

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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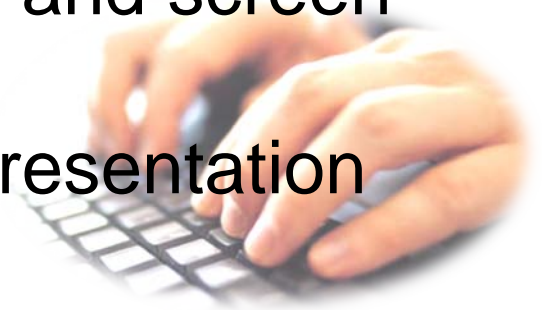
Focus on Energy

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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
 - Understand costs
 - Reduce costs
 - Better usage patterns
 - Avoid peak charges
 - Turn off equipment when not needed
- Develop answers to these questions...
 - What is important to monitor?
 - What drives energy use?
 - 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
 - Read meters by shift
 - Relate data to your operations
 - Legwork/brainwork
- See what your utility offers
 - Frequent updates
 - Web delivery
 - Analysis tools
 - Cheap or free

Metering Project Components

- Energy sensor
- Transmitter
- Data transfer medium
- Display
 - Database
 - 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

Shaft rotary displacement

Ultrasonic

Measure ping time to distance

Coriolis effect

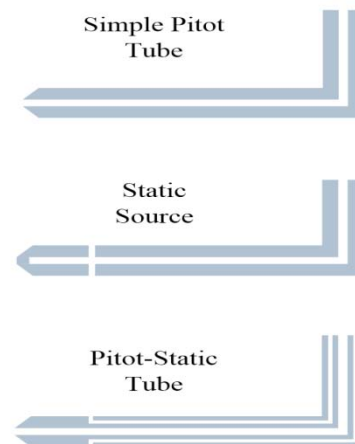
Deflection in curved tube

Thermal

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

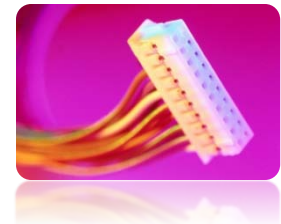


Virtual Meters

- 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
 - Media – how data is transported
 - Data – how data is packaged for transporting



Data Transfer Medium

- Wired

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



- Wireless

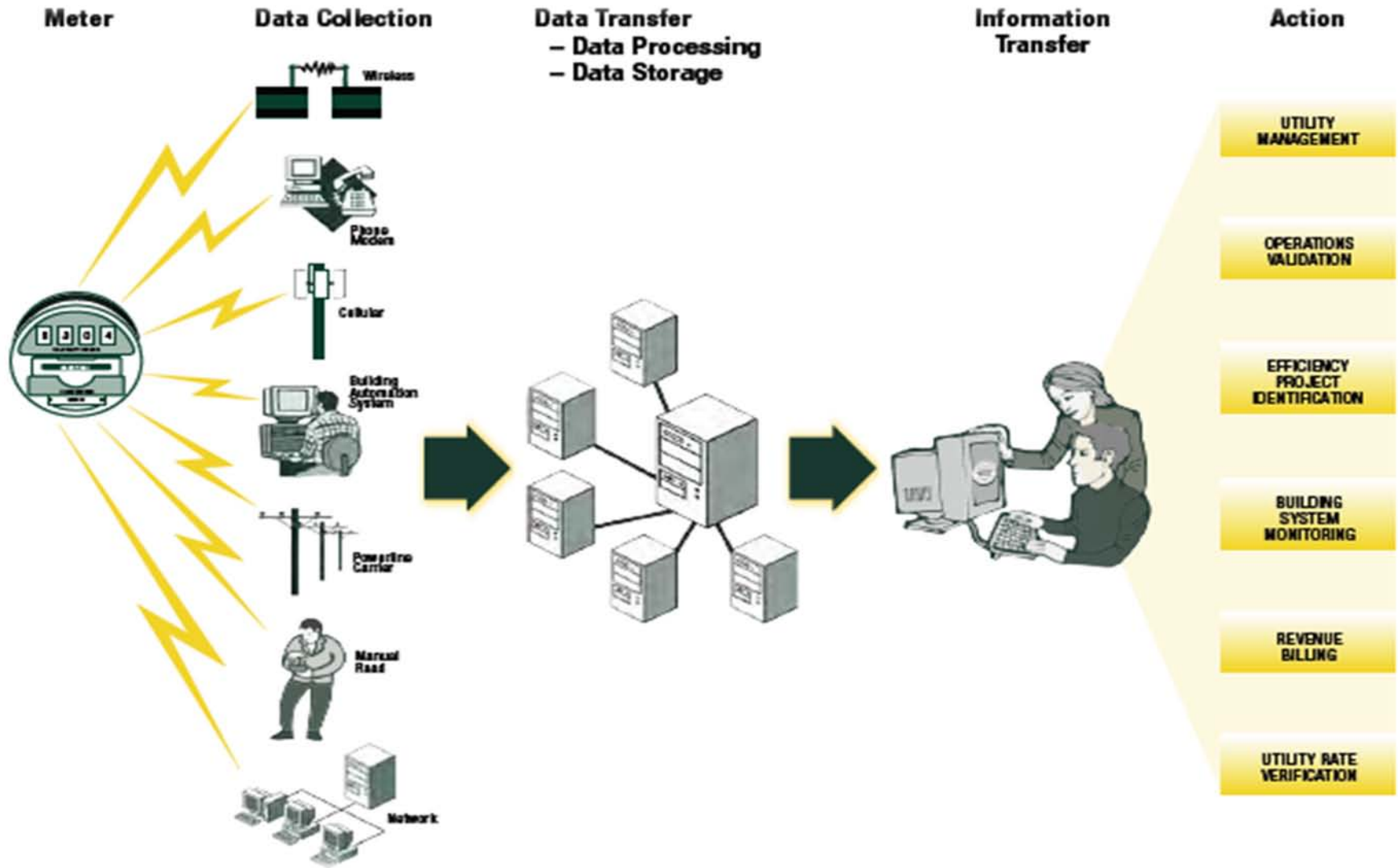
- Wireless Hart, ZigBee/802.15.4, Ethernet 802.11



