EMPOWER YOUR ANALYTICS WITH OPERATIONAL DATA
2019 OSISOFT NEW DELHI SEMINAR

Asset Framework, Asset Analytics, and Visual Analytics for Critical Operations

Michael Luo (Regional Services Manager)

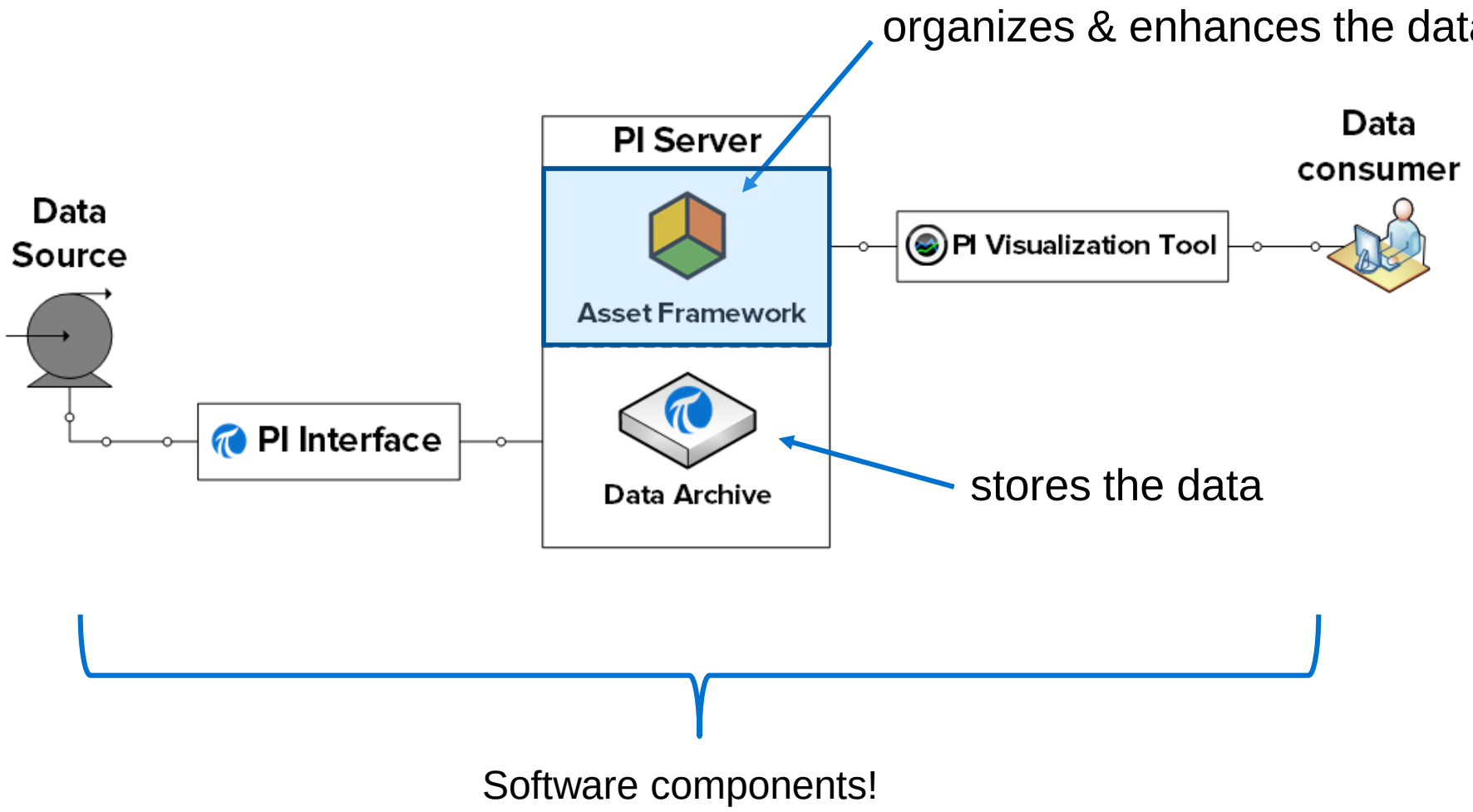
Wednesday, 16-Oct-2019

OSIsoft.

Agenda

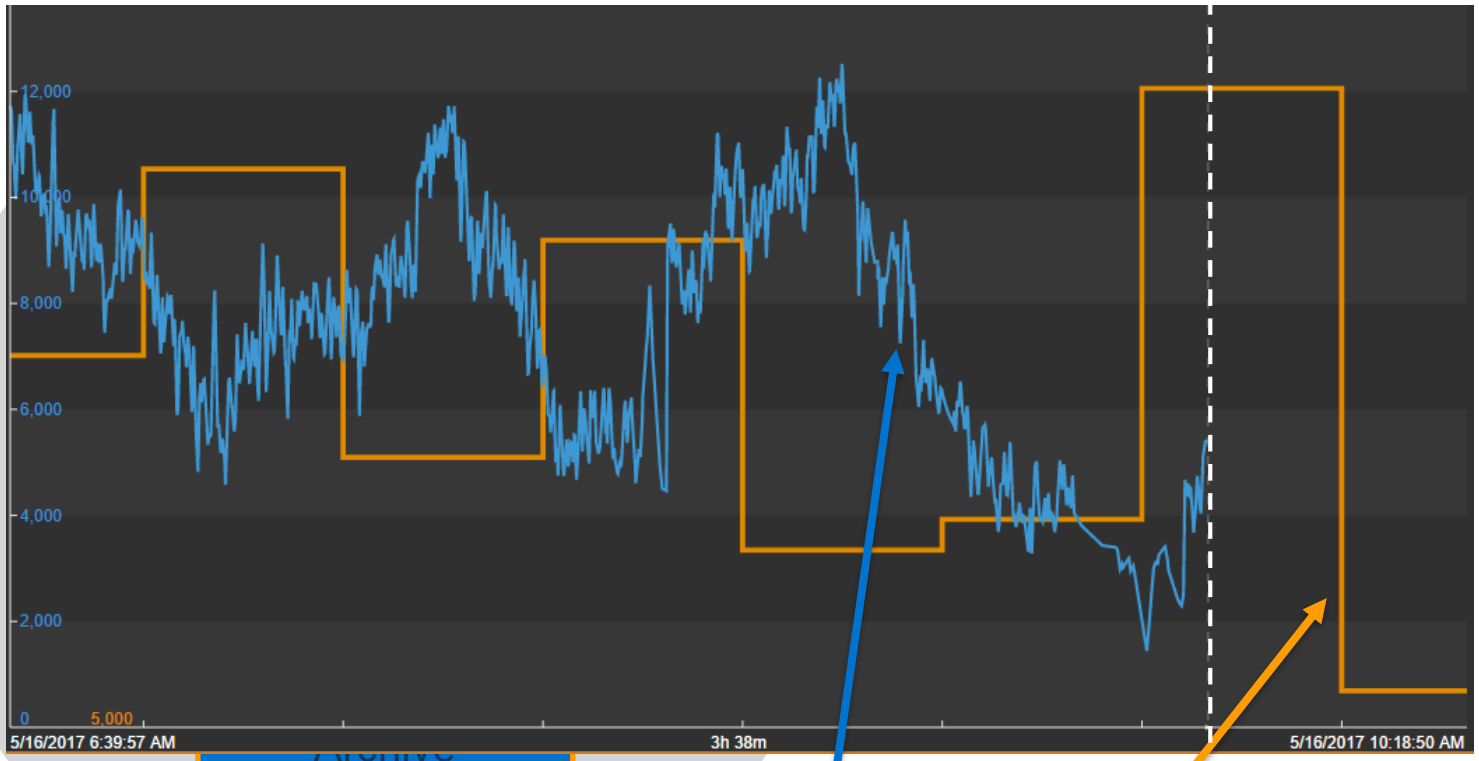
1. **Why** is Asset Framework (AF) important for analytics?
2. **What** are the key features of AF?
3. **Where** do you utilize Asset Analytics?
4. Use Case (Yasref)

Basic components of a PI System



PI System Infrastructure

PI Interfaces
&
PI Connectors



PI Server

TAG	TIME	VALUE	STATUS
HE013.HSOT.PV	11/6/2019 2:39:50 PM	205.99	GOOD
HE013.HSOT.FV	11/6/2019 2:39:50 PM	210.15	GOOD

PI System Infrastructure - Enhancement

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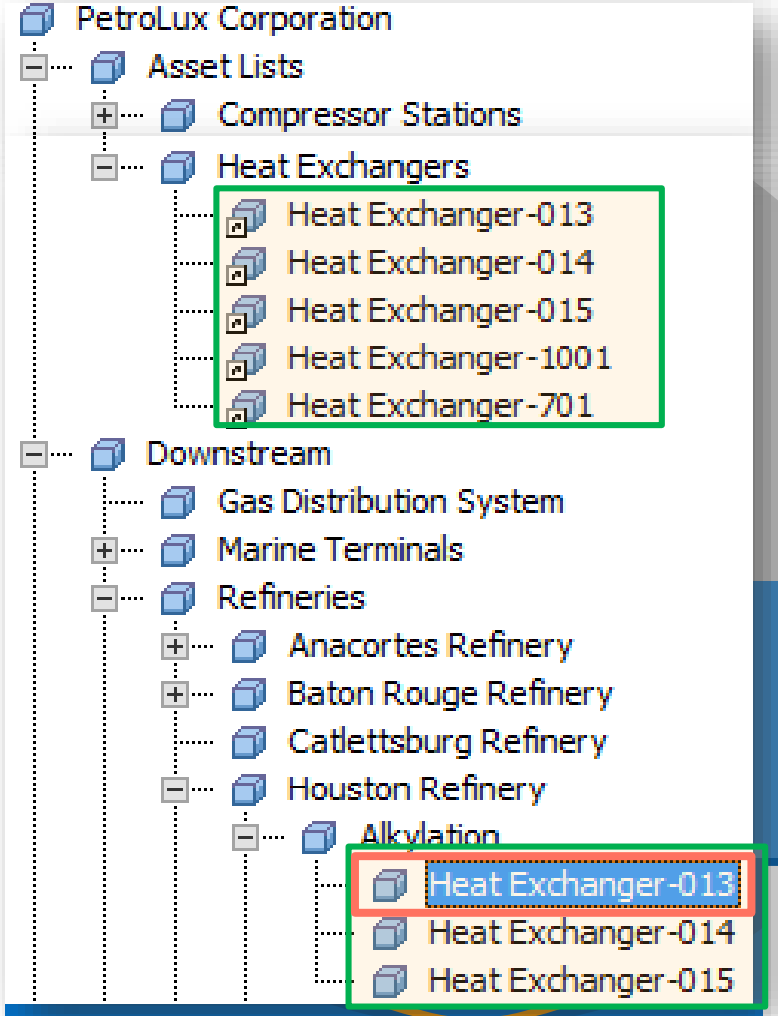
&
PI Connectors



