PowerCore ENGINEERING

Monitor - Control - Manage - Analyze

EcoXpert™

Certified by Schneider Electric

Power Monitoring and Energy Management Solutions

Challenges configuring Metering and Reporting systems:

Effective Considerations

PowerCore Engineering

COMPANY INTRO

- PowerCore is a Power Distribution System Engineering Company and a turnkey Automated Systems Integrator based in London Ontario.
- We specialize in Power Systems Engineering and Design, Engineered Drive Systems, PQ solutions, Power Management and Energy & Demand Control Automation systems.
- PowerCore is a team of skilled Electrical Engineering specialist with experience in leading edge technology solutions that enable our clients to optimize their power distribution system assets and generate sustainable results in Energy Cost Reduction
- *We deliver services and products to commercial, institutional and industrial establishments and have the capacity to provide solutions ranging from limited scope to very complex projects*

Electrical Energy

– What Makes up the Cost ?

Peak Demand charges

"Peak kW Draw"

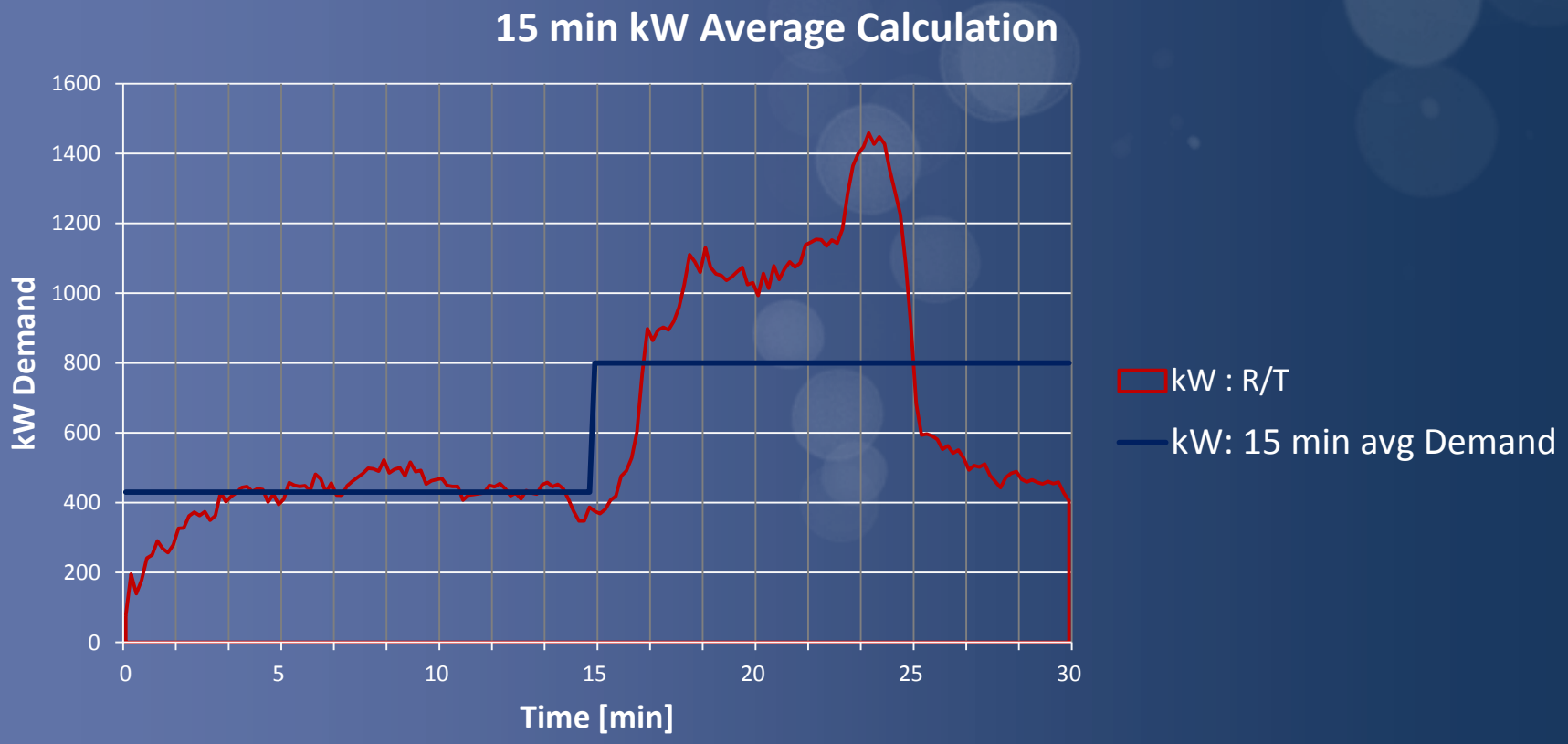
- kW Demand (*"Rate or power flow"*) is typically calculated as the facility's draw averaged over 15 min window *(SD: "Sliding Demand").* The SD value changes every 15 minutes, and is typically synchronized on top of the hour
- The maximum 15min kW Demand throughout a month will be selected as a Peak Demand (*"Billing Demand"*)
- The kW charges for the entire month are derived from one 15min Peak Demand throughout the month.
- There are number of charges related to the kW on the electrical bill.

Consumed Energy charges

"Electricity kWh consumed"

- kWh is the amount of Electrical Energy used in the facility.
- Energy is usually tied to the requirements of the bldg operation, processes, machinery, facilities req's etc.
- The kWh is the kW demand integrated (i.e. totalized) over the course of the entire month.
- The kWh charges on the electrical bill are derived from the monthly Energy Total
- There are number of charges related to the kWh on the electrical bill.

