The PI System Journey

Presented by

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Agenda

- E.ON UK
- E.ON Gas Fleet – Combined Cycle Gas Turbine & Combined Heat and Power
- E.ON UK's PI System Infrastructure
- Performance Systems Optimisation Team
- PI System Projects
  - Load Monitoring
  - Real-time Performance Monitoring
  - Third Party Access To Plant Information
  - Replacement Of Obsolete Equipment
- E.ON's PI System Strategy 2011/2012 and beyond
- Summary Of The Key Benefits - Testimonial

E.ON UK

- **Business - Electricity Generation**
- The UK has 5 GW of coal-fired generation capacity, across three sites and 4.4 GW of Gas across 18 sites.
- 2010 business restructure led to the fleet being split into steam and gas which resulted in two Global Fleet Management Centre's (FMC)
  - **Germany – Steam**
  - **UK - Gas**

E.ON (CCGT fleet)

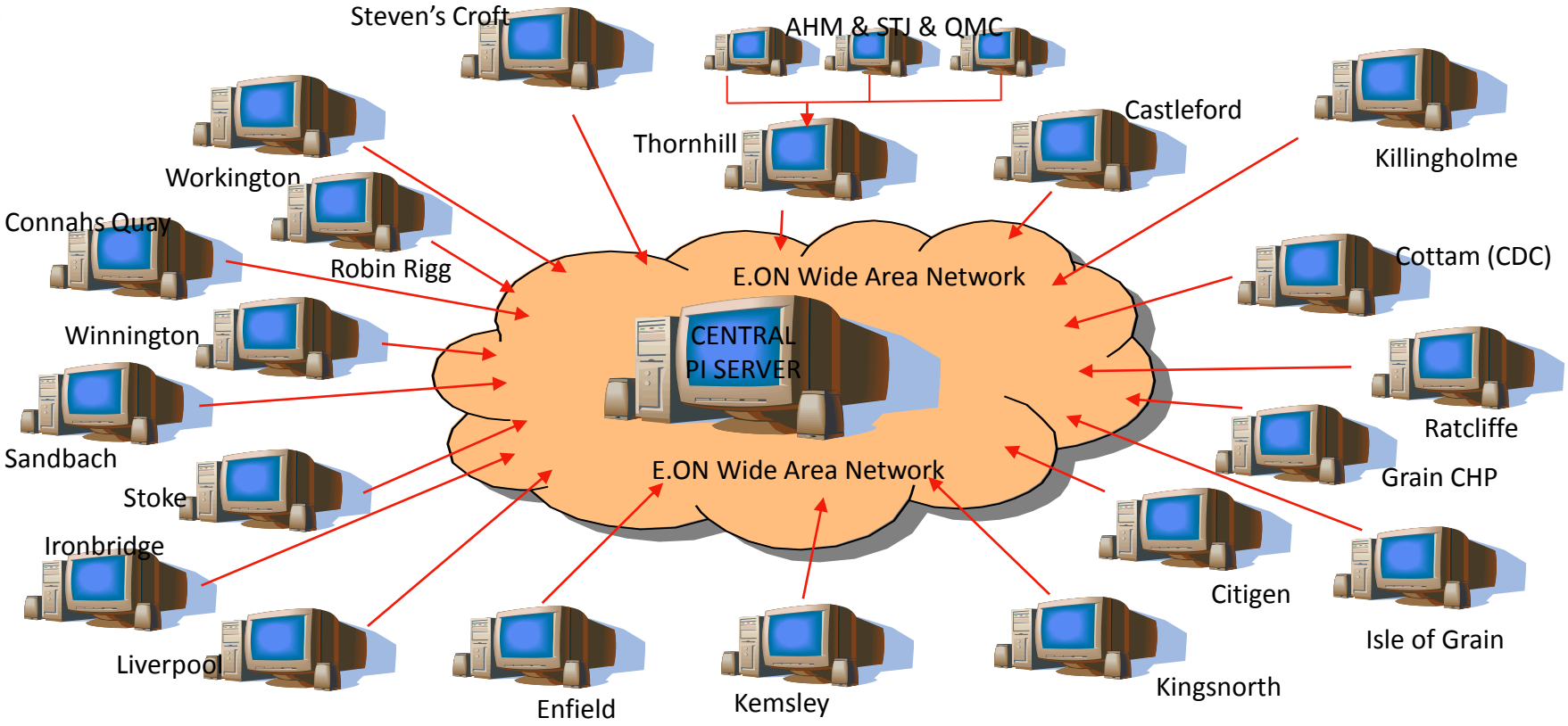
- E.ON's Gas-CCGT Fleet is present in 10 countries and responsible for a total of 69 units on 40 sites. It has an installed capacity of around 18 GW.

