

No-Regrets Approach
to
Enhancing
Grid
Resiliency

Grid Assurance, Innovative Industry-Driven Response

BY MICHAEL DEGGENDORF



With increasing concerns about the possibility of prolonged transmission grid outages due to human attack (physical or cyber) or natural forces, how can transmission-owning utilities best ensure ready access to key replacement equipment such as large transformers and circuit breakers in emergencies?

A group of utilities has developed a way to address this problem. They are combining the resiliency benefits of a large secure store of long-lead time replacement equipment with the cost efficiencies of multi-utility pooling of inventory costs.

This initiative, Grid Assurance™, offers an innovative and cost-effective way to enhance utilities' ability to recover from catastrophic losses of transmission equipment.

It is an asset-based means of mitigating the risk that needed replacement equipment cannot be obtained in the aftermath of a catastrophic event. In essence, it provides insurance on prompt access to critical spare equipment for grid recovery.

This no-regrets approach deserves careful consideration by transmission owners and regulators, given growing risks to the grid.

Risks to the Grid, Replacing Damaged Equipment

As recent events demonstrate, catastrophic events such as physical attacks, cyberattacks, geomagnetic events, and severe weather including floods and hurricanes, pose potent risks to the nation's power grid.

In April 2013, multiple transformers at a key transmission substation in California were shot by gunmen. It rendered them inoperable.

In December 2015, two hundred twenty-five thousand Ukrainians lost power after a cyberattack compromised the computer systems of three Ukrainian electricity distributors.

Superstorm Sandy resulted in power outages for more than eight million customers, due in part to extensive flooding that impacted transmission substations.

The U.S. Department of Energy found in its 2015 Quadrennial Energy Review that threats to the grid have been growing, even as society's dependence on the grid has increased.¹

Policy makers also are expressing growing concern about grid resiliency. They are calling for better and timelier access to spare transformers and other critical long-lead time transmission equipment.

In its Quadrennial Energy Review, the Energy Department identified high-voltage transformers as one of the grid's most vulnerable components. Mitigating risks to transformers and other long lead-time equipment was identified as an urgent priority.

A key part of grid resiliency is ensuring the ability of transmission owners to quickly replace critical transmission equipment that has failed. Procuring large power transformers requires

Subscribers can reduce their costs by thirty to seventy percent compared with maintaining their own stockpile.

an extended lead time between order and delivery of, on average, between five and sixteen months. But potentially can be nearly two years.²

Because they are typically custom-made, manufacturers do not maintain an available inventory of high-voltage transformers.

Utilities maintain some operational spares in anticipation of failures due to ordinary wear and tear. But, they typically

do not maintain large reserves of spare transformers and other critical equipment sufficient to address widespread damage from problems such as physical or cyber-attacks, geomagnetic disturbances, floods or catastrophic weather events.

High-voltage transformers are quite costly. Establishing utility-specific reserves capable of covering widespread, catastrophic losses on a utility-by-utility basis would be very expensive for consumers.

Responses to Date

In 2006, the power sector took a critical first step to address replacement of transformers damaged by terrorist acts. The Edison Electric Institute and a number of utilities formed the Spare Transformer Equipment Program (STEP).

STEP provides participating utilities the right to buy large transformers from other participating utilities, but only after a Presidentially-declared terrorist emergency.

However, the Quadrennial Energy Review noted that STEP alone is not sufficient to address large-scale grid vulnerabilities. The STEP inventory is not large enough to respond to a large coordinated attack.

Concerns about transformer inventory received greater attention following the Metcalf attack in California in April 2013.

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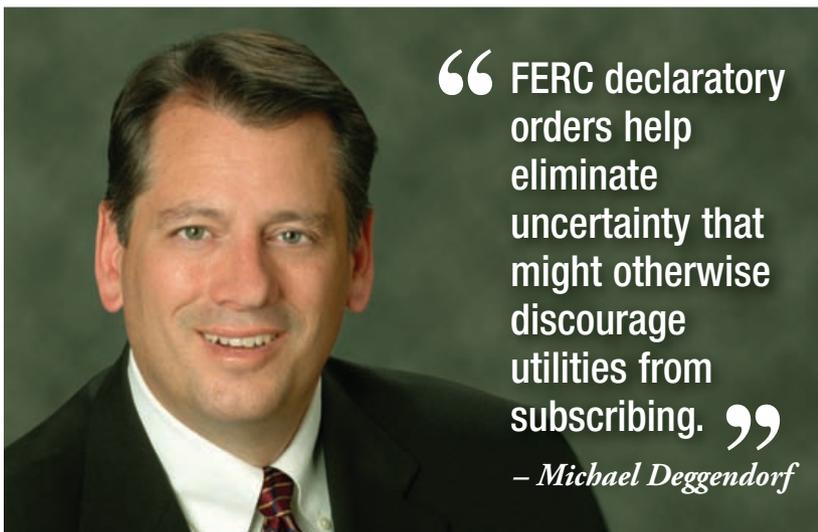
In December 2015, Congress recognized the problem and a possible solution. It found that the storage of strategically located spare large power transformers will reduce the vulnerability of the United States to multiple risks facing electric grid reliability, including physical attack, cyber-attack, electromagnetic pulse, geomagnetic disturbances, severe weather, and seismic events.³

Congress included language in the 2015 highway bill directing the Energy Department to develop a plan for a strategic transformer reserve. In particular, the Department is required to conduct a thorough analysis and prepare a plan, in consultation with industry and regulators, and to submit the plan to Congress by the end of 2016.

parameters will be optimized for the collective needs of Grid Assurance subscribers. This will ensure that individual pieces of inventory are compatible with the systems of multiple utilities.

