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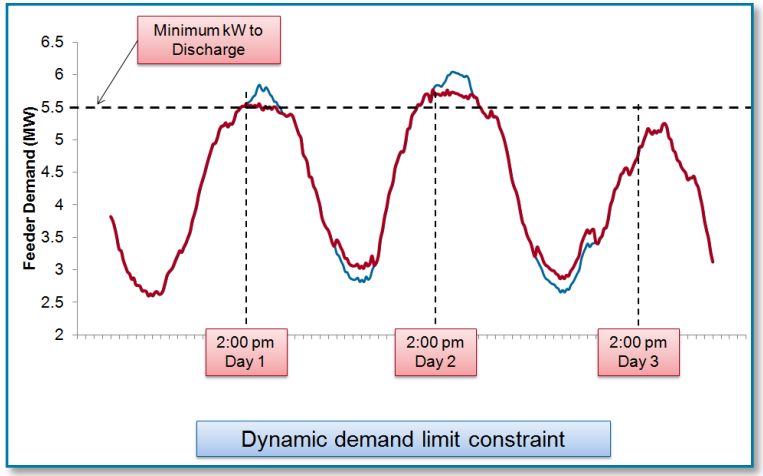
Smart Grid Demonstration Initiative

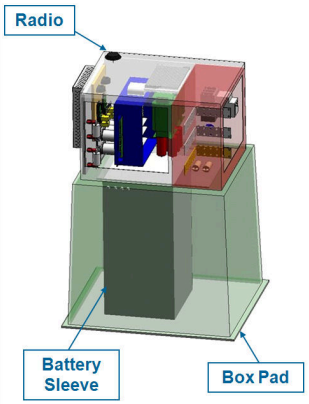
Case Studies

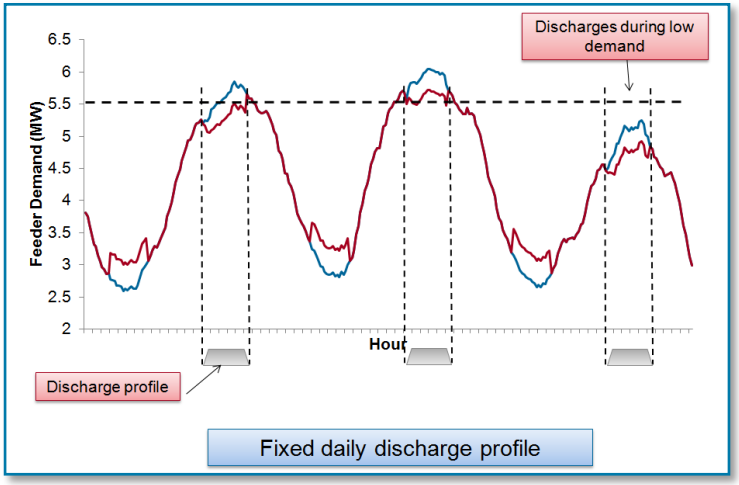
- American Electric Power
- Commonwealth Edison (Exelon)
- Consolidated Edison
- Electricité de France
- ESB Networks
- First Energy
- KCP&L
- PNM
- SMUD
- Southern Company

A Case Study on

Simulation of Community Energy Storage







Dispatch of energy storage based on monitored kW will reduce the number of battery charge/discharge cycles needed to shift the peak demand.

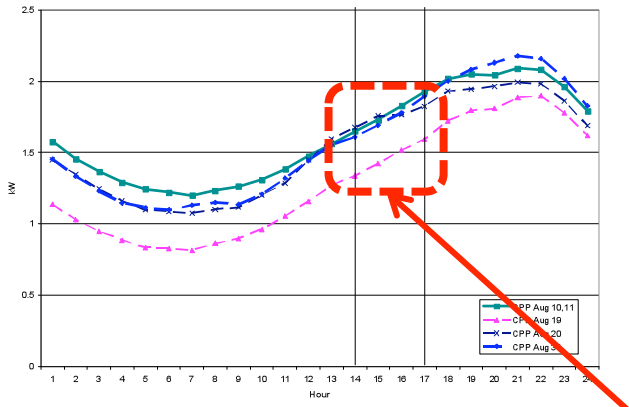
	Pros	Cons
Peak Shaving	• Fixed kW peak • Operation directly targets peak demand periods	• Risk that required kWh will exceed the stored kWh • Requires periodic review of control settings
Load Following	• Operation directly targets peak demand periods • Reduced risk that the required kWh exceeds stored kWh	• Peak demand limit is variable • Dependent upon load shape characteristics • Requires periodic review of control settings
Schedule Based	• Control settings require minimal periodic updates • No additional monitoring • Central control not required	• No preset demand limit • Battery fully discharged each day to ensure reduction of the peak • Long shallow discharge profile required to confidently reduce peak

