Intelligent Grid and Lessons Learned

April 26, 2011

SWEDE Conference

Outline

1. Background of the CNP Vision for Intelligent Grid
2. Implementation of the CNP Intelligent Grid
3. Lessons Learned from the CNP Intelligent Grid

Background

- CNP received $200M in Department of Energy Stimulus Funding.
- CNP is using $150M to accelerate the installation of the Smart Meter.
- CNP is using the remaining $50M to develop a more reliable and robust distribution network.

Implementation

- How the $50M will be spent:
  - Advanced Distribution Management System (ADMS)
  - Upgrade relaying and asset monitoring at the substation
  - Intelligent Grid Switching Devices (IGSD)

Background

Improve reliability and harden the grid through modernization and automation by achieving the following goals:

- Improve System Average Interruption Duration Index ("SAIDI") 25 percent for 202 circuits by 2012,
- Improve Customer Average Interruption Duration Index ("CAIDI") 15 percent for 202 circuits by 2012,
- Improve Momentary Average Interruption Frequency Index ("MAIFI") 15 percent for 202 circuits by 2012,

Background

Improve reliability and harden the grid through modernization and automation by achieving the following goals:

- Develop and implement, by mid-year 2012, “self healing” algorithms corresponding to outages from a major storm event to reduce restoration time of essential infrastructure by 40 percent,
- Detect and locate permanent faults within 250 feet to accelerate restoration and reduce operating and maintenance costs, and
- Increase automatic switching to isolate permanent faults utilizing field equipment to accelerate restoration and reduce operating and maintenance costs.

Background

Per the DOE Grant Agreement,:
“If you publish or otherwise make publicly available the results of the work conducted under the award, an acknowledgment of Federal Support and a disclaimer must appear in the publication of any material, whether copyrighted or not, based on or developed under this project, as follows:”
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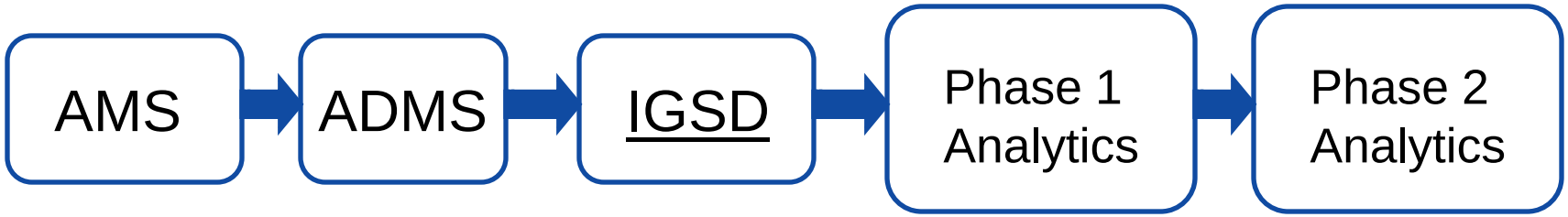
Implementation

Road Map



- Smart Meter
- Communication Backbone
- MDM and DCE

- Distribution Control
- Distribution monitoring
- Outage Management System
- Interface with Legacy Systems
- Servers at ECDC

- **Automated Switches**
- **RTUs**
- **Electronic Relays**
- **Reclosers**

- Fault Location
- Self Healing
- Asset Monitoring
- Asset Utilization
- Crew Efficiencies

- Predictive Analysis
- Proactive Event Avoidance
- Improve Maintenance
- Right Crew

Implementation

- Defining the IGSD
  A. Automatic trip and close functionality
  B. Gathering of high resolution data
  C. Low maintenance
  D. Remote control of software and firmware
  E. Reliable Communication
  F. Wildlife resistant
  G. Low cost