Peak Demand Calculation – EXAMPLE



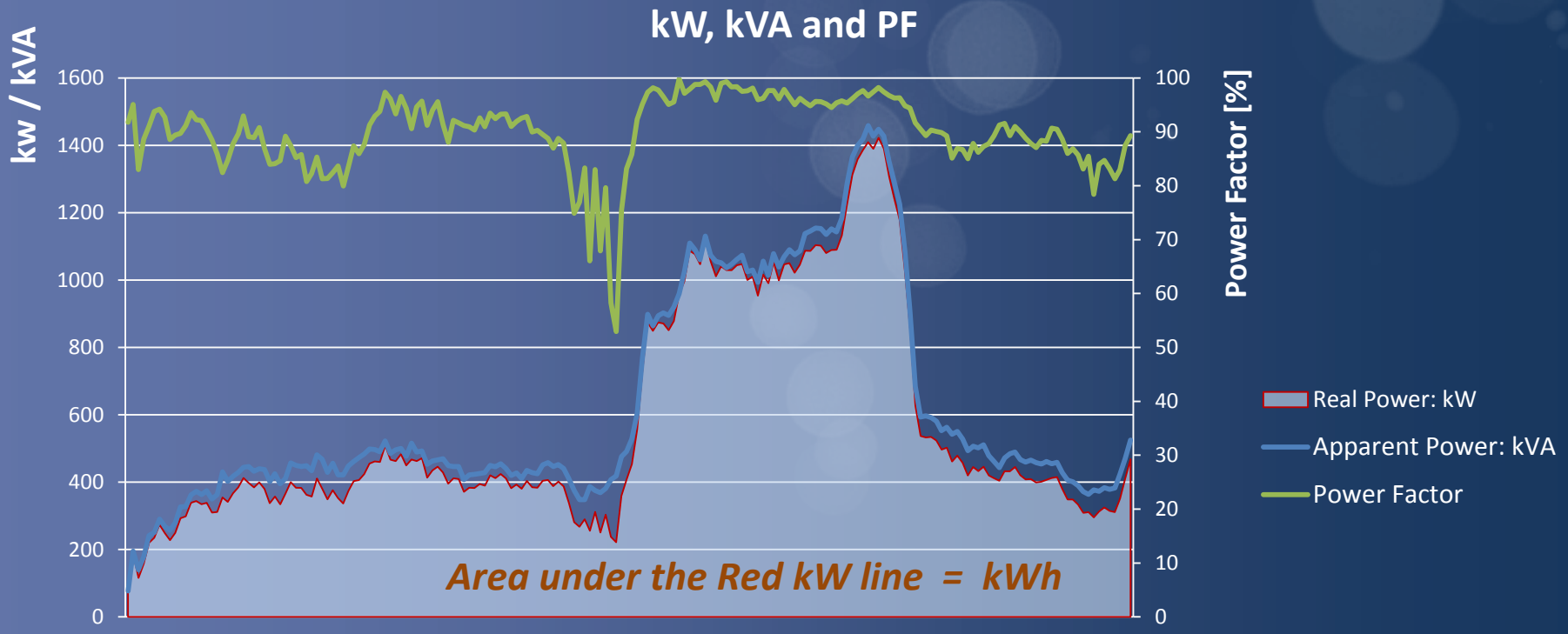
kW Demand calculated as an average value of Real Time kW over 15 minute period

NOTE 1: Instantaneous peaks have negligible effect on the 15min Demand

NOTE 2: a term "Sliding Demand "is used where the kW demand is calculated across 15 min window that continuously "slides " along the Time axis in defined increments (e.g. 15 or 5 minute "jumps")

kWh, kW & kVA Demand

– Daily Profile example



Power Factor : kW/ KVA => a measure of Real Power vs. the Reactive Power ;

the closer to one the better => 100% PF means no reactive energy is drawn

NOTE 1: Only PF at peak demand is taken into consideration for utility billing purposes

NOTE 2: PF of less than 90% results in low PF penalty

Load Factor : Total kWh / (kW_{PEAK} x # of Days X 24 Hours) => a measure of "flatness " of the demand curve

the closer to one the better => 100% LF means perfectly flat demand

NOTE: Low load factor results in higher kW Peak Demand Charges.

What makes up Electrical Bill

– Electricity Charges Components - *Example*

	Fixed	kW based	kWh based
Electricity Charge			**2.058 ¢/kWh**
Global Adjustment *Charge*			**8.718 ¢/kWh**
Distributon Fixed	**$150.00**		
Distributon Variable		**1.6995 $/kW**	
Transmission Connection Charge		**2.3902 $/kW**	
Transmission Network Charge		**2.9550 $/kW**	
Regulatory Charges			**0.560 ¢/kWh**
Debt Retirement Charge			**0.700 ¢/kWh**
Trfm Discount		**-0.6000 $/kW**	
Interval Meter Charge	**$5.50**		

Energy Efficiency Strategies

– How can Electricity Cost be reduced?

Reduce Peak Demand

=> decrease kW charges

- **Improve Power Factor**
- **Reduce the Peak Demand**
  - ***Control Monthly Peak Demand through implementation of Peak Demand Control system***
- **Demand Response Program** (DR3 - "SaveOnEnergy")
  - ***through implementation of Peak Demand Control***

Reduce Consumed Energy

=> decrease kWh charges:

- Increase **efficiency**
- **Reduce losses**
- **Shift** energy **consumption**

Some of the Strategies:

- ✓ Lighting retrofits
- ✓ VFD retrofits
- ✓ Equipment efficiency improvements

Power Monitoring and Energy Management Systems

– What's the Purpose ?

Real Time Monitoring

- R/T **WAGES**
- **System Load Demand**
- **Power Quality**
- **Abnormal Events**

Energy / Usage Reporting

- **WAGES** Cost
- **Energy Usage trends**
- **Energy usage Transparency**
- **Cost Allocation**
- **Cost-per-occupant** *(commercial & institutional)* or **Cost-per-unit** *(Industrial)*
- *Baseline for* **Energy** *efficiency* **retrofit programs** *(e.g. "SaveOnEnergy)*

Shared Infrastructure

…lling Verification

Power Monitoring and Energy Management Systems

– Who Benefits ?

