Shedding Light on Electric Transmission

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With the energy needed to power today's technological necessities, our aging and overburdened system may be living on borrowed time.

Flip a switch and the light comes on. Plug in your phone and it charges. Turn on your coffee maker and it brews. But reliable electricity has become so much more than just an everyday convenience. Nearly everything we use—from the food we eat to the clothing we wear—requires electricity to produce, package, distribute and dispose of.

In the United States, electricity is critical to commerce and daily operations, and the nation's "electric bill" for maintaining the system's reliability has been climbing steadily every year. In 2011, it cost America's 131 million electricity customers roughly $247 billion. In addition, it is also estimated that power outages and instability cost the U.S. economy between $80 billion and $188 billion annually.

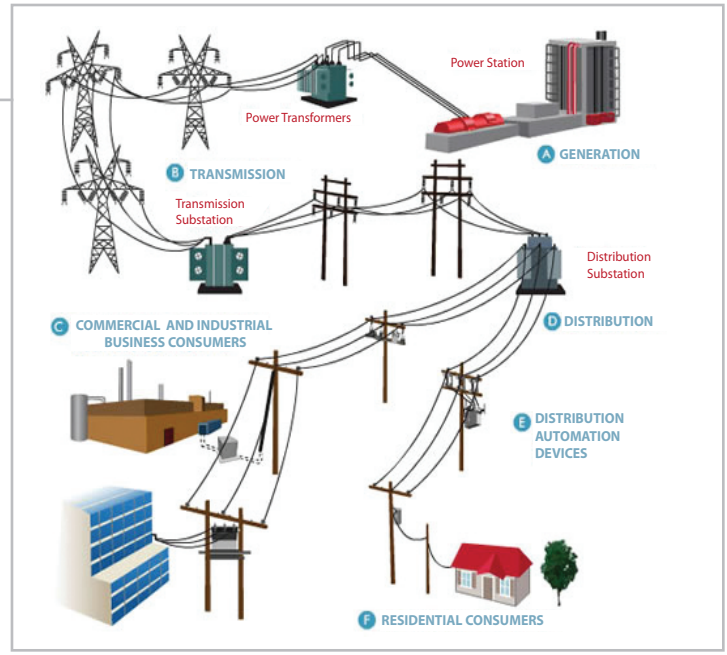
The sobering reality is that our aging infrastructure was not built for, nor can it sustain, our current volume of consumption. It has become increasingly apparent that, in order to ensure future reliability, the U.S. must bring its electrical grid into the 21st century.

The Aging Grid

The delivery of electricity is achieved through a sophisticated distribution system that transmits large volumes of high-voltage electricity from generating stations. However, many things must transpire before this electricity reaches your home or office.

The U.S. electric grid is a complex network of independently owned and operated power plants and transmission lines, the vast majority of which were built prior to 1970. The Department of Energy estimates that the total asset value of this infrastructure exceeds $800 billion with approximately 60% invested in power plants, 30% in distribution facilities and 10% in transmission facilities.

When generation plants were designed and built back in the 1960's, their intended life span was 40 years. But that was based on the construction standards of the times. Compounding the problem, consider the significant amount of energy needed



The delivery of electricity requires a sophisticated distribution system to transmit high-voltage electricity from generating stations.

to power today's technological necessities. When our electric grid was originally built, there were no microwave ovens, smart phones, personal computers or electric cars. This explosion of technology was not anticipated or planned for.

Over the years, there has been ongoing maintenance on the transmission infrastructure, but the system has now reached a point where demand has surpassed engineering design limits. To fix the system, additional generation and transmission lines are needed, which requires either planning for new systems or upgrading existing systems. In the absence of significant reinforcement and expansion, the system's reliability will be unstable, prone to equipment failures and will lack the flexibility to accommodate new interconnects. Without substantial and continued investments, the transmission system is living on borrowed time.

