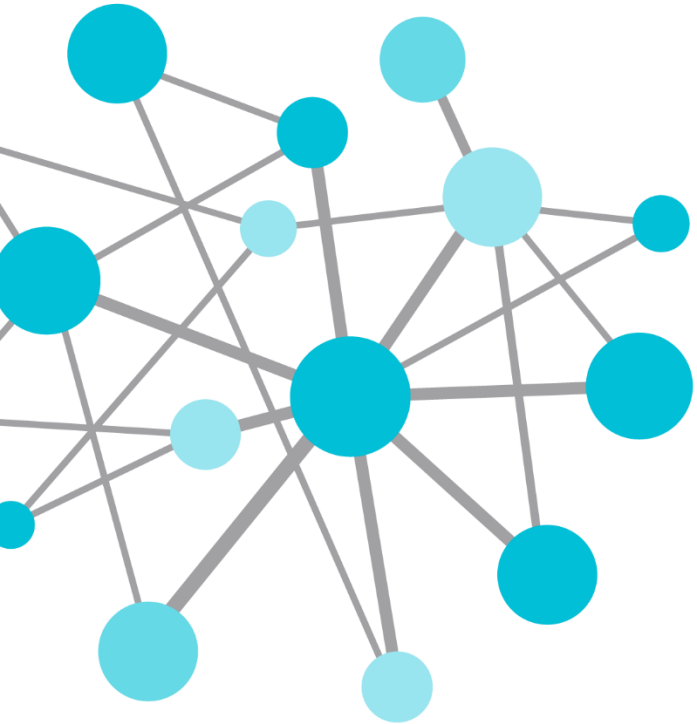


Using The Power of PI AF to Create Centralised Management Reporting at Longannet Power Station

Presented by **ScottishPower & Capula**

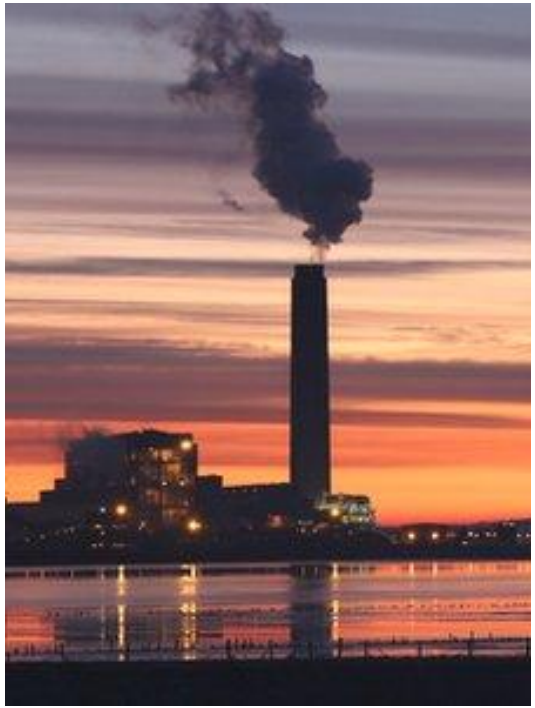
SCOTTISHPOWER

capula an Imtech company

Presenters

- Lisa Moir
  Project Manager
  ScottishPower

- James Lewis
  Software Engineer
  Capula



- Steve Field
  Business
  Improvement Manager
  ScottishPower

Company Background

ScottishPower

- One of the leading power generation and distribution companies in the UK
- Employing approx 7000 staff with headquarters in Glasgow employees
- Part of the Iberdrola group

Capula Ltd

- One of the leading independent systems integrators in the UK
- Specialising in Control Systems and Real Time Business Intelligence
- Headquarters in Stone Staffordshire. Approx 350 employees
- PI System Integrator for over 20 years
- Part of the Imtech group

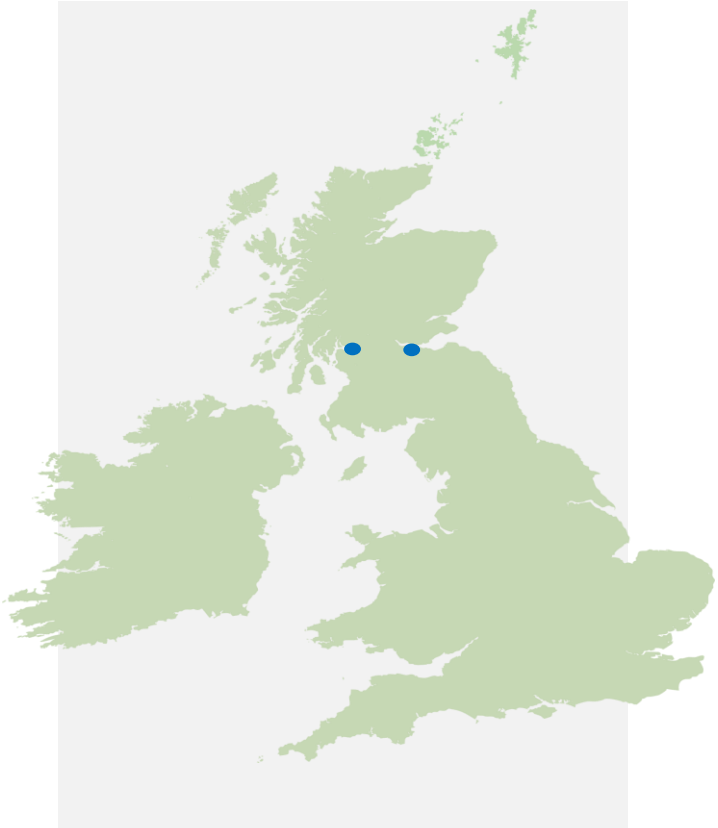
ScottishPower UK

UK, including Glasgow & Edinburgh

Transmission area and **Distribution** areas

SP Power Stations coal, gas, hydro

Longannet



Join the rush for our cheapest[1] energy deal

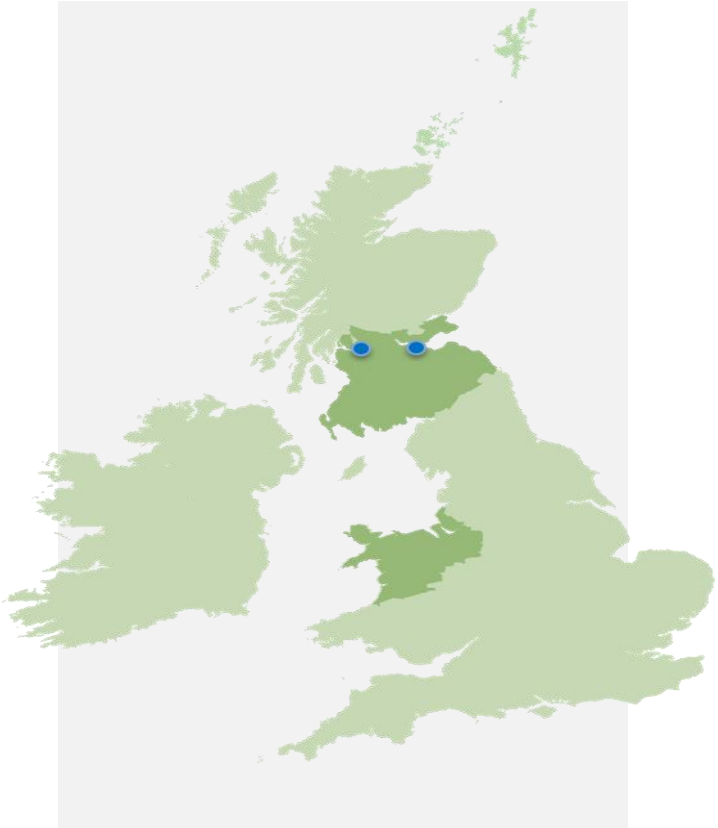
ScottishPower UK

UK, including Glasgow & Edinburgh

Transmission area and **Distribution** areas

SP Power Stations coal, gas, hydro

Longannet



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UK, including Glasgow & Edinburgh

Transmission area and **Distribution** areas

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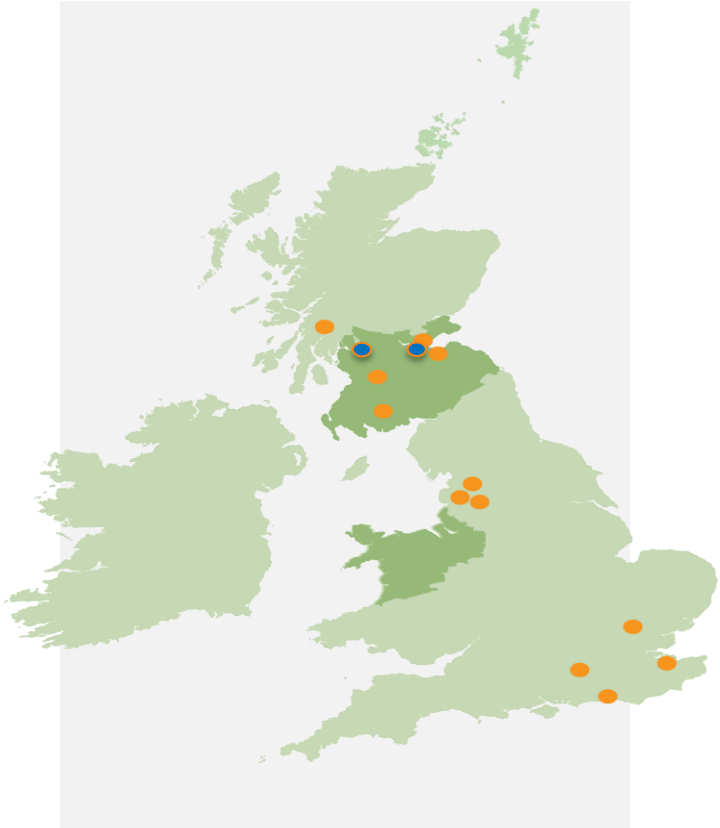
Longannet



ScottishPower UK

UK, including Glasgow & Edinburgh

Transmission area and **Distribution** areas

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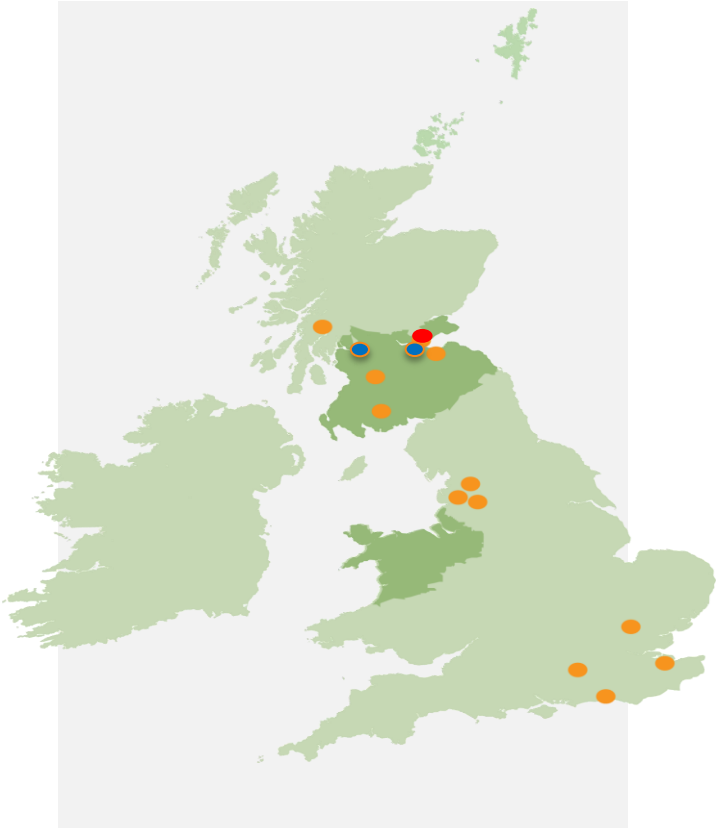
Longannet



