

Innovating a Green Real Deal

As the United States heads toward an election year in 2020, climate change promises to stay in the headlines. Increasing public concern about and desire to address the consequences of global warming drive this attention, along with the debate about a Green New Deal that promotes social justice alongside accelerated deep reductions in greenhouse gas emissions. Now is the time to translate these aspirations into action within the constraints of technical, cost, and social realities. This is optimization, not compromise—call it a Green Real Deal.

A Green Real Deal framework should be structured around a set of key characteristics. It must be science-based and analytically sound. It must be pragmatic in providing maximum optionality and flexibility, enabling a broad coalition to form. It must address all sectors of the economy, particularly those difficult to decarbonize such as transportation, industry, and agriculture. It must have a regional focus, because low-carbon solutions will necessarily be location dependent. And it must advance social equity and workforce development, avoiding stranded assets and stranded workers wherever possible and offering remedies for those most affected by the energy transition. By any name, these characteristics provide criteria for measuring Green Real Deal proposals.

What is needed to support this framework? A core component is innovation in technology, business models, and policy, and technology innovation is in many ways the key enabler among them. Without the development and deployment, at gigatonne scale, of breakthrough technologies that are affordable, the United States and the world will not reach net carbon neutrality. Breakthrough technology candidates could enable carbon direct removal, commodity-scale CO₂ utilization, biological and geological CO₂ storage at gigatonne scale, economic electricity storage at time scales from days to seasons, advanced nuclear fission and fusion energy, a hydrogen economy, full integration of information technology with the energy system, and advanced low-carbon fuels—and more.

Although we cannot expect these breakthrough technologies to have been developed and deployed at scale in the near term, innovation is nevertheless also crucial for decadal goals that put us on the pathway to mid-century deep decarbonization. The impacts of enormous cost reductions in solar energy, wind power, batteries, and light-emitting diodes are evident, but electricity emissions reductions are only 28% of the U.S. total. Major cost reductions, starting with an emphasis on energy efficiency, must be extended across all sectors of the economy. This depends on innovation that comes not only from research and development but also from the manufacturing and scaling experience gained from increasing deployment.

“The innovation agenda is also central to the social equity objective.”

The innovation agenda is also central to the social equity objective. Mitigating climate change through technology and policy is critical for underserved communities, those hit first and worst by extreme weather. Also, most clean energy technologies remain expensive relative to incumbent technologies, and lowering energy prices through innovation is progressive in its impact across the income distribution. Further, platform technologies that support innovation, such as broadband, must be universally available.

Neither the deep decarbonization nor the social equity agendas are being pursued adequately today, but steps are readily available to start to remedy this. The innovation agenda is a good place to start. Today, there is much bipartisan discussion in Congress about substantially increasing the scale and scope of federal clean energy research, development, demonstration, and deployment (RDD&D) programs. The 2015 Mission Innovation commitment by 20 countries, led by the United States, to double clean energy investments provides a good benchmark. Such a commitment to boost federal clean energy RDD&D could and should encompass substantial support for regional innovation systems. Advancing an innovation initiative through Congress now will be an important step toward a Green Real Deal and perhaps awaken the kind of climate change accountability needed more broadly in 2020.

—Ernest J. Moniz



Ernest J. Moniz
was the 13th
U.S. Secretary of
Energy and is the
CEO of Energy
Futures Initiative,
Washington, DC,
USA. ejmoniz@energyfuturesinitiative.org

Science

Innovating a Green Real Deal

Ernest J. Moniz

Science **364** (6445), 1013.
DOI: 10.1126/science.aay3140

ARTICLE TOOLS

<http://science.sciencemag.org/content/364/6445/1013>

PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. The title *Science* is a registered trademark of AAAS.

Copyright © 2019 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works