In terms of average annual investment for sustainable energy, China’s US$80 billion investment is almost equal to that of the USA (US$34 billion) and Europe (US$46 billion), combined. China does its energy innovation using socialist policies in which the government provides the majority of the support, if not all of it. Anadon, Bunn and Narayanamurti argue that, if the USA is to catch up in the energy innovation game, a similar stance with federal government support has an important role to play and extend this position to include a broad discussion about accelerating the U.S. energy innovation.

Why use government support and regulation to spur innovation? Or a better question: why are markets and private firms inadequate to drive the necessary innovation in the energy sector? This volume’s introduction provides an array of responses. First, current markets distort the prices of energy services, which do not reflect the negative environmental and social problems associated with their production and consumption. Second, the investment cost of innovation—the research, development and demonstration (RD&D) aspect in particular—is tilted. Since other actors can simply free-ride on innovations produced by the primary actors, there is less investment in energy innovation that benefits the wider society. Third, the current energy infrastructure (pipelines, transmission systems, and grids) are shaped around the incumbent energy technology. In an innovated energy system, this infrastructure may no longer be relevant. For instance, an emerging preference for distributed and decentralized systems does not necessarily require heavy investment in transmission systems and grids. Pipelines may also become stranded assets as the need for oil and gas is diminished in favor of solar and wind energy. Fourth, ‘valleys of death,’ or aspects of innovation that are perceived to be too risky for investment, are less attractive to private investors. Since private companies seek profits first, they have limited incentive to support large-scale demonstrations of new energy technologies.

Innovation, as the authors argue, is a complex web of interaction between what has traditionally been described as a process that begins with basic research followed by applied research, then development, then large-scale demonstration, and finally commercial deployment and diffusion. The innovation literature has indeed already disposed of this linear model realising the messiness of the process. Acknowledging this complexity, the authors recognize the important role of policy and regulations in strengthening the entire innovation system itself, not just one part or few parts of it. Doing this requires not only a system-wide transformation, but also the recognition that innovation—from RD&D to demonstration to diffusion—must be accomplished quickly.

To accelerate energy innovation, the authors propose that innovation approaches need to be comprehensive, adaptive, sustainable, cost-effective, agile, diversified, equitable, and strategic (hence the CASCADES mnemonic). The authors use the CASCADES framework to address the four purposes of their book: mobilizing funds for innovation (Chapter 2), strengthening energy innovation institutions (Chapter 3), enhancing the role of the private sector (Chapter 4), and pursuing international cooperation (Chapter 5).

While the authors argue that innovation is a complex process concerning several aspects of the innovation system, it is clear that the volume is focused heavily on supporting only the RD&D component. Chapters 2–5 show clearly how RD&D for energy technologies could be advanced. The concluding chapter (Chapter 6), which includes a number of recommendations, also highlights the orientation towards energy technology RD&D. First, the authors propose a dramatic expansion of investment in
technology innovation, while matching energy technology push to market pull (a theme developed in Chapter 2). Since public funds are limited, public–private partnerships are required to complement funding for RD&D beyond regular appropriations at the federal, state, and city levels. Second, reforms in the energy innovation institutions are essential. Citing the Advanced Research Project Agency-Energy (as described in Chapter 3), the authors recommend supporting institutional arrangements that focus on RD&D of high-risk but potentially high-payoff projects.

Third, the authors highlight strategic public–private partnership for RD&D (as expounded in Chapter 4) to support both large-scale technology demonstrations and the training of the next generation of energy technologists. Fourth, the authors call for strengthened international cooperation, not just competition, for technology RD&D (as argued in Chapter 5).

The volume’s RD&D focus is best verified in its index where 28 lines are assigned to RD&D, and surprisingly none to other aspects of the innovation system such as large-scale demonstration, commercial deployment, and diffusion.

Certainly, RD&D is vital, but focus on it alone seems unjustified if the entire energy innovation system is to be transformed: even more so if such transformation needs to be accelerated. Indeed, there are studies showing that discussions should now move beyond RD&D towards commercial deployment and diffusion, especially in the context of rapid climate change and development in international climate policy. Climate science suggests that the speed and scale of emissions reduction, particularly through energy transitions, are vital. Thus, the diffusion of sustainable energy technologies that have already been proven and demonstrated offers a very logical and coherent approach. Focusing on diffusion, however, does not mean that continued RD&D on energy technologies has to be completely discarded. Surely, there are gaps in the innovation system that need to be filled by serious RD&D, including storage options and improving efficiency of proven sustainable energy technologies. However, RD&D activities can be effectively addressed in concert with rapid diffusion of a select portfolio of sustainable energy technologies. At any rate, substantial government support for diffusion remains vital, given the rationale that Anadon et al. have provided in this volume.

If the USA is serious in its climate commitments, achieving its Paris emissions reduction target—on the scale and in the time promised—would mean that it has to view energy innovation as a broader system that needs accelerated transformation, not just as an RD&D question. In this regard, the authors’ argument that government should provide support for innovation across all levels, from federal to state to cities and local governments, in terms of policy and regulations, is one in the right direction. This is especially true since markets and the private sector are, according to the authors, inept at facilitating a high-risk, large-scale, and systemic innovation process. Nonetheless, the authors do not wholly reject the role of the private sector in such a transformation. Indeed, the volume contains analysis, strategies, and recommendations for public–private partnerships. Some of these strategies have, for instance, even highlighted the continued reliance on the ability of the private sector to decide what mix of technology would be best for emissions reduction (p. 24). However, the recommendation for letting the market decide on technology mix appears to be mooted.

In the new playing field defined by the Paris Climate Agreement, the rate and the scale at which energy technologies are diffused is a key factor. This means that decisions regarding what should constitute an energy technology portfolio should take into account: first, the readiness of the chosen technology in terms of the market; second, the timeline required for a particular energy infrastructure to be sited, approved by a regulatory body, and constructed or installed; third, transparent accounting of its life-cycle emissions; and finally, public perception of the technology itself. These criteria normatively provide decision-makers a clearly delineated approach in selecting which technologies should, and should not, be included in the energy mix. The criteria would also define pathways for energy innovation, including: allocation of public funds for RD&D of the chosen technologies; the policy and institutional arrangements necessary for driving markets towards these pathways; and the characteristics of the required workforce and their skills set.

Nonetheless, this volume is an invaluable addition to a wider energy innovation literature that can, and should, be read by US policy-makers, particularly at the federal level. It is an account of how the US federal government has been responding to the need for RD&D in the energy sector. It is a critical analysis of how the RD&D aspect of US energy innovation, especially its ever-changing political dynamics can be accelerated. It also offers a thorough discussion of how RD&D could be systematically facilitated through a structured approach. It is a concise, well-focused study of the RD&D aspect of a rather complex and messy energy innovation system.

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