Business Challenge – Team Longannet

- Extend the life of the Station & Secure a future beyond 2020
  - Linked to the Strategic Goal to increase profitability
  - Improve the performance of the existing assets on site
  - Gather requirements
  - Identify key metrics

The People Workstream

ENGAGEMENT

1. Strategy
2. Visible Leadership
3. Communications
4. Interfaces/relationships

Productivity/Performance

1. Performance Management
2. Metrics
3. Performance plans
4. Standards & Expectations

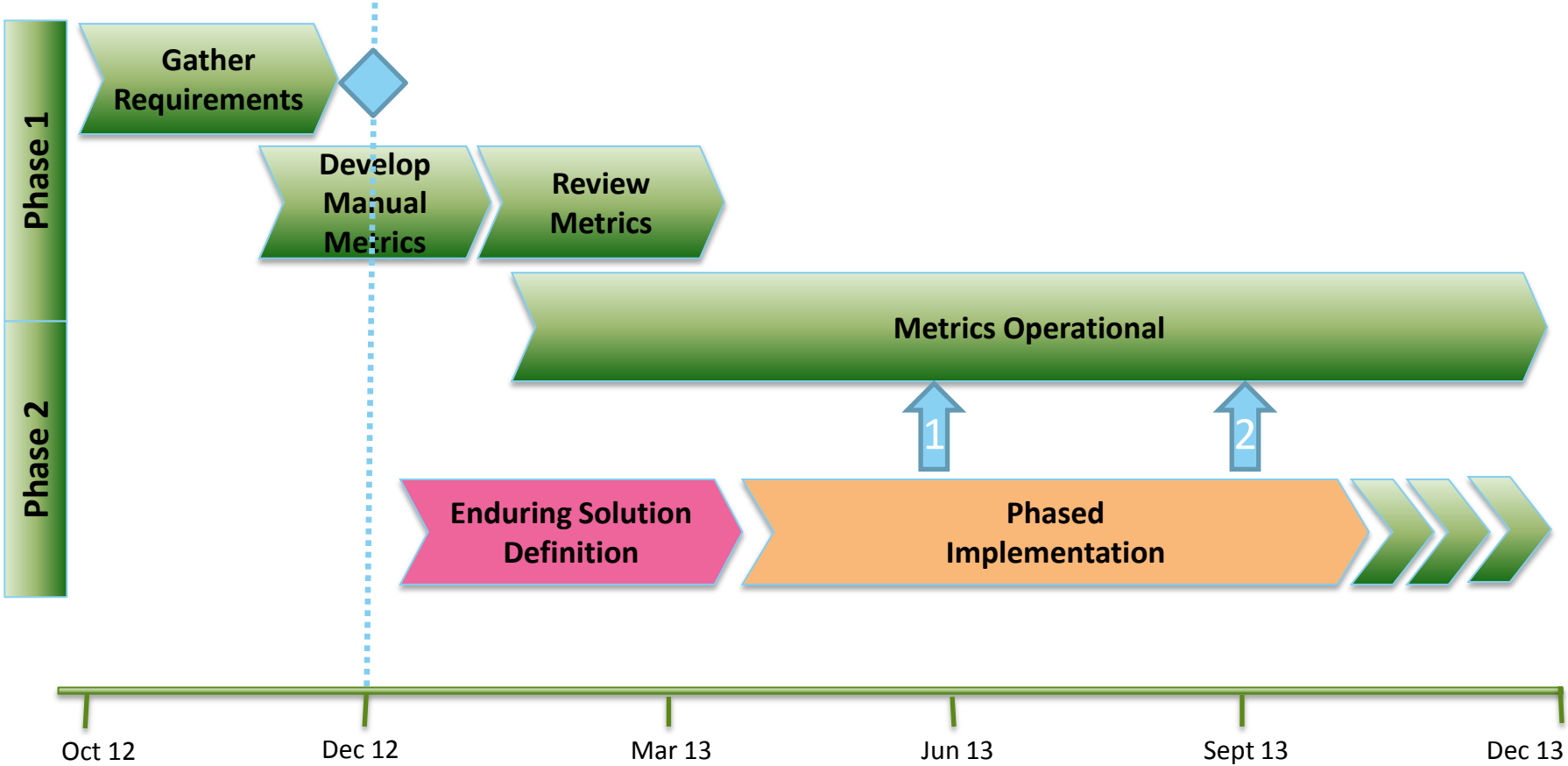
Capability

1. People Leader Skills
2. People Leader programmes
3. Develop bespoke interventions
4. Live learning sessions

Development

1. Qualifications
2. Known gaps
3. Coaching/Courses
4. TNA/Competency Framework

Overall Timeline



Solutions Considered

- Large number of systems containing data
- Options
  - Use new data warehouse and business objects solutions for reporting
  - Use existing PI System
- Benefits to using PI System
  - PI System already embedded in ScottishPower
  - Infrastructure in place
  - Data already being collected within PI System
  - Exploiting existing technology (esp in light of upgrade)
  - Trusted support partners available

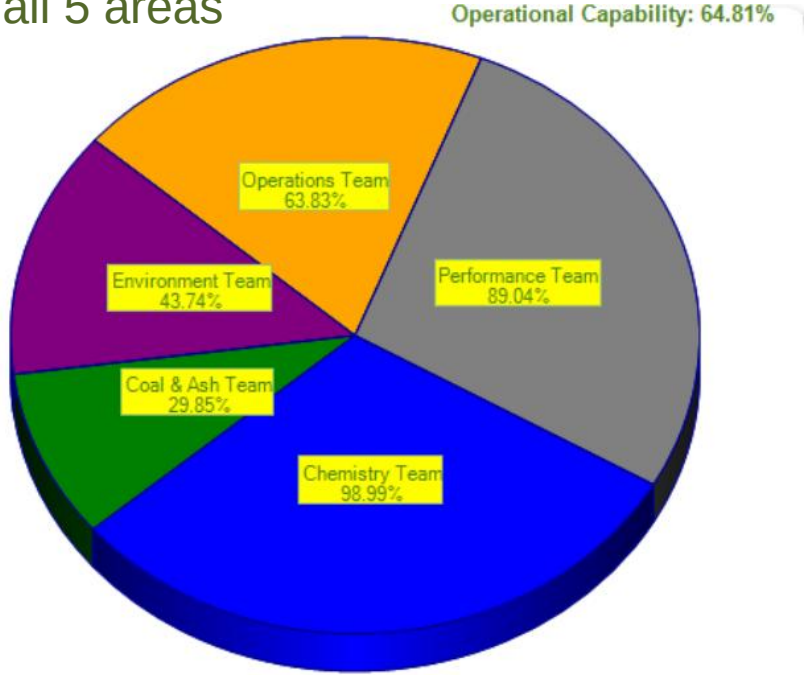
Metrics and Data – Summary of Metrics

Area (Responsible)	No. Of Requirements	No. of Metrics / Reports
Production (Production Manager)	68	53
Maintenance & Reliability Metrics (Maintenance Manager))	34	24
Housekeeping Metrics (Alan Kemp)	19	5
Total	127	83

The key metrics for the PI System were the Production metrics

Team Longannet Programme - Metrics Summary

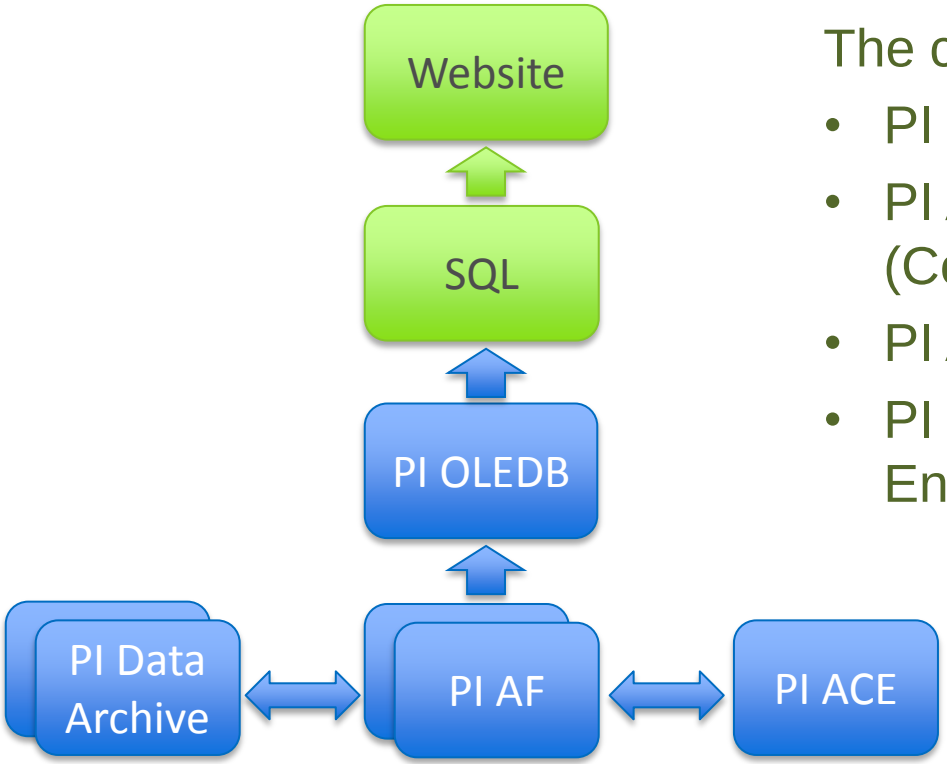
- Key Metrics & Reporting Areas
  - Operational Capability – spans across all 5 areas
- Detail metric - 5 key Production Areas
  - Operations (shift based)
  - Environment
  - Chemistry
  - Performance
  - Coal & Ash
- 53 Metrics needed
  - 17 currently on spreadsheets



Capula Approach

- Requirements were already captured
- 24 out of the 53 metrics relied on PI System data
- A prototype was created in SQL using PI ODBC
- The new solution would be tested against the prototype for accuracy
- A web-based front-end was developed by ScottishPower for visualisation of the data model values and results

