EPRI | ELECTRIC POWER RESEARCH INSTITUTE

R&D Needs to Assure Resiliency

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Fellow

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High Impact – Low Frequency Events

April 2011
Fukushima

Solar Cycle
Peak 2013

Oct 2011
NE Ice Storm

April 2011
SE
Tornadoes

Cyber
Security

June 2012
Derecho

How Resilient is the Grid?

Aspects of Resiliency

Opportunity for Improving All Three Aspects of Resiliency Through Integrating New and Existing Technologies

Grid Resiliency – Resilient from what?

Physical Infrastructure

Information Infrastructure

Key to Resiliency: Prevention, Recovery, Survivability

Prevention: Now & Opportunity for Future Technologies

Vegetation Management

Selective Undergrounding

Pole and Line Design

Hydrophobic Coating

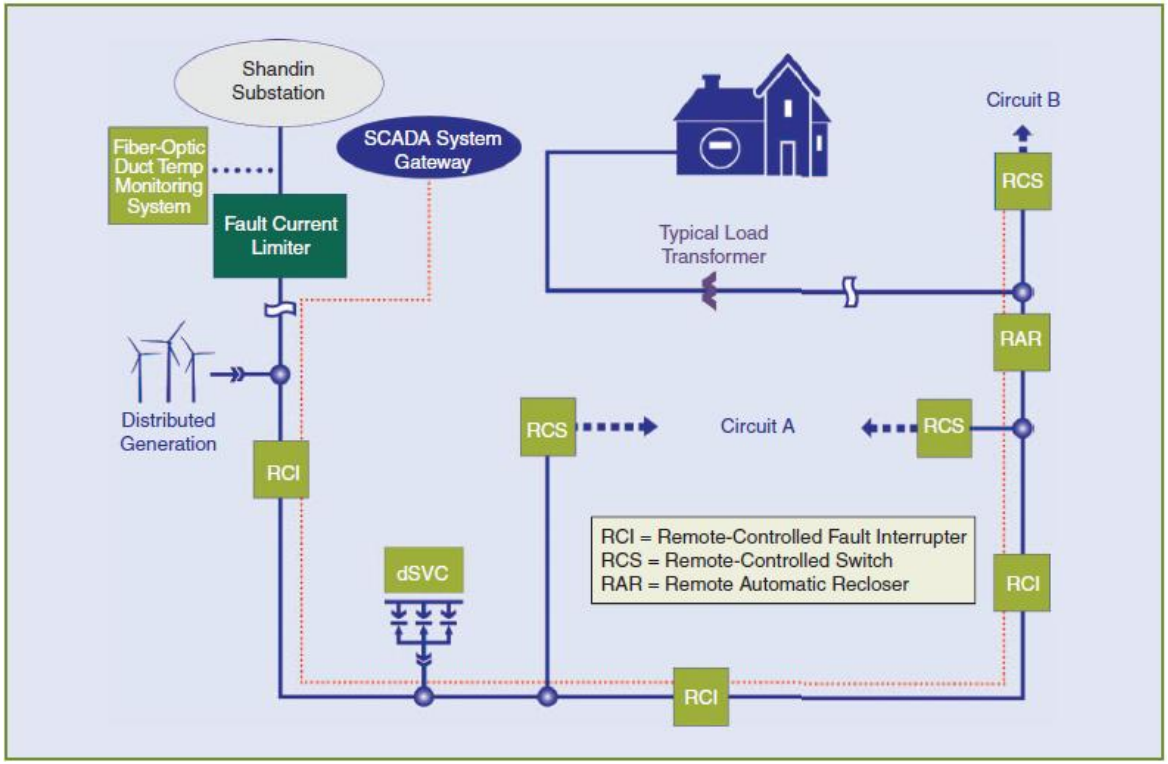
Benefit/Cost for Each Option Needs to be Factored for Storm Hardening