- We have a vision as being recognised as the **best managed portfolio worldwide.**

- Our business is simple and we will achieve our goal through a key focus on the following areas:
  - **Safety and the environment**
  - **Compliance**
  - **Making Money - we make more money by improving**
    - **Plant capacity**
    - **Availability**
    - **Flexibility**
    - **Reliability**
    - **Efficiency**
    - **Reducing costs**

E.ON CCGT & CHP fleet

UK PI System infrastructure



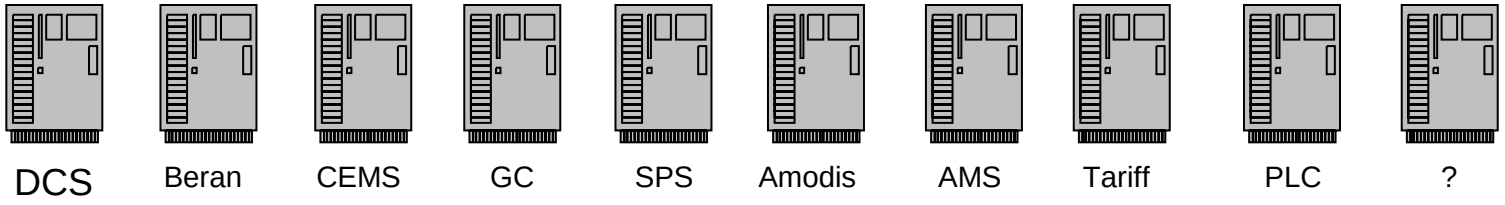
UK PI System infrastructure

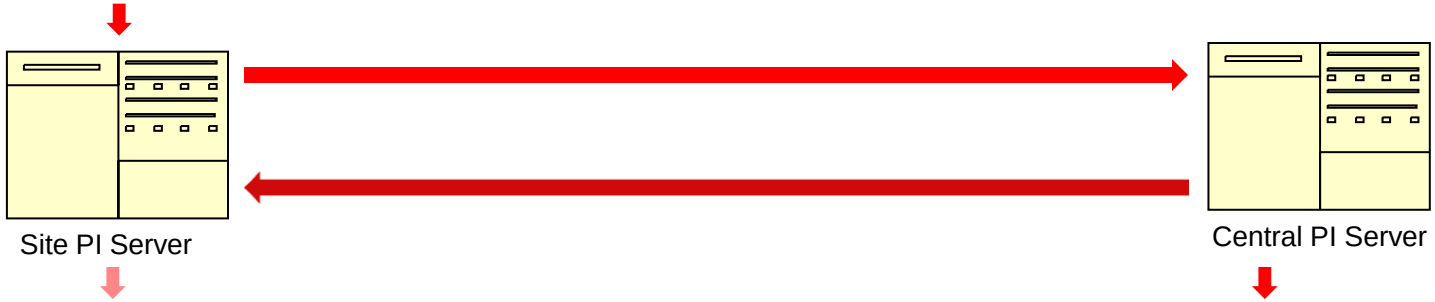
- UK - 21 PI Server Installations.
- Numerous PI Interfaces and PI Clients.
- Substantial Investment over several years – monetary, time and effort.
- 2007 PI System had become an integrated solution to our business for capturing plant data.
- Early utilisation was mainly post event analysis.
- We had a need to become more proactive through real time monitoring and analysis in order to meet our vision in the changing markets.

The Performance Systems Optimisation team

- We are a small team of 5
- Established 2007
- Manage/support and develop a standardised integrated fleet wide plant data acquisition system
- Ensure the data source providing the information to the business is uninterrupted, reliable and accurate
- Assist in the development of both value added applications and people, enabling the business to maximise its investment
- Centre of excellence within the Generation business

Evolving system





PI ProcessBook

PI DataLink

GPMS

SAP

PI WebParts

Opralog

ENT - Apps

Key fleet and site specific projects

- **Interface Failover** – Ensures a more secure data capture environment.
- **LMW Project** – Load Monitor Watchdog (Imbalance tracking).
- **Web Pages Employed** – Displays plant generation overview and allows third party access to authorised data.
- **Future data importing** – through the UFL interface it is possible to compare real values to future forecasts.
- **Capturing of web based data** – Utilising the HTML interface to record data into the PI System from the web i.e. Electricity buy/sell prices etc.
- **SAP integration** – Pushes run time data to SAP for a more accurate maintenance schedule.
- **Weather data** – import and export to Meteor & Metra Groups (**TriGas & CQ).**
- **Performance Watchdog development.**