According to the New England Energy Alliance (NEEA), our current system consists of many aging, lower-capacity lines that are undersized for the amounts of electricity that must be transmitted to meet consumer demand. This results in what the industry refers to as transmission congestion, increasing both the cost of electricity and the risk of equipment failure. Many newer generation facilities such as wind farms can sit idle due to lack of transmission capacity available to deliver their product. The NEEA likens this to transforming a secondary road into a superhighway.

A Complex Process

Transmission planning involves estimating the grid's future needs and determining how to meet those needs through expanding and improving the transmission system. Generally, this is done by bringing the lowest cost transmission and substation additions to the bulk power system, to reliably interconnect generation to load and facilitate wholesale power marketing.

The transmission planning process is complicated, and because it varies with each project, can have dire economic impacts. Reliability is achieved at a cost. Major transmission facilities can take up to seven or more years to plan, site and construct. There are many issues and factors to consider, such as the generation resources, transmission capacities, right of way limitations, economic and financial constraints, service reliability and cost considerations.

There are also many different constituents involved in transmission planning. Transmission system operators are the actual operators of the physical lines that transmit electrical power from generation plants to distribution. Balancing authorities are entities who are responsible for integrating resource plans (ahead of time), maintaining generation-transmission-load balance and maintaining interconnection frequency in real-time. State regulatory authorities, such as public utility commissions, public service commissions or utility boards, are involved by approving project route selection and cost allocation. Independent system operators or regional transmission organizations coordinate, control, and monitor the transmission system reliability and oversee wholesale electricity market performance.

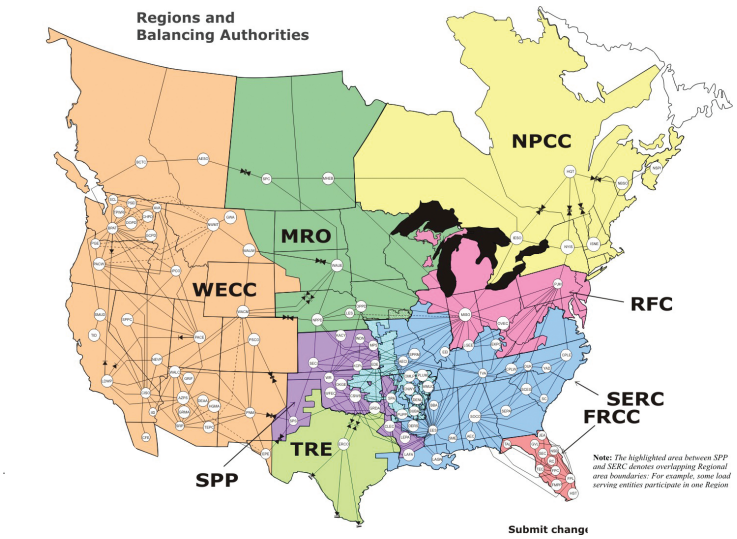
Right of Way Challenges

While an increase in electric transmission capacity and reliability offers significant benefits, getting the land rights for a new transmission project acquired and the line built can be an uphill battle. A right of way, typically in form of an easement, is needed for the utility to construct, maintain, and repair a power line, as well as keeping the line clear of vegetation, buildings and other structures that could interfere with its operation. Increasing land prices, a lack of corridors for new facilities and limitations of eminent domain continue to challenge the industry to be creative and review alternatives for projects.

Many states are urging alignment with existing corridors or even utilizing existing easements to cause less impact on land uses. However in population centers, where the demand is greatest for electricity, there is a lack of corridors to parallel caused by real estate development right up to and sometime even encroaching into existing rights of way. Building in an easement that already exists can be problematic in that the existing easements are typically already exclusive to a specific voltage. If a higher voltage is required or if the existing right of way is not adequate for a new line, a new easement must be obtained.

Additionally, even though the entire community benefits from a new transmission grid, few people want it built too close their property for fear of reducing their property value or getting stuck with an unsightly view. Landowners typically do not want new easements in their own backyard and reap no direct benefit from a project outside of the onetime payment for a permanent use of their land.

