

Smart Wires - Introduction to the Distributed Series Reactor



Summary
CIREN 10 – 13 June 2013 Stockholm

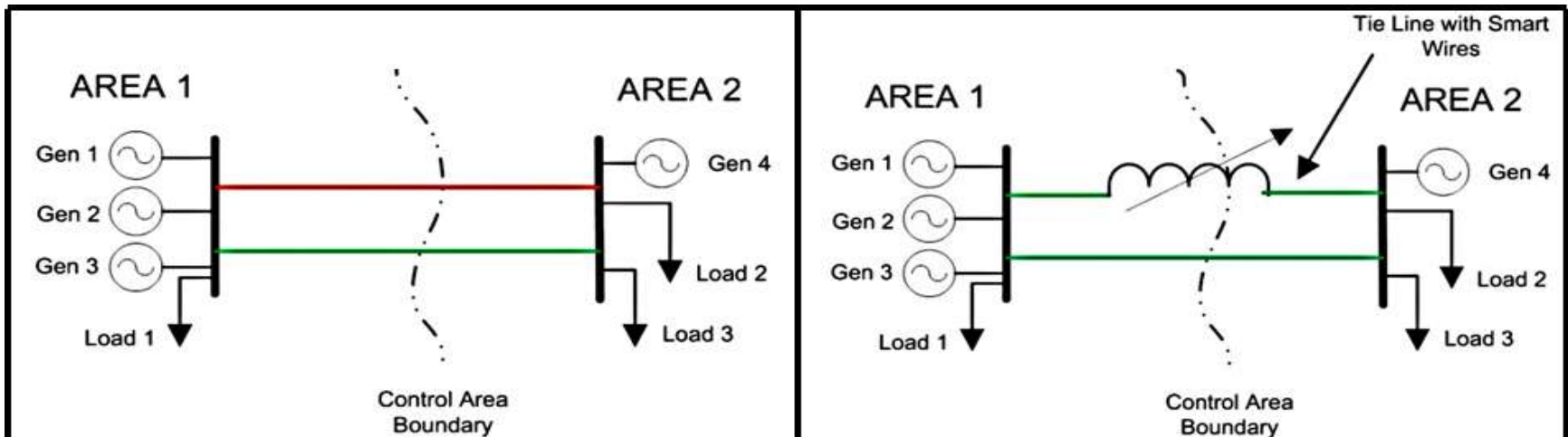
Power flow control for the Grid



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Power flow control for the Grid

- Rapidly deployable technology to control power flow through existing transmission lines
- Multi-dimensional solution:
 - Hardware – Distributed Series Reactor (DSR) changes transmission line impedance
 - Software – Monitors DSR fleet, optimizes power flows
- Applications:
 - Overload Protection, Renewables Integration, Remedial Action Scheme (RAS/SPS) Simplification, Congestion Relief

