Sacramento Municipal Utility District

SMUD

May 10, 2010

SMUD Facts and Figures

- 900 Sq. Miles Service Area
- 585,500 Customers
- 1.4 million Area Population
- 10 Bulk Substations
  - 473 Miles of Transmission Lines
- 228 Distribution Substations
  - 3,902 Miles of Dist Overhead Primary Lines
  - 5,916 Miles of Dist Underground Primary Lines
- 79,542 Dist Line Transformers

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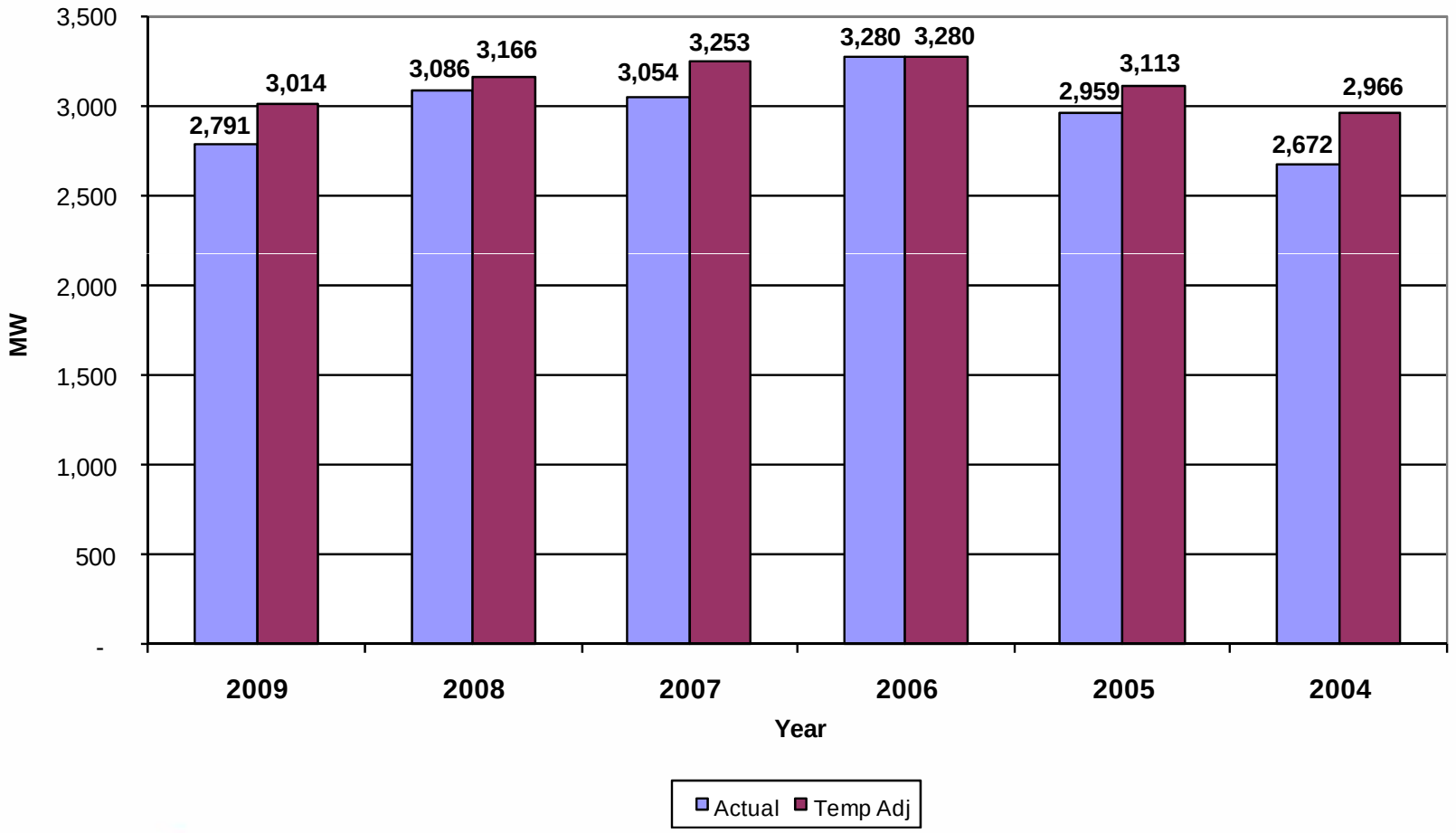
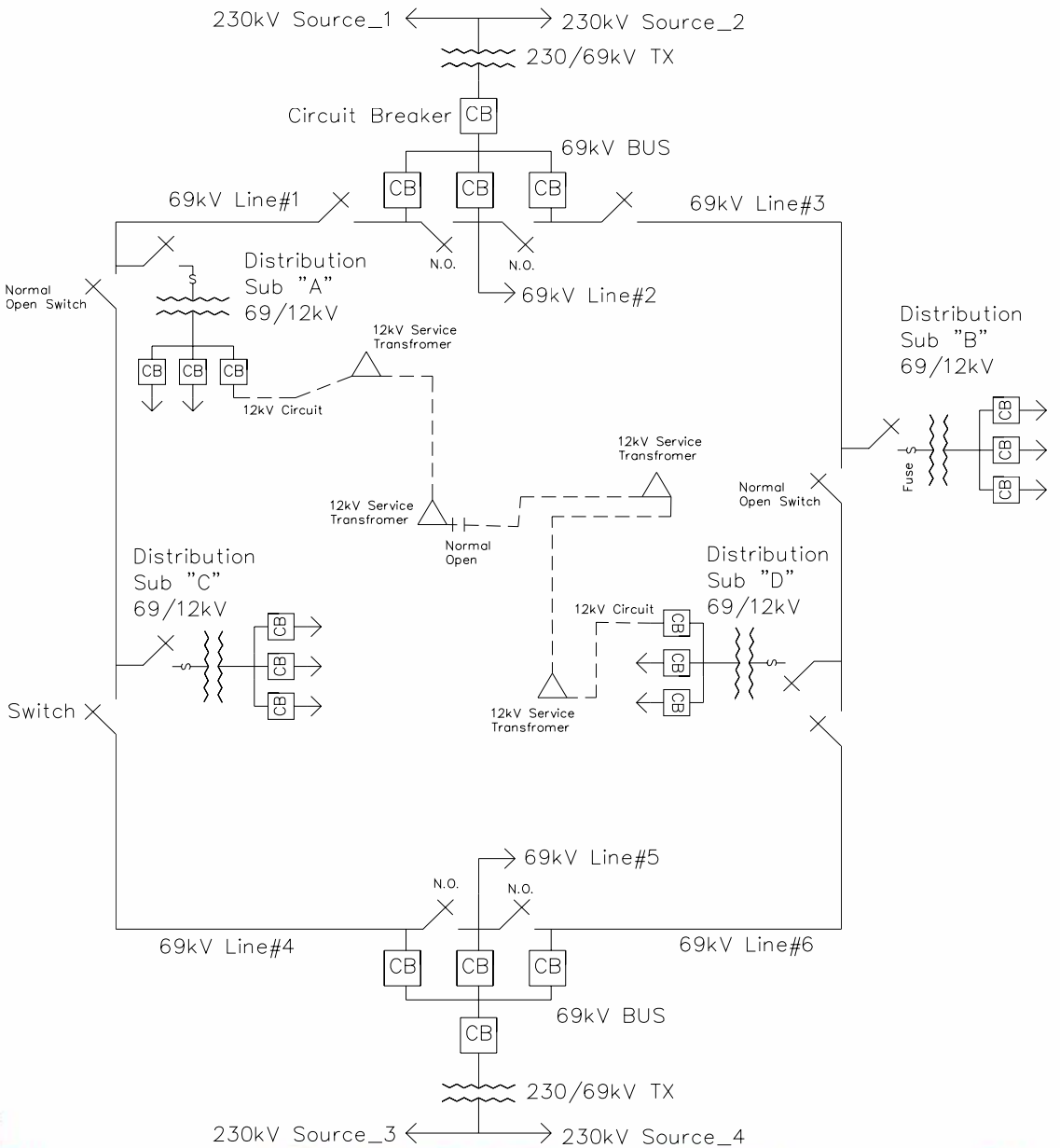
SMUD's Historical Peak (MW)





