

Letter from America—Perry Sioshansi

Europe charts future grid

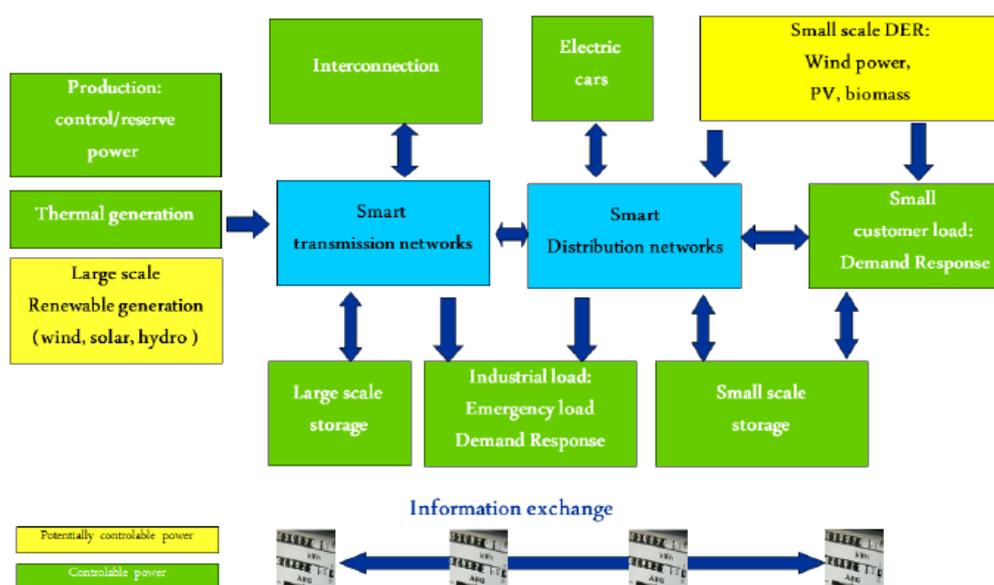
More flexible, more real-time, and more complex

There is broad consensus among the experts that the basic operating infrastructure that has served us so well for the past century will be inadequate to meet our requirements for the next one. This is in part due to new stresses, demands and service quality standards that we have come to expect from the electricity grid. It drives the interest in smart grid, smart meters, dynamic pricing, demand response, and so on.

Moreover, the growing interest in integrating vast amounts of intermittent renewable generation—among other things—is stressing the grid to perform functions that it was not originally designed to do. Finally, the information revolution, which is gradually pervading the power sector, promises to offer new and ingenious ways to change the ways we manage energy generation, transmission and consumption.

Fundamentals are the same; everything else is different

Traditional and new flexibility measures



Source: Research and Innovation Road-map 2013-22

In January 2013 the European Electricity Grid Initiative (EEGI) released a report that outlines what will be required of the grid of the future, and what it will take to develop such a grid.

Ironically, the report's very first reference is to a paper published in 1978 by MIT's Fred Schweppe, who many regard as a pioneer in the burgeoning field of electricity market design.

The physical fundamentals of power flow—from central generating plants to major load centres through a complex transmission & distribution network—has not changed (see figure left). But everything around and about

the network, including the direction of the power flows, has. This, in short, requires new thinking on how the pieces fit together so that the whole system will work efficiently and reliably.

The report highlights four key changes that must be considered in designing how the grids of the future will need to operate to cope with the additional complexities and demands placed on them. They are:

- from “supply-follows-load” to “load-follows-supply,” which encompasses the growing interest in customer demand participation (DSP), demand response, dynamic pricing and a host of other efforts designed to adjust or manage demand to match what will increasingly be intermittent, unpredictable and non-dispatchable supply;
- increased real-time balancing, which refers to the trend towards more intermittent renewable as well as distributed generation;
- introduction of aggregators, which refers to the emerging role of intermediaries who can contribute to the preceding two requirements; and
- multi-layer control structure, which is referred to as “systems of systems”—schematically illustrated below.

As EU-wide road-maps go, the report is written at a high level of abstraction, yet its underlying message, that the time has arrived for fundamental rethinking about the grid of the future, is spot on.

Many of the issues highlighted by EEGI are the same as the debate about the changing role of the grid in California confronting a growing proportion of renewable and distributed generation.

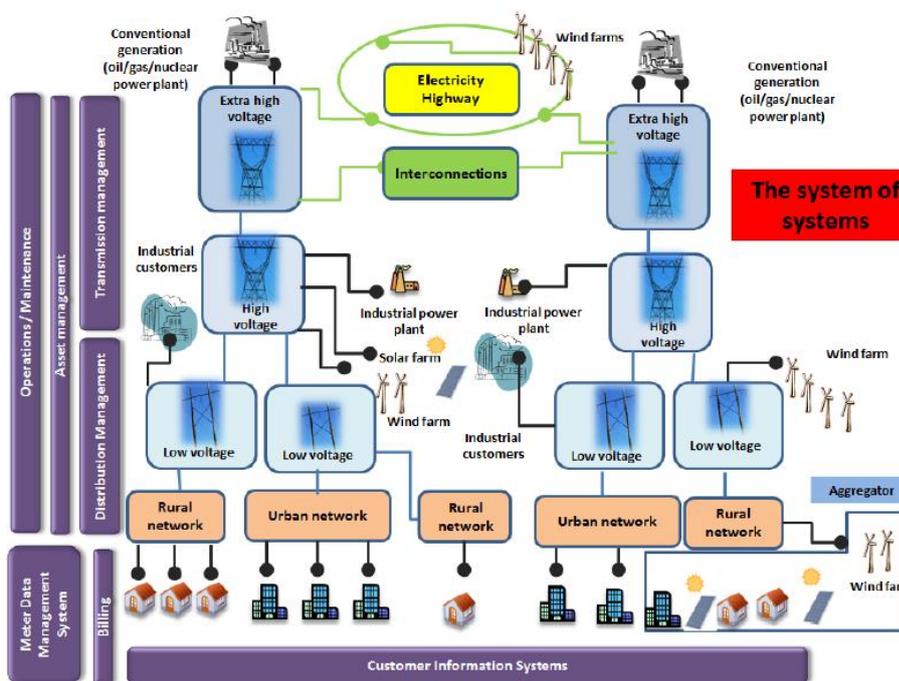
The same challenges will be facing grid operators in Germany, California or many other regions who are intent to transition to a low-carbon energy mix with a significant renewable component. One of the main take away points is to increasingly focus on managing and shaping demand, rather than adjusting supply.

With so much generation coming from non-dispatchable resources including distributed generation that is a sensible way to go.

Perry Sioshansi is a specialist in electricity sector restructuring, and he has been actively involved in discussions in a number of developed, developing and transition economies. He is founder and president of **Menlo Energy Economics** and is the editor and publisher of *EEnergy Informer*, from which we have sourced this article, and which we commend.

More complex

The electricity “system of systems”



Source: Research and Innovation road-map 2013-2022



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