Imbalance monitoring

- **Background**
  - UK fleet annual imbalance costs have been in the range of £9M-£12M per annum for 2007,8,9.
  - Main contributing events, trips and failed starts.
  - Other contributing events, missed load change instructions and plant issues causing imbalance which could be corrected.
  - Monitoring and correction of the latter events could yield an estimated loss reduction of approximately £0.5M/year saving for the UK fleet.
- **Requirement**
  - Develop a load monitoring watchdog.
  - Display real time and future data on the same screen.
  - Highlight potential plant problems.

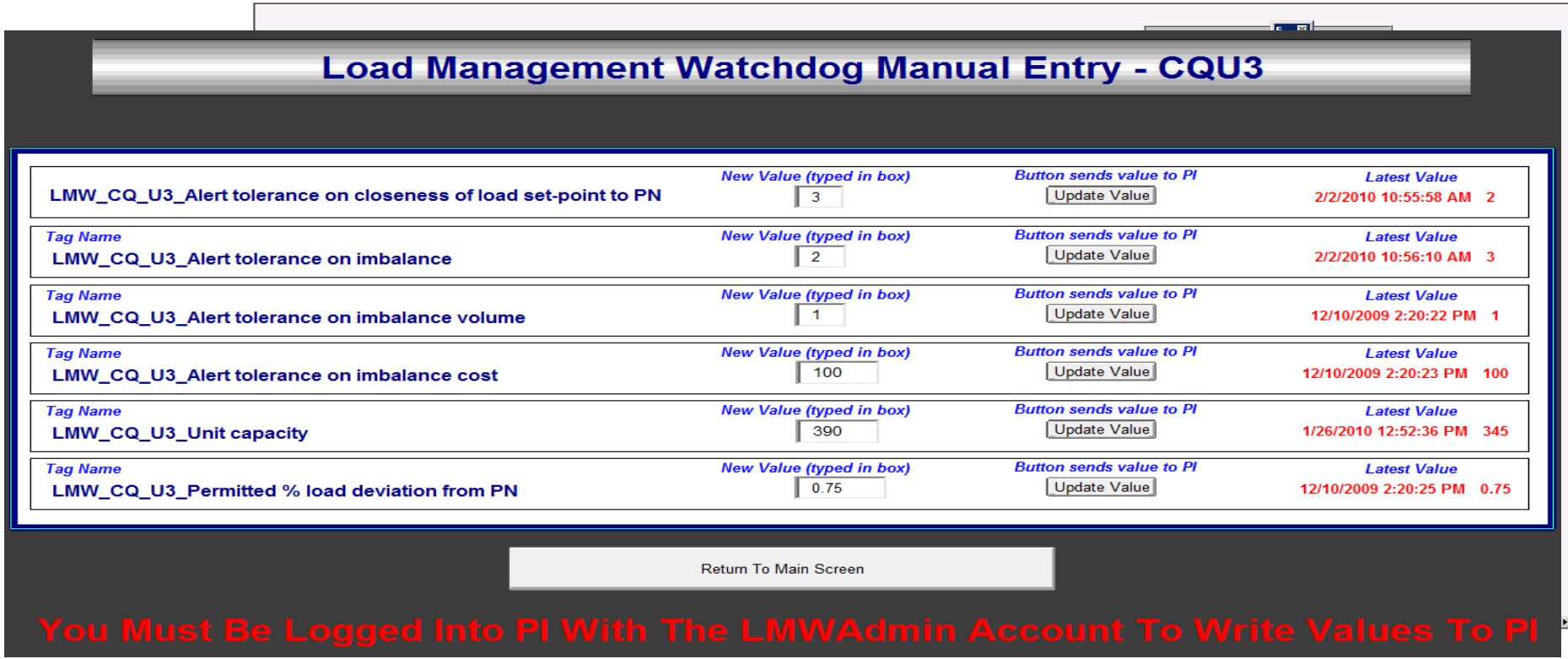
Imbalance monitoring

- **Solution**
  - Bring future data into the PI System, one data source eliminates the need for ODBC connections etc. Utilising the PI UFL Interface write future data into history.
  - Develop the necessary Performance Equations.
  - Manual input would be required to adjust constants used in calculations.
  - Develop the necessary screen displays ensuring that they are standardised for deployment across the fleet.

