



Leveraging the PI System in a Dynamic Operating Environment

Presented by

John L. Ragone

Plant Optimization Manager

National Grid



National Grid is an International Energy Company operating in the U.K. and the U.S.

In the U.K., National Grid:

- Owns and operates high voltage electric transmission networks
- Owns and operates the high pressure gas transmission system
- Distributes gas to 11 million customers

In the U.S., National Grid:

- Distributes electricity to nearly 5 million customers in Massachusetts, New Hampshire, New York and Rhode Island
- Owns and operates approximately 4,200 MW of generating capacity
- Distributes natural gas to 3.4 million gas customers in Massachusetts, New Hampshire, New York and Rhode Island
- Service contract with LIPA to maintain and operate electric transmission and distribution system on Long Island



Who am I?

John L. Ragone
Power Plant Operations
National Grid

35 years power plant experience

Controls Manager Northport Power Station

Operations and Controls Manager Port Jefferson Power Station

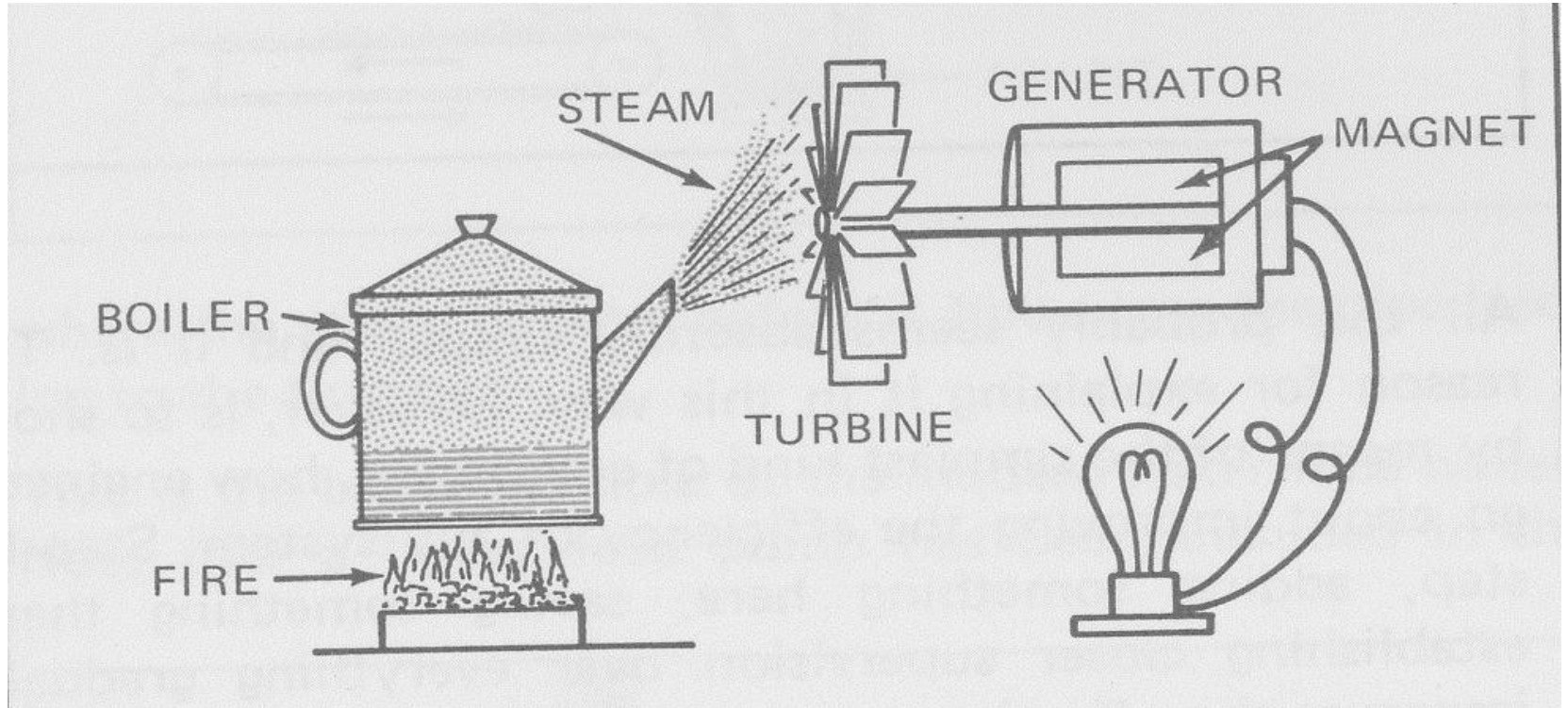
Plant Optimization Manager

NERC CIP Compliance Manager

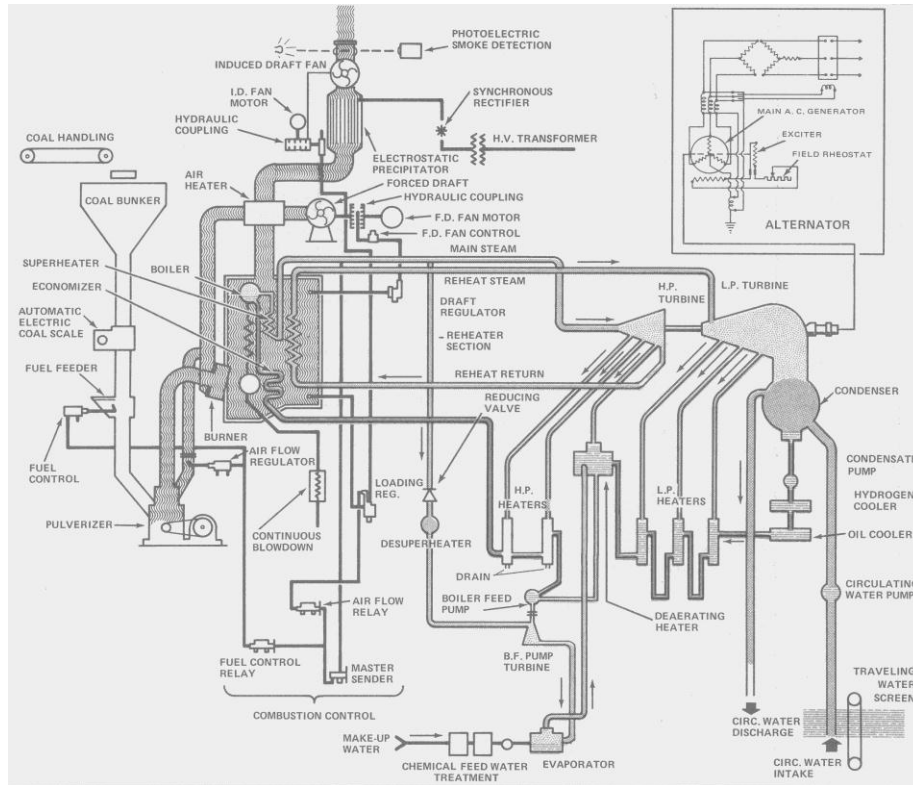
Where are we?



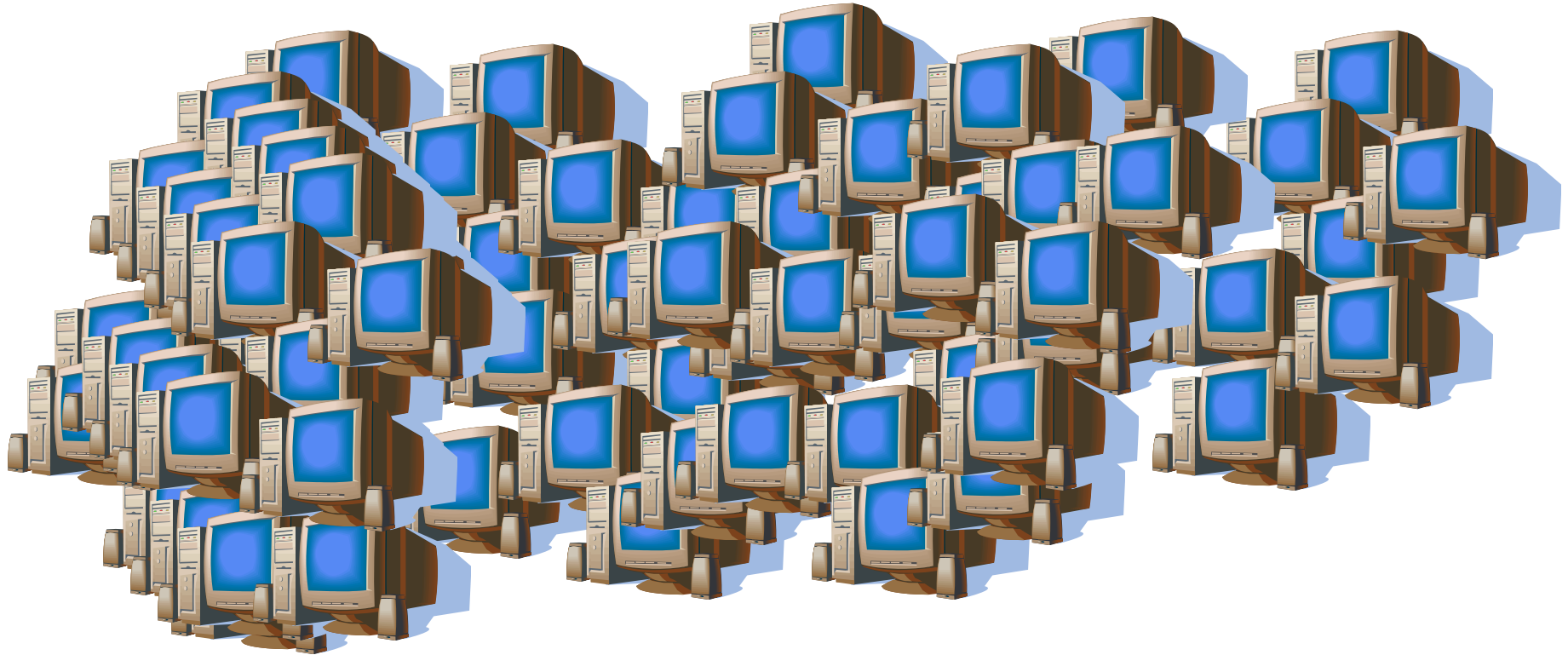
Life used to be so simple.....



