



American Energy
Innovation Council

ENERGY INNOVATION: FUELING AMERICA'S ECONOMIC ENGINE

Executive Summary

November 2018

EXECUTIVE SUMMARY

Energy innovation fuels America's economic engine. As nations around the world race to achieve technological leadership, the R&D investment decisions American policymakers make today will determine the nation's trajectory in the global economy tomorrow. Despite recent increases in energy R&D funding in Fiscal Year (FY) 2019, U.S. federal R&D commitments remain far below the level needed to match the scale of the challenge ahead—developing the next generation of energy technologies—particularly as other nations accelerate their R&D investments.

Recognizing the importance of innovation to economic growth, international competitiveness, and national security, AEIC has long advocated for doubling federal energy R&D funding as an investment in America's long-term future. The business leaders who comprise AEIC recognize that government plays a vital role by filling gaps in places where the private sector underinvests. Due to long time horizons, high capital costs, and regulatory uncertainty, it is too risky for the private sector, on its own, to support fundamental advances in energy technologies that push the U.S. economy forward.

Building on the core recommendations AEIC has touted for years, the report lays out the current state of U.S. and global R&D investments and outlines both the challenges and impact of making robust federal investments in energy R&D to America's long-term prosperity and well-being. The report also includes results from a survey of scientists and entrepreneurs funded by federal R&D programs in the DOE and explores the impact of institutional practices and features at DOE on R&D outcomes.

AEIC CORE PRINCIPALS

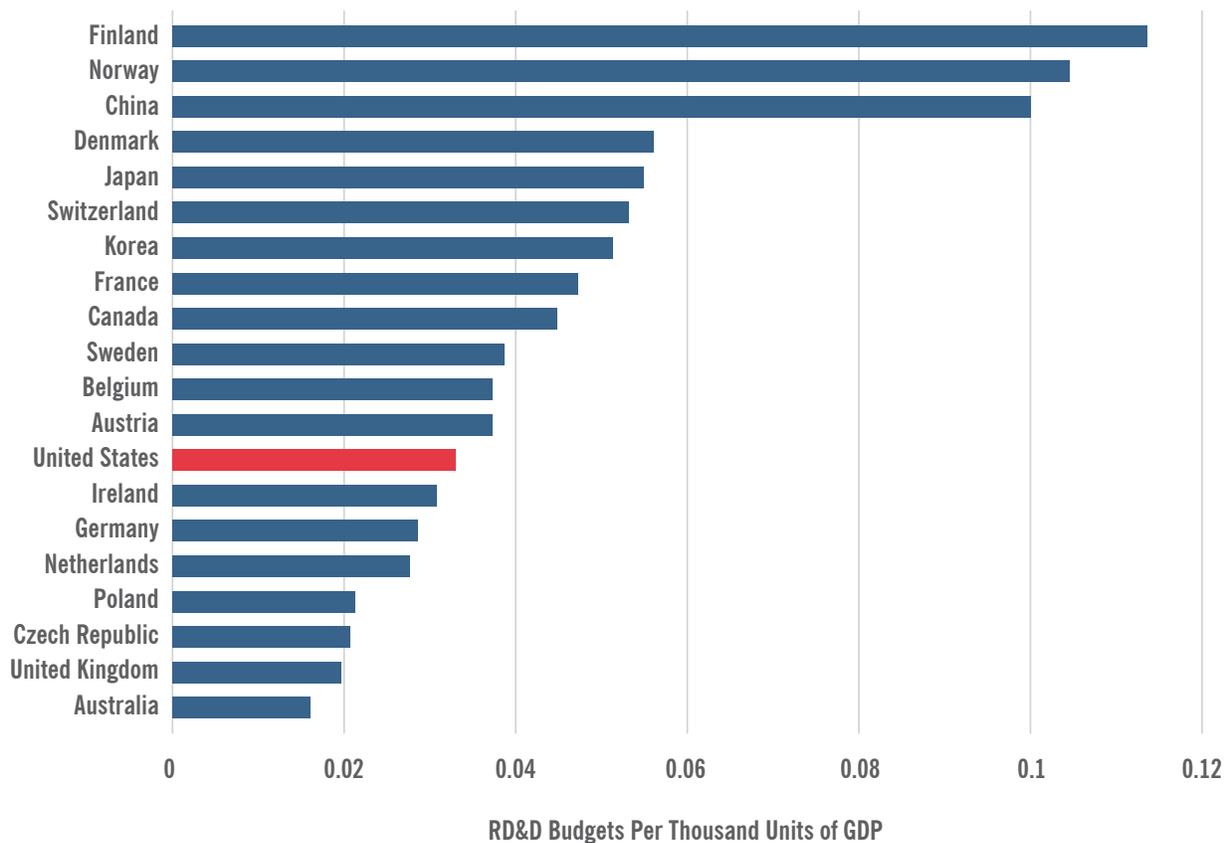
1. Build on efforts to develop comprehensive assessments and a strategic direction for the nation's energy sector.
2. Invest \$16 billion per year in advanced energy innovation.
3. Fund ARPA-E at \$1 billion per year. At a minimum, ARPA-E should receive \$400 million per year in fiscal year (FY) 2020, a \$34 million increase over FY 2019, which would allow one additional high-impact R&D program to be released by ARPA-E in that year.
4. Support and expand new and innovative institutional arrangements, such as energy innovation hubs, energy frontier research centers, the Manufacturing USA program, and the Energy Materials Network.
5. Make the Department of Energy (DOE) work smarter—along the ARPA-E model where appropriate.
6. Establish a New Energy Challenge Program for high-impact pilot projects.
7. Establish regionally centered innovation programs.
8. Have the federal government support creative efforts to incentivize private-sector investment in energy R&D.