Category: ProcessData	
Hot Side Outlet Temperature	205.99 °F
Category: Forecast	
Expected Hot Side Outlet Temp.	210.15 °F

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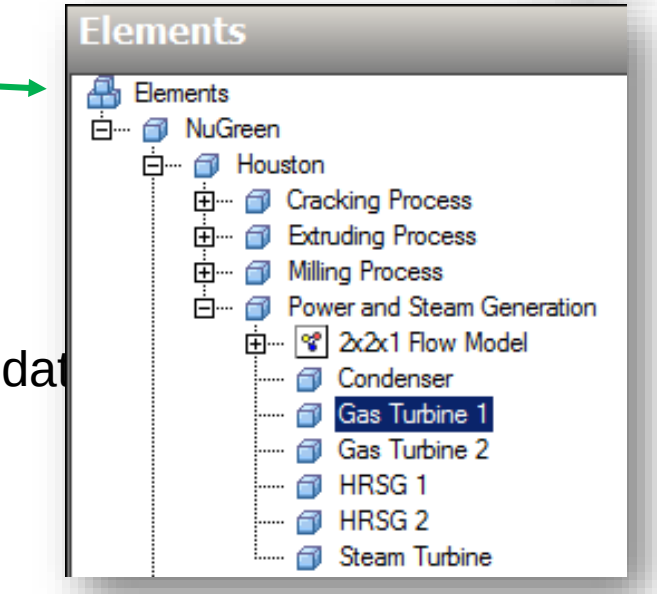
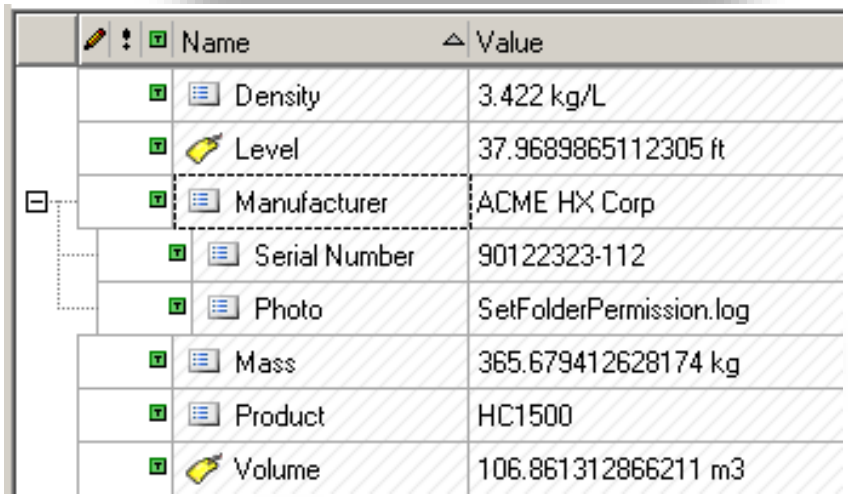
PI Server

Asset Framework (AF)

- **Object Oriented Contextual Abstraction Layer**
  - Templatised and server based

- **It allows the PI System to:**
  - Contextualized and Manage your assets in a scalable and extensible dat
  - Search data coming from different PI Servers
  - Access non time series data sources
  - Integrate with analysis and notification tools





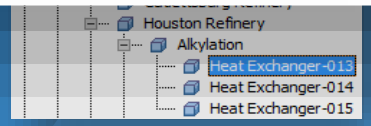
PI System Infrastructure - Enhancement

Category: Material Properties	
Shell Side Heat Capacity	0.95 Btu/lb/F
Shell Side Material	WX 1000

PI Int

PI Con

PI Data Archive



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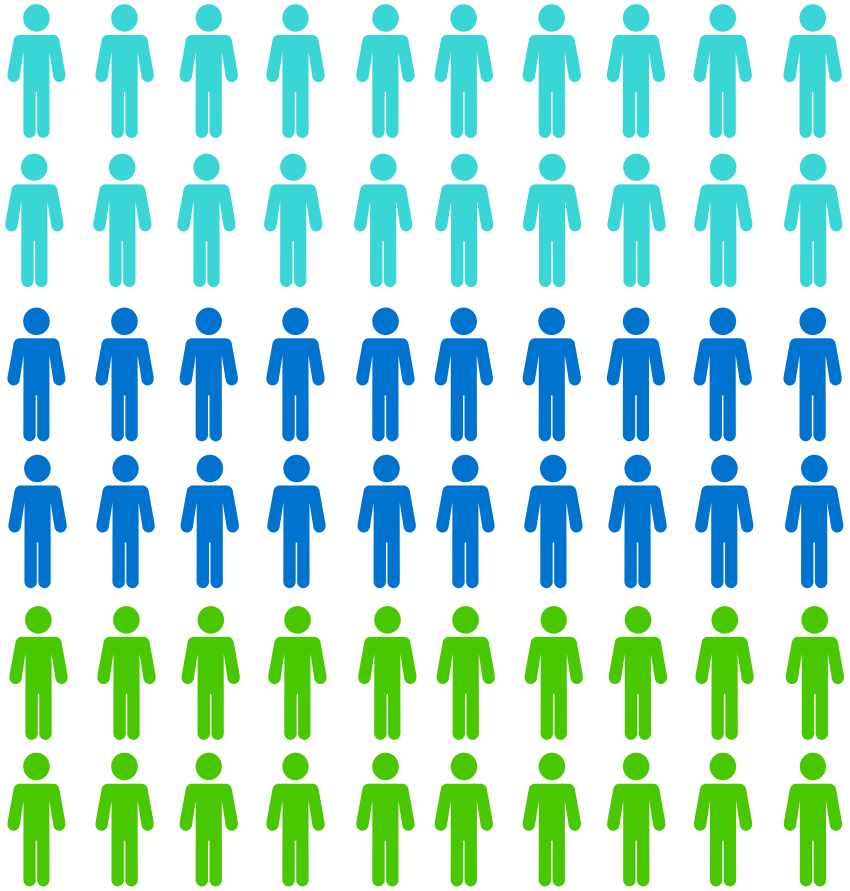
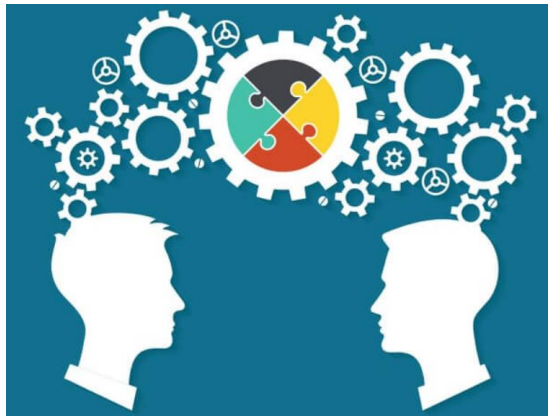
OSIsoft: Self-service Analytics to Operations

Operations



Your Experience and Knowledge

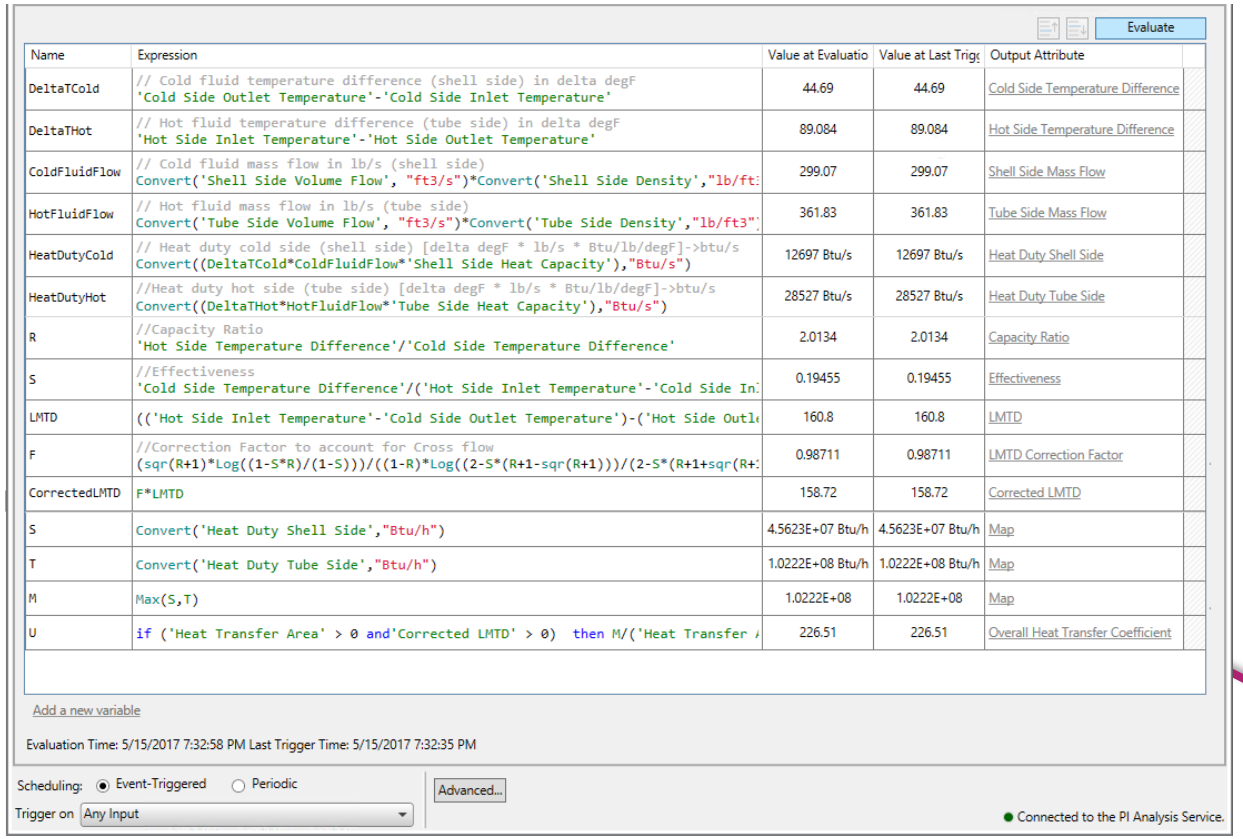


Analytics:

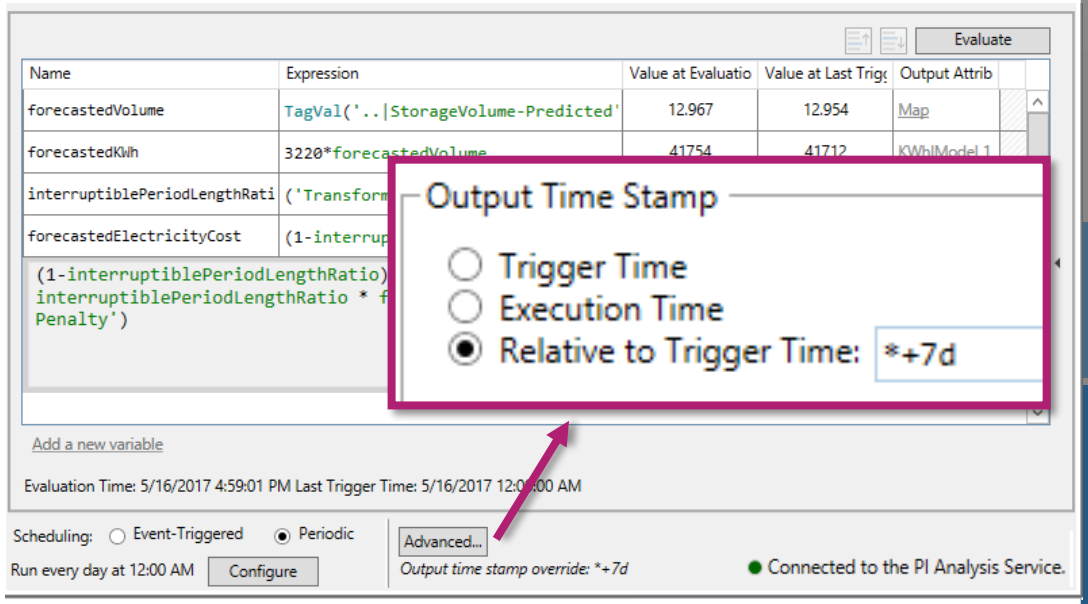
- Equipment efficiency
- Pre-failure warning
- KPI
- etc.

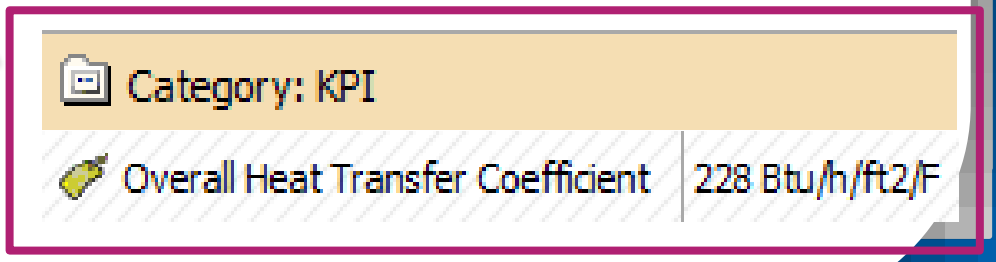
Asset Analytics

Complex Calculations

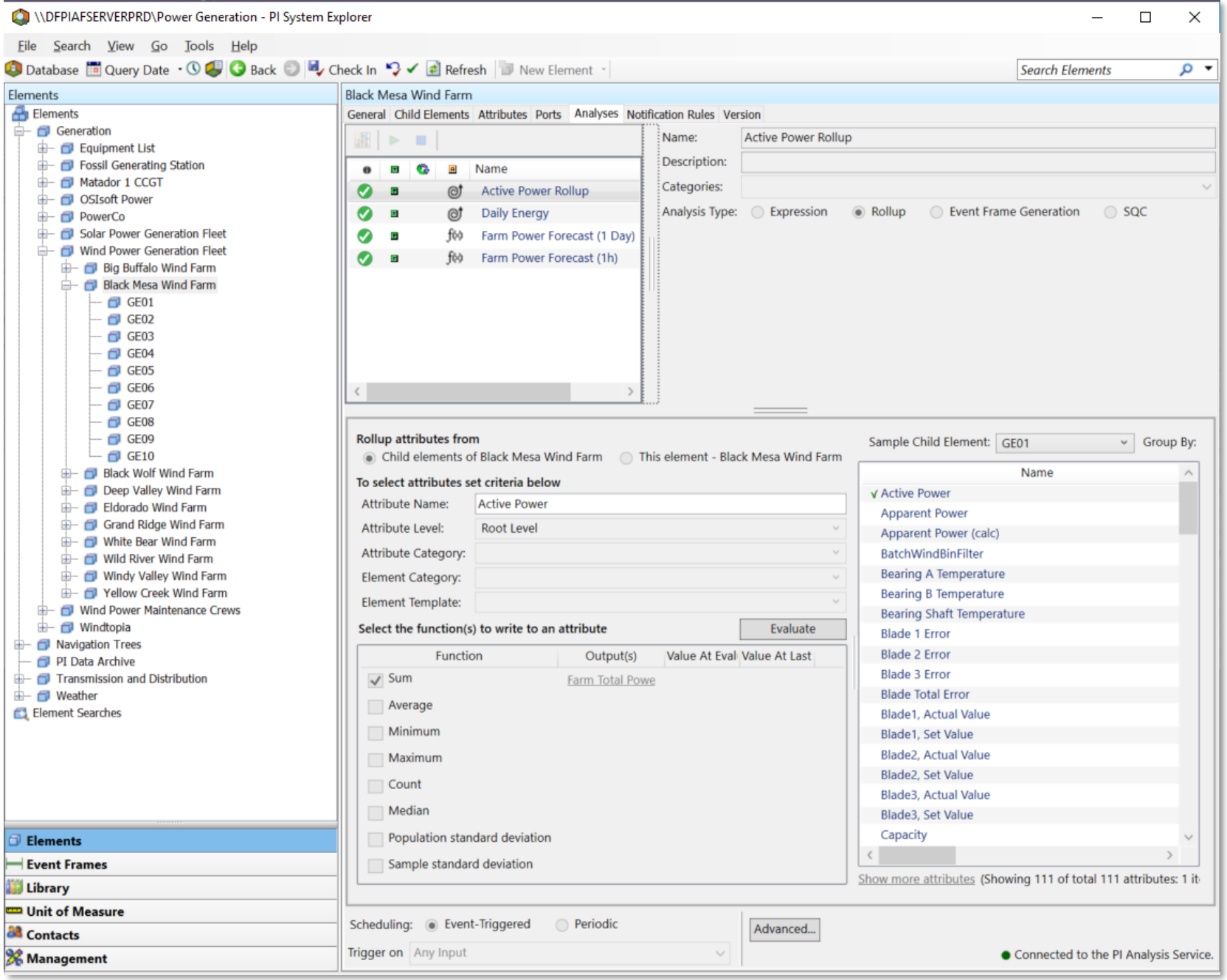


Forecasts





Configure
rollup calculations
to ensure consistency across the hierarchy



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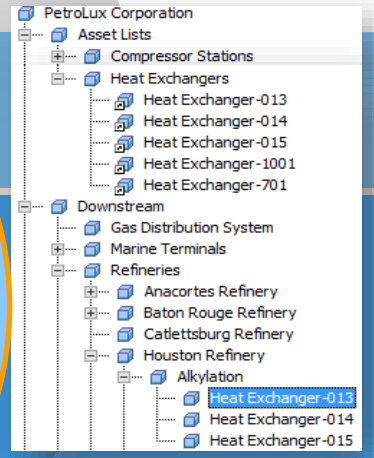
PI Interfaces
&
PI Connectors

Analysis

PI Asset Framework

PI Data Archive

PI Server



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Shell Side Material	WX1000

Category: ProcessData	
Hot Side Outlet Temperature	205.99 °F
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Expected Hot Side Outlet Temp.	210.15 °F

TAG	Category: KPI	
HE013.HSOT.PV		
HE013.HSOT.FV	Overall Heat Transfer Coefficient	228 Btu/h/ft2/F

