Power flow control for the Grid


Title:

DISTRIBUTED POWER FLOWS USING SMART WIRES FOR ENERGY ROUTING

Technology Summary:

Smart Wire Grid’s devices offer utilities cost effective power flow control for the grid, simple and reliable alternative to conventional technologies and traditional FACTS devices.

Smart Wires converts the existing transmission system to a “Smart Asset” that can bring extensive monitoring capability, regulate power flow and effectively shift excess power to under-utilized portions of the network. Using the technology, standard transmission lines will be augmented with a number of Distributed Series Reactors (DSRs) that are directly fixed onto the conductor. Each DSR on a line is designed to be autonomously switched on at a particular current level as a transmission line reaches its thermal rating or operating limit. This pushes the power to alternate lines that have available capacity. System analysis indicates that DSRs can improve Available Transfer Capacity (ATC) by up to 30% during high congestion periods.

DSR modules are self-powered using line current and are simple for line crews to install. The modules operate at line potential through 500kV and have been rigorously tested to utility HV standards. DSRs are equipped with sensors. DSR is designed with flexible communications to meet any utility need and provides for control and monitoring across an array of DSRs.

Transformational Merit:

While FACTS devices have been available for over a decade, market adoption of the technology has been poor. Custom designs, complex operation integration and high life cycle costs are major contributors to the reluctance to deploy FACTS devices. Smart Wires offers utilities a new transmission system tool and is an expedient solution.

Smart Wires addresses a void in traditional transmission system planning, engineering and operations by offering a new tool to decision makers. Beyond cost, a number of issues beset the construction of
new power lines or increasing the capacity of current lines. Power system analysis of a Smart Wire application is very quick to perform. Smart Wires can be deployed faster than any available technology currently on the market and is flexible to meet both interim and long term requirements.

Next Steps:

Smart Wires and associated Distributed Series Reactance (DSR) devices has been under development for over seven years and is known throughout the research community and utility industry. Georgia Tech and its associated utility industry organization, NEETRAC, have conducted significant theoretical and experimental work on Smart Wire technology and have consistently identified the Smart Wire technology as a very high priority in the utility marketplace. All the major concepts were validated using various laboratory models and software. Actual working devices have been constructed and tested extensively. NEETRAC has provided validation services throughout the development and testing phase for DSR units that will meet 30 year in-service design requirements and industry standards. Following successful lab demonstrations, NEETRAC negotiated a contract with SWG to act as its commercialization partner. Under this ARPA-E contract, SWG has deployed a Smart Wire and DSR Array Testbed on member TVA’s 161kV transmission line, beginning October 15, 2012.

SWG is executing a carefully crafted plan to launch Smart Wire technology and deliver it into the market. The DSR market deployment approach follows these phases:

- Product design and development
- Production facility construction and product manufacturing
- Product testing and certification
- In-field testing at selected utilities
- Full product launch

Public Summary

The Smart Wire Grid, Inc. (SWG) has developed an innovative technology called Smart Wires for controlling power flow in the transmission grid. Smart Wires optimizes transmission system capacity and enable greater levels of energy, including renewable energy, to be transferred over large distances, and effectively shift power flow to under-utilized portions of the network. Smart Wires are an array of Distributed Series Reactors (DSRs) which are simplified FACTS devices and sensors providing a low-cost, failsafe, mass-producible, dynamically-controllable, modular, and rapidly-deployable solution to improve the efficiency across the grid. DSR devices are self-powered and float electrically on existing transmission lines, allowing users to control impedance and monitor transmission line characteristics. Smart Wires can be deployed and operated in autonomous mode, or as part of an intelligent system solution. The DSR devices provide the ability to use existing dynamic transmission line capacity to route power in a cost efficient manner.