A Case Study on

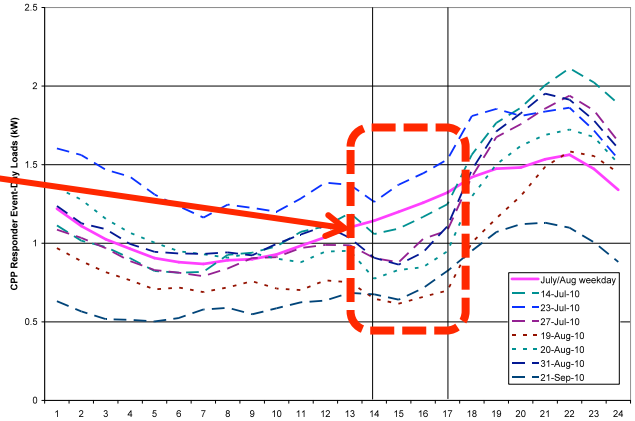
Impact of Advanced Metering Infrastructure (AMI) on Demand Response

ComEd
An Exelon Company

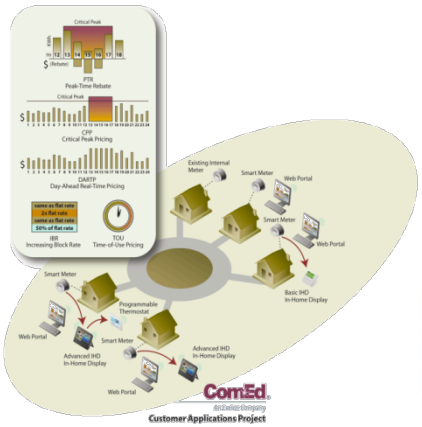
Critical-peak price and peak-time-rebate customers provided the largest demand reduction (up to 20%), while technology treatments added no measurable improvement.



Event load response notch



No event load notch



Rate Application	Responder Load as % Application Load	Average % Responder Load Change	Total Responder Load Impact % Application Load
CPP	10.2	-21.8 %	-2.2 %
DA-RTP	8.1	-14.4 %	-1.2 %
PTR	8.1	-14.7 %	-1.2 %
TOU	8.0	-11.3 %	-0.9 %
IBR	5.0	- 5.6 %	-0.3 %
FLR	4.8	- 7.2 %	-0.3 %

