

How U.S. research and innovation are reshaping the global energy future

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Cecilia Van Cauwenberghe discusses how U.S. research and innovation are transforming the global energy landscape, beginning with comments on energy innovation necessity

In a time of rapid technological change and global geopolitical flux, the United States Department of Energy (DOE) is executing one of the most ambitious transformations in its history. At the intersection of science, economic policy, and national security, the Research, Technology, and Economic Security (RTES) framework represents a bold attempt to futureproof the nation's energy architecture while ensuring responsible stewardship of public funds. In doing so, the DOE is not only refining how it governs federal investments but also how it positions America as a science and technology leader in a competitive global landscape.

The priorities of the DOE, the risk-based mechanisms underlying the RTES framework, and how those efforts are translating into tangible impacts, from protecting intellectual property (IP) and strengthening supply chains to fostering energy independence and global clean energy leadership, are evolving. The conversation comes at a critical time when American leadership in energy innovation could determine not just economic prosperity but also geopolitical leverage. Stakeholders from policy, industry, and academia will need to be aware of these changes, as they can gain particular value from understanding how the DOE is operationalizing RTES to drive resilience, growth, and sustainability simultaneously.

Resilient by design: Core elements of the RTES framework

The Research, Technology, and Economic Security (RTES) memo ⁽¹⁾, formally adopted in November 2024, provides a comprehensive lens through which the DOE governs risk, value, and opportunity across its energy and research portfolio. It reflects a structured, harmonized, and nuanced approach to balancing open innovation with national security imperatives. Let us explore it in more detail.

- Taxpayer-first risk discipline:

The framework places strong emphasis on transparency and accountability in the management of federal funding. One key example is the DOE's policy change introduced in May 2025 to cap indirect cost reimbursements, with 10% for state and local governments and 15% for non-profits and for-profit institutions. These reforms are projected to save taxpayers nearly \$935 million annually. ⁽²⁾

- Proportional risk mitigation:
RTES incorporates a tiered, stage-specific system to assess and mitigate risks across basic research, applied development, and full-scale deployment. By categorizing activities by technology readiness levels, the DOE applies proportionate risk controls to different funding instruments, including grants, loans, and cooperative agreements.
- Multi-dimensional risk coverage:
From IP theft and supply chain dependencies to grid security and foreign influence, RTES covers a broad array of risk dimensions. The framework empowers program officers to implement tailored controls across the award lifecycle, informed by inputs from DOE's Office of Intelligence and Counterintelligence. ⁽³⁾
- Enabling strategic collaboration:
Perhaps most critically, the DOE retains a commitment to open science and international collaboration. The framework recognizes that foreign partnerships and talent exchange are foundational to U.S. leadership in scientific discovery and innovation, so long as the risks are assessed and managed.

Turning policy into practice: Real-world deployments and case studies

The implications of the RTES framework are already visible across multiple operational domains. DOE program offices and National Labs are actively applying their principles to shape funding decisions, partnership eligibility, and technology investments. Let us introduce the main elements.

- Supply chain resilience with the SCRL tool:
The Office of Manufacturing and Energy Supply Chains (MESC), in partnership with the National Laboratories, developed the Supply Chain Readiness Levels (SCRL) tool. ⁽⁴⁾ This analytics platform maps vulnerabilities in critical energy supply chains, especially dependencies on “covered nations”, and guides both federal and private sector investment priorities. The tool is being used to address supply risk in battery minerals, transformers, and grid components.
- Geothermal innovation pilots:
In 2024, the DOE's Geothermal Technologies Office announced over \$30 million in funding for reservoir thermal energy storage (RTES) demonstration projects. ⁽⁵⁾ These pilots are testing new wellbore construction and high-temperature tools that can serve as baseload renewable power, offering grid flexibility while reducing emissions.
- Scientific integrity and IP protection:
The RTES Office mandates complete disclosure of foreign affiliations and institutional partnerships in all grant and contract proposals. This has led to the rejection or revision of several projects where IP risk or foreign control could not be mitigated. These processes ensure the integrity of federal investments in high-impact R&D. ⁽⁶⁾

- Post-2025 energy dominance agenda:

Following the return of President Trump in 2025, the DOE issued sweeping secretarial orders to accelerate fossil fuel permitting, expand LNG exports, and reauthorize offshore oil and gas leases. Within 100 days, the DOE approved more new LNG export capacity than any nation outside the U.S. possesses, cementing the country's status as the top oil and gas producer and exporter. ⁽⁷⁾

Building a clean tech superpower: Renewable energy and economic growth

The Office of Energy Efficiency and Renewable Energy (EERE) plays a central role in advancing clean energy innovation and commercialization. The EERE has streamlined its strategy around high-potential domains such as solar, wind, hydrogen, bioenergy, and sustainable mobility. Let us see how this is progressing.

- Capitalizing on a \$23 trillion market:

With the global renewable energy market projected to exceed \$23 trillion by 2030, the U.S. is positioning itself to capture market share through smart policy and strategic public investment. Programs like the Loan Programs Office and clean energy tax credits under the Inflation Reduction Act are enabling private capital leverage, creating manufacturing hubs, and generating clean jobs. ⁽⁸⁾

- Job creation and economic renewal:

Since 2021, clean energy projects have attracted more than \$450 billion in private investment and created over 400,000 new jobs across sectors such as solar panel manufacturing, wind turbine logistics, battery storage, and electric vehicles. These gains have helped revitalize regional economies and support the U.S. manufacturing base. ⁽⁹⁾

- Health and household benefits:

Energy-efficient technologies are reducing household utility bills, improving indoor air quality, and cutting emissions that contribute to respiratory disease. DOE analysis suggests that combined benefits from clean energy deployment could generate tens of billions of dollars annually in public health savings. ⁽¹⁰⁾

The road ahead: Future trends and strategic challenges

As the RTES framework matures and implementation scales, several trends and hurdles will define its long-term success. The use of analytical platforms like SCRL will be essential in dynamically tracking supply chain risks. Expanding these tools to cover emerging sectors such as hydrogen, Small Modular Reactors (SMRs), and rare earth magnets could help preempt future dependencies.

Furthermore, navigating the dual mandate of open science and secure innovation will remain challenging. The DOE must continue refining its evaluation criteria to allow for collaboration without compromising IP integrity or national competitiveness.

In terms of scaling deployment infrastructure, the U.S. will need trillions in grid upgrades, workforce training, and permitting reform to accommodate the full potential of renewable energy resources. This will require bipartisan policy support, private sector coordination, and ongoing EERE leadership.

Finally, geopolitical volatility persists. As tensions with China, Russia, and other state actors persist, the DOE's RTES playbook must remain agile, balancing proactive risk mitigation with a forward-looking innovation strategy.

Final thoughts: Innovation secured and scaled

The U.S. Department of Energy's RTES framework represents a paradigm shift in how public research dollars are governed. By weaving risk management into the core of its investment and oversight processes, DOE is charting a path toward resilience without sacrificing scientific openness. From grid security and clean energy leadership to economic development and international collaboration, the stakes of energy innovation have never been higher.

Through the synergy of EERE's innovation programs and RTES's accountability structures, the U.S. is laying the groundwork for a cleaner, safer, and more prosperous energy future. What remains now is to scale that vision with purpose, clarity, and enduring public trust.

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