PI System Infrastructure - Enhancement

PI Interfaces
&
PI Connectors

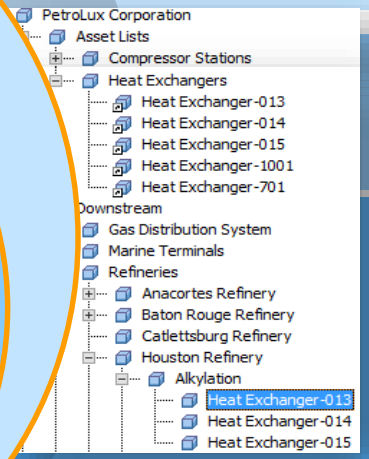
Event Frames

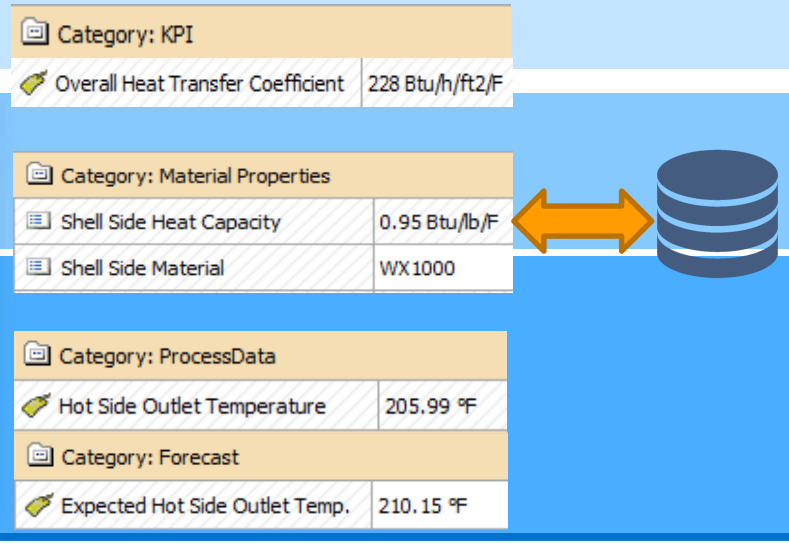
Analysis

PI Asset Framework

PI Data Archive

PI Server





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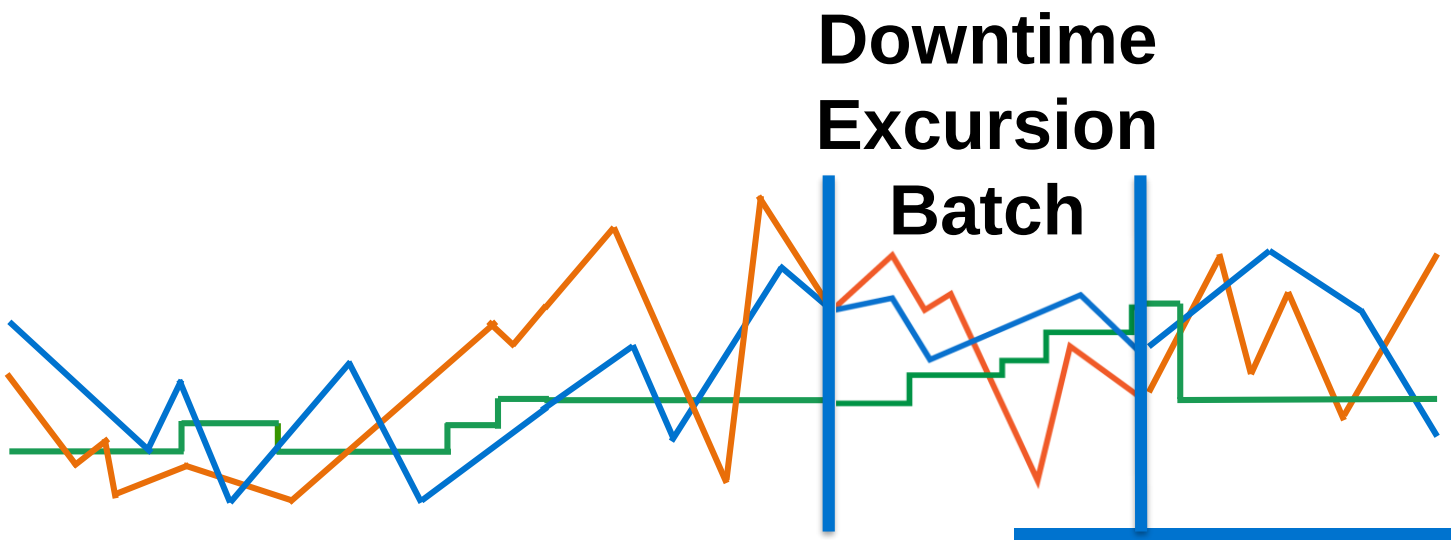
Event Frames

Event Frames Shorten the Time to Insight

Event Frames **automatically bookmarks PI time-series data** so that it's more meaningful to engineers and business users, AND easier to for them to **find, analyze, and report** on.



Too High!

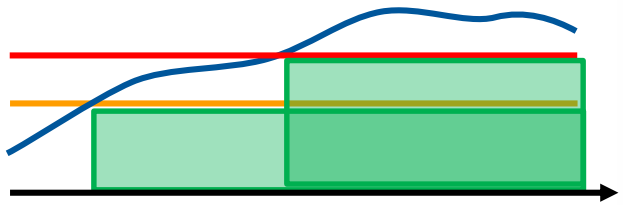
Downtime

Batches

Related Data!

Event Attribute	Value
Name	TempExc B-352 2018-12-15
Start	15-Dec-2012 10:35:02
End	15-Dec-2012 10:47:26
Duration	12 min, 24 sec
Asset	Boiler-352
Excursion Type	High Violation
Fuel Gas Flow.Avg	37.12 k sft3/h
Fuel.Start	823.48 k sft3/ton
myPIKPI.Max	47.19 bbl/d

Event Frames Generation



Fouling Factor > Limit

Fouling Factor > Critical Limit

Event Frame Template: Heat Exchanger - Low Overall Heat Transfer Coefficient

Evaluate

Name	Expression	True for	Severity	Value at Evaluatio	Value at Last Trig
Start triggers					
Limit	'Fouling factor'>'Fouling factor|Limit'	Set (optional)	Information	False	False
CriticalLimit	'Fouling factor'>'Fouling factor|CriticalLimit'	Set (optional)	Critical	False	False
End trigger					
EndTrigger	Type an expression (optional)				

Add a new variable Add a new start trigger

Advanced Event Frame Settings...

Evaluation Time: 5/16/2017 10:23:32 AM Last Trigger Time: 5/16/2017 10:23:05 AM

Multiple start triggers are configured. Child event frames will be generated when the trigger changes. See documentation for more details.

Scheduling: (•) Event-Triggered ( ) Periodic

Trigger on: Any Input

	Duration	Start-time	End-time	Severity
Heat Exchanger-013 - Low Overall Heat Transfer Coefficient	1:18:53:00	5/13/2017 9:5...	5/15/2017 ...	Critical
Heat Exchanger-013 - Low Overall Heat Transfer Coefficient	6:01:00	5/13/2017 9:5...	5/14/2017 ...	Information
Root Cause	1:0:00:00	5/12/2017 9:5...	5/13/2017 ...	None

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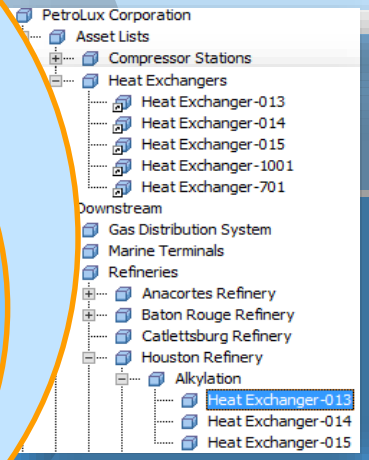
PI Asset Framework

PI Data Archive

PI Server



Category: KPI	
Overall Heat Transfer Coefficient	228 Btu/h/ft2/F

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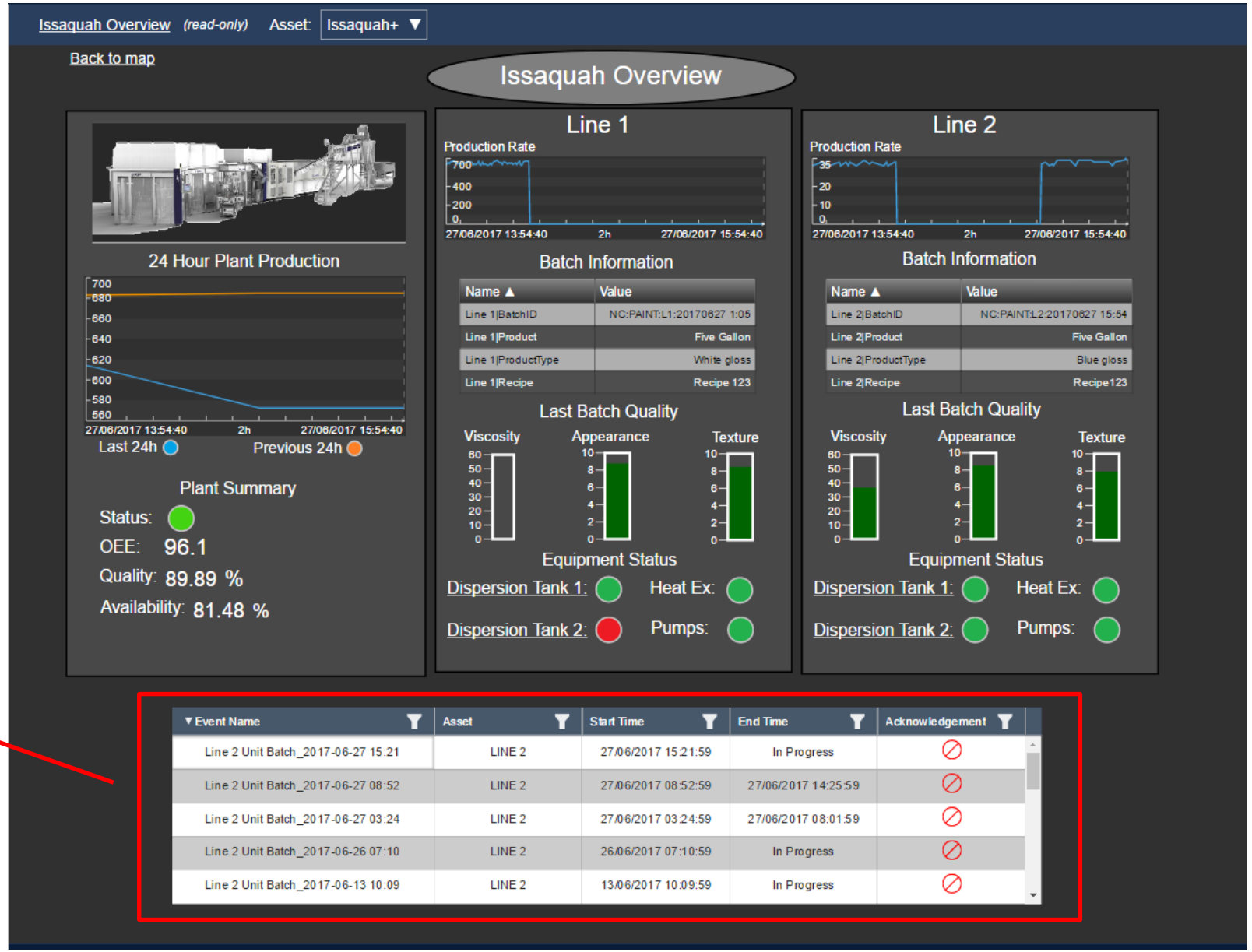
View events list on PI Vision Display