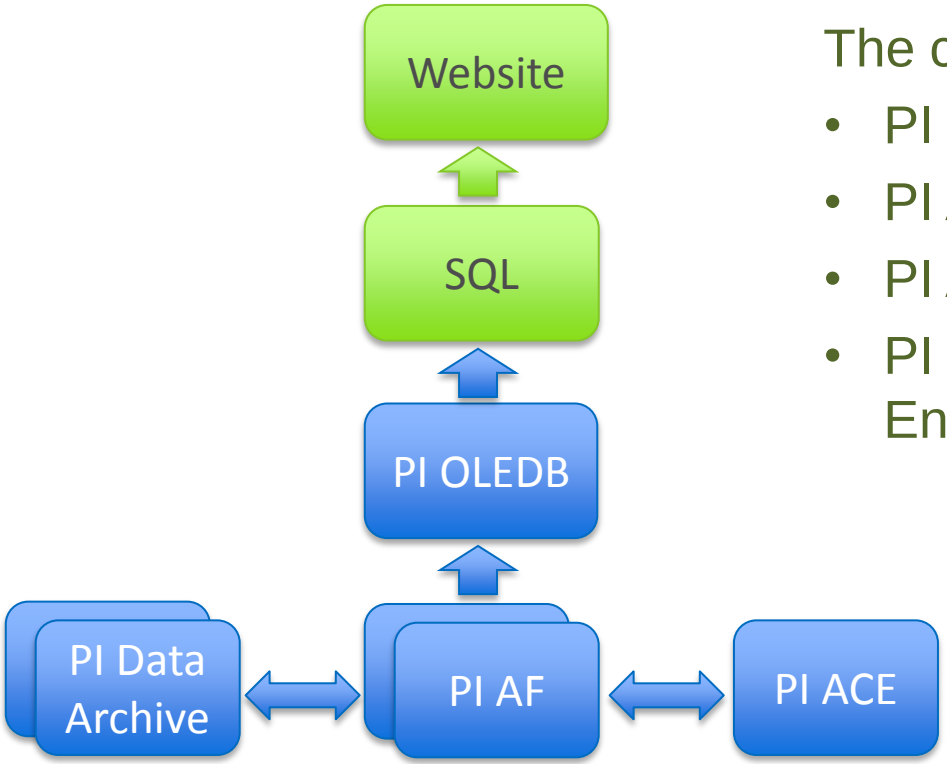
System Components



The core OSIsoft Products:

- PI Data Archive (Collective)
- PI Asset Framework (Collective)
- PI ACE
- PI OLEDB Provider & Enterprise

System Components



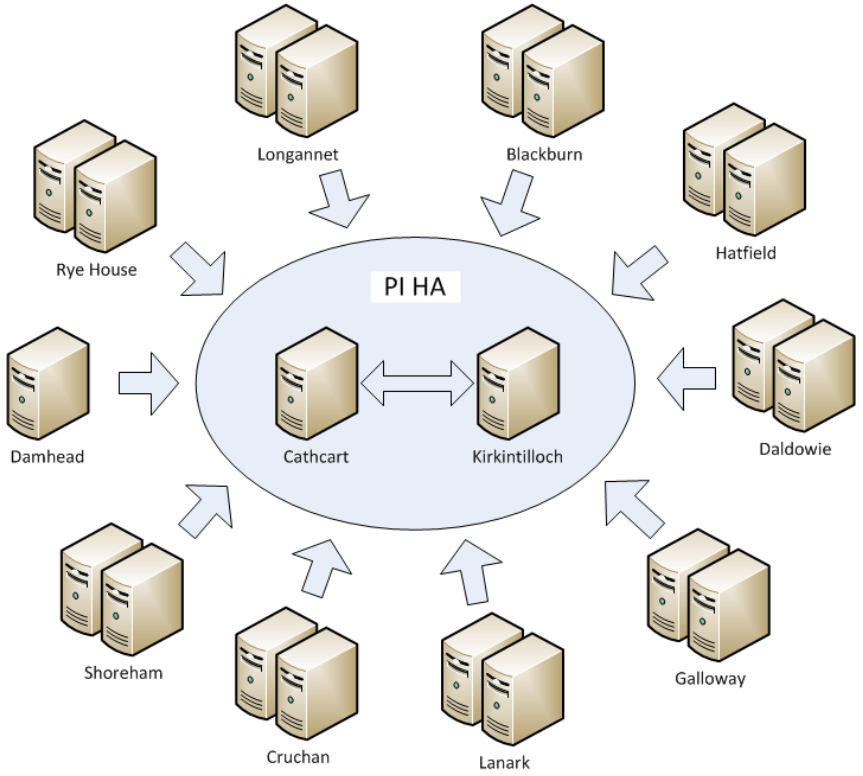
The core OSIsoft Products:

- PI Data Archive (Collective)
- PI AF (Collective)
- PI ACE
- PI OLEDB Provider & Enterprise

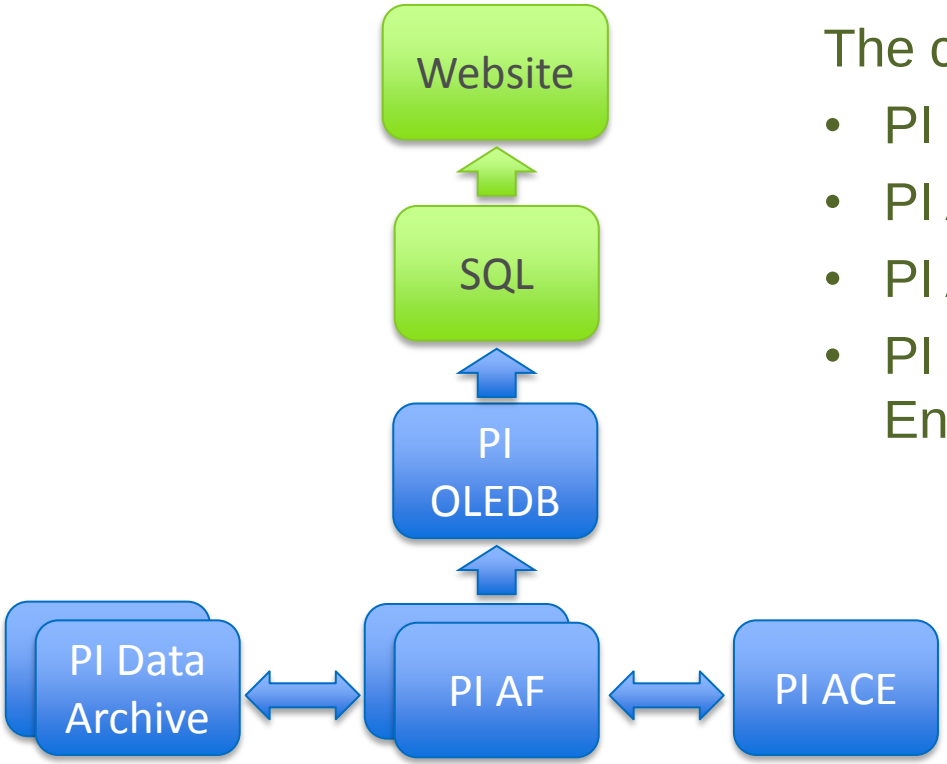
System Components

PI Data Archive

- PI Server 2010, 50k tag system
- PI Server Collective of two Servers
- Collective servers geographically separated
- Centralised data from 10 Power Stations
- Longannet is the largest consumer of PI Tags using 22,739 tags



System Components



The core OSIsoft Products:

- PI Data Archive (Collective)
- PI AF (Collective)
- PI ACE
- PI OLEDB Provider & Enterprise

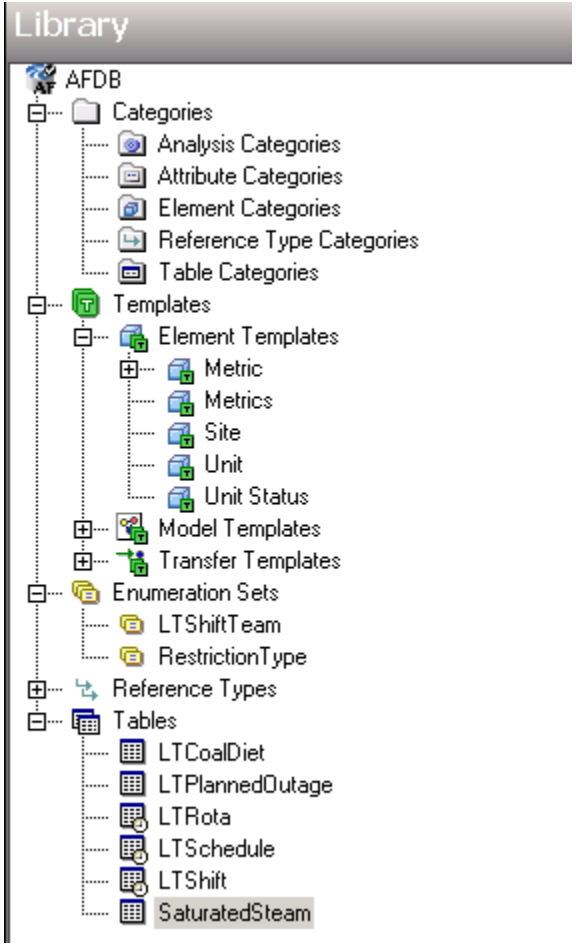
System Components

- First challenge was to create a suitable PI AF structure
- Initially created a structure that mimicked ScottishPower's work management system Maximo
- However, it proved difficult to map all the PI Tags into the structure within the limited lifespan of the project
- In the end a structure was created purely for the Metrics

System Components

PI AF

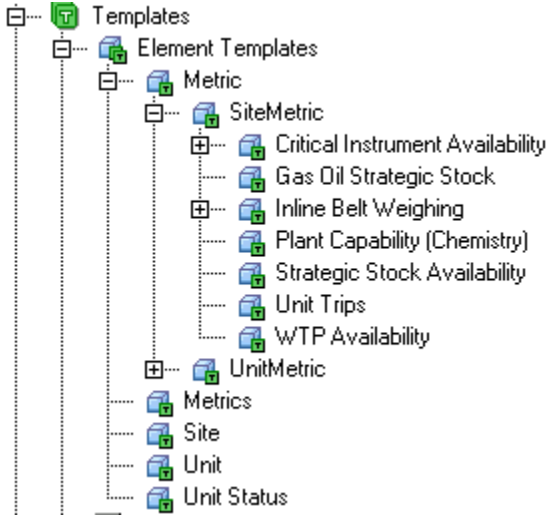
- The PI AF objects utilised were
  - PI AF Templates
  - PI AF Enumeration Sets
  - PI AF Elements
  - PI AF Tables
- In addition, PI AF Versioning was used



