OSIsoft.

REGIONAL SEMINAR 2011

EMEA

PI System in Smart Grids, T&D and Power

Presented by

Kevin P Walsh
Business Development – T&D Smart Grids

Agenda

- **Smart Grid – What does it really mean?**
- Smart Grid – Does it come with Directions?
- What are the Parts?
- What's important in a Smart Grid?
- End to End Visibility and Monitoring
  - PI System customer Use Cases
    - DTE
    - SEMPRA (SDG&E)
    - Xcel Smart Grid City
    - UCSD Micro Grid

Smart Grids – What does it really mean??

- Does it mean AMI? Smart Meters?
- Does it mean HEMS?
- Does it mean DA/DMS?
- Does it mean PMUs?
- Does it mean DER?
- Does it mean Micro Grids?
- All of the above?
- Non of the above?
- Do we know our acronyms?

Smart Grids – What does it really mean??

“The Smart Grid isn’t a thing but rather a vision and to be complete, that vision must be expressed from various perspectives – its values, its characteristics, and the milestones for achieving it.”

Joe Miller – Smart Grid News.com

Smart Grids – What does it really mean??

- We know the following;
  - It must be more reliable
  - It must be more secure
  - It must be more economic
  - It must be more efficient
  - It must be more environmentally friendly
  - It must be safer

Smart Grids – What does it really mean??

- 5 Key Technologies that enable the Smart Grid:
  - Integrated Communications
  - Sensing and Measurements
  - Advanced Components
  - Advanced Controls
  - Improved Interfaces and Decision Support

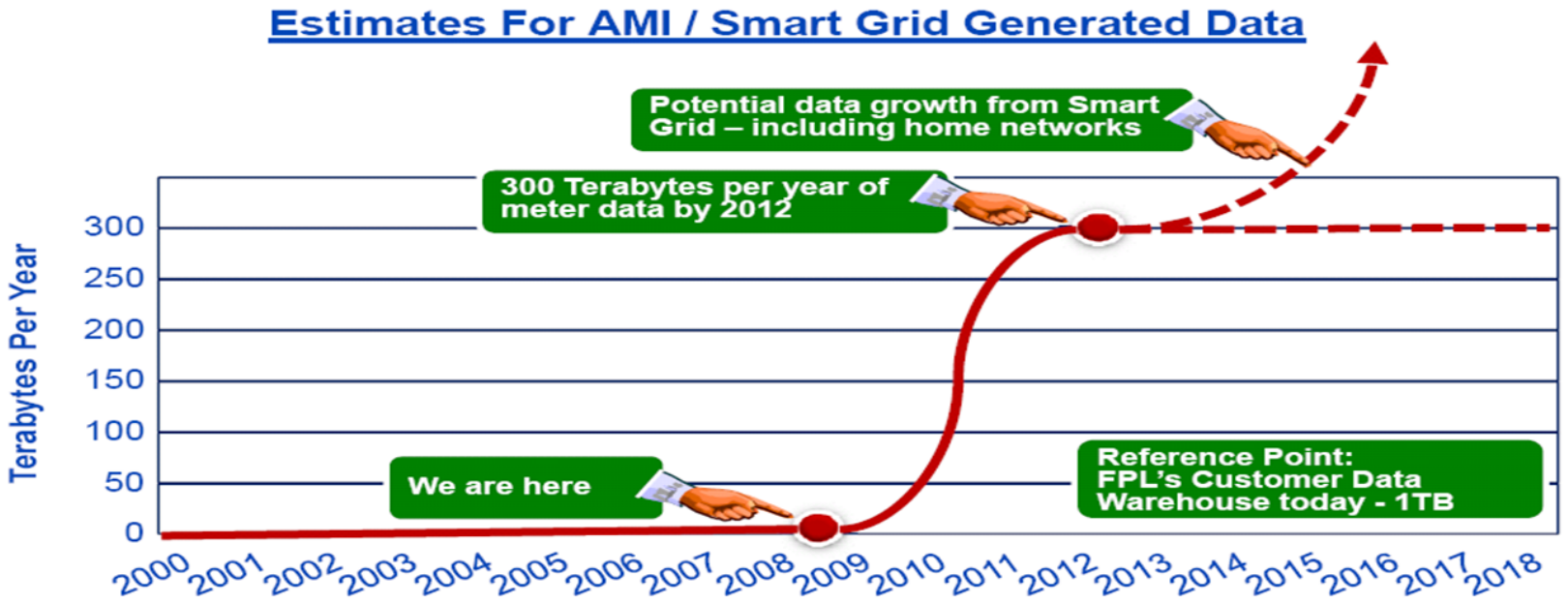
Agenda

- Smart Grid – What does it really mean?
- **Smart Grid – Does it come with Directions?**
- What are the Parts?
- What's important in a Smart Grid?
- End to End Visibility and Monitoring
  - PI System customer Use Cases
    - DTE
    - SEMPRA (SDG&E)
    - Xcel Smart Grid City
    - UCSD Micro Grid

Smart Grid – Does it come with Directions?

- AMI and Smart Grid could be viewed like a box of Legos
- Legos are great, one can build most anything

Smart Grid – Does it come with Directions?



AMI and Smart Grid will increase the amount of measurement and control points far beyond anything we have today – How we can leverage this data to compete?

FPL GROUP

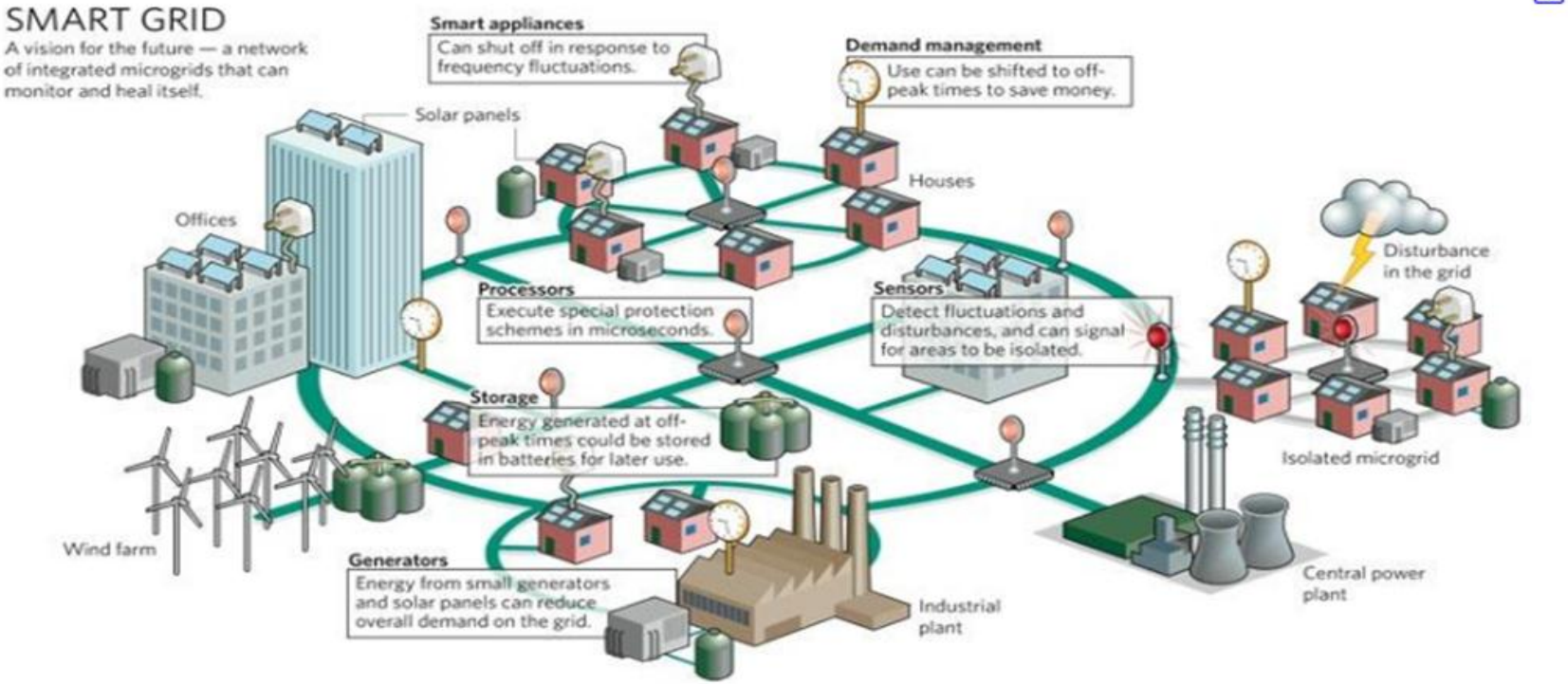
Smart Grid – Does it come with Directions?

- And does not come with directions like Legos

Agenda

- Smart Grid – What does it really mean?
- Smart Grid – Does it come with Directions?
- **What are the Parts?**
- What's important in a Smart Grid?
- End to End Visibility and Monitoring
  - PI System customer Use Cases
    - DTE
    - SEMPRA (SDG&E)
    - Xcel Smart Grid City
    - UCSD Micro Grid

What are the parts?



Agenda

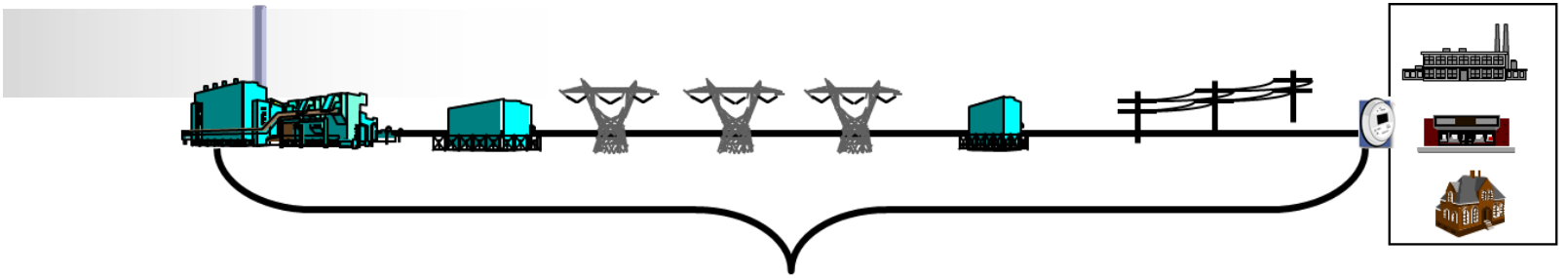
- Smart Grid – What does it really mean?
- Smart Grid – Does it come with Directions?
- What are the Parts?
- **What's important in a Smart Grid?**
- End to End Visibility and Monitoring
  - PI System customer Use Cases
    - DTE
    - SEMPRA (SDG&E)
    - Xcel Smart Grid City
    - UCSD Micro Grid

What's important in a Smart Grid?

Agenda

- Smart Grid – What does it really mean?
- Smart Grid – Does it come with Directions?
- What are the Parts?
- What's important in a Smart Grid?
- **End to End Visibility and Monitoring**
  - PI System customer Use Cases
    - DTE
    - SEMPRA (SDG&E)
    - Xcel Smart Grid City
    - UCSD Micro Grid