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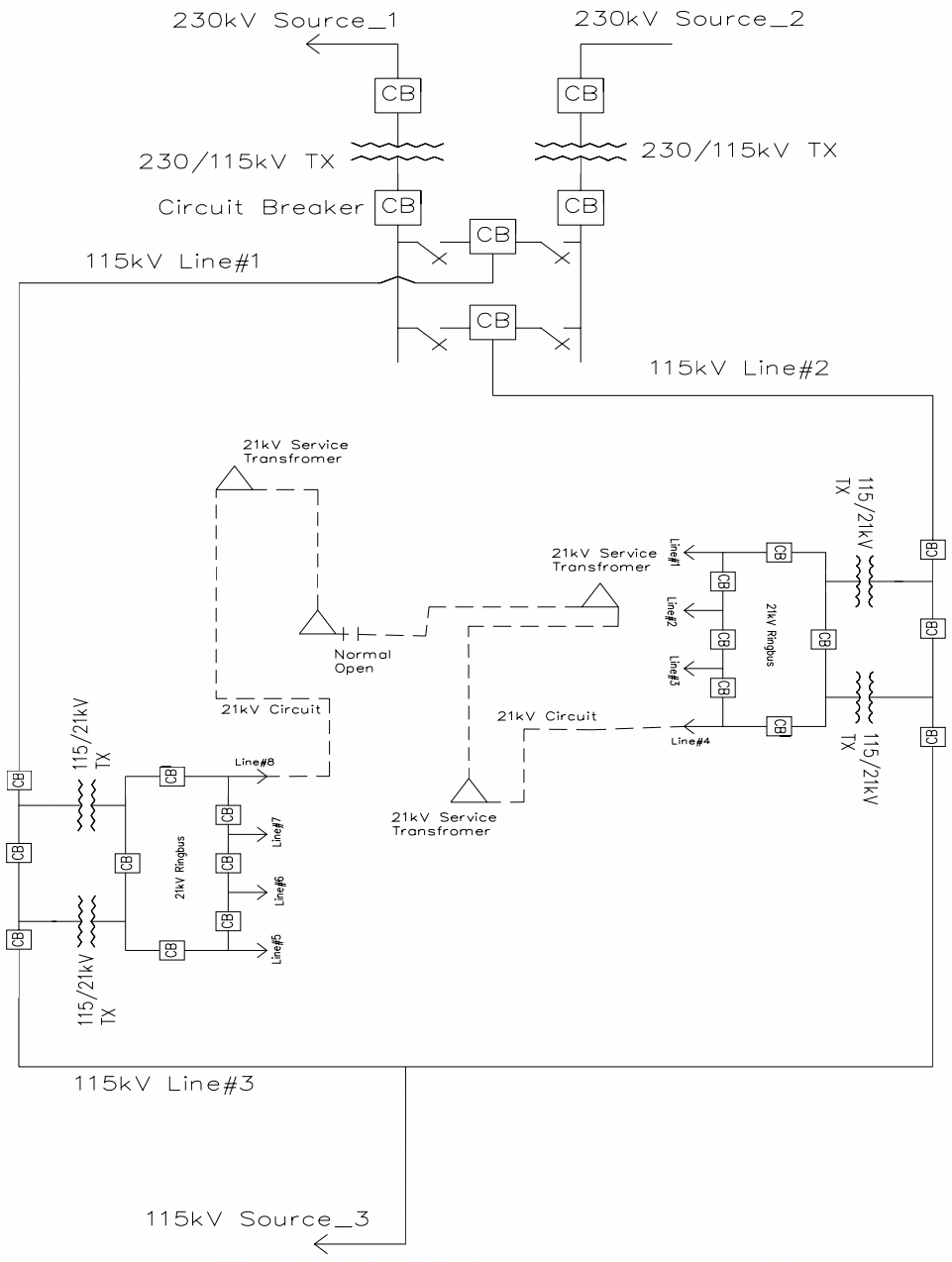
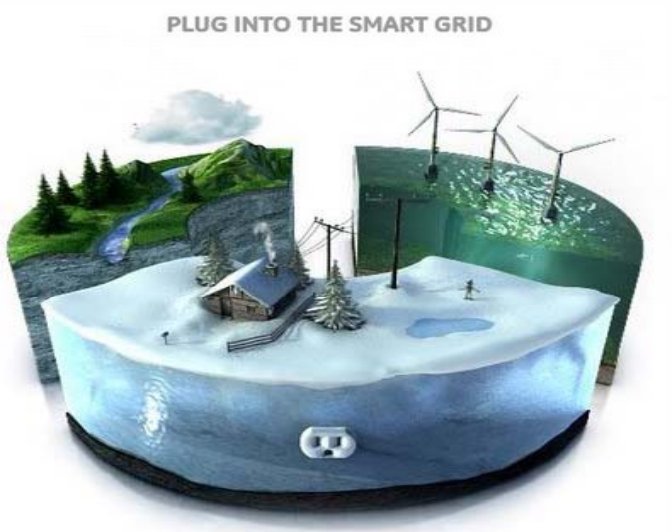


