



Using AMI to Improve the Operation of the Electric Distribution System

Presented by Glenn A. Pritchard, PE



Empowering Business in Real Time
PI Infrastructure for the Enterprise

Objective

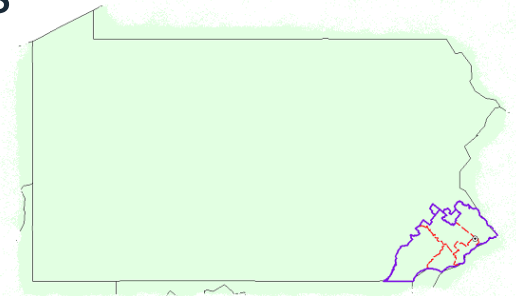
- To discuss and present examples on how PI can enhance the use of Metering data throughout a Power Delivery Organization

Agenda

- PECO Background
- Applications
 - System Load Management & Modeling
 - Transformer & Cable Load Analytics
 - Capacity Planning
 - Rate Analysis
 - Meter Maintenance
 - Revenue Protection
 - Curtailment Program Applications
- Conclusion

Exelon / PECO

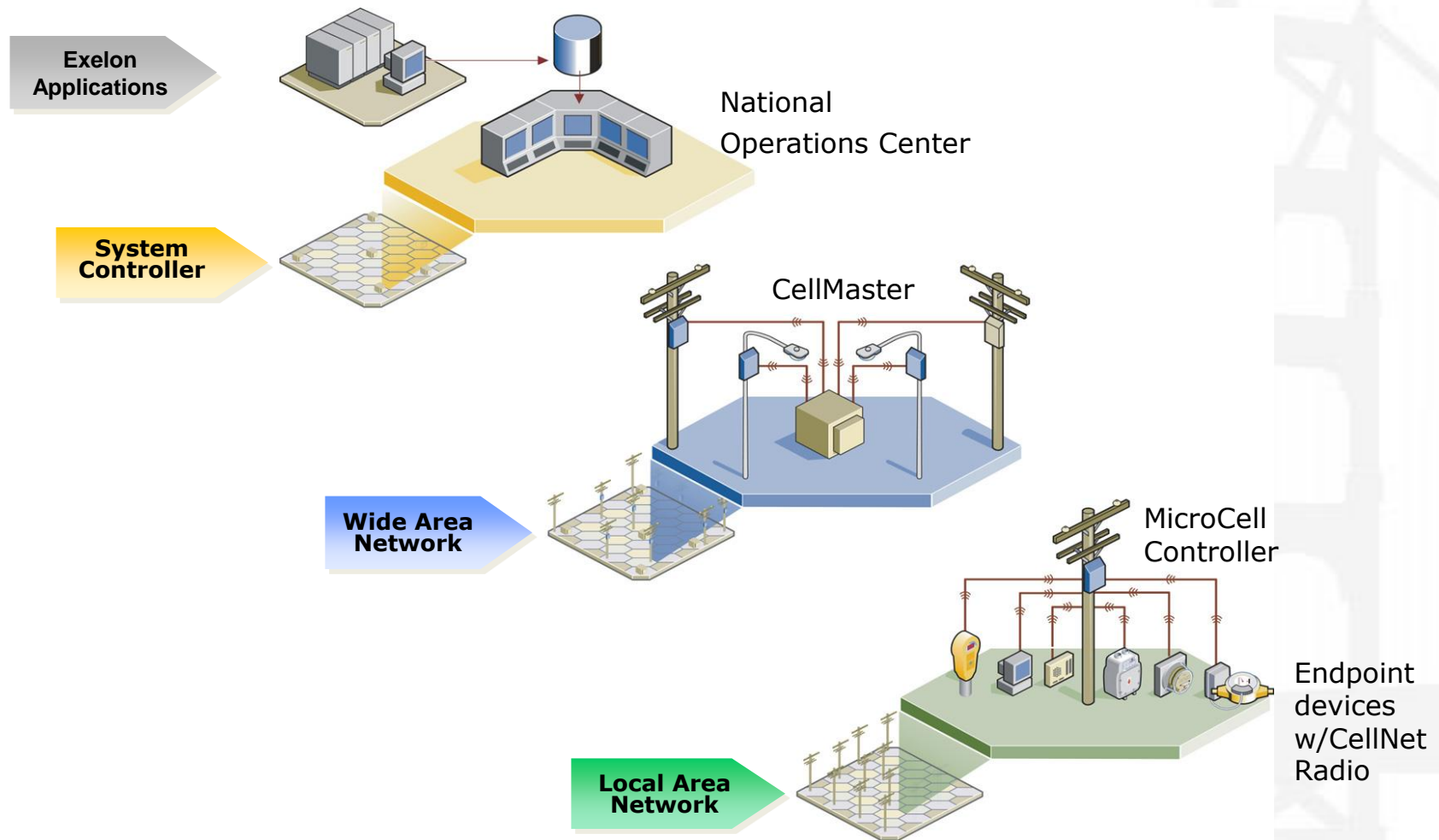
- Subsidiary of Exelon Corp (NYSE: EXC)
- Serving southeastern Pa. for over 100 years
- 2,400 sq. mi. service territory
- Electric and Gas Utility
 - 1.7M Electric Customers
 - 470K Gas Customers