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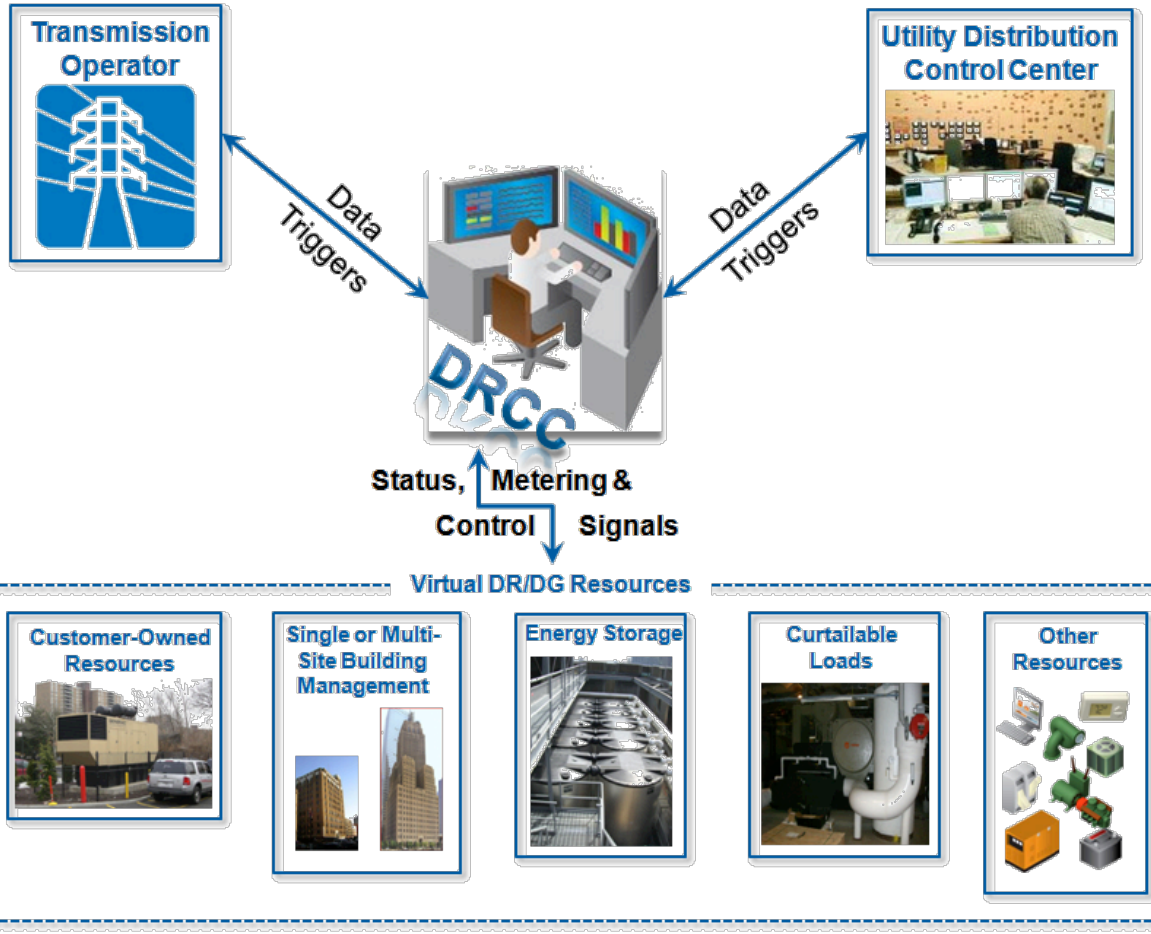
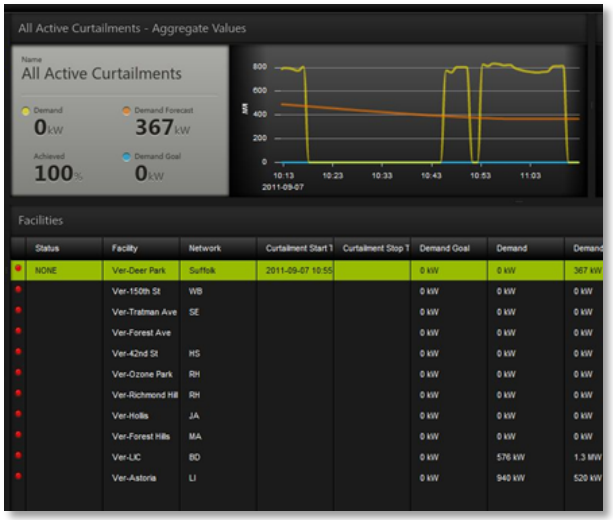
A Case Study on

Remote Dispatch of Customer-Owned Resources



Distribution operators can quickly and remotely activate customer generation resources.