Display

- Energy database
 - Dedicated designs for just energy
 - Build on existing plant, enterprise systems
- Analysis/reporting tools
 - Trends, statistical analyses, data exports
 - Reporting

Communications



Software

Consumption Report

8/31/2009 12:00 AM to 9/1/2009 12:00 AM

Time Zone: (GMT-05:00) Central Time (US & Canada)

Air (ID 22)

Air

	Air Usage (cf)
Air Flow_Meter	1,441
Total(s):	1,441

Electricity (ID 23)

Electric

	Real Energy Net (kWh)	Reactive Energy Net (kVARh)
Electric Main_Meter	23,910	7,076
Total(s):	23,910	7,076

Fuels (ID 24)

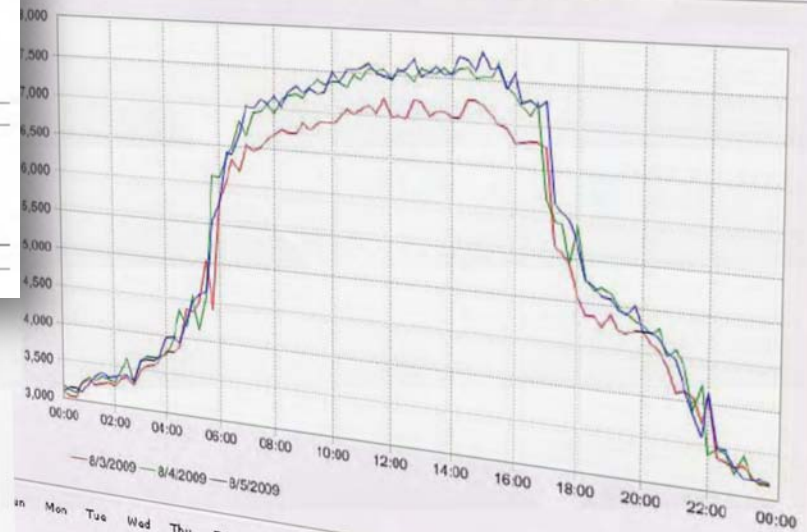
Fuel Oil

	Fuel Oil Usage (Gal)
Fuel Oil_Meter	0
Total(s):	0

type: Electric

Date Trend Calendar Trend Meter Setup

Real Power Demand Month August Year 2009 Export Data



Electrical Demand Analysis

Time Zone: (GMT-05:00) Central Time (US & Canada)

kW

Peak Demand Summary

Boiler House_Meter	865.5 kW	9.2%	7/22/2009 1:30:00 PM
Power House_Meter	352.0 kW	4.9%	7/22/2009 1:30:00 PM
Production 1_Meter	1,787.9 kW	24.7%	7/22/2009 1:30:00 PM
Production 2_Meter	1,224.6 kW	16.9%	7/22/2009 1:30:00 PM
Shipping/Receiving_Meter	3,222.4 kW	44.4%	7/22/2009 1:30:00 PM
Total	7,252.3 kW	100.0%	

Norst Case Peak Demand Analysis

Boiler House_Meter	732.0 kW	9.8%	7/29/2009 10:15:00
Power House_Meter	388.2 kW	5.2%	7/15/2009 10:30:00
Production 1_Meter	1,851.8 kW	24.8%	7/1/2009 3:45:00 PM
Production 2_Meter	1,250.4 kW	16.8%	7/8/2009 11:45:00 AM
Shipping/Receiving_Meter	3,236.0 kW	43.4%	7/7/2009 4:00:00 PM
Total	7,458.3 kW	100.0%	