Scope of AMR at PECO

- Landis+Gyr/Cellnet provides PECO with a managed-AMR service which includes network operations, meter reading and meter maintenance
- A Fixed-RF Network solution was selected.
 - 99% of meters are read by the network
 - Others are drive-by and MV-90 dial-up
- PECO's AMR installation phase lasted from 1999 to 2003
- Meter Reading Services/Data Delivered:
 - All meters are read Daily (Gas & Electric)
 - Additional services include: Demand, ½ Hour Interval, TOU, SLS
 - Reactive Power where required
 - Tamper & Outage Flags (Last-Gasp, Power-Up Messages)
 - On-Demand meter reading requests

L+G/Cellnet AMR Network



AMR Network Components



91 Cell Masters



8,400 MicroCell
Controllers

2,200,100 Meters

~1,625K Res. Electric

~455K Res. Gas

~135K Com. Electric

~42K Com. Gas



OSIsoft at PECO

- Current Uses
 - SCADA
 - Substation Asset Management
 - Engineering Studies
 - AMI Data Analysis Pilot
- Future Opportunities for AMI/AMR Data Management
 - Revenue Protection Programs and Reports
 - AMI Data Management
 - Capacity Planning

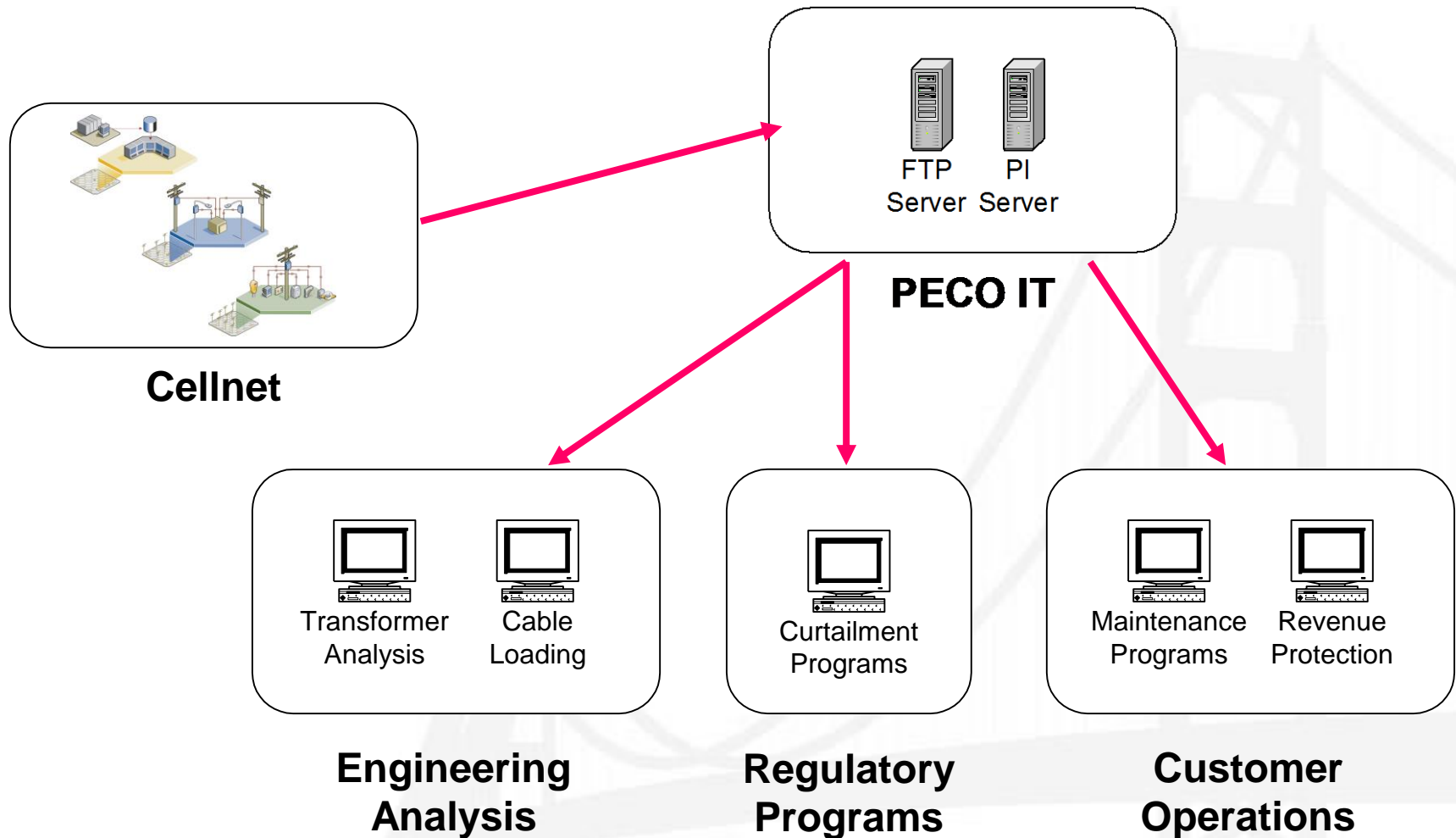
OSIsoft Applications at PECO

- **PI & ProcessBook**
 - To display customer usage, equipment loading and analysis results
- **PI ACE**
 - Used to improve complex calculations such as customer analysis and transformer & cable load analysis
- **PI Batch**
 - Used to compare customer usage over days/weeks to establish baselines and identify abnormal conditions
- **Universal File Loader Interface**
 - Used to load meter reading data files as they are received from Cellnet. (Files are received and processed daily)

Pilot Applications for Meter Data

- Several applications that are based on metering Data have been identified and developed using the PI and Data Management tools
 - System Load Management & Modeling
 - Transformer & Cable Load Analytics
 - Capacity Planning
 - Rate Analysis
 - Meter Maintenance
 - Revenue Protection
 - Curtailment Program Applications
- The following slides will review details for each opportunity

