

In Defense of the U.S. Department of Energy's Transformative Loan & Grant Programs

Part 2

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Advancing Innovations from Early-State Promise to the Threshold of Commercialization

It requires nine development steps, known as Technology Readiness Levels, or **TRLs**, and often as many as 10 to 15 years or more, for an innovation to advance from a promising concept to commercial realization.



The Department of Energy's (DOE's) grant and loan programs – administered by the **Advanced Research Projects Agency-Energy (ARPA-E)**, the **Office of Energy Efficiency and Renewable Energy (EERE)**, the Office of Clean Energy Deployment (OCED), and the **Loan Programs Office (LPO)** – provide the essential building blocks to turn innovations and emerging technologies into job-creating, local-economy-growing, local-tax-generating, and global-market-leading projects that will sustain local communities and improve the well-being of their residents for decades to come.

ARPA-E

The Advanced Research Projects Agency – Energy (ARPA-E) is the first of DOE's essential building blocks for advancing innovations. It plays a significant role in incubating and accelerating highly promising initiatives by identifying and supporting revolutionary inventions and transformational advances in high-potential areas, moving them through the first Technology Readiness Levels, *TRLs 1-3*, from concept to the initiation of active research and the development and proof of concept validation,

ARPA-E's focus is on nurturing the projects, economic drivers, and global dominating technologies of tomorrow.

It does this through dynamic technical programs, each of which addresses different parts of the energy technology space. It also accepts open solicitations on a periodic basis which seek to find and advance the most innovative new ideas in energy technology across the full spectrum of energy applications, thus allowing the agency to support the development of important technologies that fall outside the scope of its focused programs.

ARPA-E has demonstrated significant success in accelerating high-potential, novel technical approaches to existing and emerging U.S. energy challenges, as well as in accelerating the economic impact of U.S. investments in energy research and development and advancing the commercialization readiness of successful projects.

ARPA-E's Technology-to-Market Advisors and Program Directors work closely with its grantees to help identify pathways toward commercial deployment, using EERE and OCED grants and the Title 17 loan program to advance projects through each additional Technology Readiness Level to reach commercial realization.

The innovations and technologies that will create the jobs, economic growth, increased local tax revenues, and improved well-being and health for America and Americans in the years to come – **which are initiated today by science fair high school students, visionary startups, and entrepreneurs working out of spare bedrooms and garages** – are launched toward realization by ARPA-E.



EERE

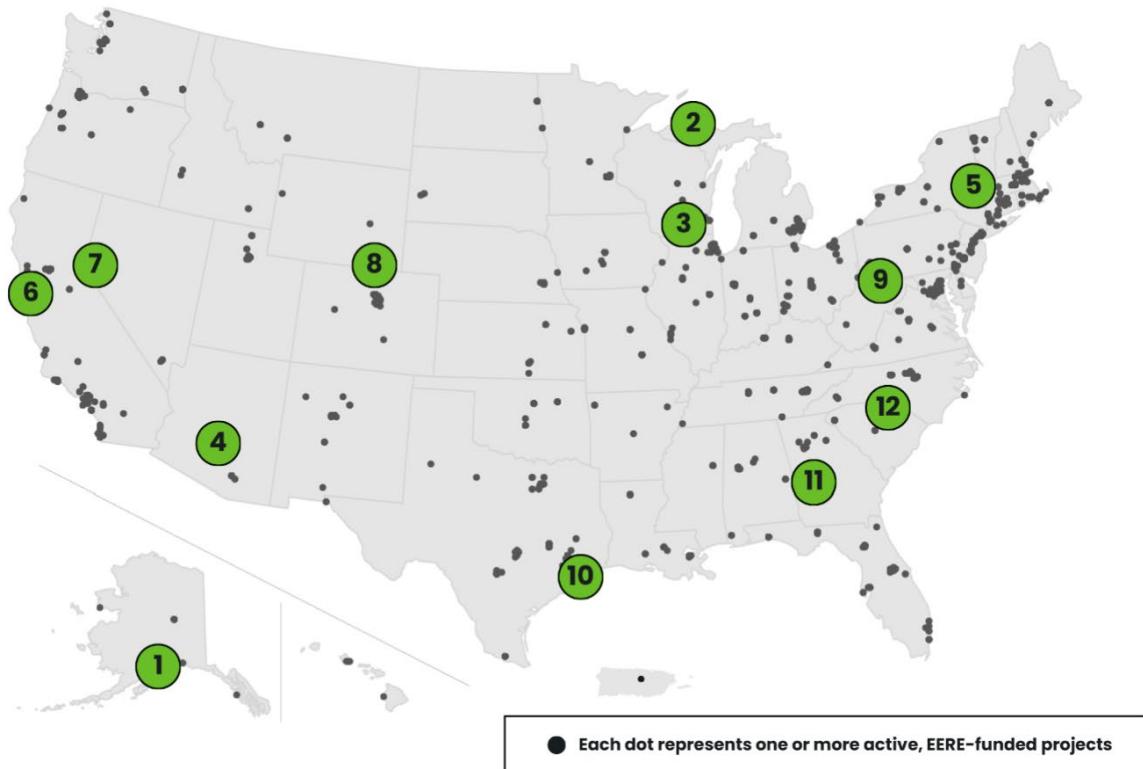
The Office of Energy Efficiency and Renewable Energy (EERE) administers multiple funding programs that are the second essential building block for advancing promising early-stage innovations and technologies, including innovations in transportation, fuels, renewable chemicals, advanced building materials and manufacturing technologies, and energy production.

