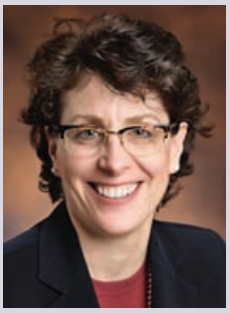
Preparing for the Inevitable

New Approach to Recovery from Catastrophic Losses of Grid Facilities

By Paul Afonso, Lauren Azar, Dian Grueneich and James Hoecker

Metcalf. Ukraine. Super Storm Sandy. The risks to the nation's bulk power delivery network are growing. The threat of physical and cyber attacks now compound the risks from natural disasters.

As former utility regulators and policymakers, we urge utilities, network operators, and regulators to recognize these growing risks, work together to develop robust grid resiliency and recovery plans, and implement a shared inventory model as a cost-effective way to expedite restoration of the power delivery network if severe weather strikes or parts of the grid come under attack.

Recent attacks on the electrical system, including the rifle attacks disabling transformers at Metcalf in California and the use of cyber-warfare to disrupt the power supply in the Ukraine, serve as important indicators. Bad actors now see disrupting the electricity supply as a way to cause havoc.

Physical attackers have demonstrated an increased sophistication in the planning and execution of coordinated strikes at multiple sites, and the motivation and means to plan and carry out these attacks without prior detection.

Strategic attacks on grid facilities could result in unprecedented loss of essential services, including water, sewer and communications, in addition to electricity. Utilities must take additional steps to enhance grid security, to protect against attacks, and to enhance resiliency and recovery if an attack is successful. Likewise, Super Storm Sandy disrupted major elements of the Northeast grid and future natural disasters are inevitable.

Policymakers are paying attention to potential threats to the nation's power supply. While federal agencies and utilities are working together to protect the grid through enhanced physical and cyber security, it is also critical for utilities and regulators to anticipate and prepare for recovery if an attack is successful, or when severe weather affects large portions of the power delivery system.

For some critical pieces of grid equipment, such as high-voltage transformers, replacements are not readily available for response to widespread losses. A high-voltage transformer can take up to two years to manufacture and deliver. For this type of equipment, it's critical and prudent to have a readily-available domestic inventory of spares to expedite recovery and lessen the impact of a catastrophic event.

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The question for utilities and regulators is how to adequately prepare for recovery from possible catastrophic losses. Doing nothing may minimize cost in the short run. But, it leaves electricity customers exposed to the risk of extended outages. A head-in-the-sand approach is not a practical resiliency policy.

At the other extreme, having each utility purchase its own dedicated inventory of critical equipment, including high-voltage transformers, sufficient to address the risk of widespread catastrophic losses would be duplicative and prohibitively expensive for utility customers.[1]

A shared inventory model offers a sensible middle-ground approach. Access to a shared inventory can ensure that a readily-available supply of securely stored spare transformers will be available domestically for deployment following a catastrophic event.

Having utilities pool the costs of maintaining an inventory of spare critical equipment will expedite grid recovery at substantial savings relative to a go-it-alone approach with every U.S. utility purchasing and maintaining its own extensive inventory of critical equipment spares that they may never need.

Moreover, a shared inventory approach will provide economies of scales in purchasing, warehousing, protecting, and maintaining the spare equipment.

Utilities understand the unique challenges of recovering from damage to the transmission grid. Grid Assurance is a joint effort by six major utilities to develop a shared inventory approach.

It will use cost-based pricing arrangements that are familiar

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Fig. 13 Electric Power CO_2 Intensity

