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An Energy Technology Corporation Will Improve
the Federal Government's Efforts to
Accelerate Energy Innovation

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An Energy Technology Corporation Will Improve the Federal Government's Efforts to Accelerate Energy Innovation

Innovation is critical to solving many of the energy and environmental challenges we face today, from reducing carbon dioxide emissions to lowering the costs of alternative energy sources. Although there is no shortage of good ideas for a transformed energy infrastructure, a major obstacle stands in the way of implementation: proving that these good ideas actually work and are therefore worth investments. In his Hamilton Project discussion paper, John Deutch of the Massachusetts Institute of Technology proposes the establishment of a new institution, the Energy Technology Corporation, that would have the authority, tools, and expertise to effectively manage demonstration projects. Focusing on a critical stage in the energy innovation cycle—technology demonstration—and drawing on a set of best practices, the Energy Technology Corporation would make sure good innovative ideas do not remain mere ideas, and instead become standard practice.

The Challenge

Underinvestment in Demonstration Within the Private Sector

Energy innovation takes place in three stages: first, coming up with new ideas (the R&D stage); second, demonstrating that these ideas can work (the technology demonstration stage); and finally, deploying innovative products for commercial use (the deployment stage).

By generating technical, cost, and environmental information for the private sector, technology demonstration makes the difference between an idea that remains stuck on the drawing board and an idea that becomes commercially viable. This stage of the energy innovation process involves implementing the results of R&D in a prototype example in order to illustrate and analyze practical performance. It can include constructing pioneer plants, testing new equipment, or piloting new production methods.

Despite its importance, technology demonstration tends to be underprovided by the private sector. It is a very expensive and uncertain process—one that does not generally result in immediate commercial value. Future energy prices are difficult, if not impossible, to predict. Regulatory policy also may not be clear. This in turn makes it difficult to assess the future competitiveness of alternative technologies. Finally, the benefits that are generated from technology demonstration accrue industry-wide and cannot be captured by any one firm.

Deutch argues that government must take the lead on technology demonstration. However, he notes that past efforts at the Department of Energy (DOE) have often failed to produce useful results. The challenge, therefore, is to determine the ways in which government can best support technology demonstration and design the appropriate institutional framework for these efforts.

Lessons Learned

The DOE has undertaken three major technology demonstration projects in past decades. Its efforts have met with mixed success but provide valuable lessons for future programs.

- 1. Nuclear and clean coal demonstrations of the 1970s.** The DOE's first major technology demonstration program took place in the early 1970s, with the direct funding of large nuclear and clean coal demonstration plants across the country. These projects were rolled out against broader regulatory and market headwinds moving in the opposing direction and therefore never became operational. These nuclear plants were abandoned due to concerns about nuclear proliferation. Synthetic coal plants were never commercially competitive: by the time the demonstration projects were completed, the cost of a barrel of oil-equivalent was more than four times the cost of oil.
- 2. The U.S. Synthetic Fuels Corporation.** The DOE's second venture into technology demonstration began with the establishment of the quasi-independent U.S. Synthetic Fuels Corporation (SFC) in 1980. The purpose of the SFC was to reduce dependence on imported oil by providing indirect financial assistance to projects that produced synthetic fuels domestically. Deutch notes that the SFC had many desirable features: First, being quasi-public in nature, the SFC could hire a staff with more technical and financial expertise than were available in government. Second, the SFC was financed by a single congressional action, which left it largely free from political pressure. The SFC's downfall was committing itself to an ambitious production target for synthetic fuels of half a million barrels of oil-equivalent per day by 1987, based on the assumption that oil prices would continue to increase. In the end, oil prices halved instead of doubling, and the SFC was abolished.
- 3. Demonstration funding in the American Recovery and Reinvestment Act.** The 2009 stimulus package authorized

large-scale demonstration projects and provided funds for direct support and loan guarantees. While it is too soon to know how this increase in energy infrastructure spending will fare, Deutch points out that the demonstration projects were selected to meet multiple objectives, including job creation, infrastructure renewal, clean energy, and improving competitiveness. The more objectives there are, the more trade-offs there will necessarily be, and the harder it will become to evaluate success.