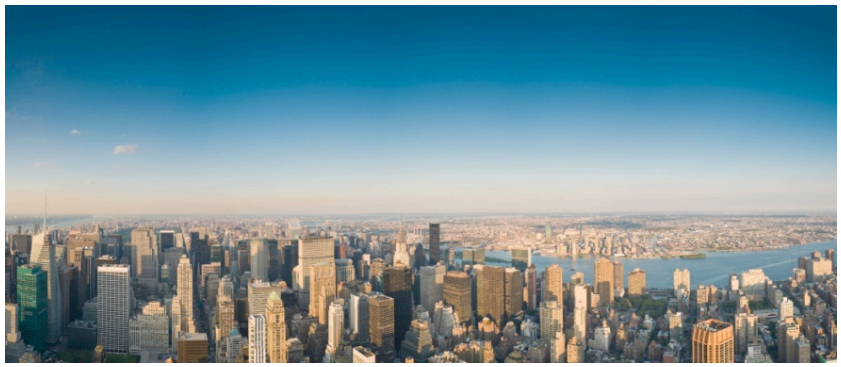


Remote dispatch occurred within 3 minutes during testing. Faster response is anticipated when customer acknowledgement is fully automated.

A Case Study on

Achieving Increased Reliability with Distributed Energy Resources

Using DER to achieve greater reliability at the Jamaica substation may be possible for about 2/3 the cost of adding additional capacity.

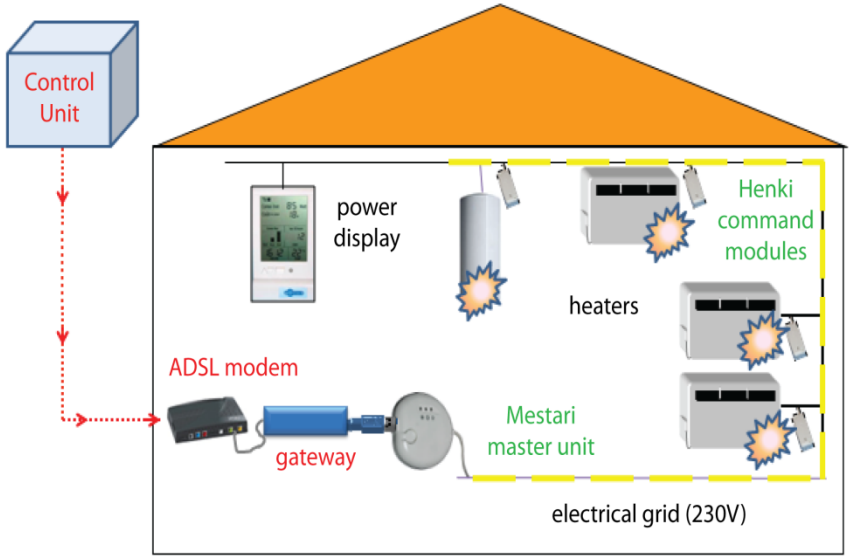


- Assessed DER/CVR in different combinations to achieve N-2 reliability.
- N-2 could withstand loss of two transformers.
- Elements assessed:
  - CVR
  - Demand response load reductions
  - Energy storage
  - PV systems & distributed generation
  - Smart-grid enabled appliances and equipment

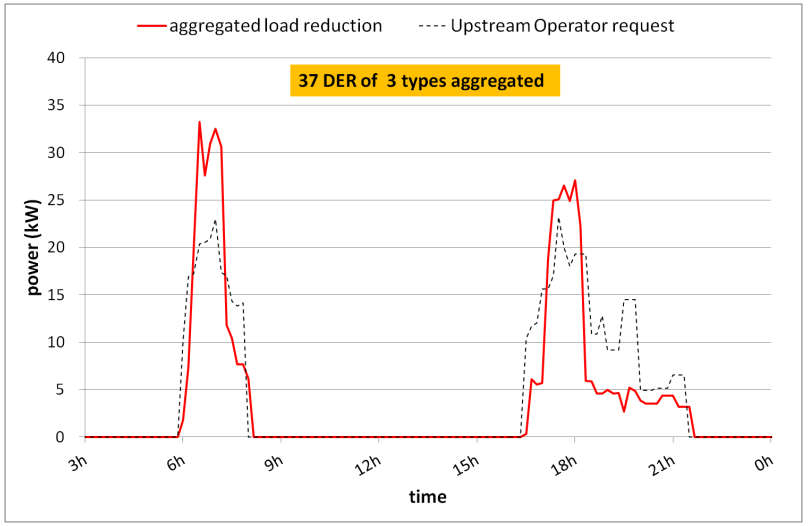
A Case Study on

Response Precision of PREMIO Virtual Power Plant

The system responded reliably and on time, resulting in a good load reduction profile – although the precision of the response profile was irregular.