GLOBAL ENERGY R&D INVESTMENT TRENDS

Total energy investment worldwide was over \$1.7 trillion in 2016, accounting for 2.2 percent of global GDP, and investment will continue to grow. Much of this investment was in advanced energy technology, which grew 24 percent since 2011 to a total of \$1.4 trillion across market segments ranging from electricity generation to manufacturing equipment to advanced fuel production and delivery. Advanced energy industries generated \$200 billion in revenue in the United States in 2016 alone.

Global energy R&D was equally balanced between public and private sources in 2016, reflecting the importance of both government and industry in facilitating energy innovation across the globe. This is a reality American decision makers must heed, particularly in light of declining U.S. federal energy R&D funding as a fraction of federal outlays. In FY2018, federal energy R&D investments were 26% below the levels set in 1978, the same year the DOE was established. China has become one of the largest spenders on energy R&D as a share of GDP, and the United States now trails 12 other nations in the amount of public dollars invested in energy R&D relative to GDP (see figure).

FIGURE 1. GOVERNMENT ENERGY RD&D INVESTMENT AS A PERCENTAGE OF GDP, 2015



Source: David M. Hart and Colin Cunliff. "Federal Energy RD&D: Building on Momentum in Fiscal Year 2019." Information Technology & Innovation Foundation. April 2018.

Available at: <https://itif.org/publications/2018/04/23/federal-energy-rdd-building-momentum-fiscal-year-2019>

Simon Bennett and Remi Gigoux. "Declining Energy Research Budgets Are a Cause for Concern." International Energy Agency. October 2017.

Available at: <https://www.iea.org/newsroom/news/2017/october/commentary-declining-energy-research-budgets-are-a-cause-for-concern.html>

Note: The statistic for China's public energy R&D investment includes government and state-owned enterprise spending.

SURVEY OF DOE-FUNDED ENERGY R&D

To assess best practices in innovation R&D management practices at the US DOE, AEIC partnered with the Energy Futures Initiative (EFI), launched by former Secretary of Energy Ernest Moniz, to survey researchers at universities and companies that received funding from R&D programs at DOE. These include DOE's applied offices as well as newer institutional arrangements such as the Advanced Research Projects Agency – Energy (ARPA-E) and Energy Frontier Research Centers (EFRCs).

HIGH-LEVEL INSIGHTS

- 1. ARPA-E is performing well.** ARPA-E projects report a relatively rapid progression in technology readiness level relative to the average project cost and were among the few in the sample to report the creation of spin-off companies, the development new or improved products, or patents awarded or pending. Respondents indicated that ARPA-E scientific and technical oversight was more rigorous than other federal R&D programs but that this oversight had a positive impact on achieving project outcomes overall.
- 2. Reported assessment metrics vary by program.** No single assessment metric was reported to DOE across all programs in the sample. This variation may reflect a difference in which metrics are considered valuable for assessing the progress of a project in different DOE programs at different places in the innovation pipeline.
- 3. DOE scientific and technical oversight is contributing positively to achieving outcomes.** Most of the respondents in the sample across DOE-funded programs had performed research at other federal agencies and indicated that DOE scientific and technical oversight was more helpful or on par with that of other federal agencies in achieving project outcomes.
- 4. Uncertainty about future DOE funding adversely impacts researchers' planning efforts.** Uncertainty in future availability of DOE funding impacted their planning for current or future energy R&D efforts.

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