System Components

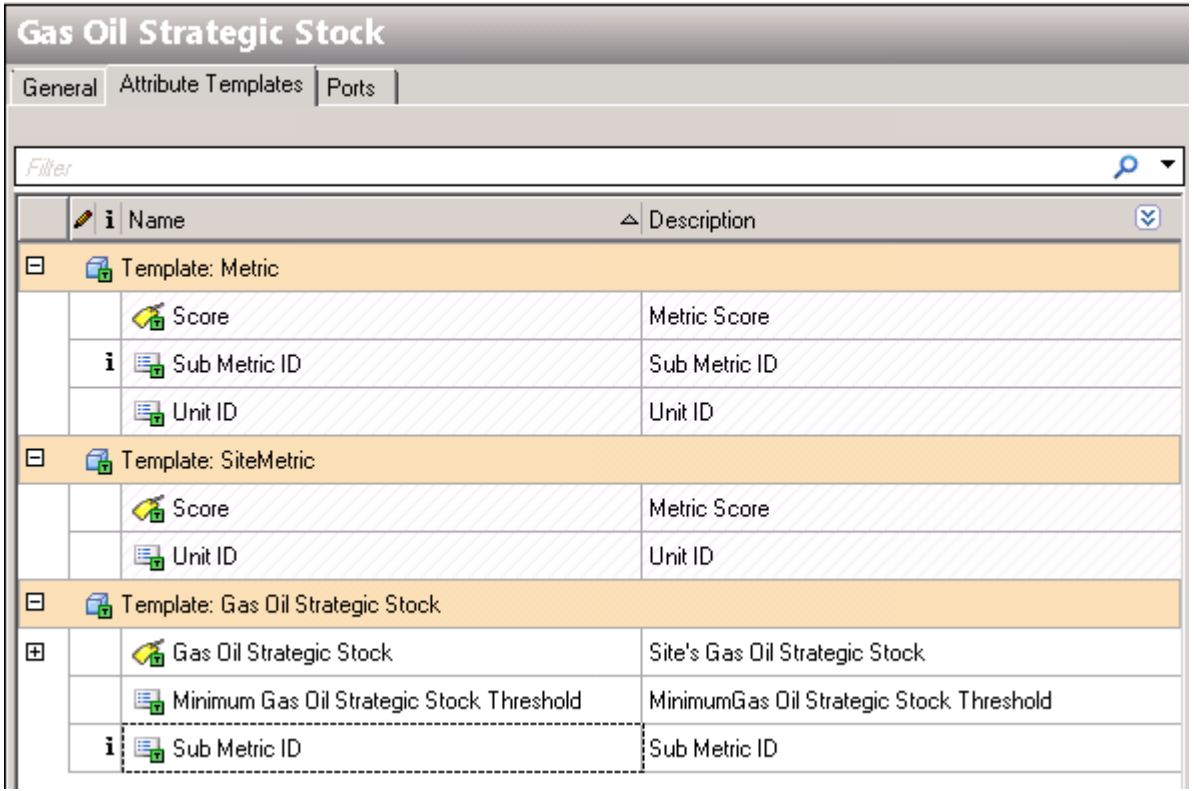
PI AF

- PI AF Element Templates
  - Base Templates
  - Derived Templates



System Components

PI AF



System Components

PI AF

- Unit Level PI AF Elements

Element Hierarchy

- Longannet
  - Metrics
  - Section Metrics
  - Unit 1
    - Metrics
  - Unit 2
  - Unit 3
  - Unit 4

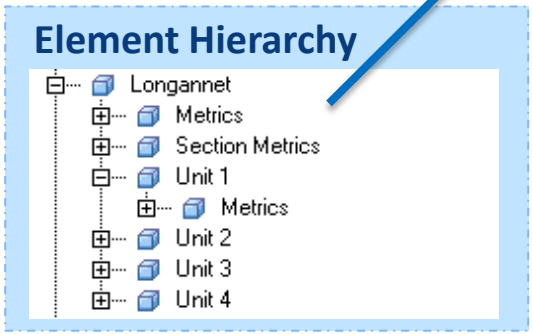
Unit Level Metrics

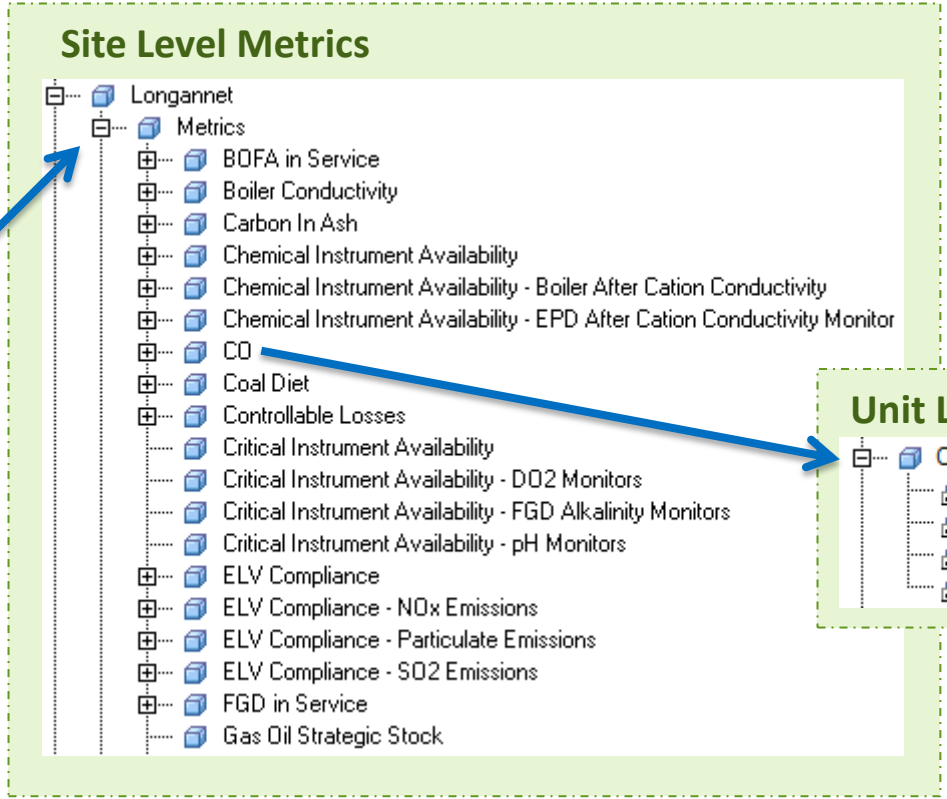
- Longannet
  - Metrics
  - Section Metrics
  - Unit 1
    - Metrics
      - LT U1 BOFA in Service
      - LT U1 Boiler Conductivity
      - LT U1 Carbon In Ash
      - LT U1 Chemical Instrument Availability
      - LT U1 Chemical Instrument Availability - Boiler After Cation Conductivity
      - LT U1 Chemical Instrument Availability - EPD After Cation Conductivity Monitor
      - LT U1 CO
      - LT U1 Coal Diet
      - LT U1 Controllable Losses
      - LT U1 ELV Compliance
      - LT U1 ELV Compliance - NOx Emissions
      - LT U1 ELV Compliance - Particulate Emissions
      - LT U1 ELV Compliance - SO2 Emissions
      - LT U1 FGD in Service
      - LT U1 Load Following
      - LT U1 NOx
      - LT U1 Plant Capability (Commercial)
      - LT U1 Platen Temps
      - LT U1 Platen Temps - 1st Stage Platens
      - LT U1 Platen Temps - 2nd Stage Platens
      - LT U1 Platen Temps - Secondary Superheater
      - LT U1 SO3 in Service

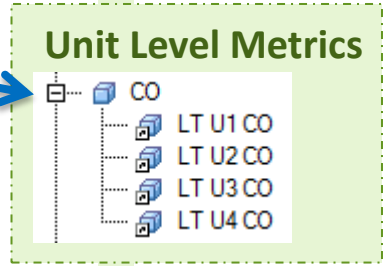
System Components

PI AF

- Site Level PI AF Elements



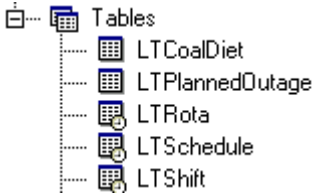




System Components

PI AF

- PI AF Tables
  - Data held in the PI AF Tables is maintained using website



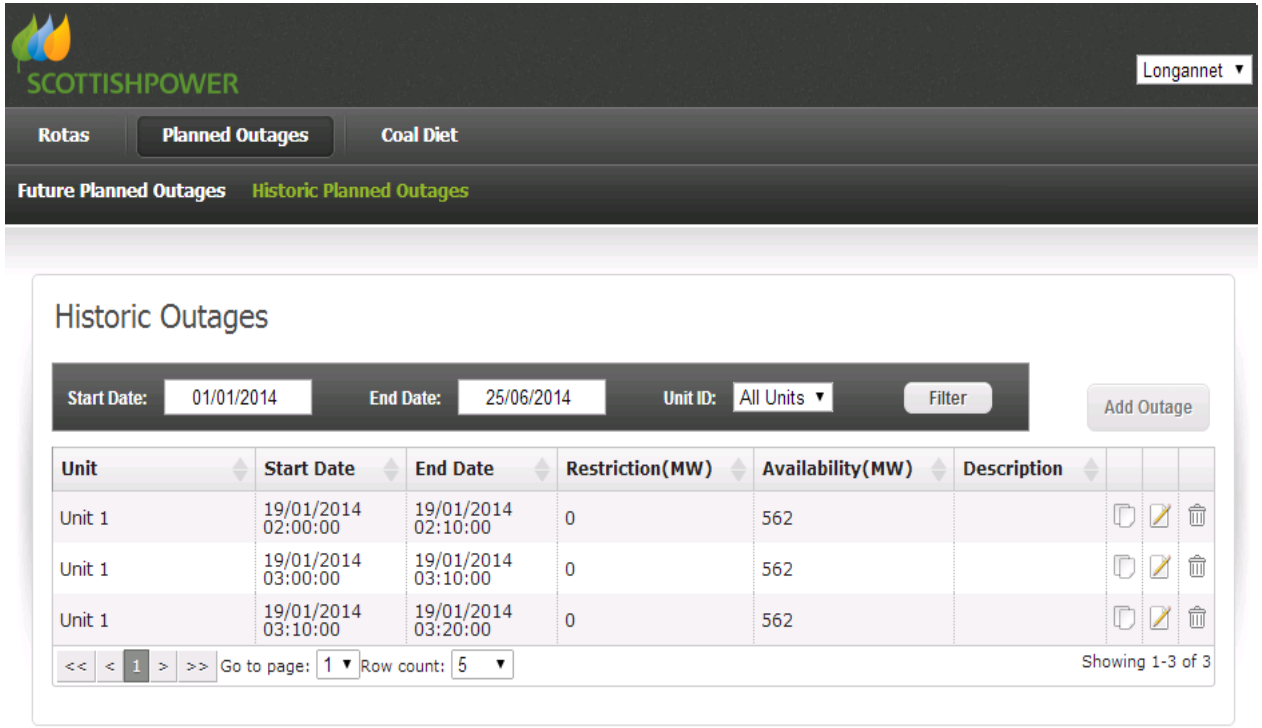
LTCoalDiet

General | Table | Define Table | Version

LTCoalDiet

	ID	Unit	ValidFrom	ValidTo	LowerLimit	UpperLimit
▶	1	1	31/12/2012 21:30:00	29/11/2013 12:47:50	1400	2000
	2	2	31/12/2012 21:30:00		1400	2000
	3	3	31/12/2012 21:30:00		1400	2000
	4	4	31/12/2012 21:30:00		1000	1400
	6	1	29/11/2013 12:47:50		40	80
*						