Smart Box Control of Space and Water Heating in Individual Home



Load Reduction Profile

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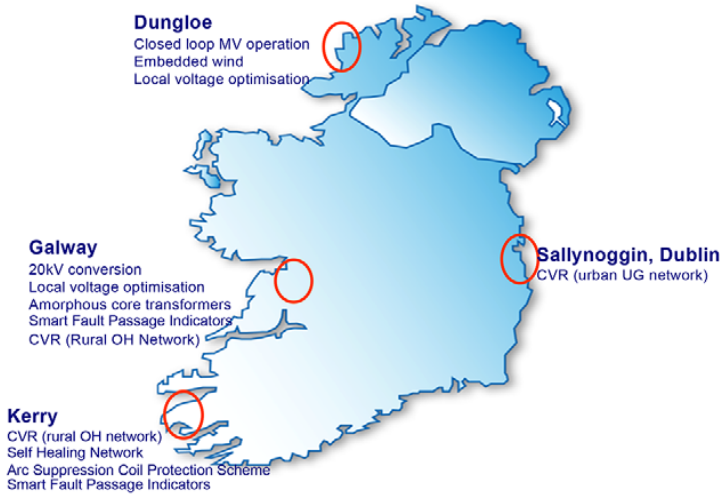
A Case Study on

Smart Green Circuits

A "self-healing" circuit has operated successfully in over 12 separate incidents, with faulted sections isolated and supply recovered to remaining customers within seconds.

An arc suppression coil protection system has helped reduce costs; fault finding time has been reduced from 9 hours to 1.5 hours, and measured continuity of performance improved by 100%.



A Case Study on

Volt-VAR Control Integrated with Wind Turbine Inverter Control

The reactive power capabilities of modern wind turbines can be used for a range of objectives, such as loss reduction, local voltage control and reactive power export.

A constant voltage mode of operation can be delivered through variation of VAR output, independent of MW generation.

A Case Study on

Customer Behavior Trial

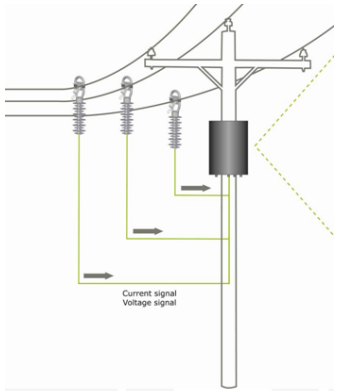
The deployment of TOU rates and energy information services were found to reduce overall electricity usage by 2.5% and peak usage by 8.8% during the one-year period of the trial.

A Case Study on

Integrated Distributed Energy Resources Management

FirstEnergy

Eighteen load-reduction events showed that aggregated resources can support distribution operations and achieve revenue goals for participating in the PJM power market.



Infrastructure deployed at JCP&L to enhance distribution system reliability and opportunities for participation in regional power markets.

Features:

- Integrated control platform
- Two-way communication system
- Distribution system monitoring
- Peak load shifting
- Optimized resource and asset utilization.

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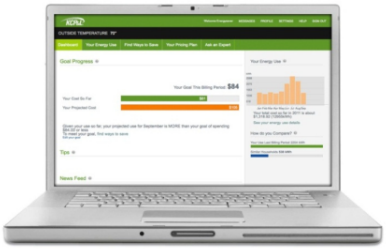
A Case Study on

Customer Perceptions, Acceptance and Technology Adoption



MySmart Portal

MySmart Display

Customer enrollment does not mean customers are engaged.