The record suggests that the DOE has a number of shortcomings that interfere with its capacity to lead technology demonstration programs. These include multiple, competing goals for demonstration projects; the absence of a sophisticated modeling and simulation capability for comparing alternative energy programs; excessive involvement of Congress; and the lack of metrics to evaluate the performance of demonstration efforts.

A New Approach

Deutch proposes a new Energy Technology Corporation (ETC) that would be responsible for selecting and managing technology demonstration projects. This independent entity would exist for an initial ten-year term and be led by an eight-person board appointed by the president and confirmed by the Senate. The organizational characteristics of the ETC and its capacities would be based on a series of best practices for U.S. government policy to support technology demonstration.

Guiding Effective Demonstration Projects

The first step to establishing an effective demonstration policy is to establish a process for selecting the best projects. Not all new technologies require demonstration, so the first task of the ETC would be selecting technologies appropriate for demonstration. Ideas that would benefit most from government-led demonstration are those in which the public has the greatest interest, which are often those projects least likely to be demonstrated within the private sector. Innovations that are unlikely to be piloted by the private sector include ideas with uncertain performance and costs, innovations that may run up against future regulatory or policy constraints, and new technologies that have significant benefits for the environment and for national security.

Once a technology has been chosen for demonstration, there are a number of best practices that should be in place and that could be supported by an ETC:

- **Encourage broad dissemination of information.** The goal of a demonstration project is for technical, economic, and environmental information obtained in the demonstration to be distributed as widely as possible within the private sector. In accordance with this goal, Deutch argues, projects

should not be contracted out to private entities that can then maintain intellectual property rights.

- **Sophisticated and transparent modeling and simulation capability.** Such a capability, based on engineering data and economic analysis, would enable the comparison of the trade-offs among competing technologies to arrive at the most promising solution.
- **An evaluation system.** Metrics would be developed to assess the financial, technical, and schedule performance of each project.

Establishing an Energy Technology Corporation

In order to carry out technology demonstration in the ways described above, a new ETC would have to have a number of important institutional features, including independence from the political system, more flexibility in the hiring of experts and policies that support the broad dissemination of information.

- **A one-time appropriation of resources for the ETC to support an agreed-on number of demonstration projects.** An initial \$60 billion commitment would support the costs of setting up the organization and would fund approximately twenty projects staggered over ten years. Approximately 10 percent, or \$6 billion, would be set aside for analysis and documentation of the technical and economic performance of all demonstration projects. The ETC would only finance the difference between project costs and anticipated market revenues. Depending on project performance, further funding might be extended.
- **Independence from the annual congressional appropriations/authorization cycle.** The ETC would be governed by an independent board of directors nominated by the president and confirmed by the Senate. The board would include eight members with backgrounds in finance, technology, project management, or environmental protection; each would serve for a fixed term of ten years. The chairperson of the ETC would have executive authority over the management of the enterprise, and maintain this position subject to the confidence of the board. The ETC would be established and funded for a ten-year period, after which additional funding could be extended or the organization would be dissolved.
- **Responsible reporting to Congress through annual assessments.** These would outline the operations, finances, and accomplishments of the ETC. Additionally, Congress would have the option of passing modifying laws to alter the structure of the ETC.
- **Provide technical and financial expertise.** The ETC would have flexible hiring authority in order to attract individuals

with private sector experience and financial and technical skills in the energy arena.

- **Promote contracting practices that are credible to the private sector.** The ETC would manage a fair and open competition among interested performers and negotiate contracts using commercial standards rather than government procurement regulations.

Ideal Conditions for Technology Demonstration

Along with the establishment of an ETC, there are a number of other ways in which the government can create an environment that fosters successful demonstration projects in both government and the private sector.

First, a more stable energy policy is needed. Greater certainty about tax provisions, subsidies, and regulation would guide private investment decisions and signal which technical advances will have value in the future. For example, if firms are not sure whether the government will establish a price for greenhouse gas emissions, they will hesitate to invest in low-carbon technology. The more government can do to establish policy stability, the more likely firms will be to serve as demonstration partners and to find demonstration results useful.

