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The Alternative Energy Future: The Scope of the Transition

Robert W. Fri

This issue of *Dædalus* expands a discussion that began in the journal's Spring 2012 issue. That earlier volume focused on the persistent stalemate in energy policy and on steps that might nonetheless be feasible to make progress in the relatively short term. This issue takes a longer and larger view.

Our discussion in the earlier volume began with the observation that since the time of the first OPEC oil embargo, every American president has promised to create a secure, clean, and affordable energy system. Unfortunately, every president has also come up short on his promise. The energy system is somewhat cleaner and considerably more efficient than it was in 1970, but it continues to rely heavily on fossil fuels – namely, oil, coal, and natural gas. The volume concluded that although some viable policies can usefully nudge the system away from fossil fuels, conditions do not now favor dramatic energy-policy initiatives. Developments since last spring affirm that stance and indeed seem to be providing a strong push in the opposite direction. In particular, America's vast reserves of oil and natural gas trapped in geologic shale formations are now accessible at highly competitive prices. Given this situation, it is hard to imagine that the next forty years will be much different than the last forty unless more powerful policy goals than secure, clean, and affordable energy come into play.

Actively pursuing the mitigation of global warming that results from the accumulation of carbon dioxide and other greenhouse gases can be that

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more compelling driving force, and in this issue, we examine the profound consequences of taking it seriously. Climate change can drive a fundamental transition in the energy system because limiting its effects means driving the emission of greenhouse gases nearly to zero over the span of a few decades. Doing so would require sharply limiting the use of fossil fuels on which more than 80 percent of today's energy system depends. And that, in turn, would set off a sweeping transition of one of the most extensive, technologically complex, and deeply embedded elements of the nation's physical infrastructure: the national energy system.

This is not news. Many careful analyses of how to manage climate change have documented the extent of the physical transition involved.¹ But the essays in this issue focus instead on an equally profound but less examined transition: that is, the far-reaching societal transition that must accompany transformation of the physical energy system. The energy system is not simply a collection of autonomous pieces of plug-and-play technology. Rather, it is an integral part of our individual lives, influencing where we live and shop, shaping how we establish social networks, and molding countless other everyday habits. Powerful industrial enterprises exist to produce, transport, and use energy; often these market incumbents wield considerable political influence. And large government bureaucracies at local, state, national, and supranational levels have evolved to monitor the system's operation and regulate its behavior. If the energy system itself changes, then all these individual and institutional links to it will have to change, too.

A useful way to gauge the magnitude of the task is to consider the budget for the quantity of greenhouse gases that can be safely emitted into the atmosphere. The

budget analogy applies because carbon dioxide, the chief greenhouse gas, is very long lived; once it gets into the atmosphere, it stays there for decades, if not centuries. Several studies, including one in this volume, conclude that we have used up a good deal of the emissions budget already, and that to continue emissions at current rates would absorb the rest of it in a few decades—after which time the emission of greenhouse gases would have to be essentially zero.² Given the scale of the energy system, however, a few decades is not a very long time to overhaul it to the point where it emits essentially no greenhouse gases. To be sure, important scientific uncertainties exist about the pace at which temperatures would increase for any given concentration of greenhouse gases in the atmosphere. But it is difficult to come up with a high-probability scenario that does not exhaust the emissions budget by roughly 2050. For this reason, dealing with climate change means changing the energy system with a speed that has rarely been seen in the past.

The associated societal change turns out to be hard as well. The contributors to this volume discuss the role that public opinion, opposition to change by incumbent institutions, and scientific timidity all play in erecting barriers to forging a political consensus that responds appropriately to the climate challenge. The interplay of these forces is unusually complex and is likely to prove Churchill right: that America will do the right thing after it has exhausted all the alternatives. Unfortunately, we'll burn more of the carbon budget while we wait.

Once policy-makers agree to get on with it, however, they will have to deal with the dual challenge of changing the behavior of both individuals and institutions to enable change in the energy system. Persuading people to change their

ways is a notoriously difficult matter, and for good reason. For example, despite compelling technical reasons to build nuclear power plants, fracture gas shale, erect windmills off Cape Cod, and spread solar panels across sacred tribal lands, there are equally good societal reasons not to do so. And even when the technology is unobtrusive, individuals have to learn to use it. Although that sounds simple enough, consider the fact that most programmable thermostats installed in homes across America are not currently programmed. The social sciences are beginning to contribute to our understanding of how to encourage individuals to accept and then adapt to a new energy system, but much remains to be done.

The institutional challenges are, if anything, more daunting. For example, the failure of the Copenhagen climate summit has demonstrated the difficulty – maybe even the impossibility – of striking a global bargain to manage greenhouse gas emissions. However, a network of less ambitious deals may suffice. The duration of the climate problem creates another institutional problem. Because the task spans several decades, climate policy has to be consistent yet flexible over that

period. We have little experience in designing durable policy frameworks of this sort. Moreover, existing institutions will have to adapt to a new order. For example, climate policy will likely need to engage federal, state, and local governments in a less hierarchical way than exists today. Finally, but crucially, the energy system is closely connected to other natural systems that help sustain life on our planet, notably those involving food and water, but others as well. Maintaining the sustainability of these systems is thus a constraint on changing the energy system to meet the climate challenge.

The authors in this issue take on the individual and institutional challenges facing the societal transition that any overall energy transformation will require. We offer few definitive solutions because so many of these topics have received too little attention. And so this volume concludes by framing a social science research agenda that would demonstrate incremental progress on the climate problem in the near term while deepening our understanding of the fundamental institutional transition that must take place over the long term.

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ENDNOTES

¹ For example, see *America's Energy Future: Technology and Transformation* (Washington, D.C.: National Academies Press, 2009).

² See also *Limiting the Magnitude of Future Climate Change* (Washington, D.C.: National Academies Press, 2010), which applies the budget concept to domestic U.S. emissions.