It moves early-stage innovations and technologies through the next stages of development: *TRL 4*, the integration of basic components for bench scale testing and prototype and pilot scale modelling ; *TRL 5*, the validation of operational integrity; and *TRL 6*, model, prototype, and pilot testing and field demonstration.

The terms “energy efficiency” and “renewable energy” are not in current favor. In fact, there are calls from some quarters to reverse decades-long federal policies in support of these industries.

Doing so would be a mistake. A huge mistake. EERE’s grant programs are critical to advancing cutting-edge and transformative innovations, without which they could not be proven and readied for commercial demonstration and deployment.

A map of EERE's almost 2,000 active awards across the country, with 12 projects highlighted



The importance of these programs is underscored by the advancements in energy efficiency and renewable energy over the past two decades, which have been creating jobs and growing local economies at an accelerating pace.

According to the International Energy Agency (IEA):

- **Clean energy employs 50% of total energy workers**, not just in the U.S., but globally, owing to the substantial growth of new projects coming online.
- **The construction of new projects, including the manufacture of their components, is the largest driver of energy employment across the value chain.**

U.S. Department of ENERGY | Office of Energy Efficiency & Renewable Energy

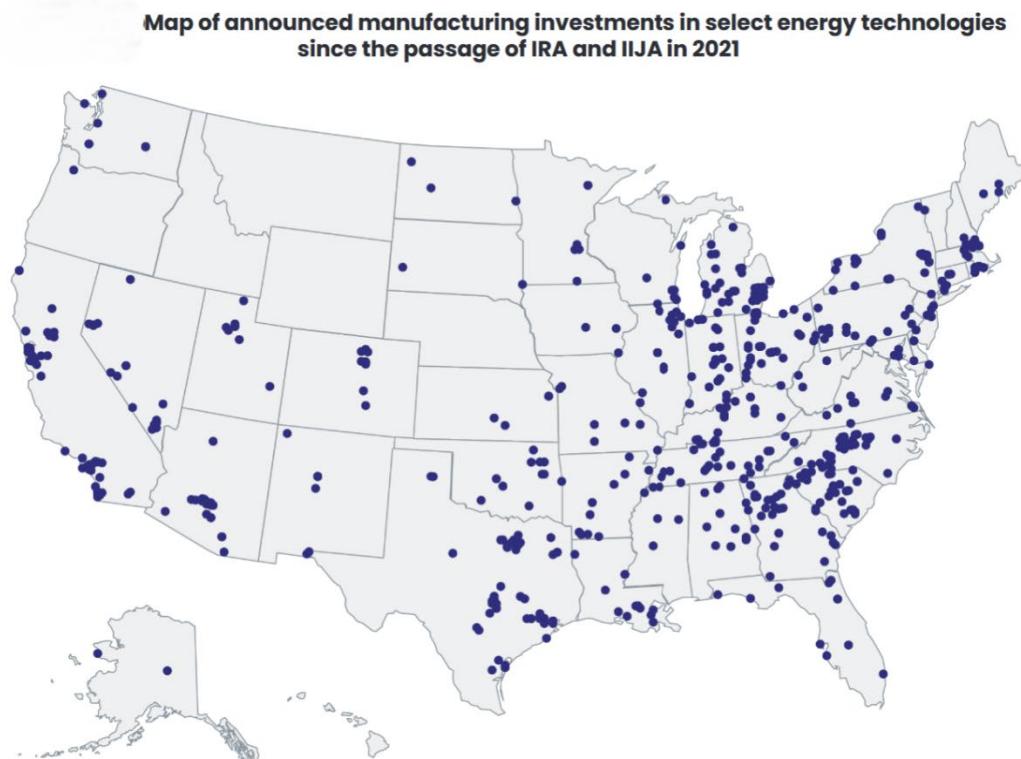
81% of renewable energy investments support counties with below-average wages, and 86% benefit regions with below-average college graduation rates.