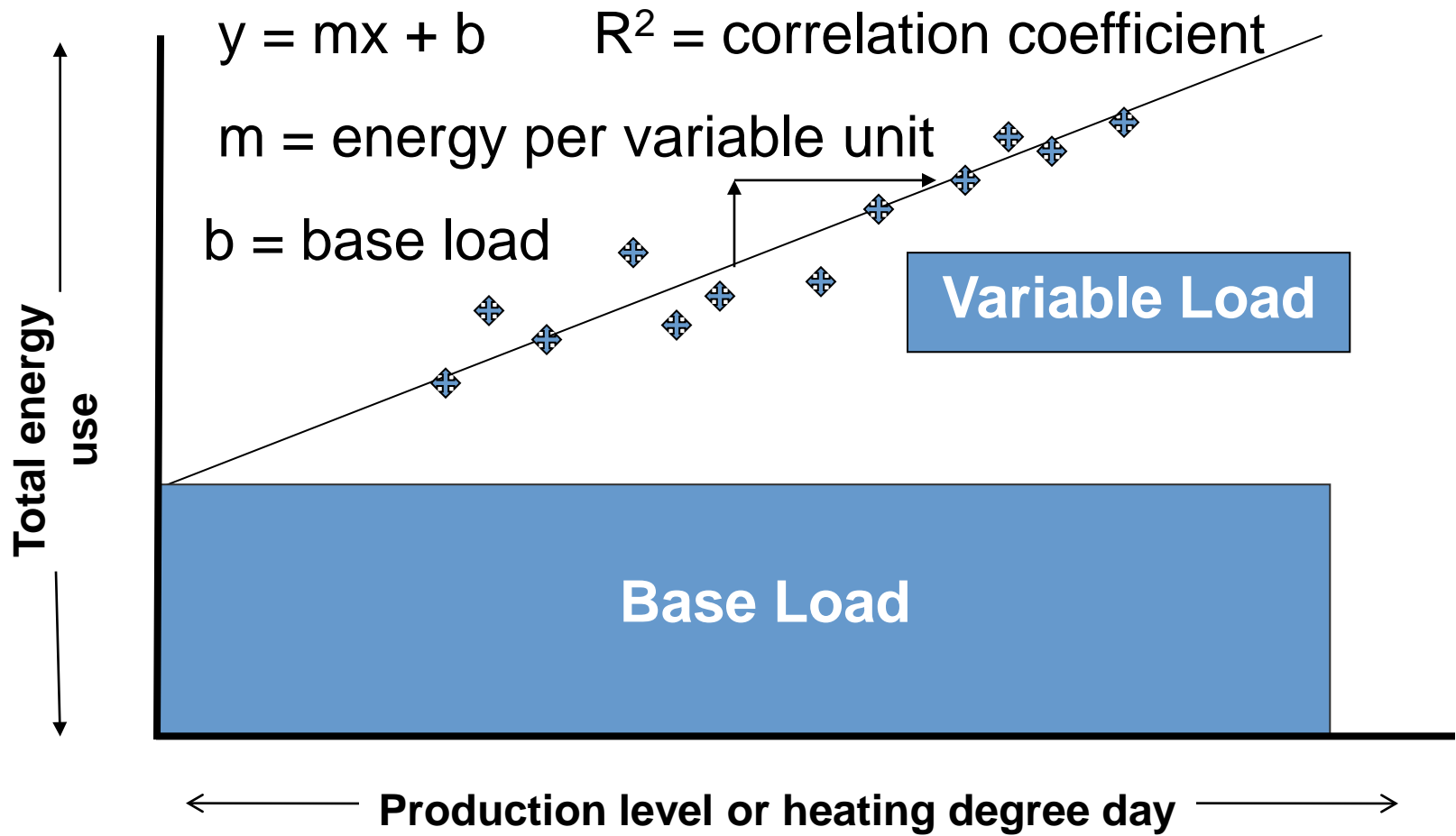
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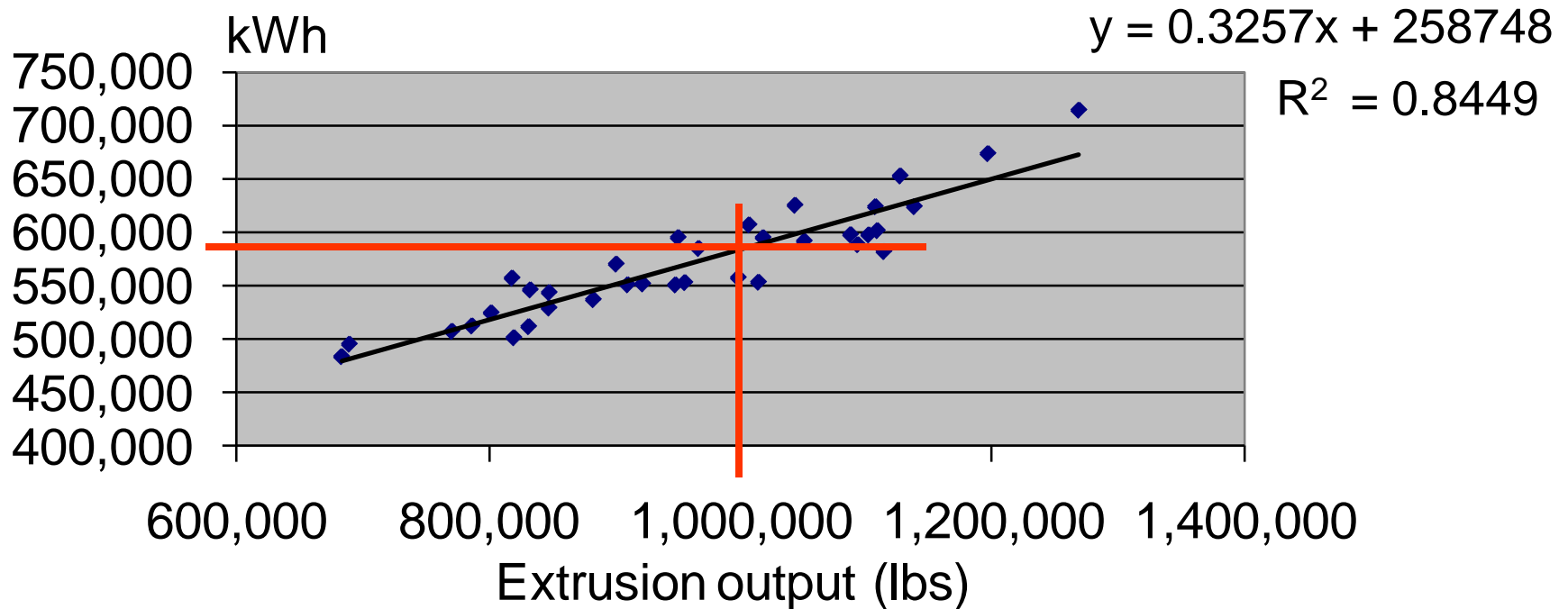
Partnering with Wisconsin utilities