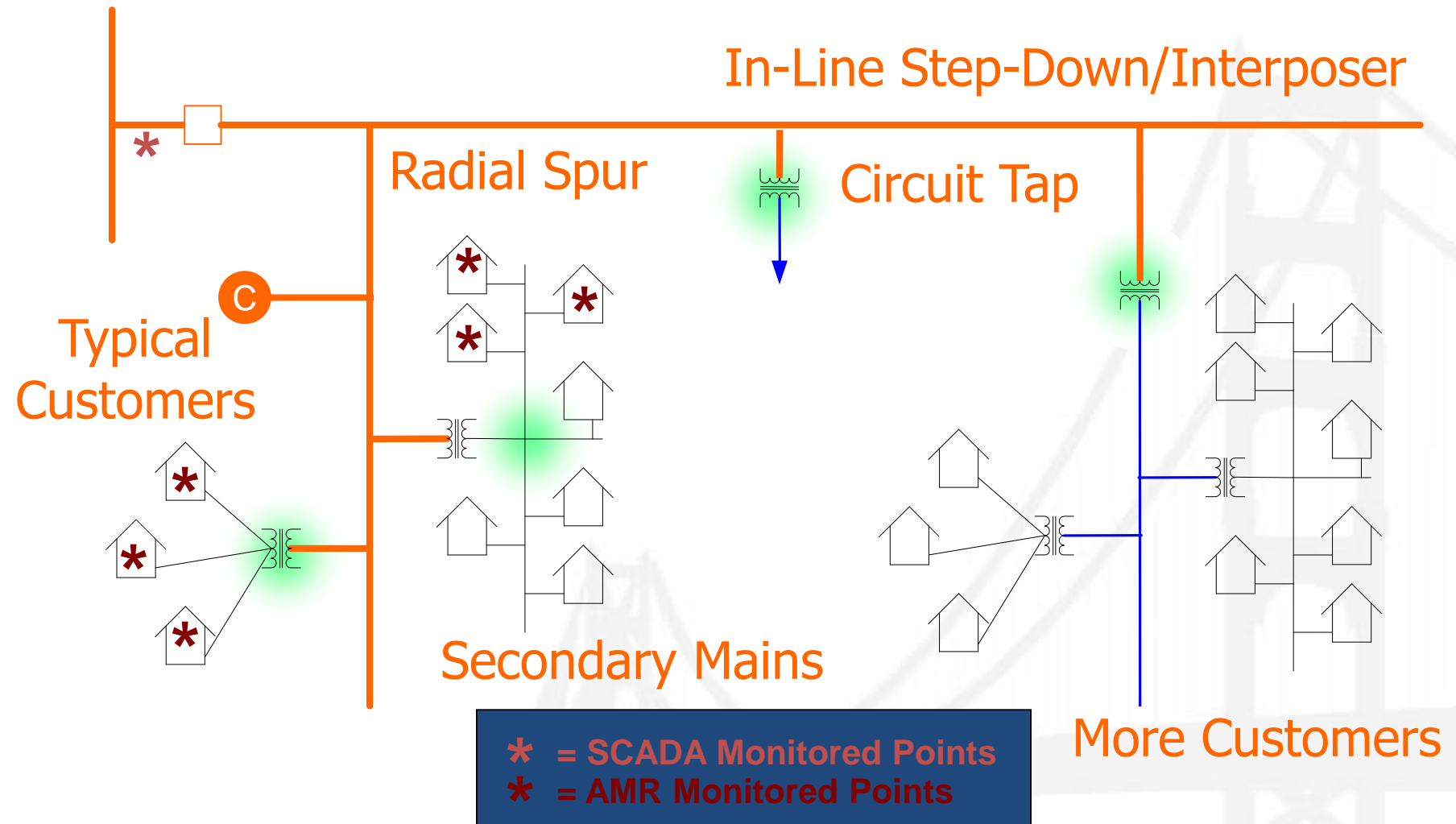
Pilot System Architecture



System Load Management

- **The current methods of identifying and assessing distribution system loading is labor intensive and often reactionary, in response to equipment failures/outages.**
- PECO's AMR System can provide accurate customer load data.
 - The data can be aggregated throughout the distribution grid to determine actual device loading.
 - The need for load models is eliminated, actual customer data is used.
 - By leveraging the capabilities of PI, the analysis process is streamlined and more effective.
- Benefits
 - Overloads and failures can be identified before they cause an outage and then problem can be corrected.
 - Reliability is increase and customer satisfaction is improved due to fewer outages and impact from construction projects