Then Control Systems got more complicated.....



All of a sudden Computers were everywhere.....





and we had all these Islands of Information....

Kaye Instruments

Bailey Infi90 DCS

Proficy iFIX

ABB Optimax

**Honeywell Multitrend
Recorders**

Bentley Nevada

Opto22

ABB Advent DCS

Metso Automation MAX I DCS



The Operators were not happy.....

- “I’ve been running this plant for 20 years without a computer and I don’t need one now!”
- “It’s big brother looking over my shoulder!”
- “I don’t want any more data!”
- “I’m not computer literate!”
- “I don’t need any more work!”



Our Managers were not happy.....

- “Web enabled devices are a luxury, we’re trying to run a business here.”
- “I don’t need anyone from headquarters second guessing our decisions without all the details!”
- “I don’t want any more data!”
- “I’m not a computer analyst!”
- “I don’t need any more work!”



Challenges included.....

- Distributed asset base
 - 20+ generating units covering Long Island/NYC
- Information required by various business areas
 - Executives, engineering, operations, environmental
- Limited resources
 - Capital and human resources (aging workforce)
- Vast amounts of data
 - Not presented in a relevant, actionable format
- Cross business collaboration opportunities
 - Need to extend “team” boundaries



So what did we do?

We focused on Operator hot buttons

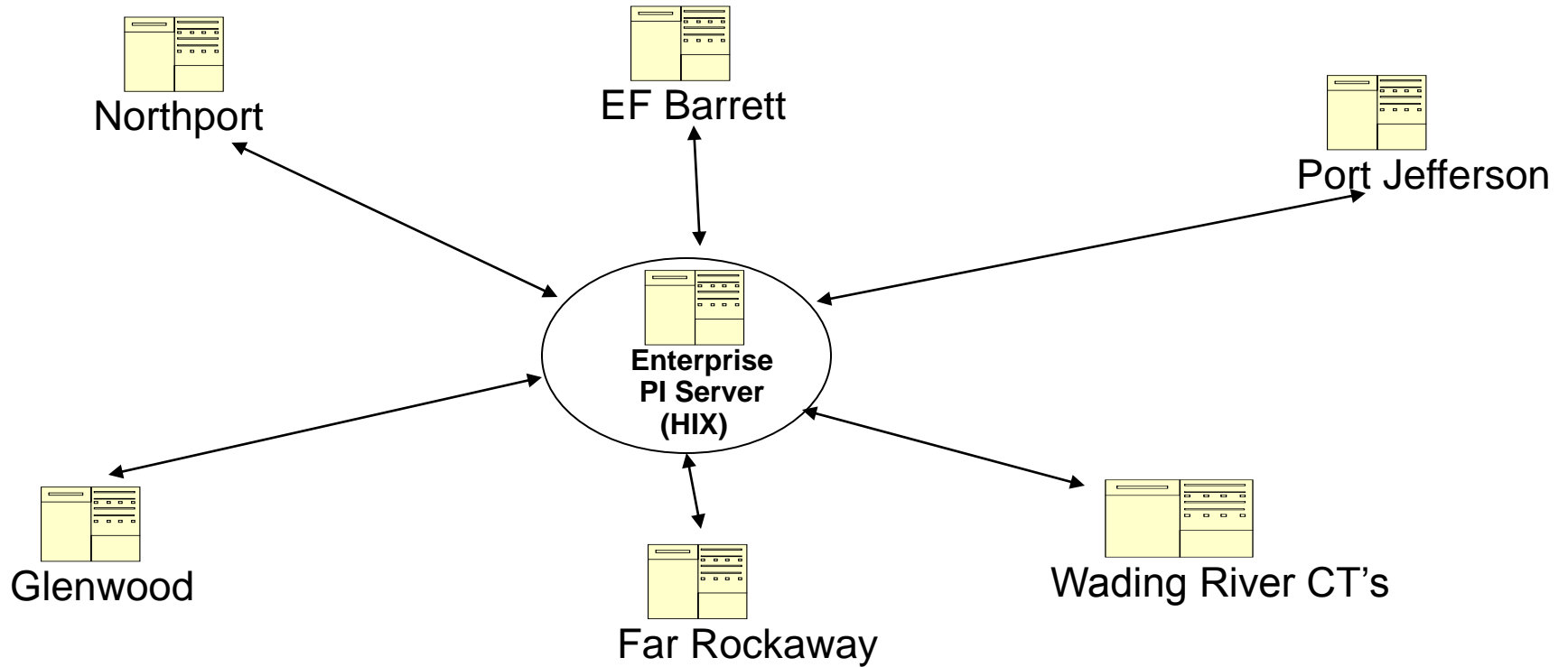
- Initially targeted local plant missionaries and opinion leaders
- Solicited user input
- Provided fewer screens with “key information” using large visible numbers, buttons and graphics in our screen designs
- Provided “role specific training”
- Minimized audible alarms. Used new systems to automate manual tasks



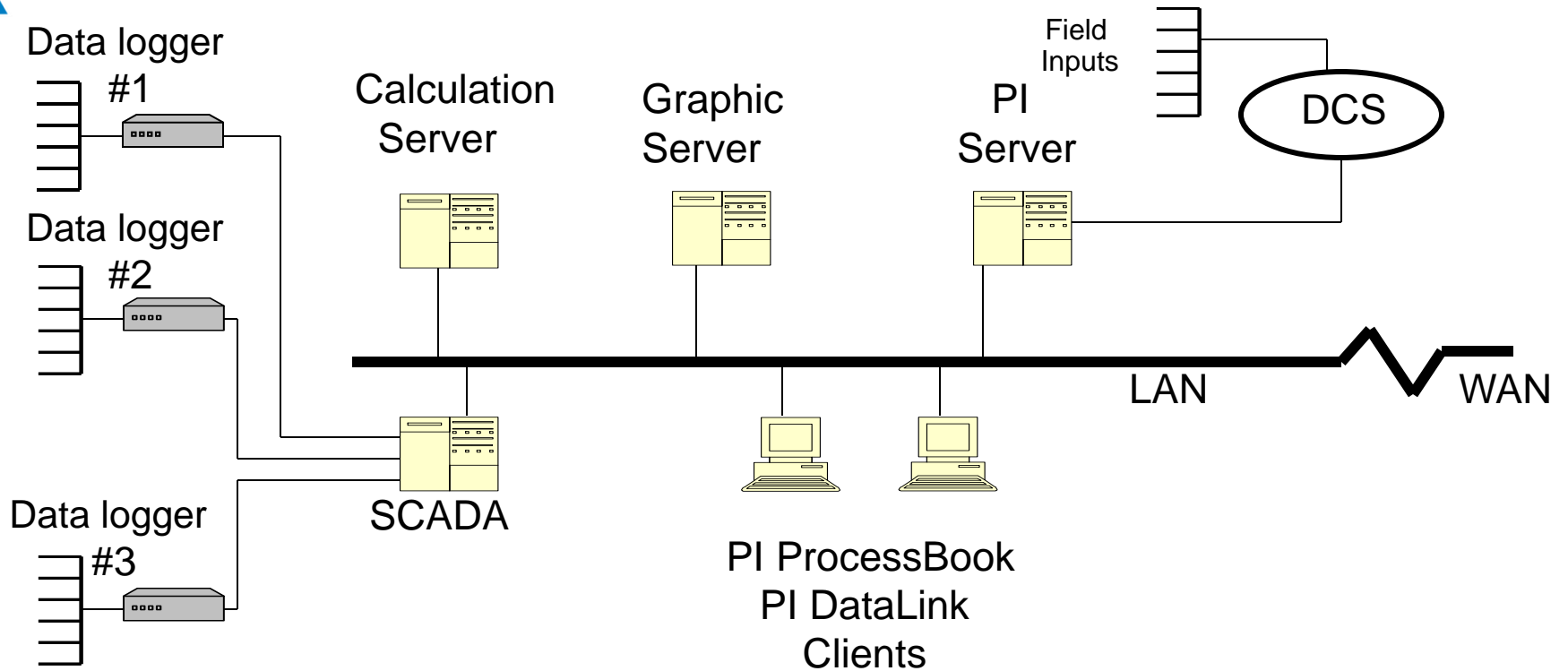
Next we went after the Manager's hot buttons

- Presented solutions that would reduce risks
- Solicited manager input to design screens
- Set up different levels of implementation for our products
- Provided “manager specific training”
- Reduced routine workload
- Initially targeted local plant missionaries and opinion leaders

PI Server Infrastructure



Typical Generation Architecture





PI System Infrastructure

- 12 Years
- 7 Servers
- 40,000 points
- 150 users
- Architecture



Where do we use the PI System?