Implementation

Reclosers

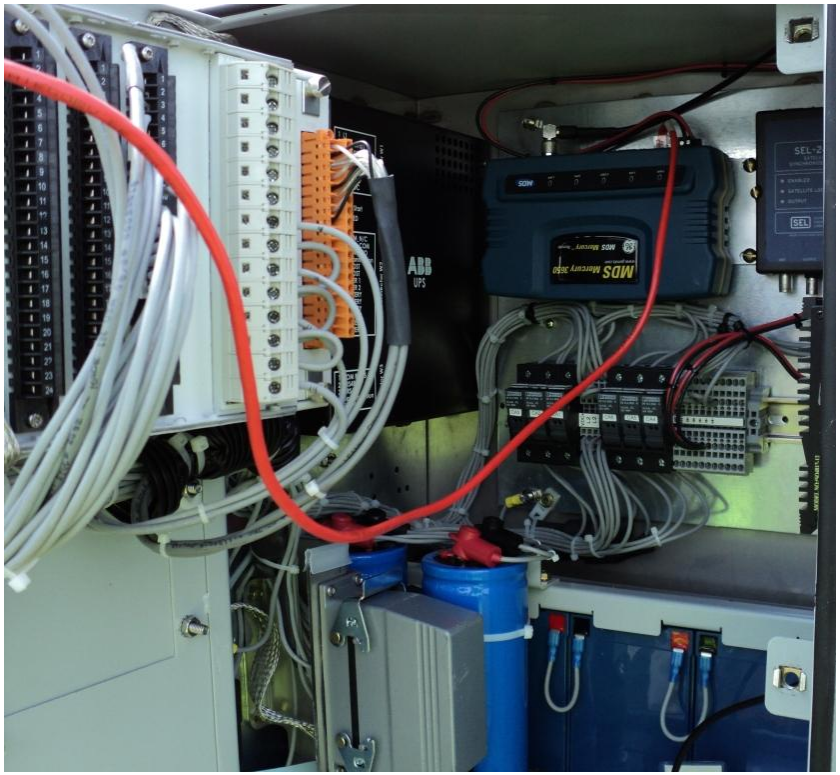
- Relay contains most of the required functionality
- Higher initial Price
- Less Maintenance
- Fault interruption (Vacuum)
- Can be used as a recloser or sectionalizer

Switches

- Relay contains most of the required functionality
- Lower initial price
- Requires routine maintenance
- Requires external sensors
- Load break only
- Can be used like sectionalizers

Implementation

- Defining the IGSD Controller Box
  - A. Relay
    - Control
    - Data Acquisition
  - B. WiMax Radio
  - C. Backup Comm Medium
  - D. GPS Clock
  - E. Batteries
  - F. Security



Implementation

Existing 12kV Installation

- Note the high mount antenna
- Note the elevated control box
- Note the red conductor covers
- Bypass Switch
- Bigger pole and set deeper

Implementation

Note the bypass and disconnect switches are on the same side as the recloser. Operations later flipped the switches to the other side of the pole. This is one example of the many iterations.

Implementation

- Communication of IGSD has primary and backup systems.
- Infrastructure includes:
  - WiMax (Primary)
  - Cellular (Secondary)
  - Satellite (Secondary)
  - Fiber backhaul at substation
  - Microwave backhaul at substation

Lessons Learned

1. There were no market-ready products that could meet all of our needs.
   - High Sampling Rate
   - Dual Ethernet Communications
   - Security
   - Recloser functionality
   - Buy American

Lessons Learned

2. Get the right people upfront to reduce the number of designs
   - High-mount vs. low-mount antenna
   - Elevated control box vs. theft deterrent
   - Bypass vs. no bypass switch

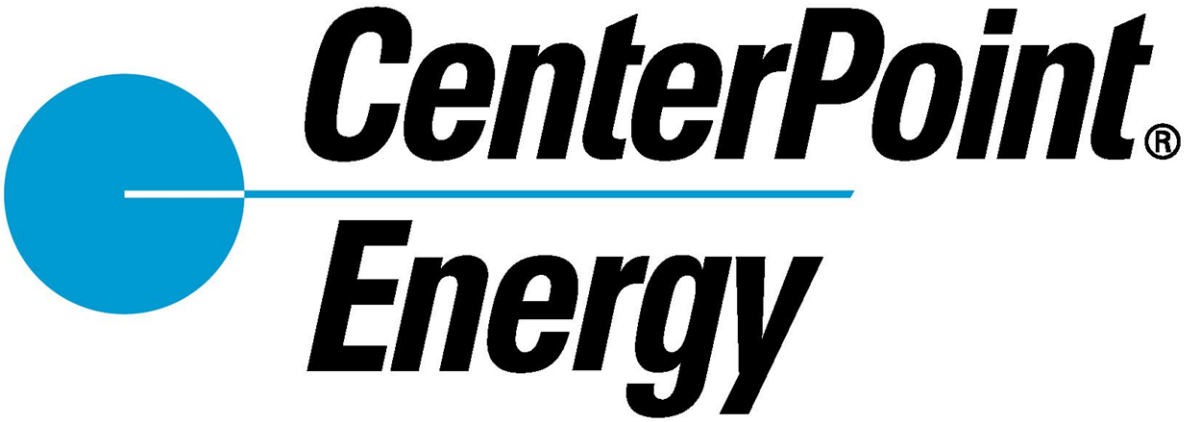
3. Learning curve anytime dealing with new materials
   - Can find ‘undocumented features’

Lessons Learned

4. Learning curve anytime dealing with new concepts
   - Expect the unexpected
   - Keep a flexible schedule

5. Balance of finding the right number of vendors
   - Too few leaves you with limited options
   - Too many places heavier burden on employees

Questions?



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