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ENERGY

Energy Innovation Needs New Private-Sector Push

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Two months after the end of the Paris climate summit, it seems natural to ask: What are the next steps? Do we need to do more?

Three initiatives launched around the Paris meeting are an important start. Bill Gates announced the formation of the Breakthrough Energy Coalition, composed of philanthropists who will invest in public-private partnerships to invent and scale technologies. More than 20 countries led by the U.S. unveiled "Mission Innovation" and pledged to seek to double their government research-and-development budgets over the next five years to accelerate clean-energy innovation. Ten of the world's largest oil and gas companies launched the "Oil and Gas Climate Initiative" to organize meaningful action through the sharing of best-practice information and other industry collaboration as well as to make investments in R&D and startups.

These statements indicate that both the public and private sectors recognize that we live in a carbon-constrained world and that there will be a charge on carbon emissions, imposed through regulations or market prices or a combination of both. Thus, there is an imperative for industry to explore the commercialization of new innovative low-carbon technologies.

Given the scale of the energy and climate challenges, the three initiatives are necessary but not sufficient. Why? Successful innovation must address technologies from creation to deployment.

Take, for example, advances in battery technology. A battery that costs less than \$100 per kilowatt-hour with a lifetime of more than 1,000 cycles would be a game changer for offering affordable and reliable renewable electricity across the world. Today's lithium ion batteries cost three times more. We need government R&D to support fundamental work in our universities and national laboratories and the Breakthrough Energy Coalition as a first step to developing product prototypes and systems.

Success means taking a promising technology all the way to the demonstration of commercial viability. This includes pilot demonstrations, the creation of supply chains, and the ability to reduce costs and meet regulatory compliance.

In the energy sector, this innovation journey requires on the order of \$1 billion over 10 years. Currently, there is no private-sector mechanism to address this challenge, and promising new technologies will likely die.

We propose a new approach to address this gap: Create a number of Energy Innovation Entities to bring key technologies to commercial use; each Energy Innovation Entity would be supported by roughly 10 companies, each committing about \$10 million a year for 10 years -- a "10-10-10" mechanism.

No single technology will address the energy and climate challenge. There are more like 10 such technologies that deserve to be considered for creating individual entities, all of which could offer the private sector the needed competitive advantage. Without them, businesses face the risk of being blindsided if they do nothing.

How should these entities be governed? The 10 sponsoring companies would select a board that would pick a chief executive officer to assemble and lead a team to design and carry out the 10-year program.

The different entities would likely choose different development paths, such as: creating a new technical facility and work force; forming partnerships with universities and small businesses; establishing R&D laboratories and companies for key subsystems; or setting up a joint venture with members of an international value chain that combines the people and facilities of the sponsors.

Each entity would own all the resulting intellectual property and know-how from its work, and decide to pursue deployment on an individual basis, in a partnership or through a new or existing enterprise. Undoubtedly, during the 10 years, some entities would not meet expected technical milestones, costs and schedules; others might meet goals early. Accordingly, at any point, a majority of the sponsors should have the right to terminate the project.

In the U.S., the only entity that can potentially afford a \$1 billion budget for 10 years to demonstrate commercial viability for a specific new technology is the federal government. But it is hard to overstate the advantages that a private-sector innovation project has over one supported by the U.S. Department of Energy for late-stage demonstration programs.

Federally sponsored demonstration projects involve many specific rules and regulations that impose

extra cost and time requirements. There are restrictions on procurement practices, requirements for cost and performance reports, significant uncertainties on the timing and amount of contract payments, let alone questions about consistent Congressional backing.

Not surprisingly, the DOE's record in downstream technology demonstration has been mixed. The various reasons for this include: changing priorities; shifting markets; congressional influence; underfunding of projects; and lack of professionals with adequate market, finance and management experience. Despite some successes, there have been many disappointments, including the Clinch River Breeder Reactor Project, the Synthetic Fuels Corporation and FutureGen.

Indeed the difference in how federally supported and private-sector technical development programs are run is so great that private investors and their banks find it difficult to evaluate confidently in the case of the government if required investment criteria have been demonstrated. A private-sector innovation project, if successful, is more likely to result in deployment of technology than a federal one.

We do not suggest that the "10-10-10" private-sector mechanism replace action by individual companies or government technology creation programs such as ARPA-E. Governments also have a role in areas where the private sector will not venture such as carbon dioxide sequestration, nuclear waste disposal and traditional approaches to fusion energy.

Is it wishful thinking that the energy sector will stand up to such a challenge? In the past, industry consortiums have come together, in some cases with government encouragement and support, to address a common technical challenge. Examples include the Gas Research Institute, the Electric Power Research Institute, the Microelectronics and Computer Technology Corporation, Commercial Satellite Corporation and Sematech.

Indeed, federal, state and local governments should support the private-sector effort to create Energy Innovation Entities, since they will lead to local economic growth and jobs. The Breakthrough Energy Coalition that intends to invest in startup ventures should also help create Entities that will help the transition of early-stage technologies into commercial products at scale.

The 10-10-10 mechanism offers a powerful innovation pathway that allows groups of companies to share the risks, costs and rewards without onerous government involvement and, potentially, to greatly broaden the scope and pace of energy innovation in the U.S. and the world. This would be a strategic advantage in a competitive and rapidly changing carbon-constrained global economy.

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