

Energizing Innovation: Federal Energy RD&D in FY22 and Beyond

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Report Summary

Full Report: <http://itif.org/energy-budget-fy22>

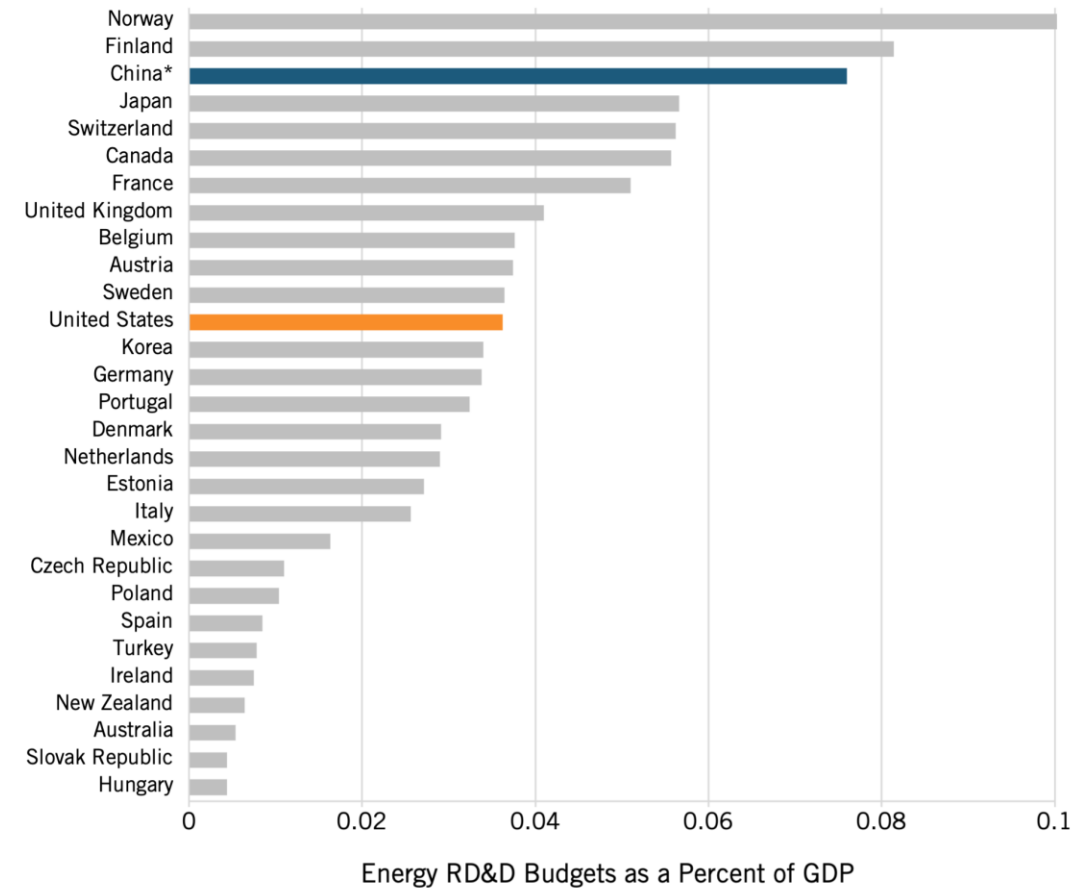
New ITIF Report on U.S. Energy RD&D Spending

- In-depth analysis of all programs and subprograms that make up the clean energy innovation budget.
- Analytical overview, plus short briefs for each of DOE's 21 energy science and technology research programs.
- Data visualizations for main report and all programs.
- 80+ recommendations for DOE and Congress.
- Available at <http://itif.org/energy-budget-fy22>
- Updated throughout the FY22 cycle.