End to End Visibility

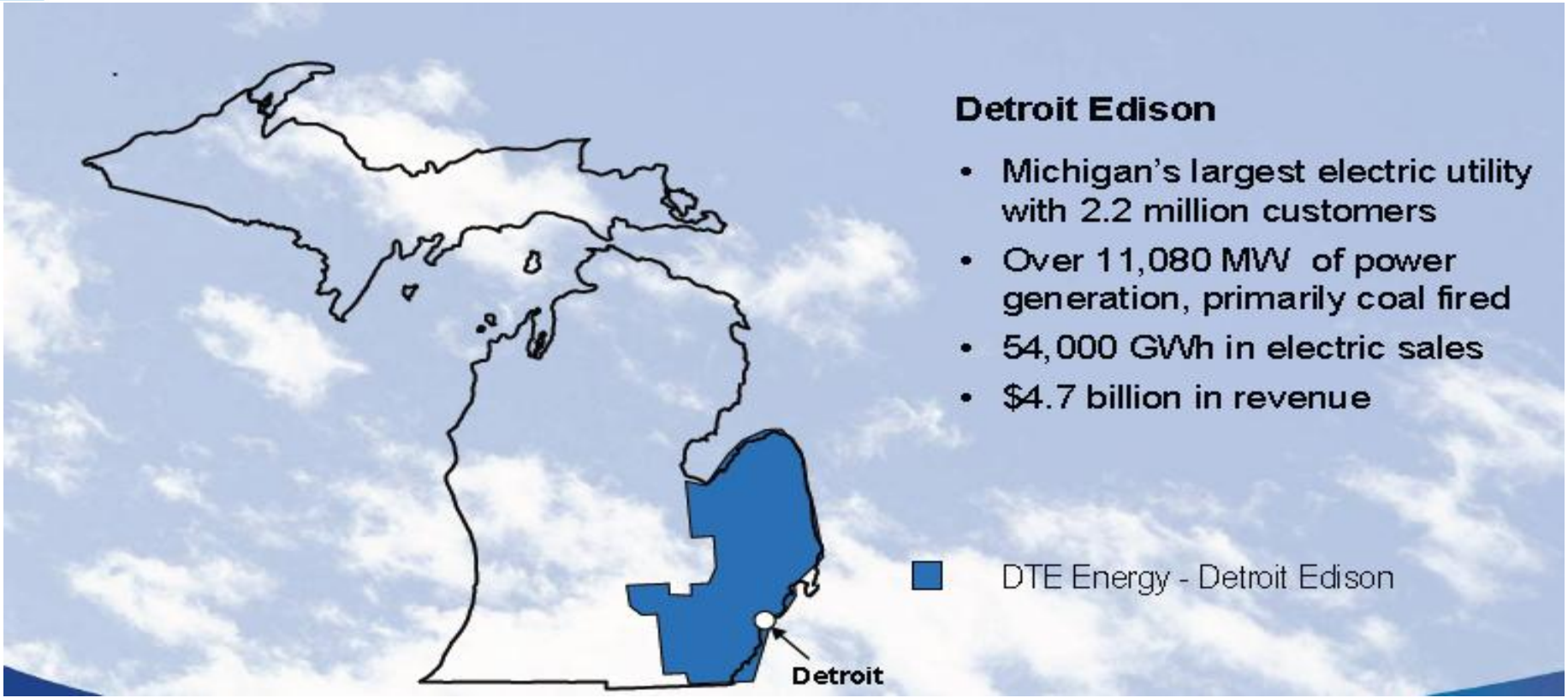


Across the Enterprise

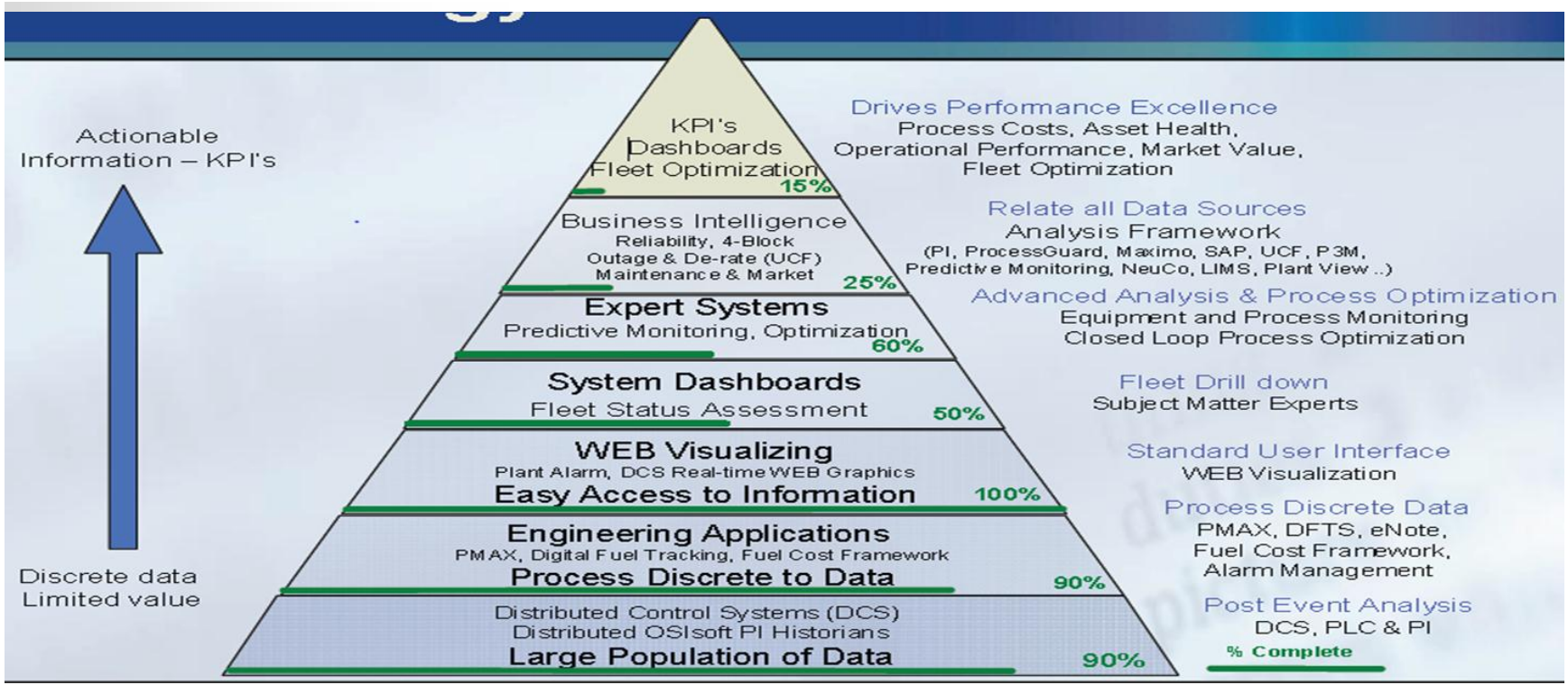
Transition

Point to Point Visibility	End to End Visibility
Latency	Real-Time
Scheduled Maintenance	Predictive Maintenance
Limited Connections	Connected
Data	Knowledge

DTE Energy

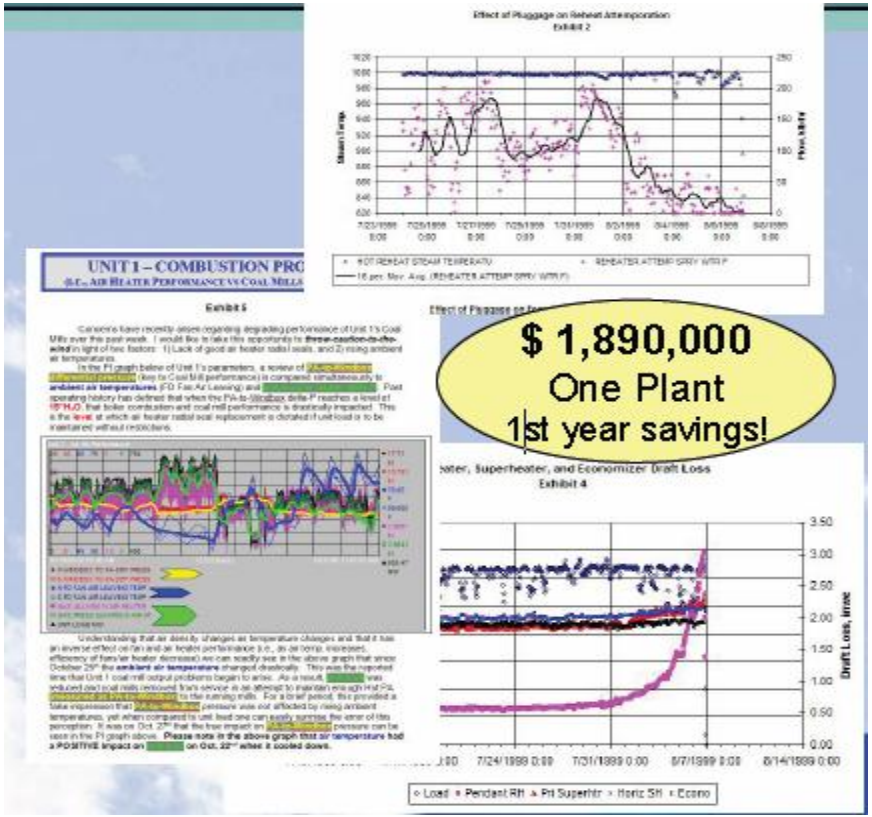


DTE Energy – Crawl, Walk, Run

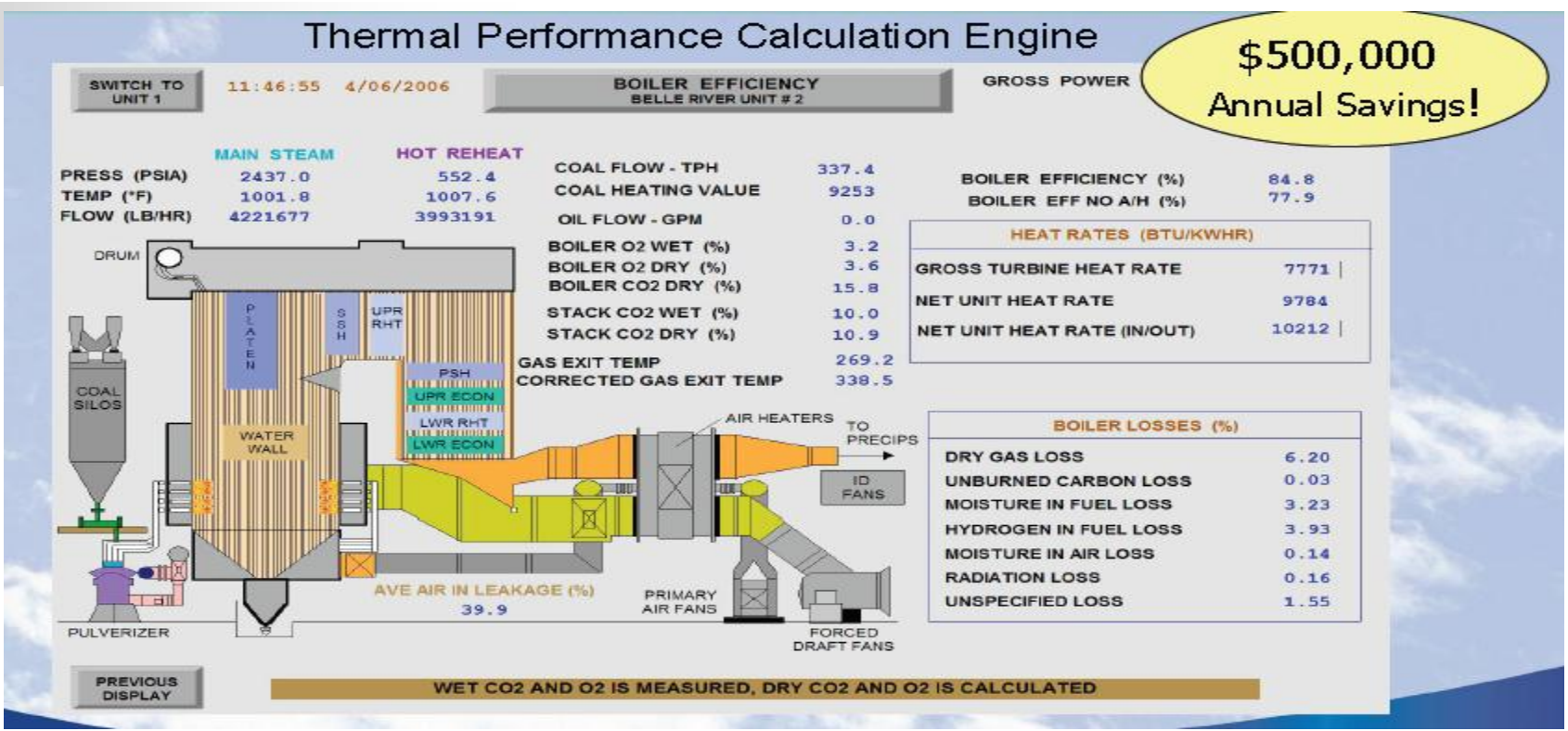


DTE Energy – Raw Data Analysis

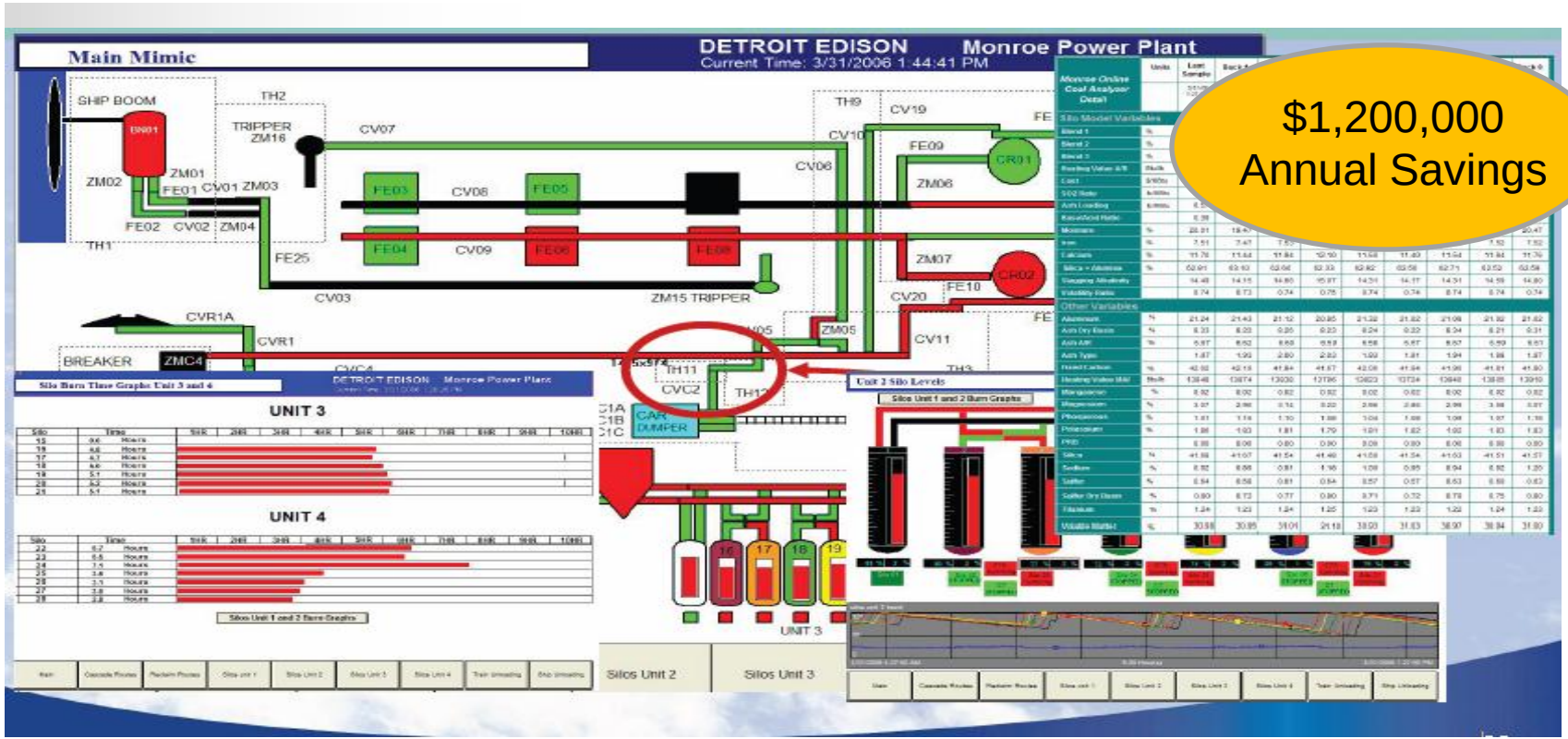
- Post trip Analysis
- Process Monitoring
- Optimization
- Early Warning
- Alarming