- Surveys showed customers expect an average 23% savings by using tools such as in-home displays.
- Recruitment included a customer awareness campaign with 10-customer touches, including:
  - Dedicated SmartGrid Support Team for customer service
  - Neighborhood outreach events and demonstration house to learn first hand about smart grid products
  - Direct mail and door-to-door promotion

http://www.kcplsmartgrid.com/

KCP&L intends to migrate from a once-a-month bill to more frequent contact with MySmart Products

A Case Study on

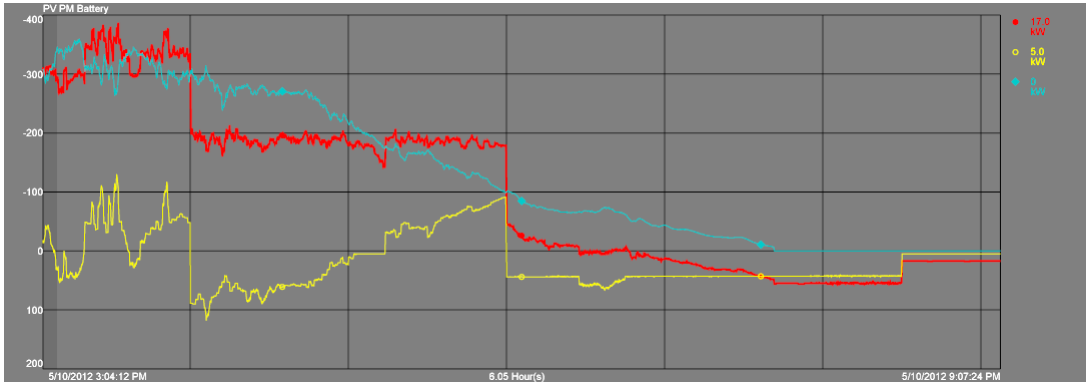
Use of Storage for Simultaneous Voltage Smoothing and Peak Shifting

A 1-second data capture rate of PV output proved essential to use storage for smoothing functions.

500kW PV and Advanced Carbon Battery for Shifting (1 MWh) and UltraBattery for Smoothing (500kW)

1 of 8 Containers Consisting of 160 Battery Cells Each

Data Acquisition System



Concept of Simultaneous Smoothing and Shifting Proven

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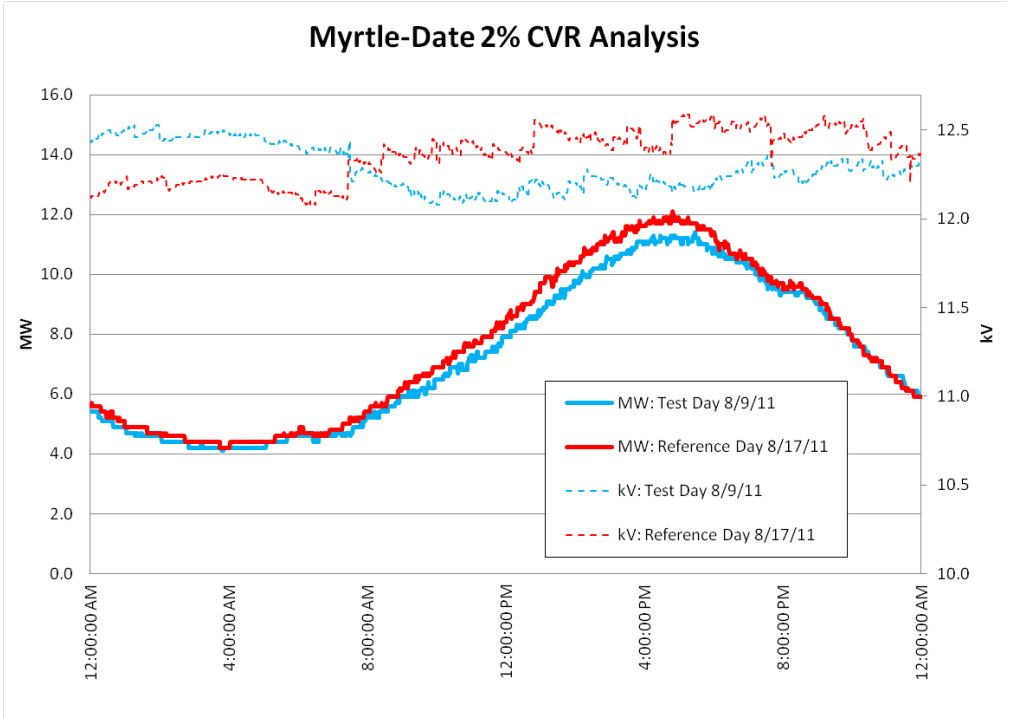
A Case Study on

Conservation Voltage Reduction and Volt-VAR Optimization

Volt-VAR optimization enabled efficient operation of the distribution system while conservation voltage reduction reduced peak demand by an average of 1.7%.