Distribution Automation



Project Scope

- **Distribution Automation project is a 3 year development project to accomplish the following:**
  - ❖ Optimize distribution feeders to reduce losses through better volt and Var management
  - ❖ Improve system reliability and restoration capability by installing multiple smart switching devices as part of the Distribution Automation improvements.
  - ❖ Test a sophisticated software that automates power factor correction, conservation voltage reduction and smart switching improvements.

Project Scope

- **Estimated Deliverables**

  - ❖ Conservative Voltage Reduction
    - 10.4 MW 36,520 MWh/year
  - ❖ System Optimization & Power Factor Correction
    - 6.1 MW 11,150 MWh/year
  - ❖ Reliability Improvement for Automated Circuits
    - 69kV Sub Transmission System **25% Reduction in SAIDI**
    - 21kV & 12kV Distribution System **20% Reduction in SAIDI**

Project Construction

- Two way communication system for Switches, Capacitors, primary monitors and Reclosures
- Proposed Feeder Automation
  - 32 - 21kV feeders (23 OH, 9 UG)
  - 90 - 12kV feeders (63 OH, 27 UG)
  - 9 - 69kV feeders
- SCADA retrofit remaining 36 non-RTU substations 20 MVA and larger
- Distribution Management Software installation and integration

Project Construction

- **Feeder DA Equipment Breakdown**

  - **Overhead feeder** - Automation for 12kV and 21kV is based on installing 3 reclosures and 3 "Power Sensors" per feeder. New Capacitor banks as required. Each DA device will have two way communication capabilities.

  - **Underground feeder** - Automation calls for the installation of remote control switches and pad-mounted capacitors. Each DA device will have two way communication capabilities.

  - **Capacitor-** Automation will add two-way communication to the existing switchable overhead banks.

  - **69kV Sub-transmission** - 3 Remote control switches between two feeders.

DA Equipment

Equipment Counts (3 year totals)

• 12 kV switches /reclosers	270
• 21 kV switches/reclosers	96
• 12 kV New Capacitors	45
• 21 kV New Capacitors	16
• 12 kV Capacitors controls	143
• 21 kV Capacitors controls	37
• 69kV Switches	13
• Power Sensors	
12kV	189
21 kV	69
Substation SCADA Retrofit	36

Except for Capacitor controls these counts were based on averages per circuit and may vary after circuit analysis is completed to determine ideal locations.

Project Team

Distribution System Planning is the project sponsor and will maintain an active role throughout implementation and ongoing operation of the project. Planning Engineers will: Analyze the distribution system to determine ideal locations and project schedule for the installation of DA devices, Monitor the effectiveness of DA devices, implement system optimitization strategies based on information provided by the DA devices.

Distribution Line Design staff will design job packages, implement required Geographical Interface System (GIS) changes, acquire permits and right of ways when required.

Line Construction personnel will construct these distribution line automation jobs. These jobs will be replacing older devices with new, adding new equipment or controls to existing equipment.

Substation Design and Construction will be responsible for the SCADA retrofit of existing substations.

Telecommunications will provide communication's platform for SCADA requirements for all DA devices.

OMS will integrate into the EMS system the information received from the SCADA system being installed for DA.

Standards will create all of the Distribution equipment specifications and construction standards required for DA.