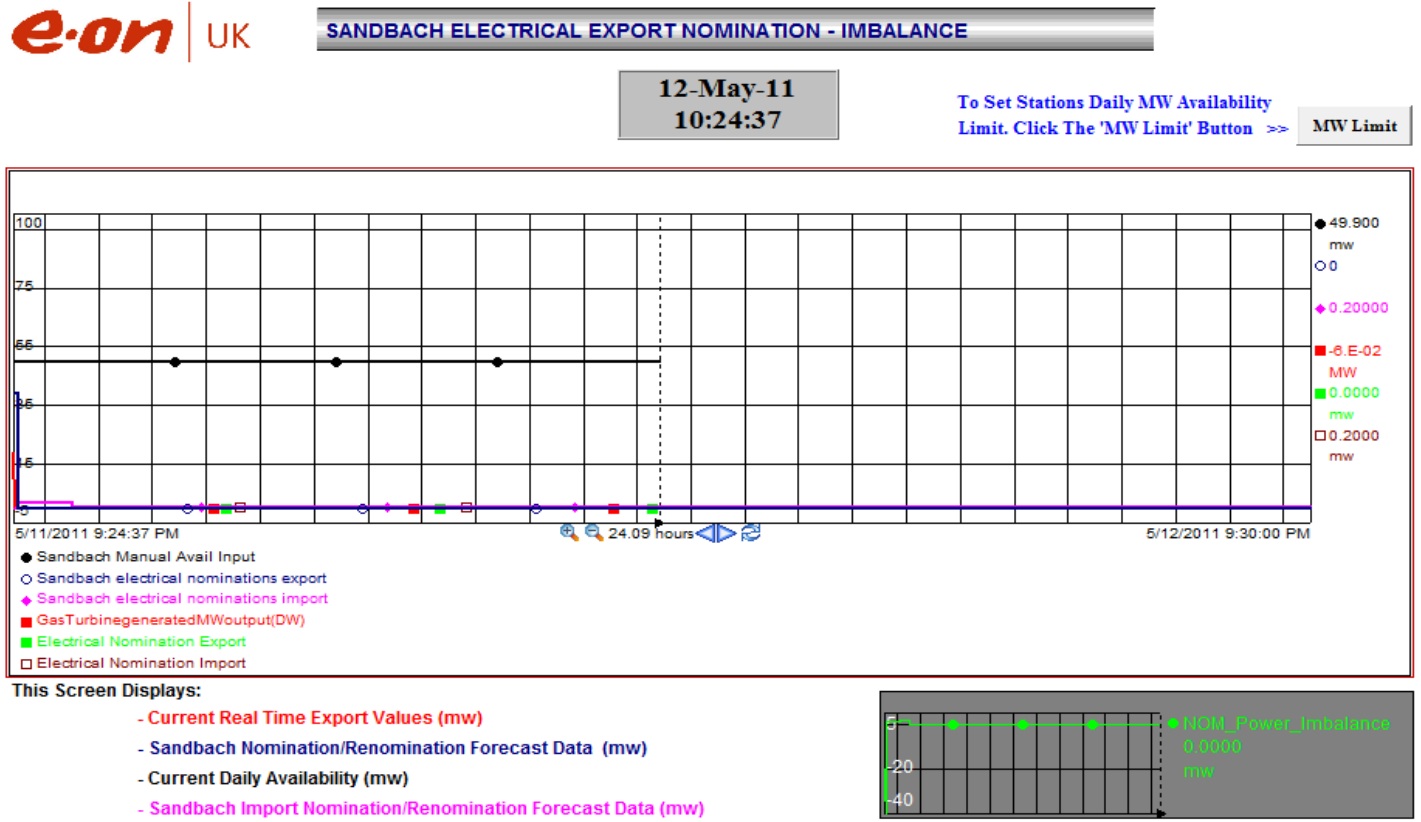
- **PI System Products Employed**
  - PI Server – data, PE's.
  - PI UFL Interface – future data into the PI System.
  - PI ProcessBook – displays and data sets.
  - PI HTML Interface – pricing data from the internet.

- **Benefits**
  - Provides the right information to the Operator to allow him to control the imbalance.

Main LMW screens



Real-time and future data display



This Screen Displays:

- Current Real Time Export Values (mw)
- Sandbach Nomination/Renomination Forecast Data (mw)
- Current Daily Availability (mw)
- Sandbach Import Nomination/Renomination Forecast Data (mw)

Real-time plant monitoring

- **Background**
  - GT Air Inlet Bleed Heating Valve found open at around 8%, bleeding off warm air to the GT Air Inlet. PI Trends indicated that this had been the case for almost 3 Days.
  - After closing valve, Cycle Output increased by 7MW & Efficiency increased by 0.5%.
  - This incident alone was estimated to have cost over £20k in lost generation.