Opportunities with Hydrophobic Coating

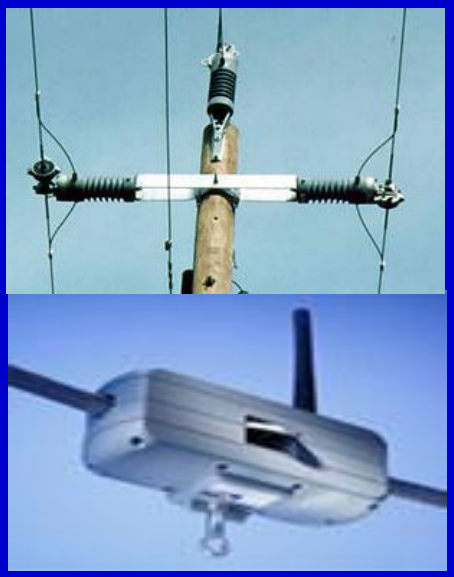
Video: De-Icing Characteristics of Hydrophobic Coating

EPRI R&D Assessing Performance and Reliability of the Coating for T&D Application

Recovery: Circuit Auto-Reconfiguration



Courtesy: Southern California Edison



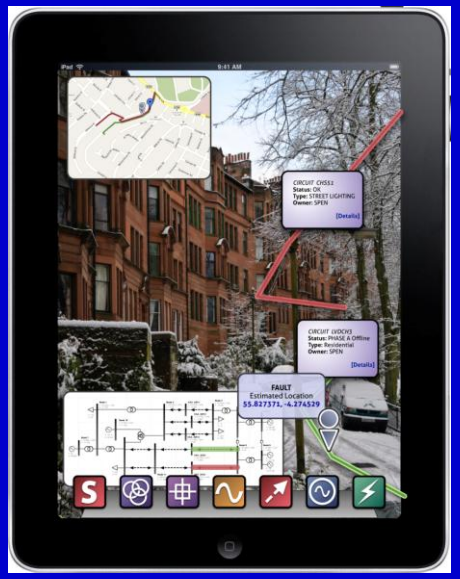
Sensors, Communication & Control

Advances in Sensor, Communication and Control Technologies Increases the Opportunity for Dynamic Circuit Reconfiguration

Next Generation Technologies for Improving Recovery

Using UAVs for damage assessment

Integrating OMS and GIS with AMI systems

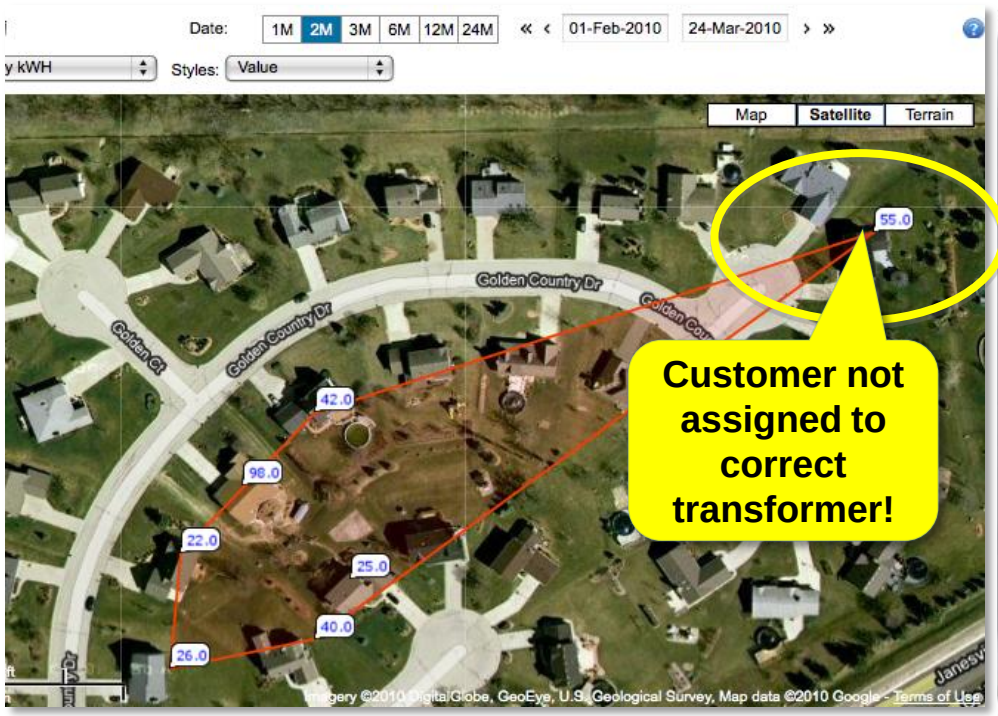


Enabling the field workforce

Leverage Damage Assessment Technology with Integrated Operational and Asset Information to Enable Faster Restoration

Improving Accuracy of Customer Connectivity

Leveraging AMI Systems



Leveraging Tablet Platforms

- Camera
- GPS
- Mapping
- Database Query
- Visualization
- Apps
- ……..
- ……..

