LISTEN.
THINK.
SOLVE.®

Energy Efficiency

Take control of your energy usage

Summer Days, September 2015

Velké Karlovice

PUBLIC INFORMATION
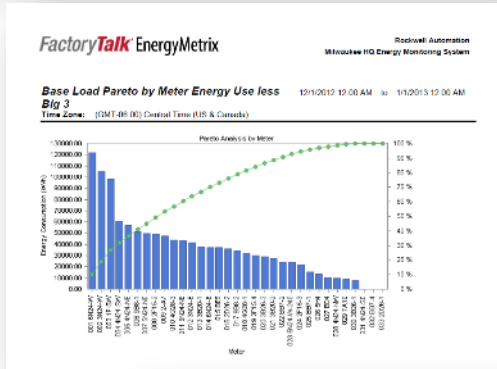
Allen-Bradley · Rockwell Software

Rockwell Automation

Energy Management
Manage energy consumption throughout the plant

Agenda

Introduction to Energy Management

PowerMonitors, FactoryTalk EnergyMetrix and E300

FT EnergyMetrix Demonstration

Summary and Q & A

Business Challenges

Cost Volatility
- Reduce costs
- Maintain Competitive Advantage
- Predictability of prices

Supply Scarcity
- Resource constraints
- Energy reliability and availability

Government Regulations
- Compliance to current and future regulations

Sustainability
- Corporate initiatives
- Brand protection
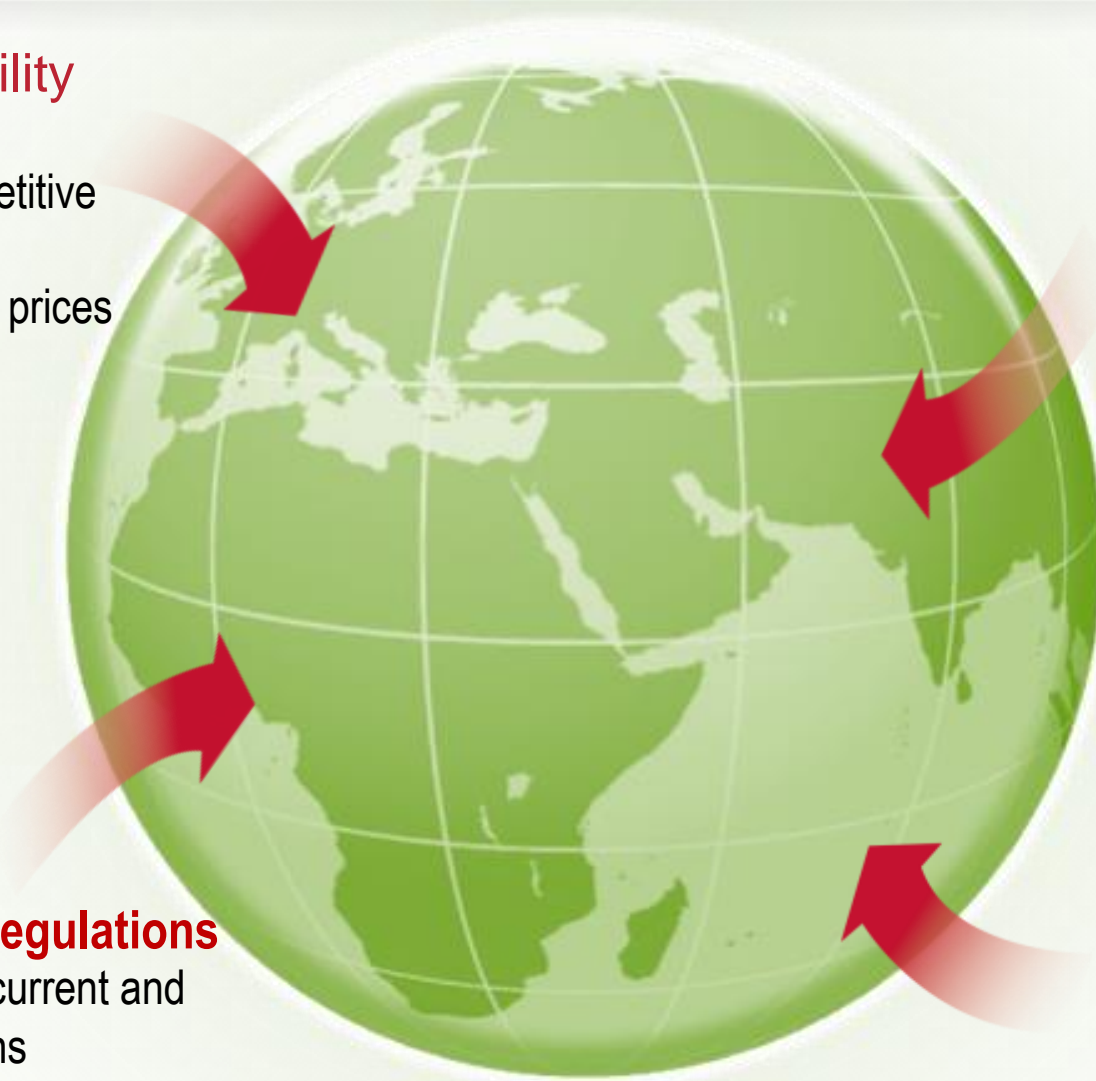
Business Drivers

- Lower CO2 Emissions
- Minimize Risks
- Increase company performance
- Cost transparency
- Lower Energy Cost
- Energy Efficiency

How are you Managing your Energy Usage?

Plant Management

How do we avoid costly energy demand charges?

How do I create a more energy efficient machine?

What are the energy intensive processes?

Plant Manger

dge Worker

Machine Builder

How much energy is consumed to make this product?

How to ensure uptime and reduce energy cost?

How do I increase throughput while reducing energy usage?

Production Manager

Operations

Maintenance

Engineering

Operator

Control Engineering

Machine Builder

Planning and Logistics

Maintenance

Rockwell Automation

Pressure Points Driving Focus on Energy

- Energy price volatility impacting profitability

- Regulatory pressures

- Resource competition and political instability keep prices high and unstable

- Stakeholder pressures for sustainability

Requirement to reduce operational cost	63%
Ensure compliance to energy and carbon regulations	50%
Maintain or achieve a competitive advantage	42%
Customers demand for eco-friendly products	13%
Customer mandate to reduce energy and carbon	10%

0%   20%   40%   60%
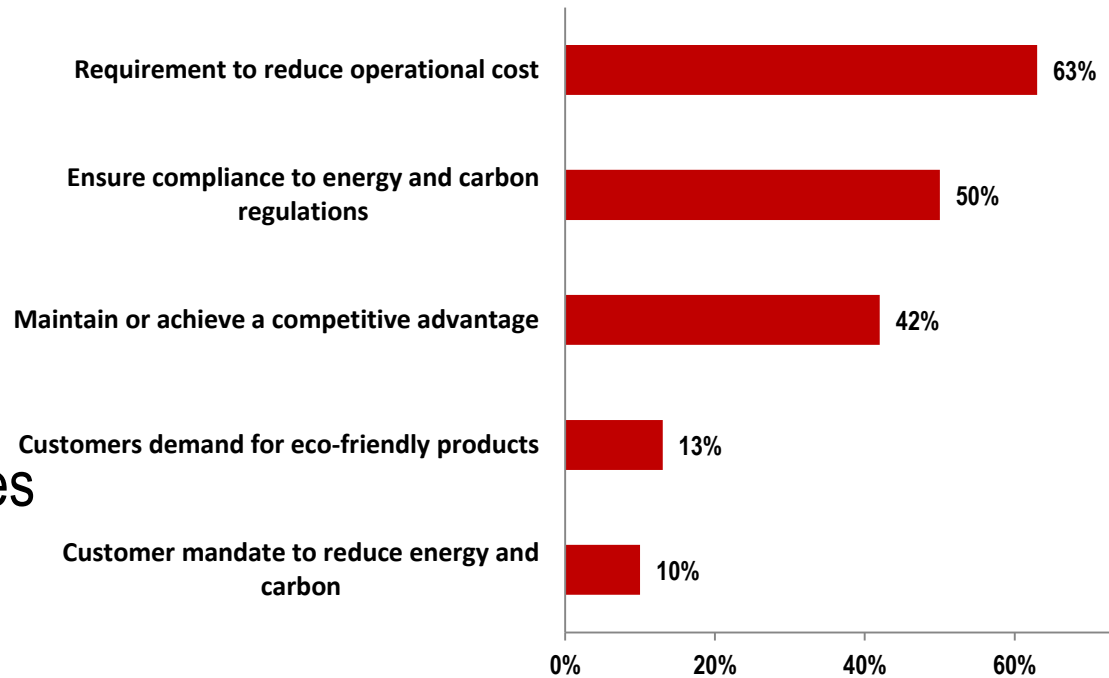
Aberdeen Group Report 2012

Energy cost can no longer be considered overhead.
It must be included as part of the cost of manufacturing

The Pressure to Improve Productivity

How your control system can help

To improve productivity, you need actionable information.
Your control system contains a hidden wealth of information.