Substation	Approximate Avg. Percentage Demand Reduction (2% CVR)
Myrtle-Date (MYRD)	2.5%
Madison-Kenneth (MADK)	1.0%

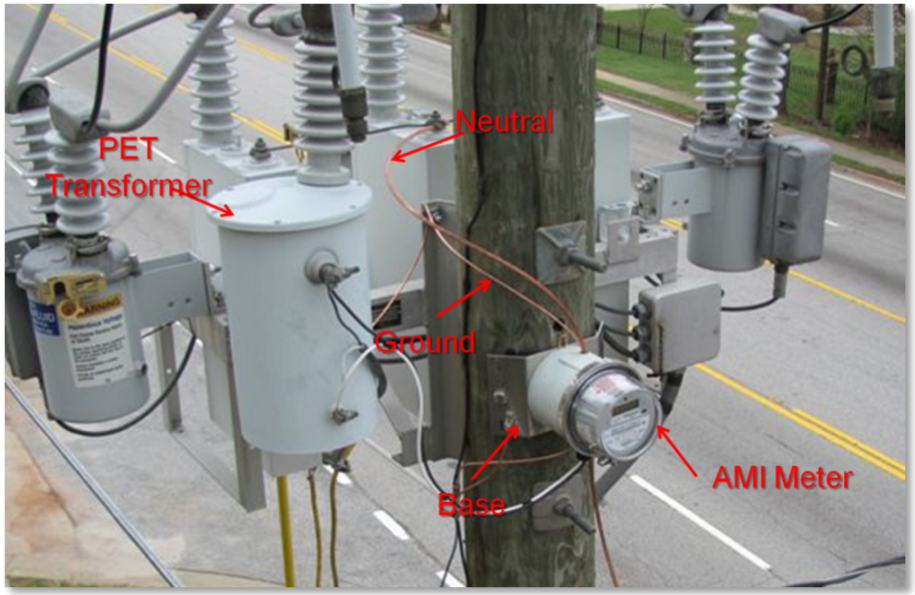
Additional testing of a larger pool of substations to be done to determine predictability of the CVR control strategy.



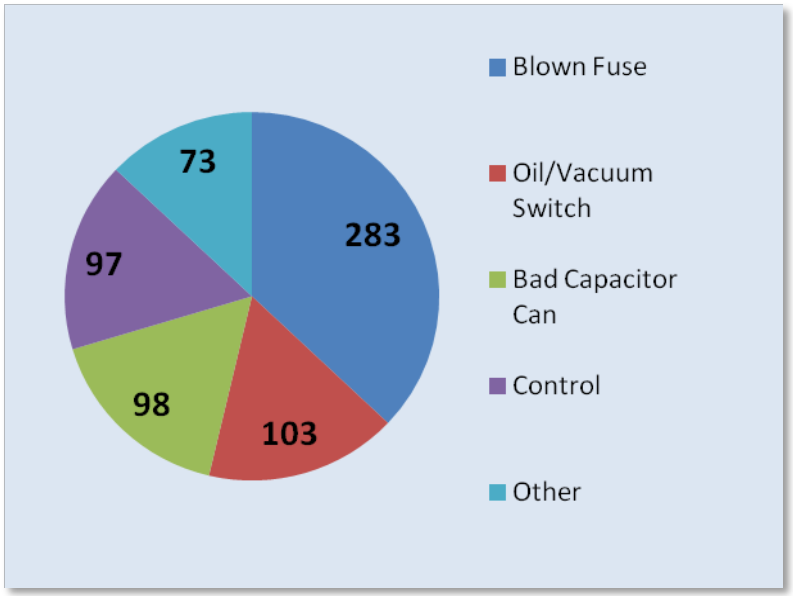
A Case Study on

A Capacitor Bank Health Monitor

AMI capacitor bank health monitors identified over 650 problems in the first 6 months and changed the inspection schedule from once a year to once a day.



Installation of Advanced Meter Capacitor Bank Health Monitor



Issues Causing Failure of Capacitor Banks