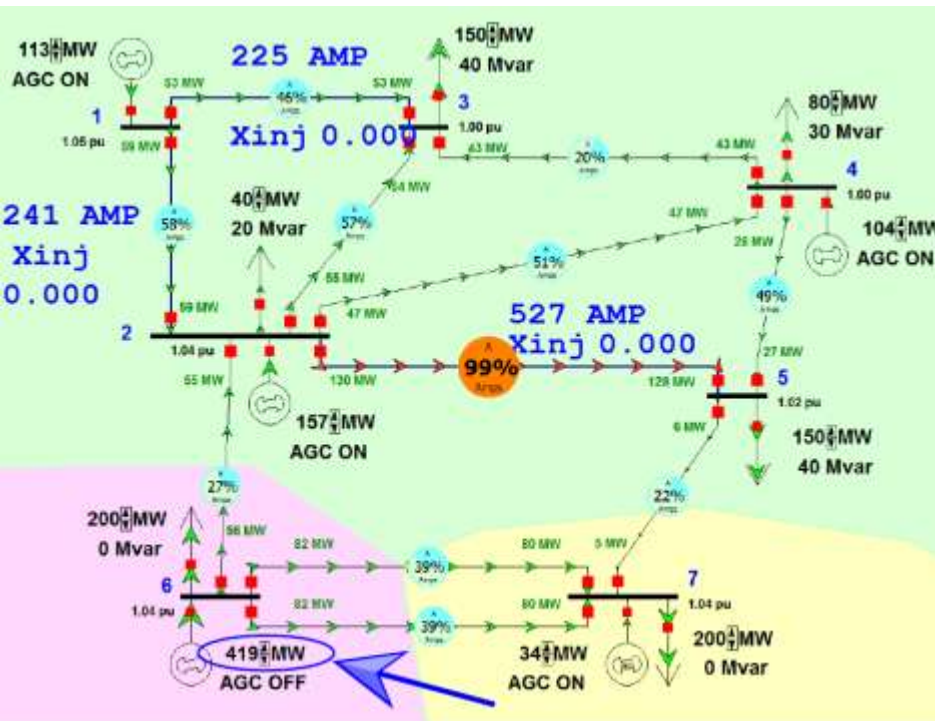


Imbalanced impedances leads to overload (red)

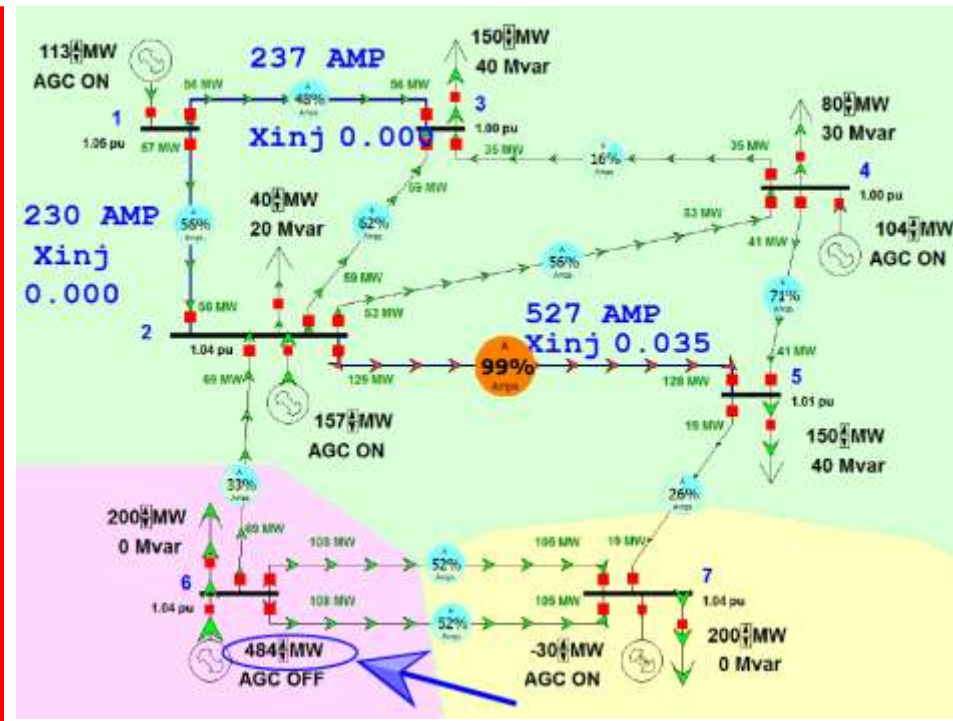
Smart Wires changes impedance to resolve overload (green)

Power flow control for the Grid

Application: Simulated Penetration of Increasing Generation under (n-1)