To this end, Deutch calls for a comprehensive multiyear national energy plan with goals that are well defined and explicitly prioritized. Having several goals, as opposed to a single goal or even a few goals, creates trade-offs and dilutes policy effectiveness. Deutch supports three main objectives for energy policy: reducing external environmental costs, improving energy security, and lowering the cost of energy for the U.S. consumer.

Second, indirect financial assistance for demonstration projects is preferable to direct financial support by government because it interferes less with the commercial basis on which plants are designed, built, and operated, making demonstration results more credible to private investors. Indirect financing mechanisms could include guaranteed purchases, loan guarantees, production tax credits, and cost-shared reimbursement. Production payments (or tax credits) are preferable to loan guarantees, Deutch notes, because they reward success rather than insure against loss due to failure.

Third, according to Deutch, the government should avoid engaging in activity associated with deployment, such as defining and attempting to meet production targets, since it cannot determine what the market or regulatory environment will look like in the future. Instead, Deutch would focus government efforts on generating technical, environmental, and cost knowledge as well as technology options for the private sector. Each demonstration project should have performance, cost, and schedule milestones.

Roadmap

- The Energy Technology Corporation (ETC) would be created for a ten-year period to select and manage technology demonstration projects, shifting focus to demonstration and private sector involvement.
- The ETC would be governed by an independent board appointed by the president and confirmed by the Senate. The board would consist of eight members with backgrounds in finance, technology, project management, or environmental protection, with each member serving a fixed term of ten years. The chairperson would have authority over the board, and would maintain the position subject to the board's confidence.
- Funding would be provided through a one-time federal appropriation of \$60 billion, which would support the initial set-up of the organization—approximately twenty projects over a ten-year period—as well as the development of sophisticated modeling and evaluation capacity.
- The ETC would have flexible hiring authority to attract individuals with private sector experience and technical energy skills.
- Projects would be selected through an open competition between interested performers, with contracts negotiated using commercial standards rather than government procurement regulations. The ETC would finance the difference between project costs and anticipated market revenues.
- Metrics would be developed to assess the financial, technical, and schedule performance of each project.
- The ETC would distribute technical, economic, and environmental information as widely as possible within the private sector.

Learn More About This Proposal

This policy brief is based on The Hamilton Project discussion paper, *An Energy Technology Corporation Will Improve the Federal Government's Efforts to Accelerate Energy Innovation*, which was authored by:

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Additional Hamilton Project Proposals

Promoting Clean Energy in the American Power Sector

Despite bipartisan interest in advancing American energy policy, comprehensive energy and climate legislation fell short in 2009. The difficulty of coming to broad agreement highlights the need for a more targeted and incremental approach. One promising intermediate step would be a technology-neutral national clean energy standard that applies to the U.S. power sector. This paper proposes a standard that would lower carbon dioxide emissions, streamline the fragmented regulatory system that is currently in place, generate fiscal benefits, and help fund energy innovation. The National Clean Energy Standard would provide certainty about the economic returns to clean energy that would facilitate investment in new energy projects, lower the emission intensity of the power sector, and serve as an ambitious bridge to economy-wide energy and climate policy.

A Better Approach to Environmental Regulation: Getting the Costs and Benefits Right

Cost-benefit analysis of environmental regulation plays a key role in determining how to achieve our environmental goals without imposing unnecessary costs on the economy. This paper proposes three reforms that address several problems that undermine the role played by cost-benefit analysis in environmental regulation. First, agencies should be required to use a checklist of good empirical practices and should promote decentralized evaluations of data and research. Second, absent compelling systematic evidence to the contrary, agencies should presume that consumers are best able to make their own energy-saving decisions, and should focus on regulations that address the harm that people impose on others. Third, a six-month early regulatory review process should be established for particularly important regulations to allow sufficient time for a thorough cost-benefit analysis and the incorporation of the results into the final regulations.