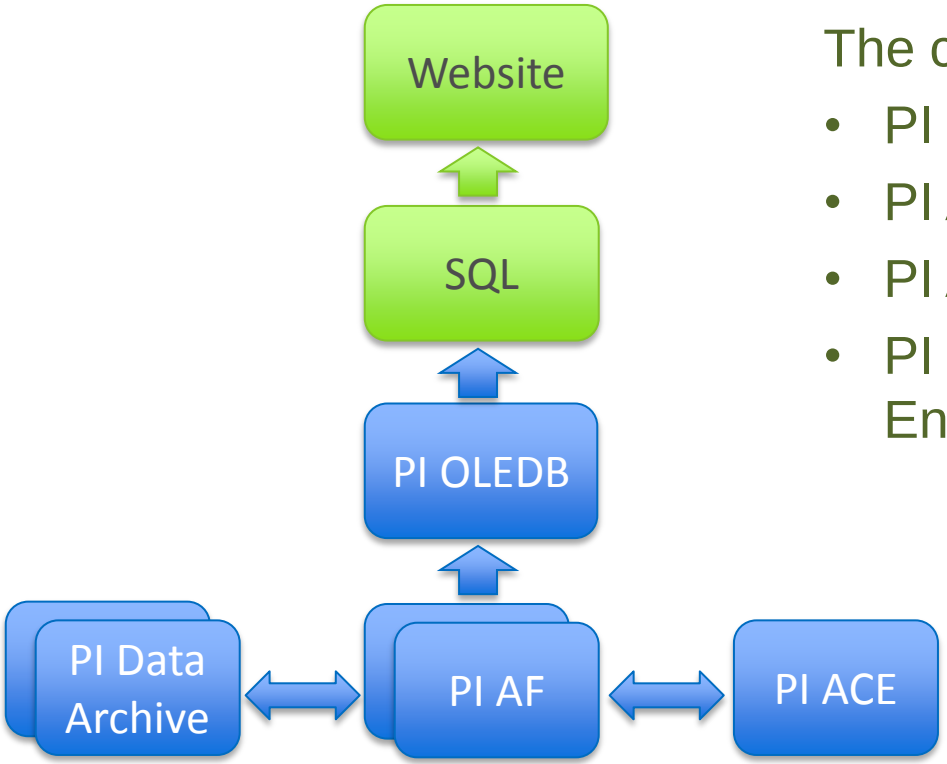
System Components



Metric Configuration

- Rotas
- Shifts
- Shift Teams
- Coal Diet
  - Future
  - Historic
- Planned Outages
  - Future
  - Historic

System Components



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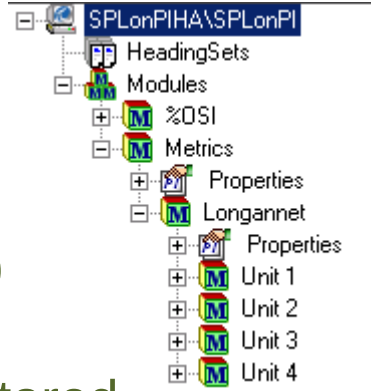
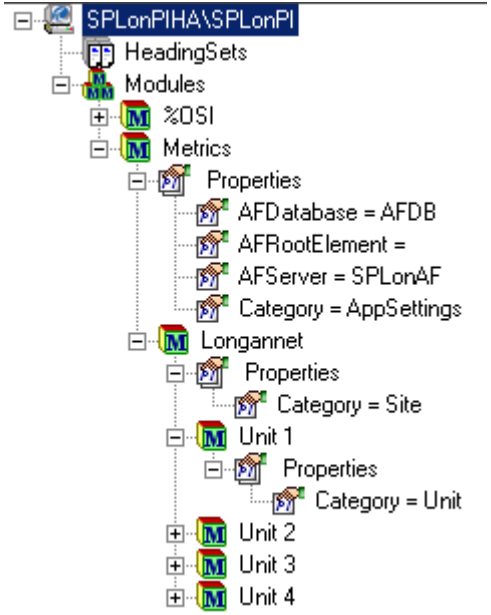
- PI AF (Collective)
- PI ACE
- PI OLEDB Provider & Enterprise

System Components

PI ACE

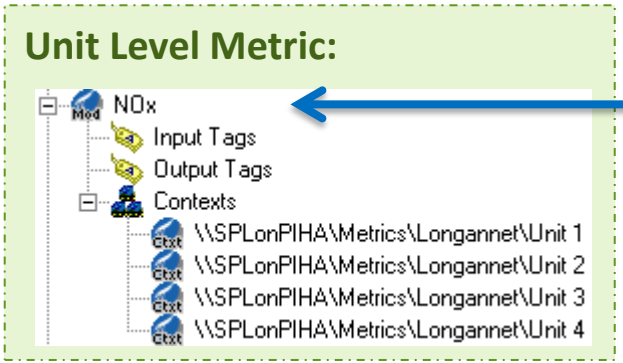
- Calculations for all 24 PI Metrics
- The Metric calculations run every 10 minutes
- The metric score is calculated and stored in PI Data Archive
- The workings for the calculations are stored as Annotations in PI Data Archive against each score
- Additional calculations for Active Shift Team and Unit Status

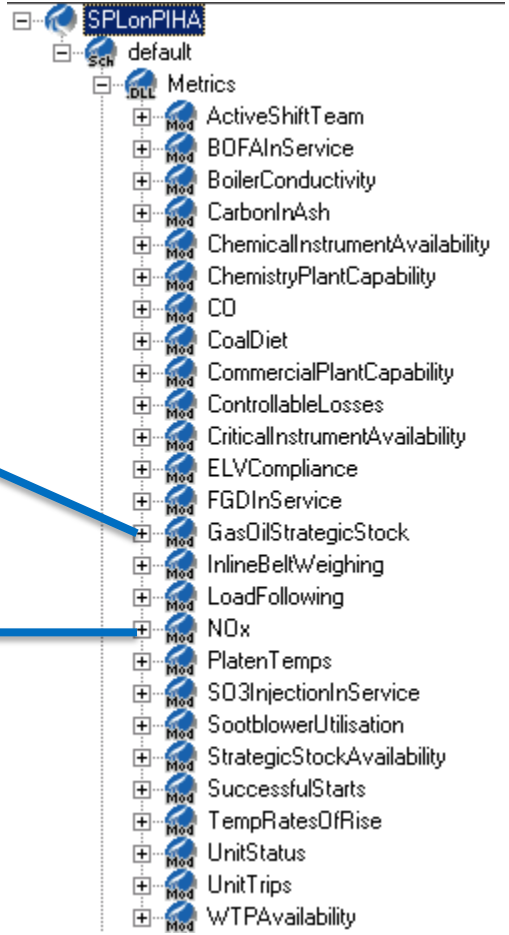




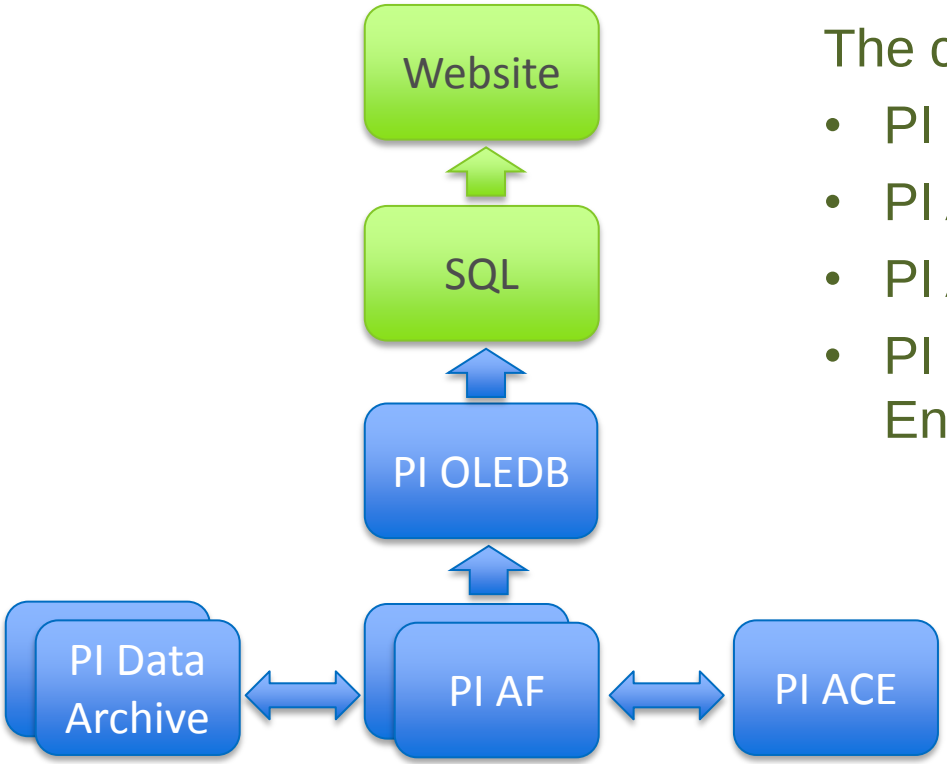
System Components

PI ACE





System Components



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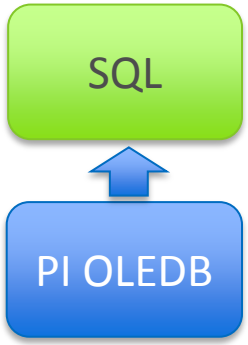
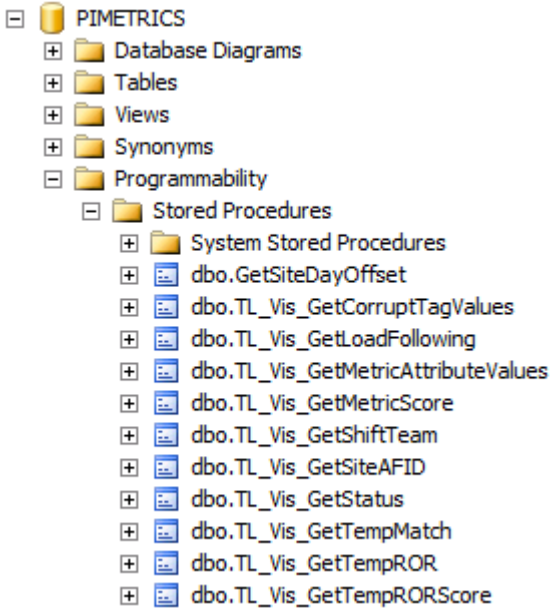
System Components

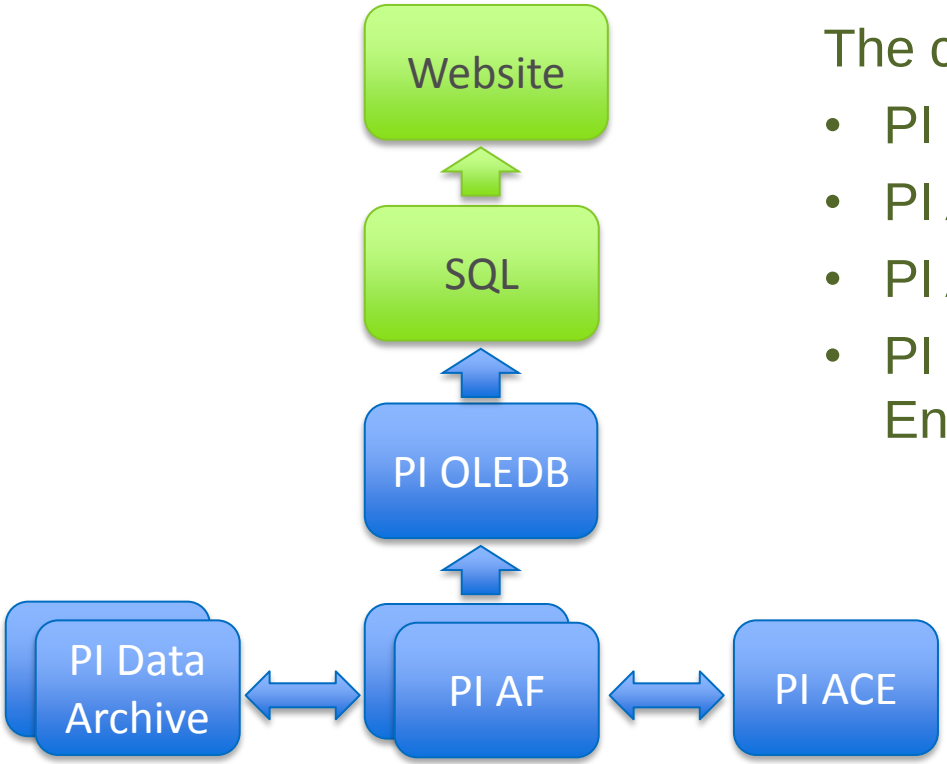


The Data Model

- ODS Database hosted on SQL Server
- Data Model Stored Procedures
  - PI OLEDB Enterprise
  - PI OLEDB Provider
- SQL Jobs call Stored Procedures to load data into the ODS