For the new FERC ruling to work, all the various state and regional entities would need to work together in creating a working plan that benefits all parties involved.



We have seen some recent cases where landowners have leases with wind developers that are an exception. This usually involves either a potential wind farm waiting for the transmission line before it can develop or the new line relieves congestion to load for an existing wind farm. In these cases, a landowner increases their monthly income from their wind leases by allowing the new power line.

Transmission Planning and Cost Allocations

One way that the government works to ensure reliability of the bulk power system is through industry-wide regulations. Organizations such as the Federal Energy Regulatory Commission (FERC) and the North American Electric Reliability Corporation (NERC) are responsible for developing, enforcing and overseeing compliance with reliability standards for the transmission of electricity. These organizations focus on assisting consumers in having reliable, efficient and sustainable energy services at a reasonable cost through appropriate regulatory and market means.

Most recently, FERC announced a final ruling on Order No. 1000, which focuses on transmission planning and cost allocation requirements. This ruling will provide a foundation needed to overcome the obstacles that currently exist in interstate electric projects. This new rule builds on the reform of Order No. 890 from 2007 which required coordinated, open and transparent regional transmission planning processes to address undue discrimination. This reform is important because it will benefit transmission planning in the long term. In the short term, it is making an already multifaceted process more complex.

Order No. 1000 calls for the following additional planning requirements:

1) Public utility transmission providers are required to participate in a regional transmission planning process that satisfies Order No. 890 principles and produces a regional transmission plan.

2) Local and regional transmission planning processes must consider transmission needs driven by public policy requirements established by state or federal laws or regulations.

3) Public utility transmission providers in each pair of neighboring transmission planning regions must coordinate to determine whether more efficient or cost-effective solutions are available.

At the regional level, this means that each transmission planning region must produce a transmission plan reflecting solutions that meet the region's needs more efficiently or cost-effectively. In addition, stakeholders must have an opportunity to participate in identifying and evaluating potential solutions to regional needs.

Order No. 1000 also establishes three new requirements for allocating transmission costs:

1) Regional transmission planning must include a regional cost allocation method for a new transmission facility selected in the regional transmission plan. The method must satisfy six regional cost allocation principles:

- Costs allocated are to be roughly commensurate with estimated benefits.
- Those who do not benefit from transmission do not have to pay for it.
- Benefit-to-cost thresholds must not exclude projects with significant net benefits.
- Allocation should not occur outside a region unless the other region agrees to assume a portion of those costs.
- Cost allocation methods and identification of beneficiaries must be transparent.
- Different allocation methods could apply to different types of transmission facilities.

2) Neighboring transmission planning regions must have a common interregional cost allocation method for a new interregional transmission facility that the regions select. The method must satisfy the six interregional cost allocation principles.

3) Participant funding of new transmission facilities is permitted, but is not allowed as the regional or interregional cost allocation method.

The ruling does not require a one-size-fits-all method for allocating costs of transmission facilities. Rather, each region can develop its own proposed cost allocation methods with the participation of its stakeholders. This rule promotes competition in regional transmission planning in support of efficient and cost effective transmission development. It also requires the development of a not unduly discriminatory regional process for transmission project submission, evaluation and selection.

This FERC order will ultimately allow for electric projects to be planned and developed in a more streamlined manner without the risk of being held up along the way. This will result in an overall improvement to our grid's success in achieving the ultimate goal, which is delivering reliable electricity to the public.

Realities of Executing the Order

It is important to understand that although this ruling is beneficial to the industry, it will take time to roll out and become successful. At best, the rule will be rolled out in late 2012 for intrastate lines and early 2013 for interstate lines. Once it is officially published in the Federal Register, it will require an additional 60 days to take effect. Filings for the new interregional transmission lines, including cost allocation, will have 18 months to meet these new requirements. Regional participants of this new interregional planning processes and cost allocation will need to develop and agree to where these projects should go within this same 18-month time period.