Innovation is Essential to Drive Economic Growth and Boost U.S. Competitiveness

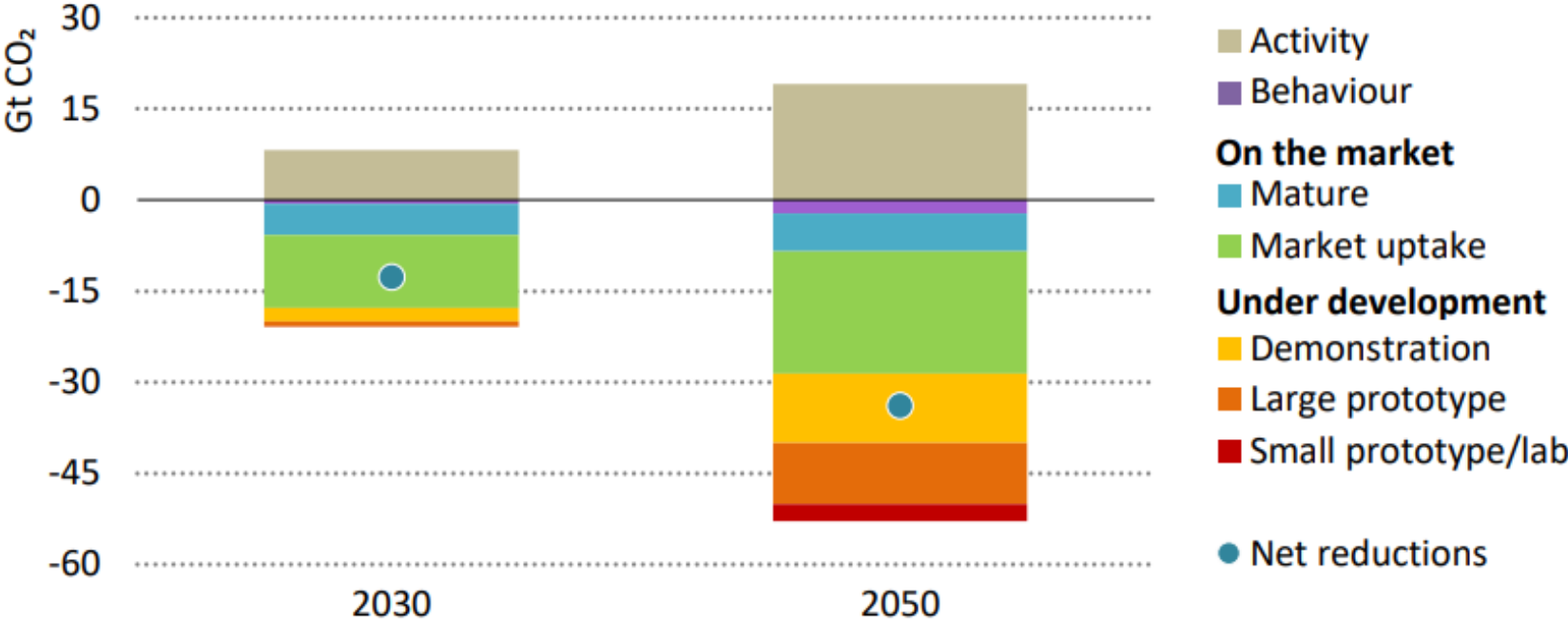
- Global annual investment grew by 2 percent for renewable energy and 28 percent for EVs in 2020 despite the pandemic, highlighting significant opportunities to capture growing global markets.
- U.S. leadership in public funding for energy RD&D is being challenged by China and Europe.
- China doubled its investment in clean energy RD&D between 2015 and 2020 to \$8 billion annually.



Innovation is Essential to Combat Climate Change

Nearly **half** of annual emissions reductions necessary to decarbonize the global economy by **2050** will likely come from technologies that are in the demonstration or prototype stage.

Global CO₂ emissions changes by technology maturity category in the Net-Zero Emissions by 2050 Scenario