Major Standards & Procedures Being Developed

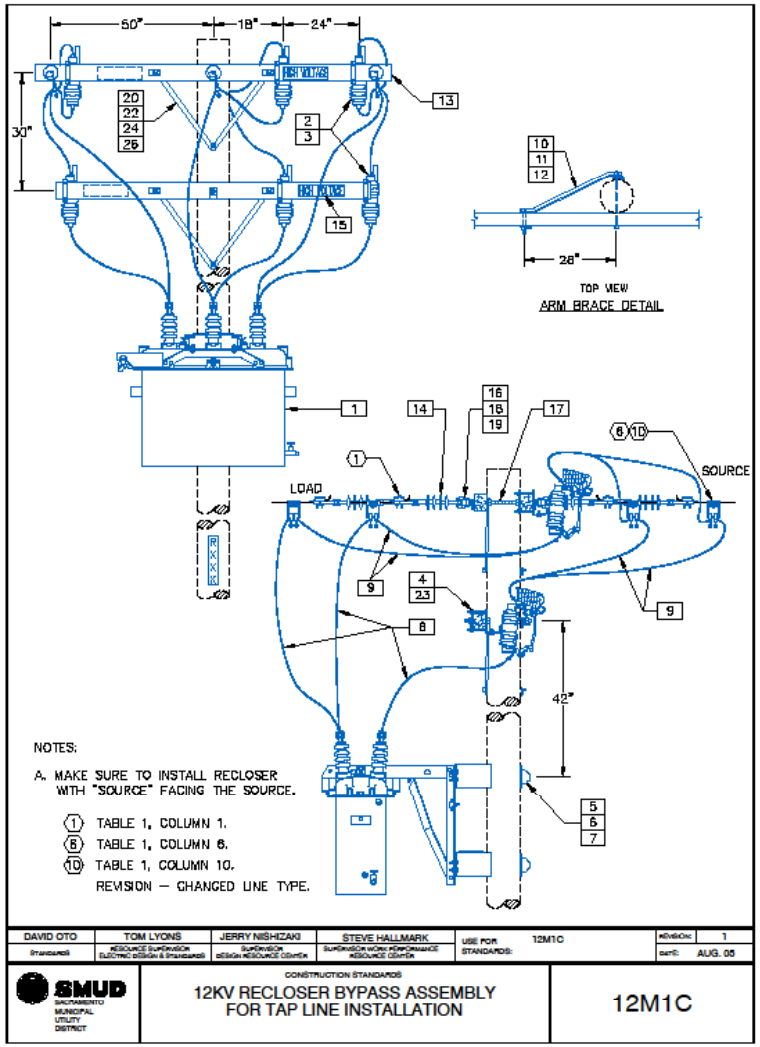
- **OH Standards – 21kV & 12kV**
  - SCADA enabled equipment required
    - a. Reclosers
    - b. Line Monitors
    - c. Capacitor Controllers

- **OH Standards 69kV**
  - SCADA enabled equipment required
    - a. Remote Controlled Switch for 69kV

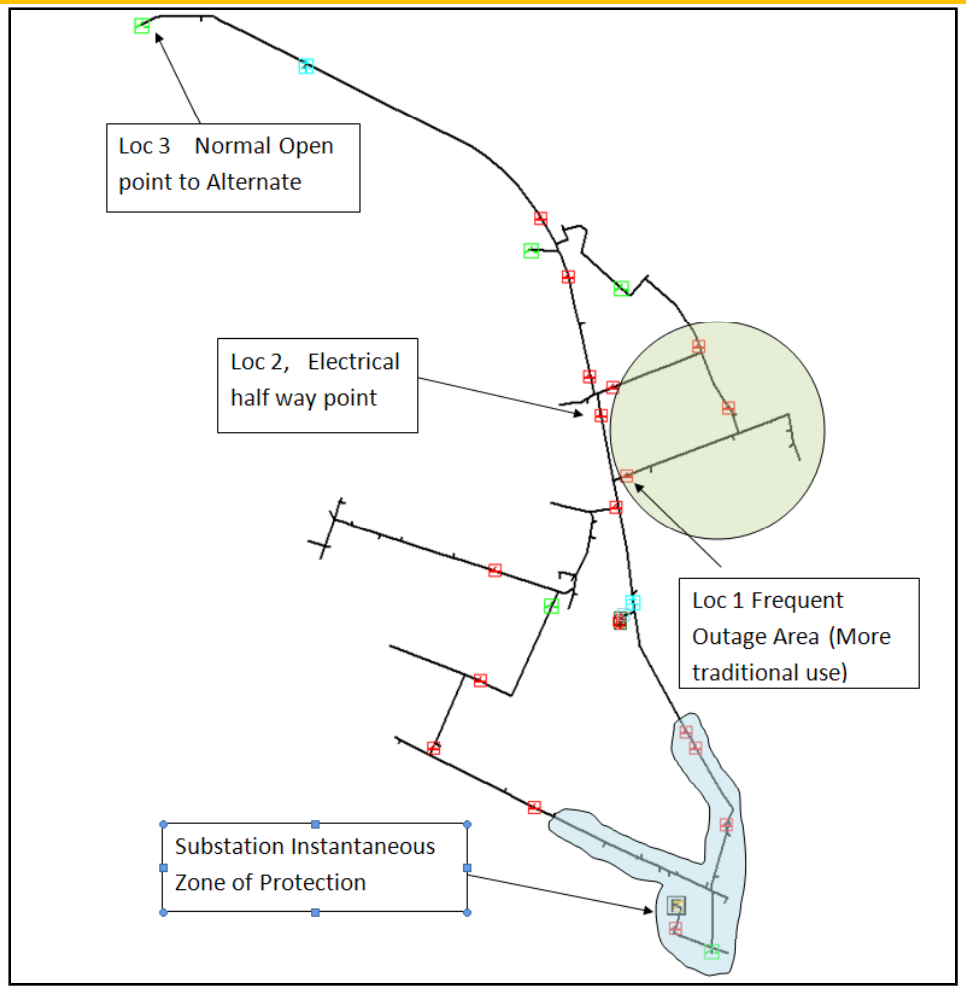
- **UG Standards**
  - SCADA enabled equipment required
    - a. Padmount Switches 21kV & 12kV
    - b. Padmount Capacitors 21kV &12kV

