

DHS Science and Technology Directorate

Recovery Transformer

Extra high voltage transformers are the backbone of the electric grid but face many challenges, creating a potential vulnerability for the grid.

The United States electric grid is incredibly complex with more than 80,000 miles of extra-high voltage (EHV) transmission lines carrying electricity over long distances from generation stations to distribution networks. At critical nodes, EHV transformers either step up voltage for transportation across long distances or step down voltage prior to distribution to consumers. Ninety percent of consumed power passes through these critical pieces of equipment at some point on the transmission grid. If these transformers fail—especially in large numbers—the nation could face a major, potentially long term, blackout.



A damaged transformer at the Salem Nuclear Plant. (Metatech)

Many of the EHV transformers installed in the United States are approaching or exceeding the end of their design lifetimes (approximately 30 to 40 years), making them more vulnerable to failure. EHV transformers are huge, weighing hundreds of tons, making them difficult to transport. In some cases, specialized rail cars must be used (and there is a limited supply of these). Typically, it can take several months to transport and install a single EHV transformer due to the size and complexity of the equipment.

S&T develops new technology for the power grid, reduces time to recover by 75 percent or more

The Department of Homeland Security Science and Technology Directorate (S&T) partnered with the electric utility industry and the Office of Infrastructure Protection to initiate the Recovery Transformer (RecX) project. Through this project, S&T developed a prototype EHV transformer that drastically reduces the time to transport, install and



RecX in-grid deployment (Paul Wedig)

energize an EHV transformer to recover from outages associated with transformer failures from several months to less than one week, in the case of an emergency. S&T developed the RecX to be easier to transport (weighing approximately 60 tons versus hundreds of tons for traditional transformers) and quicker to install, reducing potential recovery time for transportation, installation, & energization of EHV transformers by more than 75 percent.

Together with industry partners, S&T successfully demonstrated the RecX prototype for one year ending in March 2013. The team transported a RecX from St. Louis to Houston, then installed, commissioned and energized it in less than a week, then monitored the RecX's performance over to validate its design and operational behavior. The RecX proved successful in an operational environment; it has the capability to reduce the impact of outages and increase the resiliency of the uniquely critical energy sector that directly effects not only functions across all other critical infrastructures but the nation's safety, prosperity, and well-being as well.



RecX Transportation (Paul Wedig)



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