Energy

Time

People

Production

MANUFACTURING ASSETS

Data

Product

Waste

Understand What You are Paying for

- Components of an Energy Tariff
    - Consumption charges
    - Demand charges (electrical only)
    - Quality charges (power factor, BODs, etc.)
    - Taxes
    - Contribution to energy conservation programs
- Rates vary depending on:
    - Amount used
    - Time of Day
    - Day of Week
    - Season
    - Real-time markets

You can't control what you don't understand!

Rockwell Automation Energy Management Portfolio

Energy Monitors

PM 500   PMW250   PM 1000   PM 3000   PM 5000   CIP Energy

Power Control

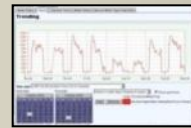PowerFlex Drives   Intelligent Motor Control   Power Control Components
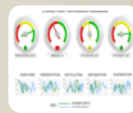
Information

FTEnergy Metrix   VantagePoint   Pavilion
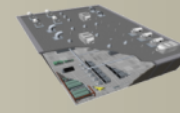
Solutions

Energy Info.   Electrical Load Mgt   HVAC -R   Central Utilities.
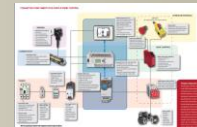
Services

Energy Assessment   Asset Management   Training

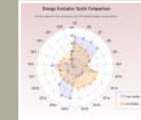**Tools**

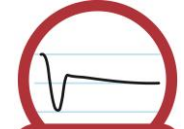Energy Accelerator Toolkit   CCBB Energy   Energy Savings Calc   Energy Evaluator

Common Problems Associated With Power

- ## Sag (Dip)
  - Variation below nominal RMS voltage of 10-90% with a duration ½ cycle to 1 minute

- ## Interruption (Outage)
  - Complete loss of line power

- ## Harmonics / Noise
  - Harmonics/Noise are non-useful voltages and currents that are the result of non-linear electric loads. Harmonics/Noise impact the waveform, creating complexity and non-uniformity to sinusoidal electrical circuits

- ## Surge (Transients)
  - Momentary non-uniform changes in voltage or current (less than 1 cycle)

- ## Over voltage
  - Steady state voltage event of more than 110% nominal for one minute or longer

- ## Under voltage
  - Steady state voltage event of less than 90% nominal for one minute or longer

Rockwell Automation Power Quality

Power Quality Monitors

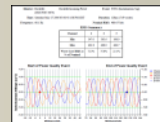I-Sense   PM 3000   PM 5000
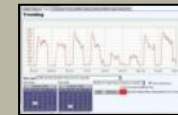
Information

I-Grid   FTEnergy Metrix

Interruption

UPS Portfolio

Sag

DySC Portfolio

Surge / Noise

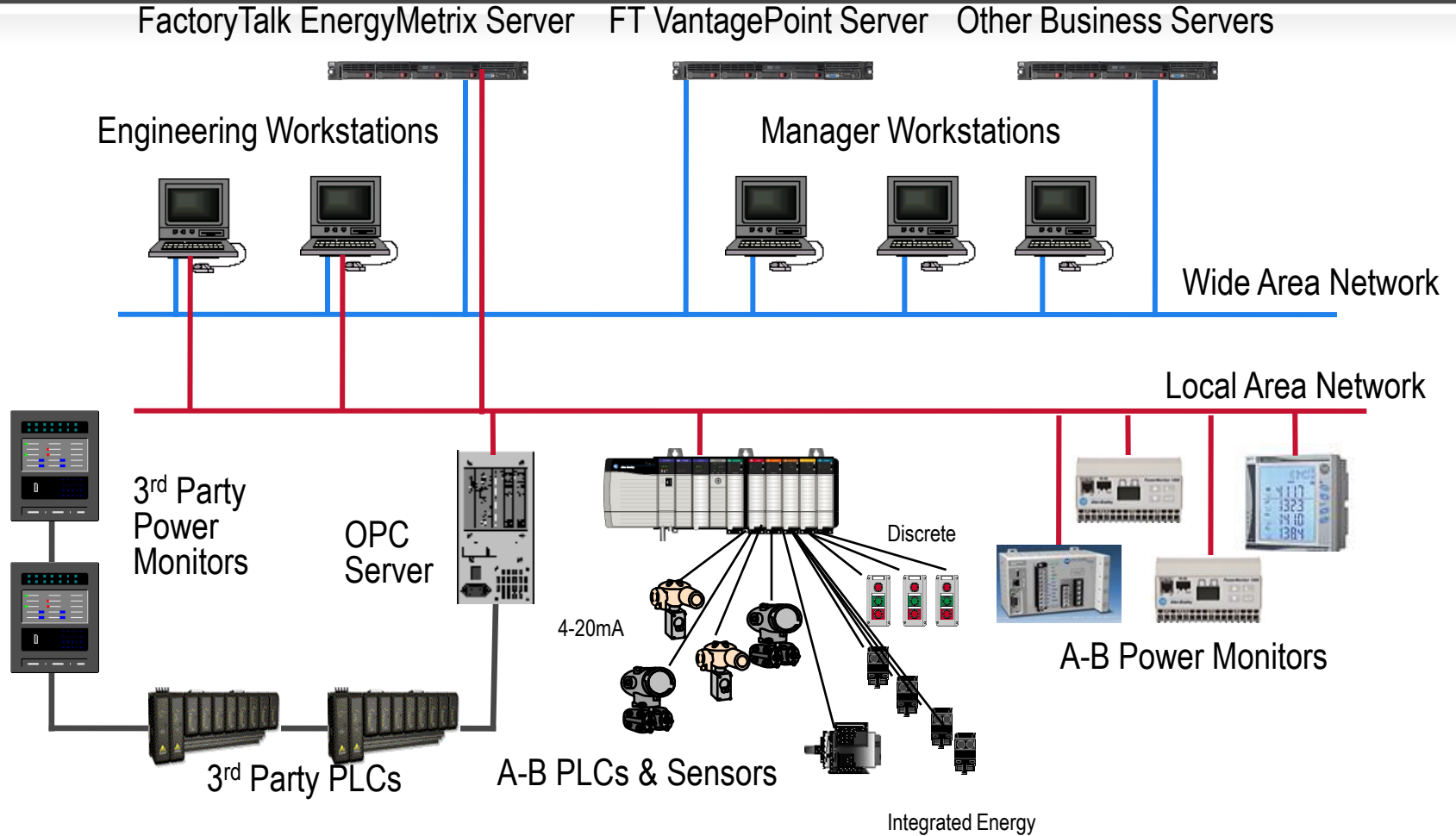Surge   Filters

Energy Information Architecture

FactoryTalk EnergyMetrix Server   FT VantagePoint Server   Other Business Servers