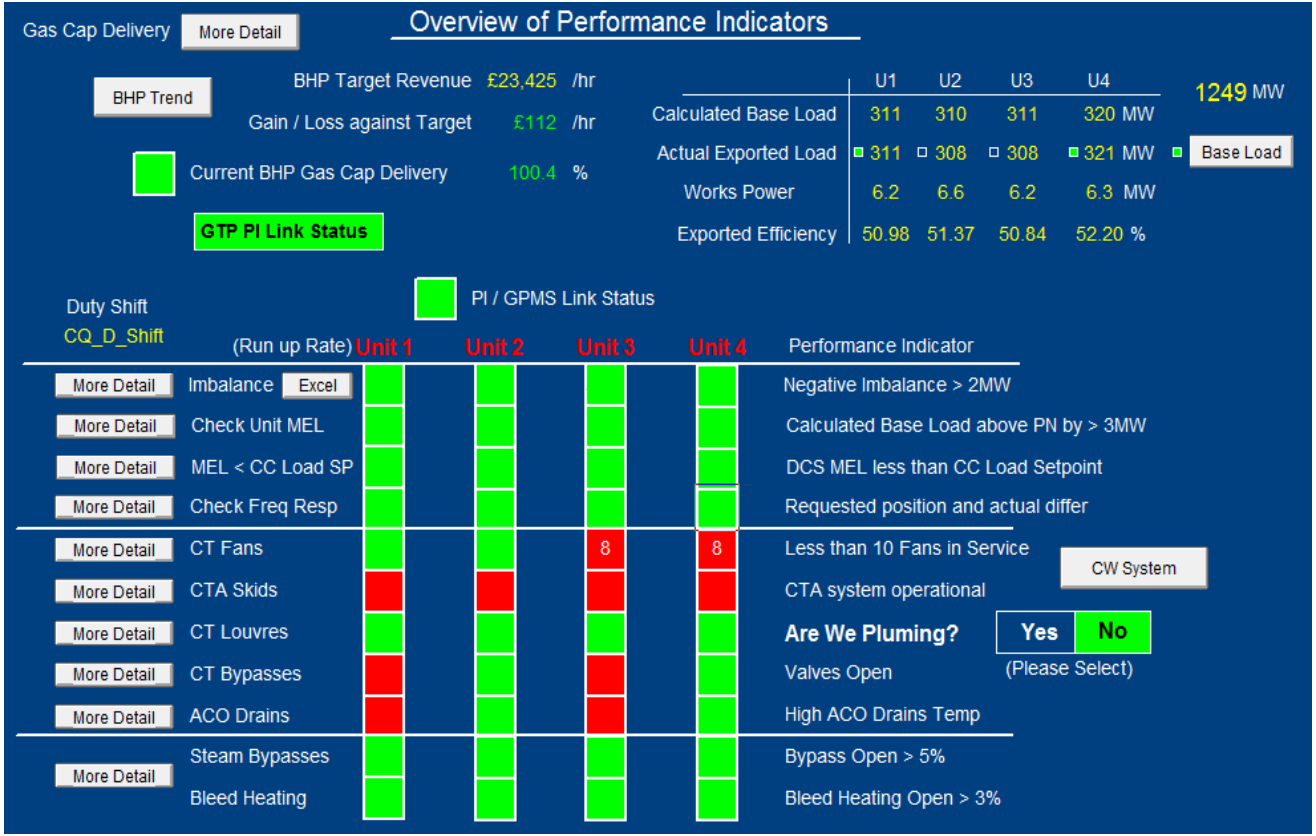
- **Requirement**
  - Develop a real time monitoring system that gives easy visualisation of plant conditions highlighting issue so that they can be addressed quickly.

- **Solution**
  - Develop the necessary Performance Equations.
  - Develop the necessary site screen displays.

Real-time plant monitoring

- **PI System Products Employed**
  - PI Server – Plant data, PE's.
  - PI ProcessBook – Control room displays.
  - PI HTML Interface – Prices.
- **Benefit**
  - Early indication of issues effecting performance and efficiency.
  - Reduction in response time therefore reduction in losses.
- **Example** – Control Room PI ProcessBook Displays at Connah's Quay helps maintain a 0.5% efficiency improvement per unit, through optimising output and performance, saving of over £4m per year across the site.