Petrolux Refining

Overview
Equipment
Pumps
Report

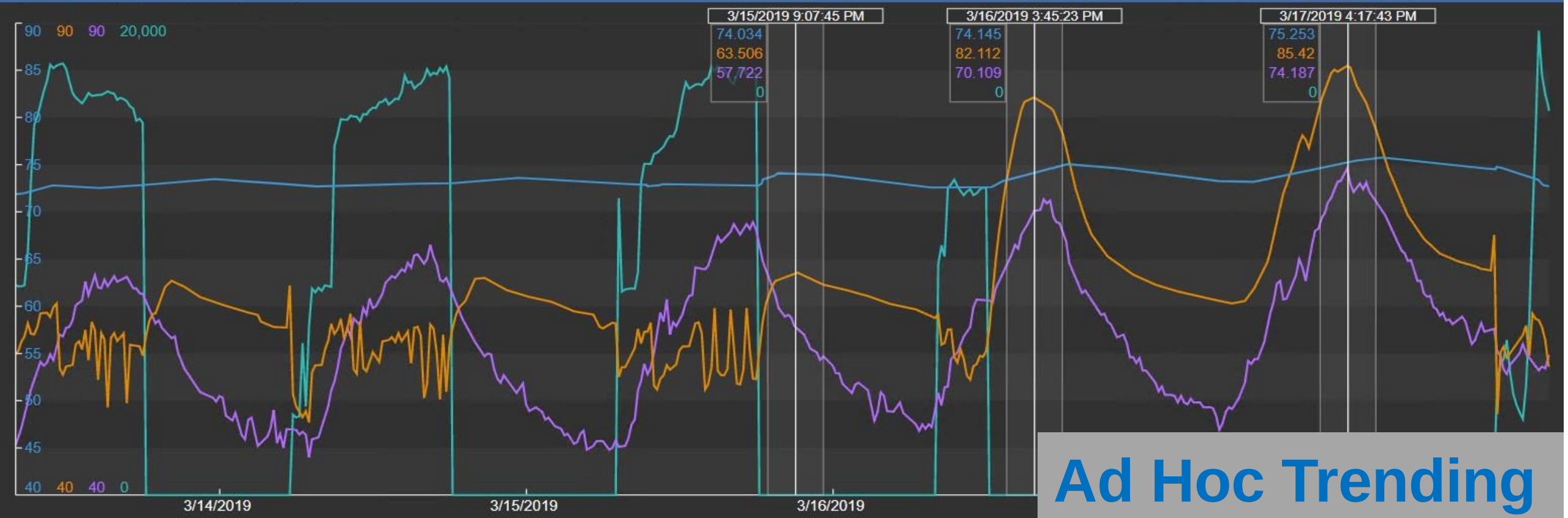
Equipment Summary

	OEE	Pumps				Air Blowers	Heat Exchangers	Wet Gas Compressors
Anacortes	23 %	1,991 rpm ANA FCC Pump 1	2,961 rpm ANA FCC Pump 2	1,987 rpm ANA FCC Pump 3	1,984 rpm ANA FCC Pump 4	1,982 rpm ANA FCC Blower 1	Overall U 198 Btu/h/ft2/F Heat Exchanger-013	3,010 rpm ANA FCC Wet Gas Compressor 1
Baton Rouge	44 %	2,017 rpm BAT FCC Pump 1	3,020 rpm BAT FCC Pump 2	1,985 rpm BAT FCC Pump 3	1,997 rpm BAT FCC Pump 4	2,014 rpm BAT FCC Blower 1	Overall U 219 Btu/h/ft2/F Heat Exchanger-014	2,000 rpm BAT FCC Wet Gas Compressor 1
Houston	32 %	2,003 rpm HOU FCC Pump 1	2,995 rpm HOU FCC Pump 2	1,994 rpm HOU FCC Pump 3	2,993 rpm HOU FCC Pump 4	2,014 rpm HOU FCC Blower 1	Overall U 198 Btu/h/ft2/F Heat Exchanger-015	2,015 rpm HOU FCC Wet Gas Compressor 1
Martinez	42 %	2,009 rpm MAR FCC Pump 1	1,993 rpm MAR FCC Pump 2	2,963 rpm MAR FCC Pump 3	1,984 rpm MAR FCC Pump 4	1,994 rpm MAR FCC Blower 1	Overall U 198 Btu/h/ft2/F Heat Exchanger-013	1,996 rpm MAR FCC Wet Gas Compressor 1
Sarnia	64 %	1,994 rpm SAR FCC Pump 1	2,017 rpm SAR FCC Pump 2	3,036 rpm SAR FCC Pump 3	2,006 rpm SAR FCC Pump 4	2,014 rpm SAR FCC Blower 1	Overall U 219 Btu/h/ft2/F Heat Exchanger-014	1,986 rpm SAR FCC Wet Gas Compressor 1

OSIsoft
PI Vision

New Display | OSI\rmcerlean

Ad Hoc Workspace



Ad Hoc Trending

		Name	Description	Value	Units	Average	Minimum	Maximum	Top	Bottom
☑		SLTC|Floor Temp_Average	Average Floor Temperature	72.713	deg F	73.526	71.881	75.77	90	40
☑		AC Unit 2|Discharge Air Temperature Active	Discharge Air Temperature Active	53.589	°F	61.788	47.686	85.463	90	40
☑		AC Unit 2|Outdoor Air Temperature	Present Value	54.837	°F	56.839	44.002	74.604	90	40
☑		AC Unit 2|Outdoor Air Flow	Present Value	16,282	ft3/m	4,974.4	0	19,680	20000	0
☐		AC Unit 2|Cool Output 3	Present Value	1		1.1354	1	2		

3/13/2019 8:01:47 AM ↺ ◀ 5d ▶ Now 3/18/2019 8:01:47 AM

PI System Infrastructure - Enhancement

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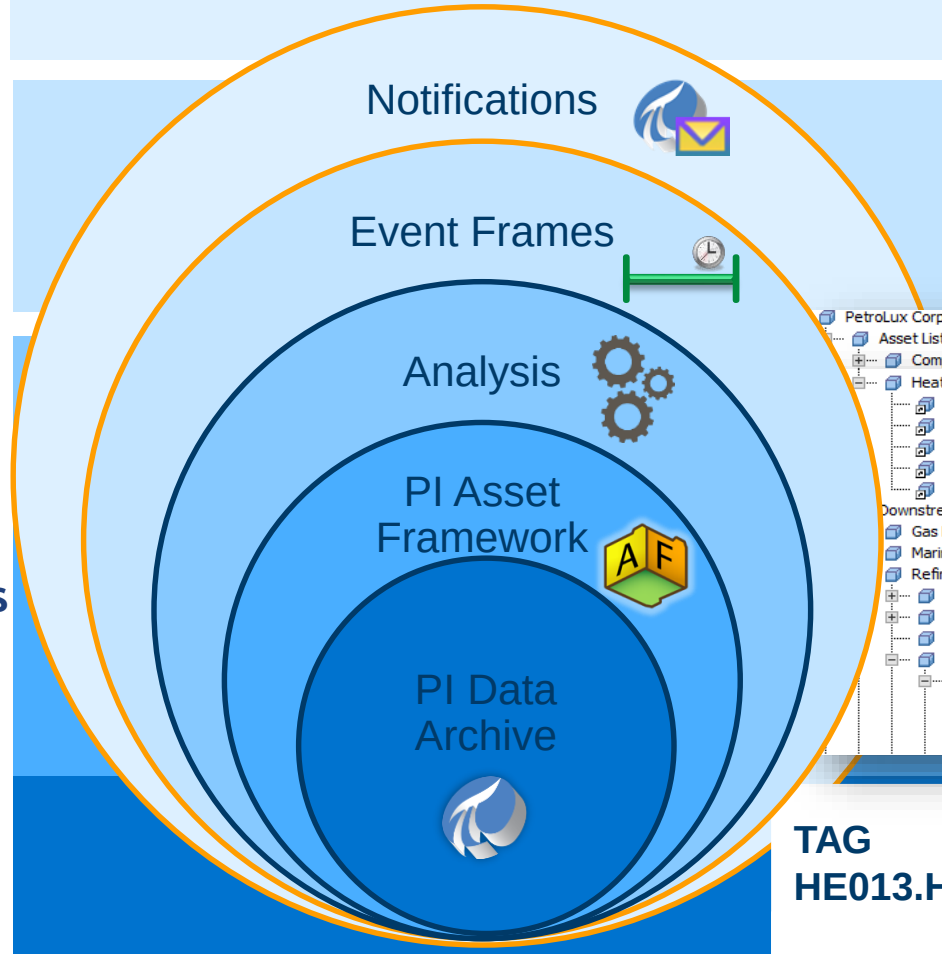