Engineering Workstations

Manager Workstations

Wide Area Network

Local Area Network

3rd Party Power Monitors

OPC Server

Discrete

4-20mA

A-B Power Monitors

3rd Party PLCs

A-B PLCs & Sensors

Integrated Energy

WAGES - Water, Air, Gas, Electric and Steam

Start with Metering

- Typically a solution starts with energy meters:
    - At the main – for Power Quality/ shadow billing
    - At each switch gear / main branch – for sub metering
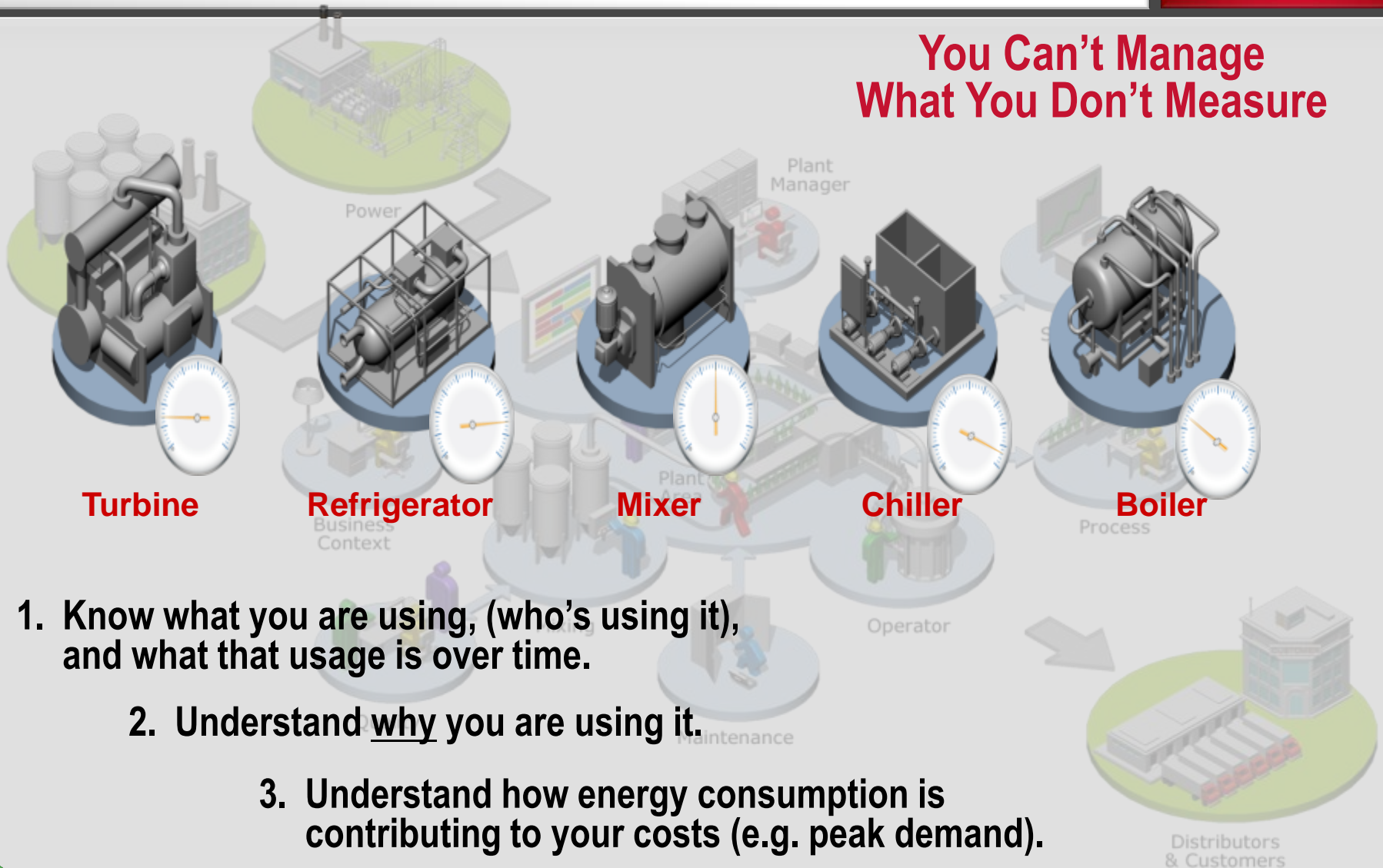   - At each High Value asset – for more detailed billing
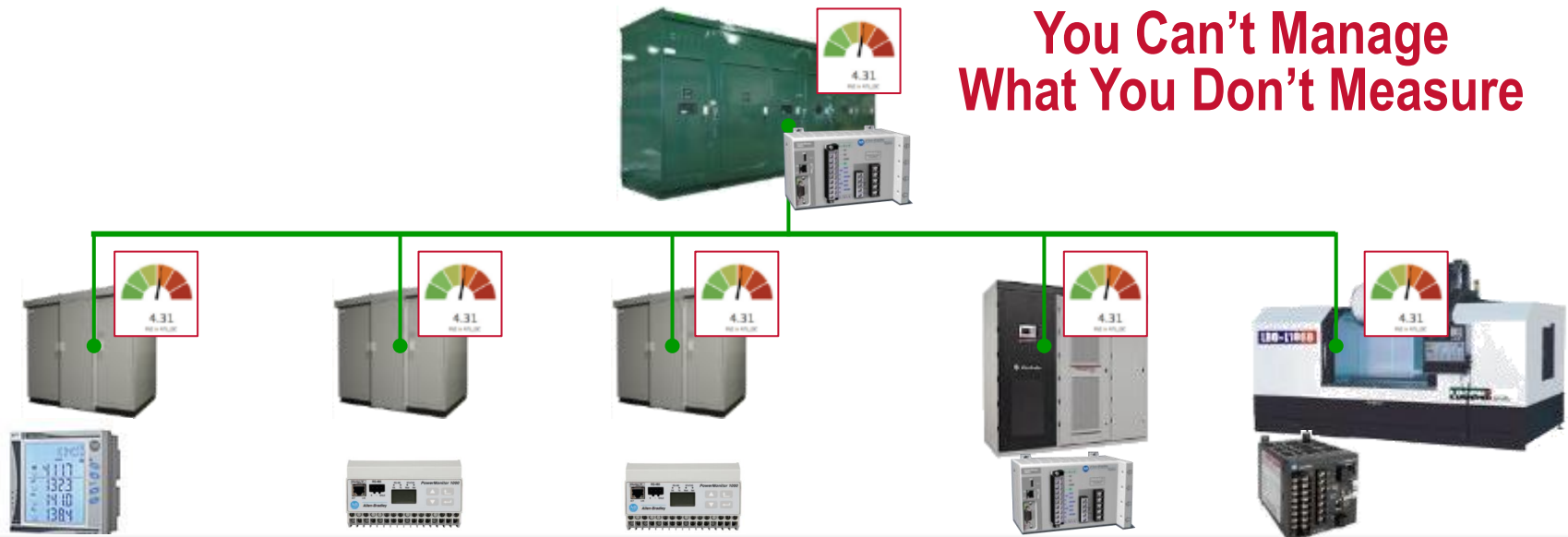
**You Can't Manage
What You Don't Measure**

Effective Energy Management

**You Can't Manage
What You Don't Measure**

Turbine   **Refrigerator**   **Mixer**   **Chiller**   **Boiler**

1. Know what you are using, (who's using it), and what that usage is over time.

   2. Understand <u>why</u> you are using it.

      3. Understand how energy consumption is contributing to your costs (e.g. peak demand).

Agenda

Introduction to Energy Management

PowerMonitors

FT EnergyMetrix Demonstration

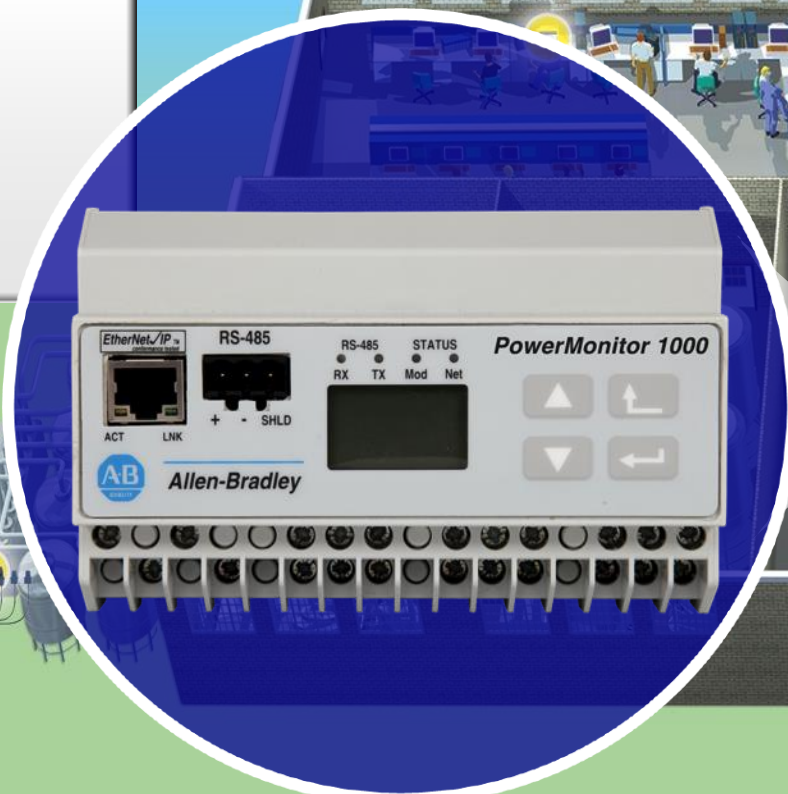Summary and Q & A

PowerMonitor 1000

PowerMonitor 1000 is a compact power monitor for load profiling, cost allocation or energy control.