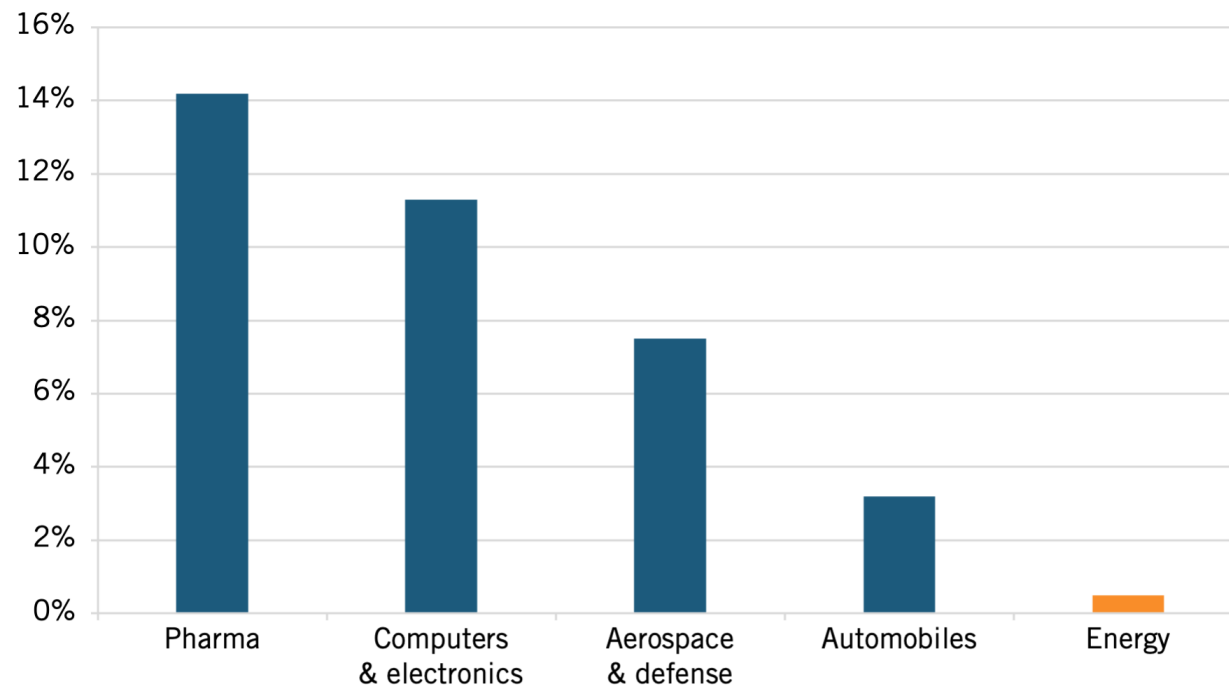


Source: IEA, 2021

The Federal Government Is Well-Suited To Make High-risk, Long-term Investments

- The energy industry only invests **0.5 percent** of revenue in R&D.
- Unlike many other major global industries, clean energy faces scale-up and commercialization challenges because of its long technology development lifecycles, capital intensity, and technical and financial risks.

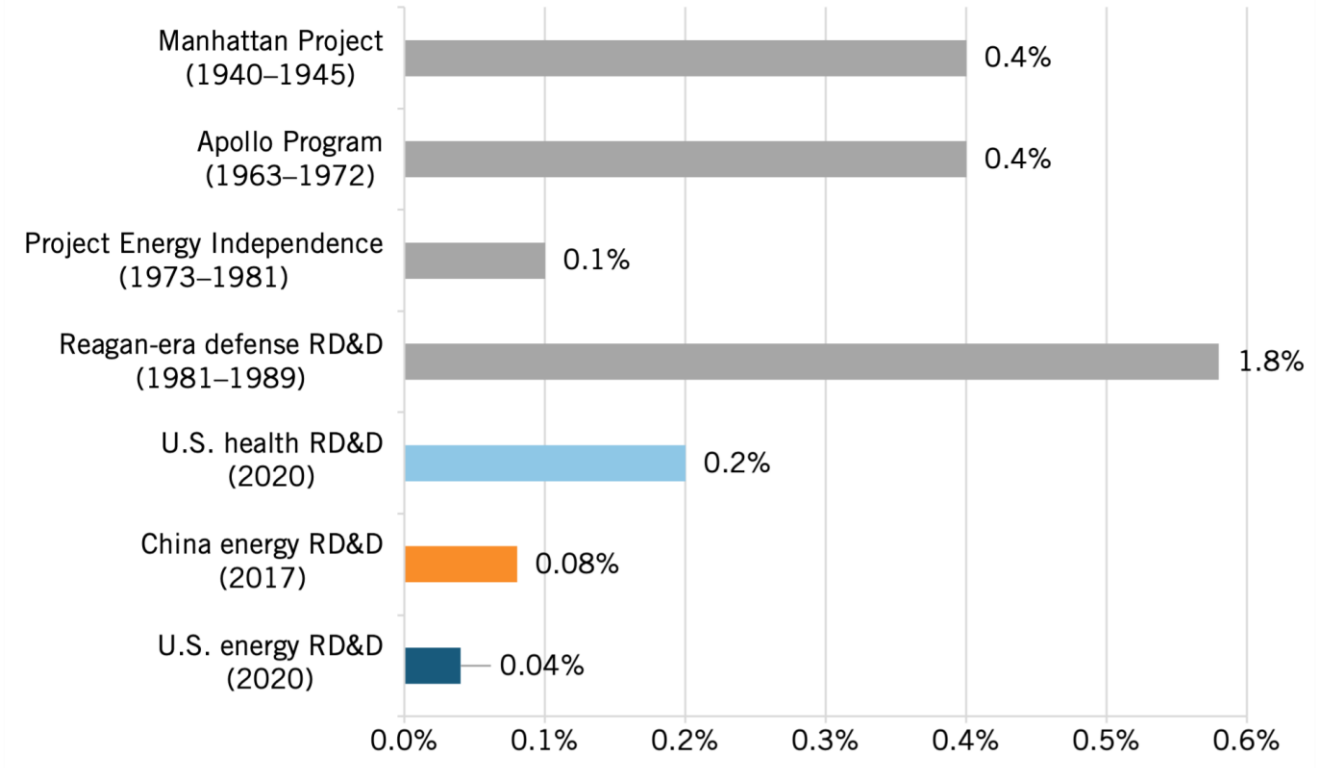
R&D spending as a percentage of revenue across major global industries, 2018



Source: PwC, NSH

Time for a Moon Shot in Clean Energy

- Federal investment in RD&D has accelerated the development of life-saving drugs, modernized the military's arsenal, and put a man on the moon.
- Current U.S. federal energy RD&D investment as a share of GDP lags behind other national innovation missions and the comparable investment by China.

