

Geospatial Technology and the Smart Grid*

By Peter Batty, President of Spatial Networking and Chief Technology Advisor, Enspira Solutions, Inc.

Barack Obama said in a recent interview “One of the most important infrastructure projects we need is a whole new electricity grid ... We’re going to have to have a smart grid if we want to use plug-in hybrids [to provide power to the grid].”

SMART GRID?

A “smart grid” is an electrical transmission and distribution network that’s more flexible and resilient than current networks, through having more “intelligent electronic devices” (IEDs) on the network that communicate in real time with software systems controlling the grid. IEDs provide the ability to detect what’s happening in the network (e.g., power flow, problems, etc.)

There’s currently a lot of focus on automated meter reading (AMR) and advanced metering infrastructure (AMI). At a basic level, AMR makes the billing process more efficient by not needing a utility employee to manually read meters. AMI builds on this to enable customers to get current information about consumption, help utilities detect network tampering by identifying unusual consumption patterns, and enable utilities to remotely disconnect and connect customers (due to non-payment or moving).

A smart grid, however, can do much more. It can give a detailed near-real-time picture of current power consumption, which is critical in managing a system that’s overloaded. It can accurately indicate which customers are out of power and confirm that all customers have power restored after repair.

Smart meters also can play a key role in demand-response (DR) programs, which enable utilities to reduce power consumption when the system is overloaded. By providing usage information to consumers, the smart meters provide education and encourage conservation and changes in consumption patterns. The utility also may have programs enabling them to remotely adjust thermostats to reduce consumption or turn off power to a home or specific appliances.

DR provides multiple benefits by reducing peak loads. One is environmental, reducing the amount of energy needed to be generated, with the consequent carbon emissions. It also provides major cost savings for utilities by reducing their need to build additional generation capabilities and buy additional power from other utilities to handle peak loads (which is much more expensive than non-peak power).

Another important development is growth in distributed generation to allow small generators such as solar panels, wind turbines or electric cars to contribute power to the grid. This requires significant changes in software and processes used to manage the grid.

GEOSPATIAL TECHNOLOGY’S ROLE

When rolling out smart meters, benefits can be achieved more quickly by targeting appropriate customers. Areas with greater benefits include those with high disconnect rates for non-payment, large numbers of hard-to-access meters, safety concerns for meter readers (e.g., high-crime areas) or higher outage rates.

Much of the benefit relating to outages is achievable by installing meters in a sparse fashion, whereas complete coverage of customers in an area makes sense for most other benefits. Geospatial analysis is key to developing a rollout plan for a given utility, based on the benefits wanted and the service territory characteristics. Many AMI deployments use a wireless communications infrastructure, which adds another geospatial aspect to planning.

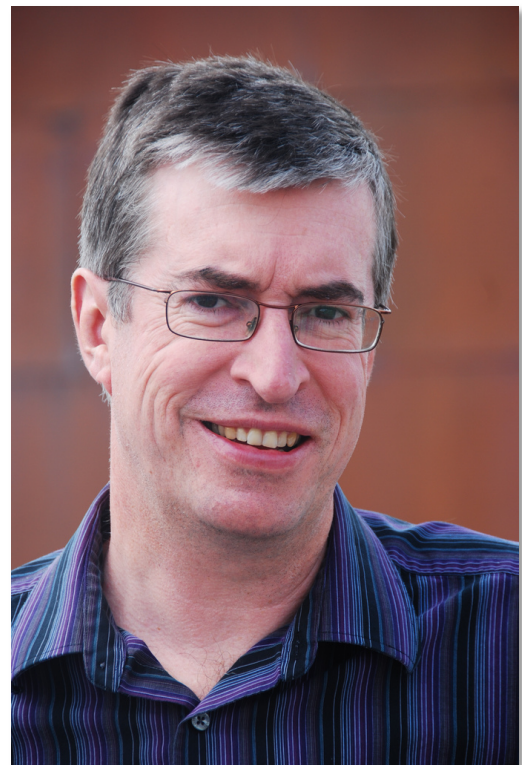
After smart meters or other smart devices have been deployed, managing their operation in an integrated fashion requires geospatial technology. Network modeling is an important element in these software platforms.

Traditionally, some elements of what's needed have been provided by GIS as well as outage and distribution management systems, and supervisory control and data acquisition. Of those systems, geospatial capabilities typically decrease and real-time capabilities increase in that order.

There will increasingly be a need for these previously (at best) loosely coupled systems to become more tightly integrated. But such progress has been slower than expected.

In addition to complex technical issues, there are organizational and operational challenges. But we're beginning to see more tightly integrated systems, and there are significant opportunities for geospatial technology to help design and manage the smart grid.

Author's Note: I would like to thank Kevin Cornish, Erik Shepard and Cindy Menon of Enspira Solutions for providing input to this column.



Peter Batty is the president of Spatial Networking and chief technology advisor at Enspira Solutions. He can be reached via email at peter.batty@gmail.com