OUTPUTS:
- Modbus RTU
- EtherNet/IP
- KYZ Signal

INPUTS:
- Digital signal

FACTORY FLOOR

PowerMonitor™ 1000

Metering

- Consumption (kWh)
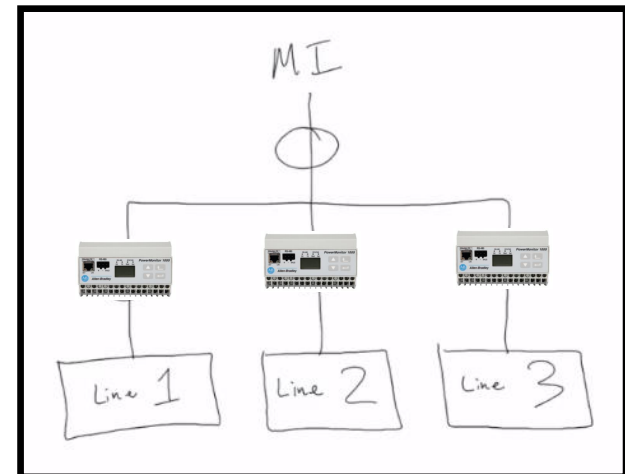- Demand (kW)*
- Power Factor (%)*

Optional

Communication

- EtherNet/IP
- Serial

Key Features

- Embedded web page for real-time data and configuration
- DIN-rail mounted
- Diagnostic utility for incorrect wiring
- Two status inputs for external metering (Water, Air, Gas, etc.)
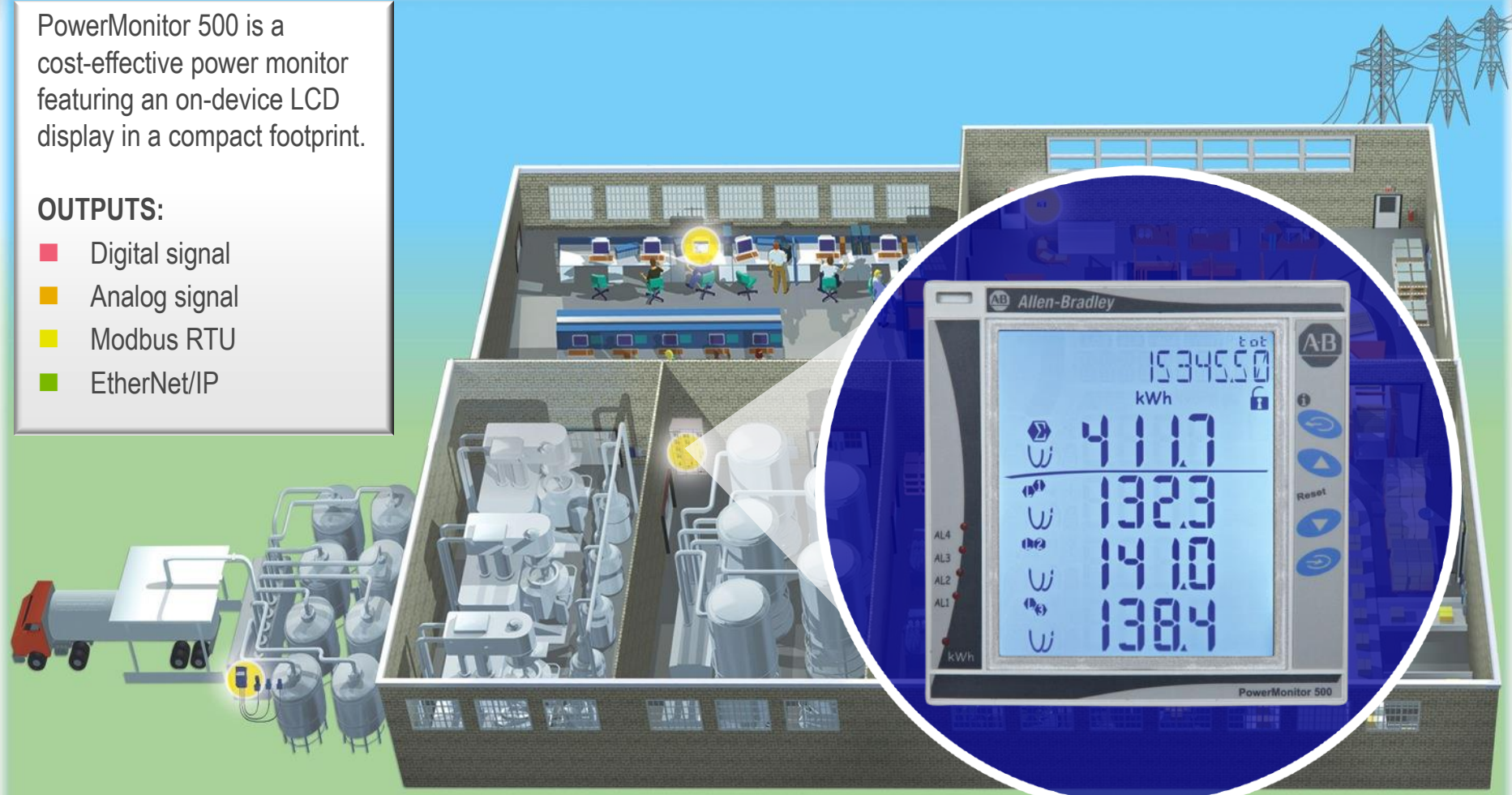- Integrated display for configuration

Sub-Process Meter

PowerMonitor 500

PowerMonitor 500 is a cost-effective power monitor featuring an on-device LCD display in a compact footprint.

OUTPUTS:

- Digital signal
- Analog signal
- Modbus RTU
- EtherNet/IP

FACTORY FLOOR

Allen-Bradley PowerMonitor 500

The PowerMonitor 500 features an on-device LCD display giving you instant visibility into your energy use.

Greater Visibility

- Display and data communications allow you to record data centrally and display it locally
- Easy-to-configure on-device display simplifies installation
- Built in LCD display helps you make at-process decisions using real time data

Compact Footprint

- Compact size and panel mounting saves space
- Fewer components and simplified wiring make it easy to install
- Optional digital or analog outputs

Monitor and Reduce Energy Consumption

- Better understand where and when power is used
- Fully integrated with FTEnergyMetrix
- Instant accurate energy information can help lower operating costs

PowerMonitor™ 500

Metering
- Consumption (kWh)
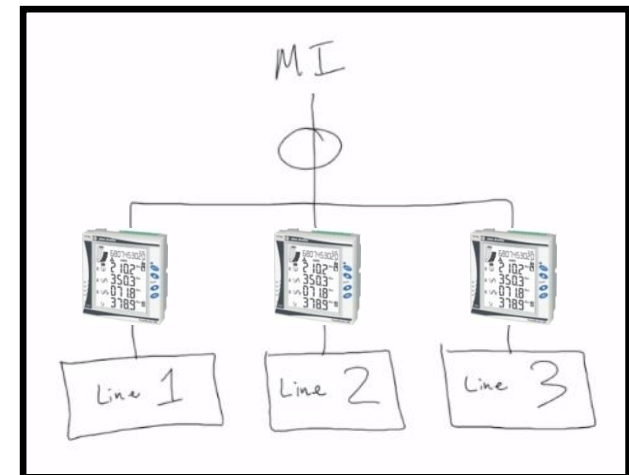- Demand (kW)
- Power Factor (%)

Communication
- EtherNet/IP
- Serial

Key Features
- Door mounted
- Large backlit display for real-time monitoring
- Fully configurable by touchkeys and display
- Configurable alarming
- Integration with FactoryTalk EnergyMetrix
- Integrated analog or digital outputs (optional)

At-Process Meter

Allen-Bradley PowerMonitor 5000

The PowerMonitor 5000 is the next generation of high-end, power quality metering product from Rockwell Automation. This PowerMonitor leverages new technology and capabilities to capture an exhaustive amount of data about your energy network.

