Obstacles to Renewable Energy and Energy Efficiency

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In spite of a flood of articles about green energy and global warming, renewable energy accounts for only a tiny percentage of total power generated in the U.S. Together, wind and solar power contributed less than 3 percent of power produced last year. In fact, as a percentage of power produced, the U.S. produced less renewable power than it did in 1950. Surely, if the U.S. is to do its part to tackle climate change, create those much discussed "green" jobs, and to achieve energy independence, it must do more.

So what are the obstacles? I suspect that they are not what most of us think.

The problem isn't technology.

Some policy makers have advocated a "Manhattan-type" Project to solve our energy problem, meaning a government intensive R&D effort to come up with a silver bullet technology solution. After all, if renewable energy is more expensive than traditional sources, then surely we need more innovation to reduce costs. In fact, in spite of having been starved for years, the renewable energy innovation engine in the U.S. is working adequately. U.S. universities, National Labs, and corporations have substantial intellectual property in renewable energy and energy efifciency technology; in fact, many of the technologies now being deployed outside the U.S. were developed here. Many European countries have substantially more renewewable energy than the U.S., showing that renewables can make up a significant portion of power production by promoting technology available today.

We've got the innovation deployment cart and horse backwards.

By providing markets, the European renewable energy industry lowered costs by getting scale. We know from the PC industry where computer chips are ever cheaper and have greater performance that innovation follows commercialization, not the reverse. Moore's Law is not an independent law of physics but rests on the role of markets; without a vibrant market into which to sell integrated circuits, the shape of

the performance curve would look very different. However, in renewable energy technology, we keep waiting for breakthrough technology that will achieve cost parity with conventional sources before deployment. Because most renewable energy technology is by definition capital intensive, much of cost reduction per unit produced stems from manufacturing scale advantages; these manufacturing scale advantages will rely more on extant manufacturing capabilities in other industries than on fundamental underlying renewable energy technology. A good example is the wind turbine where costs have declined dramatically; large market opportunities created by favorable European electricity rates encouraged established industrial players—in this case Siemens and General Electric—to enter the market with initially "good enough" technology, and through these firms' manufacturing and engineering expertise, they were able to produce larger and larger windmills at lower costs per watt. In the U.S., we instead direct policy attention to innovation over deployment. Providing government funding to an early stage technology company makes a good photo op, but without large scale markets, the barriers to cost competiveness are nearly insurmountable since the manufacturer has to find a technology solution that is cost competive without manufacturing scale benefits.

The energy problem isn't production, it's inefficiency.

Americans use more than twice the energy per capita as Europeans. And the biggest source of energy use is in our buildings. Our built environment generates more than 40 percent of greenhouse gases because our buildings use lots of electricity. Because electricity seems clean as it comes out of the socket, we don't appreciate that most of our electricity comes from burning coal. More than 90 percent of energy is lost from its conversion to electricity, transmission, and inefficiency loss in the building before it is used for heating, cooling and lighting. If we want to solve our energy problems, we need to tackle energy efficiency in buildings. And we don't need a Manhattan Project to get people to change lightbulbs or to get restaurants and shops to close their doors to the outside in the summer. We have national fire codes, but we don't have national building standards for energy efficiency. India has an energy efficiency standard for buildings that exceeds ours.

Markets aren't working properly.

Renewables are expensive relative to traditional forms of energy. But the playing field isn't level. There isn't yet a cost of carbon for fossil fuels. While a cap and trade bill will help, there are other areas where renewable energy is put at a competitive disadvantage. Traditional energy industries get much more substantial government support, in the form of $10 billion in annual tax incentives, or in the case of the nuclear industry, insurance. Solar appears "expensive", yet its costs for 30 years are known, while the costs of providing peak power from conventional sources is high and future costs are unknown. Political support for renewables is uncertain. It is ironic that after nearly expiring in 2008, federal tax credits for renewables were added at the last minute to the TARP bill. Advocates of a cost of carbon treat it as a its own

silver bullet solution, but a cost of carbon is only one part of putting renewable energy and energy efficiency on a level market playing field.

