With 60 percent of the U.S.’s gross domestic product tied to electricity, the electric grid is a vital pillar of the economy. Estimated losses due to power failures are over $100 billion annually, and every four months a blackout impacts over a million people. Additionally, Presidential Policy Directive-21 “identifies energy… as uniquely critical due to the enabling functions they provide across all critical infrastructure sectors.”

Despite the importance of the grid, it faces vulnerabilities from severe weather, solar storms, and man-made attacks, and the options for dealing with these threats resiliently are constrained to the architecture of the grid. Currently, urban power distribution substations are intentionally isolated from each other to prevent cascading effects from fault currents (i.e., power surges). However, this architecture limits the resiliency of the grid as substations operate in isolation and restricts recovery options for outages.

To address this architecture limitation and improve the resiliency of the grid, the Resilient Electric Grid (REG) program has developed an inherently fault current limiting, high temperature superconducting (IFCL-HTS) cable. This cable will enable re-architecting grids to be interconnected in an internet-like fashion and allow multiple paths for power to flow. This capability will allow power to be routed around downed substations and enable rapid and resilient recovery to grid outages.

During normal operation, the cable is cooled to a superconducting state, allowing current to flow unimpeded. However, during a fault current event, the cable’s temperature rises and enters a non-conducting state, halting the flow of current. This provides the cable’s inherent fault current limiting capability and prevents fault currents from cascading to connected grid components.

Due to its superconductivity, the IFCL-HTS cable has ten times the power density of traditional copper cables and enables connecting substations to share power and assets. Instead of having to build out new, expensive substations to serve additional load in high-growth areas, utilities will have the option to use an IFCL-HTS cable to share power from underutilized substations.

An in-grid pilot demonstration of the IFCL-HTS cable is underway with Con Edison in Yonkers, N.Y. After completion of the installation, the system will continue to be tested for a one year observational period.

Plans for a commercial-scale installation in downtown Chicago with Commonwealth Edison are currently under evaluation. This installation would validate the maturity of the technology in an operational environment, increase utility interest in the technology, and reduce the cost of the cable system to commercially sustainable levels.

To learn more about the Resilient Electric Grid project, contact Sarah Mahmood, Program Manager, at SandT.RSD@hq.dhs.gov.