SCE’s Smart Grid Update

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Southern California Edison

- 50,000 square miles
- ~23,000 MW peak demand
- 4.7 million customers
- 11 million people served
- 845 cities and communities
SCE Smart Grid Activities

- Generation
- Transmission & Sub-transmission
- Distribution
- Customer
- Advanced Metering, Demand Response, and Distributed Resources
- SCADA and Phasor Measurements
- Substation Automation
- Distribution Automation
Phasor Measurement Unit

- Provides
  - Real-time system monitoring for reliability and post event analysis
  - Control for system components (e.g. FACTS, HVDC)
  - Integration with existing SCADA/ EMS systems
  - Info. to avoid blackouts like ones in the Northeast and West
  - Situational awareness on event locations and severity
  - Info. to facilitate system restoration after disturbance
- SCE is working with WECC members and SCE neighbors like APS, SRP, PG&E, LADWP and WAPA for data exchange
Phase Angles: July 24, 2006 event
Old Substation Automation

DNP 3.0
Dedicated 1200 baud
4 wire circuit

ModBus Plus Token Ring Loop

ABB TPU
ABB DPU
MODICON QUANTUM PLC

Pricom HMI

Momentum PLC Interface for Bank temp., Battery Charger etc.

SEL-2030
New Sub. Auto. Objectives

- Open System local network
  - Ethernet/ ModBus
  - Multi-vendor equipment
  - Support future standards (IEC 61850)
  - Topology supports interfacing with legacy systems

- Dedicated HMI
  - Local Control
  - Remote SCADA control

- Gateway for ‘beyond SCADA’ data
  - Securable pathway
Distribution Automation

- Distribution Switches (2773)
  - On 1611 of 4300 circuits
- Sub-transmission Switches (57)
  - 66 kV and 115 kV
- Automatic Reclosers (984)
- Circuit Alarms (324)
- Capacitor Controls (8273 of 9500)
- Remote Fault Indicators (148)
- Load Survey meters (8500)
- Large Customer meters (4500)
Distribution Automation

- New applications:
  - Vacuum Fault Interrupters
  - Automated P/E (Auto Transfer)
  - Automated Distribution Regulators
  - Intelligent Fault Indicators
  - Distribution Automatic Restoration System
  - Network Protectors
Distribution Automation

- All distribution automation presently accomplished through the use of CellNet Utilinet radios
  - Spread spectrum, peer-to-peer
- Some meter reading/ load survey functions will be replaced by Advanced Metering (SmartConnect™)
SCE has identified a need to come up with new ideas to build more reliable and efficient distribution circuits

- Provide customers with better service
- Improve safety
- Reduce costs
Location of CoF

- New circuit
- Will serve approximately 2,000 customers
- Overhead / Underground facilities
- New hardware and protection schemes
- High speed communications
- Approximately 23,000 amps fault duty
CoF Features

Fiber Optic Duct temp Monitoring System

Solid State Fault Current Limiter

SEL 2100 Logic Processor

Multi-Stage Capacitor Banks

SCADA System Gateway

Comm. Fiber

Typ. Load Transformer

Sweetwater 12KV

Northpark 12KV

Circuit Tie Switch

Distributed Generation

Distributed Generation USAT

RCI 1

RCI 3

RAR

RCI

RCS

- Remote Controlled Fault Interrupter
- RCS = Remote Controlled Switch
- RAR = Remote Automatic Recloser
CoF Schedule

- Initial operation began on August 14, 2007
- Entering testing phase
- Future phases will test other advanced devices
  - 2008 – Fault current limiter, multi-stage cap
  - 2009 and beyond – other new concepts
DOE Advanced Protection

- Advanced protection methods on the Circuit of the Future (CoF)
- Three tasks over 3 years:
  - Evaluation of new protection scheme on CoF
  - Design and evaluation of protection scheme with fault current limiter on CoF
  - Develop and test advanced fault location, sensing and prediction methods on CoF
New Protection Scheme

Typical Time Overcurrent Protection between Sub and RAR

Logic Processor

RAR

RCI

RCI

RCI

Tie RCS

Tie RCS

Block Trip

Trip

Trip

FAULT
Distributed Generation/ Storage

- Interconnection point for dist. generation or storage on CoF
- Investigate distributed gen/storage (plug-in-hybrid)
- Benefits:
  - Supplement the feeder during high load conditions
  - Voltage/ VAR support
SmartConnect (Advanced Metering Infrastructure)

- Enable Energy Smart Customers
  - Integrated information from utility
  - Payment options (e.g., pre-payment)
  - Outage & service condition information
  - Support rate option innovations
- Manage Distributed Resources
  - Economic dispatch of load resources
  - Dispatch of load for grid management
  - Intelligent net metering
- Operational Efficiencies
  - Field communication links to distribution
  - Revenue cycle improvements
  - Situational data in near real-time
  - Wholesale - retail markets integration
- Built with the future in mind
  - Upgradeable WAN/HAN communications
  - Leverage open architecture principles in system design
  - Future customer service offerings

SCE seeks to leverage a 2-way communications infrastructure with 5 million intelligent metering devices on our distribution network to create lasting value for our customers and our operations.
AMI Program will use a multi-phased approach to development and deployment of a next generation advanced metering infrastructure over a 6 ½ year timeframe.
SCE Smart Grid Program Goals

- Provide advanced visualization for operators and planners
- Provide information for maintenance
- Implement advanced protection techniques
- Better outage detection/ quicker restoration
- Better load management abilities
- Increased distributed generation and storage
- Better grid and cyber security
- Improve safety
What Needed to Accomplish

- Integrate “islands of automation”
- Standardize protocols for communications and data transfer
- Construct common databases
- Install advanced sensors
- Improve cross-system communications
- Implement advanced hardware
- Provide system-wide view of security
Questions?

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