DTE Energy – Fleet Performance Analysis

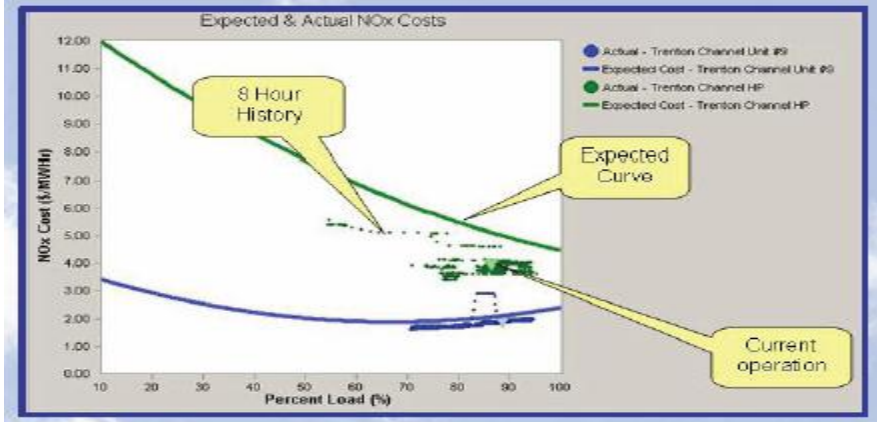


DTE Energy – Digital Fuel System Tracking



DTE Energy - NOx Emission Strategy

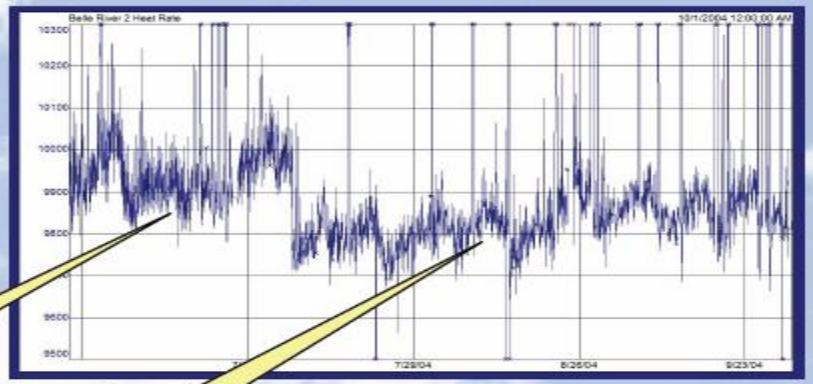
$2,200,000
Annual Savings



NOx Reduction with Improved Heatrate

Before Implementation

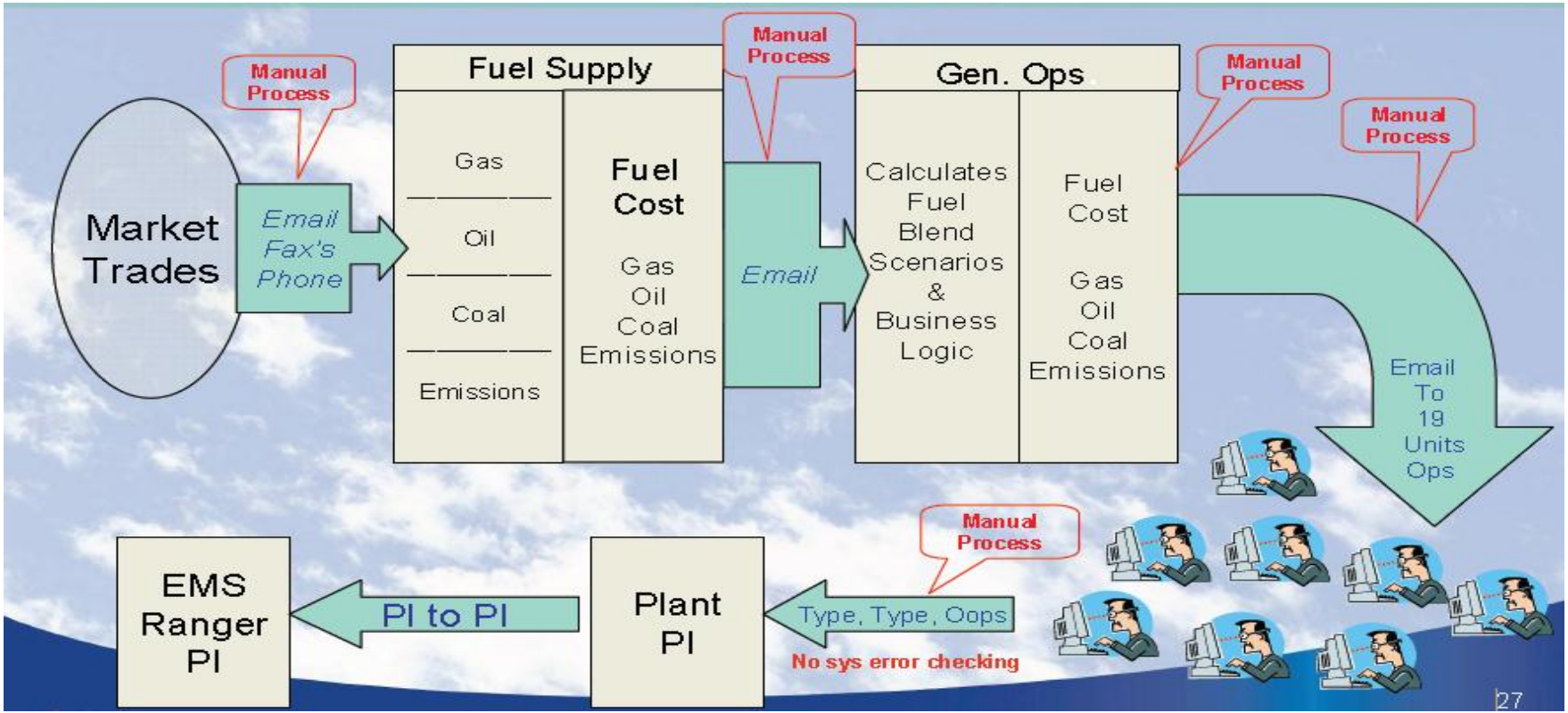
After Implementation



Primary focus is NOx reduction only

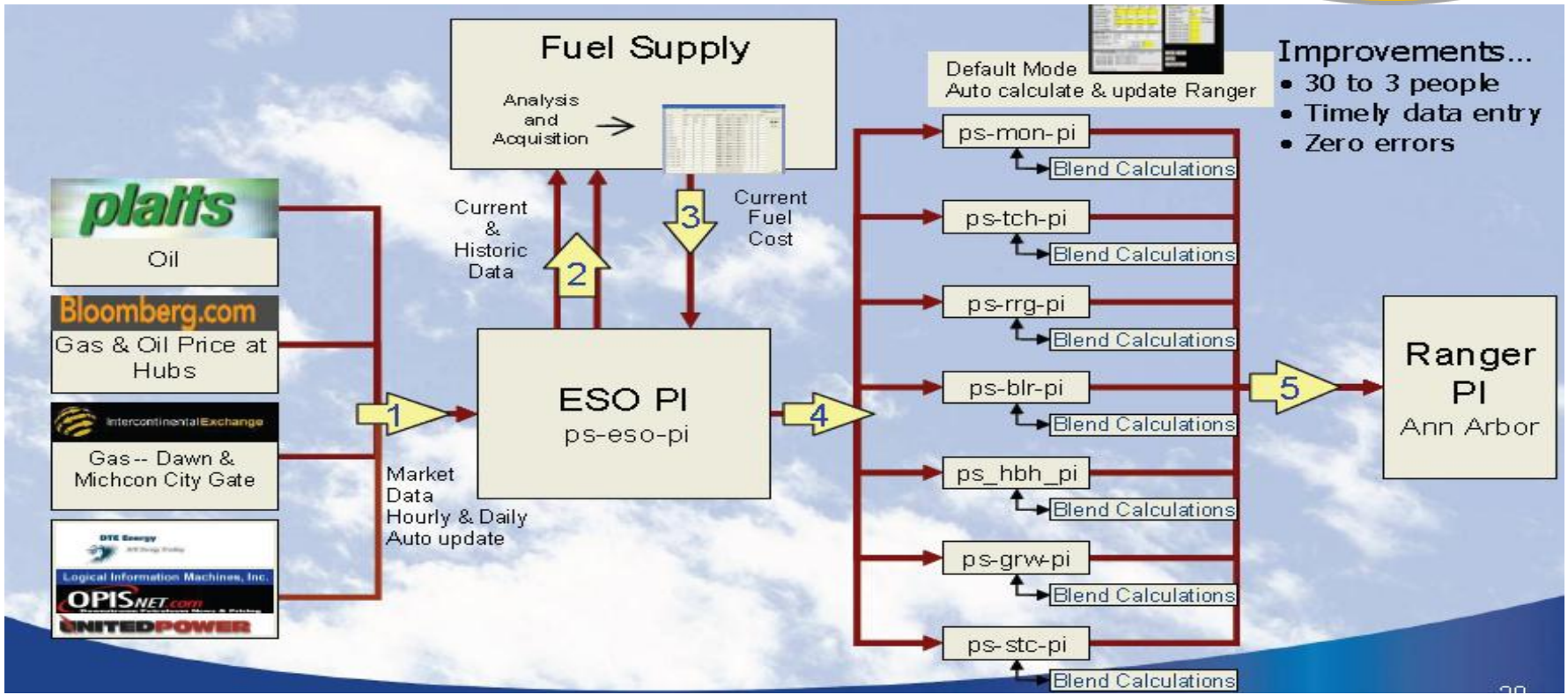
Focus on operating near NOx budget curve

