What Happens to Electric Utilities When It Is Cheaper for Consumers to Generate Their Own Power?

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Utilities have been in the business of generating electricity and distributing it to consumers since

the 1880s. Utilities pass on to consumers the costs of providing that power—the costs of building, owning, and operating power plants, substations, transmission lines, distribution lines, and other equipment, as well as administrative costs, fuel costs, and power purchase costs, to name just a few. In many countries, electricity tariffs are set so that the utility recovers those costs, plus some profit. Some countries, including in Asia (Korea is a current example, as is Mongolia), use other government income to subsidize power costs to some or all consumers through utilities that are state-owned or state-controlled. With the exception of some large industrial customers, a few "early adopters" (customers eager to try new technologies without much regard for cost), and those living "off grid" (too remote from the electrical grid for cost-effective service), most consumers do not think much about generating their own power, being content to allow the utilities to perform that function and/or unaware that they have an option. A recent report, The Economics of Grid Defection: When and Where Distributed Solar Generation Plus Storage Competes with Traditional Utility Service, by authors from the Rocky Mountain Institute (RMI), Homer Energy and CohnReznick Think Energy, suggests that within a few decades—and much sooner in some places—the combination of advances in solar photovoltaic and battery technologies, and marked decreases in prices for both, may well result in huge changes in the role of the consumer in power provision, and in the role of the utility in providing power.

The RMI report compared the projected per-unit cost of utility power with the cost of "off grid" power from solar PV/battery power systems for residential and commercial customers living in five US States: Hawaii, California, Texas, Kentucky, and New York. These states represent a range of power costs and solar resources. They explored a "base case" scenario, with "an average of generally accepted cost forecasts for solar and battery systems", an "[a]ccelerated technology improvement" scenario offering faster improvements in system cost and performance, a scenario in which users of solar/battery systems also adopt demand-side energy efficiency improvements to reduce the energy and power that the system must supply, and a scenario in accelerated technology and demand-side improvements are combined. The report found that for some consumers in Hawaii, the costs of solar/battery systems are already less than that of grid electricity, that under an increasing number of scenarios, and for more and more locations and customer groups, solar/battery systems will reach cost "parity" with grid electricity over the next 10 to 30 years. Parity will be reached before 2050 for commercial customers in all five states, and for residential customers in three of the five states, even under the base case scenario. As more consumers adopt on-site renewable energy systems, whether grid-connected or grid-independent, the fixed costs of power provision, including the costs of power plants and other long-lived assets, must be spread over a reduced pool of electrical energy sales, pushing electricity rates up, and making renewable energy systems even more cost-effective and attractive.

Of course, mere parity between solar PV/battery system costs and grid electricity costs does not necessarily imply immediate flight of utility customers to stand-alone systems. After all, advocates (and even neutral analysts) have for years shown the significant economic benefits to consumers of energy efficiency improvements, yet electricity-hogging devices and buildings persist. Many consumers lack the confidence to take the leap to grid-independence, are indifferent to electricity costs that are a relatively small portion of their budget, and/or, perhaps most importantly, lack the information, expertise, and funds to make the investment in solar PV/battery or other alternative sources of electricity supply. This inertia to change on the part of consumers offers utilities willing to consider new roles in electricity supply both time to adapt and, for intrepid entrepreneurs, inside and outside utilities, openings to help consumers to make the jump to utility-supported, rather than utility-served, energy systems.

How well might the utility systems in the countries of East Asia adapt to the technological changes foreseen in the RMI report? First, the effect will be most pronounced in places where electricity

demand is not growing or is growing only slowly. Second, solar/battery systems will be more attractive in nations with better solar resources. Third, utilities with business structure that are monolithic and/or inflexible will have a harder time reacting to shifts toward customer-sited generation, although the political and economic power of such utilities, exercised through technical regulations (for example, related to grid interconnection), market access restrictions (for example, against entrepreneurs who might help consumers finance and acquire solar/battery systems), and continued subsidized energy prices may help to delay the widespread adoption of customer-sited generation. Each of the countries of the region offer a different combination of these conditions.

Utilities in Japan, with little or no growth in electricity consumption, very high power prices, and utilities that operate in highly protected markets, are likely at significant risk of losing market share—a process that has arguably already begun. Taiwan, with electricity demand that is not growing too fast, a single utility, and a good solar resource, may soon be in a similar position. In the Republic of Korea, with an effectively single-provider electricity market, slowing but still-significant growth in electricity demand, and subsidized power prices (to some consumers) and a moderate solar resource, parity of grid power costs with solar/battery systems may come somewhat later. In China, with many utilities (though many of them serve customer bases the size of medium-sized nations), growing demand, and utilities that may be more open to evolution in business practices, especially with national leadership emphasizing pollution reduction, may be in a better position to adapt to widespread solar/battery system adoption than its (presently) wealthier neighbors. The countries of Southeast Asia—including Thailand, the Philippines, and Vietnam, also have fairly monolithic state utilities with considerable economic and political clout, good solar resources offset by often subsidized electricity prices, and lower per-capita incomes, may be able to resist substantial grid defection for a while, but demand growth, the expense of investing in new power supplies, and the eventual need to move to full cost recovery, may accelerate the adoption of solar/battery systems.

Ironically, the nation in Northeast Asia that might arguably have the smoothest adaptation to customer-sited generation with solar PV technologies—even though it has at best a moderate solar resource—is the Democratic People's Republic of Korea (DPRK). The antiquated and, in many places, decrepit electrical grid in the DPRK would leave few sunk costs to worry about under a rebuilding/recovering economy—which necessarily assumes engagement and rapprochement with the international community as the DPRK nuclear weapons issue is resolved over time. Most of the demand-side and virtually all electricity supply-side equipment will need to be replaced in a redeveloping DPRK anyway, providing the perfect opportunity to couple renewable energy systems with highly efficient end-use equipment and new grid systems designed to take advantage of both. With effectively no electricity market at present, and utility institutions and regulatory agencies that will likely need to be rebuilt virtually from the ground up anyway, plus a cultural and practical bias towards self-sufficiency, a redeveloping DPRK may make an attractive regional test-bed for the implementation of solar PV and battery storage, and the development of electric utilities that complement and support consumer-sited generation. Of course, like any project in the DPRK, such an effort would hardly be hurdle-free, but the rewards could be very significant and beneficial, in the long run, for both Koreas and for the region.

Reference / Further Reading:

Rocky Mountain Institute, Homer Energy, and CohnReznick Think Energy (2014), The Economics of Grid Defection: When and Where Distributed Solar Generation Plus Storage Competes with Traditional Utility, February 2014. Available from

http://www.rmi.org/electricity_grid_defection#economics_of_grid_defection.

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