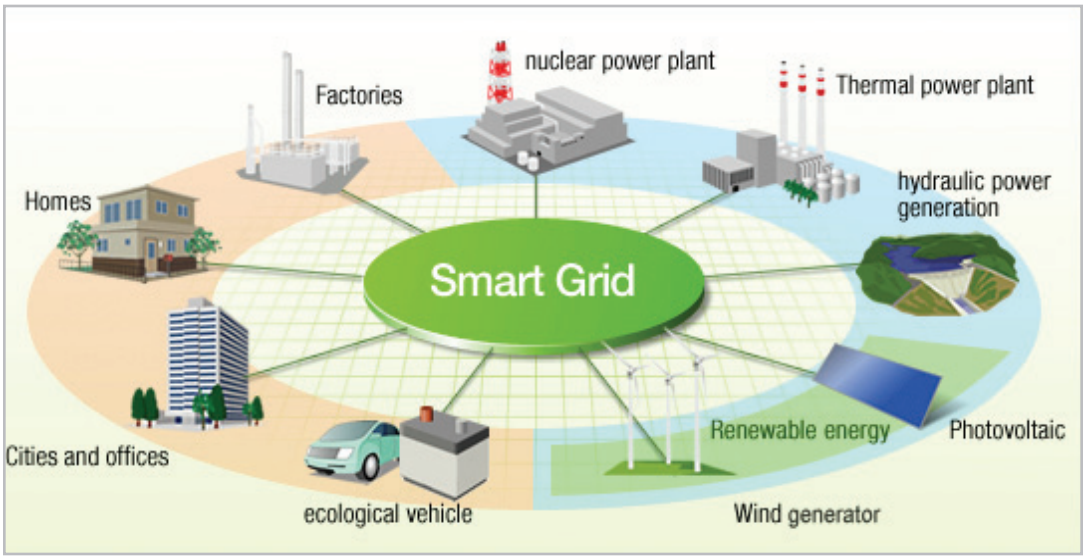
Assuming Order No. 1000 becomes effective in the first quarter of 2013, and if the interregional processes are in place at that time, it may be late 2014 before an actual electric project has the opportunity to file under this order. Keeping in mind that these are new processes, this timeline does not consider the additional planning studies needed or the project development time leading to a filing. While some projects can get started, without a finalization to this new process and an agreed upon system for cost allocation, developers are hindered in planning and funding potential new projects. There are few government incentives for this work, so project funding must be determined in advance. A project can only develop so far without processes and requirements in place.

While Order No. 1000 identifies some key issues facing electric projects, it only provides a baseline framework for a solution. This framework is dependent on the same participants of state regulatory authorities, regional entities, independent system operators, regional transmission organizations and utilities that have been unable to come to agreement for decades to now work together to move these projects forward. The biggest gain from these new regulations is that it now requires these participants to all take a seat at the table and come up with a working plan for all members involved. In reality, it could be 2015 before the first electric transmission projects follow this FERC order. This may be pushed out even farther when environmental permitting issues occur, as they typically do.

Emerging Technologies

As the industry and the planning process continue to evolve, there are other key areas to watch. These will have dramatic changes or impacts on the overall electric system and more specifically transmission planning. MIT recently completed a study on the Future of the Electric Grid, which concluded that new and innovative technologies have the potential to improve the reliability and efficiency of bulk power systems by enhancing the operators' ability to observe and control these systems. Similar technologies can enhance distribution systems and make demand more responsive to real-time costs, but effective use of these technologies will require changes in regulatory policy.

The term Smart Grid is often used to refer to the modernization efforts of the electric grid. The U.S. Department of Energy defines it as a class of technology designed to bring utility electricity delivery systems into the 21st century by using computer-based remote control and automation.



The Smart Grid is designed to bring utility electricity delivery systems into the 21st century using computer-based remote control and automation.