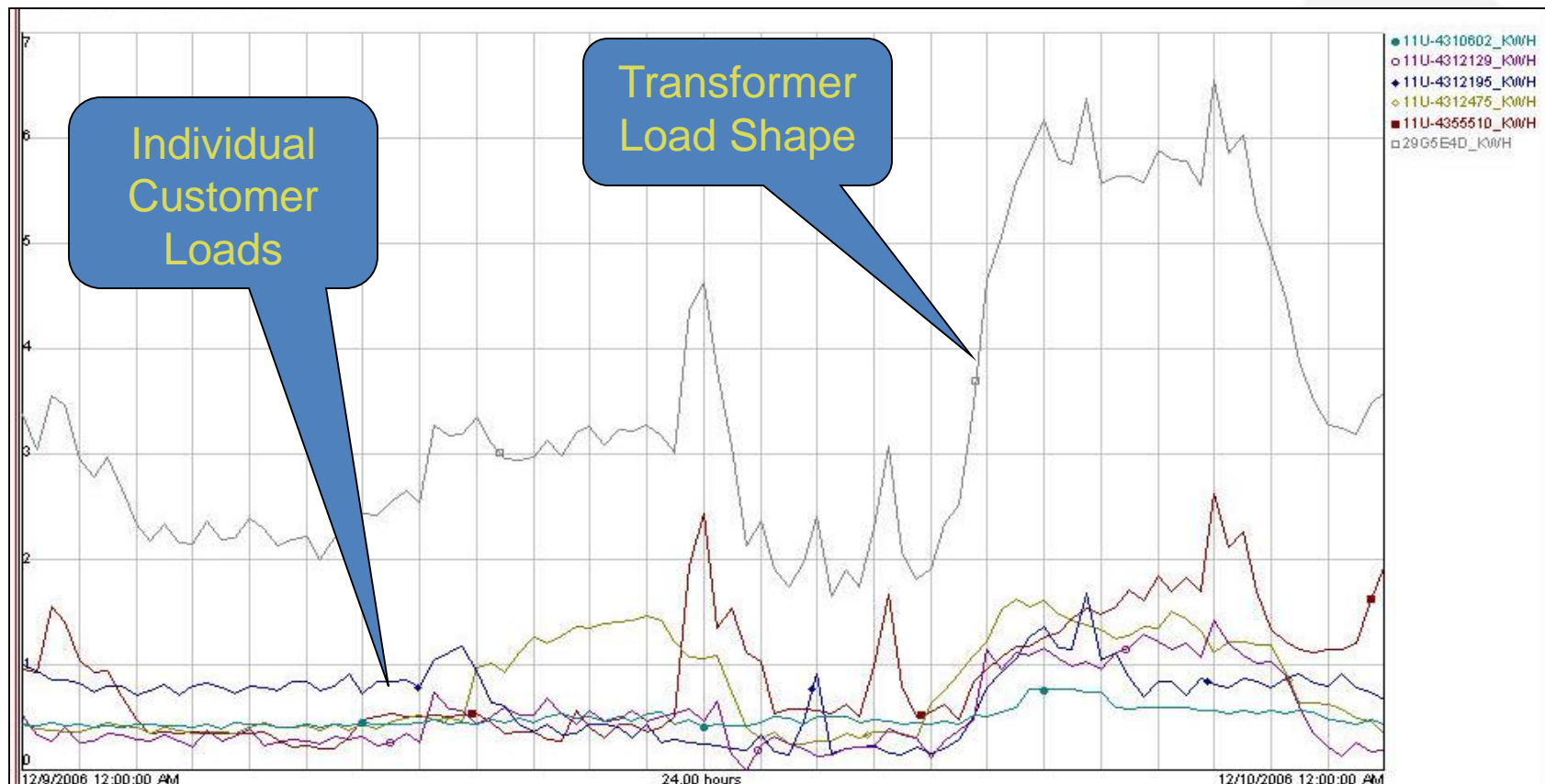
Creating Virtual SCADA Points



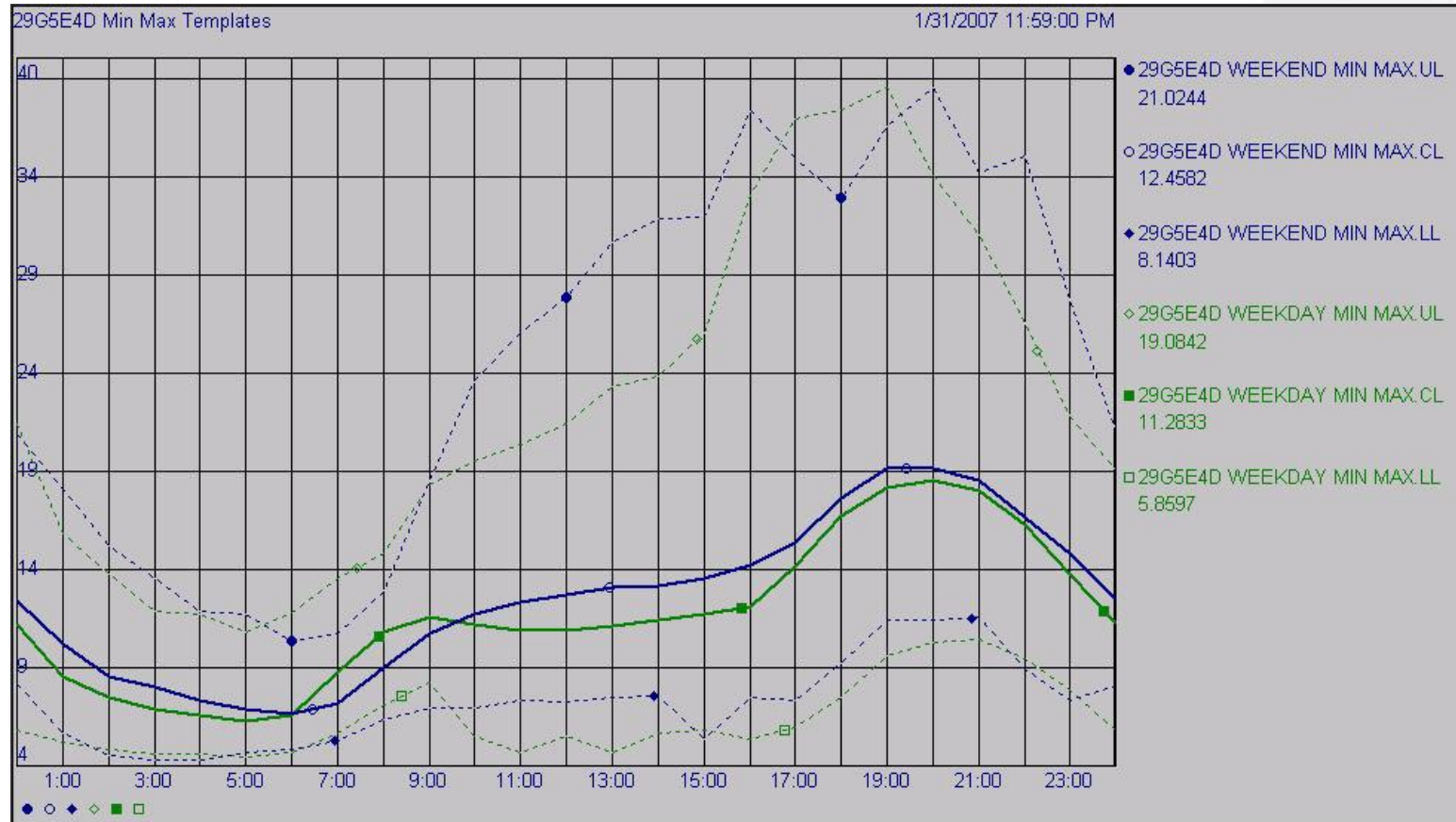
Interval Data Pilot Details

- Goal: To assess the feasibility and potential benefit of using AMR data to monitor cable and transformer performance via a virtual SCADA system
- 4,500 meters, representing 145 transformers and cable sections, were enrolled in the AMR interval data service
 - Hourly meter readings for each meter is recorded
- System Details:
 - Data is sent daily from Cellnet to PECO via an FTP process.
 - Data is loaded in PI, via the UFL Application
 - Transformer and Cable Loads are created within PI ACE