System Components



The core OSIsoft Products:

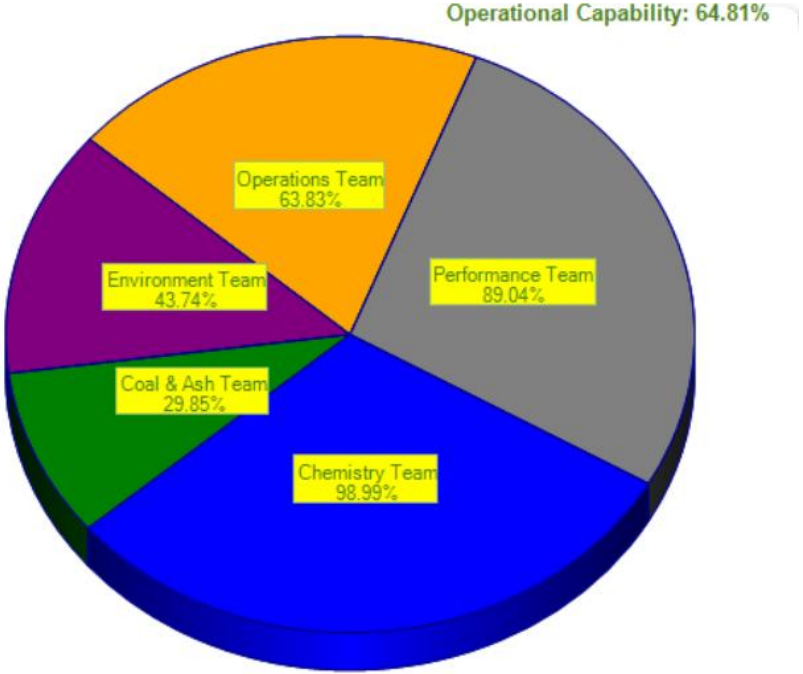
- PI Data Archive (Collective)
- PI AF (Collective)
- PI ACE
- PI OLEDB Provider & Enterprise

System Components

Website

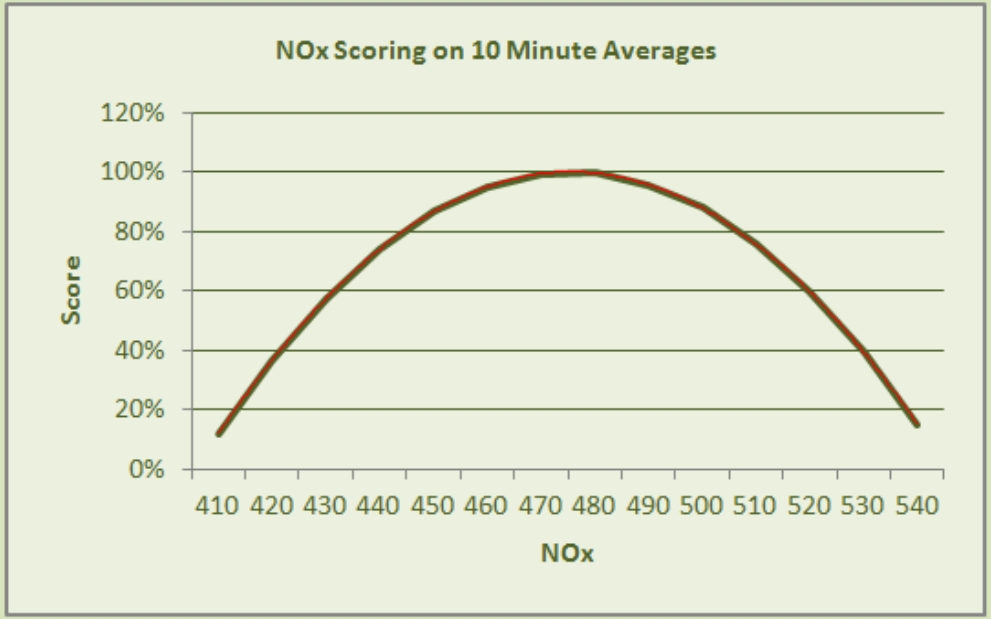
Key Metrics delivered:

- Coal Diet
- Commercial Plant Capability
- Gas Oil Strategic Stock
- Inline Belt Weighing
- Successful Starts
- Temp Rate of Rise
- WTP Availability
- NOx

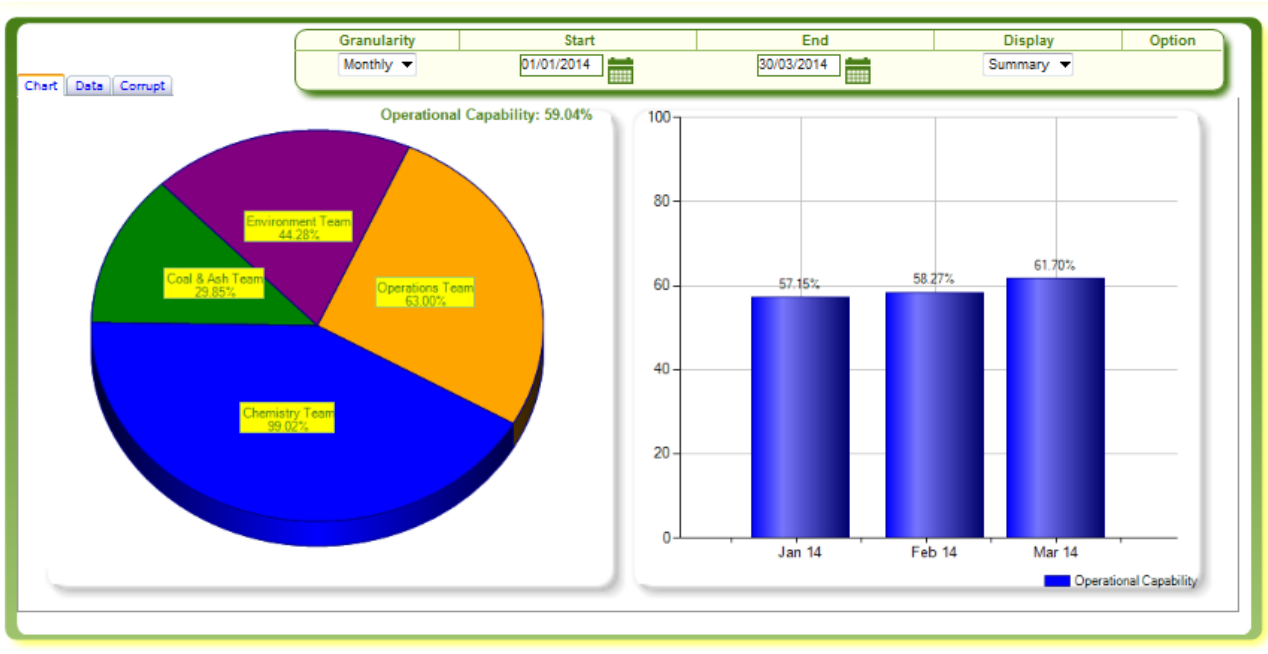


NOX Example

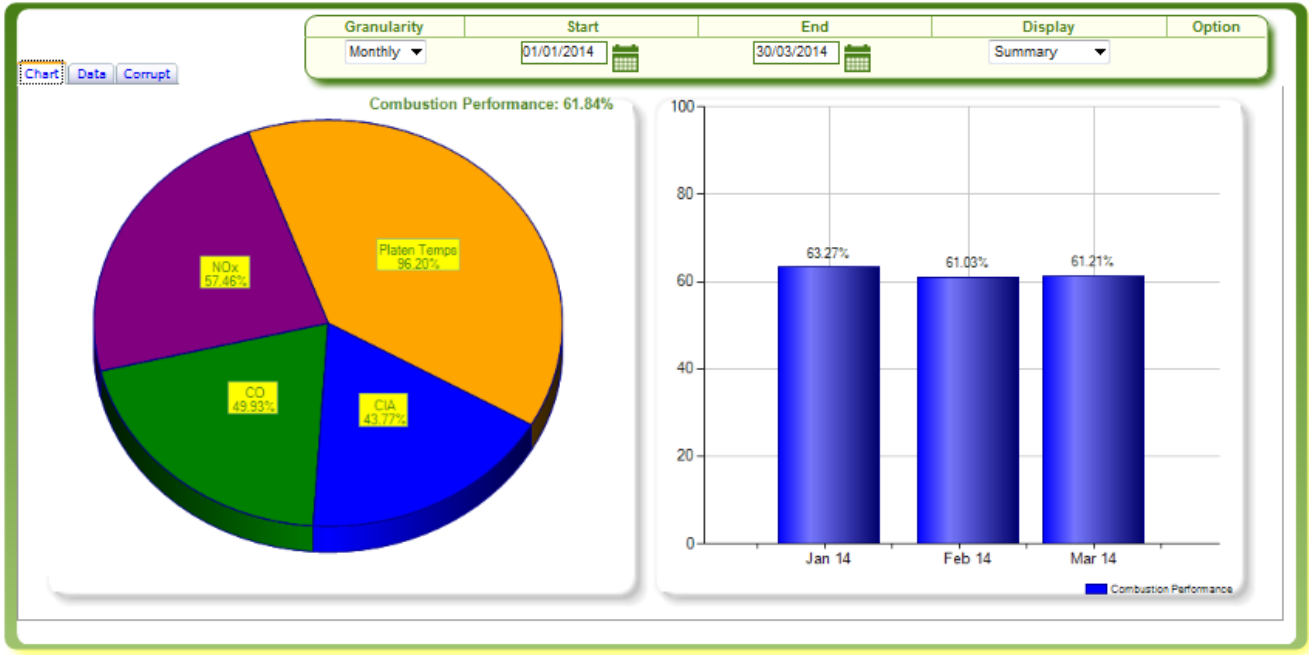
Production Measure NOx Constants		
NOx	Score	Constants
410	12%	-0.0002
420	37%	0.195
430	58%	-45.370
440	74%	
450	87%	Filters
460	95%	>300MW
470	100%	
480	100%	
490	96%	
500	88%	
510	76%	
520	60%	
530	40%	
540	15%	

