

Technological Innovations That Could be Spurred by Grid West

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Problem Statement

Cost/benefit analyses of the type done by Tabor Caramanis and Henwood ignore benefits from technological and strategic innovations made possible by making access to markets easier. These benefits could far exceed those that come from more efficient operation of the grid. This paper makes the case that those benefits, although unknowable, may be large, and should not be ignored in the work of the Risk/ Reward group.

Grid West, if designed as anticipated, could facilitate greater participation by entities that have not historically played a role in transmission planning. These entities may be generators embedded in the grid and those behind meters. They will also include those in control of demand-side resources, either automatically in response to system conditions, or in response to market conditions.

Entities in control of loads will be able to offer ancillary services and free-up transmission flow capacity to Grid West, and in so doing will mitigate the exercise of market power by generators.¹

Baseline Description

Transmission design and planning is done today much like it has been done historically. Even though the electrical grid is one big synchronized machine encompassing wires, generators, and loads, generators and loads have not been fully integrated into transmission planning. Transmission planning continues to be transmission centric. A few efforts exist to change the status quo, such as BPA's Non-Wires Solutions Round Table, whose charter it is to look at the opportunities for non-wire strategies to complement transmission planning.² Also, PacifiCorp, for one, has installed a large battery at the end of a long 69 kV line that would otherwise have had to be expanded. But, without major changes to markets and education of those in control of non-wires resources, it will be hard to change current practice.

¹ Thomas, Robert J. et al. Experimental and Theoretical Evaluation of Current and Proposed Markets Including Effects of Ancillary Services. Power Systems Engineering Research Center (PSERC). March 2000. Report posted at http://certs.lbl.gov/pdf/PSERC_000331.pdf. Also see FERC Docket AD02-23, Demand Response Programs.

² http://www.transmission.bpa.gov/PlanProj/Non-Wires_Round_Table/

Status quo

- ◆ The status quo will result in continued transmission centric planning for transmission and continued balkanized planning of the “big machine.” Loads will continue to use power regardless of system conditions, unless emergency conditions force them to do otherwise. And generators will continue to be sited where lower bus bar costs are possible, without regard for the differential costs that occur throughout the grid.

Known and measurable changes

- ◆ Activities spurred by the promise of Grid West, such as TIG and others, will undoubtedly result in some movement before Grid West is operational. But, that progress will be slow without comprehensive strategies in place to allow non-wires strategies and other innovations to make a difference.

Potential Grid West Approach (Beginning State)

Grid West has to enable and aggressively seek out innovative technologies that help achieve the most efficient grid possible. Easy entry to markets has spurred innovation throughout history. The most recent striking example of this is the breakup of AT&T, which undoubtedly led to cell phones, ubiquitous Internet connections, and other spin-offs too numerous to mention.

Credit Suisse Boston³, in a note to its investors “... concludes that continued rapid innovation is all but inevitable”... “One of the most important conclusions is that the larger the pool of ideas, the faster the potential for growth.” The “pool of ideas” will grow with more entities being able to provide services through Grid West markets. Other important points noted in the Credit Suisse report are:

1. Five of the top fifteen companies in the S&P 500 by market capitalization effectively didn't exist 20 years ago.
2. Over 60% of the technology companies with current market caps over \$50 billion went public in the past two decades.
3. These relatively new technology companies have a combined market capitalization exceeding \$1.5 trillion.
4. The whole high technology industry group that includes companies such as Cisco, Yahoo, Oracle, and America Online didn't exist 20years ago.

The corollary to Credit Suisse's findings is that industries that have not kept up with innovation have suffered. Credit Suisse has even gone so far as to advise its investor

³ Credit Suisse, “Innovations and Markets: How Innovation Affects the Investing Process”, Michael J. Mauboussin and Alexander Shay

clients not to buy stocks that are subject to change or co-option by technological advances.

Merrill Lynch⁴ has looked at the electricity sector and concluded that if the Public Utility Holding Company Act (PUCHA) were repealed, companies like General Electric could take over the industry. This position is based, in part, on the large amount of capital used in the industry and the relatively low capacity factor associated with that capital. The electric utility industry capital investments in 1998 were about \$600 billion and growing at about 6\$ billion per year⁵. Further this capital is used on average 43% of the time. If PUCHA is repealed, as it appears it might be, there will be different entries coming into the electric industry. These entities, not steeped in historical practice, will undoubtedly be looking for more efficient ways of delivering services to their customers

Utilities will have to innovate or allow for innovation in order to stay in business. An independent operator of the grid with an objective to increase efficiency of the operation of the grid without the competitive baggage carried by individual transmission owners competing against one another can be a positive vehicle for change.

Innovations Possible with Grid West

If we assure that entry to markets within Grid West are not constrained, I believe that we will see innovation in all parts of the grid, but especially at the end-use, because this part of the “big machine” has been given less attention by utilities throughout history.

As an example of just one innovation that should be commercially ready in the near future, Pacific Northwest National Laboratories (PNNL) is working with Motorola on a chip that can be installed in appliances and that would automatically and instantaneously control that appliance to respond to frequency drops on the system. This characteristic provides frequency regulation—an ancillary service that is valued in wholesale power and transmission markets. PNNL, through the Portland Business Alliance has designed a “test bed,” involving PacifiCorp, among others, to test this technology, and others. In its next generation the chip will allow appliances to be shut off and turned on by a remote grid operator. Provided the right incentives and market structure, this technology could make a big difference in the markets for ancillary services, congestion management and even in the timing of the need for new transmission capacity. It is but one element of a project, known as the “Smart Grid” on which several of the national laboratories are working. EPRI and others, including BPA, are working on the “Self Healing Grid,” a similar concept to Smart Grid. These efforts will almost assuredly bring changes to the electricity grid if markets are open through the advent of an independent operator.

Another technology that shows potential in markets that are open to distributed resource technologies is vehicle-to-grid (V2G) applications.⁶ Using this technology, electric

⁴ “Cutting the Cord” Merrill Lynch web site, 2002

⁵ US Statistical Abstract, 2000

⁶ www.udel.edu/v2g

vehicles become energy storage devices on the power grid with the ability to regulate load and even deliver power to the grid for short periods.

Innovation will not only be technologically driven; there also will be more innovative strategies once markets open to demand-side resources to offer services into Grid West markets. An investment firm I met with recently in Portland invests in parts of buildings. For example, they may own the wiring system, and lease it back to the building owner. The idea is to improve the balance sheet of the building owner when it applies for financing. This firm would be in a great position to buy HVAC systems and other energy using equipment in multiple buildings and, in the aggregate, offer load flexibility into markets established within Grid West. The load flexibility would supply ancillary services as well as congestion relief and could delay transmission expansion.

Venture capitalists are investing millions of dollars to develop better fuel cells, better fuel reformers to produce hydrogen to drive these fuel cells, and even into creating cost-effective streams of hydrogen from waste byproducts of other industries. One of these might be successful and completely change how we view the production of power and where it is produced. Fuel cells are being designed and applied to run individual appliances; if successful on a grand scale this technology could change how we plan and operate the power grid.

All of these efforts could be spurred by a Grid West design that accommodates the introduction of innovations. We should be vigilant in making sure that Grid West does not become “transmission centric.”

Summary

Will technological and strategic innovations happen as a result of Grid West? Nobody knows for sure, but history in other industries and activities that currently abound will, with high probability, result in innovation in this industry. All that is needed is the opportunity. Well-designed Grid West markets that are easy to enter will enhance the probability that innovations will come forward to make the grid a more efficient machine.