 - Data and analysis results are displayed in Process Book

Meter to Transformer Rollup

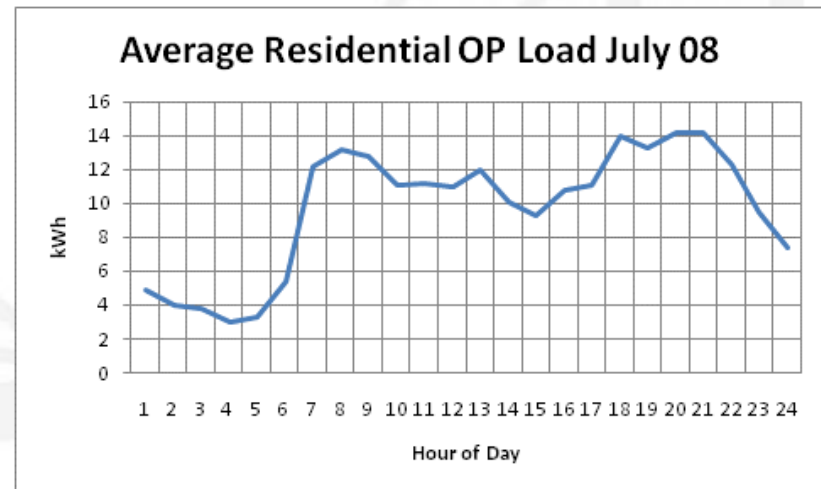


Average Transformer Loading



Rate Analysis

- PECO is currently operating under a rate cap which is set to expire on 1/1/11
- The current rate-class models must be updated with current usage to reflect today's customer load profiles
- Over 5,000 sample customers were selected to create new usage models for each rate class
 - Half-Hour interval data for each customer is being gathered for a sample 12 month period
- Load Shape for each rate-class are being developed



Meter Operations and Billing Support

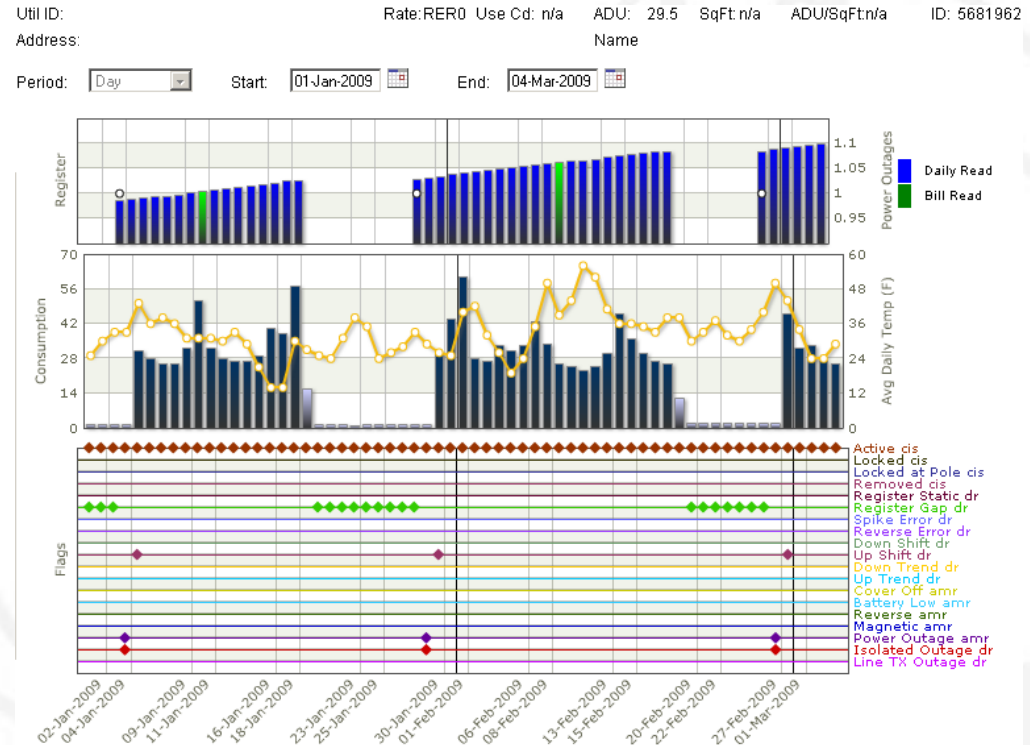
- Meter Maintenance Programs and activities are often driven by a Utilities' Customer Information System or its Billing System
- These systems are designed to identify problems through billing exceptions. The subsequent work is reactionary
- Many of the billing exceptions are a result of metering issues or data problems. Furthermore, many of the tests are too generic to identify emerging issues
- By analyzing meter reading data as it is received, many billing exceptions can be avoided and the Billing Departments can work more effectively
- A system such as PI can pre-process the raw data to sort out the various issues before the account is billed and the customer is impacted