- **Create Operating Procedures**

Typical Standard

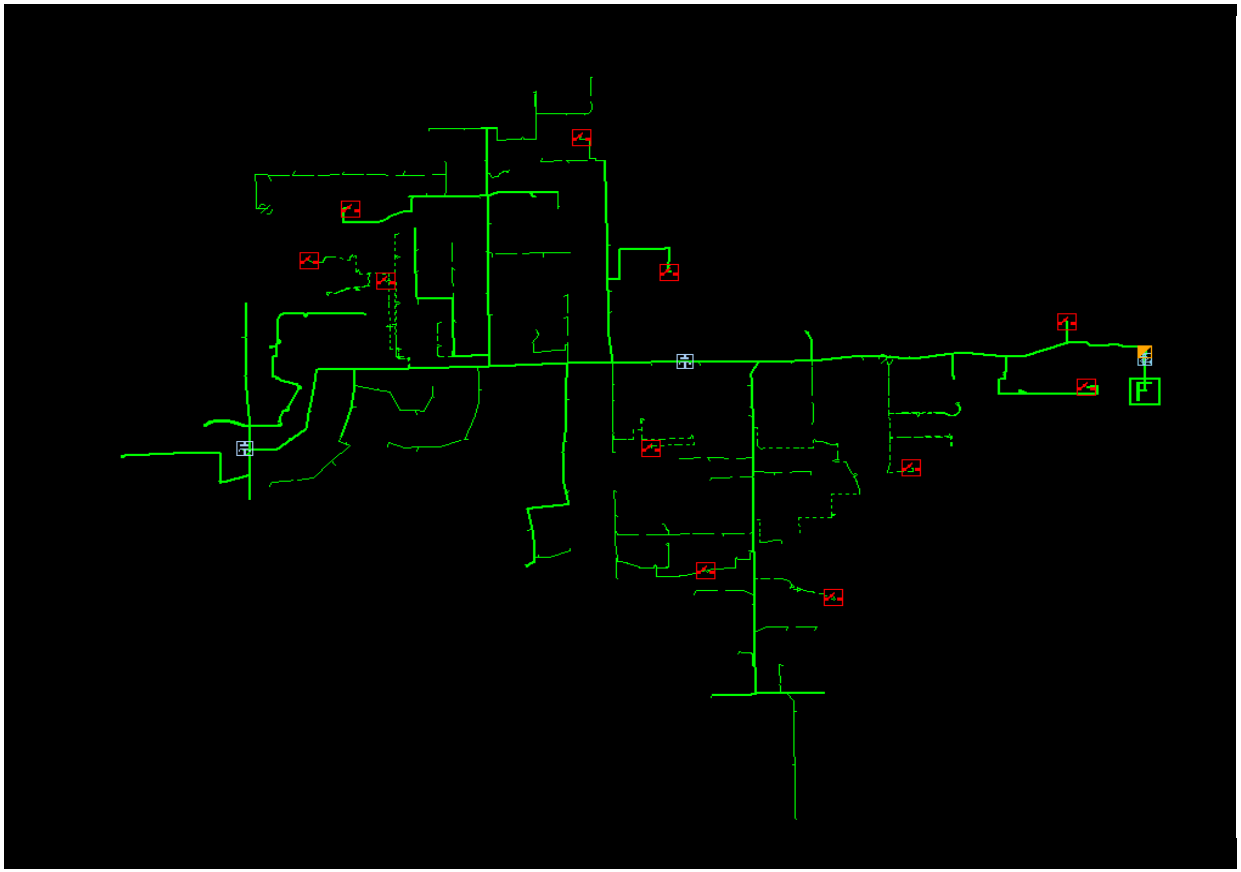


Recloser Site Evaluation



Typical Feeder

System Optimization
Single 12kV Feeder



Feeder Improvement

Before Optimization

	Demand			Load		kW Loss				
Source - Id	**kW**	**% pf**	**Amps**	**kW**	**kvar**	**Total**	**%**	**Line**	**Tran**	**Reg**
Feeders for -M09-1201										
M091201	5710	86	308	5650	3296	60	1.04	60	0	0