Real Time Monitoring

Facility Managers, Engineers and Operators

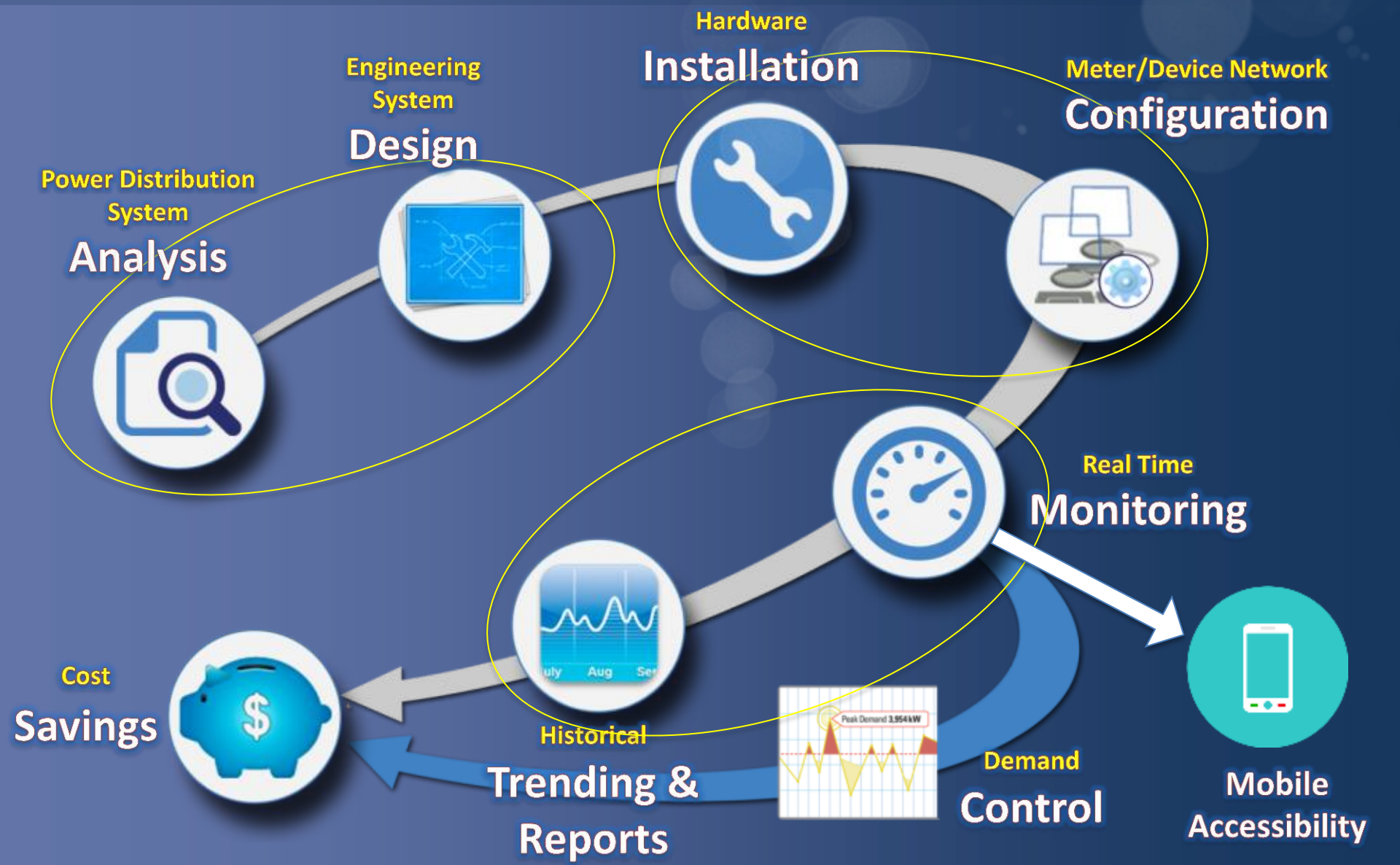
- Real Time Data
  - **Dashboard Overview** (via local or remote PC or Mobile App)
  - **Instant information** on loading and capacity.
  - **Alarms and Warnings**
  - Feedback on **Demand Control performance** *(for Peak Demand control or DR3 Events)*
  - Remote **System Control**
- Logs and Historic Data Analysis
  - **loading** and **power quality trends**
  - **Analyze disturbances**
  - **Root cause Analysis** for abnormal events affecting operation or production

Energy/Usage Reporting

Cost Centers & Energy Managers

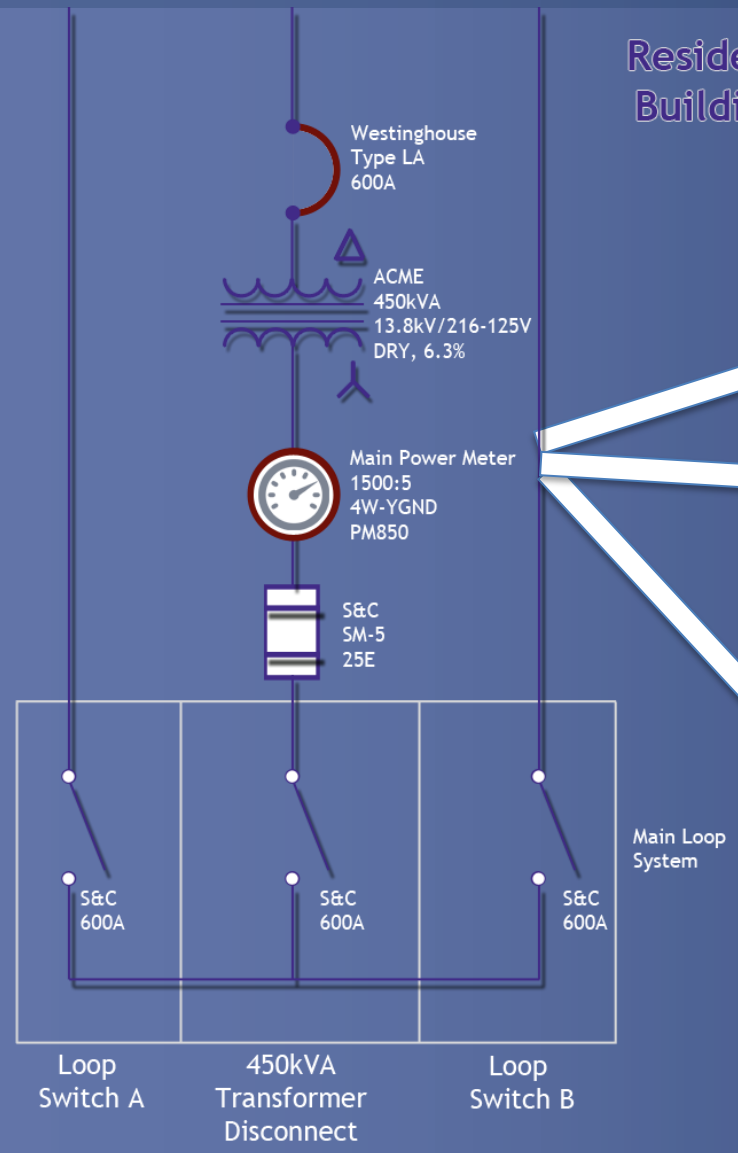
- Energy usage Reports & Logs
  - **Energy** Usage and **Cost Reports** in form of
    - **Profile Charts**
    - **Usage Tables**
  - **Cost-per-unit** analysis, cost **allocation**
  - Utility **billing verification**
  - Baseline & Usage data logs to **monitor performance** following energy saving **retrofits**
  - **Energy usage transparency** to drive conservation