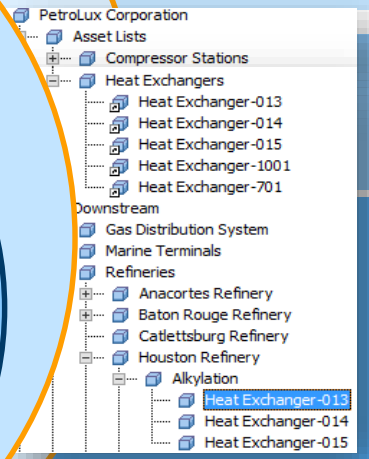

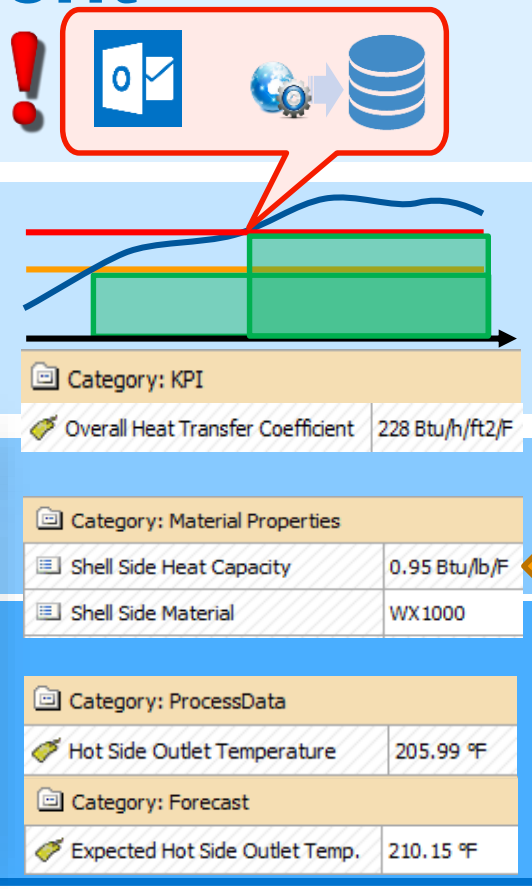

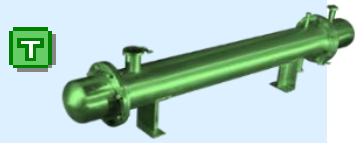

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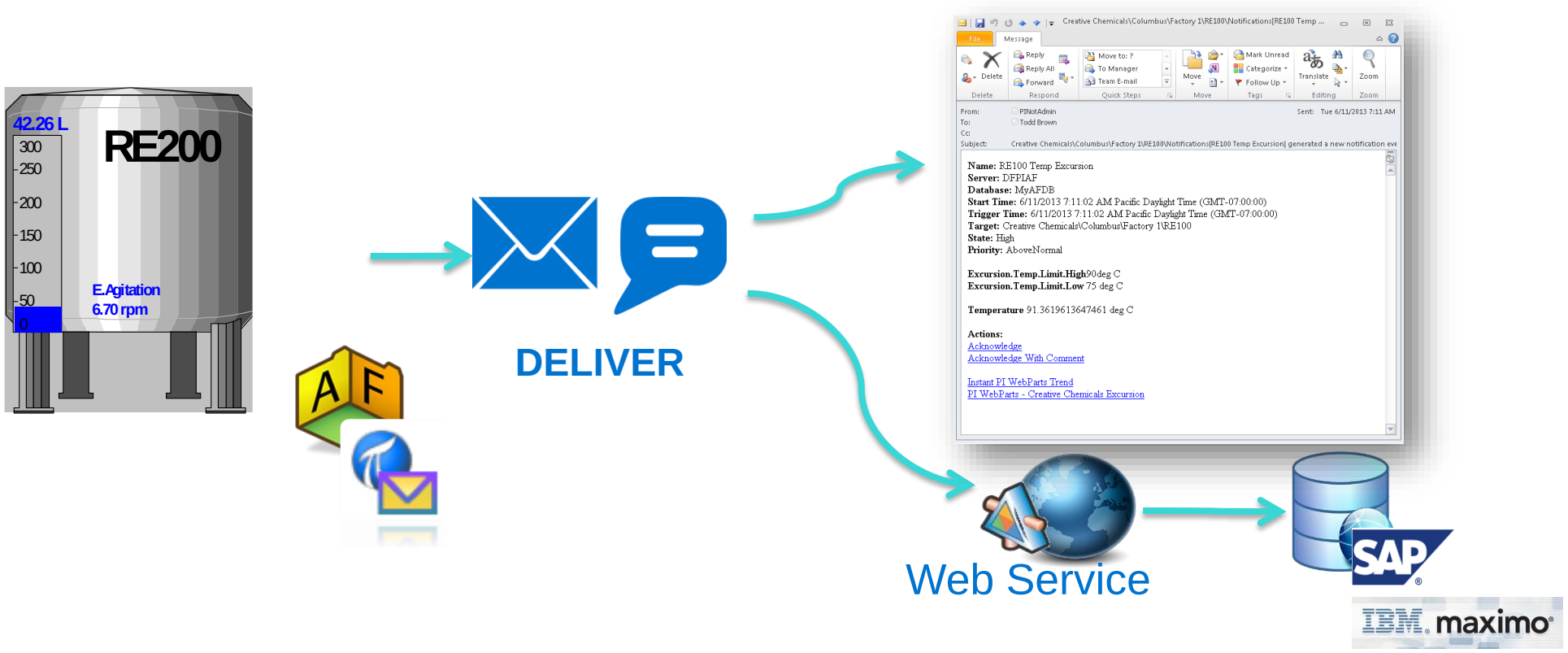
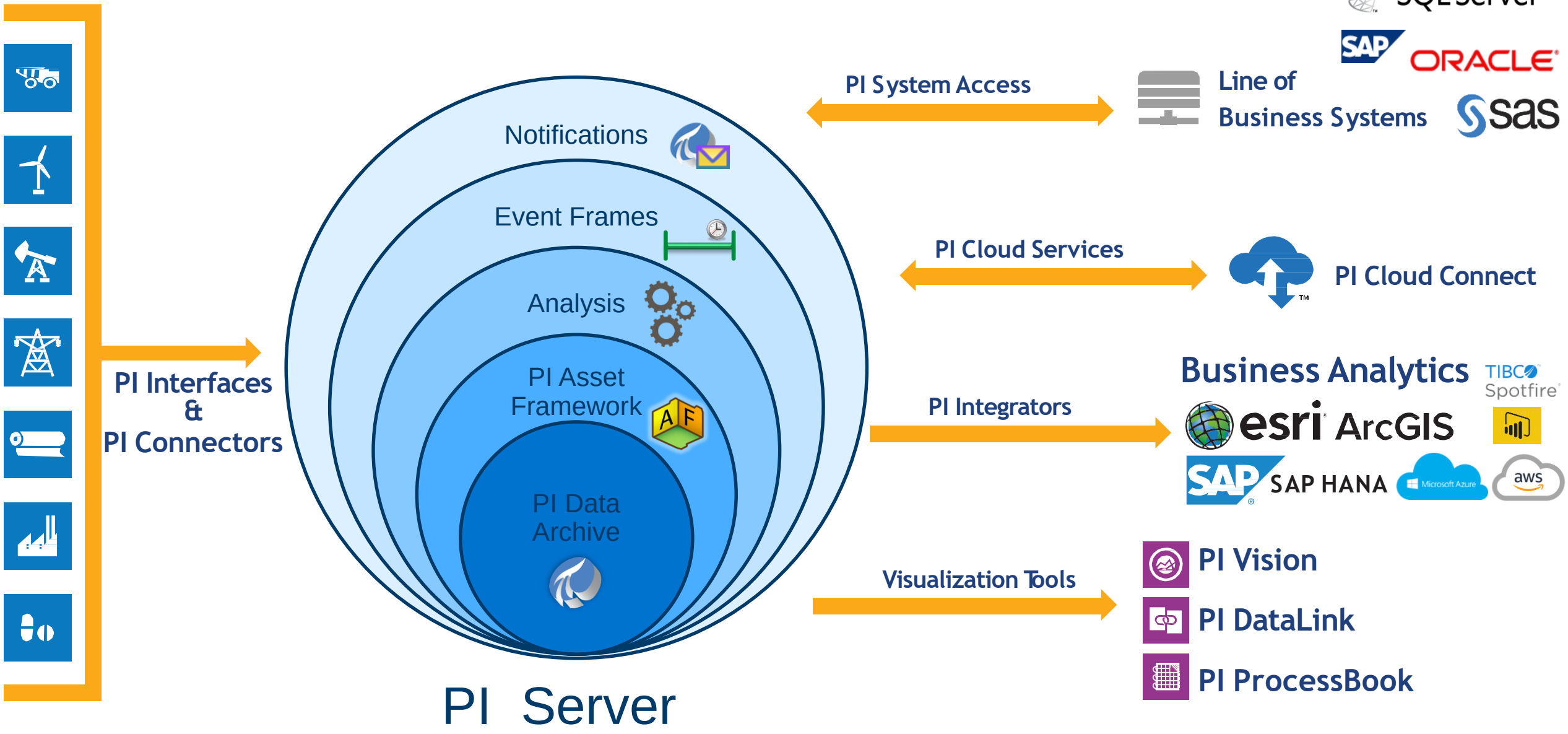
PI Notifications Keeps You Informed of Event/Asset Condition

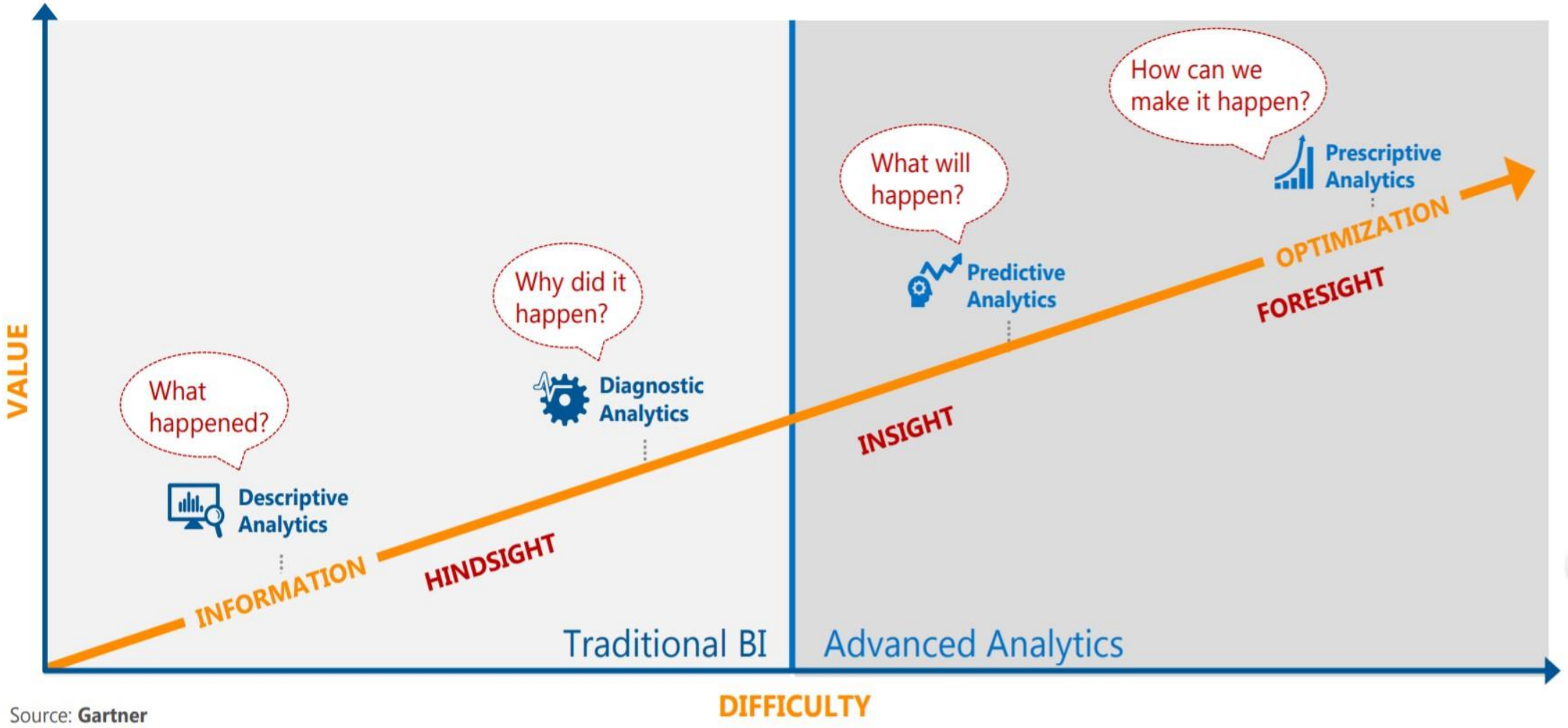
"One of turbine's exhaust thermocouples has been acting up… Let's keep an eye on it and create a work order for maintenance if it fluctuates more than 5% in 5 seconds. Make sure Bob is notified of this also."



