cameron, Quinn). By placing this thinking in the context of Moore's 'public value' it is possible to design a credible and trustworthy method to measure leadership and development impact and dispel the long-standing assumption that return on investment from such programmes is unachievable. The goal is to strengthen the leadership of our public services and improve the value to our citizens.



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# Winning Support for Continuous Improvement Projects

Your quick step-by-step guide

**G**aining support to implement and sustain a continuous improvement program is an oft-voiced concern within organisations. These concerns reflect frustration in both senses of the term – feeling frustrated personally and encountering attitudes that frustrate the effectiveness of the program.

Three sets of skills and methods have shown success in gaining buy-in. They are:

- Using a proven step-by-step process for leading change.
- Recognising and overcoming resistance to change.
- Applying influence principles to engage resistant stakeholders.

## Step-by-Step Process for Leading Change

### Step 1: Establish a Sense of Urgency – Confronting Reality

People tend to feel comfortable with their current situation and naturally resist change – unless there is a good reason for change. The outcome of Step 1 is, in effect, a compelling business case for change. Why is this change necessary? Articulating that compelling reason – the issues with the current reality that drive an individual, a group or a company to drive others – is a critical first step.

For an individual project, the project charter – approved and supported by key stakeholders – can provide this compelling reason, this urgency. For a

broader initiative, such as implementing an entire Lean Six Sigma (LSS) program, substantial effort might be required to identify major issues holding the organisation back, and thus provide compelling motivation for change.

### Step 2: Form a Guiding Coalition – Early Stakeholder Engagement

Implementing change by yourself is not only lonely and frustrating – it is also ineffective. It may be appropriate to combine Steps 1 and 2 to form a guiding coalition that shares your sense of urgency and then brainstorm ways to clearly articulate the “burning platform.”

For an individual project, the team is the obvious coalition – with the addition of a management sponsor or Champion committed to the success of the project. For a LSS program, key stakeholders such as management sponsors or Champions would make a good guiding coalition – especially if the LSS program can be shown to align with achieving their own goals, the organisation’s “must-do’s” going forward. In that sense, the LSS program provides the how for achieving the goals.

### Step 3: Define the Vision

Defining the vision for improving a process or developing a new product can be a team-building activity that leads to a vital deliverable: for a smaller-scope project, a compelling



business case for the project; for a larger-scope program, the compelling vision that the stakeholders (the guiding coalition) would share with the larger organisation for how the LSS program aligns with achieving the goals of the organisation.

Team building with the guiding coalition is part of the desired outcome, and the development of the vision should involve the stakeholders so that they feel ownership of that defined vision. The vision could include such concepts as doing things right the first time, dramatically reducing new product development time or ensuring that the voice of the customer (VOC) is heard and heeded.

For a smaller-scope project, the vision can initiate and establish the project charter. For a larger-scope project, an effective set of steps for defining the vision could be:

- The senior manager/executive clearly articulates the burning platform. The stakeholders then brainstorm the issues, starting with the issues from Step 1.



- The stakeholders brainstorm keywords, phrases and terms that seem to capture the direction they would like to take.
- Either the team begins to construct a first-pass vision statement, or a stakeholder or a pair of stakeholders volunteer to work on a first draft of the vision statement for the team to review, amend or replace.
- The team reviews, edits, modifies and finalizes the vision. The vision should be easily remembered, brief, clear and compelling – powerful!

#### Step 4: Communicate the Vision

If the vision has been polished so that it is brief, clear, compelling and easily remembered, then it has fulfilled the first part of the equation:

Quality x acceptance = effectiveness

This equation explains that the effectiveness of a proposed change within an organisation depends not only on the quality of the change and the preparation for the change, but also on the receptiveness of the organisation to accepting and even embracing the change.

Some key elements required for communicating a vision well include the following1:

- Simplicity
- Analogies and examples
- A variety of media: meetings, memos, lunches, emails and newsletters. Some of these allow for a two-way communication, which is more powerful than simply talking “at” people and allows messengers to address questions and concerns.
- Repetition
- Leadership by example. Nothing

undercuts a vision like having leaders undercut the message by inconsistent behaviors or snide or counter-message remarks. Even expressions of lukewarm or contingent support undermine the credibility of the message, and subsequently its acceptance. Communicating the vision is a time to show leadership, not hesitancy.

- Addressing of seeming inconsistencies, which otherwise might also undermine the credibility of said vision.

#### Step 5: Empower Others to Act on the Vision

The term frustration is unusual in that it defines both the symptom and the cause. If people begin to feel frustrated and discouraged, it probably means that something seemingly or actually beyond their control is preventing them – frustrating them – from accomplishing the goals.