Product Highlights:

- Monitors 4 voltage and 4 current channels for every electrical cycle
    - 1024 data points across 8 channels every 12-17 milliseconds
- Measures up to the 127th Harmonic
    - Roughly 1,000 data points every cycle
- Calculates over 6,000 parameters every cycle
- Option for two communications ports
- 4 digital inputs for WAGES data collection
- 4 outputs for connection to SCADA or control systems
- Configurable alarms for up to 20 events
- Virtual Rewiring Capability
- EtherNet/IP and/or DeviceNet communcations
- Separate display (1426-DM) for displaying power and energy data for up to 3 PowerMonitor 5000s

Key Features

- Power and Energy Metering
    - Voltage
    - Current
    - Real, Reactive, and Apparent Energy
    - Demand
    - Power Factor
- Revenue Metering Accuracy (0.2%)
- Internal webpage for configuration and data review
- Flicker
- Waveform Capture
- Harmonic Analysis
- Sub-Cycle Transient detection
- Full metering update every cycle
- Virtual rewiring capability
- System event snapshot capability
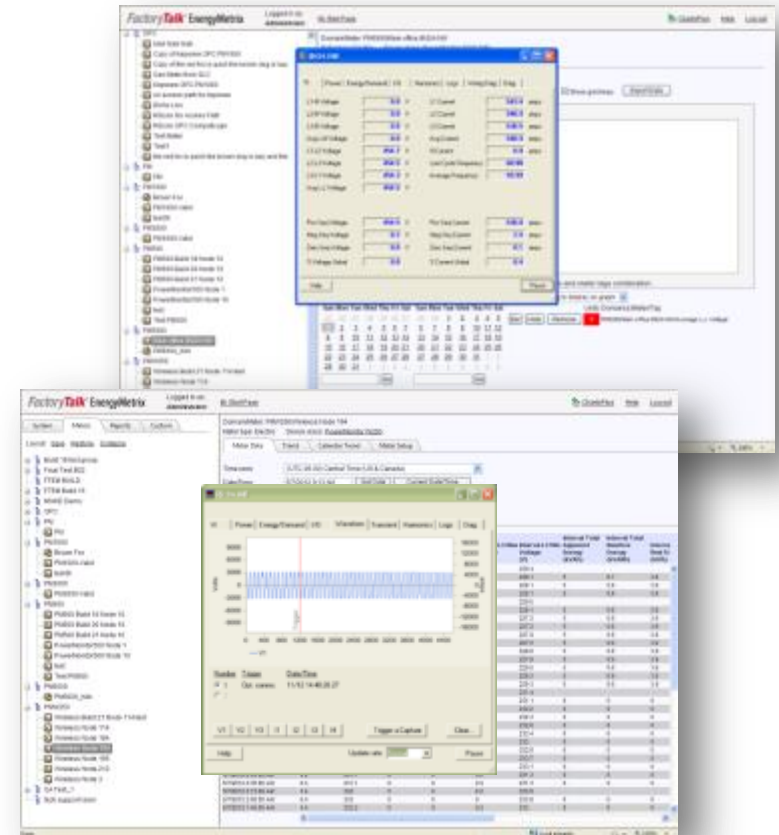
Agenda

Introduction to Energy Management

E300 Overload Relay

FT EnergyMetrix Demonstration

Summary and Q & A

E300 Electronic Overload Relay

The E300 Electronic Overload Relay is the latest technology for motor protection that will help reduce your motor control investment and keep your plant running

- Intelligent Motor Control
  - Native Ethernet/IP connectivity with easy commissioning, control, and monitoring.

- Scalable Solutions
  - Modularity in the design provides the right solution for your specific needs

- Real-time Information
  - Motor diagnostics to reduce unplanned downtime

Intelligent Motor Control

The E300 is fully integrated into the Integrated Architecture

- Network connectivity - *Native Ethernet/IP reduces hardware and engineering cost*

- Integrated into Logix – *Device profiles and faceplates reduce engineering time and project development*

- Automatic Device Configuration – *Reduces time to repair*
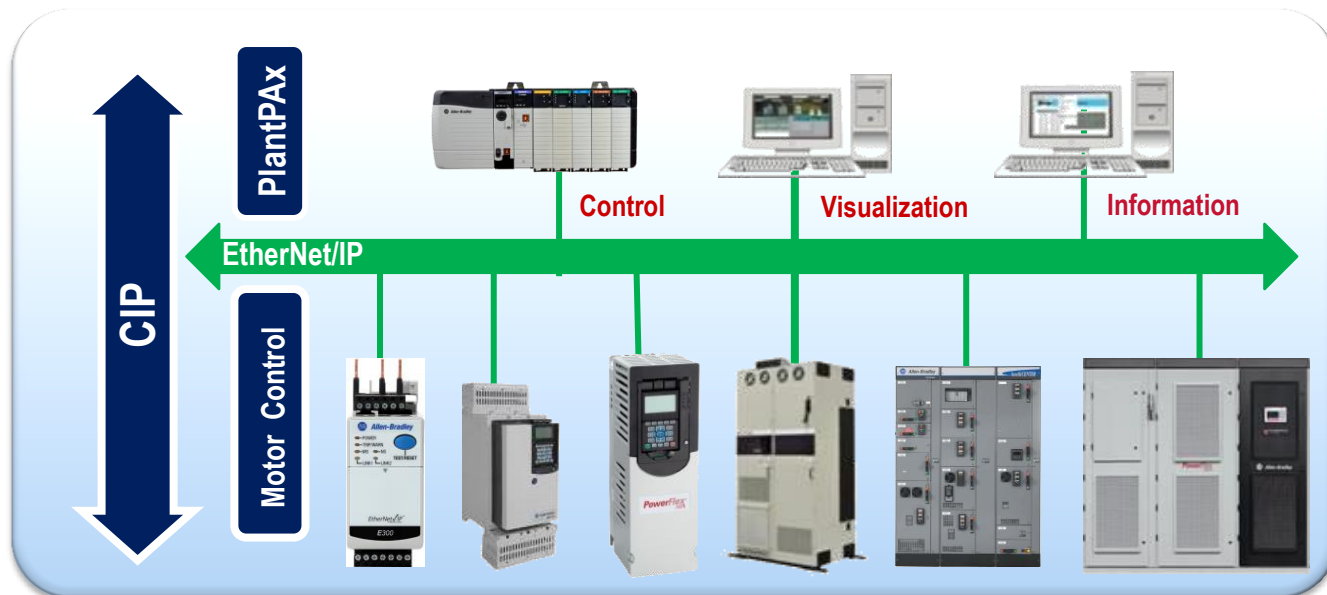
Simultaneous real-time control, configuration, and data acquisition

Scalable Solutions
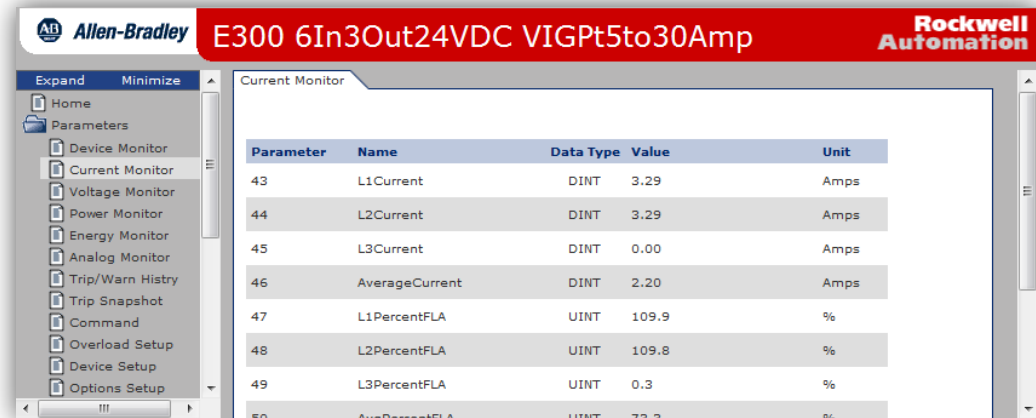
The modular design allows users to have choices in each of the sensing, control, and communications modules with additional accessories to tailor the E300 overload for the application's exact needs:

- Multiple Sensing Capabilities *(Current, Ground Fault Current, and Voltage & Power)*

- Simplified Control Wiring *(120V AC, 240V AC, and 24V DC)*

- Wide Current Range *(10:1 and Higher)*

- Expansion I/O *(Digital & Analog I/O)*

- Operator Interfaces

- Stocked Modules for Fast Replacement

Motor Diagnostics

- The E300 provides a wide variety of diagnostic information to monitor motor performance and proactively alert users to possible motor issues

- This information can trigger either manual or automatic intervention before the occurrence of an unplanned shutdown