DTE Energy – Before Fuel Cost Framework

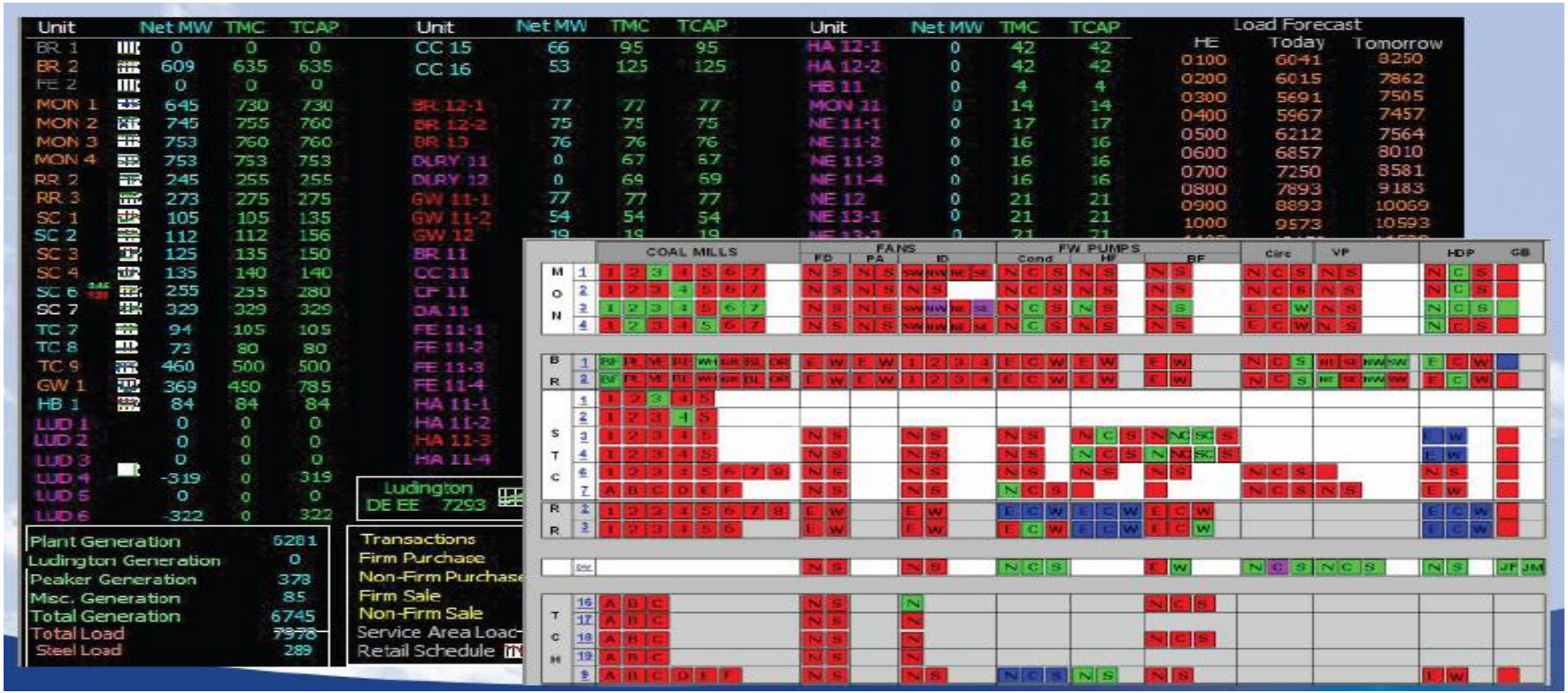


DTE Energy – Fuel Cost Framework

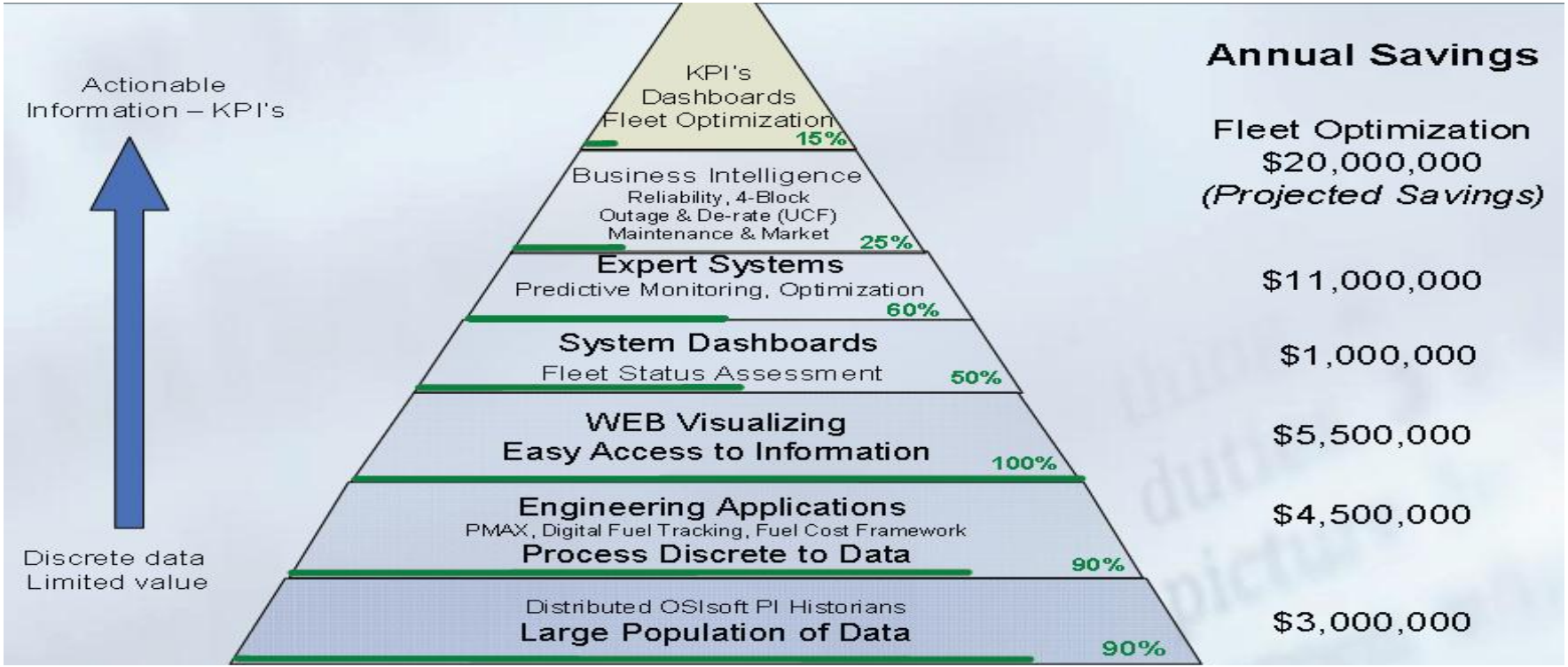
$530,000
Annual Savings



DTE Energy – Fleet Status



Technology Frame Work – Complete Picture

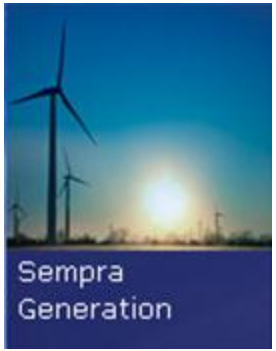


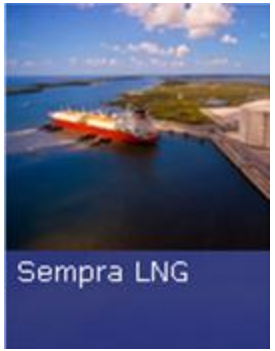
Sempra Energy

Sempra Energy®

‘Regulated’ Operations

‘Unregulated’ Operations





Sempra's Integrated Energy Business

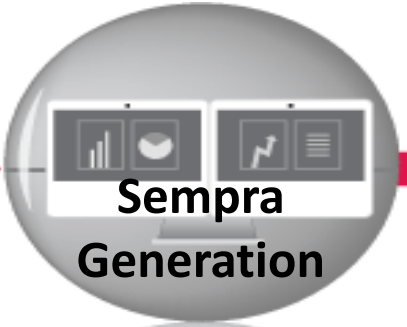
New Supplies

- Leading developer of LNG import facilities

Gas Transportation & Storage

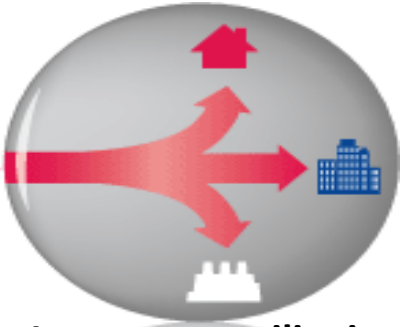
- Rockies Express is the largest pipeline built in 20 years
- 150 Bcf of natural gas storage

Electric Generation



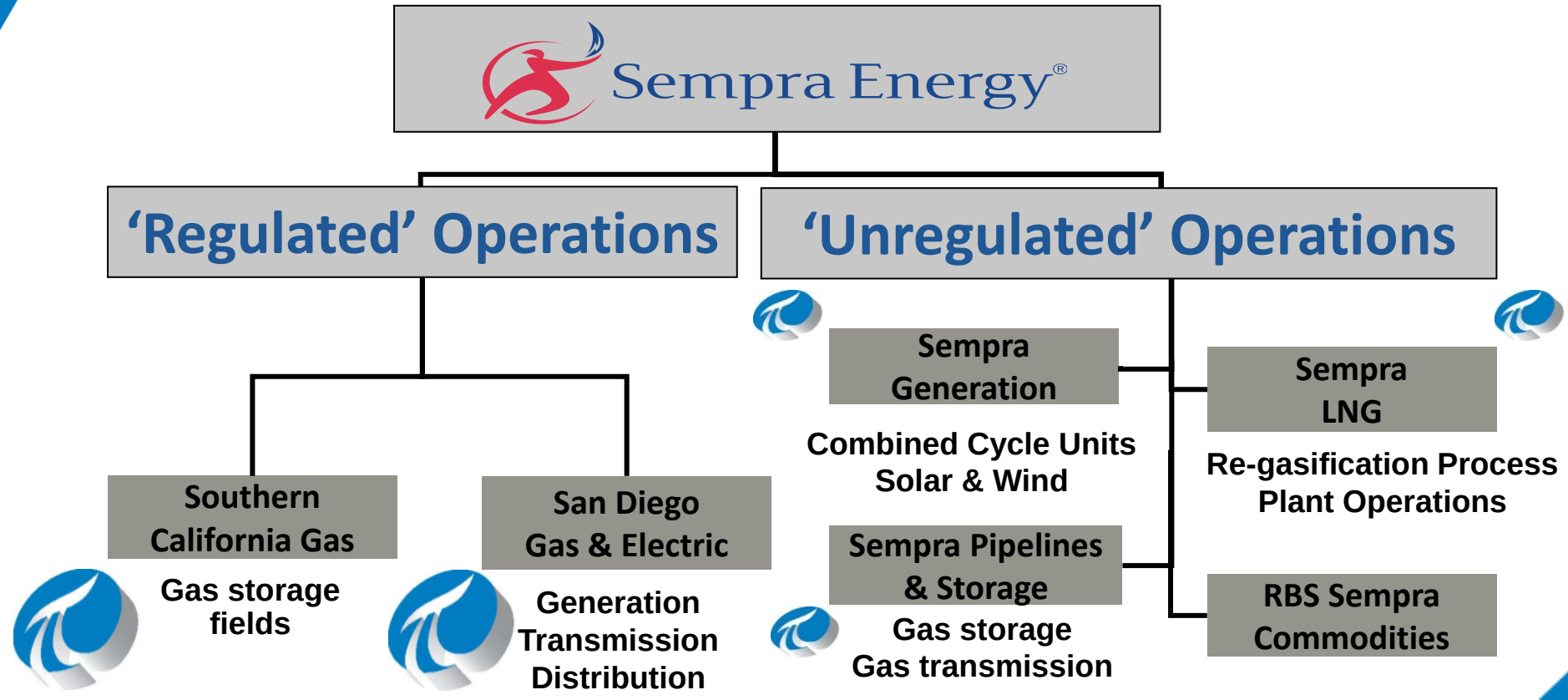
- Thermal power plants and renewable

Gas & Elec. Transmission & Distribution



- Largest gas utility in the U.S.
- Serve 29 million consumers

OSIsoft PI System Deployment in Sempra

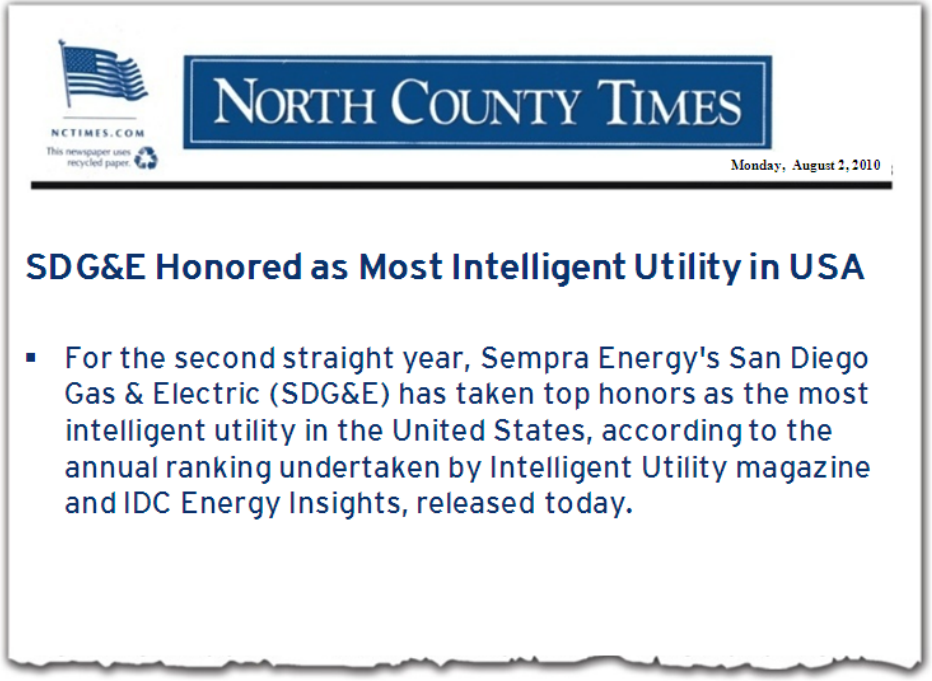


Quotes:

“We turned all of our operators into **businessmen**.” Vice-President Sempra Generation

“In every business I’ve been in where we put the PI System in…**we made money**.” Senior Vice President, SoCalGas

San Diego Gas & Electric (SDG&E)



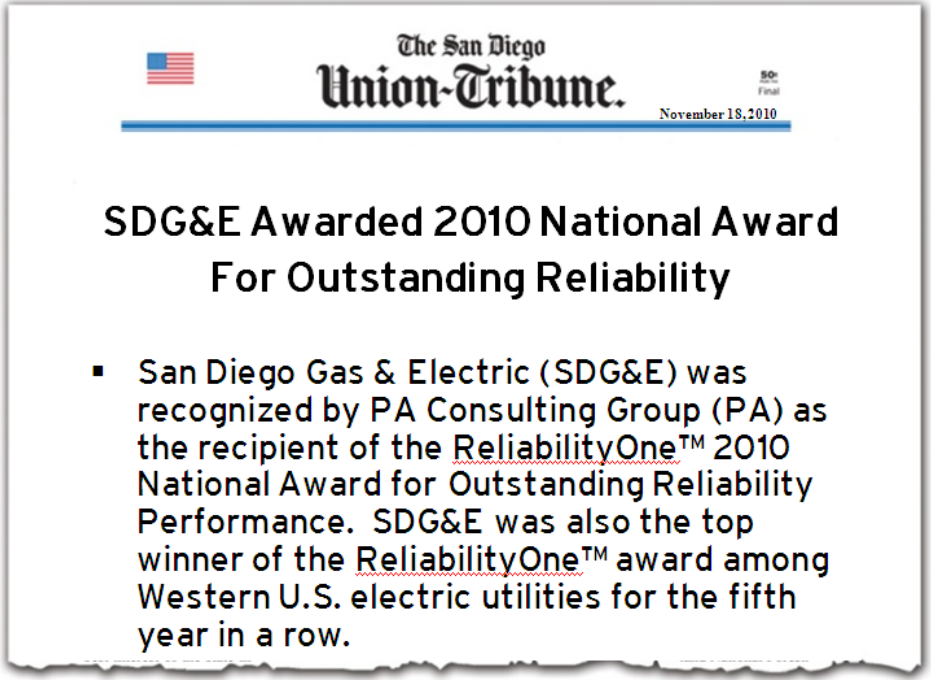
NCTIMES.COM
This newspaper uses recycled paper.

NORTH COUNTY TIMES

Monday, August 2, 2010

SDG&E Honored as Most Intelligent Utility in USA

- For the second straight year, Sempra Energy's San Diego Gas & Electric (SDG&E) has taken top honors as the most intelligent utility in the United States, according to the annual ranking undertaken by Intelligent Utility magazine and IDC Energy Insights, released today.



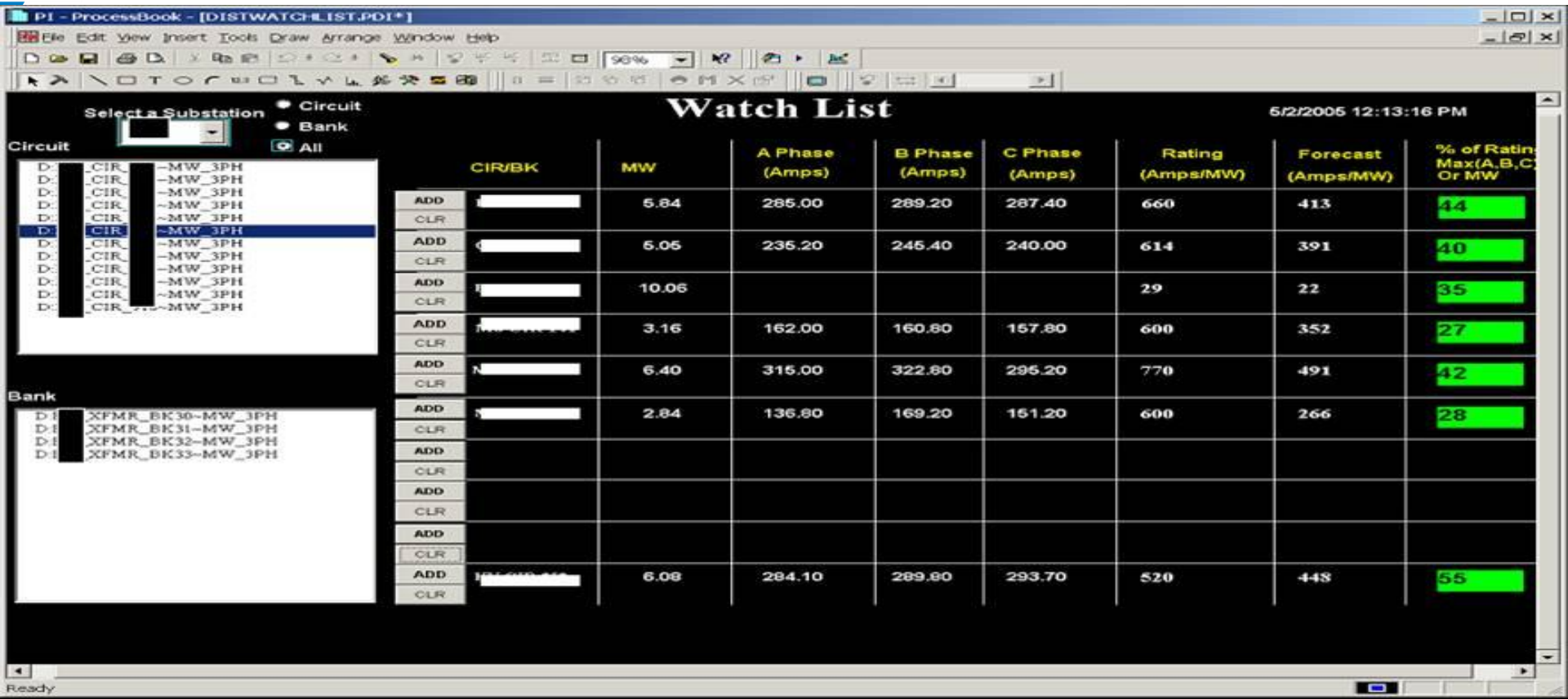
The San Diego Union-Tribune.