The Champion’s role is to help individual project leaders and Lean Six Sigma ‘Belts’ remove roadblocks in their projects.

#### Step 6: Generate Short-term Wins

Short-term wins help a team in a multitude of ways. They:

- Provide evidence that supports and provides justification for the project or program.
- Deliver a sense of accomplishment.
- Convey helpful feedback for the leadership team.
- Undermine cynics and critics.
- Strengthen support from the managers.
- Help build momentum.

DMAIC (Define, Measure, Analyse, Improve, Control) Lean Six Sigma proj-

ects lend themselves to low-hanging fruit. They find opportunities for quick wins in the Define and Measure phases through process mapping and the identification of non-value-added activities. Beyond that, team-building activities such as brainstorming and fishbone diagramming can achieve visible, if small-scale, success. From small acorns grow...

#### Steps 7 and 8: Consolidate Gains and Anchor the New Approach in the Culture

People rise to challenges if they trust that:

- Leaders care about the project.
- The team will be supported.
- Individual successes and the full team’s success will be recognized.

People also feel recognised when they are encouraged to share their successes, through presentations to management and elsewhere within their organisations as well as through presentations to other organisations. Media such as staff meetings, newsletters, bulletin boards, posters and banners can be used to recognize people and teams and celebrate success.



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# Why governance matters

**David Armstrong, Head of Profession at the Chartered Quality Institute details the benefits of using governance to transform organisations...**

**F**or all organisations, the delivery of high-quality products and services is essential. The consequences of failure grow ever more significant in today's world of increasing customer and stakeholder expectations, regulatory oversight and the use of social media to broadcast success or failure.

Yet we live in a world where organisations are persisting with wasteful and inefficient ways of working, delivering products and services that do not meet requirements. Organisations that are unable to transform at speed and meet customer and stakeholder expectations see their reputations and customers slip away.

To address these problems you have to start with the foundation stone for any organisations' activities – governance.

Governance is about having a clear intent that is documented through a suite of policies, processes and plans, and is established with reference to all stakeholder requirements – whether it's at the organisational, functional or product/service-delivery level. You have to have an understanding of what is to be achieved, how it can be accomplished and be certain the approach is fit for purpose. This clearly requires well-communicated policies and processes.

The real challenge is making sure the defined intent is fit for purpose and that all stakeholder requirements are clearly understood. At an organisational level, it's easy to focus on a particular stakeholder – sometimes at the expense of others – but this is usually a mistake. Organisations who only look after their customers and shareholders often see their reputations become severely compromised because they haven't properly respected the needs of their employees, suppliers or the community where they operate – or indeed the law.