CQ – performance watchdog



Third-party access – utilisation of PI WebParts

- **Background**
  - Steven's Croft Biomass plant had a fuel shortage over a Christmas holiday period, which meant the plant had to reduce load until fuel, in the form of wood chips, could be imported.

- **Requirement**
  - Provide the fuel supplier with a view of the fuel storage silo's.
  - Provide this view even though they are outside of the E-ON I.T. influence.
  - Display real time data on fuel levels, belt weigh data, and site loading.

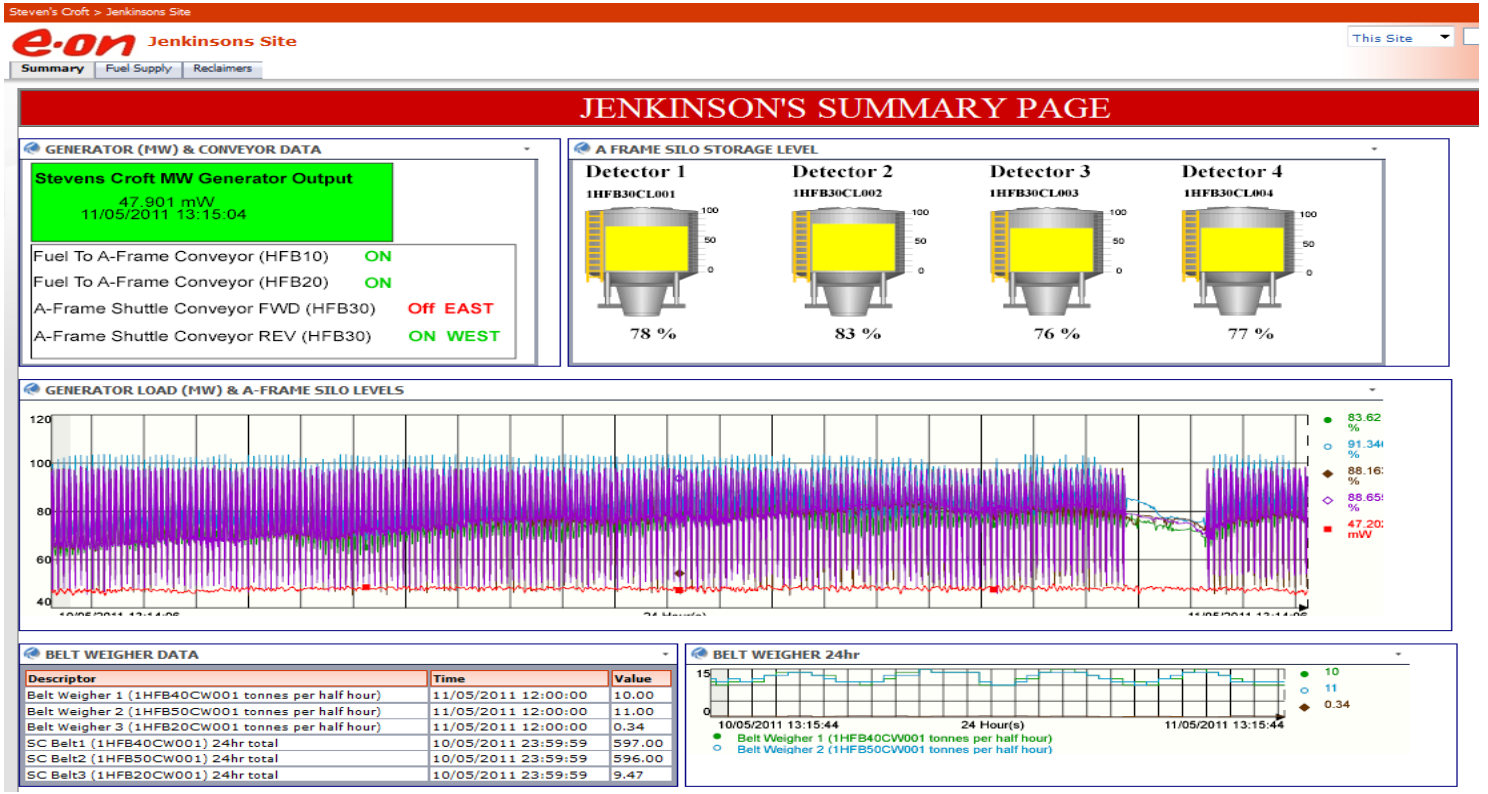
- **Solution**
  - Develop a web based screen display that can be accessed by the fuel supplier from his regional office and at the local plant.
  - Provide security controls for access and data control.