Power Monitoring System
– Successful Implementation Strategy

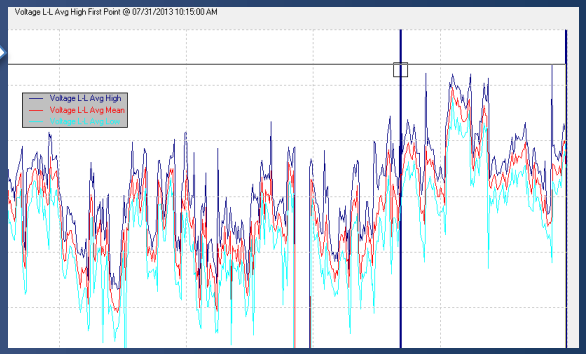


EXAMPLE:
Simple Power Monitoring System

Residence
Building A

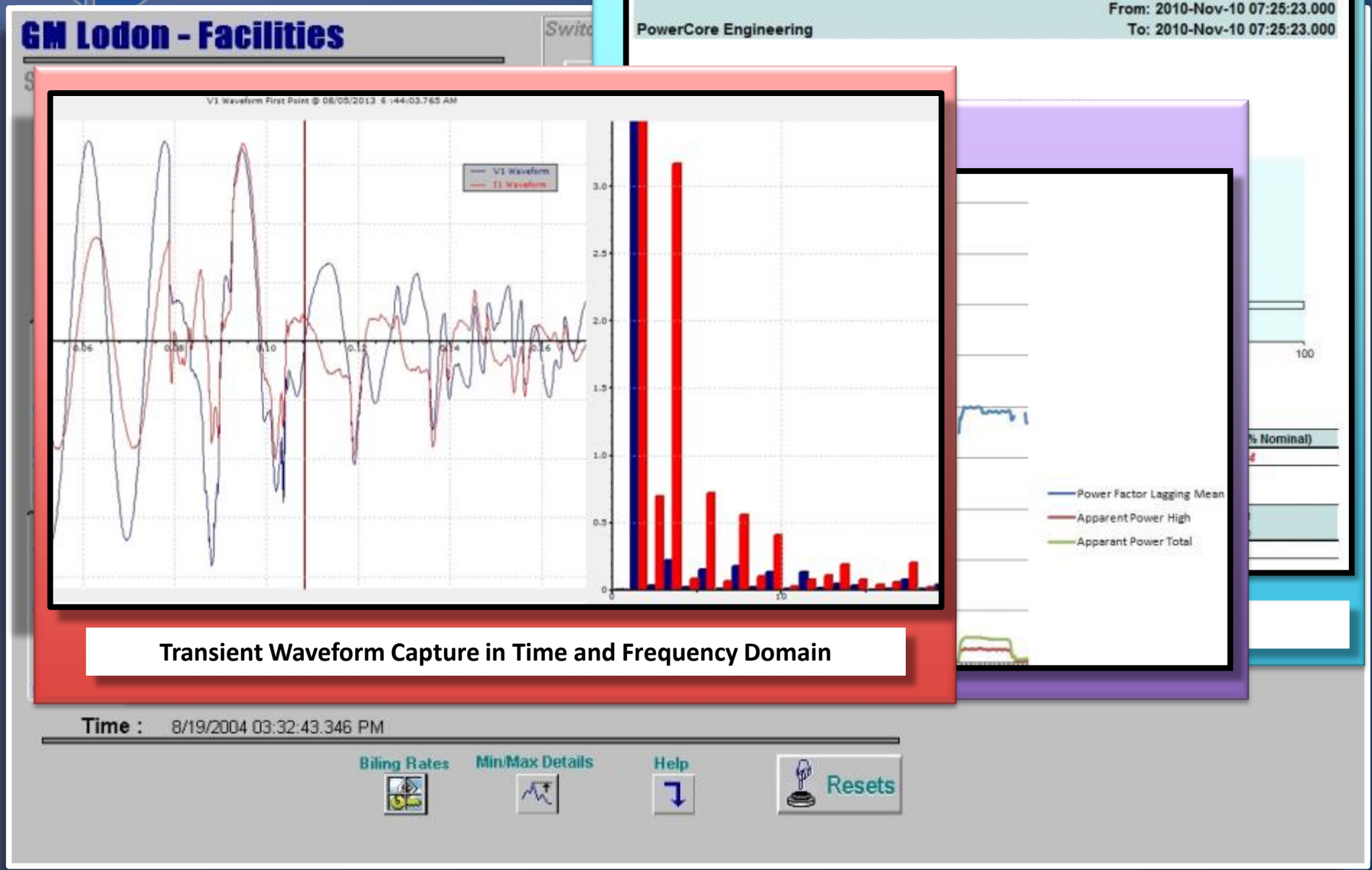


IA	138 A	V A-B	603 V
IB	124 A	V B-C	602 V
IC	118A	V C-A	601 V
I Avg	128 V	V L-L Avg	602 V
kW Total	201 kW		
kVA Total	207 kVA		
PF Total	-99.1%		



ALARM: V L-L Unbalance
9:15AM August 13th, 2013
Phase A-B -> 8.4% **Over Voltage**