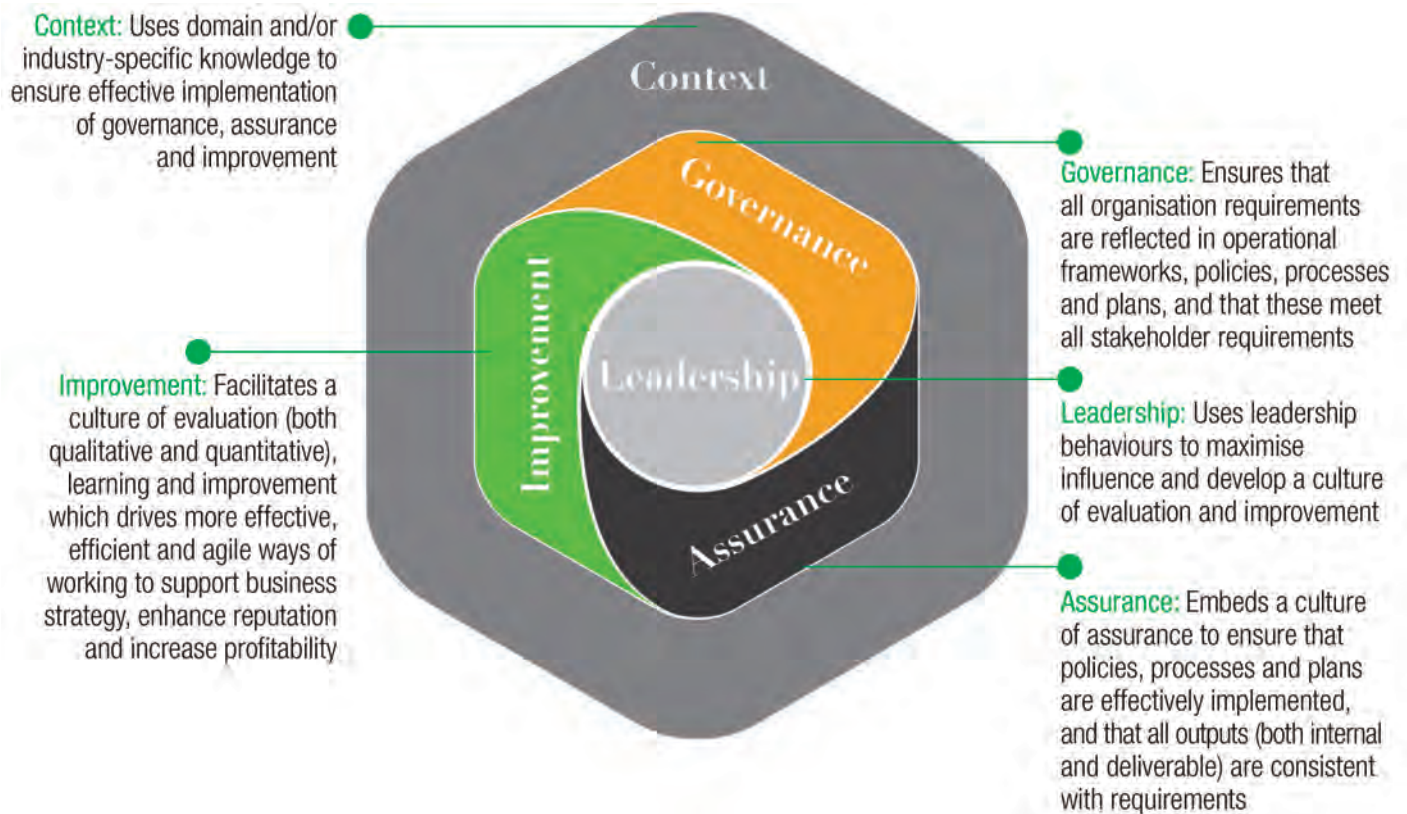


David Armstrong, Head of Profession at the Chartered Quality Institute

When organisations fail to identify their stakeholders properly, things go wrong and reputations are compromised, with some organisations going out of business.

## **Driving change**

Quality professionals who work across governance are best placed to provide the support organisations need to be effective. Governance is always owned at the point where accountability for a particular activity and outcome resides. The role of the quality professional is not to take direct responsibility for establishing good governance but to question whether governance is effective.



For example, the head of HR defines HR policies and processes for activities, such as Personal Development Reviews (PDR). There is never any suggestion that the PDR process is owned by the quality function. However, the role of the quality professional is to ask whether a policy or process for PDRs is required, to what extent it should be mandated, if it has been adequately defined and whether it's considered to be fit for purpose by the stakeholders – in this case management and employees.

### The future of governance

Governance is an area of growth because it has the most significant impact in terms of organisational robustness and protecting/enhancing reputation. Quality professionals are best placed to develop organisational capability in this regard because the profession is already heavily involved in things such as BMS, quality management systems, certifications and standards.