PI System is the Core of our:

- Performance Analysis Engine
- E-notification System
- Distributed Control System (DCS) Historical Database
- Independent System Operator (ISO) Interface to Control Rooms
- Performance Analysis Historical Database
- Monthly Heatrate Packages

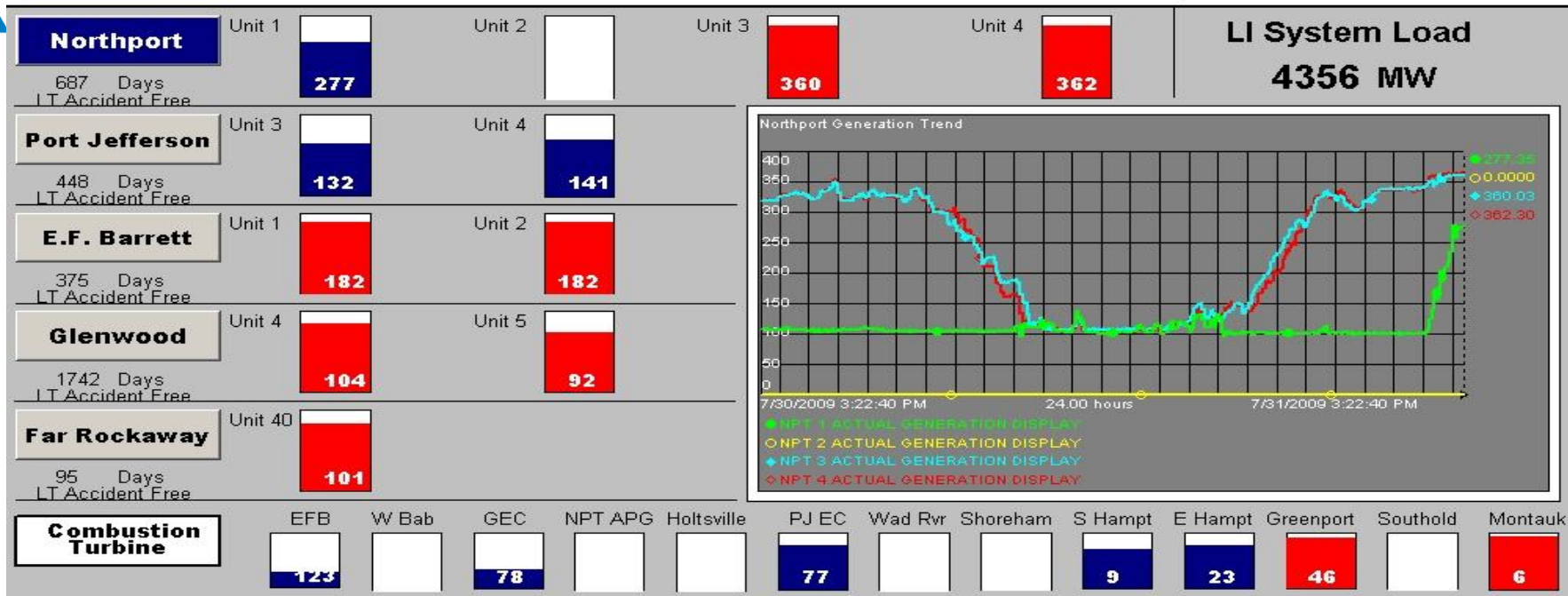


**So how about a few examples of what
this PI System stuff looks like?**

Performance Assessment Center

Office of Electric Generation

7/31/2009



nationalgrid

Electric Production
 95 Days LT Accident Free
 Performance Improvement
 6421 Days LT Accident Free

Maintained by Plant Process Optimization

Last Updated 7/31/2009 3:22:41 PM

For this screen, **RED** is good!

Unit Performance Overview - NPT

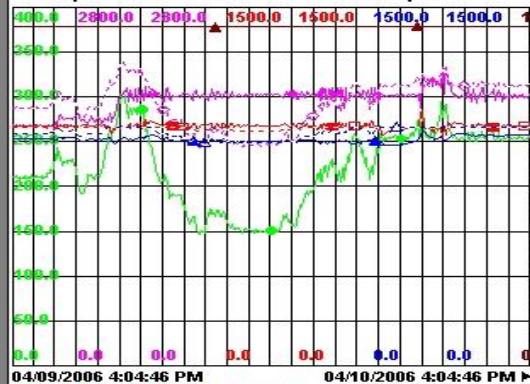
Northport Unit 1

Gross Load **253.8** MW Aux Load **11.0** MW

Net Heat Rate **10588** Btu/kWh

Dsgn Net Heat Rate **9748** Btu/kWh

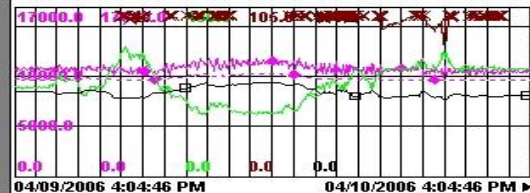
NPT1 Op Controllable - Steam Press & Temps



- ◆ UNIT 1 GROSS LOAD from PI
- ◆ MAIN STEAM LINE (THROTTLE)
- ◇ MAIN STEAM PRESSURE (EXPEC)
- MAIN STEAM LINE (THROTTLE)
- MAIN STEAM TEMPERATURE (EX)
- ▲ REHEAT TEMPERATURE (ACTUAL)
- △ REHEAT TEMPERATURE (EXPECT)
- ▲ % FUEL GAS

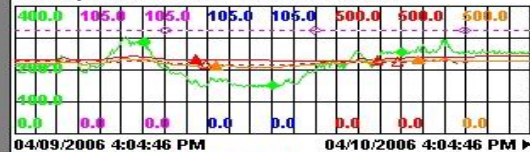
Alarms

NPT1 Heat Rate & Efficiencies



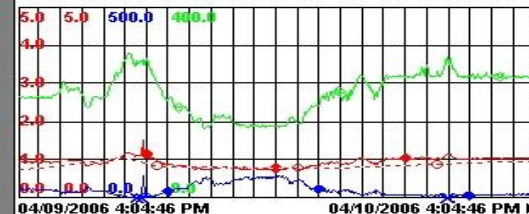
- ◆ UNIT NET HEAT RATE (ACTUAL)
- ◆ UNIT NET HEAT RATE (EXPECT)
- ◇ UNIT 1 GROSS LOAD from PI
- HIGH PRESSURE TURBINE EFFI
- INTERMEDIATE PRESS TURBINE

NPT1 Op Controllable - Exit Gas & Excess Air



- ◆ UNIT 1 GROSS LOAD from PI
- ◆ BOILER EFFICIENCY (HL)
- ◇ BOILER EXPECTED EFFICIENCY
- AIR HEATER-A EFFICIENCY
- AIR HEATER-B EFFICIENCY
- ▲ AH Gas Outlet Temp- degF
- △ AH Gas Outlet Temp- degF
- ▲ BOILER EXIT GAS TEMPERATUR

NPT1 Condenser



- ◆ CONDENSER BACK PRESSURE fr
- CONDENSER PRESSURE (EXPECT)
- ◆ CONDENSER PRESS HEAT RATE
- ◇ UNIT 1 GROSS LOAD from PI

BOP Start-Up Trends

| Turbine Bearing Vibrations & Temperatures | |
|---|----------------------|
| MBFP & Hyd Cplng Bearing Parameters | |
| BCP Bearing Temperatures | Turbine Performance |
| BCP Bearing Seal Parameters | HP Feedwater Heaters |
| ID Fan (Bearing) Parameters | LP Feedwater Heaters |
| FD Fan (Bearing) Parameters | Air Preheater Data |
| GR Fan (Bearing) Parameters | Boiler Drum Data |
| FOBP Bearing Temperatures | HDP Bearing Temps |
| Condenser Data (MTH) | |

