



U.S. Department of Energy
Office of Electricity Delivery & Energy Reliability

GridWorks



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Cables and Conductors

Today's transmission system is being operated at power flow levels that reach the voltage, stability, and thermal limits of the cables and conductors. Transmission constraints and instabilities can cause negative impacts on the entire power system. Transmission lines require endurance against higher electrical and mechanical stresses in order to maintain the reliability of system operations.

Greater demands on the transmission system require greater power transfer capabilities, more capacity, and greater flexibility. Investment in the transmission system has been minimal and is lagging investments made in generation assets. Other challenges include difficulties obtaining new rights-of-way or expanding capacity in existing rights-of-way. Since most U.S. transmission is overhead, thermal limitations of sag is the major focus. Business drivers for overhead transmission include safety, reliability, longevity, and cost.

The standard, most common, overhead conductor that serves as the basis for comparisons is Aluminum Conductor Steel Reinforced (ACSR).

Underground electrical infrastructure is aesthetically more appealing and can be more reliable than overhead lines. Underground systems have about one-third the failures of overhead systems, but locating and repairing problems can take twice as long. The main impediment to building underground lines is cost, but a number of new technologies are becoming available and will allow for greater efficiencies and lower costs. Horizontal directional drilling allows conduits to be placed underground without opening trenches. Similarly, high-voltage insulated underground cables are proving to be more durable while cable trenches located in sidewalks and covered by "pavers" are supposedly easy to remove and allow for simple maintenance.

Conductors

Materials research needs to be conducted to increase the transmission corridor power density, with the ultimate stretch goal of achieving power densities for cables and conductors of 50 times ACSR by 2025. Advanced materials in conjunction with sensors, insulators, and other components of power line systems will lead to an integrated conductor system capable of achieving the 2025 stretch goal. Areas of materials research should include: lower thermal expansion materials, lighter weight conductors, higher strength conductors, higher operating temperature materials, and second-generation superconducting materials.

By 2010, overhead conductors should be developed to increase the capacity of existing corridors by five times ACSR at current costs.

Cables

The ultimate for cable activities is to develop advanced cable systems that are capable of delivering 30x the capacity of current underground cables. Other cable activities will address nearer-term industry needs such as diagnostics and installation techniques. Diagnostic work will improve the operational and maintenance characteristics of current and future cable systems. Installation improvements such as horizontal drilling techniques will make cable systems more affordable and less environmentally intrusive.

Since there are overlapping issues with the HTS program, GridWorks will work closely with HTS to look for synergies and opportunities for potential collaboration to address the barriers.

OE Linkages

The GridWorks cables and conductor activities can build on activities already going on in the Office of Electricity Delivery and Energy Reliability. The Transmission Reliability program has on going activities in diagnostics and sensors for cables and conductors. The HTS program is currently working on cable systems that can greatly increase the carrying capacity of cables. Gridworks will also look for synergies outside OE including existing cables and conductors efforts at utilities, national laboratories, and EPRI.

OE Objectives

Reliability - Increases delivery capacity

Affordability - Reduces the needs for new ROW

Efficiency - Reduces energy losses from the transmission system

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2025 Milestone

Demonstration of 50x ACSR advanced transmission system





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www.energetics.com/gridworks/cables.html