

A photograph of a city skyline at night, with several skyscrapers illuminated. A bright lightning bolt strikes the sky on the left side. The image is partially obscured by a dark red rounded rectangle that contains the main text.

# Reliable, Redundant, Resilient



**Gridtec**  
Solutions™

## Resilient Electric Grid Systems for Urban Power Networks

### Providing a new system solution to protect against urban power outages

Catastrophic equipment failures, physical and cyber threats, and weather-related disasters can all leave entire sections of a central business district and nearby neighborhoods without power for hours or days. These vulnerabilities are of particular concern since they can be triggered by events when the need for grid resiliency is heightened. Such extended power outages in urban load centers can be difficult to recover from, making even worse a situation where the personal safety of residents and the economic health of businesses is threatened. Resilient Electric Grid (REG) systems provide protection against the calamitous effects that follow the loss of critical substation facilities in urban areas by allowing the interconnection of nearby substations, enabling them to share transmission connections and excess station capacity, while controlling the high fault currents that naturally result from such interconnections.

**REG systems are ideal for improving the resiliency and reliability of urban networks, while significantly increasing load serving capacity.**

### Keeping cities powered when it's most critical

The secondary network design common in many cities around the world makes the day-to-day reliability of urban power grids very high. Yet contingency events such as losing multiple transformers and/or transmission sources, makes the restoration of power time consuming, costly and unpredictable due to the nature of secondary network substations. The key component to the REG system developed by AMSC is a break-through cable system that combines very high power handling capacity with fault current limiting characteristics; both features attributable to AMSC's unique high temperature superconductor wire. A REG system consists of a number of these inherently fault current limiting cables together with other system design elements to allow sharing of substation assets while limiting the flow of fault currents.

**Providing more power. Everywhere. All the time.**



- **Significantly improve network redundancy and resiliency**
- **Improve survivability of catastrophic system events**
- **Increase load-serving capacity of existing substations**
- **Back-up for loss of transmission**
- **Add flexibility to maintenance schedules**



## REG systems increase both network resiliency and reliability AND increase the load serving capacity of existing substations

### REG systems enhance urban power grids

#### Increased Resiliency

Networking entire distribution substations provides multiple sources of back-up power supply to any given substation. This provides system resiliency in the event of a catastrophic event.

#### Increased Reliability

All of the transformers residing in interconnected substations can serve to back each other up. Moving from an N-1 to N-2 or greater reliability model becomes simple and cost effective.

#### Back Up for Loss of Transmission

The high capacity of a single superconductor cable delivers transmission-level power (over 100MW @15kV) from adjacent substations, providing backup for loss of a station's transmission connections.

#### Serve More Load from Existing Substations

By interconnecting substations, expensive substation assets can be shared. Transformer capacity previously held as spare can now serve new loads.

#### Simplify Maintenance and Repair Schedules

The ability to readily power secondary buses from adjacent substations allows for maintenance and repair operations to take place anytime and eliminates the need to ever fully take a substation offline.



Courtesy of LS Cable

#### Eliminate or Defer Substation Expansion or New Construction

Serving additional load from released spare transformer capacity avoids the need for installing additional or larger transformers or the construction of expensive new substations.

#### Control Fault Currents

Paralleling substations increases fault current levels. In the presence of high fault-currents, the REG system cables – through use of AMSC's unique Amperium® superconductor wire – automatically switch to high resistance operation within milliseconds, providing true first-cycle peak fault current limiting capability.

### Eliminating issues with network expansion

**A REG system eliminates many issues associated with expanding transmission and distribution circuits and networks:**

- Limited cable ampacity
- Need for multiple cable circuits
- Limited right-of-way
- Environmental limitations
- Excessive fault currents

#### Your HTS cable resource

- Cooperative consulting with your engineering department or preferred design firm
- Completely engineered cable systems, including cables, terminations, refrigeration system, control and protection scheme
- Installation, commissioning and testing service

# Resilient Electric Grid Systems for Urban Power Networks

## About AMSC

AMSC (NASDAQ: AMSC) generates the ideas, technologies and solutions that meet the world's demand for smarter, cleaner ... better energy. Through its Windtec Solutions, AMSC enables manufacturers to launch best-in-class wind turbines quickly, effectively and profitably. Through its Gridtec Solutions, AMSC provides the engineering planning services and advanced grid systems that optimize network reliability, efficiency and performance. The company's solutions are now powering gigawatts of renewable energy globally and enhancing the performance and reliability of power networks in more than a dozen countries. Founded in 1987, AMSC is headquartered near Boston, Massachusetts with operations in Asia, Australia, Europe and North America.

## Talk to us about

- Solving your most complex power challenges
- Enhancing your competitive advantage
- Improving your system's performance, reliability and profitability

Whether you wish to make new advances in renewable technology, optimize power generation or delivery, or simply gain a better understanding of the issues you face, please get in touch. We're here to help.

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Smarter, cleaner  
... better energy