This modernization, according to the Electric Power Research Institute, could cost as much as $476 billion to implement, but will result in as much as $2 trillion in benefits. The MIT study found that the benefits of evolving to a smart grid solution will come in the form of improved reliability (shorter and less frequent outages), lower costs for power transmission, more efficient markets (lowering electrical rates), an improved ability to transmit and handle power from alternative energy sources, and overall better grid security.

In the near future, superconductor technology will begin to replace existing wires. In fact, the U.S. and Japan already have plans to replace underground copper power cables with superconducting cable-in-conduit cooled with liquid nitrogen. By doing this, more current can be routed through existing cable tunnels. In one instance, 250 pounds of superconducting wire replaced 18,000 pounds of vintage copper wire, making it over 7000% more space efficient. Superconductors are highly efficient and because of their size, they are out of sight, out of harm's way and require a very small right of way.

Distributed Generation

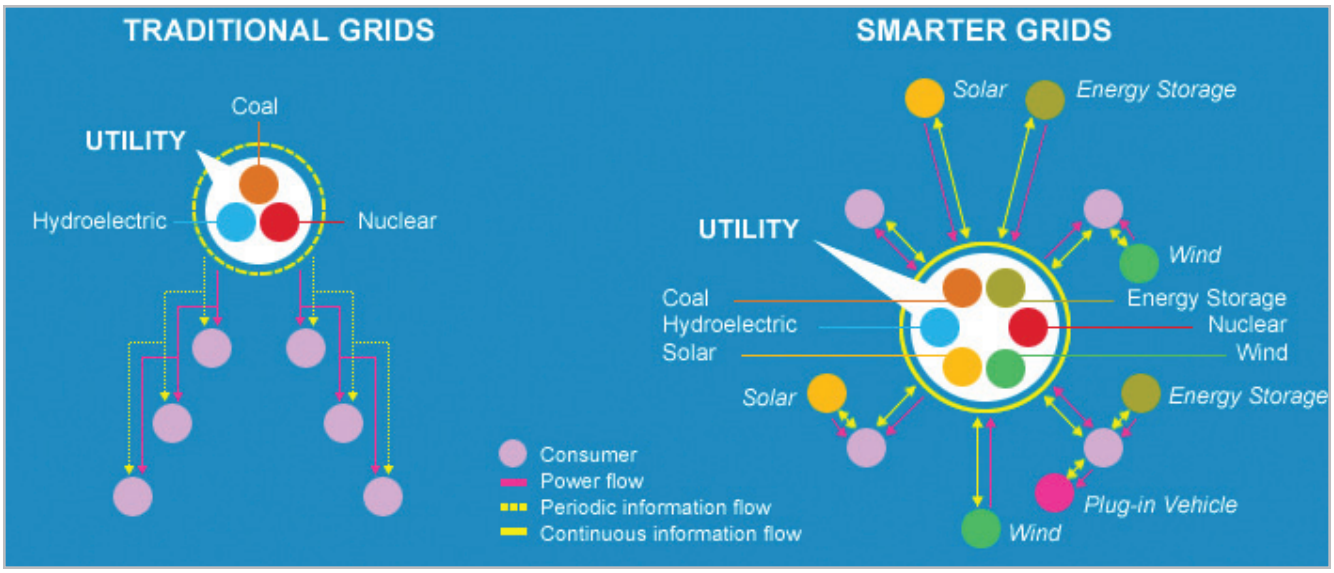
Generating power onsite can eliminate inefficiencies related with transmission and distribution. When electricity is generated on a small scale from renewable and non-renewable energy sources at or near the point of consumption, it is called distributed generation. As noted by a FERC study, there are currently more than 12 million distributed energy units installed in the U.S., with a total capacity of about 200 gigawatts. Comprised mostly of back-up power units (primarily natural gas and diesel fired generators), these energy units are used to provide emergency power during power outages. Other examples of distributed generation include solar panels installed on rooftops, community wind projects and geothermal.