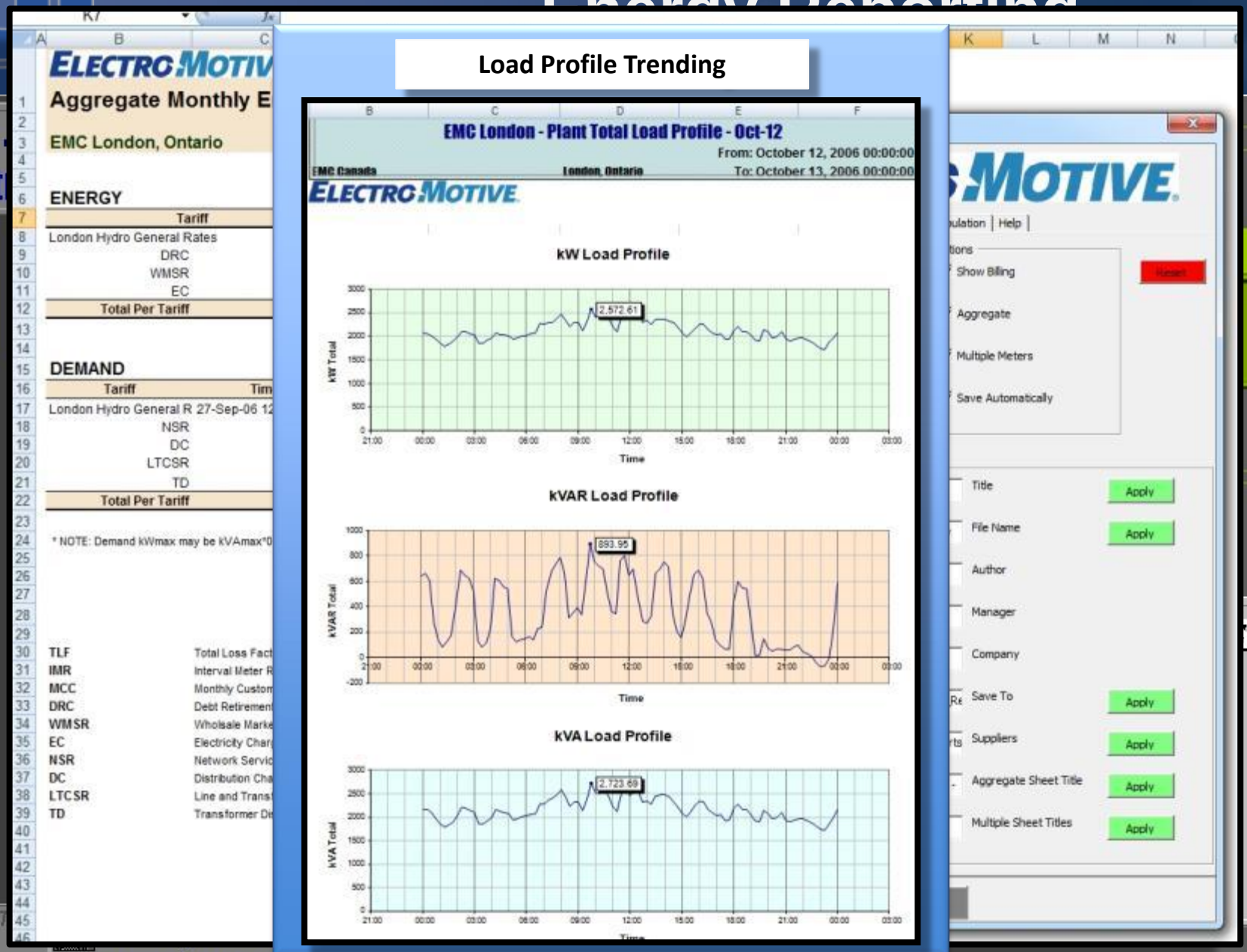
EXAMPLE:
Full Scale PM Application



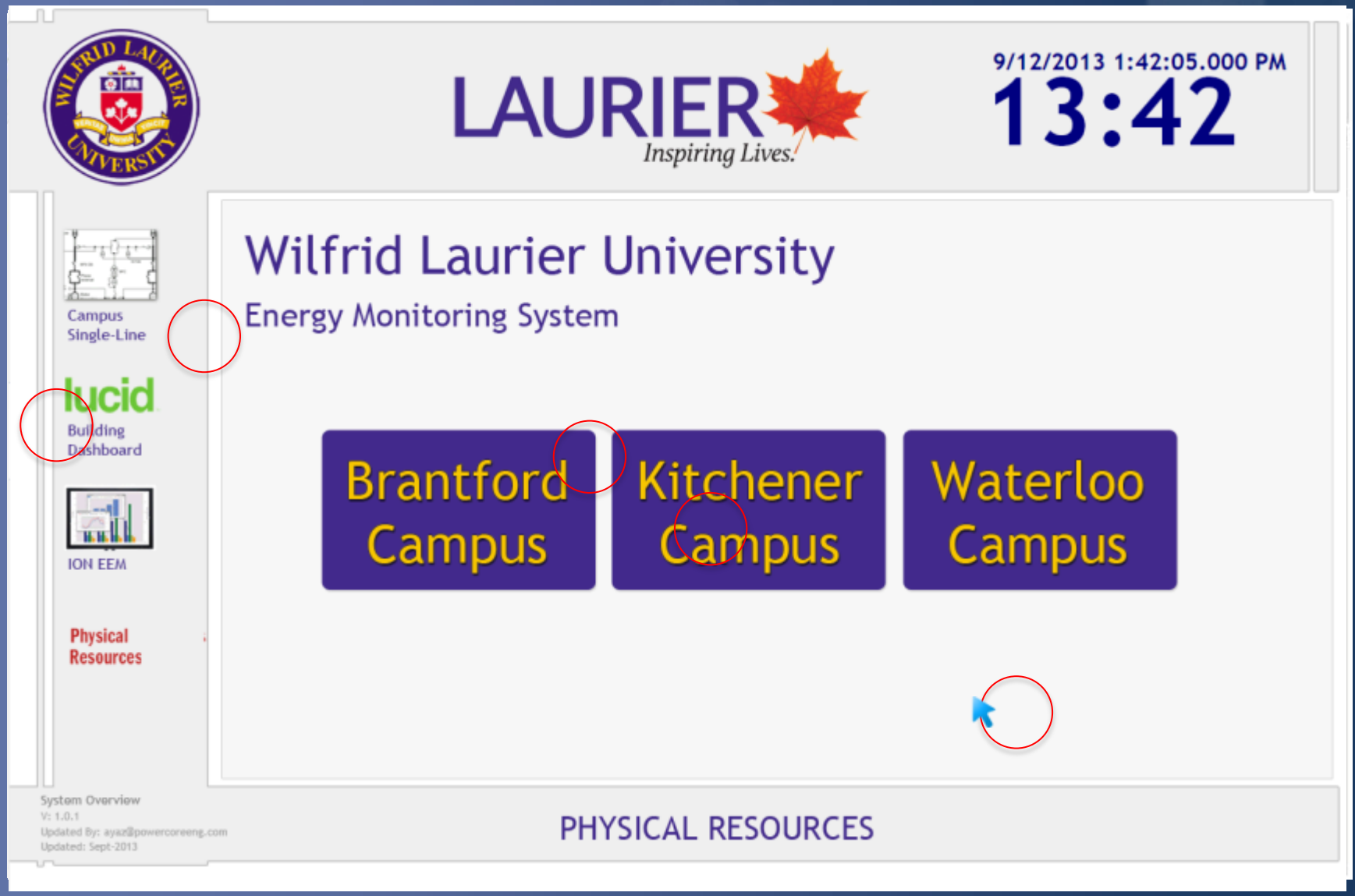
Transient Waveform Capture in Time and Frequency Domain

EXAMPLE:

Energy Reporting



Fully Integrated Commercial/Institutional Power Monitoring System

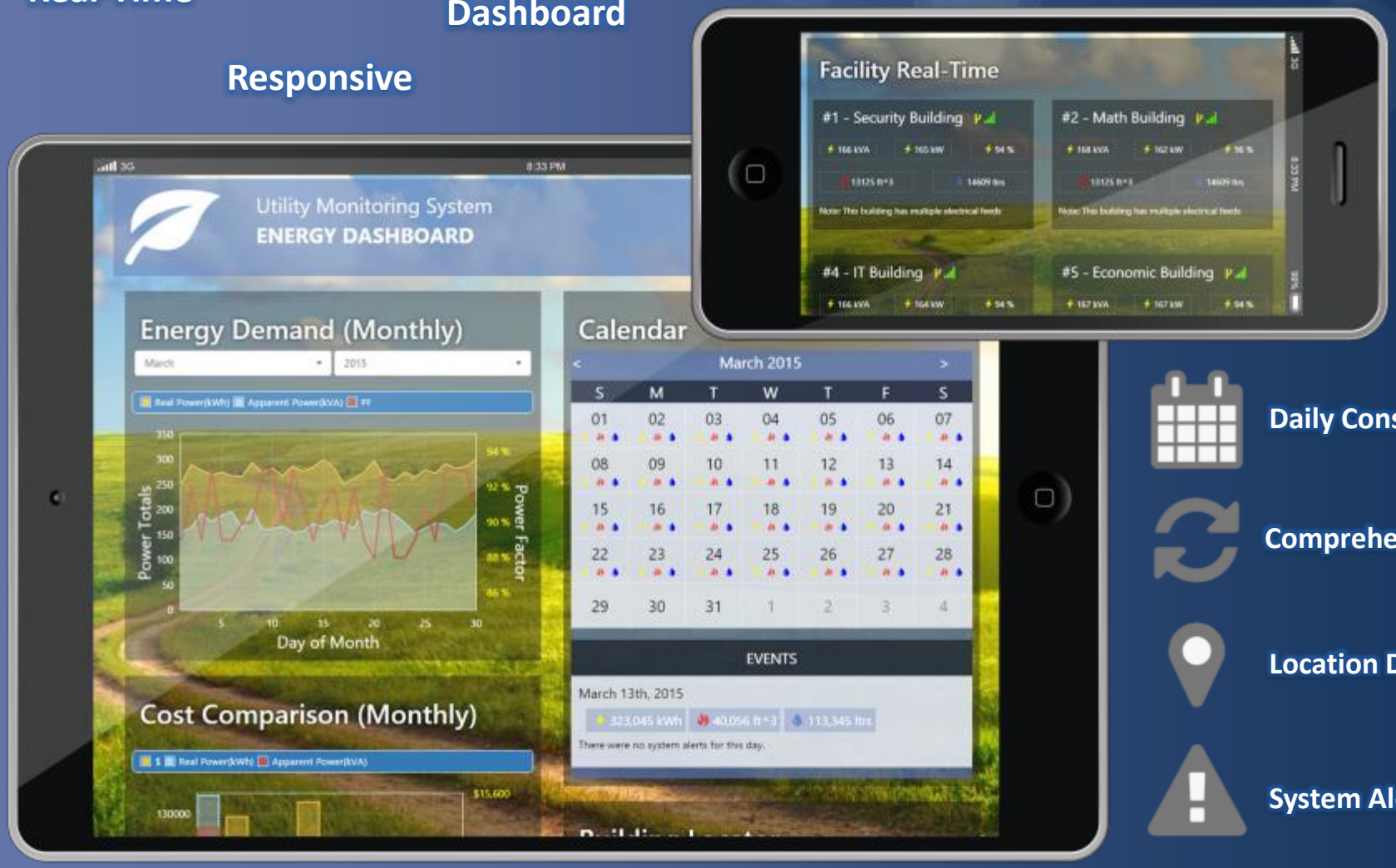


Utility Monitoring System Mobile Application

Real-Time

Interactive Dashboard

Responsive



Daily Consumption

Comprehensive R/T

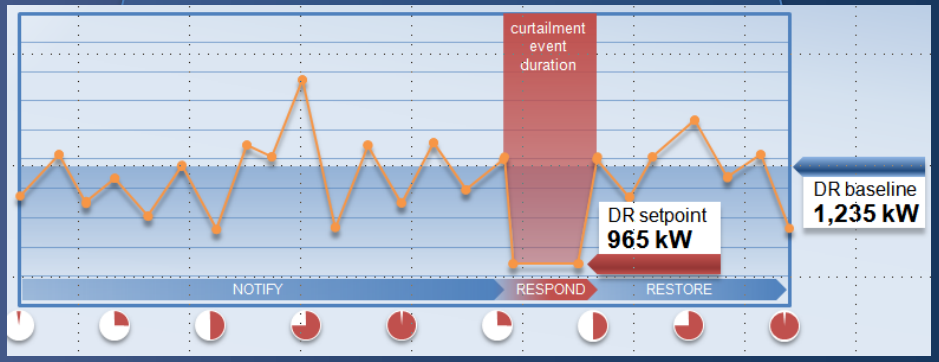
Location Details

System Alerts

Demand Control Basics

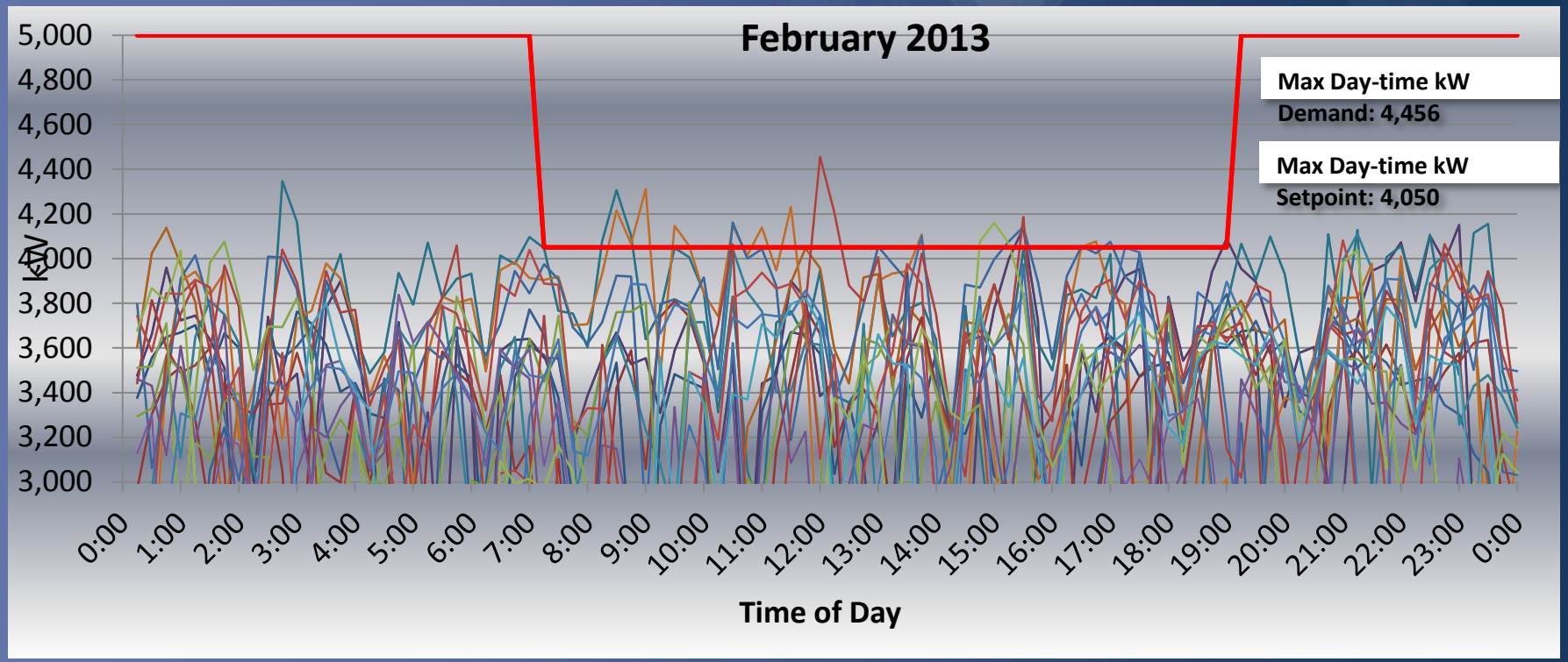
Demand Control

- **Demand Control** is a process of understanding **where**, **when and why** high cost kW demand spikes occur and **taking measures to reduce them.**
- The goal is to **reduce** the **kW Peak Demand** and thereby:
  - **Reducing Billable** kW **Demand** charges which can make up to 40% of the total Electricity bill
  - **Al** Ontario's **Demand Response** Program (DR3) for maximum sustainable payoff.
- Demand Control can be **problematic** to manage **manually** in facilities with **multiple** **equipment types** and process demands.