Revenue Protection Programs

- During tough economic times, the incidence rate of tampering and theft have been observed to increase
 - **Tampering with meters and electric services is unsafe and dangerous!**
- Innovative new tools and applications must be developed and used to keep any such activity in check and maintain a safe electric distribution system.
- Traditional approaches to Revenue Protection include meter inspections and manual account analysis.
- PECO is developing tools and automated processes to identify tampering patterns in the Meter Data to speed to identification of tampering and to more effective dispatch technicians to probable tampered meters
- The PI environment can be used to identify such patterns and to predict likely tamper accounts with great accuracy.
 - ProcessBook and PI Batch are particularly effective for this purpose.

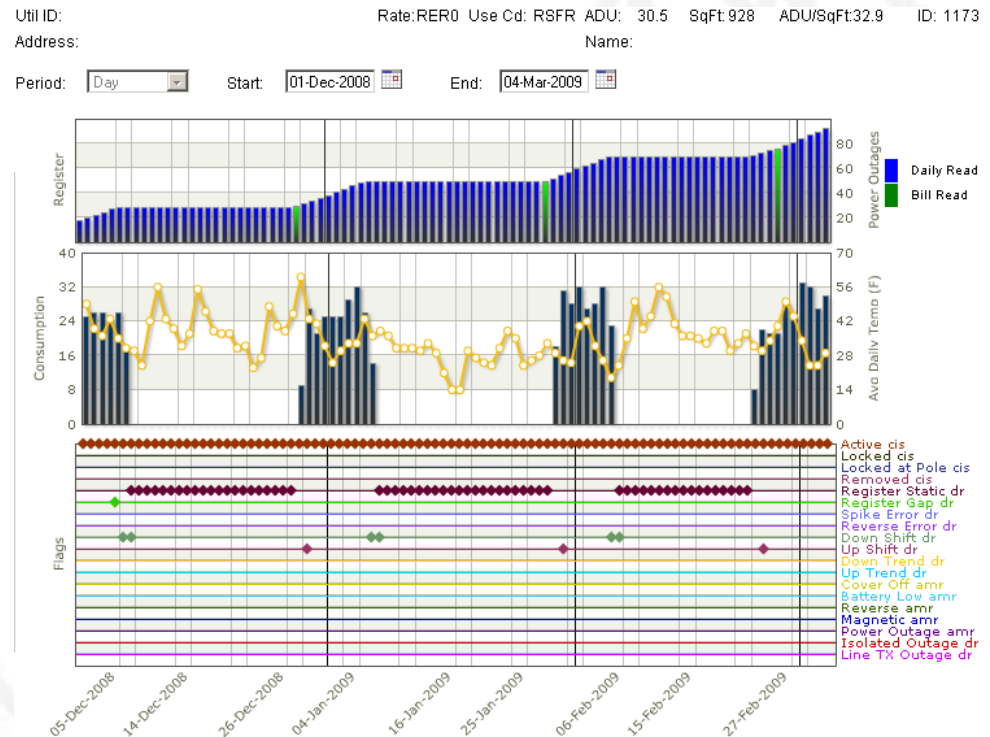
Sample Tamper Accounts

Potlatch Switch



Sample Tamper Accounts

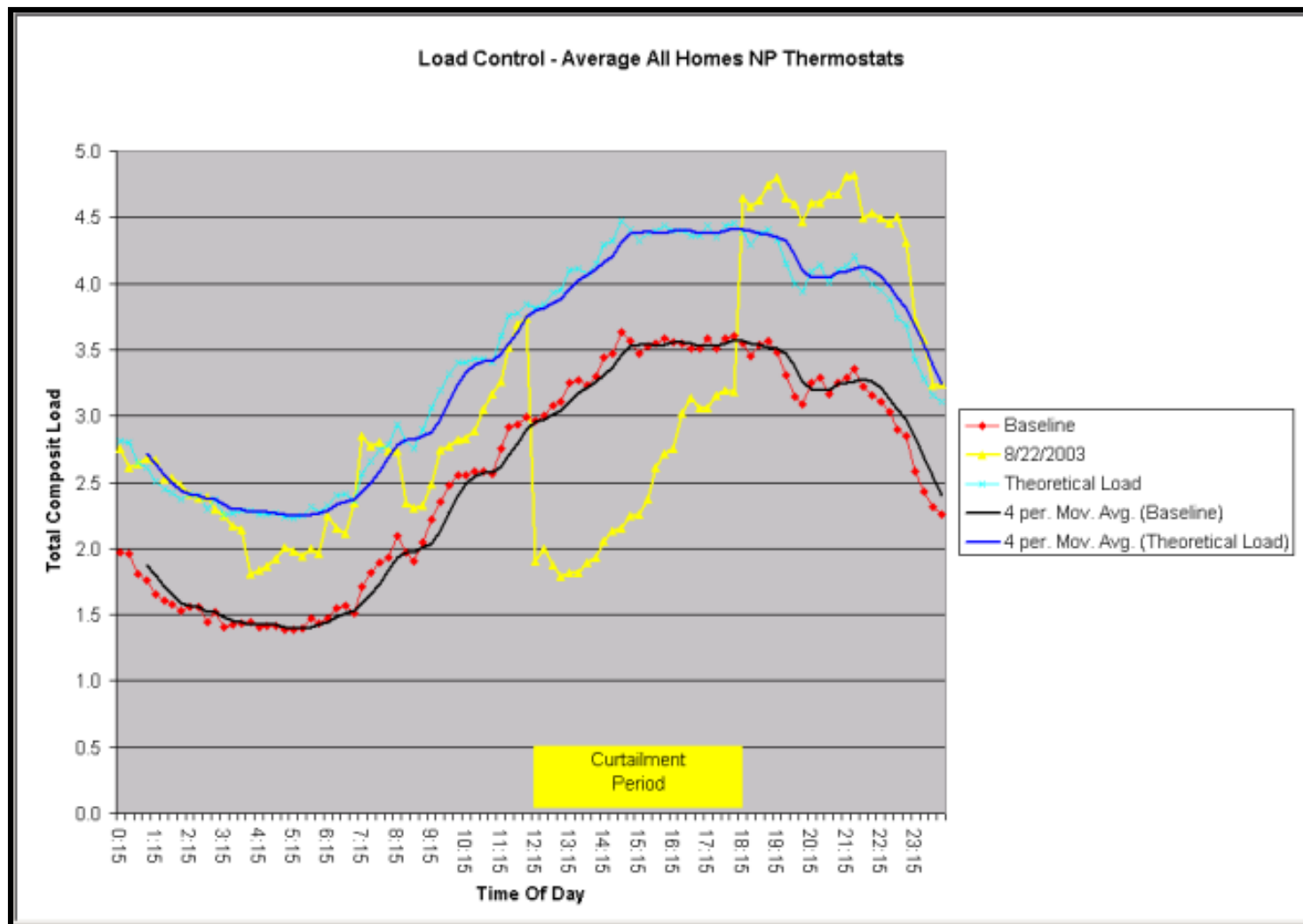
Drill Hole/Disc Tamper



Curtailment Program Analysis

- Residential Curtailment Programs often offer the ability to adjust HVAC thermostat settings to reduce electric demand
- The effectiveness of curtailments may be difficult to calculate unless the customer's energy use is closely monitored
- By collecting interval data for the participants, the actual reduction in energy usage can be observed and calculated
- Easy to use analysis tools are required to quickly assess the curtailment and program effectiveness

Curtailment Programs



Conclusion

- As demonstrated, there are many uses for PI when considering a system to manage Meter Data.
 - Asset Management
 - Load Forecasting
 - Operations and Billing Support
 - Revenue Protection
 - Curtailment Programs
- While meter data management is often thought to be a Customer Operations centric tool, the uses go beyond traditional boundaries to address areas to address the needs of Engineering, Regulatory and Marketing.

Thank You

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