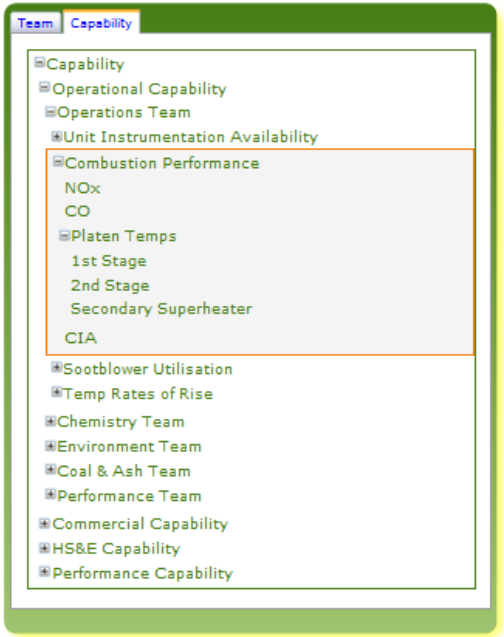


Operational Capability



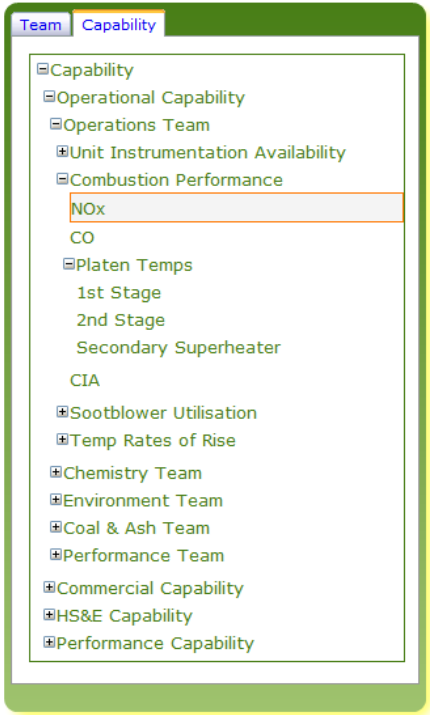
Combustion Performance



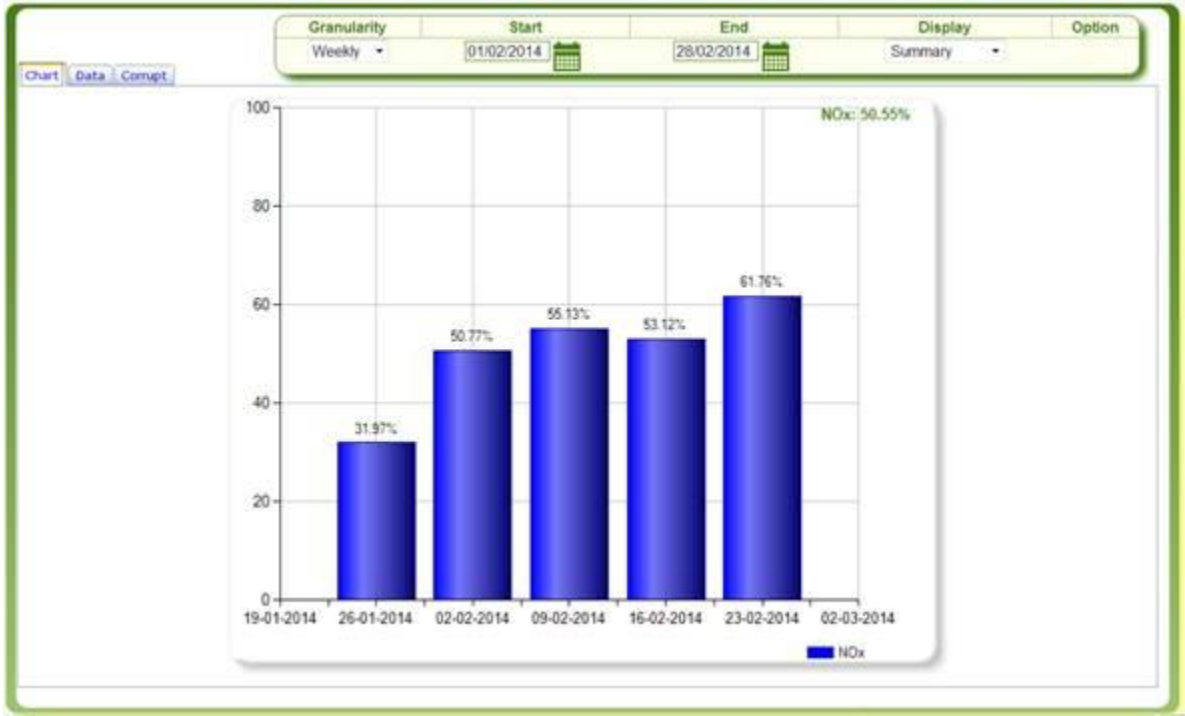


NOX


Granularity
Start
End
Display
Option
Monthly
01/01/2014
30/03/2014
Summary
Chart
Data
Corrupt
NOx: 57.46%
100
80
60
40
20
0
59.40%
53.99%
58.99%
Jan 14
Feb 14
Mar 14
NOx

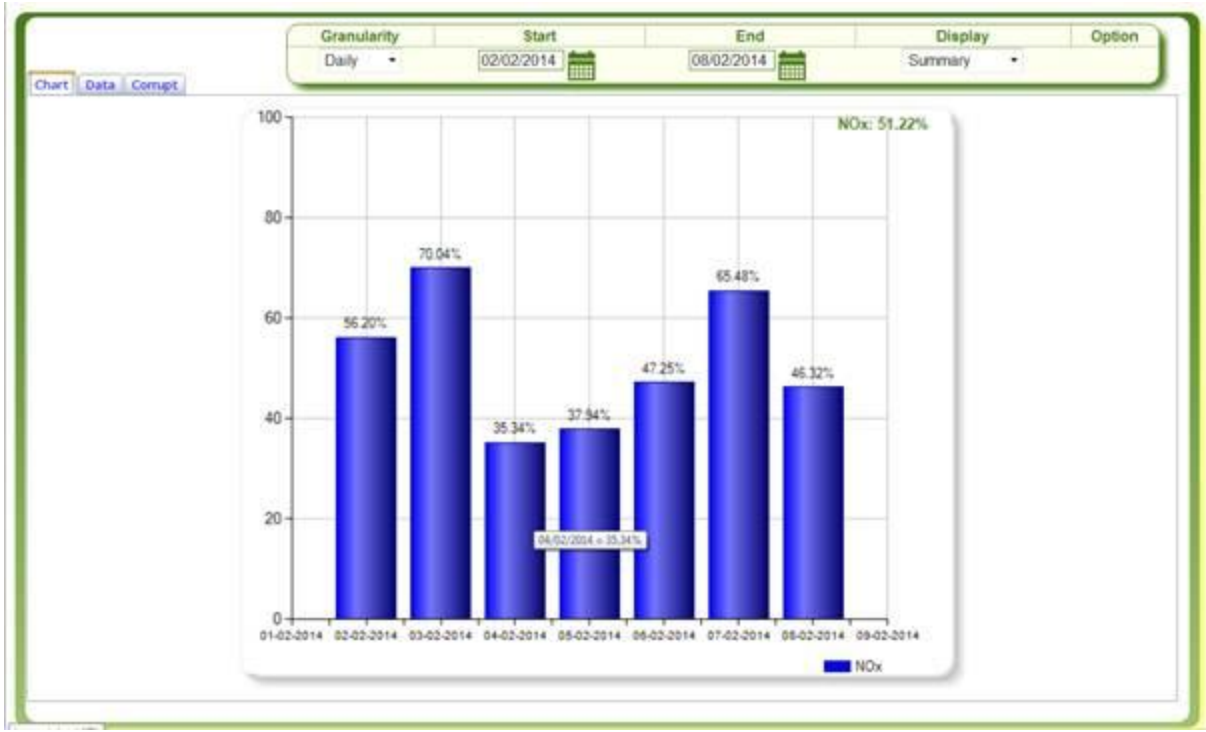

Team
Capability
Capability
Operational Capability
Operations Team
Unit Instrumentation Availability
Combustion Performance
NOx
CO
Platen Temps
1st Stage
2nd Stage
Secondary Superheater
CIA
Sootblower Utilisation
Temp Rates of Rise
Chemistry Team
Environment Team
Coal & Ash Team
Performance Team
Commercial Capability
HS&E Capability
Performance Capability

Weekly


Granularity
Start
End
Display
Option
Weekly
01/02/2014
28/02/2014
Summary
Chart
Data
Corrupt
NOx: 50.55%
100
80
60
40
20
0
31.97%
50.77%
55.13%
53.12%
61.76%
19-01-2014
26-01-2014
02-02-2014
09-02-2014
16-02-2014
23-02-2014
02-03-2014
NOx

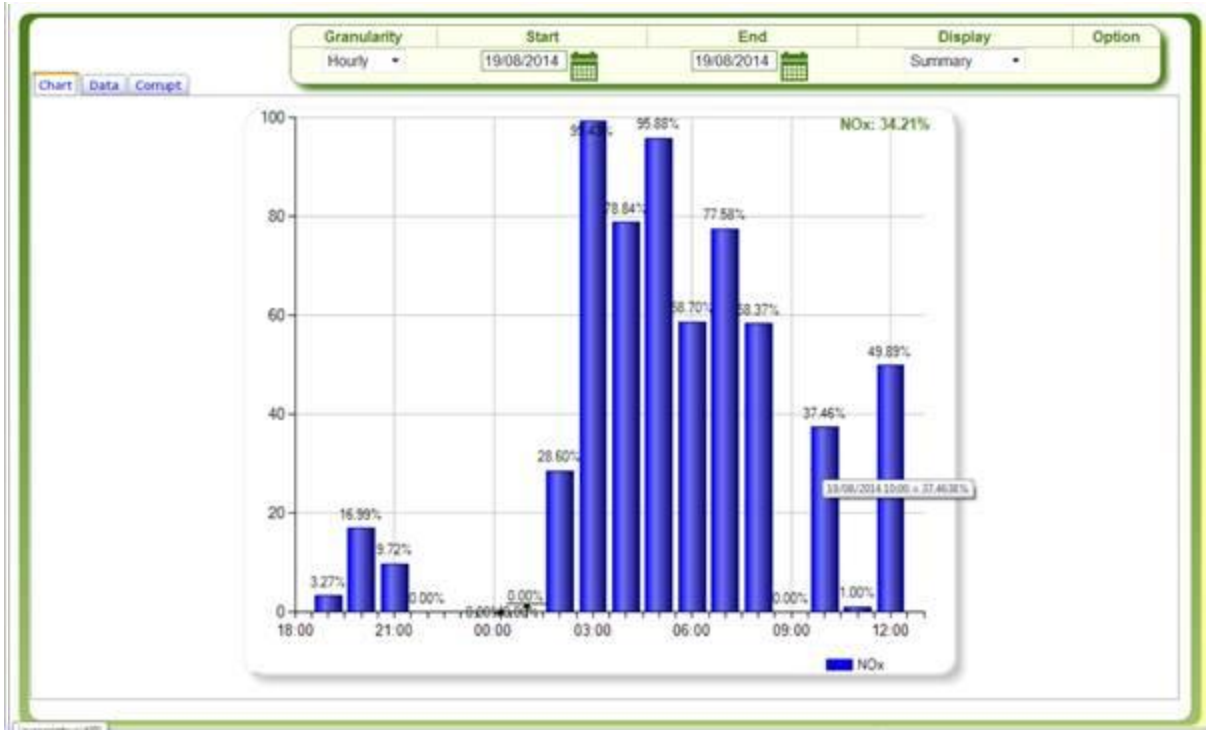

Team
Capability
Capability
Operational Capability
Operations Team
Unit Instrumentation Availability
Combustion Performance
NOx
CO
Platen Temps
CIA
Sootblower Utilisation
Temp Rates of Rise
Chemistry Team
Environment Team
Coal & Ash Team
Performance Team
Commercial Capability
HS&E Capability
Performance Capability