PI System Infrastructure



The Analytics Evolution

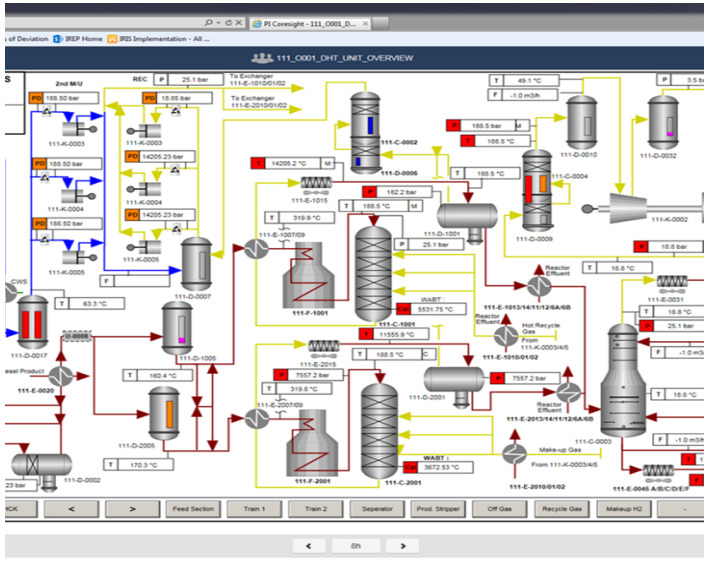


Most Advanced Refinery in the World

YASREF (Yanbu Aramco Sinopec refinery JV)

"Selecting the **PI System and EA early** *supported a smooth refinery start up and set the foundation for an integrated, collaborative data based decision making culture that* **supports YASREFs vision of being the most advanced refinery in the world by 2020."**

Mahmoud M. Madani, IRIS Lead Project Engineer



CHALLENGES

- 23 separate applications from a variety of vendors including DCS; aggressive grassroots schedule

- Lack of collaborative, data based decision making using standard DCS supplier approach
- Weak data and analytical foundation to enable OpEx and continuous improvement

SOLUTION

YASREF strategically chose the PI System as an integration and applications infrastructure applications

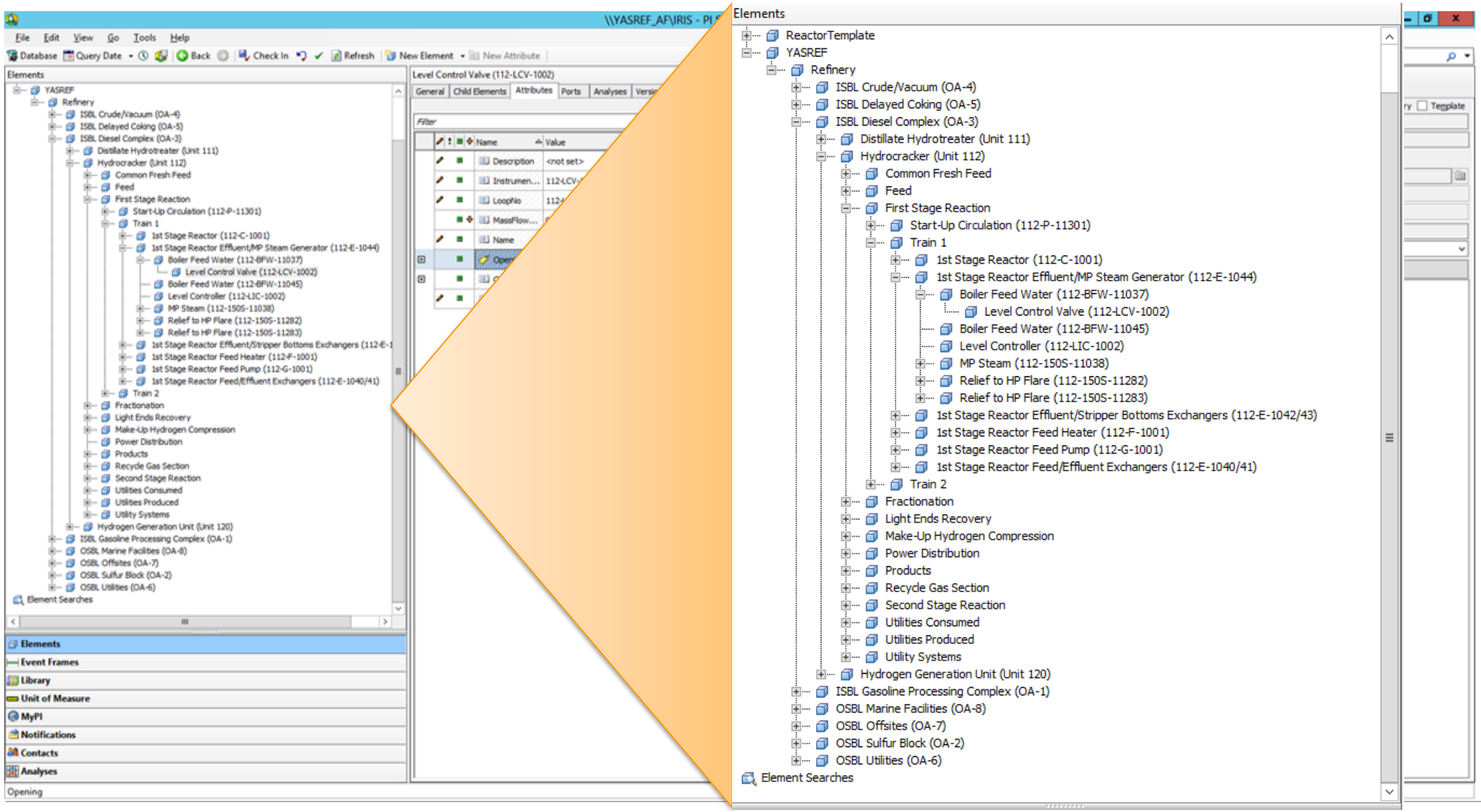
- Migrated standalone applications to the infrastructure with PI AF
- Used Microsoft platform to provide advanced web based reporting and decision support

RESULTS

Enabled a smooth refinery startup, reduction of over 50% of the standard applications

- All calculations and analytics done once in the infrastructure
- Provided KPIs and performance reporting foundation for OpEx

Asset Analytics with AF



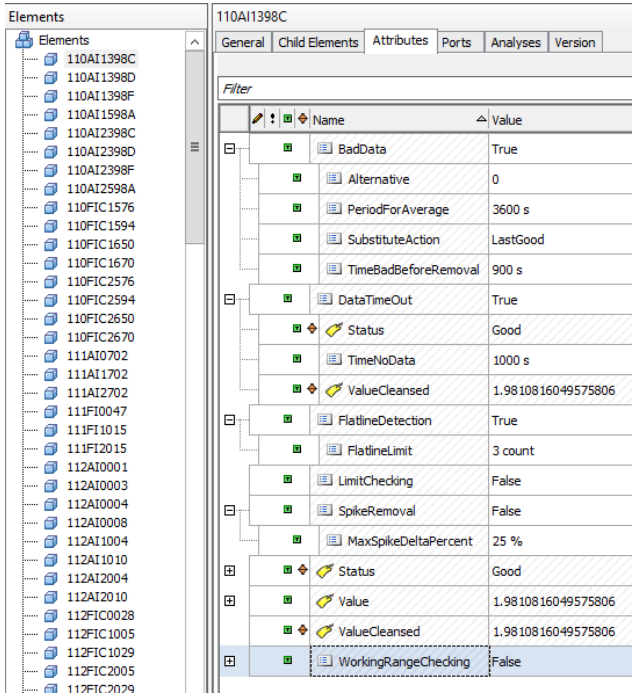
Multi-step Data Quality Assurance with AF

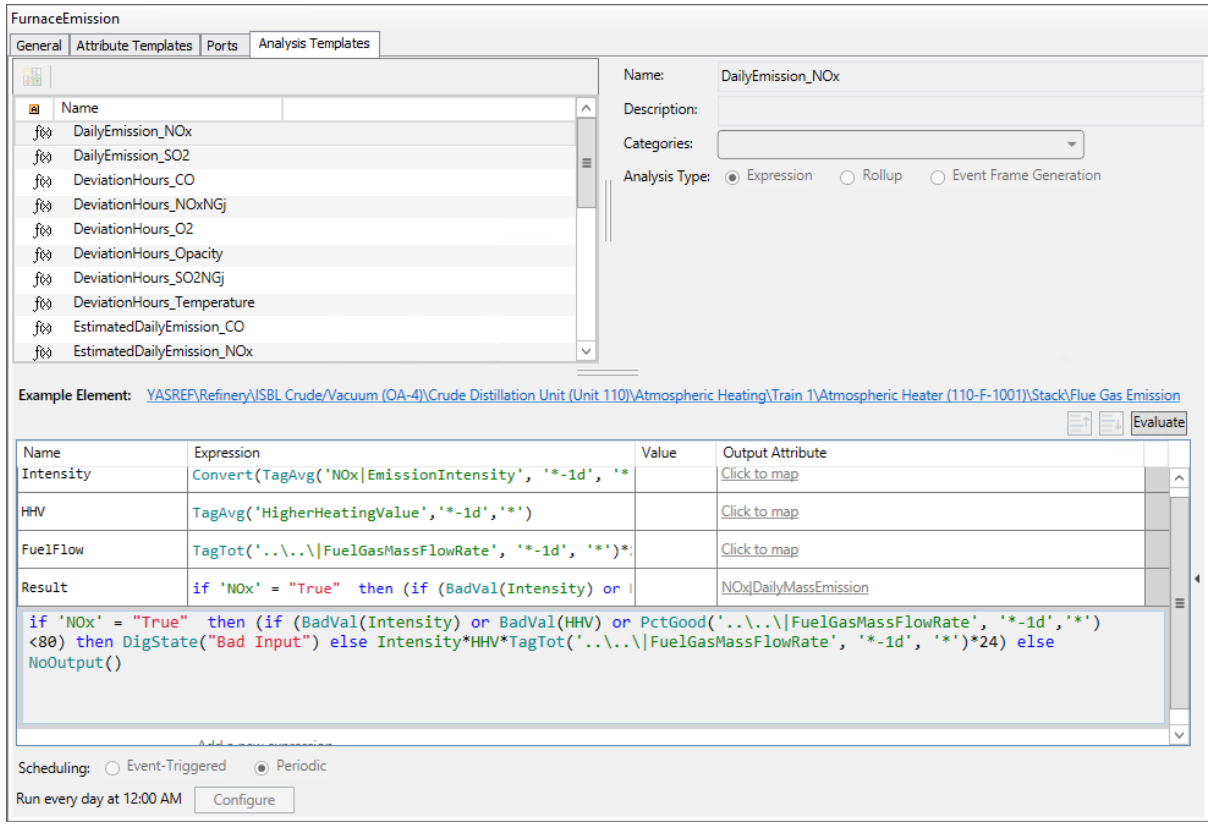
Data Quality is particularly important for regulatory and compliance reporting parameters. Users must be aware of the quality of the data they are basing their decisions on.