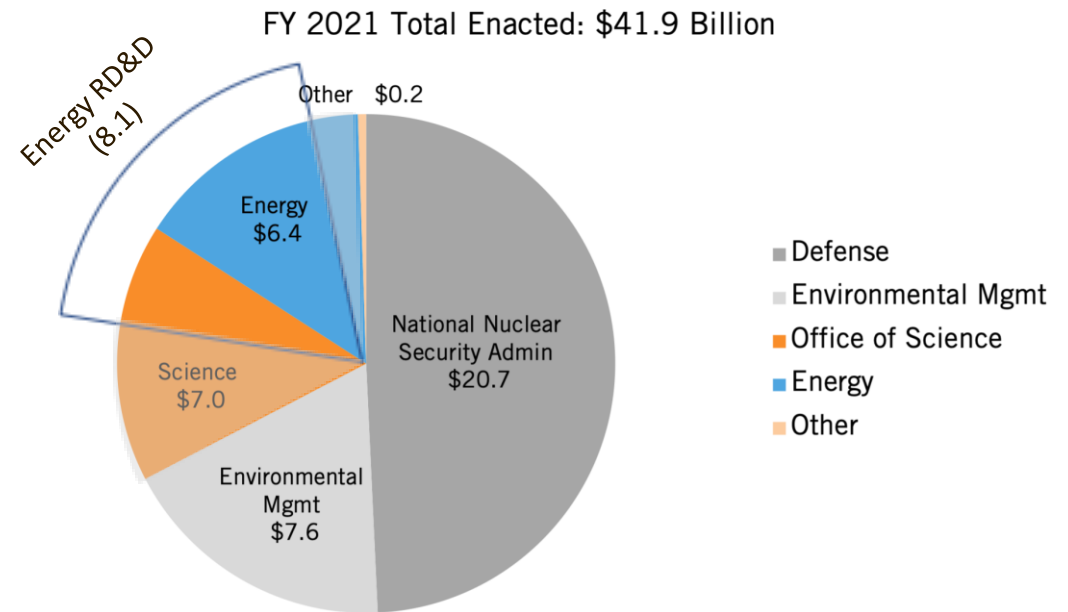


Case Study: The Federal Role in the Shale Gas Revolution

The shale gas revolution example illustrates the synergies of “technology push” and “market pull” policies working in concert to shepherd a new technology to market. Beginning in the late 1970s, the federal government funded fundamental research in directional drilling and shale resource characterization, countenanced and funded industry-wide collaboration in applied RD&D that might otherwise have drawn antitrust scrutiny, and subsidized industry-led demonstrations of the first horizontal wells in West Virginia and Texas. This technology push overlapped with a time-limited market-pull production tax credit for wells drilled between 1980 and 1992, with production eligible for the credit through 2002. By 2002, when federal support tapered off, shale gas had grown to account for 2 percent of domestic gas production and was able to compete in the market on its own. Since then, hydraulic fracturing technologies, combined with vast domestic shale resources, have enabled shale gas to grow to 70 percent of domestic production.

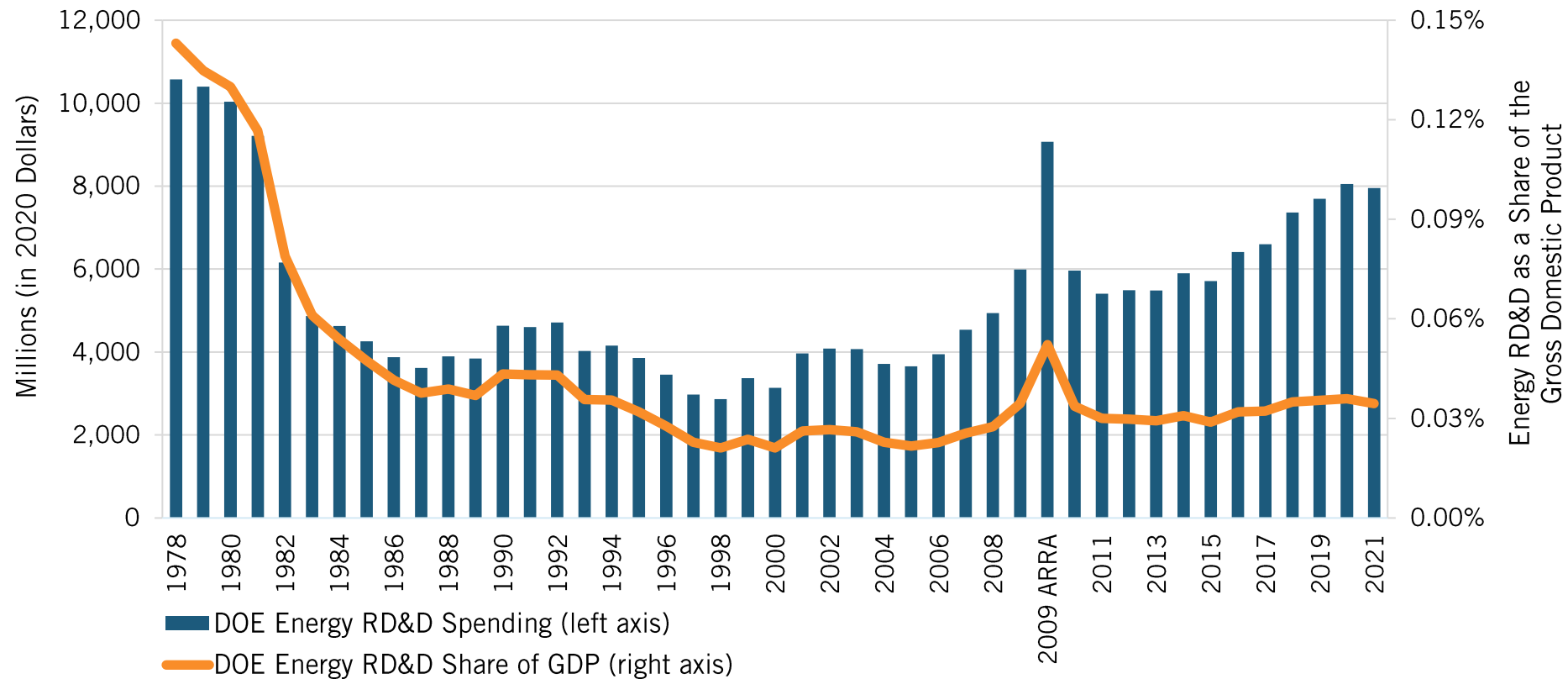
DOE is the Department of Everything, Not Just Energy