Daily


Granularity
Start
End
Display
Option
Daily
02/02/2014
08/02/2014
Summary
Chart
Data
Corrupt
NOx: 51.22%
100
80
60
40
20
0
56.20%
70.04%
35.34%
37.94%
47.25%
65.48%
46.32%
01-02-2014
02-02-2014
03-02-2014
04-02-2014
05-02-2014
06-02-2014
07-02-2014
08-02-2014
09-02-2014
NOx

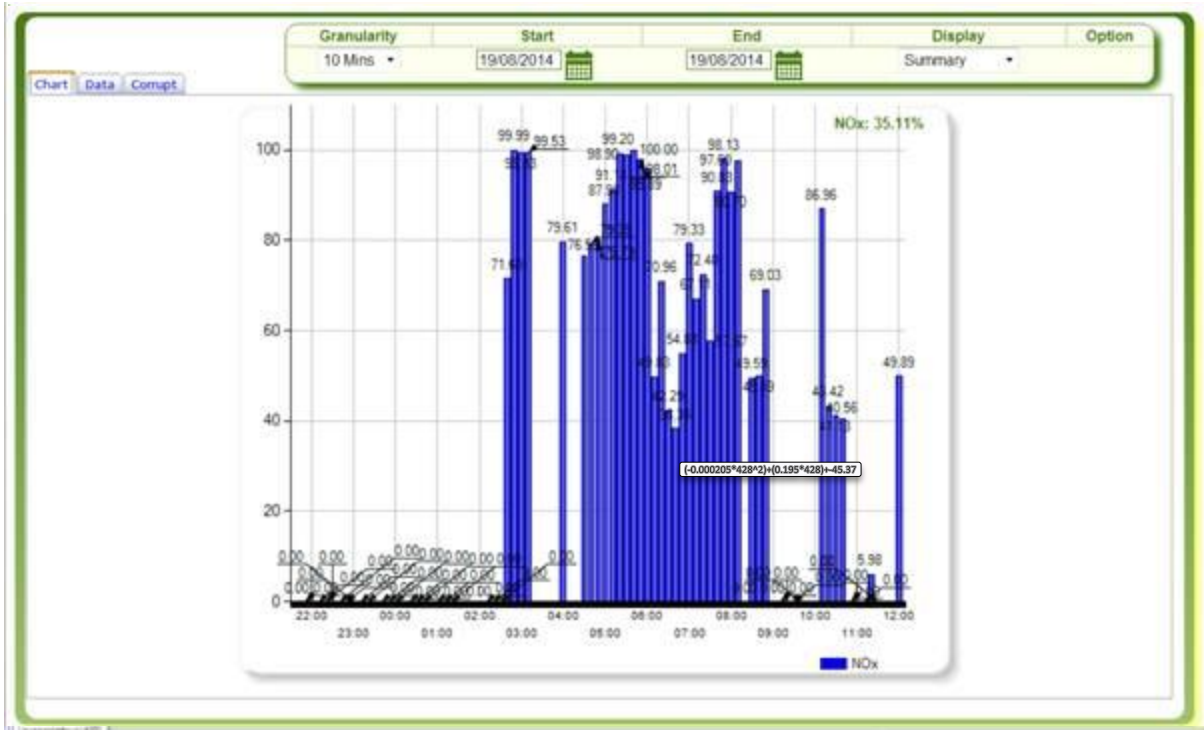

Team
Capability
Capability
Operational Capability
Operations Team
Unit Instrumentation Availability
Combustion Performance
NOx
CO
Platen Temps
CIA
Sootblower Utilisation
Temp Rates of Rise
Chemistry Team
Environment Team
Coal & Ash Team
Performance Team
Commercial Capability
HS&E Capability
Performance Capability

Hourly

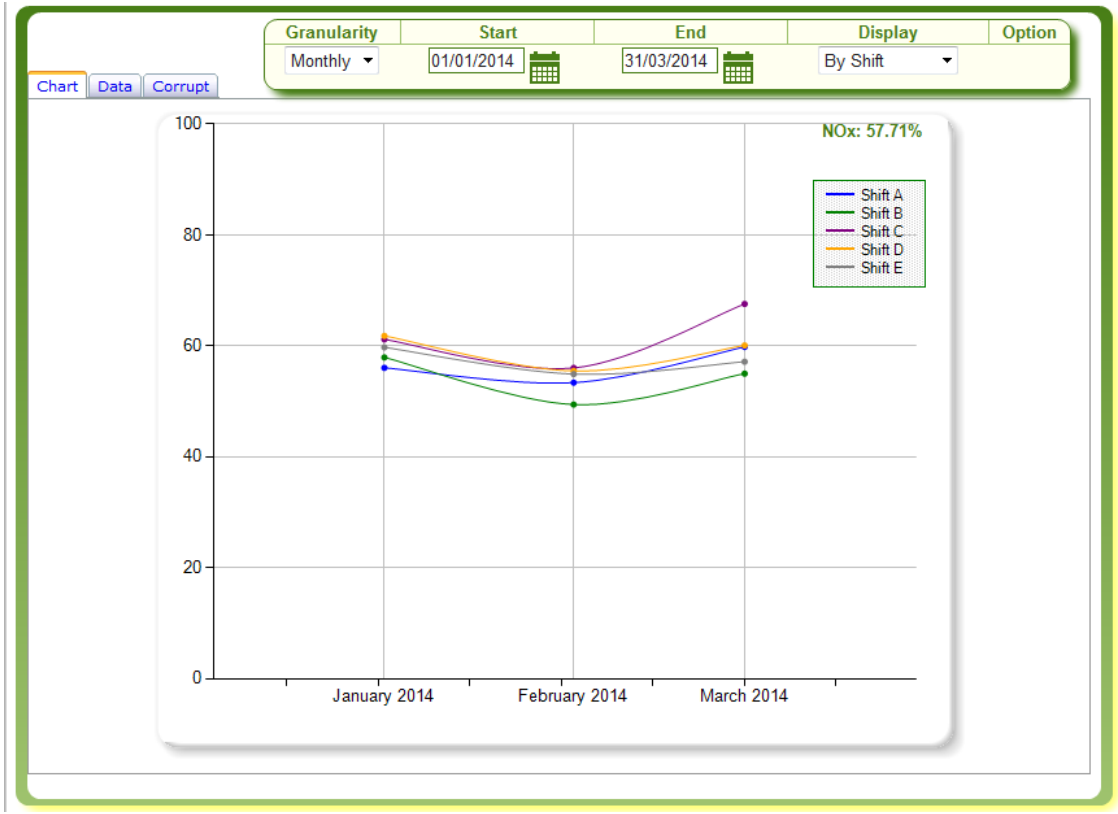

Granularity
Start
End
Display
Option
Hourly
19/08/2014
19/08/2014
Summary
Chart
Data
Corrupt
NOx: 34.21%
100
80
60
40
20
0
3.27%
16.99%
9.72%
0.00%
0.00%
28.60%
95.88%
78.84%
77.58%
58.70%
58.37%
0.00%
37.46%
1.00%
49.89%
18:00
21:00
00:00
03:00
06:00
09:00
12:00
NOx

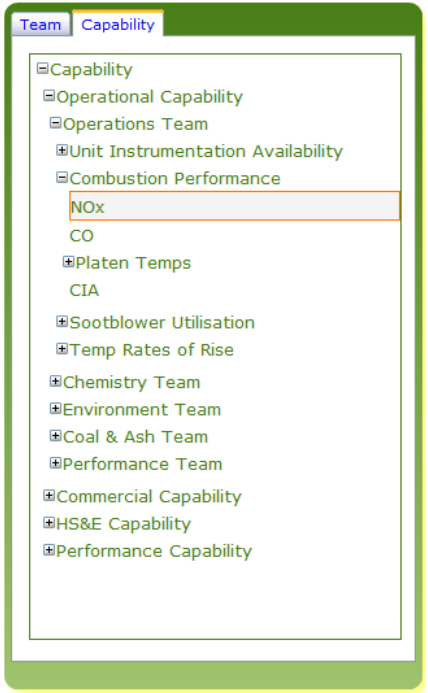

Team
Capability
Capability
Operational Capability
Operations Team
Unit Instrumentation Availability
Combustion Performance
NOx
CO
Platen Temps
CIA
Sootblower Utilisation
Temp Rates of Rise
Chemistry Team
Environment Team
Coal & Ash Team
Performance Team
Commercial Capability
HS&E Capability
Performance Capability

(-0.000205*428^2)+(0.195*428)+-45.37



Shift Performance Comparison





Project Summary

PRODUCTION MANAGER

Also, has contributed to [illegible] the NOx emissions to well within the allowable level. [illegible]

This has contributed [illegible] reduced [illegible] availability for the plant.

The metrics have provided a greater focus for the operations staff.

The metrics have provided a greater focus for the operations staff.

The most obvious benefits have been in the combustion area.

Business Challenge

- Extend the life of the largest coal fired power station in Scotland by up to 20 years

Solution

- Provide real time information to support major efficiency improvements in the plant
- Develop Business metrics
- Visualise the metrics for monitoring

Results and Benefits

- Lower NOx Emissions
- More efficient start ups
- Reduced Boiler tube leak rate
- Increased Availability

Results & Benefits

Availability Up

- ✓ 2014 YTD figures up on 2013 up by **12.4%**

Tube leaks Down

- ✓ 2014 YTD figures down on 2013 by **0.14 leaks per 1000** running hours

NOx

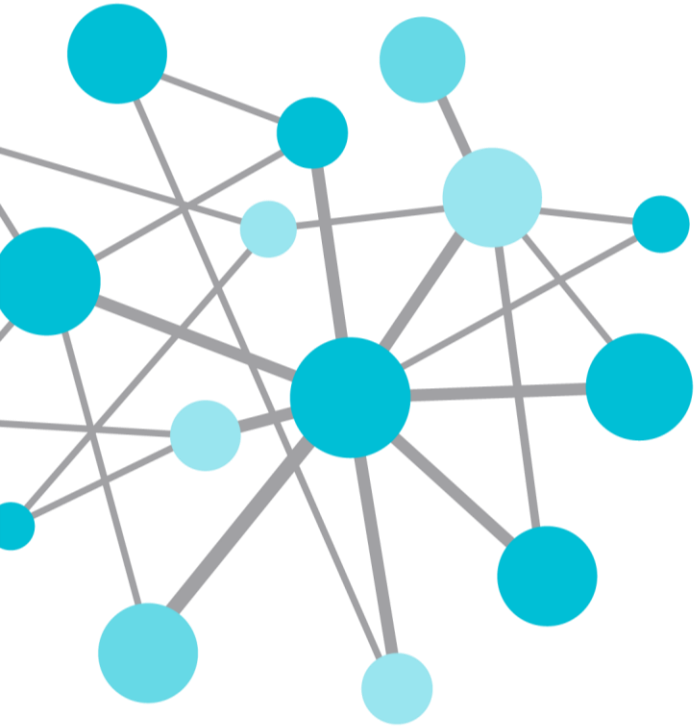
- ✓ 2014 YTD figures have reduced by **0.1t/GWh**

Through the production metrics the production staff are now more aware of the what is important to the business.

Questions

Please wait for the **microphone** before asking your questions

State your **name & company**



THANK YOU

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