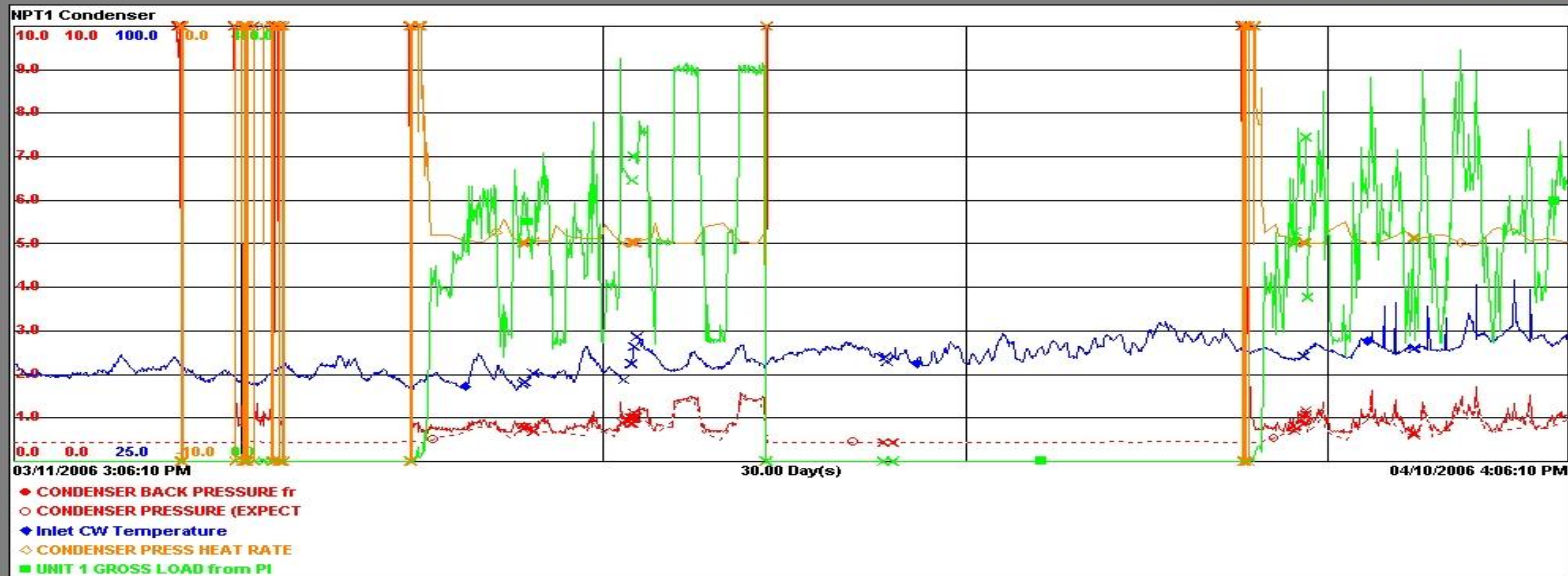
| | |
|---------------------|---------------------------|
| NPT2 Level I Trends | NPT1 Heat Rate Deviations |
| NPT3 Level I Trends | NPT4 Level I Trends |

Condenser Performance - NPT

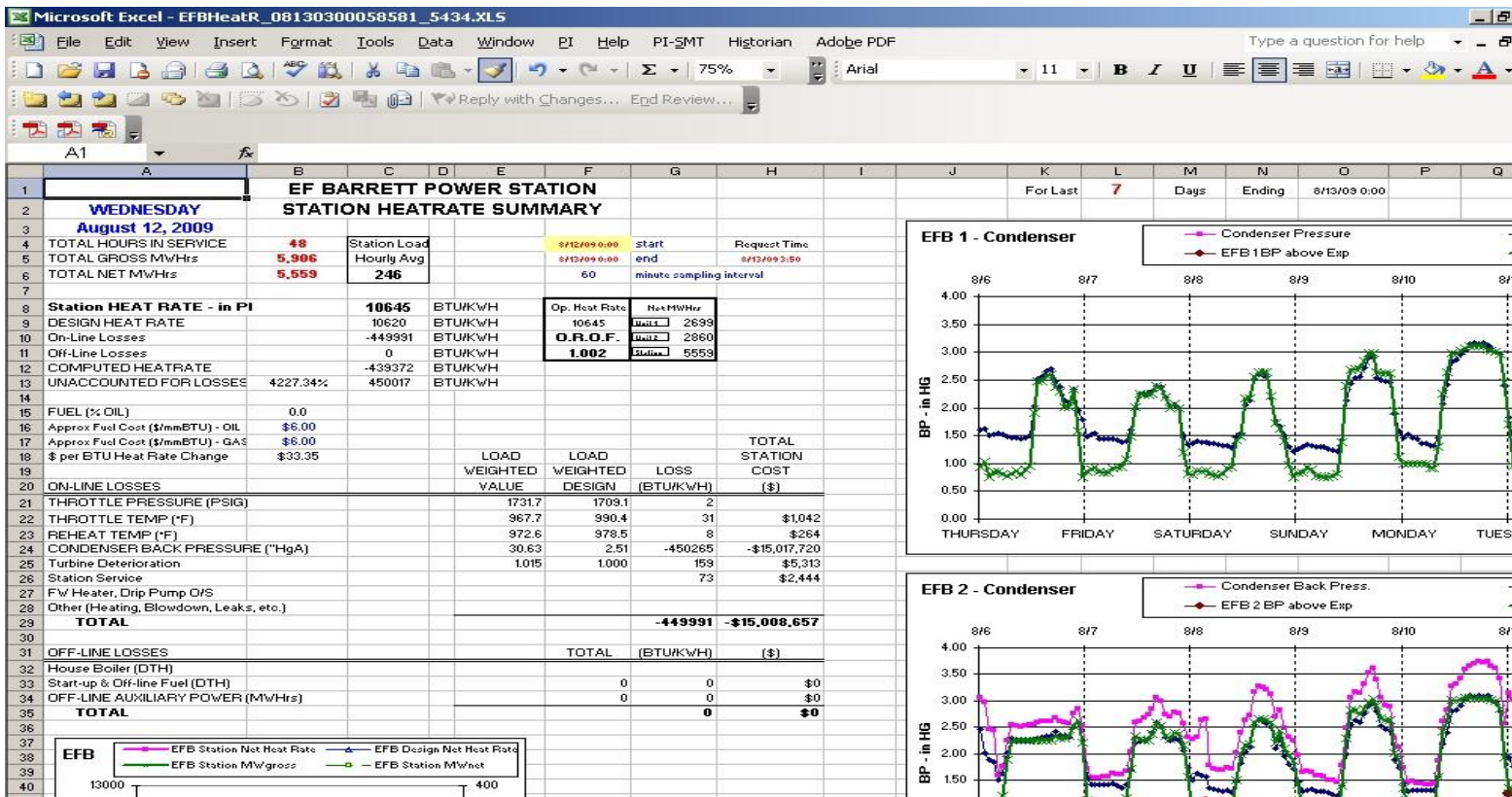
NPT1 Condenser Data (Month)

| | | | |
|------------|----------|--------------------|---------------|
| Gross Load | 253.7 MW | Net Heat Rate | 10578 Btu/kWh |
| Aux Load | 11.0 MW | Dsgn Net Heat Rate | 9748 Btu/kWh |