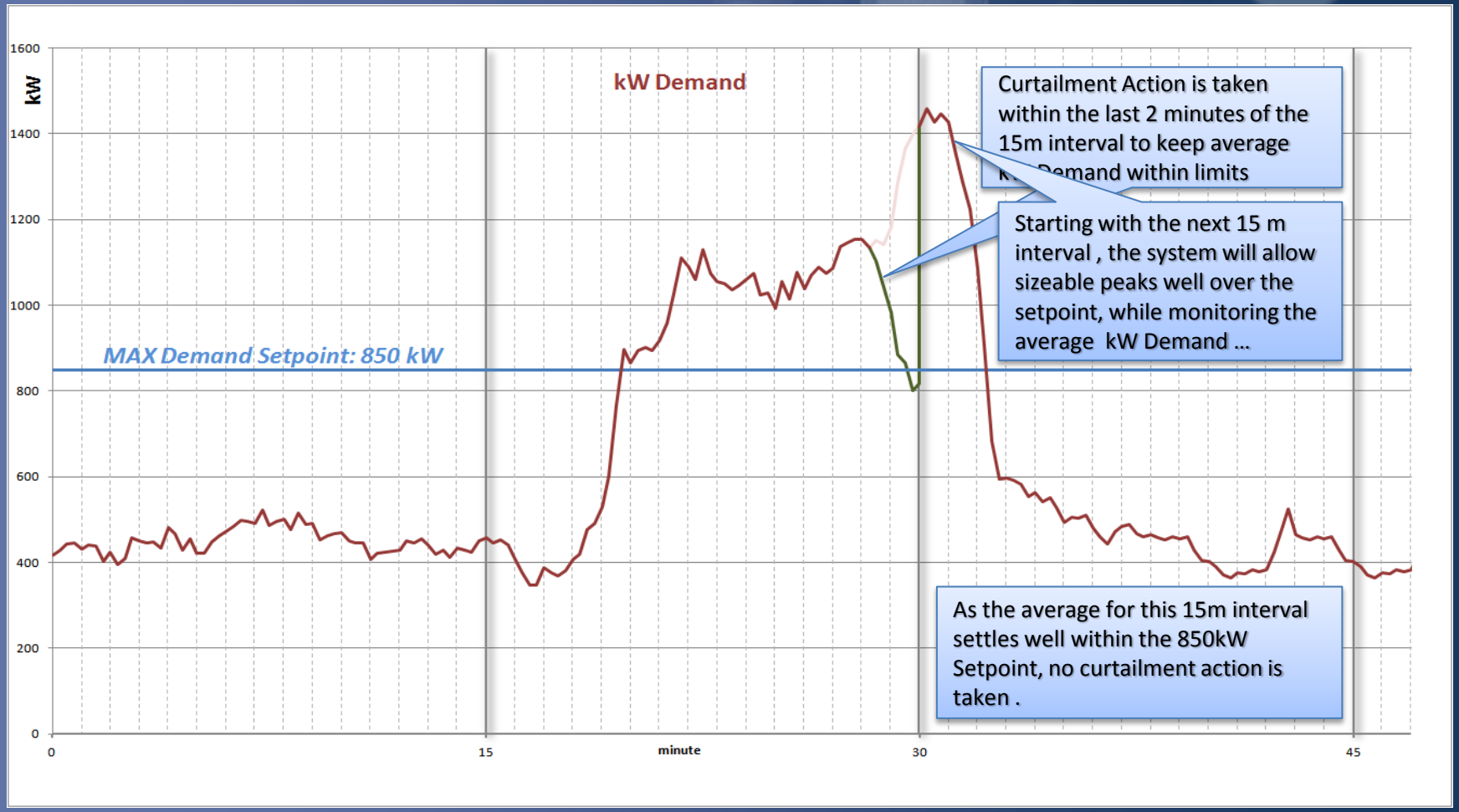


Automated Demand Control
EXAMPLE

Establishing Demand Control Setpoints :



