Industrial Metering
Energy Concepts and Best Practices

Or…
Who left the air compressors running all weekend?
And…
Why were the air compressors running all weekend?
Presenters

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Webinar Logistics

• **Interactive** – type questions into the chat box at any time. Send to the whole group. If you need to send to an individual presenter, please send to the one not speaking at the moment to get your question answered as quickly as possible.

• Make sure any pop-up blockers and screen savers are disabled.

• Resources will be provided at presentation end for your reference.
Agenda

• Major Concept Areas
  – Why Meter?
  – How To Meter?
  – What Can Metering Show You?

• Metering Basics

• Ways To ‘Sell’ Your Metering Project

• Tips To Get Started
Big 4 Management Areas

Production
- Rate
- Uptime

Quality
- Conformance to spec
- Grade design
- Metrics

Cost
- Materials
- Labor
- Energy

Safety
- Training
- Accident prevention
- Record keeping
Why Meter?

• Improve demand side management
  o Understand costs
  o Reduce costs
  o Better usage patterns
    ▪ Avoid peak charges
    ▪ Turn off equipment when not needed

• Develop answers to these questions…
  o What is important to monitor?
  o What drives energy use?
  o What drives action?
How To Meter?

• Importance of metering project planning
• Simple systems
• Metering project components
Metering Project Planning Importance

• Demonstrate need to be a top priority in funding race
• Choose carefully when cost is object
• Paybacks – can be difficult to calculate
Good Metering Project Plan Elements

• Well-developed financial/technical arguments
• Build off existing data
• Show ‘big hitters’
• Integrate with existing infrastructure
• Small, focused implementation team
Simple Systems

Consider these low cost ideas to start…

• Slice/dice your utility bills
  o Read meters by shift
  o Relate data to your operations
  o Legwork/brainwork

• See what your utility offers
  o Frequent updates
  o Web delivery
  o Analysis tools
  o Cheap or free
Metering Project Components

• Energy sensor
• Transmitter
• Data transfer medium
• Display
  o Database
  o Analysis tools
Energy Sensors

• Electrical
• Natural gas
• Steam
• Virtual
Electrical

- Measure voltage potential directly across legs
- Install current transformers on each leg

Natural Gas

This meter type shows flow→ Using this principle

Rotary with pulse outputs
Ultrasonic
Coriolis effect
Thermal

Shaft rotary displacement
Measure ping time to distance
Deflection in curved tube
Electric current needed to maintain temp above reference
Steam

• Orifice plate – measures differential pressure across a calibrated orifice, converts to flow

• Pitot tube – points into flow, measures stagnation pressure, converts to flow

http://en.wikipedia.org/wiki/Pitot_tube
http://www.spiraxsarco.com/resources/steam-engineering-tutorials/flowmetering.asp
Virtual Meters

- Use existing sensors, formulas to calculate energy flows
- \( Q = MC\Delta T \) – Find heat flow from mass flow/temperature (frequently measured in processes)
- Others – conduction, radiation, free, forced convection
Transmitter

• Condition/calibrate signal output from sensor to data in engineering units

• Place engineering data into standardized protocol(s) for transmission

• Protocol categories
  o Media – how data is transported
  o Data – how data is packaged for transporting
Data Transfer Medium

• Wired
  o RS-232, RS-422, Profibus, Hart, Modbus, manufacturer proprietary/licensed methods, Ethernet 802.3

• Wireless
  o Wireless Hart, ZigBee/802.15.4, Ethernet 802.11
Display

• Energy database
  o Dedicated designs for just energy
  o Build on existing plant, enterprise systems

• Analysis/reporting tools
  o Trends, statistical analyses, data exports
  o Reporting
Software
What Can Metering Show You?

• Practical energy management example
• Troubleshoot, optimize processes
• Verification on energy projects
• Department cost allocations
• Weekend downtime, base load evaluation
KPI, Energy Tracking – Continual Improvement

\[ y = mx + b \quad R^2 = \text{correlation coefficient} \]

- \( m \) = energy per variable unit
- \( b \) = base load

Production level or heating degree day

Total energy use
• Total kWh = (0.3257 kWh/lb x total lbs) + 258,748 kWh
• Assume total lbs = 1,000,000 then total kWh = 584,448
• At $0.075 per kWh, energy cost = $43,834
• Or $0.044 of electrical energy/lb of output
Troubleshoot And Optimize Processes

Left = Bad
High HX feed water flow reduces heat recovery opportunity while increasing pumping costs

Right = Good
Reduced feed water flow increases discharge temp, maximizing heat recovery opportunity
Energy Project Verification

20,000 pph

16,450 pph

Wood Free Fine Drying Rate Chart

Drying Rate After Rebuild

Drying Rate Prior To Rebuild
Energy Project Verification

Pressure screen rotor data – pre & post

9 PM dry end pulper – average kW for 2 days
Department Cost Allocations

- $$$ Power Quality  
- $$ Multi-meter  
- $ kW

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Focus on Energy
Partnering with Wisconsin utilities
Base Load – Weekends

Air Compressors On and Showing Considerable Leakdown

Memorial Day Weekend Base Load Condition
Base Load – Weekends (continued)

Memorial Day Weekend Base Load Condition

Data Black Hole

Following Weekend AC On
Another Look!

Memorial Day Weekend Base Load Condition
Q & A

Discussion


http://en.wikipedia.org/wiki/Pitot_tube
http://www.spiraxsarco.com/resources/steam-engineering-tutorials/flowmetering.asp

http://www.offshore-technology.com/contractors/instrumentation/yokogawa-europe/yokogawa-europe5.html
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