NPT1 Level I Trends



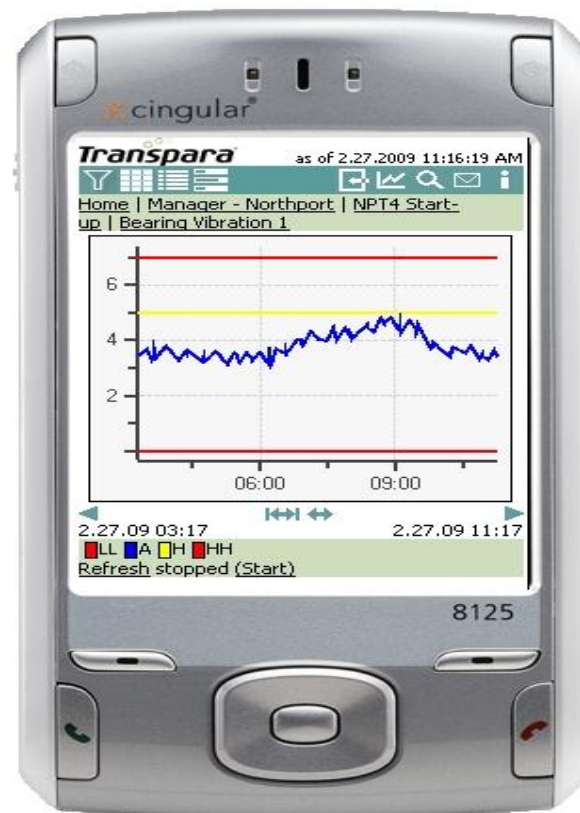
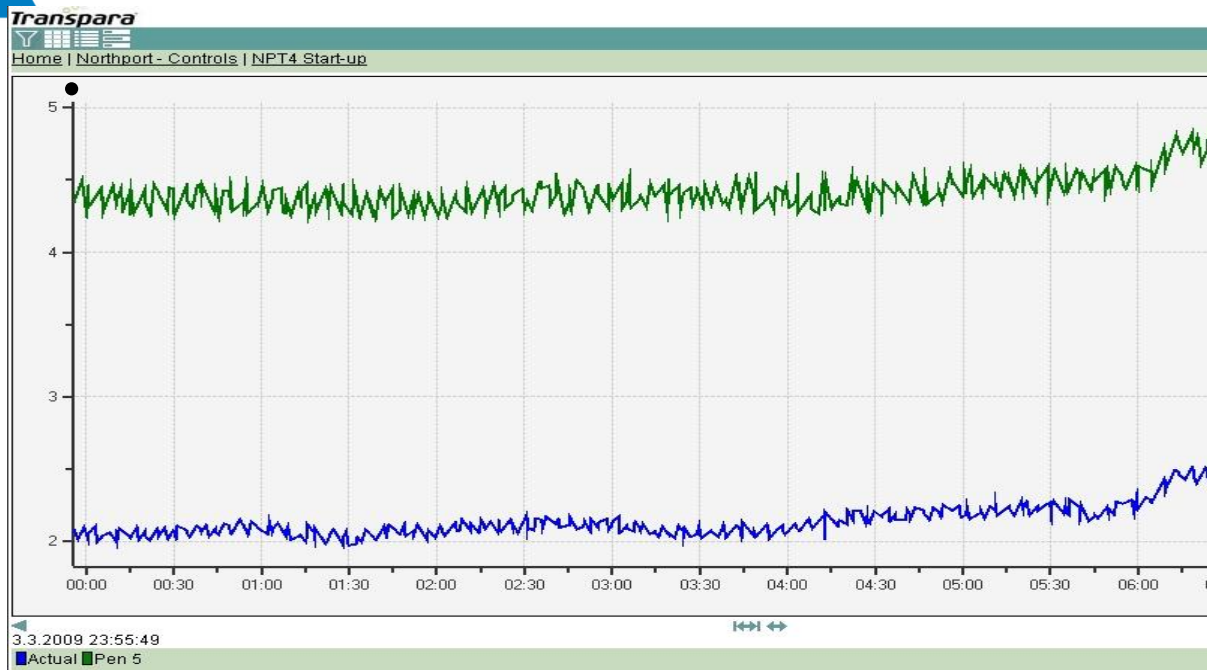
PI DataLink for Excel



Northport Unit 4 Startup



Unit Start-up Trends



Startup Snapshot

Transpara

as of 9.3.2009 1:00:42 PM



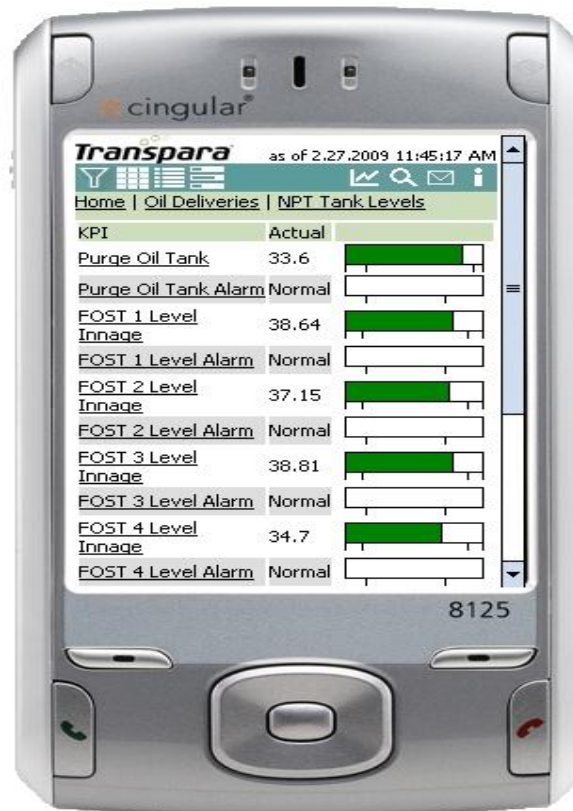
Home | Northport - Controls | NPT1 Start-up

| | | | | | |
|-----------------|----------------|----------------|---------------|------------|--------------|
| Unit 1 Load | NPT1 RPM | NPT1 MSP | NPT1 FSP | NPT1 ACC | NPT1 Max ACC |
| NPT1 Max IP Ram | NPT1 Max Ramp | NPT1 Xover | NPT1 RH Shell | NPT1 INN | NPT1 Ecc |
| NPT1 1st Stg St | NPT1 Ramp Rate | NPT1 RH Ramp | NPT1 LOT | Brg 1 Vib. | Brg 2 Vib. |
| Brg 8 Vib. | Brg 7 Vib. | Brg 6 Vib. | Brg 5 Vib. | Brg 4 Vib. | Brg 3 Vib. |
| Brg 9 Vib. | Brg 10 Vib. | Frnt. Standard | | | |

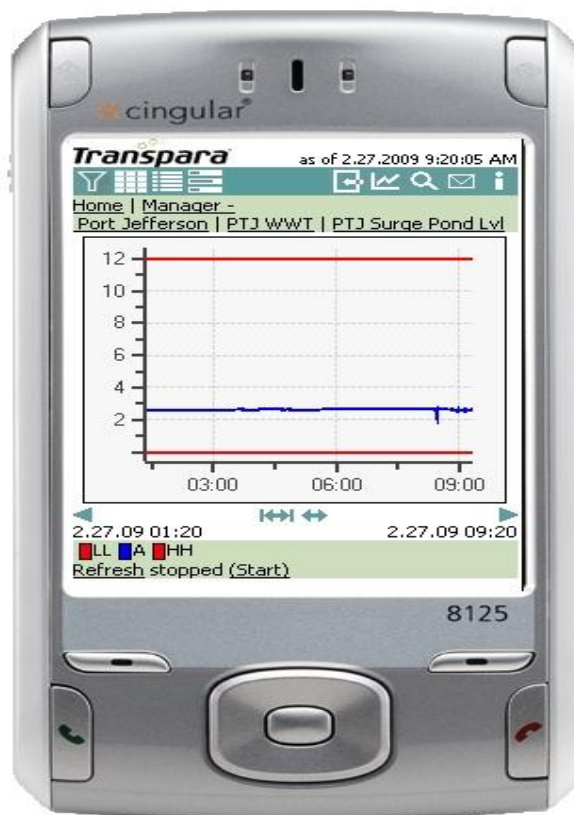
■ Low Low ■ Low ■ Good ■ High ■ High High ■ Unknown ■ Not In Service □ N/A

Refresh in 56 seconds (Stop)

Northport Off-Shore Platform Fuel Deliveries



Port Jefferson Wastewater Treatment



Unit Desired Generation information





We focused on a “Role Based Implementation”

Top Menu of All Views

Summary View – Desktop & PDA

Transpara

7.25.2007 9:47:34 PM

Views

[Executive - Overview](#)

[Executive - Northport](#)

[Executive - Ravenswood](#)

[Manager - Northport](#)

[Northport - Controls](#)

[SmartSignal](#)

[Manager - EF Barrett](#)

[Executive - EF Barrett](#)

[Port Jefferson - Controls](#)

[Technician Toolbox - Northport](#)

[Manager - Port Jefferson](#)

[Northport - Mechanic Toolbox](#)

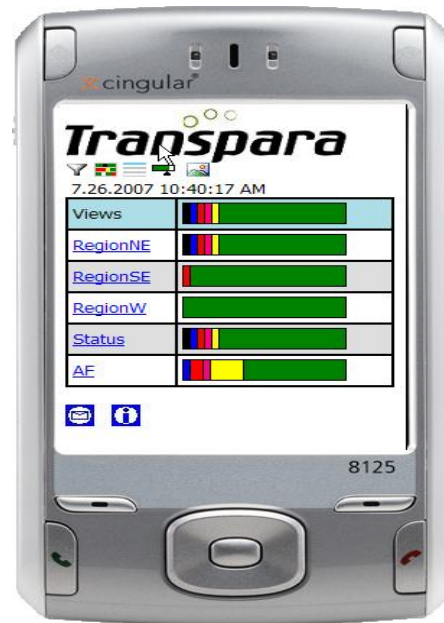
[Oil Deliveries](#)

[Northport - Maintenance](#)

[Manager - Combustion Turbines](#)

[KETS](#)

[Plant Process Optimization](#)



Role 1 – Executives and Managers

High-level overview of system status

Transpara Visual KPI - Windows Internet Explorer

https://realtime.keyspanenergy.com/visualkpi/map.aspx?view=0fe7d13b-d4d5-4f69-9d23-4be6bcfd51e5&sc=All&filter=