Without “Smart Wires” on Line 2-5

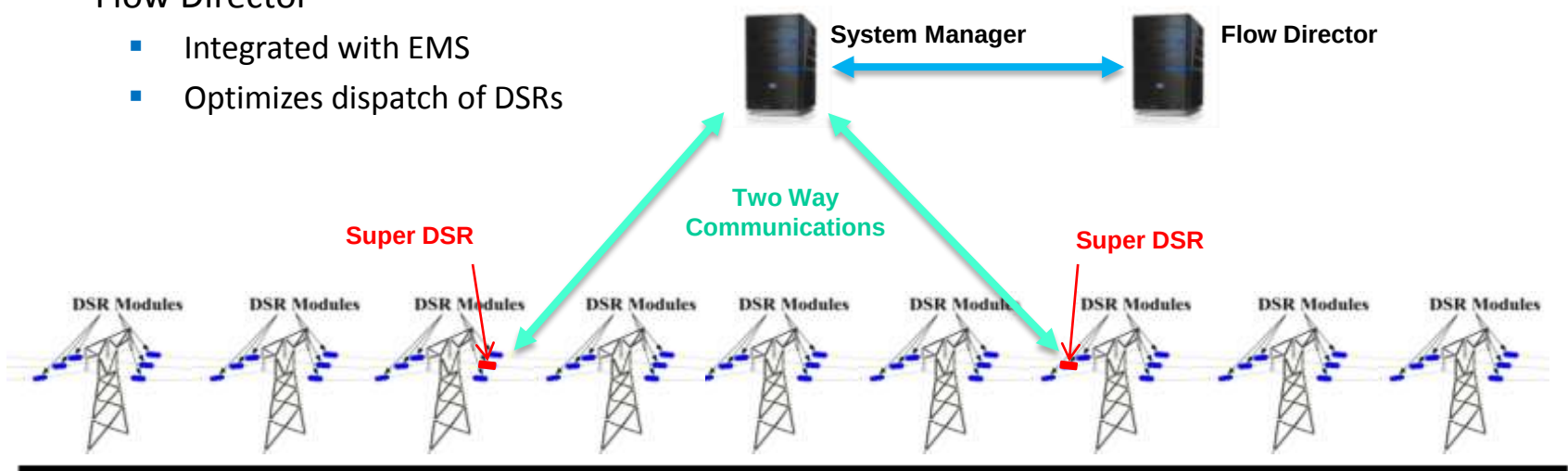


With “Smart Wires” on Line 2-5
15% Increase of Generation at Bus 6

Power flow control for the Grid

Software Overview

- Control Manager
 - Runs on each Super DSR
 - Manages operation of the DSRs associated with the Super DSR
- System Manager
 - Monitors state of entire fleet of DSRs
 - Reconfigures communication networks
- Flow Director
 - Integrated with EMS
 - Optimizes dispatch of DSRs



Power flow control for the Grid



Smart Wires Installations in US

Tennessee Valley Authority (TVA)

Installed October, 2012



TVA

Double Line
Length: 20 miles
Line voltage: 161 kV
Rated current: 750 A

One line equipped:
Model DSR-750b
99 DSR modules (33 per phase)
Inductance gain: 0% to 5%

Southern Company

Installed March, 2013



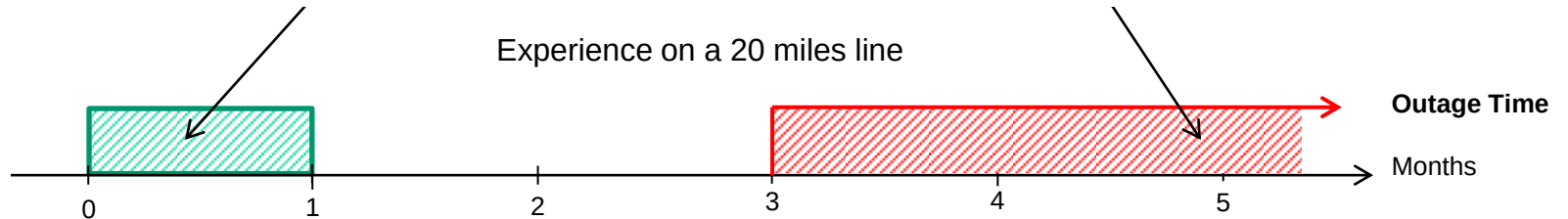
Southern Company

2 single lines
Lengths: ~8 miles each
Line voltage: 115 kV
Rated current: ~1000 A

Two lines equipped:
15 + 18 DSR modules (5+6 per phase)
Inductance gain: 0% to ~5%

Power flow control for the Grid

Smart Wire Technology vs. Reconductoring



- 99 DSR modules installed
- 7 minutes per module
- Live line or de-energized installation



TVA Lineman: "One of the easiest things I have installed..."

Power flow control for the Grid



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Power flow control for the Grid