- Around 45% of energy workers today are in high-skilled occupations, compared to only one-quarter across the economy. This share is even higher for jobs in research and development for new energy innovations, many of which are set to grow rapidly to 2030.

EERE is a key propellant for this growth, which is done through its funding programs that accelerate the research, development, demonstration, and deployment of technologies and solutions to meet the nation's growing energy demands (which are projected to increase by 50% or more, per the March 17, 2025 New York Times article cited below) due to the expanding use of AI and the mushrooming need for data centers.

The transition to renewable energy is a dominating global market trend in which the U.S. can either strive to compete ... or retreat and cede the global market to China.



Here are some additional trends that bear consideration:

As noted in a February 27, 2023 New York Times article, “*As Oil Companies Stay Lean, Workers Move to Renewable Energy*”:

- “In more than a dozen interviews, energy workers and executives said they had switched to renewable energy because they felt that the oil and gas industry’s best

days were behind it. Others said they were no longer willing to tolerate the extreme ups and downs of oil and gas prices, and the accompanying cycle of rapid hiring followed by crushing layoffs.”

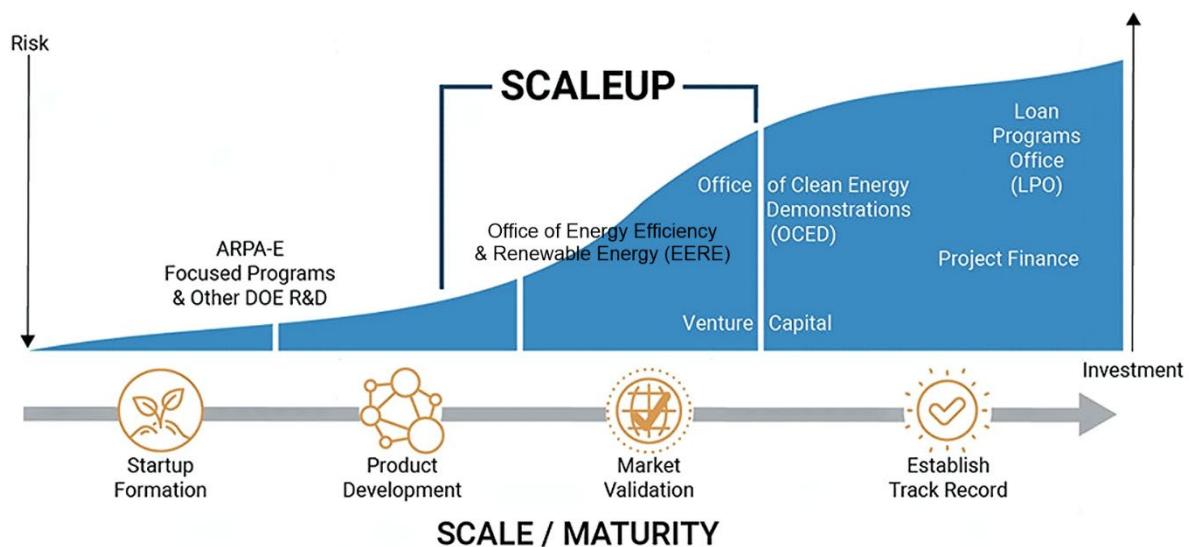
Another New York Times article, on March 17, 2025, entitled “*Want Cheap Power, Fast? Solar and Wind Farms Have a Suggestion,*” states:

- **“Wind, solar and battery storage are relatively quick and cheap to construct.** That could help avert energy shortages and keep prices low, an argument that renewable energy firms are making to policymakers [emphasis added].
- “Our message to the administration is, let’s be realistic about this,’ John Ketchum, the chief executive of NextEra Energy, one of the country’s largest power producers, said in an interview. **‘If you take renewables and storage off the table, we’re going to force electricity prices to the moon.’”**
- Ketchum goes on to say: **“power companies now have to wait up to five years to order new gas turbines as manufacturers struggle to keep up with global demand. Any new gas projects that aren’t already under development are unlikely to come online before 2030,** he said. Other nascent technologies like advanced nuclear power are even farther off.”
- “By contrast,” he continues, **“many wind and solar projects can be built within 12 to 18 months,’ adding ‘the cost of building new gas power plants has also nearly tripled since the inflation shock of 2022 ... while wind and solar prices have increased only modestly”**