Demand Control Strategy

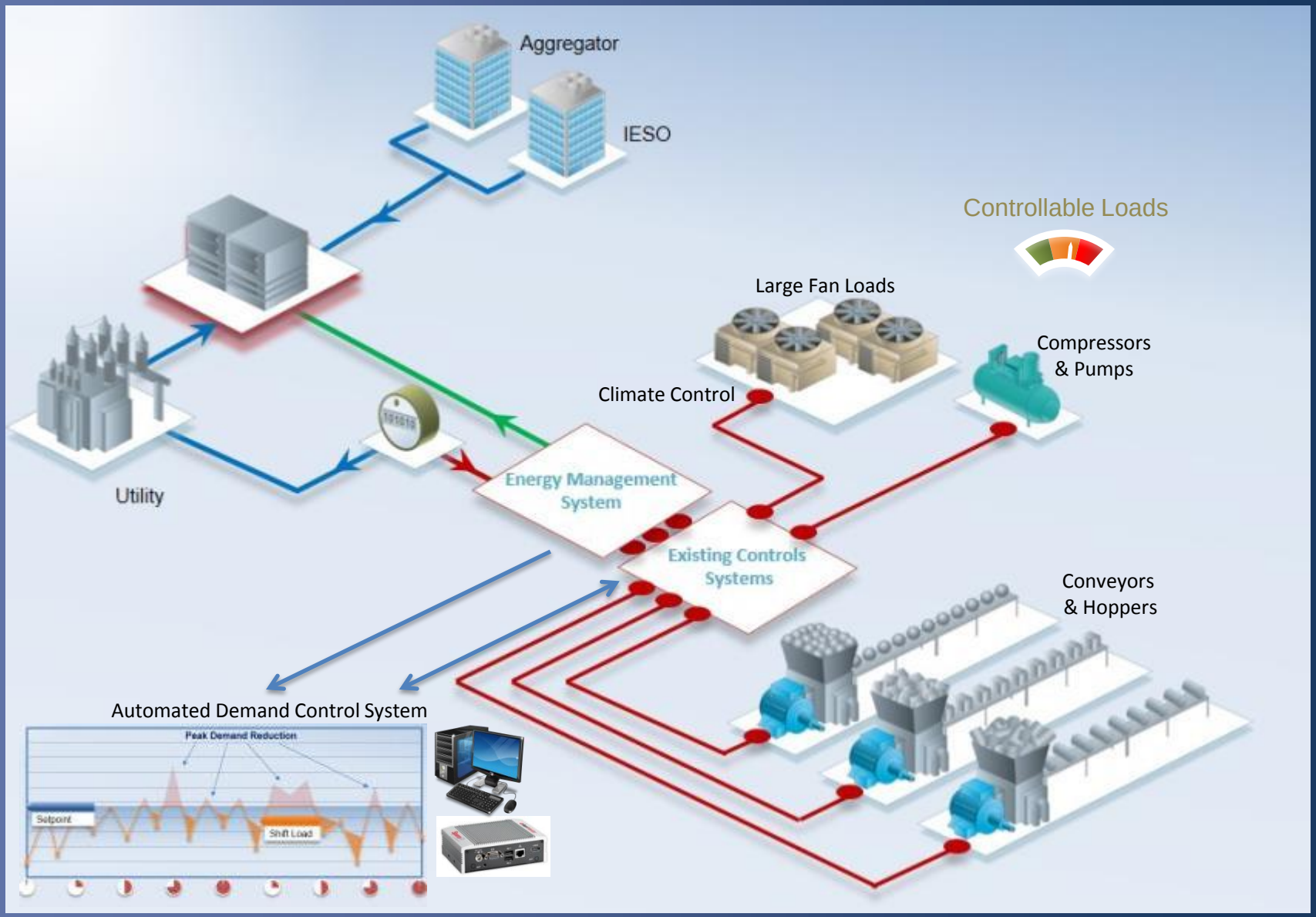


Demand Control Challenges

Demand Control Solution must address these concerns:

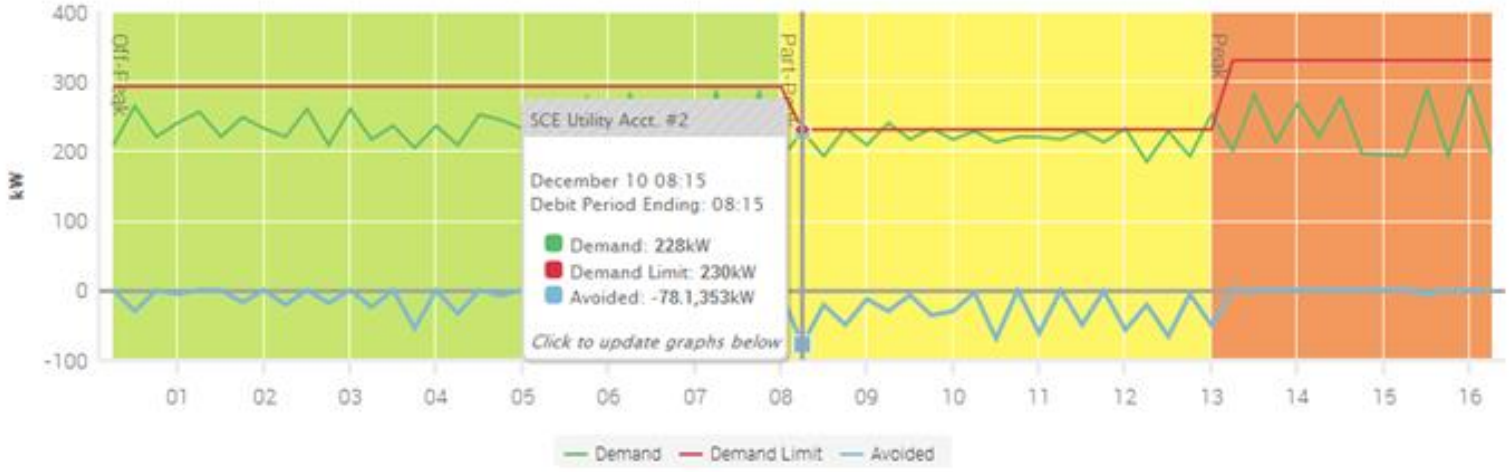
- **Load Shedding** can be **risky** *(or non-feasible)*
- **Manual Load Control** may be **unreliable** *(or non-feasible)*
- **Ability to determine exact curtailment needs**
- **Intuitive End User control**
- **Adaptive setpoints**
- **Tap into existing Control and Automation** infrastructure
- **Prioritize loads**
- Provide **Tools for performance Analysis**
- **Achieve savings large enough to justify the investment**

Demand Control Targets



Intelligent Operator Interface

“Post-mortem” Performance Analysis



Demand Power Distribution by Load

Demand Control Impact

	Impact of kW Demand Reduction		
Strategy	**Monthly Billable Peak Demand Reduction**	**DR3 Program Participation**	**Global Adjustment Class A - PDF Reduction**
$ / kW Savings	**$6 /kW /month**	**$38 /kW /year**	**$63 /kW /year**
Pros	- No Contract required - Payoff is immediate	- Open to Class A & B customers - Contract can be tailored	- No Contract required
Cons	- Payoff is low in many instances	- Contract is required - Payoff is several months away	- Payoff is a year away
Notes	*If the load Factor is close to 1.0, Payoff may not justify the cost of Demand Control Measures.*	*Proper analysis should be done to determine the optimum level of DR commitment.*	*__Every kW counts__*
DR 3 Assumes 5 DR Events a year, OPA DR3 Program Option C (Call Hour Window: 12:30 PM - 6:30 PM)			

An effective and responsive *Peak Demand Control System* is crucial to maximize the Demand Reduction impact while maintaining Facility Priorities !

Additional INFO

Global Adjustment Strategies

$ /kW

Reducing the Peak Demand Factor – the $ IMPACT:

- If the customer is able to reduce the demand during the Coincidental Peaks, It will directly impact the PDF for next year
  - ✓ Example: Base Period 2012 – Customer ABC - *Reducing Demand*:
    - ✓ Customer ABC reduces the demand during the 5 Coincidental Peaks by 100 kW in each instance to:
      5.9 , 6.9, 7.9, 6.9 & 4.9 [MW] *(Combined demand reduction of 500 kW)*
    - ✓ The Provincial Load during 5 Coincidental Peaks was: 24.46, 23.8, 23.87, 23.81, 23.47 [GW] **
    - ✓ Customer's reduced PDF will be: $\frac{\sum(5.9, 6.9, 7.9, 6.9, 4.9)}{\sum(24.46, 23.8, 23.87, 23.81, 23.47)\times 1000} = 0.0272172\%$
    - ✓ The IESO Set GA cost for October 2013: $ 634.3M ***
    - ✓ Customer's Reduced GA Cost for Oct 2013 will be: 0.0272172 % x $634.3M = **$172,611.17**
    - ✓ Resulting in monthly savings of : **$ 2,655**
    - ✓ Projected yearly savings: **$ 31,866**
    - ✓ **Savings per kW reduced:** $\frac{\$31{,}866}{500kW} =$ **$ 63.73/kW / year**