November 18, 2010

SDG&E Awarded 2010 National Award For Outstanding Reliability

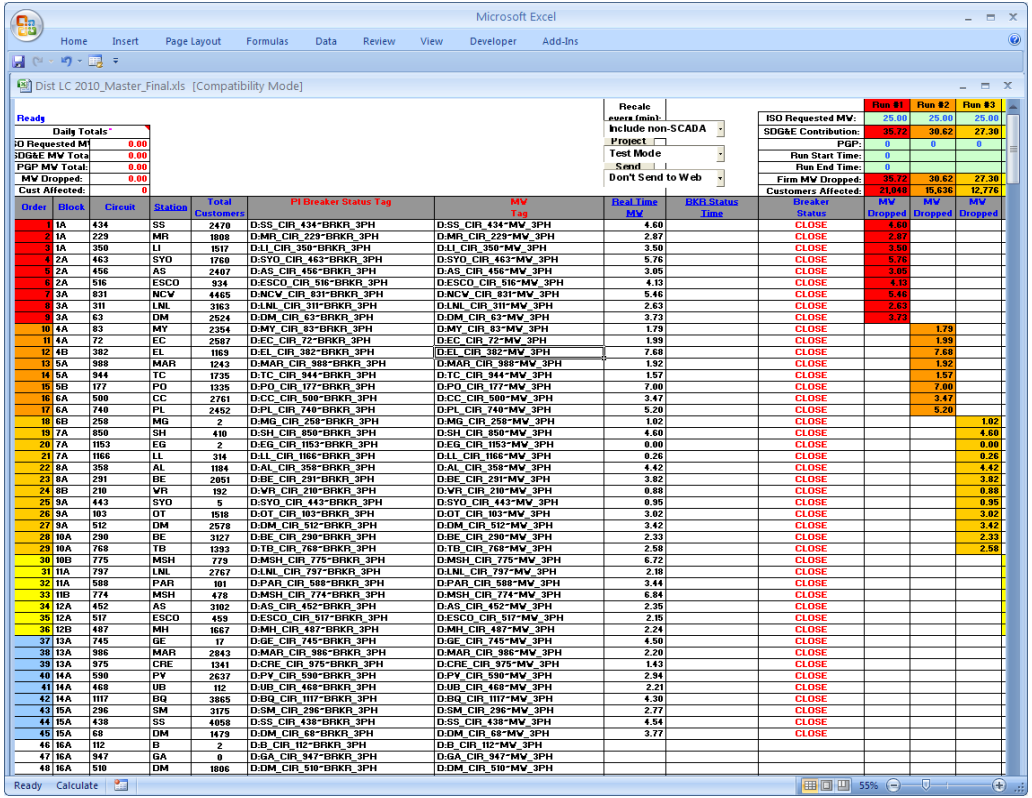
- San Diego Gas & Electric (SDG&E) was recognized by PA Consulting Group (PA) as the recipient of the ReliabilityOne™ 2010 National Award for Outstanding Reliability Performance. SDG&E was also the top winner of the ReliabilityOne™ award among Western U.S. electric utilities for the fifth year in a row.

Distribution Planning – Potential Overload Watch List

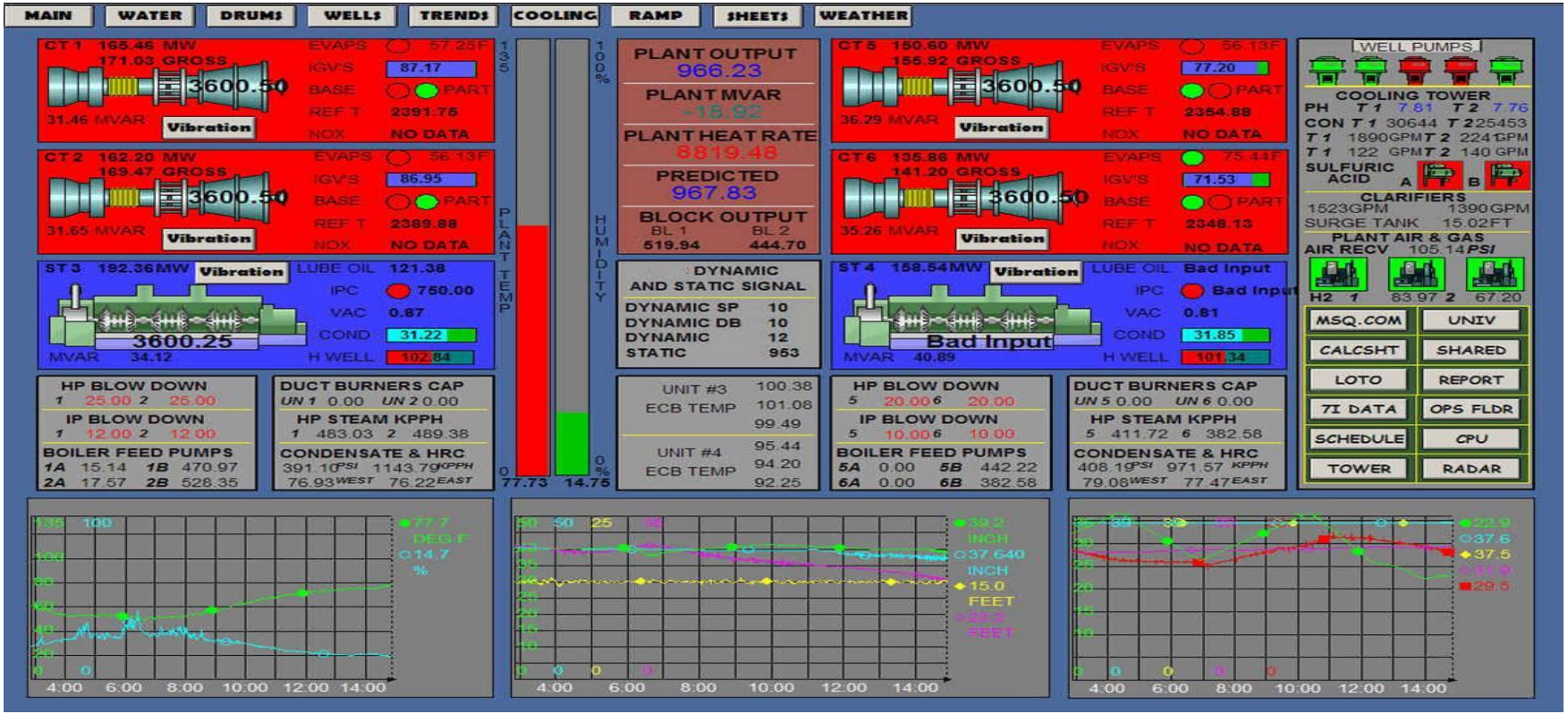


Emergency Operations Load Curtailment – Rolling Blackout

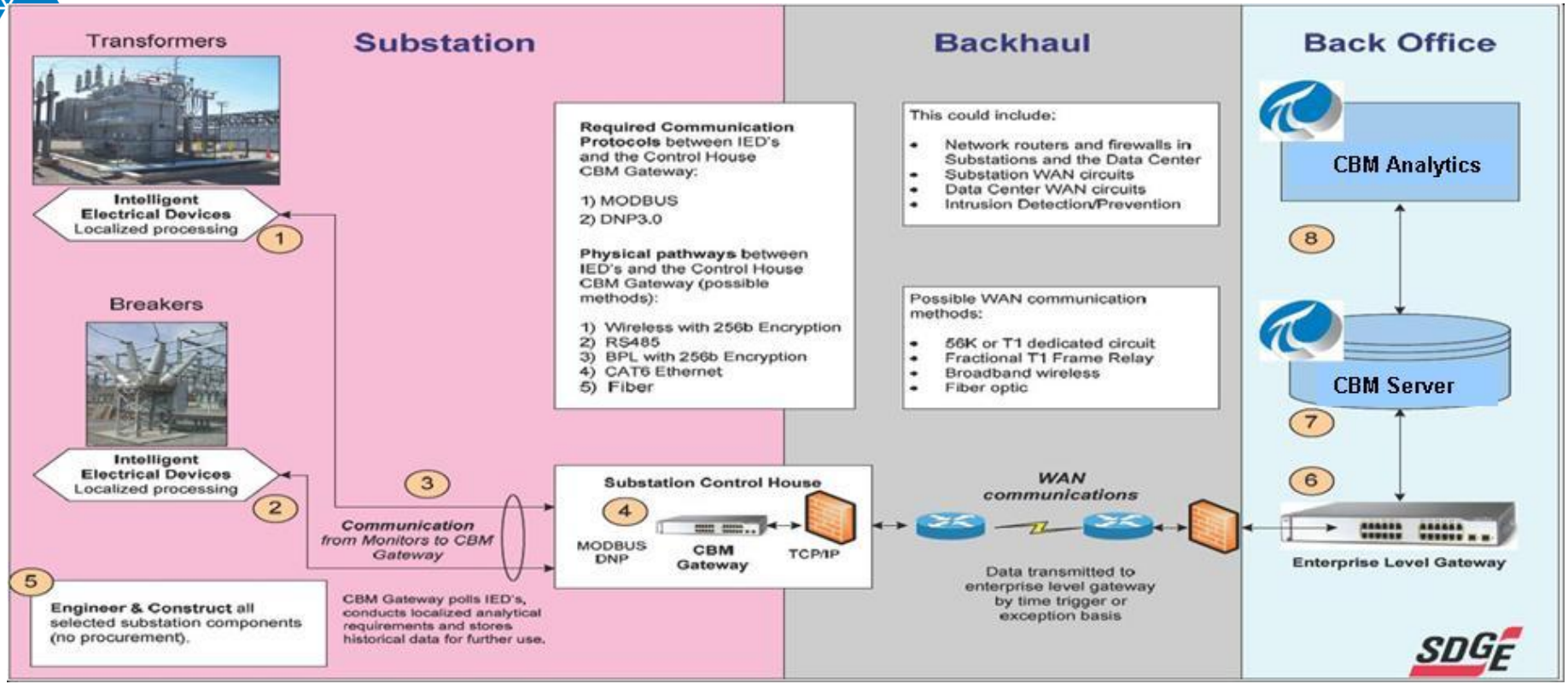
- Enter total MW's required to be dropped
- Show circuit breakers status and MW load
- Automatically calculate how many breakers need to be opened and total customers are out
- Automatically publish to SDG&E public website and report to Utility Commission and Regulator



CCGT Plant Operation



Substation Condition Based Maintenance



Condition Based Monitoring – PI Notifications Email Alert

From: [redacted]@semprautilities.com
To: CBM-XfmrLv4 Ack
Cc:
Subject: [redacted]_BK71_THER_AlarmLevel4

Sent: Wed 1/21/2009 11:57 AM

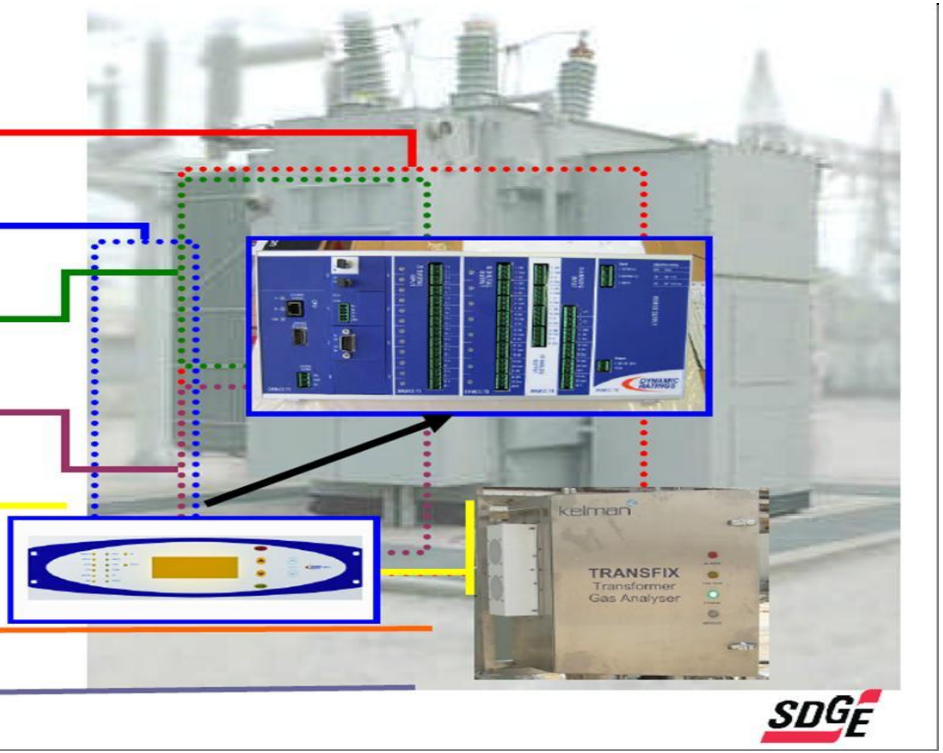
Name: [redacted]BK71_THER_AlarmLevel4
Description: [redacted] Bank 71 Thermal Alarm Level 4
Server: [redacted]T-P01
Database: CBM2
Start Time: 1/21/2009 11:56:24 AM Pacific Standard Time (GMT-08:00:00)
Trigger Time: 1/21/2009 11:56:24 AM Pacific Standard Time (GMT-08:00:00)
Target: [redacted]T-P01\CBM2\SISCO Managed Models\SDGE_CBM\ClassView\thermal[redacted]1 Thermal
Value: Alarm 4
Priority: Normal

Link:
[redacted]- BK71 - Thermal

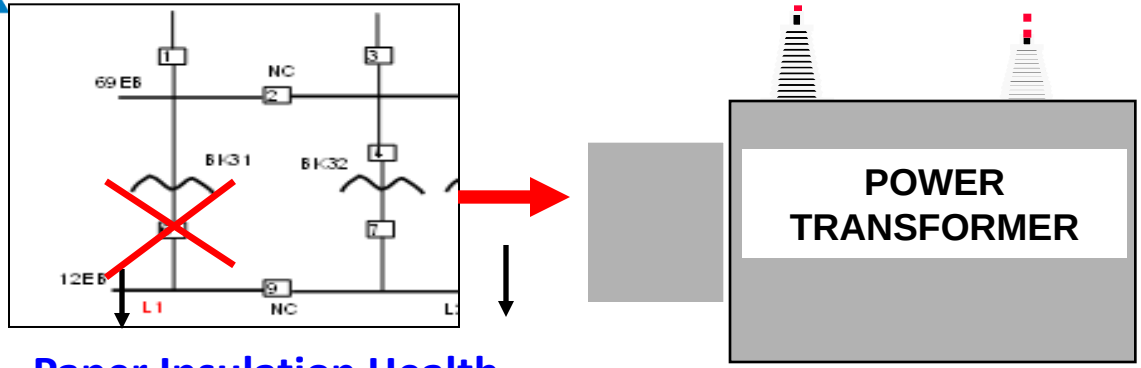
Actions:
Acknowledge
Acknowledge with comment

Condition Based Monitoring – Transformers

- Temperatures
- Cooling System
- LTC Monitoring
- Alarm Contacts
- DGA & Moisture
- Bushing
- Partial Discharge



Operations Decision Support – Transformer at Emergency Rating?