Home | Executive - Northport

7.25.2007 11:16:57 PM

| | | | | | | | |
|--------------|--------------|--------------|--------------|----------------|-------------|--------------|--------------|
| NPT1 Load | NPT2 Load | NPT3 Load | NPT4 Load | NPT1 Gen | NPT1 6 sec | NPT1 5 min | NPT1 % Oil |
| NPT2 % Gas | NPT2 % Oil | NPT2 5 min | NPT2 6 sec | NPT2 Gen | NPT1 NOx | NPT1 Opacity | NPT1 % Gas |
| NPT2 Opacity | NPT2 NOx | NPT3 Gen | NPT3 6 sec | NPT3 5 min | NPT3 % Oil | NPT3 % Gas | NPT3 Opacity |
| NPT4 NOx | NPT4 Opacity | NPT4 % Gas | NPT4 % Oil | NPT4 5 min | NPT4 6 sec | NPT4 Load | NPT3 NOx |
| Unit 4 Load | Brg 1 Vib. | Brg 2 Vib. | Brg 3 Vib. | Brg 4 Vib. | Brg 5 Vib. | Brg 6 Vib. | Brg 7 Vib. |
| NPT2 Load | NPT1 NOx | NPT1 Opacity | NPT1 Load | Frnt. Standard | Brg 10 Vib. | Brg 9 Vib. | Brg 8 Vib. |
| NPT2 Opacity | NPT2 NOx | NPT3 Load | NPT3 Opacity | NPT3 NOx | NPT4 Load | NPT4 Opacity | NPT4 NOx |

Refresh stopped (Start)



Role 1 – Executives and Managers

Drill-down for system status Scorecard

Transpara Visual KPI - Windows Internet Explorer

https://realtime.keyspanenergy.com/visualkpi/scorecard.aspx?view=0fe7d13b-d4d5-4f69-9d23-4be6bcfd51e5

File Edit View Favorites Tools Help

Transpara Visual KPI

Home | Executive - Northport

7.25.2007 11:17:57 PM

| Scorecard | KPI | | Actual | Target |
|----------------------------------|-------------------------------------|---|--------|--------|
| Northport - Load | NPT 1 | ● | 302.3 | |
| Northport - Load | NPT 2 | ● | 107.7 | |
| Northport - Load | NPT 3 | ● | 107.7 | |
| Northport - Load | NPT 4 | ● | 313 | |
| NPT 1 UDG | NPT 1 Load | ● | 302.3 | |
| NPT 1 UDG | NPT 1 Desired 6 sec | ● | 303 | |
| NPT 1 UDG | NPT 1 Desired 5 min | ● | 304 | |
| NPT 1 UDG | NPT 1 Oil % Burn | ↓ | -.07 | |
| NPT 1 UDG | NPT 1 Gas % Burn | ↑ | 100.1 | |
| NPT 1 UDG | NPT 1 Opacity | ● | .665 | |
| NPT 1 UDG | NPT 1 NOx | ● | .117 | |
| NPT 2 UDG | NPT 2 Load | ● | 107.7 | |
| NPT 2 UDG | NPT 2 Desired 6 sec | ● | 115.7 | |
| NPT 2 UDG | NPT 2 Desired 5 min | ● | 120 | |
| NPT 2 UDG | NPT 2 Oil % Burn | ● | 78.93 | |
| NPT 2 UDG | NPT 2 Gas % Burn | ● | 21.07 | |
| NPT 2 UDG | NPT 2 Opacity | ● | 1.65 | |
| NPT 2 UDG | NPT 2 NOx | ▲ | .143 | |
| NPT 3 UDG | NPT 3 Load | ● | 107.7 | |
| NPT 3 UDG | NPT 3 Desired 6 sec | ● | 115.4 | |



Role 1 – Executives and Managers

Detail = Total MW for all sites

[Home](#) | [Executive - Headquarters](#) | [MW - All Sites](#) | [Trend](#)

LI Load  | [9/10/2006 5:09:57 PM](#)



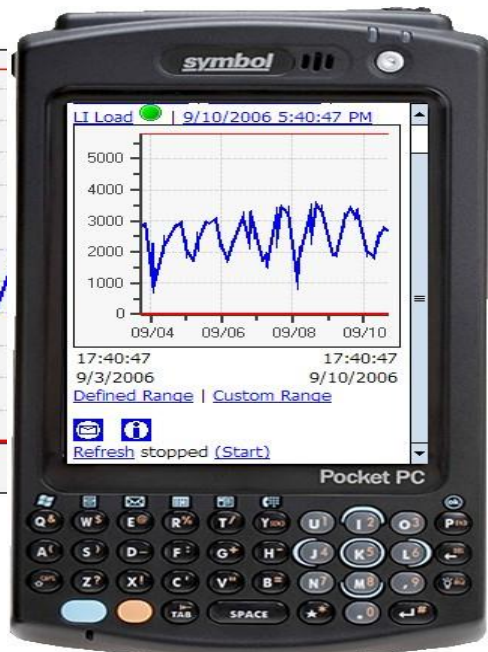
17:09:57

9/3/2006

[Defined Range](#) | [Custom Range](#)



[Refresh stopped \(Start\)](#)



Role 2 - Plant Managers

Focus on his Units only

[Home](#) | [Manager - Northport](#) | CEM

9/10/2006 5:20:47 PM

[View KPI Map](#)

| KPI | | Actual |
|--------------------------------|---|--------|
| Unit 1 Opacity | ● | 2.45 |
| Unit 1 NOx | ● | .15 |
| Unit 2 Opacity | ● | 2.05 |
| Unit 2 NOx | ● | .12 |
| Unit 3 Opacity | ● | 6.07 |
| Unit 3 NOx | ● | 0 |
| Unit 4 Opacity | ● | 4.82 |
| Unit 4 NOx | ● | .08 |



[Refresh](#) stopped ([Start](#))



Role 2 - Plant Managers

Detail = single unit performance

[View KPI Map](#)

Scorecards

[CEM](#)

[Condenser](#)

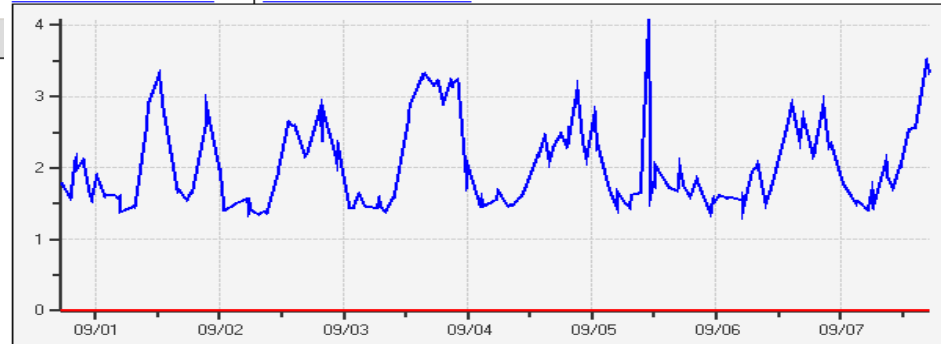
[View KPI Map](#)

[Load](#)

[Main Steam](#)

| KPI | | Actual | Target |
|--------------------------------------|---|--------|--------|
| Unit 1 Back Pressure | ● | 3.02 | |
| Unit 2 Back Pressure | ● | 2.98 | |
| Unit 3 Back Pressure | | | |
| Unit 4 Back Pressure | | | |

[Unit 4 Back Pressure](#) ● | [9/7/2006 5:24:45 PM](#)



17:24:45

8/31/2006

[Defined Range](#) | [Custom Range](#)

17:24:45

9/7/2006

Role 3 - Technician

Asset- and task- centric focus

[Home](#) | [Technician Toolbox - Northport](#)

9/11/2006 11:21:26 PM

[View KPI Map](#)

| Scorecards |
|---|
| Continuous Emissions Monitoring (CEM) |
| Modified Turbine Test (MTT) |
| Station Thermal Output |
| Tank Farm - Wireless Troubleshooting |
| Weather Station |



[Refresh](#) stopped ([Start](#))

[Home](#) | [Technician Toolbox - Northport](#) | [Continuous Emissions Monitoring \(CEM\)](#)

9/11/2006 11:23:08 PM

[View KPI Map](#)

| KPI | | Actual |
|-------------------------------------|--|--------|
| Unit 1 Load | | 130.86 |
| Unit 1 Opacity | | 2.83 |
| Unit 1 NOx | | .1 |
| Unit 2 Load | | 113.48 |
| Unit 2 Opacity | | 1.62 |
| Unit 2 NOx | | .12 |
| Unit 3 Load | | 0 |
| Unit 3 Opacity | | 5.9 |
| Unit 3 NOx | | 0 |
| Unit 4 Load | | 101.35 |
| Unit 4 Opacity | | 5.22 |
| Unit 4 NOx | | .08 |
| Ambient Temperature | | 62.16 |