  - Voltage, Current, & Energy

  - CIP Energy Enabled

  - Trip / Warning Histories

  - % Thermal Capacity Utilization

  - Motor Winding Temperature

  - Trip Snap Shot

  - Time to Trip

  - Time to Reset

  - Operational Hours

  - Number of Starts

Reduced Wiring and Installation Costs

E300 Overload Relay modules easily snap together and are secured with tabs.
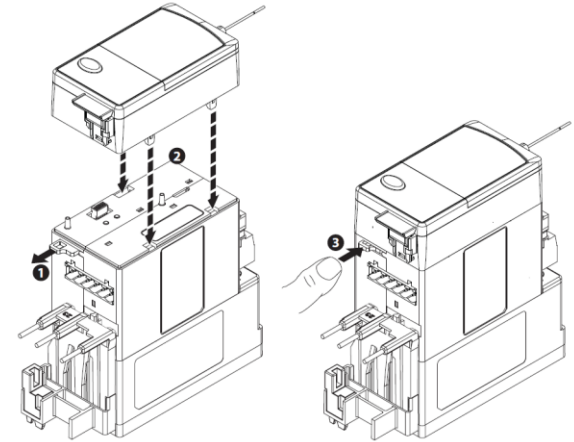
Simplified wiring between E300 Overload Relay and 100-C Contactor
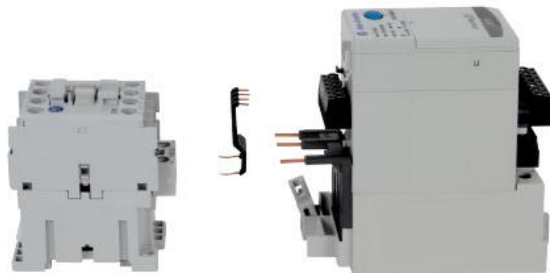
Operating Stations feature a 22mm push button cutout

Flexibility and Functionality

The E300 can be applied to three styles of motor starters

- Panel / DIN Rail

- 100-C IEC Contactors

- 300/500 NEMA Contactors

Agenda

Introduction to Energy Management

FactoryTalk EnergyMetrix

FT EnergyMetrix Demonstration

Summary and Q & A

Energy Intelligence Products

Under the umbrella of **Energy Intelligence**, we have the following offerings:

- **FactoryTalk VantagePoint Energy**
  - EnergyMetrix Connector, Model components and Report content
  - Extend an existing FactoryTalk VantagePoint solution
  - or purchase as a bundle with VantagePoint EMI

- **FactoryTalk EnergyMetrix**
  - A complete power quality and analysis tool
  - Billing and energy cost allocation capabilities

- **IntelliCENTER Energy**
  - Preconfigured setup of FactoryTalk EnergyMetrix as part of an intelligent motor control solution

Energy Intelligence Product Overview

FactoryTalk VantagePoint EMI
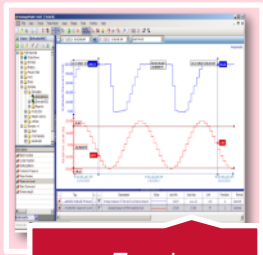
- Trend
- Excel Reports
- Dashboard
- Customized examples

FactoryTalk EnergyMetrix

FactoryTalk VantagePoint Energy Add-on

- Energy Organization Level Types
- Energy Equipment Types
- Energy Meter Types
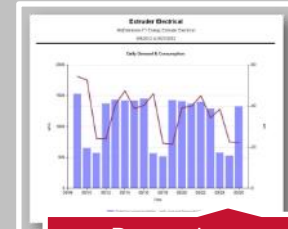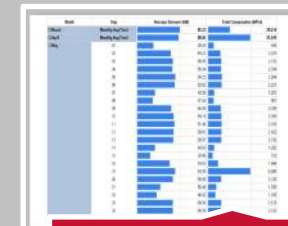
- Demand vs. consumption charts
- 48hr dashboard
- Tabular reports
- Demand charts
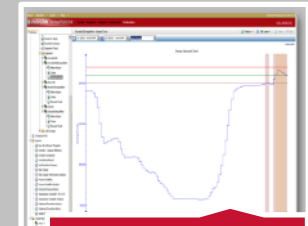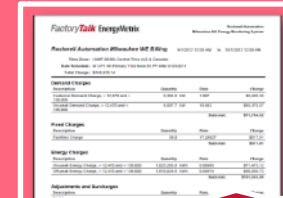
- Real time access to Power Meters
- Demand and consumption reporting
- Advanced billing capabilities
- Power Quality reporting and analyses

FactoryTalk VantagePoint Energy
Energy information for making intelligent decisions
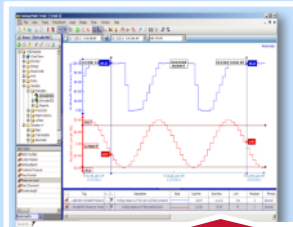
Trend

Excel Reports

Demand vs. consumption charts

48hr dashboard

Demand charts

Dashboard

Tabular reports

Customized examples
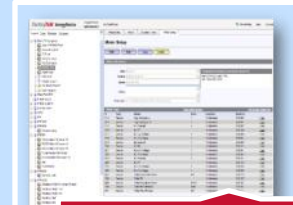
Real time access to Power Meters

Demand and consumption reporting

Advanced billing capabilities
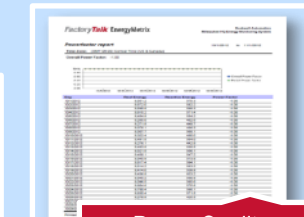
Power Quality reporting and analyses

FactoryTalk® EnergyMetrix

Scalable, web-based energy management software that captures, analyzes, stores, and shares energy data across the entire enterprise for informed energy decisions

- Optimize energy procurement

- Accurate cost accounting for energy usage

- Drive intelligent decisions around electrical capacity

- Integration with all Allen-Bradley hardware

  (PMW250, PM500, PM1000, PM5000, VFDs, E300)

- Visualization tools and reports for process, department, facility, or enterprise reporting

  - Load profiling, cost allocations, tariff analysis, billing, etc.
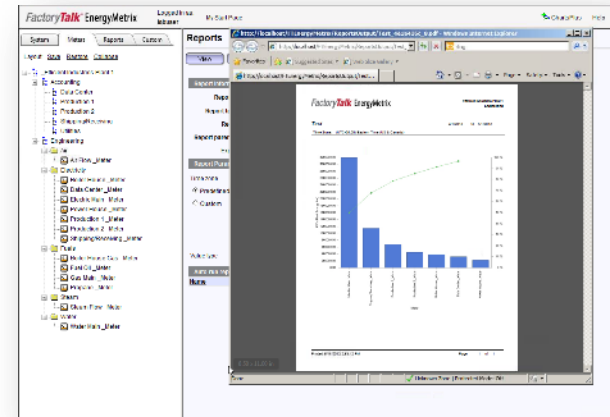
Meter data is important for any Energy Management system!
EnergyMetrix is a source of meter data for Energy Intelligence.

Meter Data Management
Centrally manage Power Meters throughout the Plant
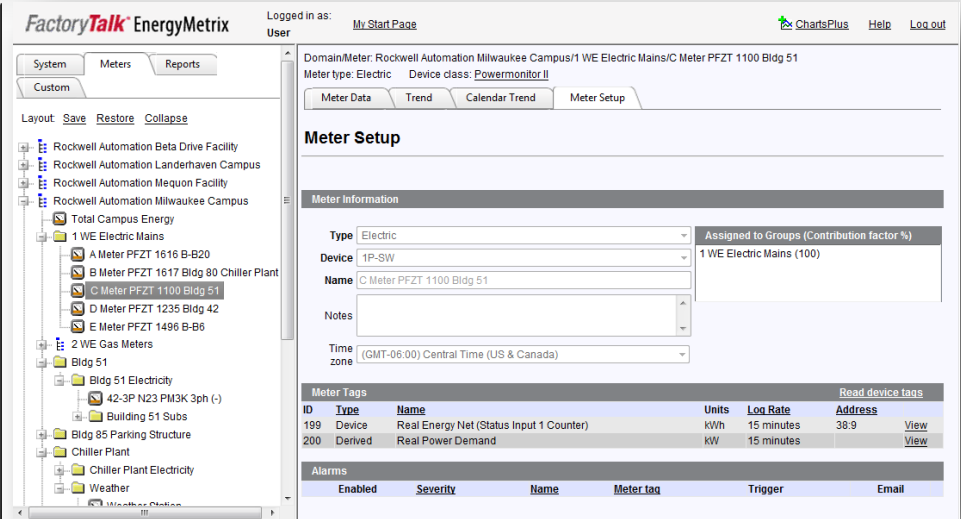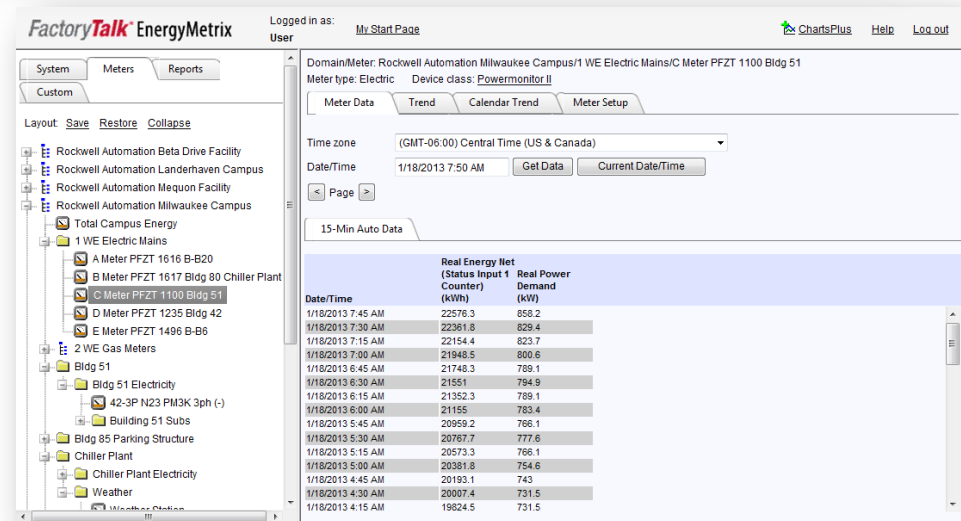
- **Configure Meters**