Utility regulation doesn't encourage renewable energy adoption or efficiency.

Although in a few states such as California regulators have provided economic incentives that permit utilities to get an equivalent economic return for investing in efficiency, in most states, the sad fact is that utiltities get paid more when consumers use more electricity. Utilites and regulators continue to favor centralized power plants, rather than distributed solutions such as solar and small scale wind. Even though we have observed an evolution towards distributed solutions in telephony and IT, we have resisted this transition in energy, In contrast to these other industries where incumbents saw potential opportuntiies and threats of new technology and therefore helped change the regulatory environment, most utilities are happy with the regulatory status quo. The "intermittancy problem"—that the wind doesn't blow all the time and the sun doesn't shine at night—is belied by examples in Europe where wind and solar energy represent a much higher percentage of power production than in the U.S. American utilities prefer centralized production because it is easier to "store' energy in unburnt coal sitting by the power plant. However, unfortunately the bias in favor of centralized production makes it much more difficult to implement efficiency solutions at the building level, which, by their nature, are local problems. Put differently, it may be that the best attribute of solar power is that policy and political infrastructure to support it—a regulatory regime and smart grid that permits time of use metering and net metering—are the very things that will enable efficiency; and it is effciency that is the problem we are trying to solve.

We don't have the infrastructure.

The scale of infrastructure investment is enormous, and little will be done if there is inadequate government direction as to our energy future. Capturing carbon dioxide from burning of coal? It would require a pipeline system for handling CO_2 greater than the current U.S. gas pipeline system. The Plains states could be the Saudi Arabia of wind. The problem is that the electric grid doesn't go there. Solar power in the Southwest which can be transported to the Midwest and East? There's no grid there either. Nor do we have a "smart grid" that would allow for more distributed power generation or time of use pricing that would provide incentives for consumers to shut off certain appliances at peak periods or to sell renewable power over the grid. The stimulus bill providing some funding for the grid, but it a tiny downpayment on the total cost.

Getting debt to finance renewable energy projects is difficult.

Many renewable energy projects are developed by smaller companies, not by big utilities. In the past, these projects were financed by banks. Because of the financial crisis, banks are not lending as much. These projects, however, will provide 20+ years of fixed returns that bonds investors might like. While the bond market has replaced

bank lending in mortgage and in long term corporate debt, the bond market has yet to replace bank lending for renewable energy projects.

Put most simply, the obstacles to great adoption of renewable energy and energy efficiency in the U.S. relate mostly to improper market signals and to poor regulation. The bad news in this conclusion is that many of the classical problems in economics are represented: There are agency problems in the differences between building owners and tenants that lead to avoided investments in energy efficiency. Then, there are economic problems associated with regulation. Electric utilities are regulated entitities whose profits are determined by the amount of capital deployed; as a result, there is more profit to be gained by utilities from investment in generation assets than in efficiency. Economists also have to wrestle with the way consumers seem to act illogically in applying very high discount rates on investments that pay back later (in this way, investments in energy efficiency are like investments in disease prevention). And, of course, the issue of climate change raises the fundamental problem of externalities. The good news is that policies can be put in place to address these market failures, and, in so doing, can quickly unleash human and financial capital.

Finally, a key part of the solution is to get consensus on the problem we are trying to solve. Reading a list of proposed policy solutions makes one wonder whether we are trying to solve a production problem or an efficiency problem, an innovation problem, a cost problem, a transportation problem, a fuels problem or an electrical problem. That the degree of global policy intervention during the recent financial crisis occured at such magntiude and at such speed without ideological debate suggests that policymakers, academics and the private sector generally had common understanding of the problem they were trying to address; it is not likely that this shared view of the world would have existed even a few decades ago and is no doubt a result of years of debate, common study, and policy trial and error. We need to recognize that in the area of overcoming the barriers to renewable energy and energy efficiency adoption, this global community of shared views has not yet coalesced. We can take heart from the financial crisis that it is possible to develop such common purpose, but must also recognize that we do not have decades to do so.