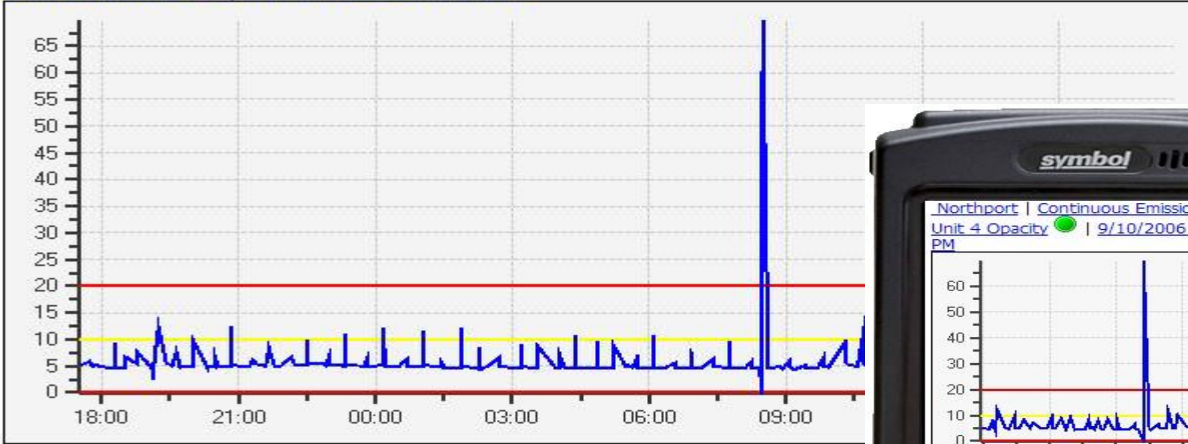
[Refresh](#) stopped ([Start](#))

Role 3 - Technician

Detail = remote CEM subsystem tuning

[Home](#) | [Technician Toolbox - Northport](#) | [Continuous Emissions Monitoring \(CEM\)](#) | [Trend](#)

Unit 4 Opacity ● | [9/10/2006 5:31:41 PM](#)



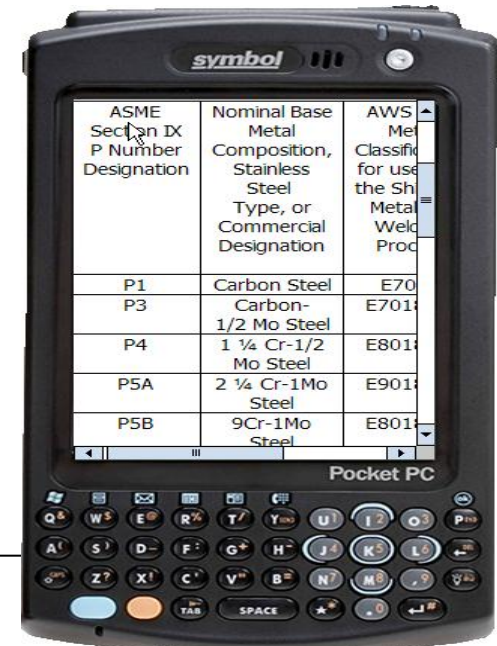
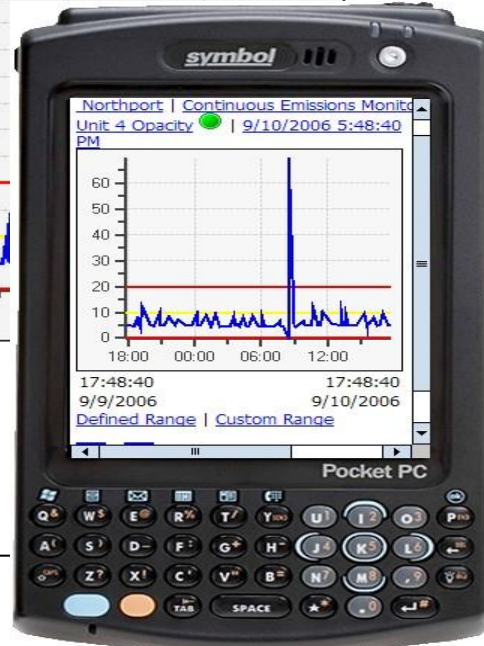
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9/9/2006

[Defined Range](#) | [Custom Range](#)



[Refresh](#) stopped ([Start](#))



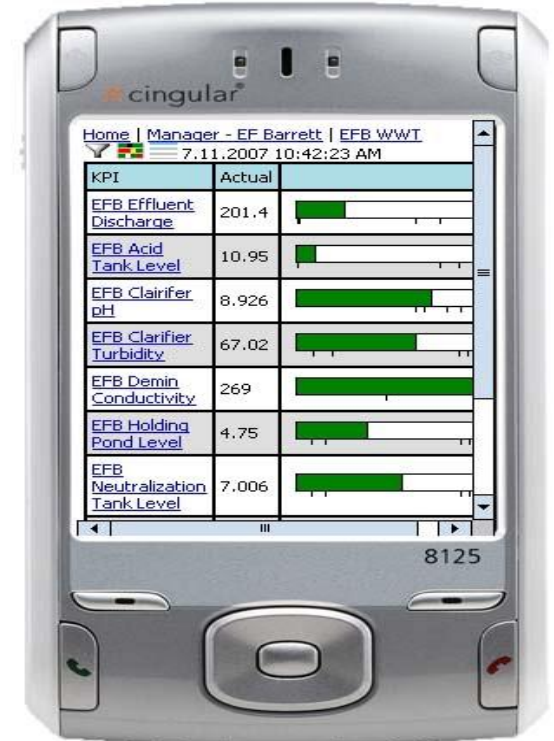
Role 4 – Regulatory Manager

Detail = Waste Water Treatment Plant Status

[Home](#) | [Manager - EF Barrett](#) | [EFB WWT](#)

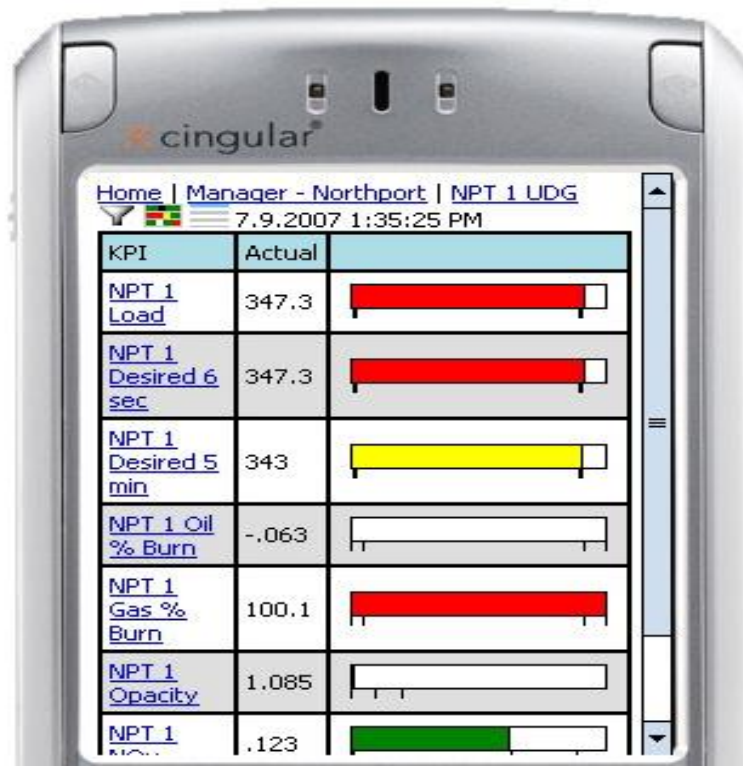
7.13.2007 3:06:23 PM

| KPI | | Actual |
|---|---|--------|
| EFB Effluent Discharge | ↓ | .18 |
| EFB Acid Tank Level | ● | 11.43 |
| EFB Clairifer pH | ● | 9.015 |
| EFB Clarifier Turbidity | ● | 67.3 |
| EFB Demin Conductivity | ● | 258.5 |
| EFB Holding Pond Level | ● | 4.325 |
| EFB Neutralization Tank Level | ● | 6.823 |
| EFB Reactor Tank pH | ● | 10.54 |
| EFB Surge Pond Level | ● | 4.057 |