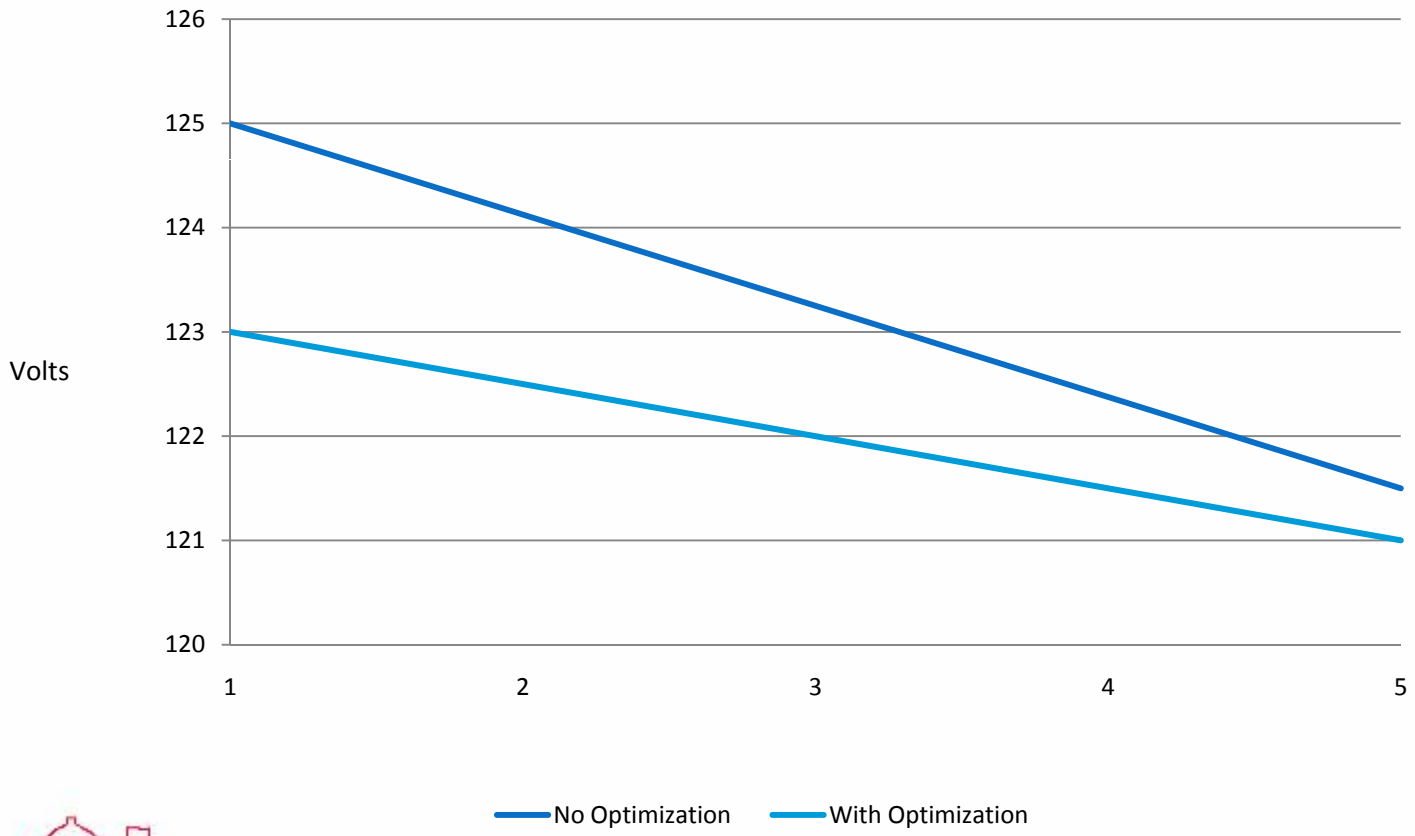
Minimum Voltage	121.36

After Optimization

	Demand			Load		kW Loss				
Source - Id	**kW**	**% pf**	**Amps**	**kW**	**kvar**	**Total**	**%**	**Line**	**Tran**	**Reg**
Feeders for -M09-1201										
M091201	5661	99	269	5612	3272	49	0.86	49	0	0

Minimum Voltage	120.77

System Optimization



Recloser

Functionality

- Remote control
- Power monitoring data

Benefits

- Improve reliability
- Enable remote switching
- Provide real-time current, voltage, real and reactive power data
- Better analysis of line loading
- Prevent component overloads
- Increase in system utilization

Capacitor

Functionality

- Remote control
- Voltage regulation

Benefits

- Real-time control of VAR flow
- Enable bus voltage regulation