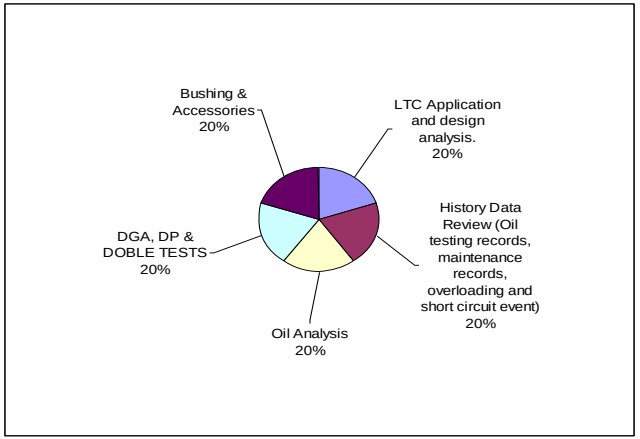
TRANSFORMER Health Indices

- Insulation Power Factor
- LTC Application & Design
- Oil Conditions
- Bushing & Accessories
- Operating History & Conditions

Paper Insulation Health

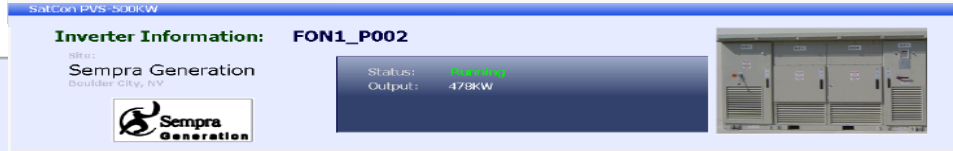
Location of Paper Sample	Degree of Polymerization (DP)
NLTC – Phase A	586
NLTC – Phase B	737
69kV Bushing C	688

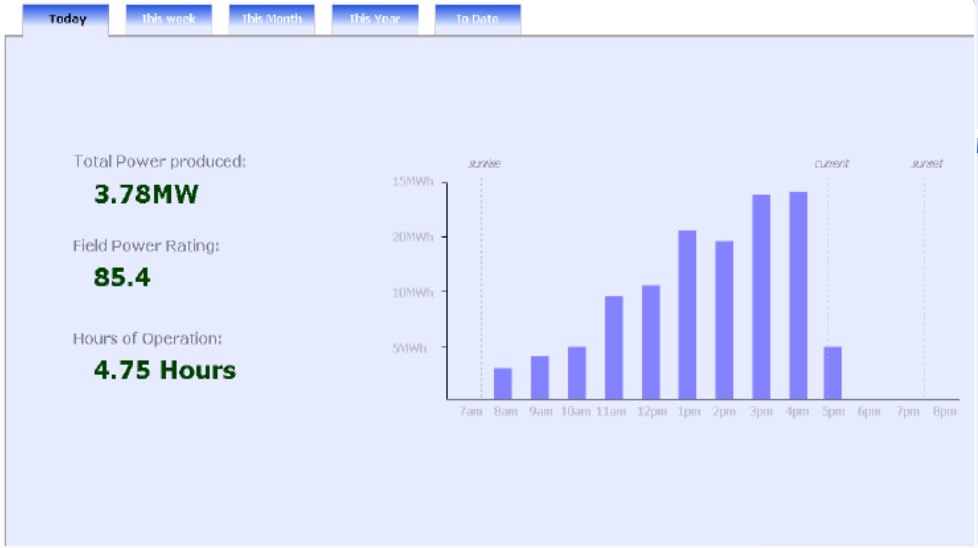
New Insulation Paper:	1000 < DPv < 1300
Middle Aged Insulation Paper:	DPv = 500
Old Age Insulation Paper:	DPv < 251
Severely Degraded Insulation Paper:	DPv < 151

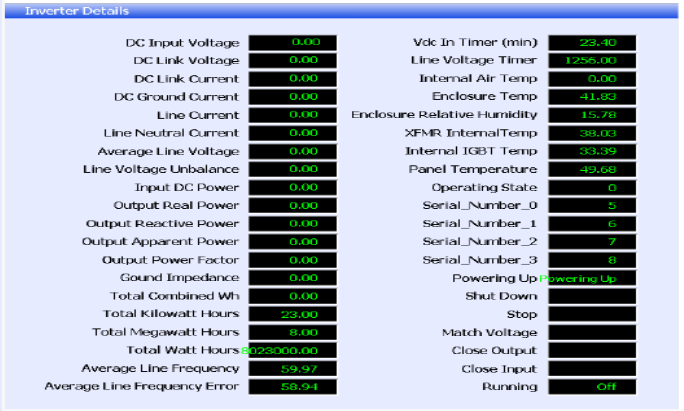


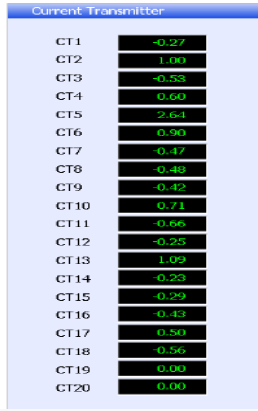
Solar Field Monitoring

- Performance Monitoring
  - DC and AC Output
  - Inverter Operating Conditions
- Weather Conditions





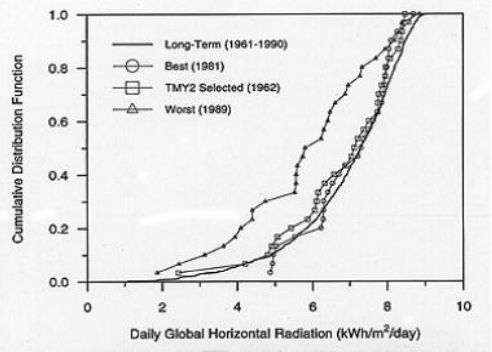




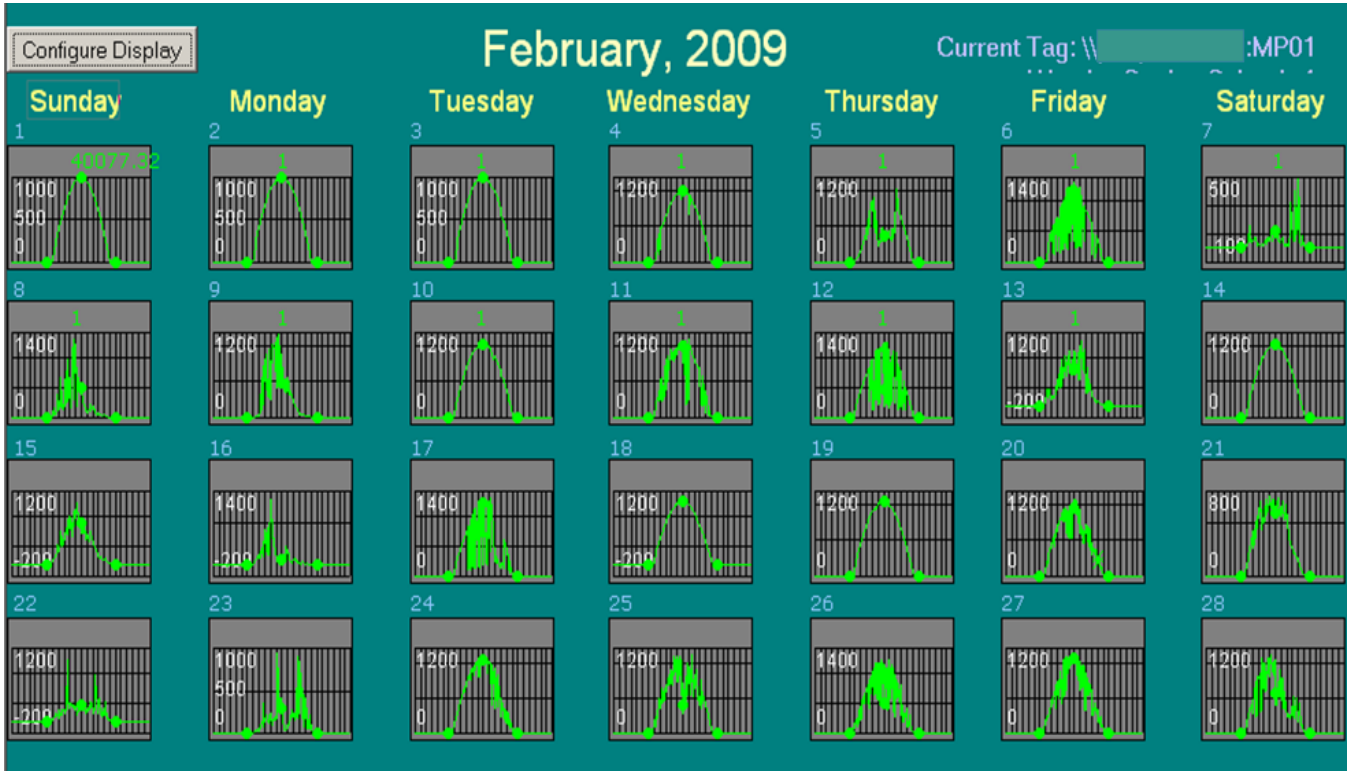
Solar Generation Applications - Irradiance Analysis (Historical, Predicted, and Actual)

National Renewable Energy Lab (NREL)

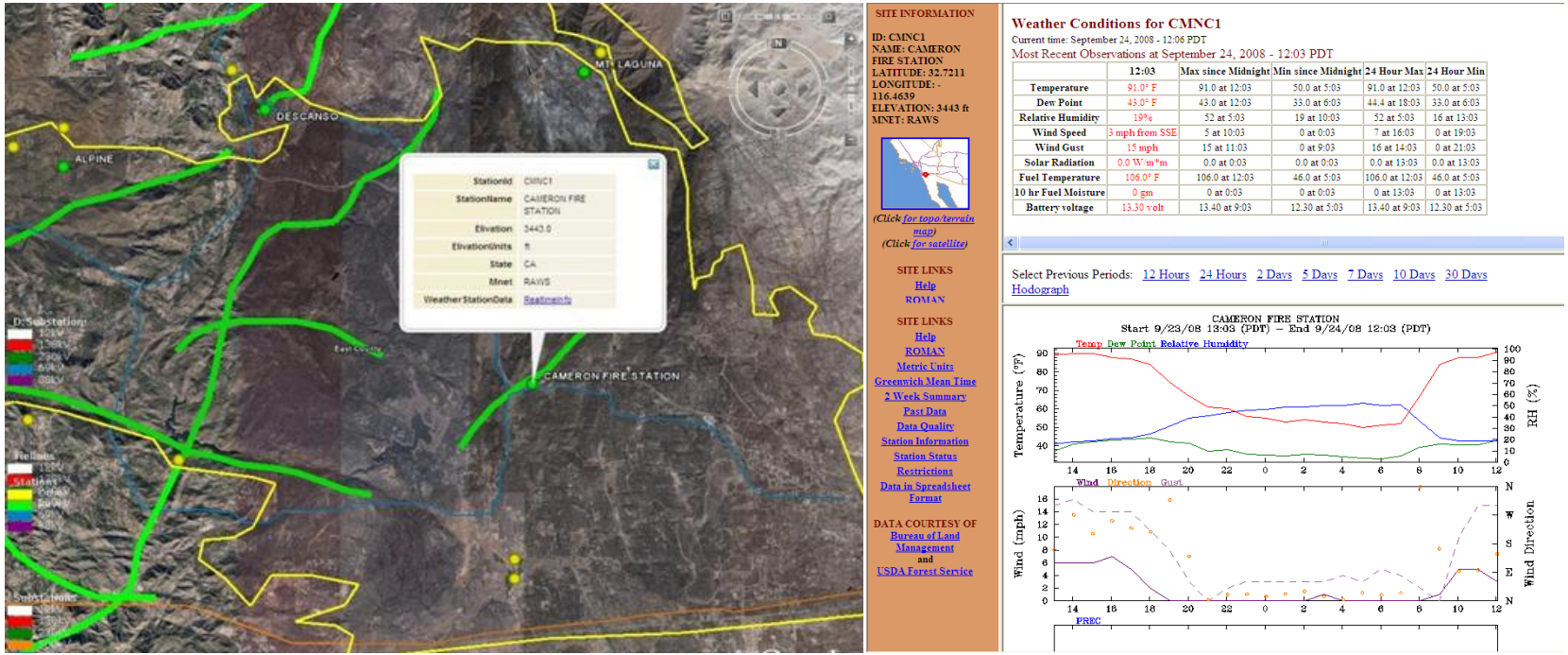
- Typical Meteorological Year (TMY)
- TMY2 and TMY3 Data Sets



Statistical Modeling



Weather Intelligence



- More than 90 pole mounted weather stations to support fire operations and Smart Grid vision
- Currently the 4th largest privately owned weather station network in US; the densest weather station network in the world
- Locations selected by SDG&E's Meteorologist, based on topography, field observations, and fire hazard

Weather Station Network Project

- Real-time weather data every 10 minutes (wind direction, wind speed, wind gust, temperature, and relative humidity, etc.) to provide SDG&E with a better tool to maintain and operate the system safely