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

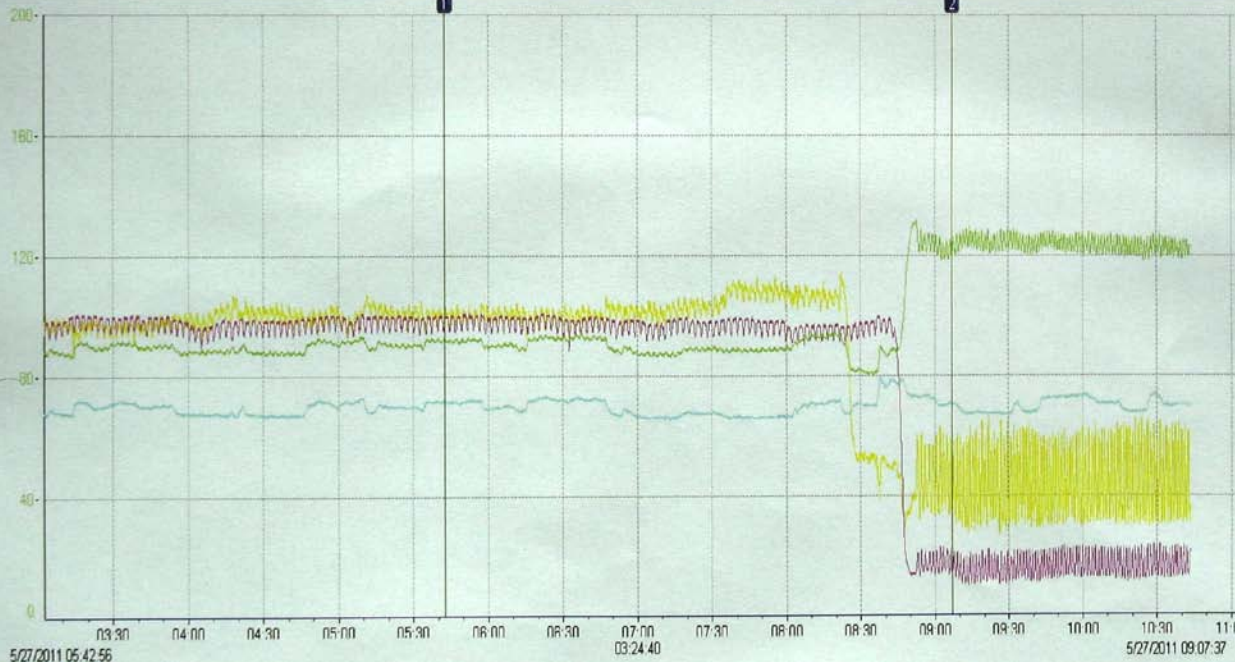




- Total kWh = $(0.3257\text{kWh/lb} \times \text{total lbs}) + 258,748 \text{ kWh}$
- Assume total lbs = 1,000,000 then total kWh = 584,448
- At \$0.075 per kWh, energy cost = \$43,834
- Or \$0.044 of electrical energy/lb of output

Troubleshoot And Optimize Processes

Tag	Description	Units	Min	Max	Current	M1	M2	Delta
TT_2878A	PM7 Dryer drainage heat exchanger FW inlet temperature	deg. F.	0	200	69.8	71.9	70.6	-1.3
TT_2878B	PM7 Dryer drainage heat exchanger FW outlet temperature	deg. F.	0	200	123.3	92.3	119.5	27.2
FI_2879	PM7 Dryer drainage heat exchanger FW flow	GPM	0	1000	106	491	66	-424.6
CALC.R7_DD_H	R7 Dryer drainage heat exchanger heat transfer	MMBTU	0	10	1.793	5.175	1.641	-3.534
7PM_Hayout	PM7 Sheet Break		0	1	0.00	0.00	0.00	0.0000



Left = Bad

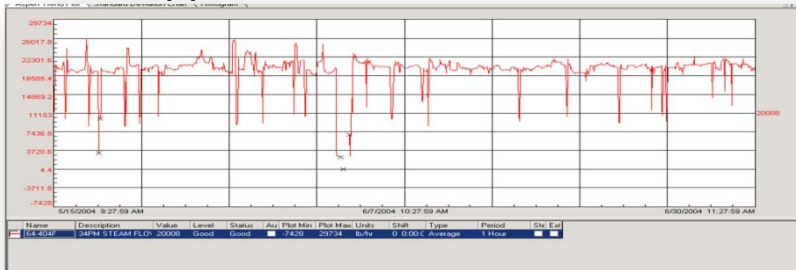
High HX feed water flow reduces heat recovery opportunity while increasing pumping costs