Grid Assurance will warehouse the inventory in secure domestic locations. It will release spare equipment to subscribers, as needed, in response to qualifying events, including physical attacks, cyber-attacks, electromagnetic pulses, solar storms, earthquakes, windstorms, wildfires and severe weather.

Inventory will be readily available after a qualifying event affecting the transmission grid. Grid Assurance will give transmission-owning utilities a cost-effective way to promptly get replacement equipment that will supplement the spare equipment they already own.



“FERC declaratory orders help eliminate uncertainty that might otherwise discourage utilities from subscribing.”
— Michael Deggendorf

Benefits for Utilities and Customers

It would be exorbitantly expensive for each utility to plan for and stock the spares needed to address high-impact, low-frequency events such as coordinated physical attacks and extreme weather events that could incapacitate multiple sites. Grid Assurance’s pooling approach offers economies of scale, diversification and improved logistics. By purchasing in volume, Grid Assurance expects to negotiate more favorable pricing on equipment supply and maintenance agreements.

Most importantly, because spare inventory will be optimized for the collective resiliency needs of a large group of subscribers, each subscriber’s share of the cost of access to inventory will be only a fraction of the cost of each utility purchasing and holding all of the spares it might need to respond to a catastrophic event. A pooled inventory approach leverages geographic diversity and allows utilities to share costs.

While the exact savings of any one utility will be influenced by many factors, Grid Assurance has estimated that the total spare equipment needs can be reduced by up to thirty-three percent using this approach. Subscribers can reduce their costs by thirty percent to seventy percent compared with maintaining their own stockpile.

Inventory will be stored at secure strategically-located warehouses, enhancing security and reducing costs for protecting spare equipment.

Grid Assurance will contract with equipment manufacturers to periodically test, service, and maintain equipment in inventory. The company will manage inventory so that manufacturer warranties are preserved for subscribers.

The company will also perform ongoing logistics planning. And it will maintain expertise in large asset transportation, including intermodal transportation for inbound and outbound inventory.

The Energy Department is to consider a number of issues. These include the size and type of inventory needed to provide sufficient resiliency to the bulk-power system, the degree to which utility sector actions and initiatives address the need, possible strategic storage locations, cost estimates, options for funding the acquisition and secure storage of equipment, and other operational considerations.

It is not clear what the Energy Department will recommend. Or, if a federal transformer reserve would get the necessary federal authorizations and appropriations to get off the ground.

Utility-Led Model for Pooling Spare Equipment Inventory

Grid Assurance is a new procurement, inventory management and logistics support company. It will enable transmission-owning utilities to cost effectively address concerns about grid resiliency.

Grid Assurance will maintain an inventory of spare transformers, circuit breakers, and other critical transmission equipment. The company will provide access to this equipment to subscribing transmission owners following catastrophic events.

Equipment specifications such as high-side and low-side transformer taps, transformer windings, and other equipment



Cartoon drawn exclusively for *Public Utilities Fortnightly* by Tim Kirby

Grid Assurance is offering sparing service to any transmission owner in the continental U.S. and Canada. The company allows subscribers to specify the equipment covered. Service can be tailored to individual subscriber needs to supplement existing spare equipment resources.

It will provide service at cost-based prices. Equipment purchased in an emergency will be sold at Grid Assurance's original cost. The annual subscription fee is based on the company's operating costs. The efficiencies of the pooled inventory approach will allow a utility to enhance its ability to recover at much less cost than purchasing a dedicated utility-owned inventory.

Grid Assurance has finalized its subscription agreement, and is currently contracting with subscribers. Subscribers may also choose to invest in the company.

FERC has already addressed a number of regulatory questions. Recent FERC declaratory orders help eliminate uncertainty that might otherwise discourage utilities from subscribing to a sparing service.⁴ In these orders, FERC confirmed that Grid Assurance sparing service can play a role in compliance with NERC reliability standards.

FERC also addressed cost recovery issues for prospective subscribers. It found that utility decisions to subscribe to Grid Assurance sparing service and to purchase spare equipment following a qualifying event are prudent. And, FERC found

that single-issue ratemaking procedures can be used to recover Grid Assurance costs.

FERC also made helpful declarations on the applicability of the Federal Power Act section 203 prior authorization requirements and affiliate pricing rules.

As threats to the grid continue to evolve and grow, utilities must take additional steps to enhance confidence in their ability to recover promptly and restore service to consumers. Resilience can't be left to chance.

Grid Assurance is an innovative, industry-driven response to collective concerns about attacks on our nation's power delivery system. Its pooled inventory model will provide subscribers ready access to critical equipment needed to recover from catastrophic events that damage the transmission system. It also will reduce the cost of enhancing resiliency for utility customers, a no-regrets approach. [PDF](#)

Endnotes:

1. "Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure," U.S. Department of Energy, April 2015.
2. Infrastructure Security and Restoration, Office of Electricity Delivery and Energy Reliability, Department of Energy, "Large Power Transformers and The U.S. Electric Grid," April 2014.
3. Public Law 114-94, Fixing America's Surface Transportation Act, § 61004(a).
4. Grid Assurance LLC, 152 FERC ¶ 61,116 (2015); Grid Assurance LLC, 154 FERC ¶ 61,244 (2016).