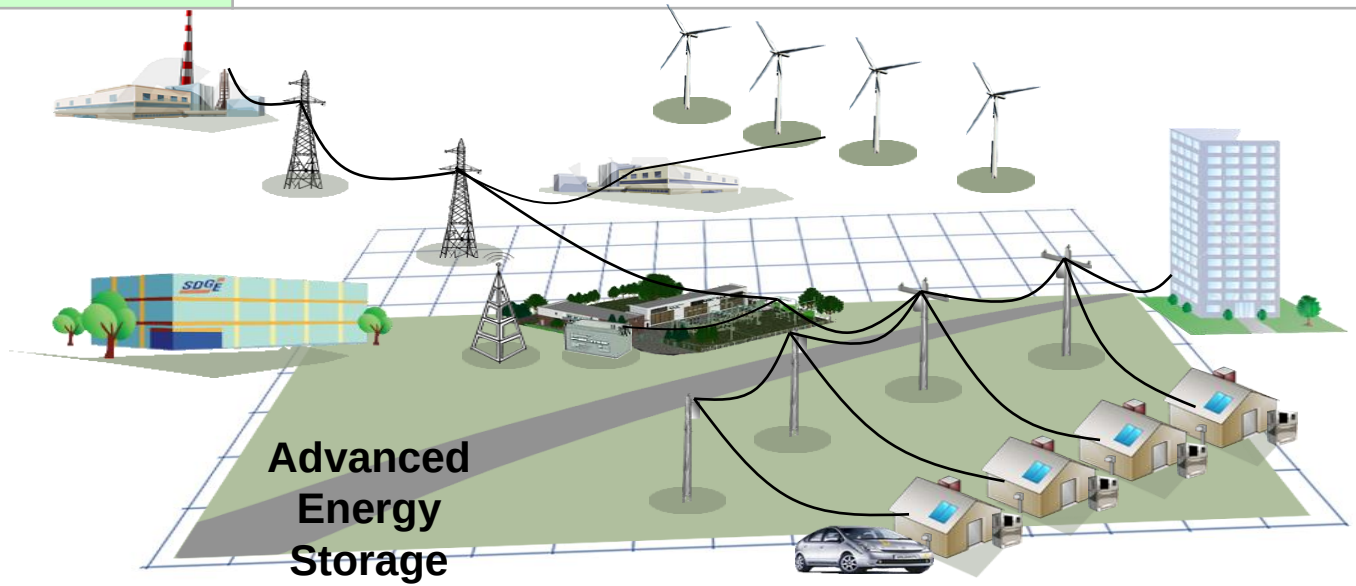
- Viewing winds in areas that have never been monitored to help to “harden” overhead electric system with larger conductors and steel poles to better withstand high winds

- Sharing data with the public, local universities and posting on the National Weather Service (NWS) Site and MesoWest

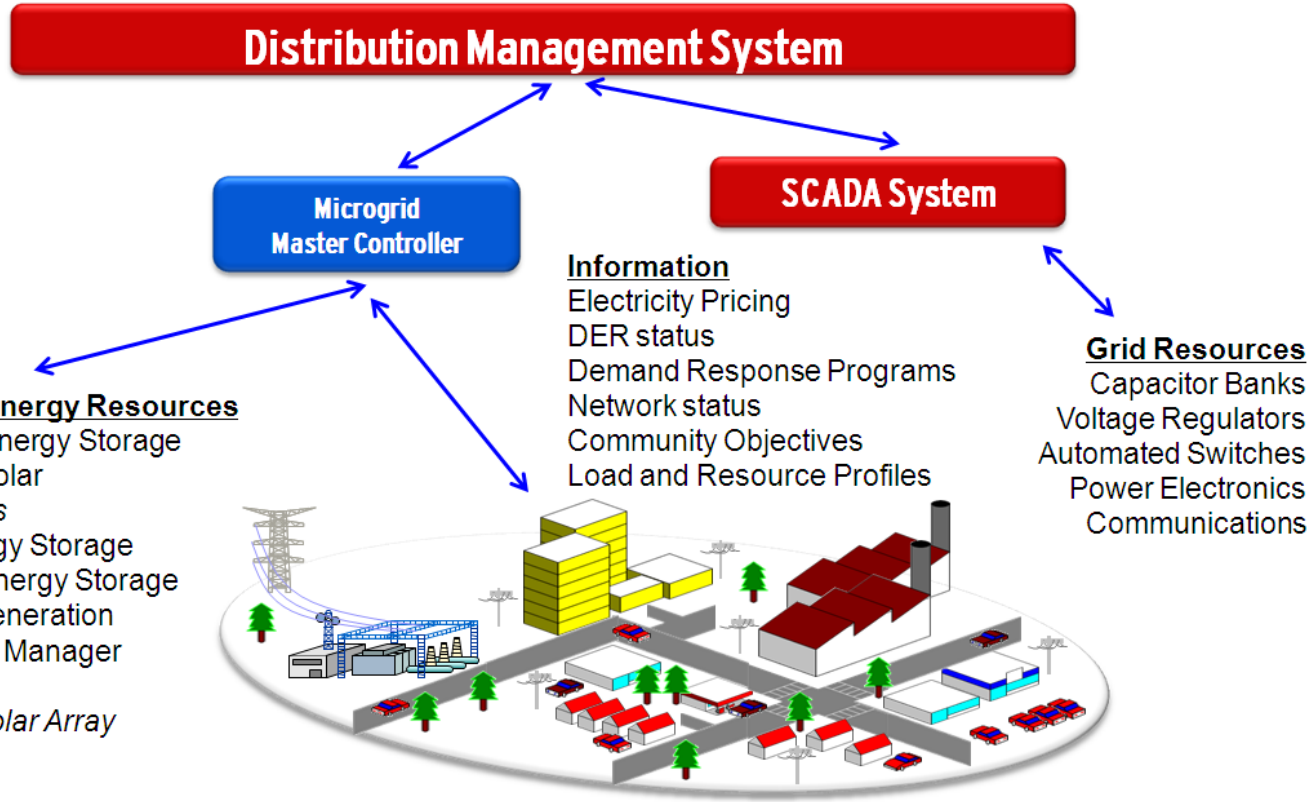
- San Diego First Responders (Fire Agencies) have been provided a mobile SDG&E weather station application and website to access to all SDG&E weather station data and maps

SDG&E RDSI Project

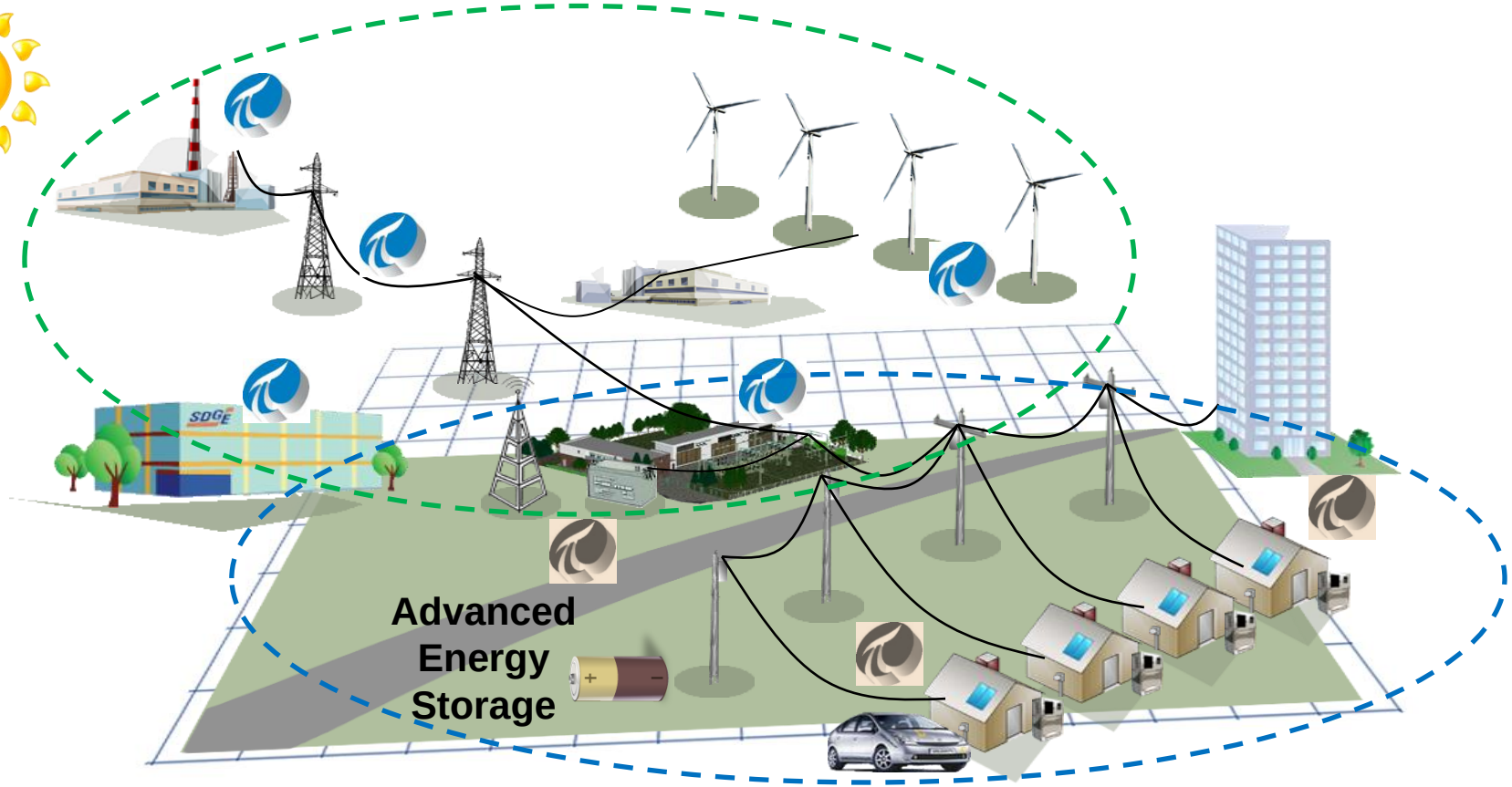
Budget:	$15.2M ($4.1M SDG&E, $7.5M DOE, $2.8M CEC, and $0.8M partners)
Benefits:	▪ Integrate and leverage various generation and storage configurations ▪ Reduce peak demand and enhance overall system reliability



Microgrid Applications



SDG&E's End-to-End Energy Value Chain



Quotes: Patrick Lee, Vice-President Energy Supply, SDG&E

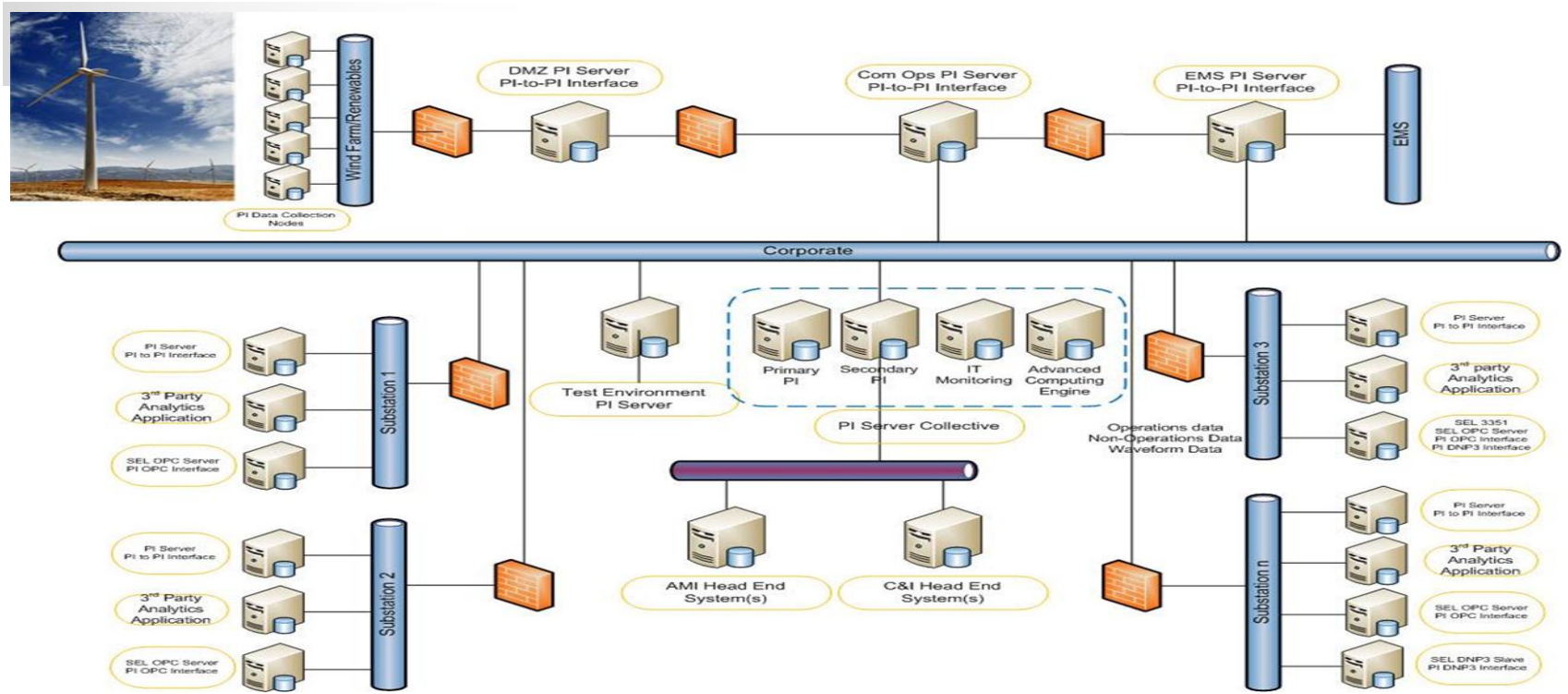
“Data is in silos today…Smart Grid will drive end-to-end data integration!”

“As you have seen in some of our applications using the OSIsoft PI System, I believe we have only scratched the surface in turning available data into valuable and relevant information. We will continue to expand our data collection, analysis, and modeling capabilities at Sempra Energy. ***We believe a successful company must have the ability to make good judgment decisively.*** This core capability is best augmented by a powerful data and information system. We believe the OSIsoft PI System is a key component of this data system.”