- DOE's National Nuclear Security Administration, Office of Environmental Management, and other defense programs make up **two-thirds** of DOE's \$42 billion budget.
- **Less than half** of DOE's \$7 billion Office of Science funding is devoted to advancing energy research.
- DOE's energy programs include both **RD&D and non-RD&D** functions.
- Energy RD&D thus makes up **only about \$8 billion** of DOE's total budget



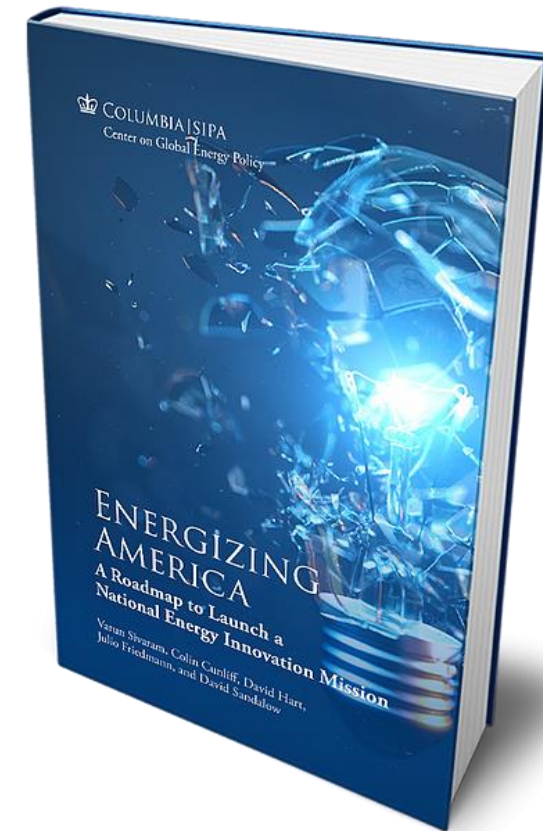
Federal Energy R&D Funding, FY 1978–2021

Congress has increased budgets for DOE's energy programs for 11 of the last 15 years, but annual appropriations have fallen short of doubling targets, and funding has not yet returned to its 1978 levels.