When planned properly, distributed generation can increase the reliability of the grid. Solar, in particular, has recently become a popular distributed generation option and will grow as the cost of implementing photovoltaic systems continues to become more affordable. The appeal of solar is that it is renewable, has low maintenance and is much less obtrusive than other forms of generation. The downside is that it can be intermittent, as it relies on sunlight, making it a challenging source when power is needed 24 hours a day. In general, distributed generation systems serve in addition to and in support of a traditional electric power system.

Distributed generation will continue to evolve significantly over the next five years. As technology advances and the Smart Grid is implemented, even more incentives will be available to users. One example is net metering where an electric user is paid for generation fed back into the grid.

Cyber Security

Reliability in the business of electricity is mandatory in today's world. Federal and state regulators along with utilities all agree that cyber vulnerabilities and the security of their systems to operate the electric grid are in need of protection.



Distributed generation will continue to evolve as technology advances and incentives are implemented.

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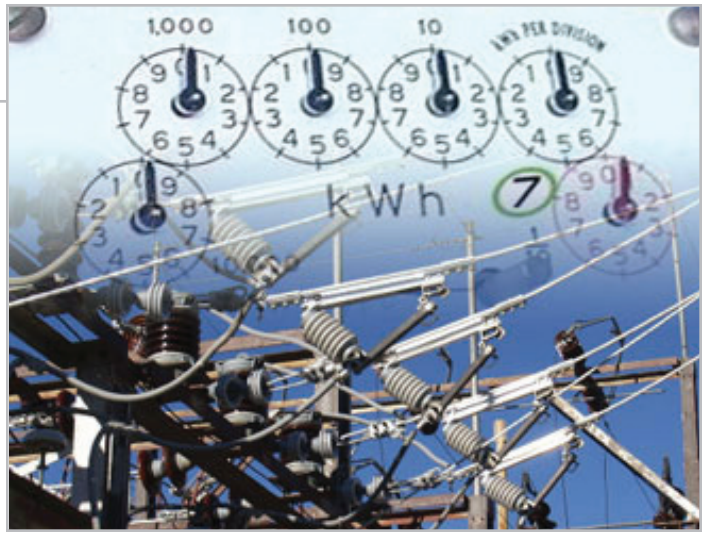

As with most issues in electric transmission, protecting the grid from cyber attacks involves a coordinated effort from many parties, including FERC, NERC, transmission system operators, the U.S. Department of Homeland Security and the U.S. Department of Energy.

MIT's study on the Future of the Electric Grid finds that, while FERC and NERC have authority over the standards, development and compliance for the bulk power system, there is currently no national regulatory oversight of cyber security compliance for the distribution system. There is however, a push toward creating a comprehensive security model for the entire grid that would be overseen by one single entity. As a result, this could affect transmission planning and implementation, requiring more lead time in developing a project. This would add yet another entity that must approve a project and could potentially require full security implementation studies on a line before it can be constructed and energized.

What the Future Holds

Updating and modernizing the U.S. electricity infrastructure is an economic and environmental imperative. It is vital to renewing the country's economic growth, strengthening national security and addressing the threat of global climate change. Investments are needed to make the system more reliable, resilient and secure, as well as to accommodate renewable power and enable more energy efficiency by individuals and businesses.

When it comes to electric transmission, FERC's Order No. 1000 is considered long overdue, and to a large extent, mandatory for any real improvements to planning and cost allocation. As with any new process, some short-term hardships may result, but the fact is, our current system is not only ineffective, it's prohibitive to the development of an efficient, cost effective, reliable and a truly national transmission system.

The challenges in creating a 21st century electric transmission system are not insurmountable. From emerging technologies and energy efficient developments to federal regulations and investments, change is happening daily. It is exciting to see developments unfold as organizations start working smarter and more cooperatively at improving the system.

References

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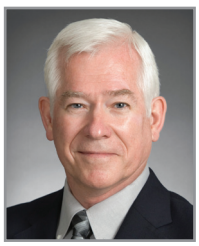

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