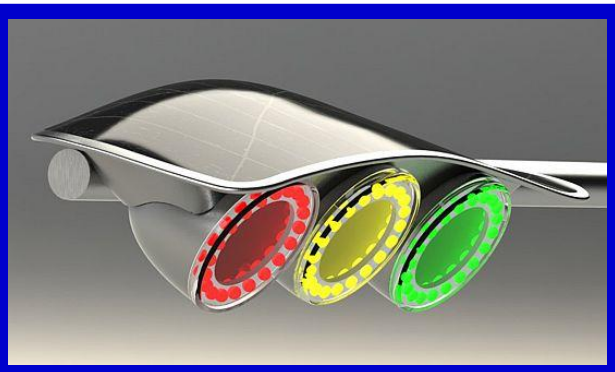
Significant Opportunity for Integrating Existing Technologies with Utility GIS Systems

Survivability: Leveraging New Technologies

EV Power Source

Courtesy: Nissan

Micro Grid



PV+Storage+LED Traffic Lights

Solar Chargers for Cell Phones

Continuation of Essential Missions even after the Grid has Failed

Courtesy: Carnegie Mellon Electricity Industry Center (CEIC).

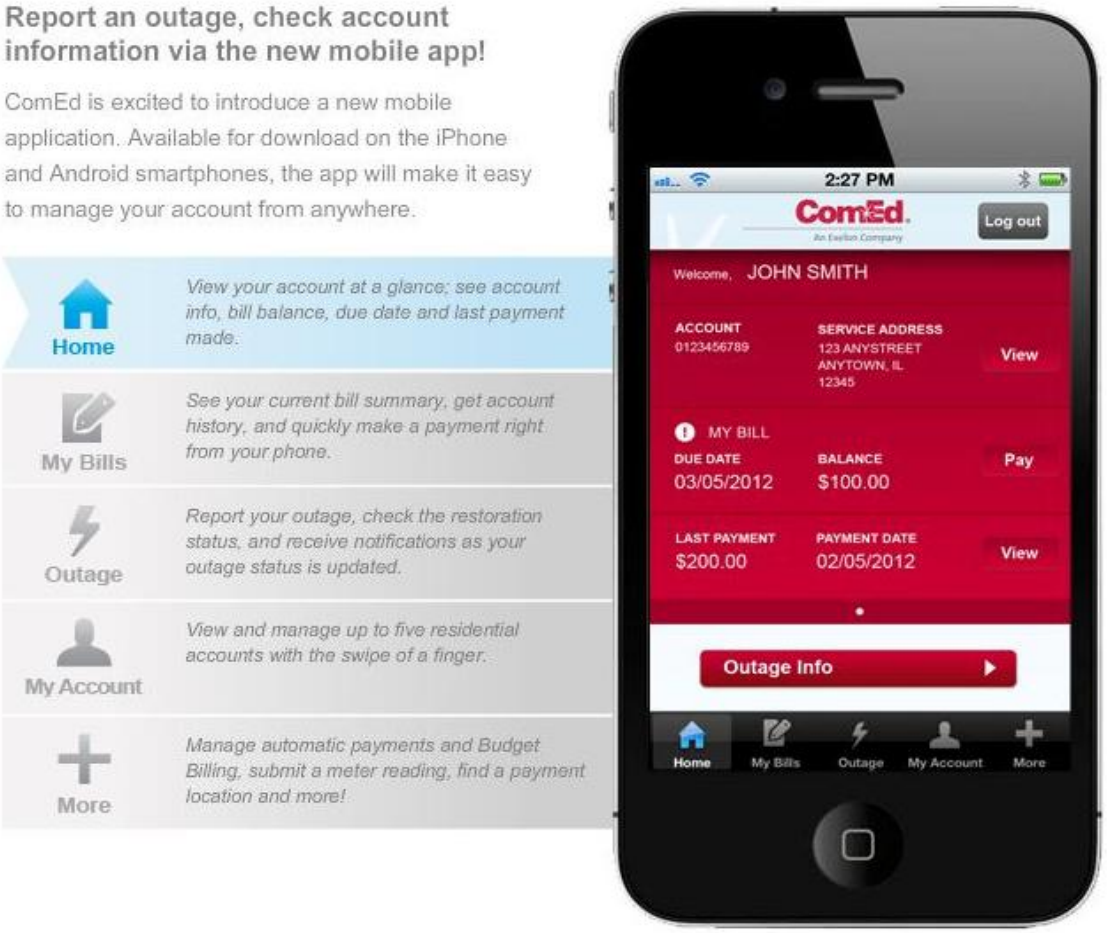
Eaton Smart Power Distribution Panel for Demand Response Applications