Opportunities For Future Applications in PI System

- More renewable energy development
- Electric vehicles planning
- Roof top solar and electric vehicles integration
- Roof top solar PV monitoring
- Smart meters
- Renewable and distributed systems integration (RDSI)
- Microgrid
- Energy market assessment & transaction
- Create synergy across the integrated business

Smart Grid City – Xcel Boulder CO

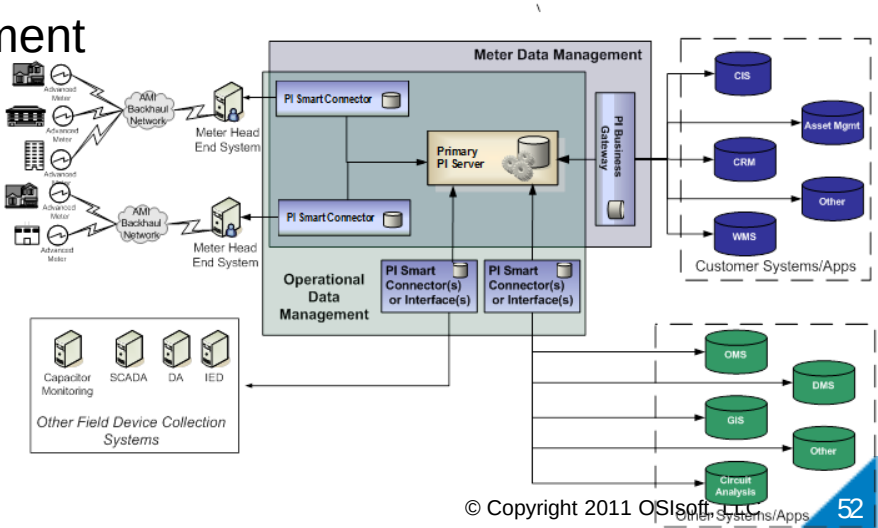


Meter to Cash and Smart Grid with Meter Data

- Primary Reason for AMI
  - Billing
  - Customer Service
  - Metering Efficiencies
- Secondary Reasons for AMI
  - Operations
  - Voltage/PQ
  - TLM
  - Outages

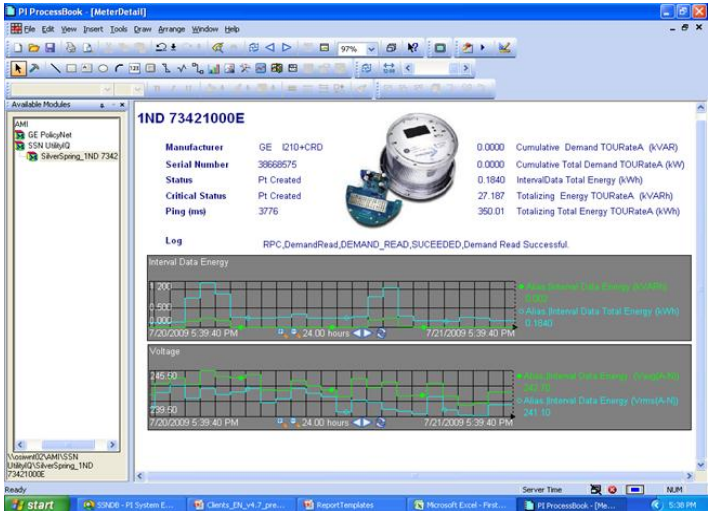
Operational Data Management – What is it?

- Operational Data Management System
  - Blend of **Meter** and **Operational** data in one system
  - Provides end to end seamless view of the Grid
  - Data Base of record for time series data
  - Meter and Substation data Management
  - Visualization with Situational awareness



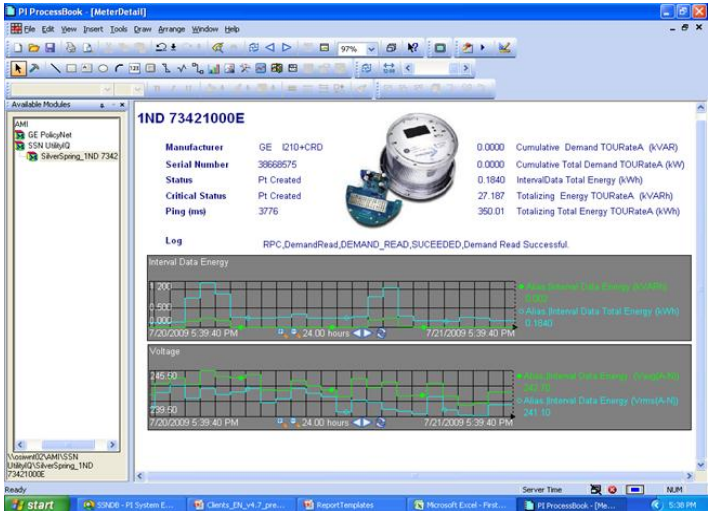
Smart Meter Data Value – Outage Management

- Outages
  - Remote meter reading
  - Assist in Identifying Nested Outages
  - Data Base of record for time series data
  - Reduces “Ok on arrival” calls
  - Fewer Truck rolls



Smart Meter Data Value – Low Voltage Monitoring

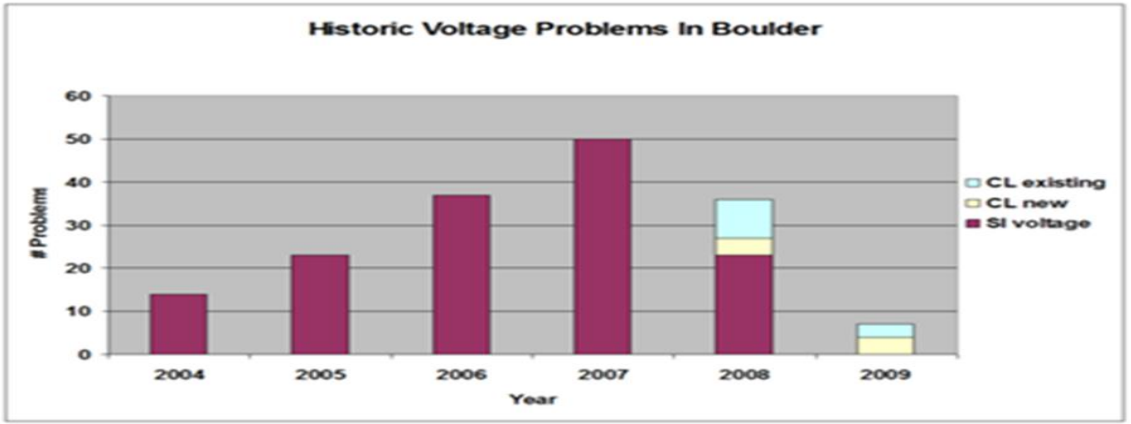
- Voltage
  - Enhance Power Quality
  - Improved Customer Service
  - Better Grid Efficiency



Smart Meter Data Value – Low Voltage Monitoring

Voltage Problem Resolution

Data: YTD, June 2009



CL existing: Existing issue monitoring
CL new: Detected issue
SI voltage: Service investigation needed

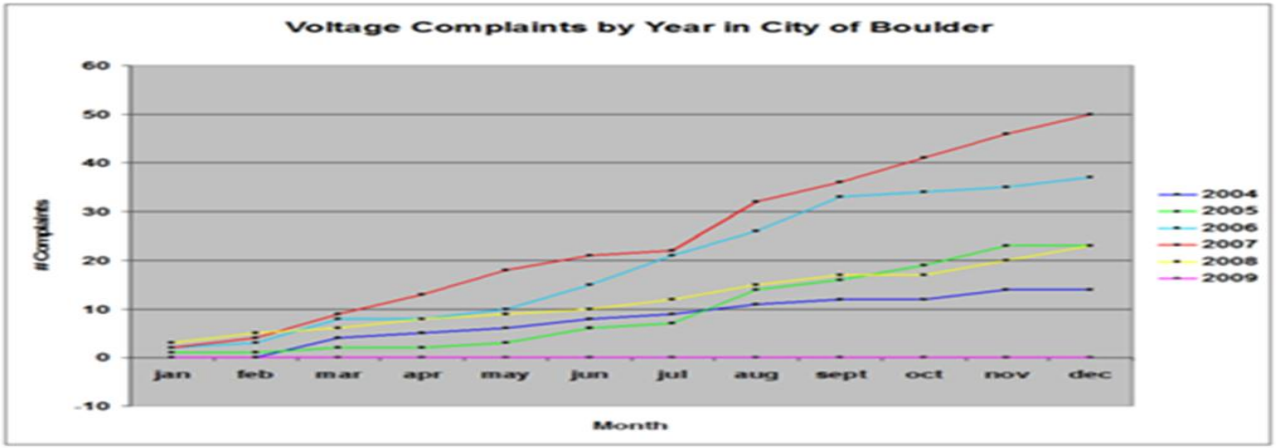
Xcel Energy® | RESPONSIBLE BY NATURE™

11

Smart Meter Data Value – Low Voltage Monitoring

Reduced Customer Complaints

Data: YTD, June 2009

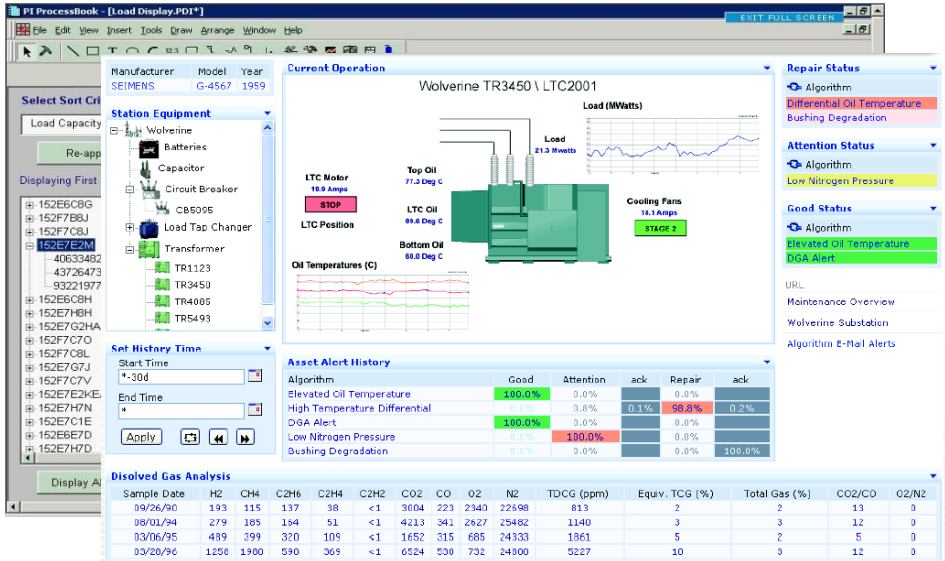


Xcel Energy® | RESPONSIBLE BY NATURE™

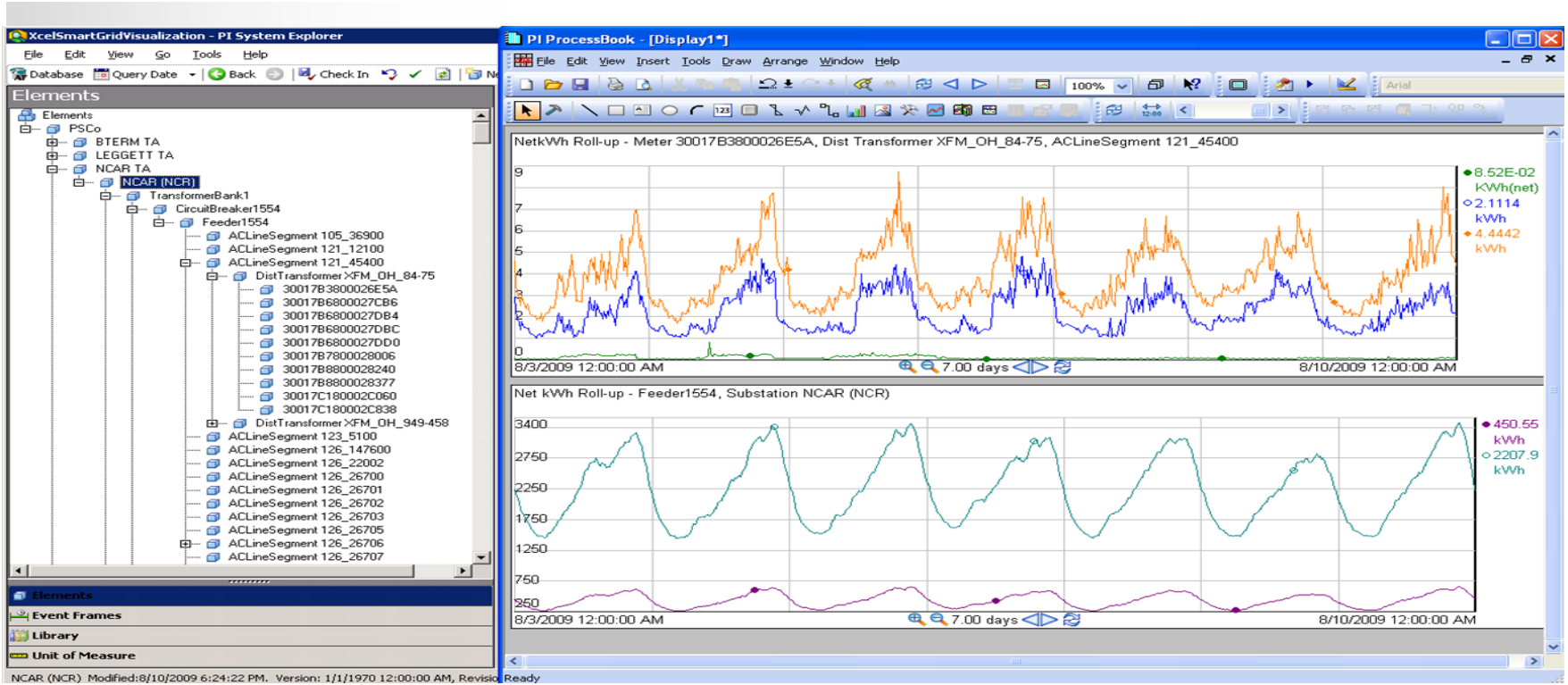
12

Smart Meter Data Value – Transformer Loading from AMI Data

- Outage Avoidance
  - Early Detection of Problems
  - Shorter and few outages if they occur
  - Improve maintenance



Smart Meter Data Value – Transformer Loading from AMI Data



Smart Meter Data Value – Transformer Loading from AMI Data

Transformer Overload Detection

Data: YTD, June 2009

YEAR	UNPREDICTED FAILURES	CURRENTLOOK DETECTIONS	BOULDER TOTAL
2005	7	NA	7
2006	13	NA	13
2007	6	NA	6
2008	6	3	9
2009	0	4	4

Xcel Energy® | RESPONSIBLE BY NATURE™

9

PI System Value Proposition

- Improve real-time & historical data analysis & modeling
- Increase timely decision making capability
- Enable energy market assessment & transaction
- Improve abilities for new business development
- Extract value from capital investments
- Support innovation
- Optimize operations and maintenance costs
- Improve system performance and reliability
- Increase productivity
- Improve customer satisfaction
- Improves safety and environmental compliance
- Enable end-to-end integration

Conclusion

- PI System delivers value out of the box and over time
- Customers can improve their businesses in silos
- PI System can deliver value in ‘regulated’ or ‘unregulated’ operations
- Acceleration of PI System expansion can occur with cooperation between operating units, IT and leadership
- Enterprise agreements can help customers accelerate end-to-end integration
  - Enterprise Project Manager and Account Manager
  - Access to Center of Excellence (Max VALUE from PI System)
  - PI System monitoring
  - Lose the “tag” constraint mentality and think “eat more PI”

Thank you