Right = Good

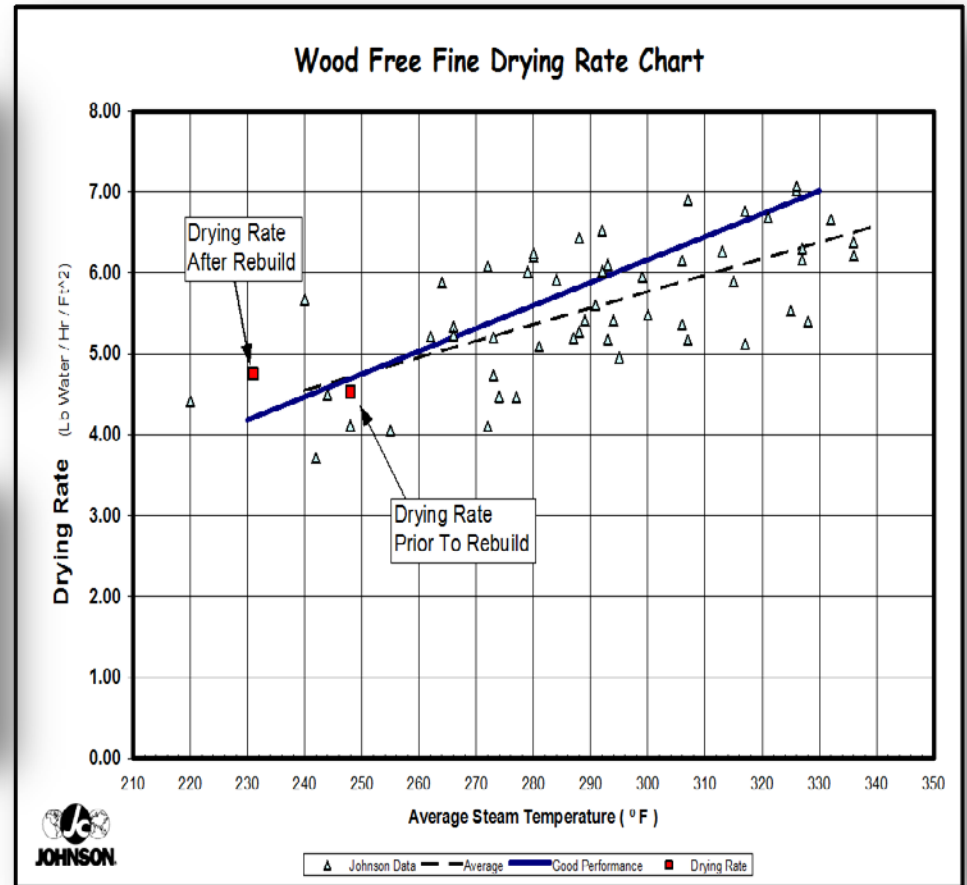
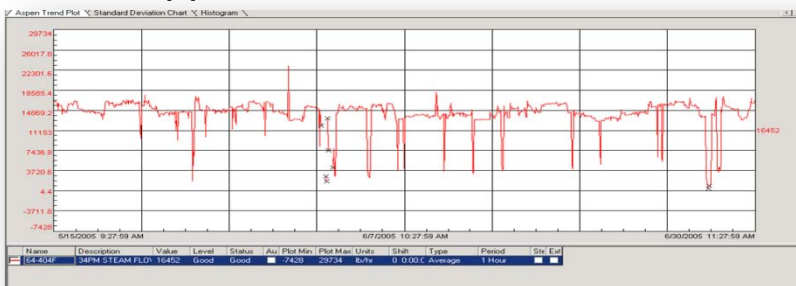
Reduced feed water flow increases discharge temp, maximizing heat recovery opportunity