  - Connect to Rockwell Automation Power Meters and configure meters and meter tags

- **Collect Meter data**

  - Collect and store meter data from Rockwell and 3rd party meters in Database

  - Trend meter data

Advanced Trending of Power Data

Traditional trend and advanced "Calendar Trend"

- ## Trending Energy

  - Trending Power and Consumption data over time

- ## Calendar Trend

  - Powerful tool to compare Power and Demand day to day, week to week etc.
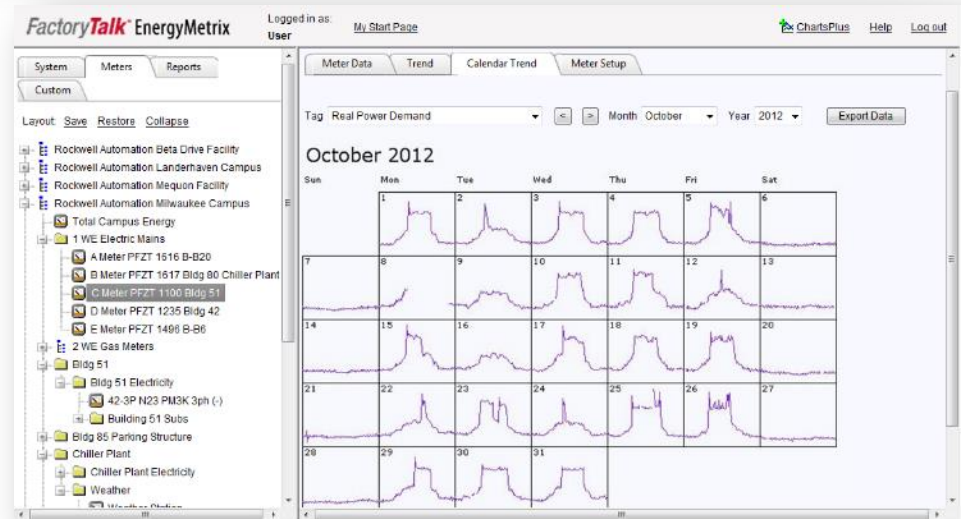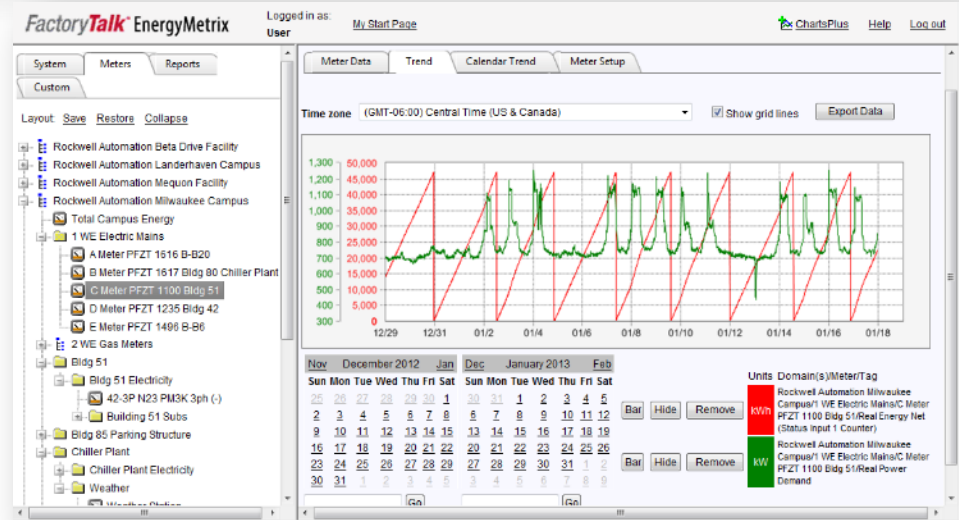
Additional Charting Capabilities

Shared Charts improve collaboration and save valuable time

- **Pareto Charts**
  - Plots Energy data from various meters of your choice on a Pareto chart

- **Enhanced and Custom Charts**
  - Enhanced Charts package
  - Load Factor Charts
  - Custom Charts
  - X-Y Trending
  - Targeting and COSUM analysis
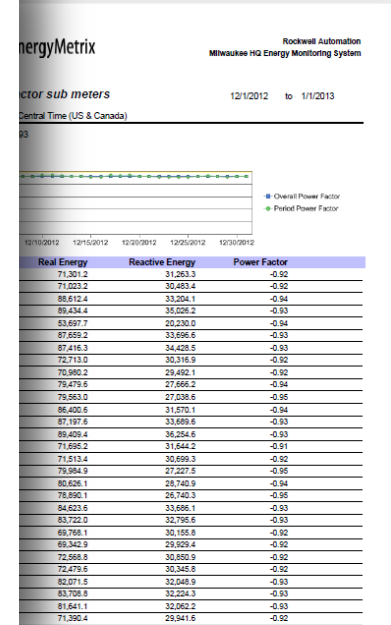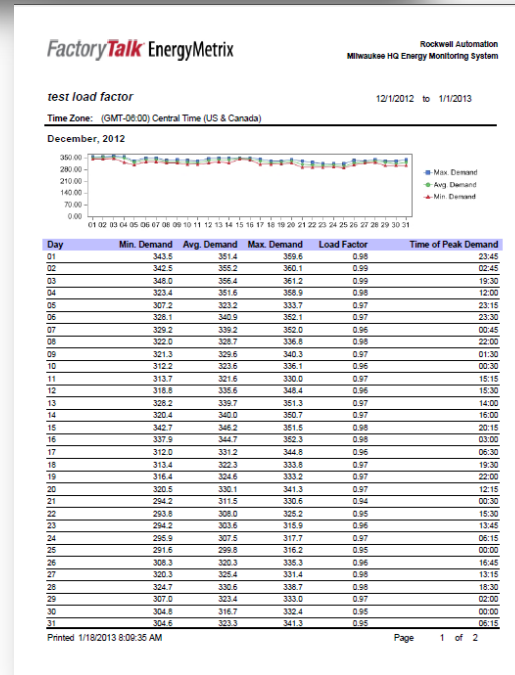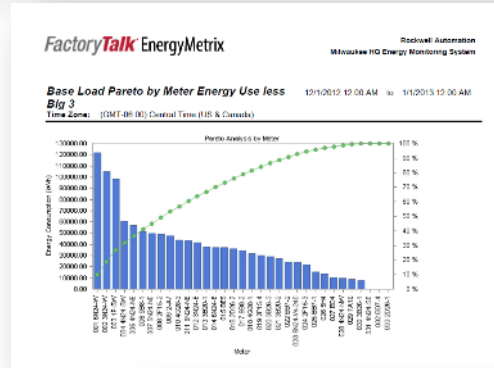
Flexible Reporting
Reporting Tool and Excel Add-on

- **Reports Templates**

  - Comparative Billing

  - Billing Roll-up

  - Efficiency

  - Trend

- **Custom Reports**

  - Customizable Reporting

    - Excel Template

    - Excel Add-on

    - Visual Basic scripting

Demand and Consumption Reporting
Shared Reports improve collaboration and save valuable time

- ## Consumption Report
  - Shows consumption values (kWH, kVARh, etc) for selected meters/groups for the specified time range

- ## Demand Analysis Report
  - Shows Demand values (kW) for selected meters/groups for the specified time range
  - Shows Peak Demand Usage

Advanced Billing Capabilities
Shadow billing as well as department / tenant billing

- Billing Report

  - Provides billing information for the selected meters/groups for the specified time range

  - Provides line items and a total charge amount.