Alternative Approaches

Four other ideas for reforming government policy supporting technology demonstration have been suggested:

1. The creation of a semi-independent unit within the DOE to finance and manage technology demonstration projects, to be called the Clean Energy Deployment Administration (CEDA).
2. Expand DOE-sponsored industry consortia—for example, the Partnership for a New Generation of Vehicles, the Advanced Battery Consortium, and the Carbon Sequestration Regional Partnership—beyond R&D to technology demonstration.
3. A clean energy bank. This approach would establish a quasi-public entity similar to the Export-Import Bank for the purpose of funding clean energy.
4. Industry investment boards. Made up of private sector firms and financed in part by tax revenue, the boards would help decide which investments have the greatest potential for common benefit.

According to Deutch, the fact that CEDA- and DOE-funded industry consortia are connected to the DOE is problematic because it would make congressional involvement in project selection and management more likely. CEDA also would have a broader mission of demonstration and deployment assistance rather than the narrower (and less expensive) demonstration focus that Deutch advocates for the ETC. Proposals for a clean energy bank also would extend credit on favorable terms for deployment rather than technology demonstration. In addition to the mistaken focus on deployment, Deutch also notes that there are no precise details about the criteria that would be used to select projects or the extent to which these criteria would differ from those applied by a commercial bank.

Conclusion

Technology demonstration is a critical part of the energy innovation process—a part in which government must take the lead. But government support by itself does not guarantee useful results, as previous technology demonstration efforts make clear. A new institution, the ETC, would be structured to follow a series of best practices, based on lessons learned, to ensure that the resources allocated to technology demonstration are well spent. To support its capacity to effectively manage technology demonstration, the ETC would have a high degree of independence, expertise, and flexibility. Properly managed and executed, the ETC could be the best option for sponsoring technology demonstration projects that generate valuable results for the private sector and help speed the pace of energy innovation.

Questions and Concerns

Given DOE's uneven track record, why should government take the lead on technology demonstration?

Mixed results in the past should not be taken as evidence that the government is not capable of supporting an effective technology demonstration program. Rather, it points to the need for better practices and an institution that is structured to adhere to them.

Technology demonstration is a key step in the energy innovation process, but one in which the private sector underinvests. Firms have little way of knowing what the market and regulatory environment in the future will look like and whether up-front spending on pioneer facilities, equipment, or methods will pay off. In addition, the benefits of technology demonstration—namely, the technical, cost, and environmental information that is generated—accrue to many firms: it is difficult for only one firm to capture these benefits. This reality greatly reduces the incentive firms have to make such an investment. Government is not constrained by the same need to produce immediate commercial value and therefore is in a better position to carry out a technology demonstration program.

What are some examples of promising technology demonstration candidates? Which technologies can be left to the private sector?

Promising technology demonstration candidates laid out in the proposal include large-scale solar thermal power, nuclear power plants, smart electricity grids, carbon sequestration facilities, clean coal and new or retro-fit carbon capture, and cellulosic biofuels production. Not every energy technology requires a large-scale demonstration project. For example, demonstration in distributed photovoltaic electricity generation may not be necessary, as key information may already be widely available and required investment levels low.

Highlights

John Deutch of the Massachusetts Institute of Technology proposes a series of best practices for government support of technology demonstration and a new institution, the Energy Technology Corporation (ETC), that would bear responsibility for selecting and managing technology demonstration projects.

The Proposal

Technology demonstration that generates critical knowledge and options for the private sector.

Technology demonstration is a key step in the energy innovation process because it generates technical, cost, and environmental information, and provides a range of possibilities for the application of energy R&D. The government would provide a valuable service by supporting and executing technology demonstration projects.

An independent organization with private sector expertise.

The ETC would be financed for one ten-year term (subject to renewal) and would have the authority to hire technical and financial experts from the private sector. It also would develop a sophisticated simulation capability and evaluation metrics that would enable it to assess technology programs before and after those programs are completed.

Clarity of purpose and credibility.

Technology demonstration projects would be selected for clear, specified reasons, and would be managed and financed using commercial practices that are credible to the private sector.

Benefits

Independence and expertise would enable the ETC to select and credibly carry out the most promising technology demonstration projects. Following best practices and incorporating lessons from previous technology demonstration efforts would ensure that the ETC contributes to and accelerates the energy innovation process.



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