

Smart Wires - Introduction to the Distributed Series Reactor

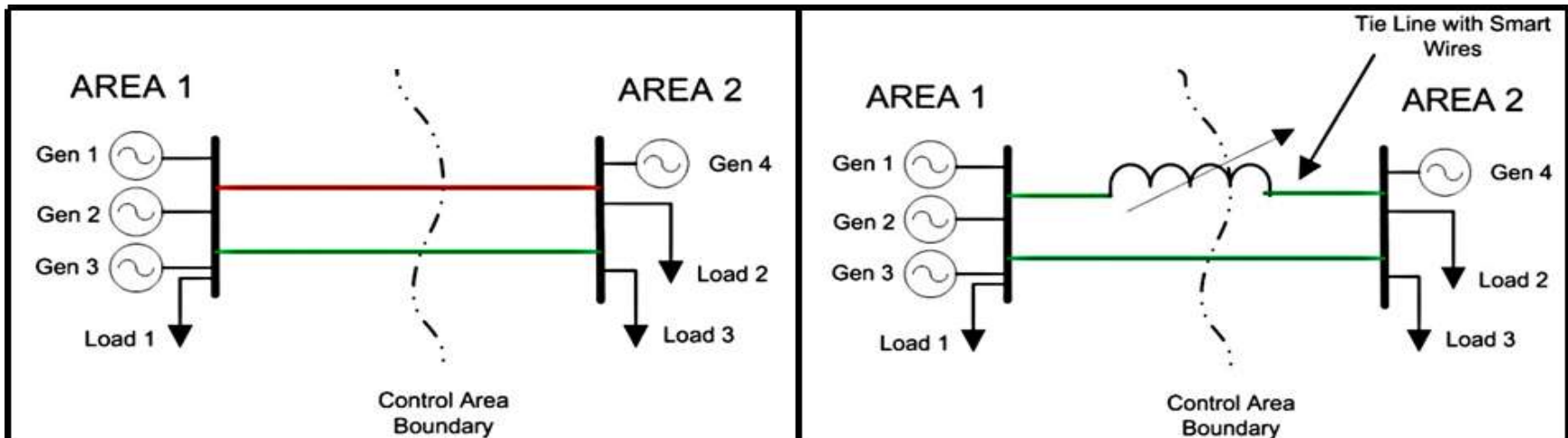


Summary
CIREN 10 – 13 June 2013 Stockholm



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- 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



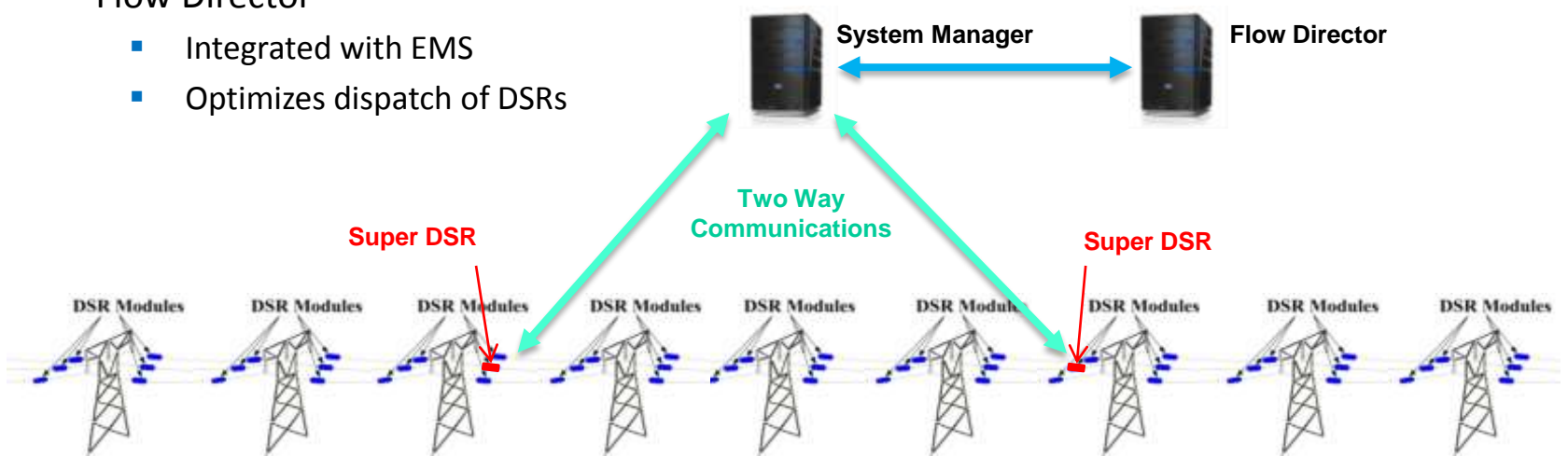
Imbalanced impedances leads to overload (red)

Smart Wires changes impedance to resolve overload (green)

Power flow control for the Grid

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

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 % bis 5 %

Southern Company

Installed March, 2013



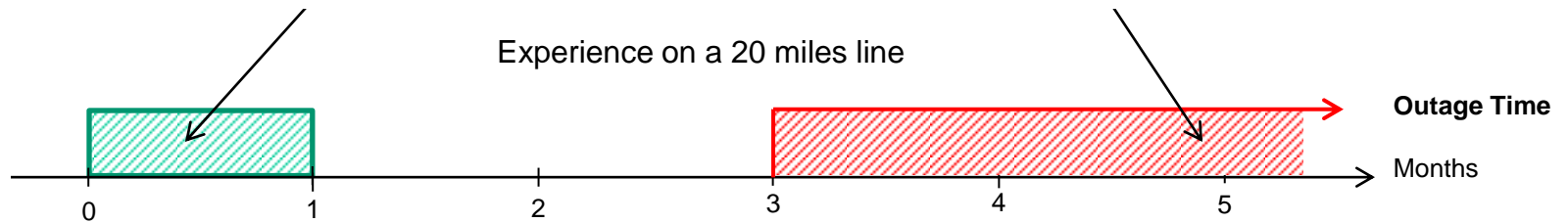
Southern Company

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 % bis ~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



Contact Details

For more information please contact

Dr. Detlev Kirsten

detlev.kirsten@smartwiregrid.com

Phone +49 170 2309888

Martin Jones

martin.jones@smartwiregrid.com

Phone + 44 7771 985155

www.smartwiregrid.com

Head Office:

Smart Wire Grid, Inc.

1300 Clay Street, Suite 840

Oakland, CA 94612-1428

United States of America

Power flow control for the Grid