- Reduce total power consumption
- Reduce system power losses

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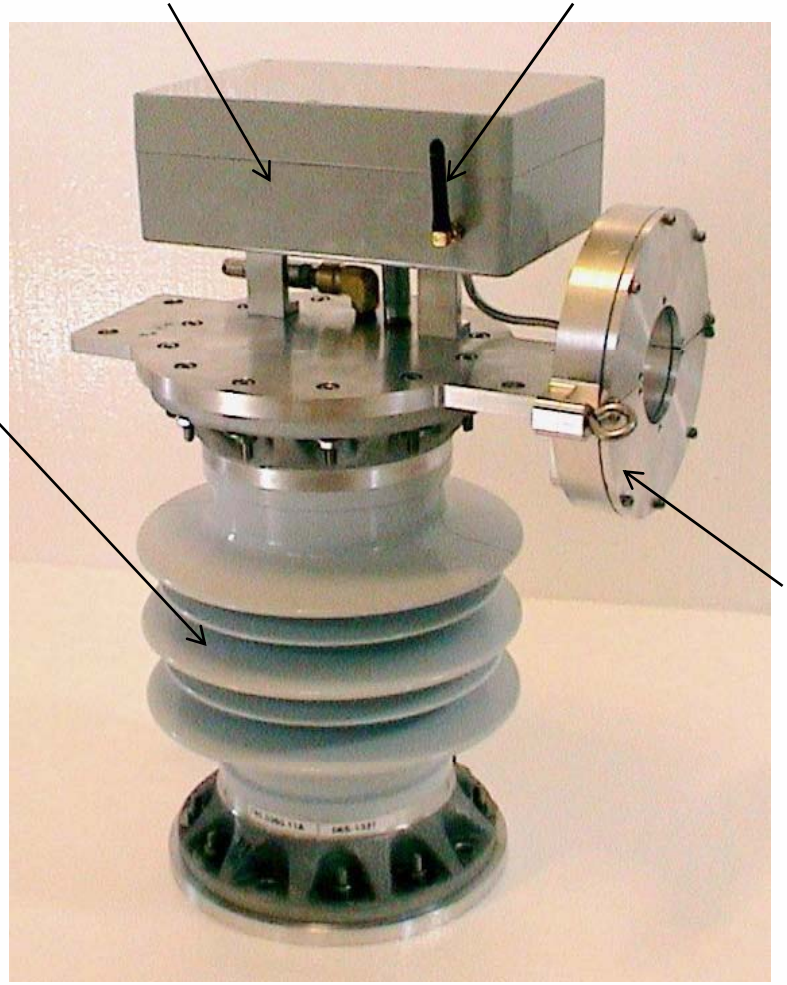
Power Sensor

Functionality

- Feeder monitoring
- Harmonic load monitoring
- Power theft detection
- Load flow studies

Benefits

- Easier identification of fault locations to improve recovery time
- Identifies system losses
- Power quality, harmonic pollution
- Provides harmonic analysis for design improvements



PM Remote Control Switch

Functionality

- Remote control
- Automated switching
- Auto-sectionalizing without tripping the main breaker
- Load or fault interrupting

Benefits

- Improve reliability
- Enable remote switching
- Automated system isolation and restoration
- Increase system utilization

Questions?