Energizing America: A Roadmap to Launch a National Innovation Mission

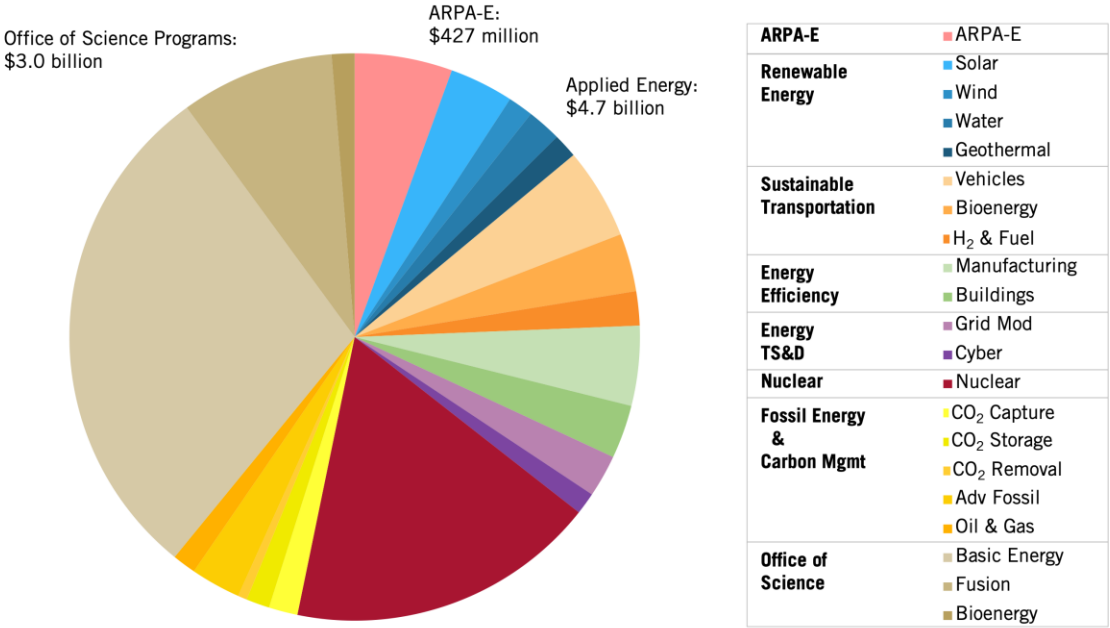
- This report builds on *Energizing America* and its recommendations to accelerate critical energy technologies.
- Other ITIF reports referenced include:
 - David M. Hart, “Building Back Cleaner With Industrial Decarbonization Demonstration Projects” (ITIF, 2021) <https://itif.org/sites/default/files/2021-industrial-decarbonization.pdf>.
 - Colin Cunliff, “An Innovation Agenda for Deep Decarbonization: Bridging Gaps in the Federal Energy RD&D Portfolio” (ITIF, 2018) <http://www2.itif.org/2018-innovation-agenda-decarbonization.pdf>.
 - Robert Rozansky, “An Innovation Agenda for Advanced Renewable Energy Technologies” (ITIF, 2020), <http://www2.itif.org/2020-advanced-renewables-energy.pdf>.



DOE Energy RD&D Funding by Program Area

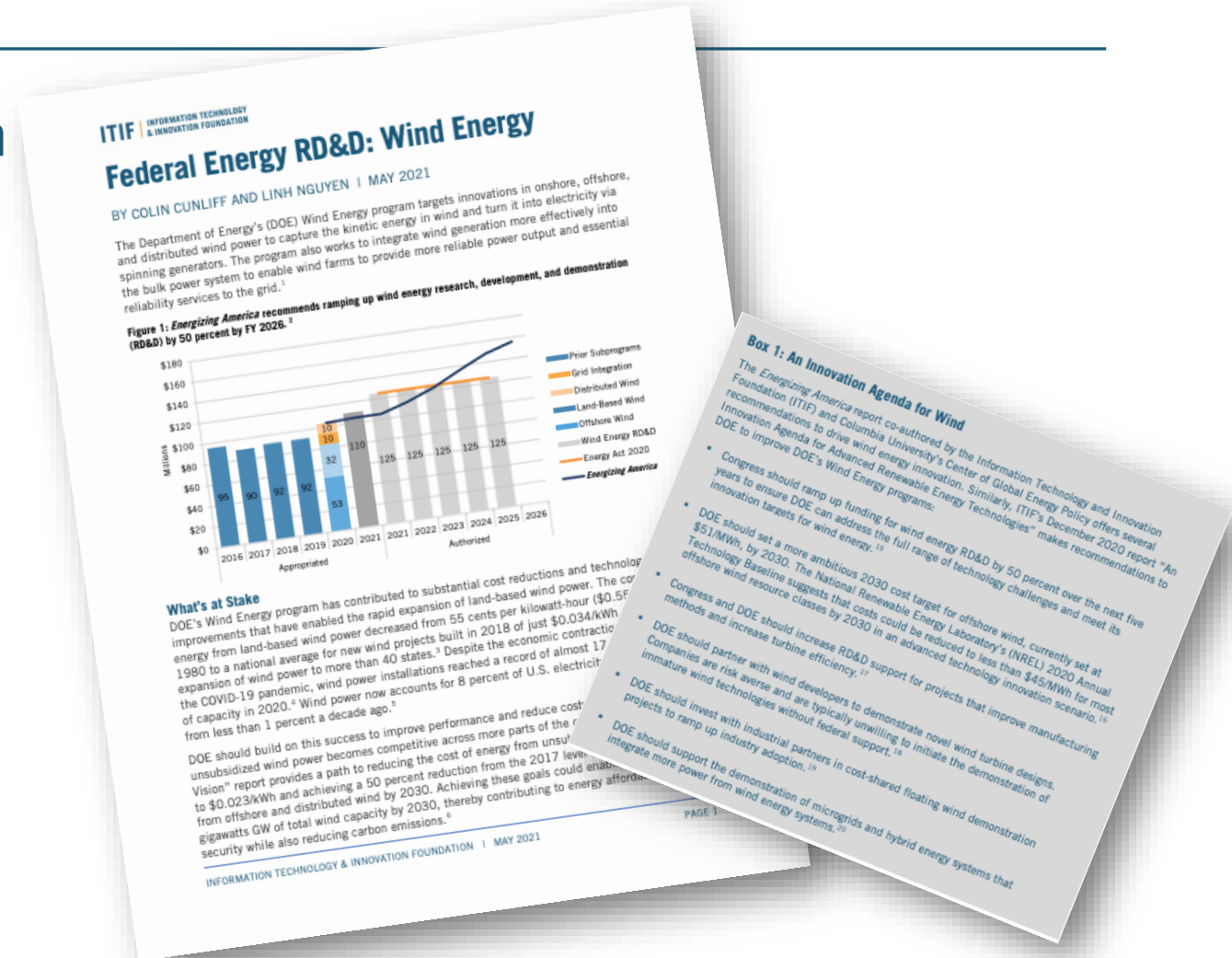
- 21 briefs that span DOE's energy RD&D programs across these offices:

- ARPA-E
- Renewable Energy
- Sustainable Transportation
- Energy Efficiency
- Electricity
- Nuclear Energy
- Fossil Energy and Carbon Management
- Science



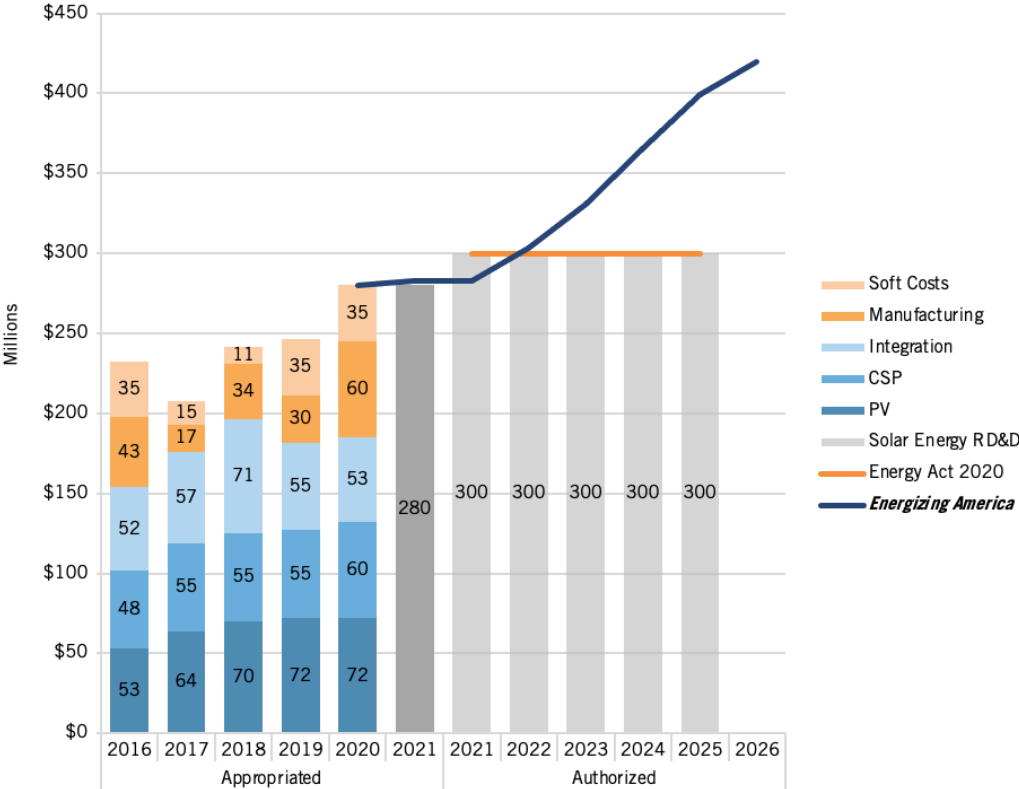
What's in Each Brief?

- Description of the DOE's program and technology goals.
- What's at stake and potential impacts of the program.
- Historic and authorized funding levels.
- Targeted recommendations for Congress and DOE to accelerate innovation.