(Courtesy: Eaton)

Recovery Transformer

Photo Courtesy of DHS S&T

Communication with Customers



(Source: ComEd.com)

Smart Grid Issues (Drivers for DMD & TMD Initiatives)

Where EPRI's Collaborative Model Can Make Impact

Top Down - 10 Smart Grid R&D Challenges
Standards & Interoperability
Communications Technology
Energy Mgmt Architecture & Integration
Security & Privacy
Renewable & DER Integration
Data Mgmt, Analysis & Visualization
Grid Management & Planning (Bulk)
Smart Grid Cost Benefit Analysis
Customer Integration Strategies
Advanced Technology Assessments

Transmission Example Applications

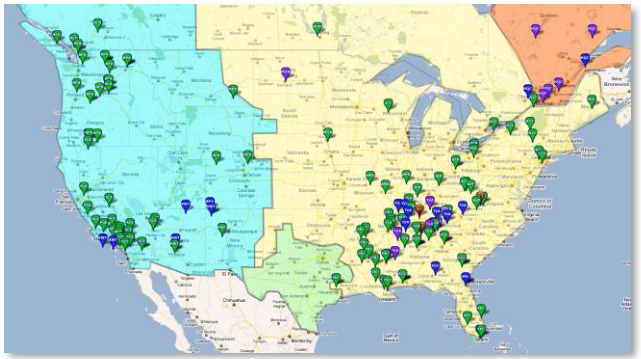
- Adaptive Transmission Line Protection
- Synchrophasor - Situational Awareness
- Synchrophasor - Decision support
- Asset Condition Information/Management
- Dynamic Model Development and Validation
- Disturbance Location Identification
- Dynamic Thermal Rating (DTR)
- …..
- …..
- What is in your 1, 3 & 5 Year Roadmap?



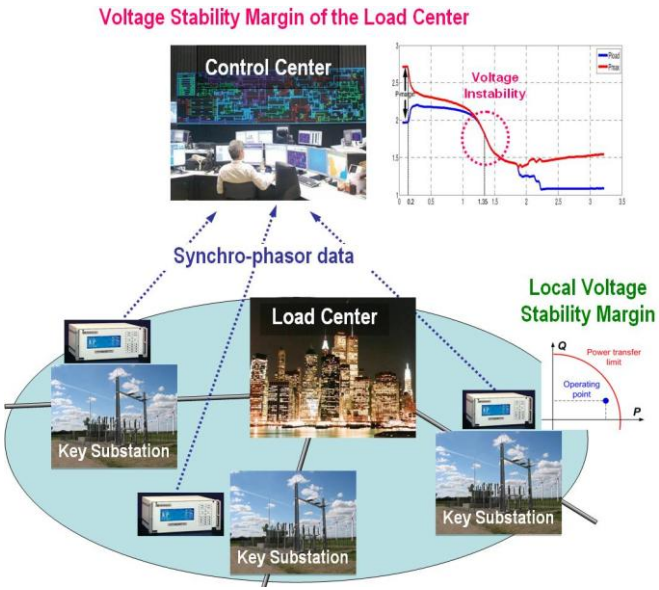

Technology to Improve Resiliency
Synchrophasor Applications

Develop applications that take advantage of high-resolution, high-speed, synchronized power system measurements from PMUs located across a wide area

- Leverage the industry efforts, accelerated by DOE SGIGs, being invested on this promising technology
- Challenge remains to convert data to meaningful, actionable information to improve resiliency



PMU Deployment



PMU Application

NYS 2100 COMMISSION

Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure

Together…Shaping the Future of Electricity