- Cost Allocation Report

  - Shows cost per specified area based on actual usage

FactoryTalk® EnergyMetrix

Rockwell Automation
Milwaukee HQ Energy Monitoring System

Rockwell Automation Milwaukee WE Billing   9/1/2012 12:00 AM   to   10/1/2012 12:00 AM

Time Zone: (GMT-06:00) Central Time (US & Canada)
Rate Schedule: W CP1 WI Primary TOU fixed 85 PF After 01012011
Total Charge: $240,920.14

Demand Charges

| Description	Quantity	Rate	Charge
Customer Demand Charge, > 12,470 and < 138,000	6,364.8 kW	1.007	$6,409.35
On-peak Demand Charge, > 12,470 and < 138,000	6,007.7 kW	10.882	$65,375.57
		Subtotal:	$71,784.92

Fixed Charges

Description	Quantity	Rate	Charge
Facilities Charge	30.0	17.26027	$517.81
		Subtotal:	$517.81

Energy Charges

Description	Quantity	Rate	Charge
On-peak Energy Charge, > 12,470 and < 138,000	1,023,265.8 kWh	0.06985	$71,475.12
Off-peak Energy Charge, > 12,470 and < 138,000	1,810,026.6 kWh	0.04974	$90,030.72
		Subtotal:	$161,505.84

Adjustments and Surcharges

| Description	Quantity	Rate	Charge
Fuel Cost Adjustment, On Peak	1,023,265.8 kWh	0.00251	$2,568.40
Fuel Cost Adjustment, Off Peak	1,810,026.6 kWh	0.00251	$4,543.17
		Subtotal:	$7,111.57

Blended rate
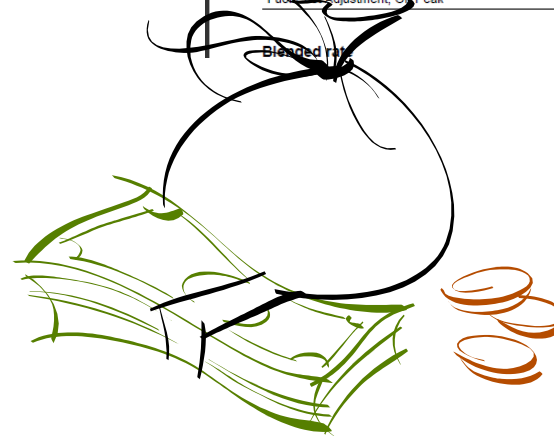
Power Quality Reporting and Analysis

When system is connected to AB Power monitors

- ### Power Quality Report

  - Shows sag/swell information detected by AB PowerMonitor products

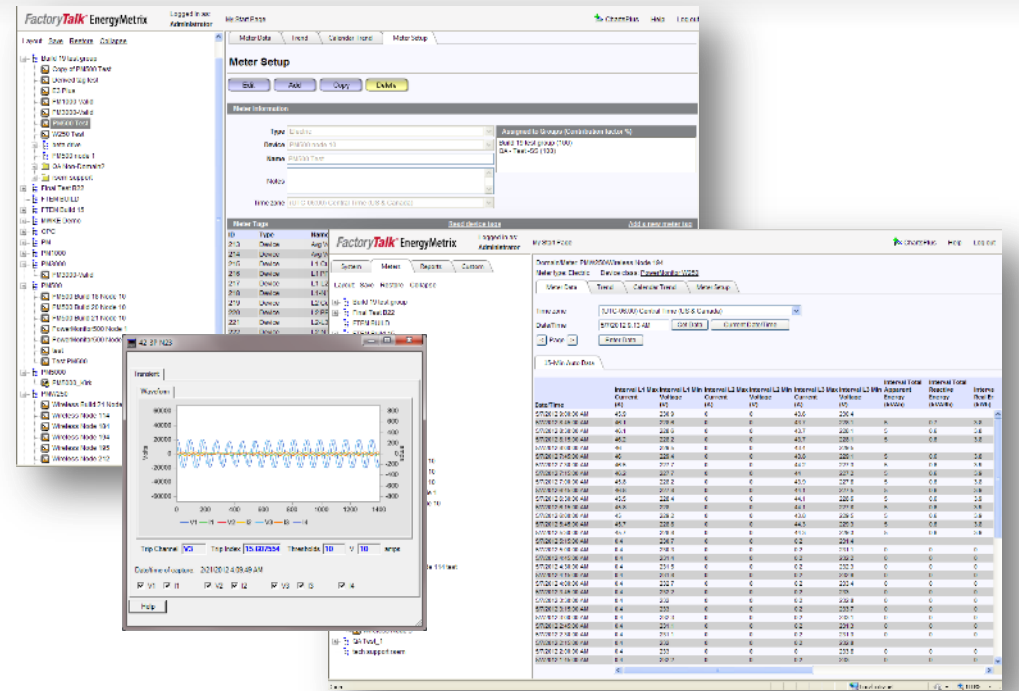 - Display waveforms and harmonics in graphical or log formats
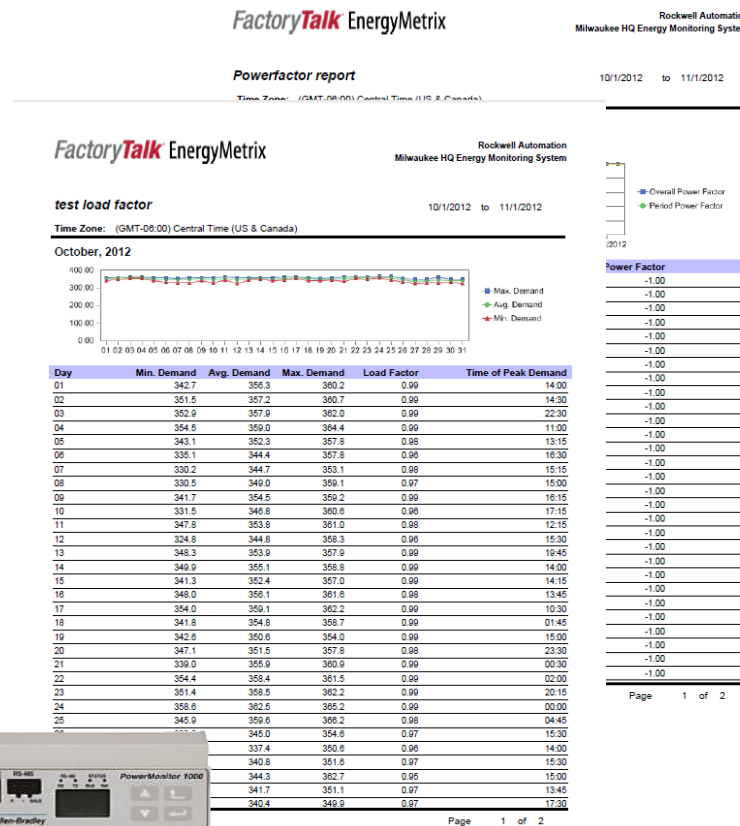
Real-time Access to Power Monitors
When system is connected to AB Power monitors

- Configure and view Allen-Bradley power monitors

- View meter data including real-time and historical (stored within the monitors)

- Display waveforms and harmonics in graphical or log formats

Demo?

Questions?

For more information:

http://discover.rockwellautomation.com/**energy**

Download the Energy Intelligence e-Book

Training

- Training is available for the FactoryTalk Products through Rockwell Automation's training site at:

  - http://www.rockwellautomation.com/services/training/schedules.html

Energy Management Accelerator Toolkit

- Modeled after other RA Integrated Architecture Accelerator Toolkits

- hhttp://www.rockwellautomation.com/go/iatools

- CD   IASIMP-SP014

- Contains:
    - Step by Step Quick Start Guide
    - System Design and Configuration
    - Hardware Selection Tools
    - CAD Layout and Wiring Drawings
    - Simplified Device Configuration
    - Preconfigured Logic
    - Preconfigured Faceplates
    - System Operation Guide

Energy Management Accelerator Toolkit

Thank You!

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