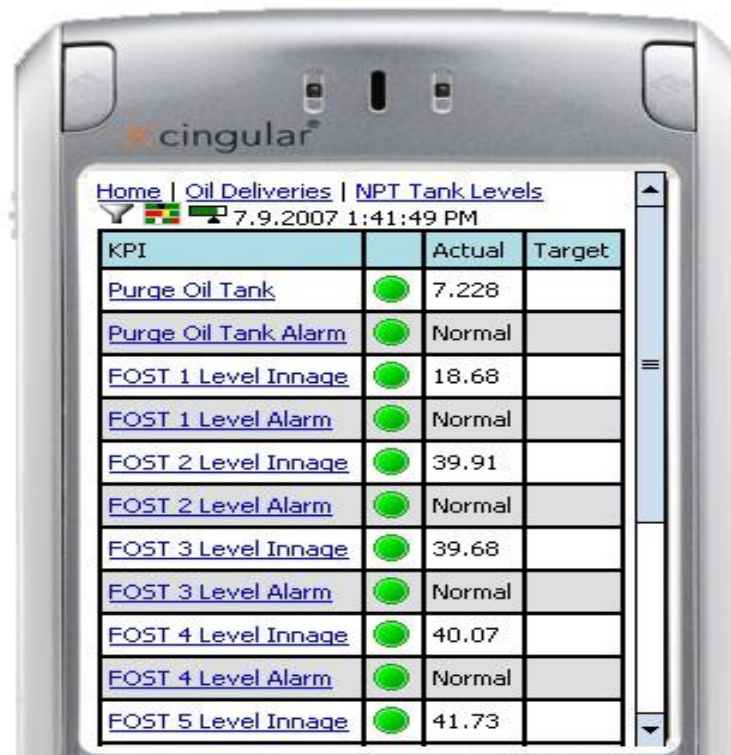
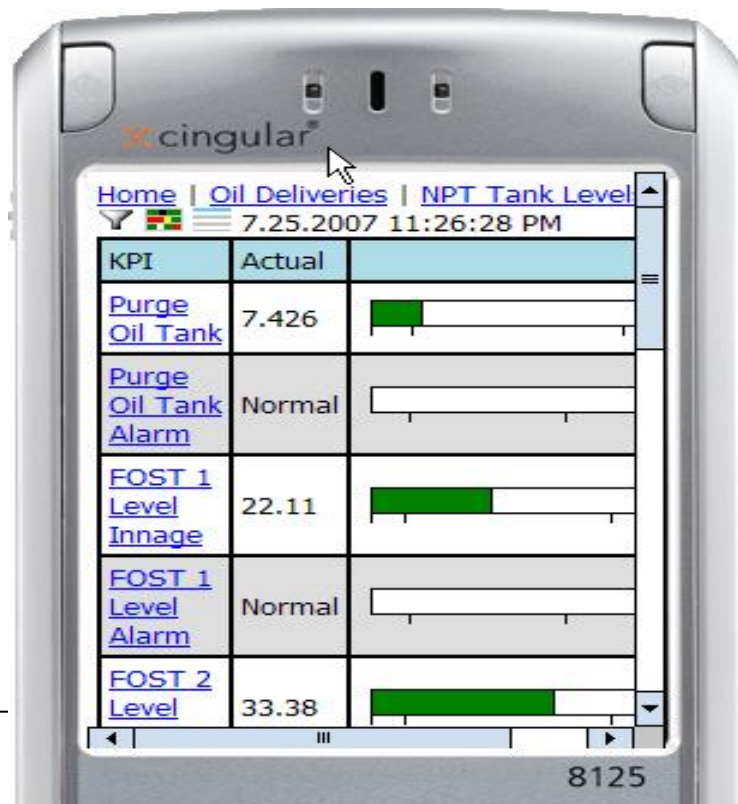
Role 5 – Watch Supervisor

Detail = Unit base points



Role 6 - Mechanic

Detail = Offshore fuel loading platform



Role 7 – Test Engineer

Detail = Modified Turbine Test KPIs



cingular

Internet Explorer

https://realtime.keyspanenergy.

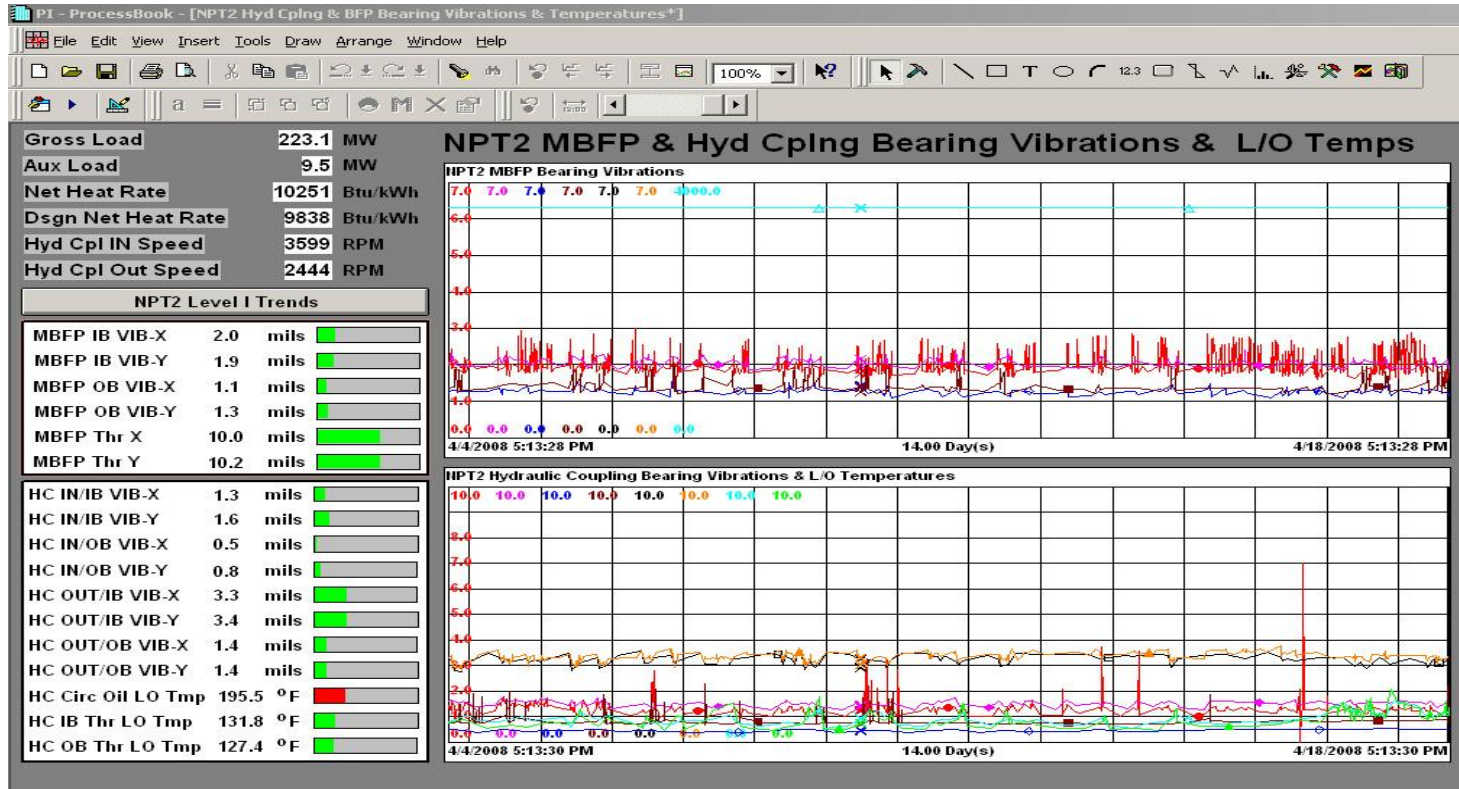
Home | Technician Toolbox -
Northport | NPT4 MTT

7.9.2007 1:16:34 PM

| KPI | | Actual | Target |
|--|---|--------|--------|
| NPT4 10th Stg FW In Temp | ● | 331.3 | |
| NPT4 1st Stage Press | + | 1,790 | |
| NPT4 7 STG DRIPS Temp | ● | 395.1 | |
| NPT4 7 STG Feed Water In Temp | ● | 366.5 | |
| NPT4 7 STG Feed Water Out Temp | ● | 456.8 | |
| NPT4 7 STG Steam In | ● | 615.5 | |

Back Menu

Role 8 – Performance Engineer





Initial Savings

- 2% reduction in Technician overtime = \$16,000/yr
- 2% Tech/Operator productivity gain = \$12,000/yr
- Environmental incursion = \$5,000-\$100,000/incident
- Cell Phone deployment over notebooks with air cards for 18 users = \$52,000 capital savings
- Training savings for 18 users = \$14,000
- Leveraging existing PI System investment saved start-up costs = \$80,000
- Competitive edge could be worth = \$100,000
- Return on Investment Less than 6 Months



Benefits include

- Rapid deployment
- Technology acceptance
- Team collaboration
- Off-site connectivity
- KPIs directly aligned with “role” needs
- Corporate visibility and transparency



Future plans and next steps...

Building **NERC CIP** PI System Infrastructure

Building a **NERC CIP** PI System Database

Building **NERC CIP** Information Interface for Plant Optimization and Generation CNI

Building a Mission Critical PI System Infrastructure

Building a Mission Critical PI System Database

Building Mission Critical Information Interface for Plant Optimization and Generation CNI



Questions

- Contact information

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Plant Optimization &

NERC CIP Compliance Manager

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516.545.3729



Thank you