Energy Project Verification

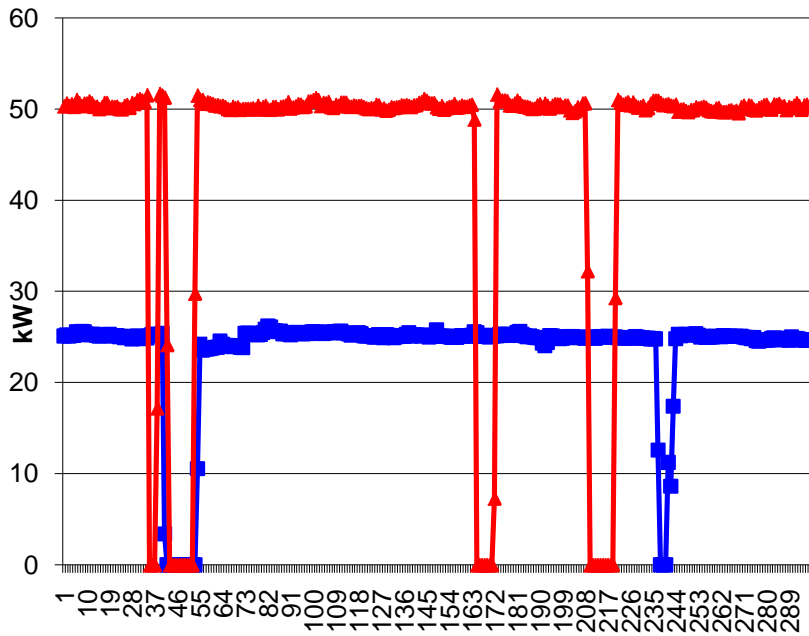
20,000 pph



16,450 pph

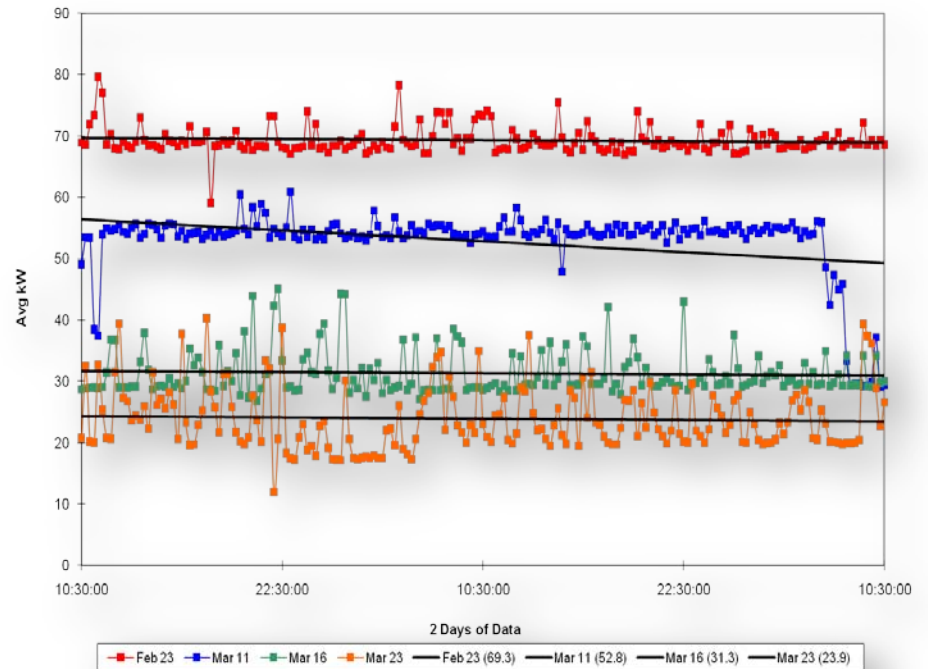


Energy Project Verification