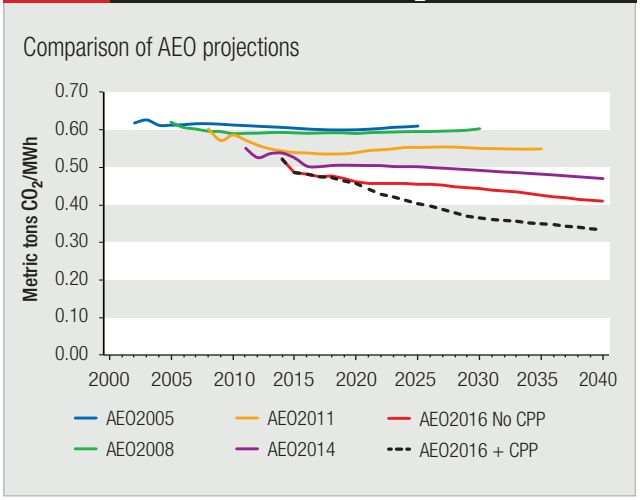
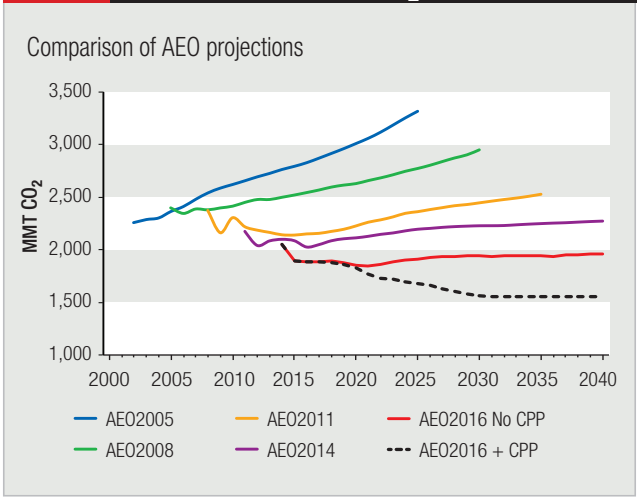


Fig. 14 Electric Power CO_2 Emissions



Previous projections of ever-increasing oil and gas imports have now given way to a future outlook of declining reliance on imported fuel supplies, eventually pointing to the U.S. as a net energy exporter.

Shale and tight oil technologies are the main factors in this dramatic turnaround in U.S. energy supply. This increase in fuel supplies is also largely responsible for lower world oil prices and sharply lower U.S. natural gas prices.

Lower natural gas prices have had a great impact in the electric power sector, enabling gas-fired generating capacity to undercut the energy costs of legacy coal plants in much of the U.S.

Together with the improved economics for renewable generation, coal's historical share of about 50 to 55 percent of total generation has been dropping. AEO2016 projects coal's share to drop below 30 percent by 2040. And with the Clean Power Plan this could drop to below 20 percent.

These shifts in generation are lowering carbon dioxide intensity. The old average of about 0.60 metric tons of carbon dioxide per megawatt-hour has been dropping as natural gas and renewables increased share.

In AEO2016, even without the CPP, carbon dioxide intensity drops to below 0.45 metric tons per megawatt-hour by 2040. This drops below 0.35 metric tons per megawatt-hour with the CPP.

In the electric power sector, projections of ever-increasing carbon dioxide emissions have been reversed. Actual carbon dioxide emissions peaked at over 2.4 billion metric tons in 2005-2007, and have now dropped to around 1.9 billion metric tons.

In AEO2016, emissions are projected to remain below two billion metric tons even without the CPP. With the CPP, emissions are projected to decline further, leveling off at below 1.6 billion metric tons in the post-2030 timeframe. PUF

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to utilities and regulators, selling equipment from its inventory to subscribers at the original cost, and sharing the other costs of the business, such as storing and maintaining the equipment in inventory, equitably among the subscribers.

Each subscriber can customize coverage based on the type and volume of grid equipment that it has in service, and any access to spare equipment the subscriber might already have.

With the growing threats to the nation's energy delivery network, transmission owners and their regulators must be proactive and should strongly support innovative, cost-effective solutions for bolstering grid resiliency.[2]

Pooling approaches, like Grid Assurance, offer a sensible, balanced, and effective approach to expediting recovery if (or more precisely, when) a catastrophic event occurs. The ultimate costs and impacts of being unable to respond effectively to a large-scale grid outage are too high for our nation's electric industry to ignore. PUF

Endnotes:

1. The U.S. Department of Energy is studying the potential for a government-run strategic transformer reserve. The fate of the effort, the service it would provide, and the economics of participation, are all highly uncertain.
2. For utilities seeking to recover these costs through FERC-jurisdictional transmission rates, FERC has already cleared away Federal Power Act-related underbrush in two declaratory orders. Grid Assurance LLC, 152 FERC ¶ 61,116 (2015); Grid Assurance LLC, 154 FERC ¶ 61,244 (2016).