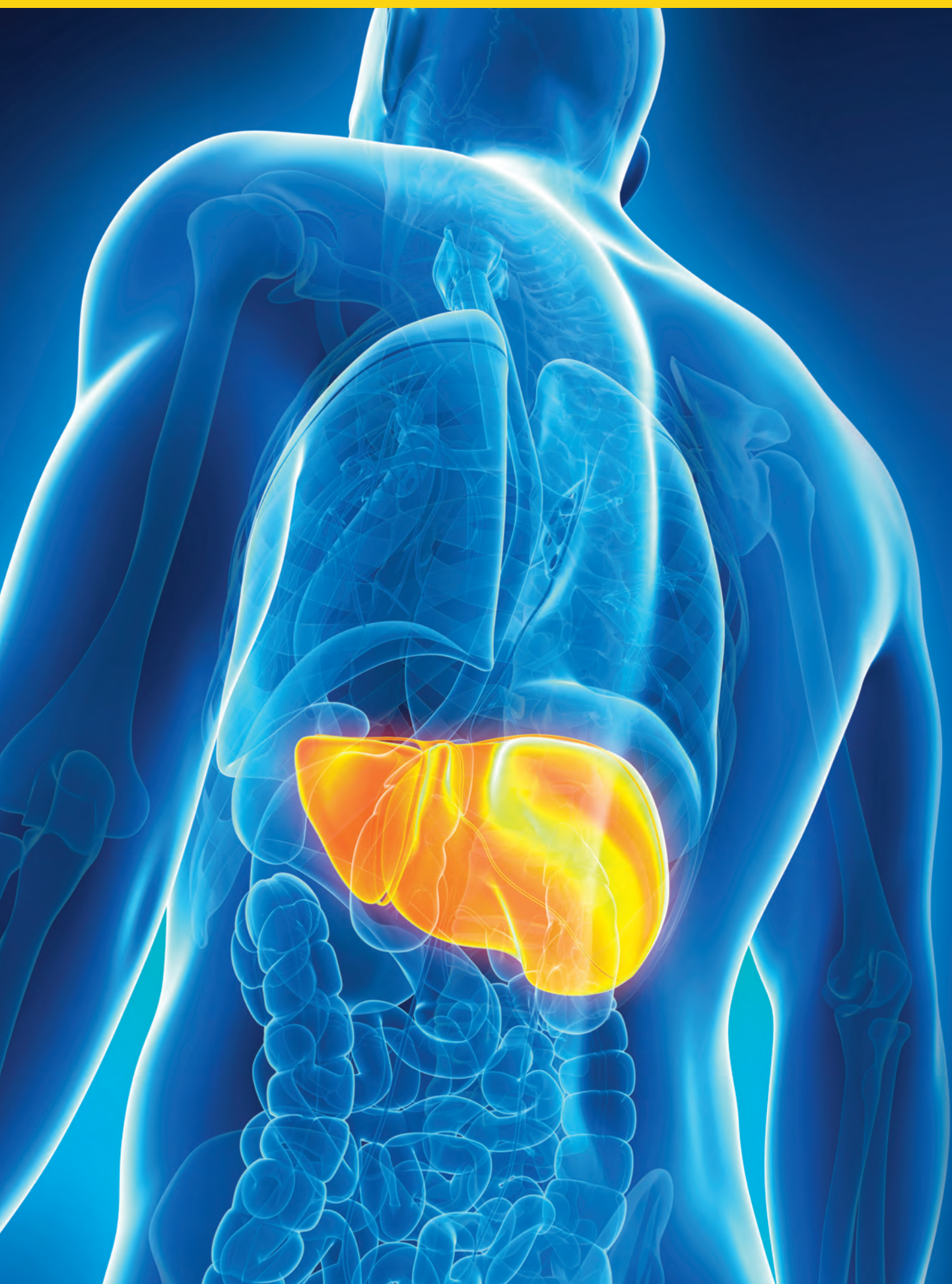
The Chartered Quality Institute is addressing the issues with a new Competency Framework (as pictured above) designed to support organisations and develop their quality staff. Society is demanding that organisations get better in this area – they can achieve this by working closely with their quality professionals and utilising their skills and knowledge. ■



.....  
**David Armstrong**  
**Head of Profession**

Chartered Quality Institute  
[www.thecqi.org](http://www.thecqi.org)





# FATTY LIVER DISEASE

## AND THE CONSEQUENCES FOR EUROPE

Alterations in our diet over the last decades, combined with a sedentary lifestyle have contributed to the worldwide incidence of overweight and metabolic syndrome, characterised by abdominal obesity, insulin resistance and Type-2 diabetes, hypertonia and dyslipidemia.

This trend is not only observed in industrialised countries in the US and Europe but also gradually now in developed as well as developing countries.

Currently it is believed that approximately 90 million Americans and 40 million Europeans suffer from a fatty liver (also called Non-alcoholic fatty liver disease (NAFLD)).



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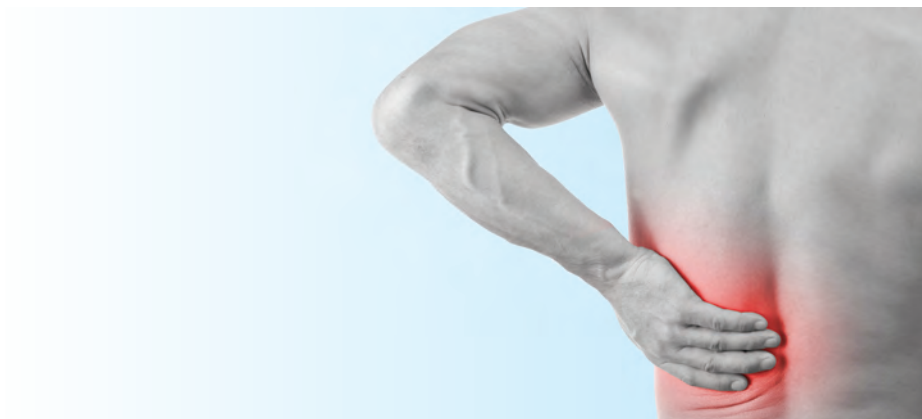
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**EUROACADEMY'S RECTOR**, since its inception, is Jüri Martin, Academician of the Estonian Academy of Sciences, DSc. The vice-rector is Peeter Karing, DSc.

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