Third-party access – utilisation of PI WebParts

- **PI System Products Employed**
  - PI WebParts.
  - PI Server and Web Server – data and PE's.

- **Benefit**
  - Security of supply for both fuel and plant output.
  - Efficient fuel management.

Steven's Croft web page



Web-based high level plant information

e·on | UK

UK GENERATION TOTAL MW
5553.77

CCGT TOTAL MW GENERATED	STEAM TOTAL MW GENERATED	CHP TOTAL MW GENERATED
1699.93	3608.31	245.53

Elec Buy Price (£/MWh)	Elec Sell Price (£/MWh)	Market Price (£/MWh)
61.90	42.58	40.36

CCGT Generation | Steam Generation | CHP Generation

Obsolete equipment replacement

- **Background**
  - Kings North power station control room was fitted with LCD displays of turbine and Boiler temperatures, which due to their age were continually failing. There was a need to investigate either the replacement of the hardware with newer models or an alternative way of displaying the information.

- **Requirement**
  - Utilise the PI System to collect and display the data, repair and replacement was too expensive.
  - Provide large screen displays on control desks.

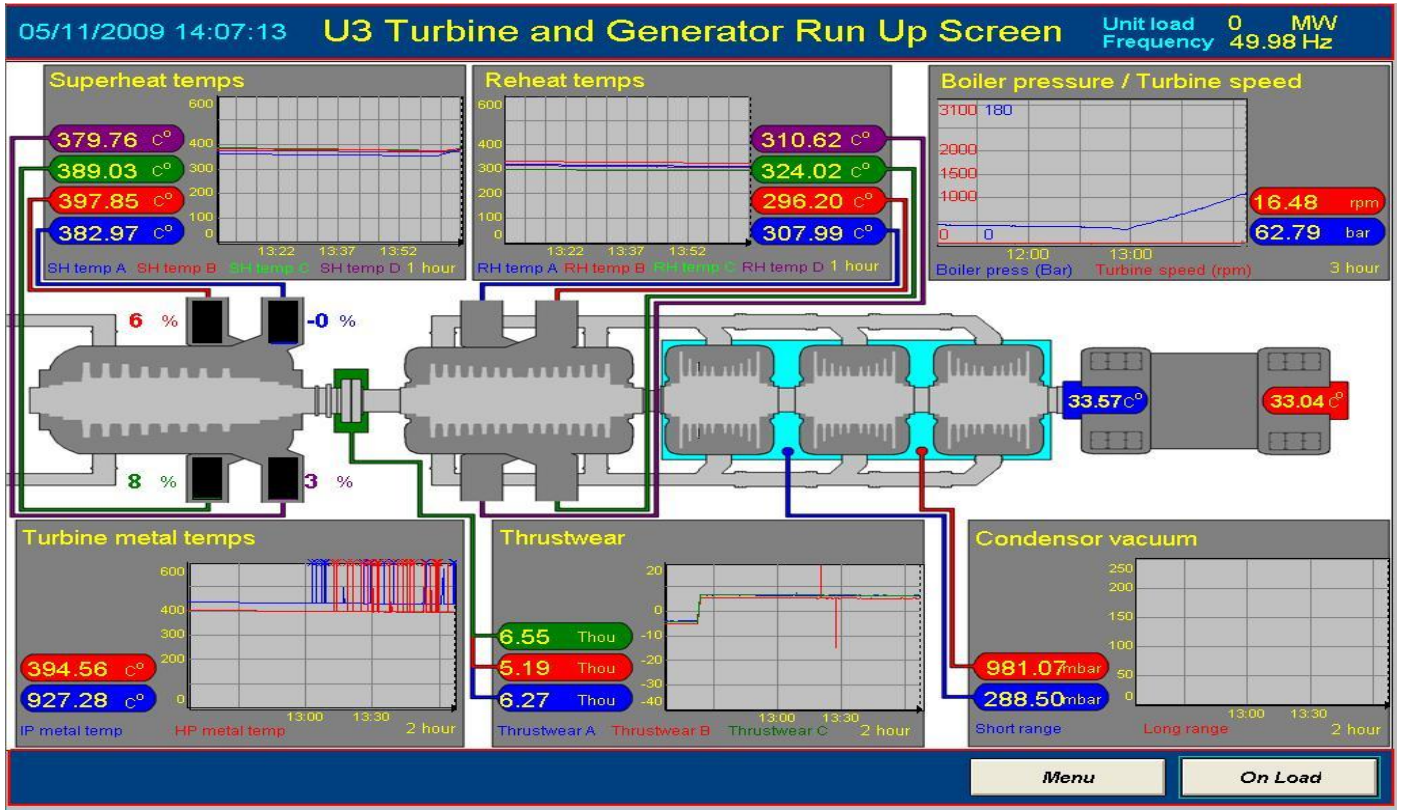
- **Solution**
  - Enable the turbine temperature points within separate DataScan units, and allow the PI System to interface via OPC with them.
  - Develop PI ProcessBook displays to show information.