Forbes Magazine has published several articles over just the past few weeks (on March 13, 21, and 23) backed by multiple sources that are cited in the articles, emphasizing the costs that could result from turning away from the advancement of energy innovations and deployment of renewable energy systems. These include:

- “The economic case for ... action is clear, yet not broadly known and understood”,
- “Inaction could cost 1/3 of global GDP this century,”
- “Data from the National Centers for Environmental Information (NCEI) shows that since 1980, the U.S. has suffered 403 weather-related disasters, each causing over billion dollars in damage. It is worth noting that before 1980, there were only three such billion-dollar events” [emphasis added].
- In contrast, “Investment in both mitigation and adaptation [through energy innovations and renewable energy] could bring a return of around tenfold by 2100.”
- “What all this points to is that [weather extremes] provoke innovation, new infrastructure, technologies and markets in the context of a world where security is now a priority ...” [emphasis added].

DOE's grant and loan programs are critical to being able to respond to ... and address ... these issues.



OCED

The Office of Clean Energy Demonstrations (OCED) OCED invests in demonstration projects that will catalyze private sector capital in the coming decade to achieve commercial liftoff across a range of technology areas and set the nation on a course to a modernized, advanced, and more resilient clean energy infrastructure.

Using over \$25 billion in federal funding appropriated in the Infrastructure and Investment Jobs Act (IIJA), Inflation Reduction Act (IRA), and prior annual appropriations, OCED funds first-of-a-kind commercial-scale demonstrations that achieve sustained operations and deploy them at commercially viable scales to lay the foundation for an advanced energy economy.

Private industry has been eager to work with OCED on demonstration projects across a range of technologies according to in-depth DOE Liftoff Reports, consultations with financiers and industry, and as evidenced by almost all of OCED's IIJA and IRA provisions being oversubscribed.

This is what OCED accomplished in its first two years:

One of the solicitations issued by OCED in early 2023 received over 800 applications, more than 12 times the number of awards that were available.

Stood up 9 programs



**ADVANCED REACTOR
DEMONSTRATION PROJECTS
(\$2.5 BILLION)**



**CARBON MANAGEMENT
(\$7 BILLION)**



**CLEAN ENERGY DEMONSTRATION
ON CURRENT AND FORMER
MINE LAND (\$500 MILLION)**



**DISTRIBUTED ENERGY
SYSTEMS DEMONSTRATIONS
(\$50 MILLION)**



**ENERGY IMPROVEMENTS IN
RURAL OR REMOTE AREAS
(\$1 BILLION)**



**INDUSTRIAL DEMONSTRATIONS
PROGRAM (\$6.3 BILLION)**



**LONG-DURATION ENERGY
STORAGE DEMONSTRATIONS
(\$505 MILLION)**



**REGIONAL CLEAN HYDROGEN
HUBS (\$8 BILLION)**



**LIFTOFF ENABLING PROGRAMS
(\$133 MILLION)**

OCED provides the final testing, validation, commercial certification of products, and readiness for deployment, which is done under commercial conditions, for the innovations and emerging technologies that have progressed through each of the previous Technology Readiness Levels.

The pre-commercial demonstration stage, which integrates all inputs, components, operations, processes, and product outputs at a scale which typically is mid-way between pilot/prototype and commercial, greatly reduces the risk of failure as a technology/process/innovation is scaled up for its initial commercial deployment.

What may seem like an insignificant or hardly noticeable issue at the prototype, model, or pilot scale can (and has, many times) become a fatal flaw at commercial scale.

This is why private sector lenders and investors are wary of first-of-a-kind projects. They are more than happy to fund the second, third, and subsequent projects, once the first project has been proven.

Programs



18
funding opportunities
announced



More than
\$21 billion
in funding announced



116
projects selected

Selection Stats

36 through **FOAs** and
80 more through **prizes**

*Locations of all selected projects and prizes



Hence, it takes all four of DOE's building blocks – ARPA-E, EERE, OCED, and the Title 17 and ATVM programs – to advance innovations through each Technology Readiness Level so they can be transformed into job-creating, local-economy-growing, local-tax-generating, and global-market-capturing projects that will sustain and improve the well-being of local communities.