

# What it will take to decarbonize the economy

December 5 2017, by Steve Cohen, Earth Institute, Columbia University

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Credit: Flickr user richardghawley

The transition to a renewable resource-based economy should not be limited to energy, but extend to all material goods; nevertheless, the most urgent transition must focus on energy. This will be a massive and complex endeavor and its difficulty should not be underestimated.

The transition depends on five key components, and I will address them in this summary:

1. Technical obstacles and potential;
2. Financial obstacles and opportunities;
3. Political will;
4. Organizational capacity, and;
5. Mass public and elite values and perspectives.

The technology of [renewable energy](#) has advanced rapidly, but no transformative technology is yet available. This statement is tautological, because by definition when the transformative technology is available it will transform our [energy](#) system. The current technologies with the most potential appear to be solar cells and energy storage batteries. Improved battery technology overcomes the issues of intermittent solar and wind energy and makes electric vehicles feasible. What is missing is a technology that is lower priced, more convenient and at least as reliable as [fossil fuels](#). When that technology is developed, the fossil fuel business will be disrupted and the losses to that industry will be profound and destabilizing. The fear of this transition is pushing the fossil fuel industry into massive political mobilization that may delay the transition, but it will not prevent it.

The technical and financial constraints on the transition to renewable energy in the United States converge on the issue of the electrical grid. One issue is development of low cost, widespread distributed generation of electricity. If consumers become net producers of electricity, they may pay grid utilities for protection against intermittent sources of electricity, but they will not pay utilities as much as they do now. There is also the possibility that for home consumption, battery technology could become so reliable that some people might disconnect from the grid. This leaves those remaining dependent on the grid with higher costs to maintain the grid. As with fossil fuels, power utilities have long

wielded significant political power, in this case lobbying is focused on the state level utility regulatory bodies. In Florida, utility political power has discouraged household [solar energy](#) installation. In some other states we can expect opposition to development of microgrids and smart-grids and net metering rules due to opposition to distributed generation of electricity. But as Mary Ellen Klas [wrote in the Miami Herald](#) about a year ago:

"Florida's utility industry steered more than \$20 million of their profits into a failed constitutional amendment to impose new barriers to the expansion of rooftop solar energy generation, but developers say that as the cost of installing solar panels drops, the state could quickly become a leader in private solar energy expansion no matter what the energy giants do."

The Florida political battle demonstrates the grassroots support for lower cost renewable energy. This political support cuts across the ideological spectrum: both conservatives and liberals love lower-cost energy. Continued reductions in the cost of renewable energy will embolden more political leaders to support the transition to renewable energy. Some leaders are anticipating those cost reductions and acting now. The role of political will is highlighted by the impact that determined state governments can have in facilitating the transition to renewable energy. California's Governor Brown and New York's Governor Cuomo have both set ambitious renewable energy and energy efficiency goals and those states have been making steady progress in decarbonizing their economies. Political will is certainly needed to push grid modernization. But the wild card here is technological development. If [battery technology](#) and solar cell technology continue to advance, people will begin to disconnect from the grid.

We have already seen this drive to disconnect with communications technology. It is the rare millennial who installs a land line telephone in

their home. We are also seeing young people replacing cable TV with internet-based streaming services. It is not difficult to see a similar tipping point possible with electricity. However unlike home communications and entertainment systems, energy systems perform household functions that are essential to human health and well-being. Energy is needed for food refrigeration, cooking, climate control, lighting, home security and often water and sewage pumps. It may also be needed for medical devices. Going it on your own brings risks; while you can do without streaming video, try going without climate control in the Arizona desert. Although this may change, energy systems are more complicated than home entertainment systems and connecting the renewable energy system to the home may require equipment and expertise that may not be readily available.

The issue of organizational capacity is often overlooked during discussions of decarbonization. Economists typically assume that if the price is adequate, capacity will be developed. But when a nation is close to full employment and both immigration and training programs are under attack by the national government, it may be difficult to recruit the trained personnel needed to perform the tasks required. While household decarbonization may end up being relatively straightforward, the work required in factories, office buildings, mass transit systems and in modernizing the grid itself will present engineering, logistic, and other operational challenges.

Meeting these challenges will require sophisticated public-private partnerships. Government's role involves regulation of electric utilities, delivering technical education, funding basic and applied research, revising building codes and decarbonizing its own facilities. Private firms will need to manufacture, market and install [renewable energy technologies](#) including the software and hardware required to modernize the electric grid, solar cells, batteries, electric vehicles, vehicle charging stations, and the devices to connect and disconnect from the grid. The

political clout of the fossil fuel industry may be deployed to block the government elements of the partnership required. I am guessing that just as tech firms have developed political clout once they gained wealth and economic power, we will see a similar pattern with renewable energy companies. As they grow, they will lobby more effectively and gradually be able to counter the political power of the fossil fuel business.

We are certainly capable of developing the organizational capacity needed to transform our energy system, but it will take time to develop. Many companies will grow broke in the effort to enter this market, but others will make a great deal of money as the transition to lower priced renewable energy picks up momentum. In parts of the world not yet connected to the grid, the profit potential of locally based microgrids built on renewable energy will attract business interest and those businesses will build the needed capacity.

New forms of energy are not self-implementing and the market for new goods and services must be motivated as customers decide that something new is better than something they've gotten used to. The comfort with old arrangements must be overcome if new technologies are to be implemented. It took some people, especially older people, a long time to get comfortable with the internet and cell phones. Changes in consumer behavior are based on changes in opinions, preferences and values. This motivation may begin with a concern for protecting the planet, but that concern is not sufficient to stimulate decarbonization and may not even be needed. Energy is central to modern economic life and to our contemporary lifestyle. Before changing the energy we use, we will need to be sure it is as reliable and convenient as what it is replacing. It will also need to be less expensive than fossil fuels. Even then, some people will be very slow to adopt the new technologies. The mass public takes cues from the elite. If we learn that celebrities and community notables are adopting the new technologies, the rest of us may follow along.

The fundamental economics of energy favors renewable sources over the long run. Fossil fuels must be mined and transported before they are used. Fossil fuels may be plentiful but they are finite. The source of renewable energy is free, and the [technology](#) to capture and store the energy will only get less expensive over time. The cost trends are already obvious. Despite these fundamentals, technical, political, organizational, financial and attitudinal challenges must be overcome if our global economy is to transition off of fossil fuels.

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