① Cleanse Raw Data
- Remove Spikes
- Check range
- Detect flat line
- Use alt source for bad data

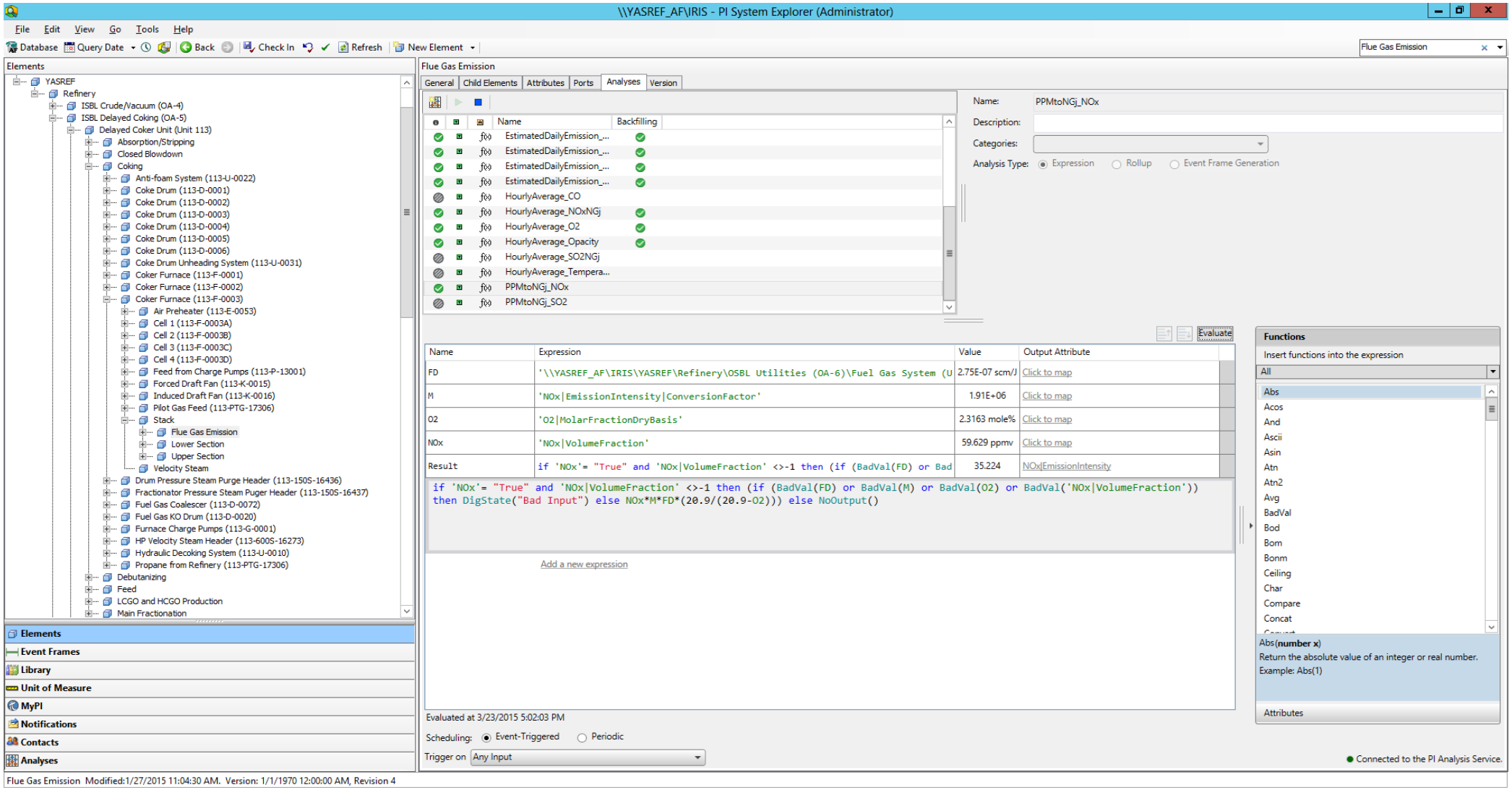
② Calculate confidence level based on percent of good data of all input parameters

③ Reject Calculated results with the Confidence level below a threshold (e.g. 80%)



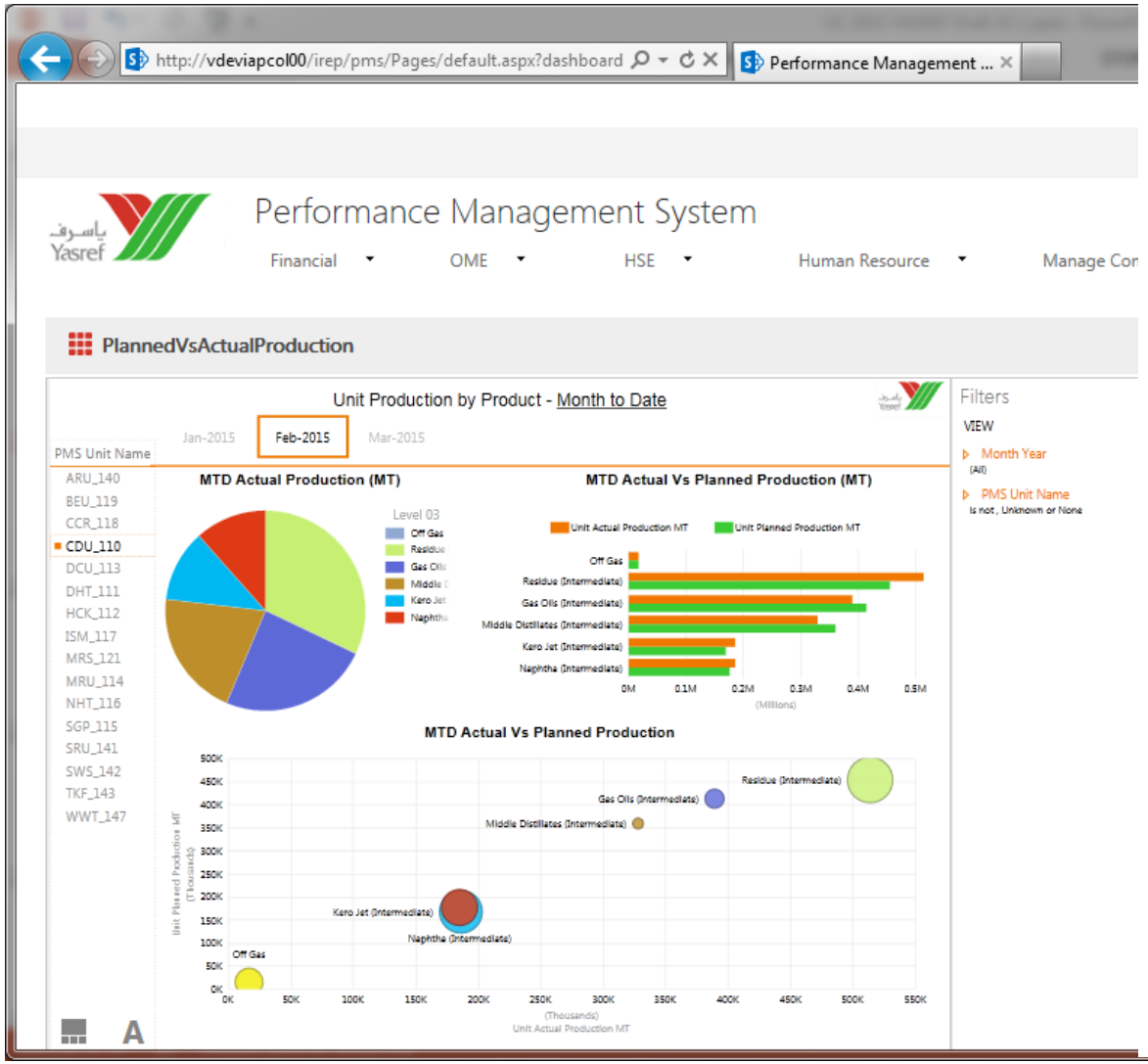


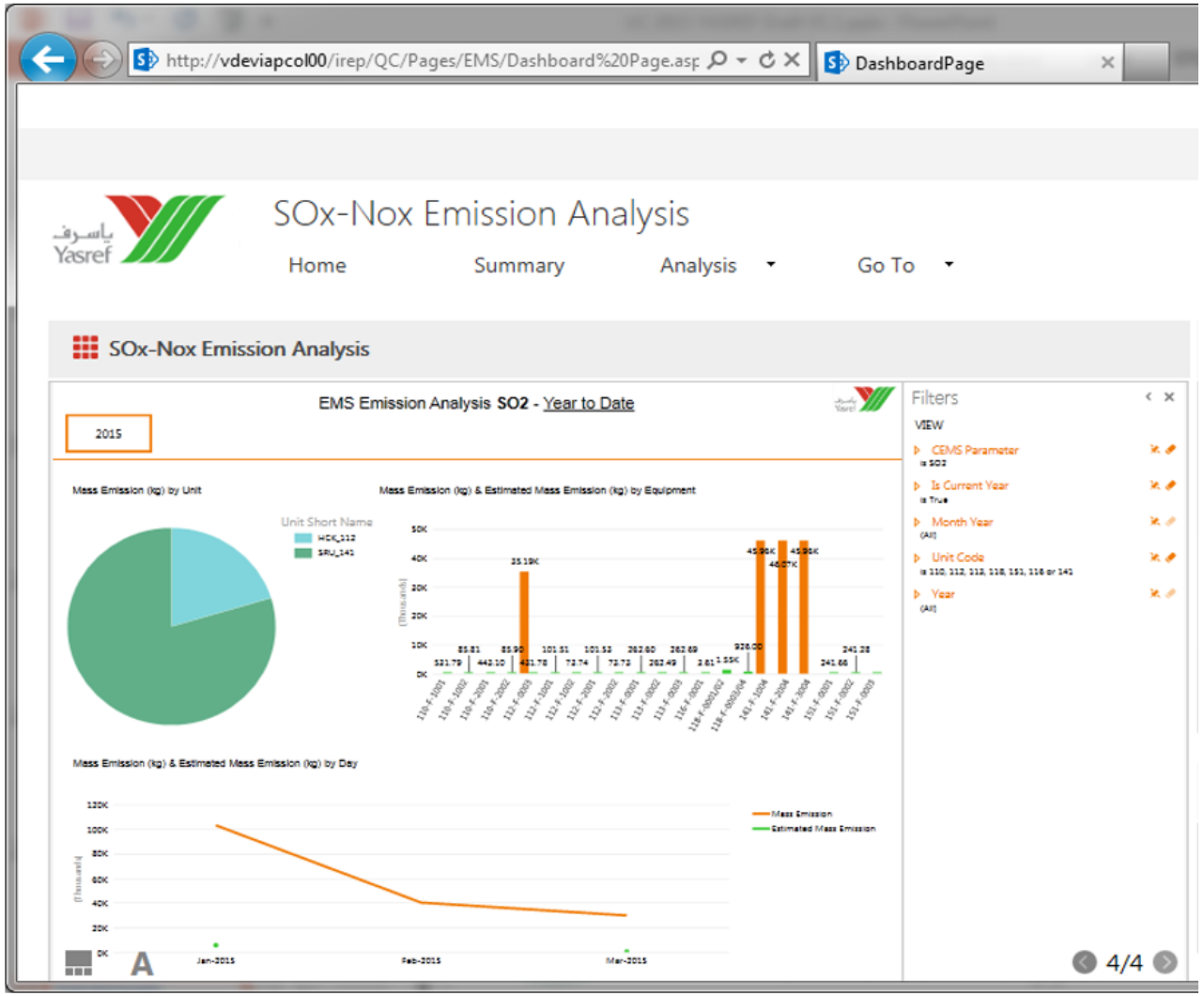
Emission Monitoring with AF (1 of 2)



Dashboards

Performance Management & Emission Analysis





Thank You

When and what is your PI AF/Analytics Journey?