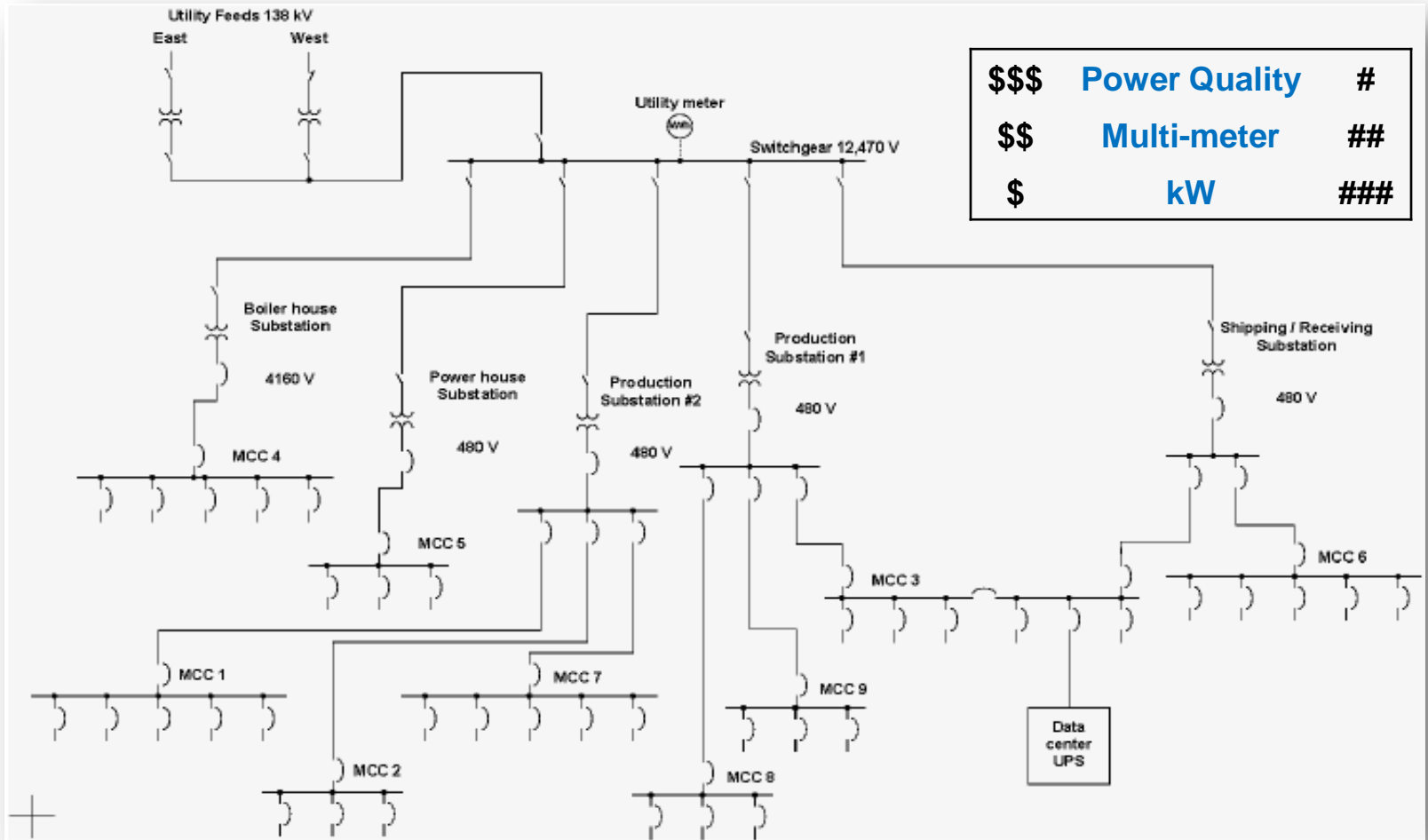


Pressure screen rotor data – pre & post

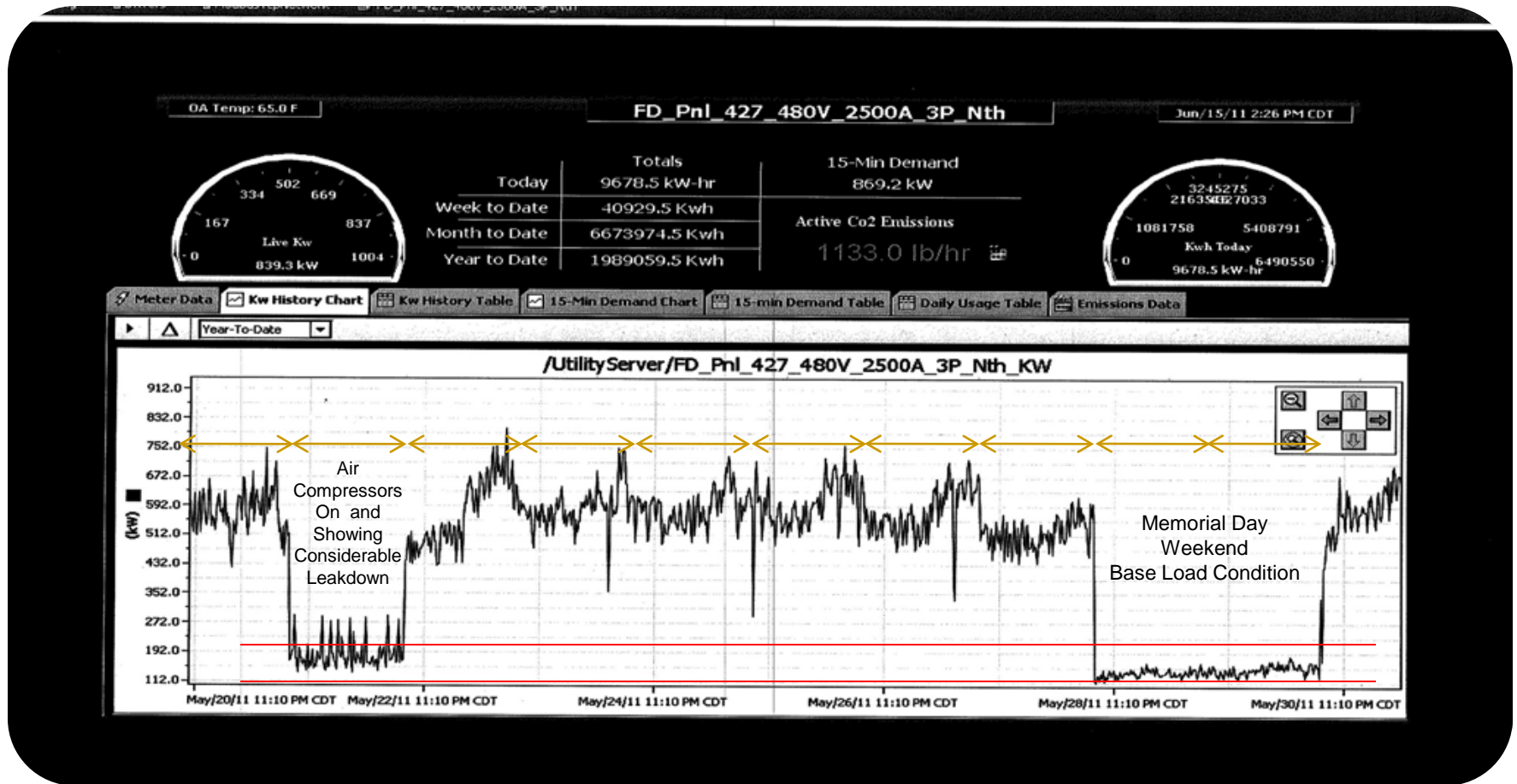
9 PM dry end pulper – average kW for 2 days