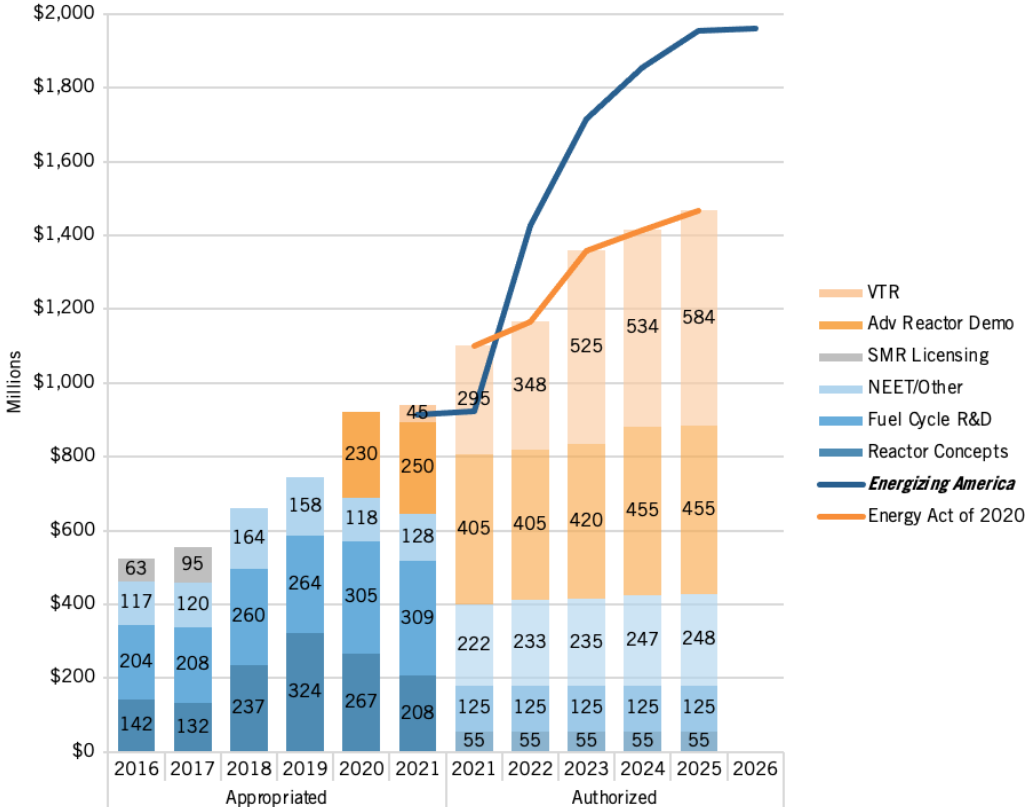
Example: Solar Energy

- The Solar Energy Technology Office** funds RD&D on photovoltaics, concentrating solar power, system integration, manufacturing, and soft costs.
- The Energy Act of 2020** provides the first reauthorization of this program in over a decade. It directs DOE to explore a range of advanced solar energy technologies, including perovskites, thin-film devices, solar heating and cooling, and integration.
- Energizing America** recommends ramping up solar energy RD&D by 50 percent by FY 2026.



Example: Nuclear Energy

- DOE's Nuclear Energy program** funds RD&D on the versatile test reactor, advanced reactor demonstrations, small modular reactor licensing, the nuclear fuel cycle, and more.
- The Energy Act of 2020** provides the first reauthorization of this program in over a decade, including the advanced reactor demonstration program and funding for the Versatile Test Reactor.
- Energizing America** recommends roughly doubling the funding for nuclear RD&D by FY 2026.



Case Study: Launching the Pollution Control Industry

Federal investments in pollution control technologies provide an example of the multiple benefits of energy RD&D. Prior to DOE's coal RD&D programs, flue gas desulfurization (FGD) systems (aka "scrubbers") were costly to build and maintain, incurred substantial energy costs to run, and produced a sludge waste requiring considerable land use for proper disposal. Advancements in pollution control helped drive capital and operating costs down by nearly 50 percent, kept energy costs low, and turned the waste from FGD scrubbers into valuable byproducts such as wallboard-grade gypsum. DOE investments in FGD scrubbers resulted in over \$50 billion in savings from lower FGD costs and public health benefits, and also helped turn America into a global leader in environmental technologies. Environmental technologies and services contribute to a trade surplus, yielding net exports of nearly \$27 billion annually.

Federal Energy RD&D – Read the Complete Series

Available at <https://itif.org/energy-budget-fy22>

- [Summary](#)

ARPA-E

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Nuclear

- [Nuclear](#)

Office of Electricity

- [Grid Modernization](#)
- [Cybersecurity](#)

Office of Science

- [Basic Energy Sciences](#)
- [Fusion Energy Sciences](#)
- [Bioenergy Research Centers](#)

Bipartisan Support for Clean Energy Innovation is Surging

DOE energy RD&D budgets **have increased by 40%** over the past four years.

Energy Act of 2020 reauthorized many DOE programs, and included measures sponsored by **100+ Members from both parties**

President Joe Biden has pledged to **quadruple government-wide clean energy RD&D over four years.**



Energy Act of 2020: A Significant Step Forward

- Key elements include:
 - Revising and updating program authorizations to account for technological advances over the last decade and to address current and emerging challenges;
 - Creating new programs in clean manufacturing and carbon removal—sectors that have historically been underrepresented in DOE's portfolio; and
 - Providing the first significant new investment in large-scale demonstration projects—which are essential for scaling up and validating emerging technologies—in more than a decade.

Time for a Moon Shot!

The United States should launch a “moon shot” in clean energy that mobilizes the nation’s unmatched innovative capabilities to meet the climate challenge and capture global markets. Congress and the administration should seize on the momentum created by the passage of the Energy Act of 2020 and provide a multi-billion-dollar increase in energy innovation programs at DOE in its FY 2022 budget.

- [Report](#)
- [Data visualization](#)
- [Event video](#) (featuring Deputy Secretary of Energy Dave Turk)
- [Database](#)

Thank You!

Check back for updates throughout the FY 2022 budget cycle.

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