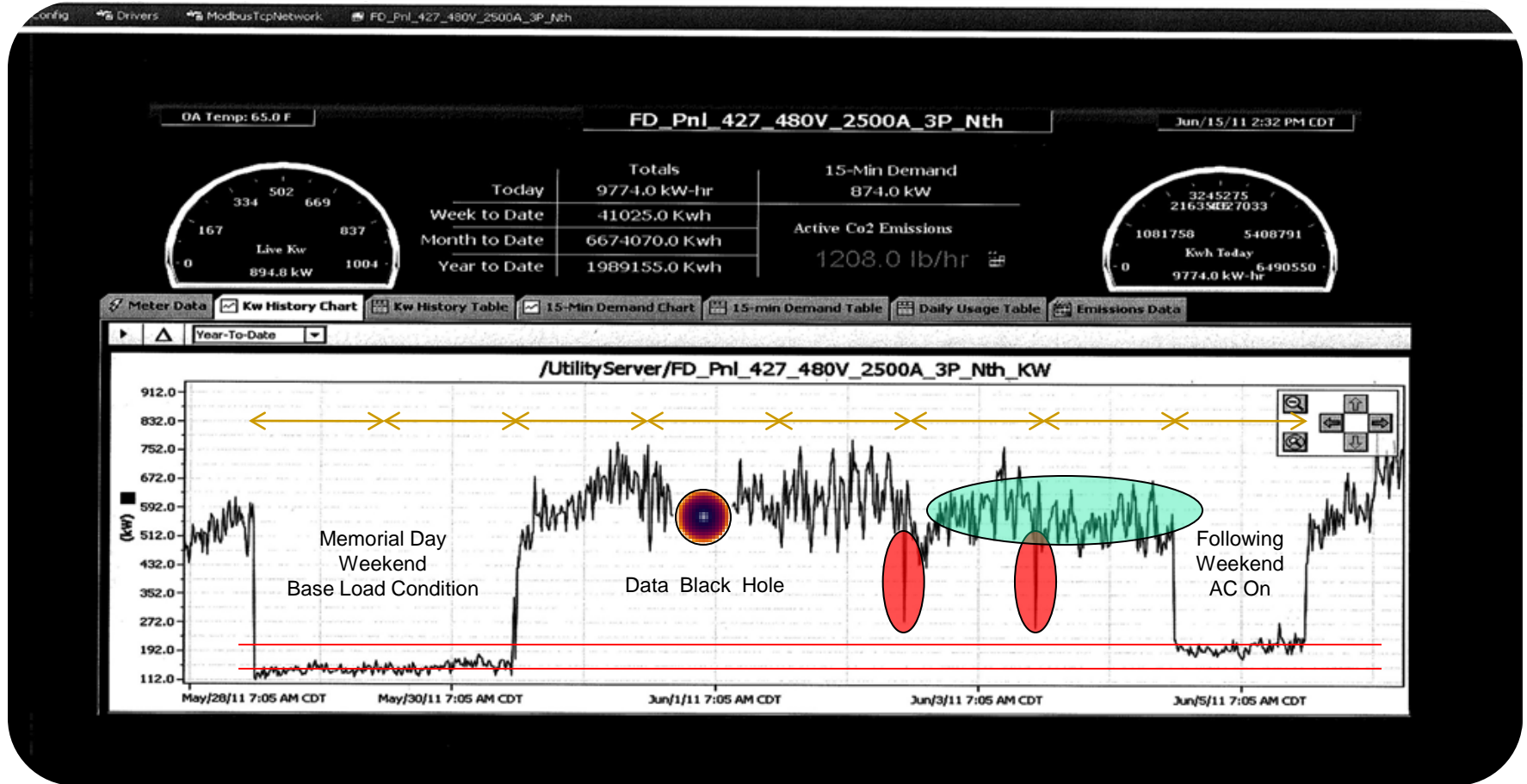
Department Cost Allocations



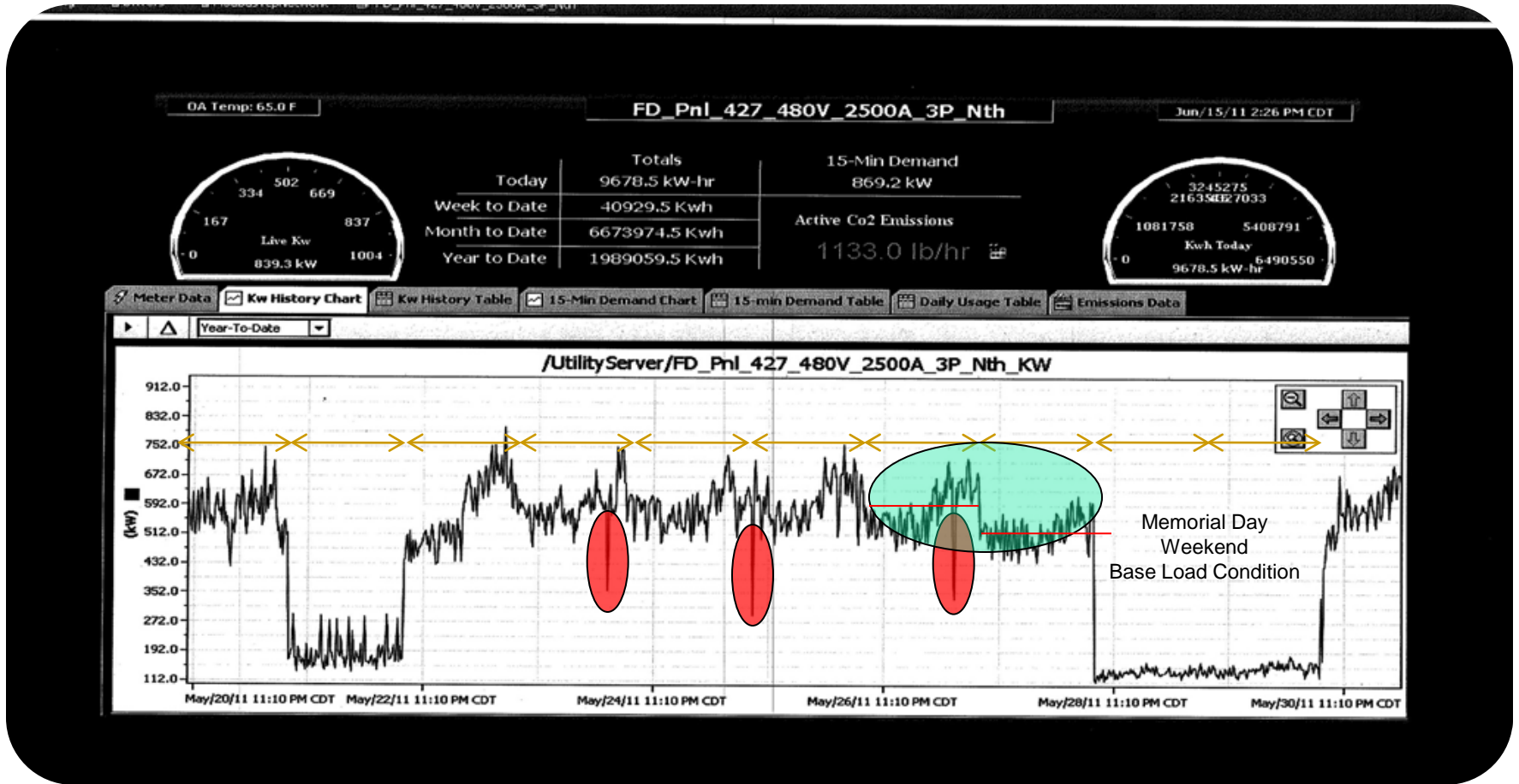
Base Load – Weekends



Base Load – Weekends (continued)



Another Look!



Q & A

Discussion

<http://en.wikipedia.org/wiki/File:CurrentTransformers.jpg>

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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