Obsolete equipment replacement

- **PI Products Employed**
  - PI Server – data.
  - PI OPC Interface.
  - PI ProcessBook.

- **Benefit**
  - Large high contrast displays.
  - Overall cost saving of £72K.
  - Scalability – additional plant information and history.

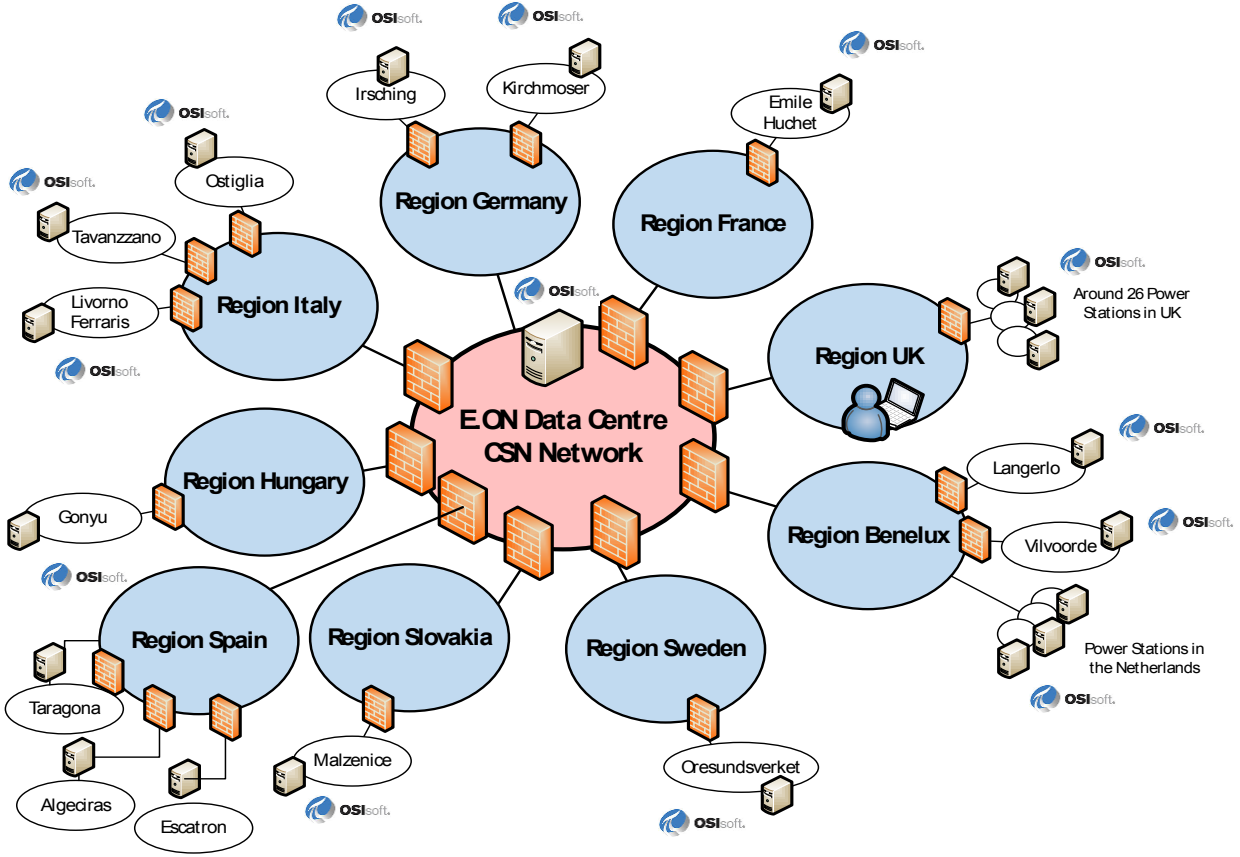
Obsolete equipment replacement



Strategy/Projects for 2011/12 and beyond

- **Roll out PI Systems to all of the European CCGT Fleet by 2012**
- **Establish E.ON CCGT Fleet PI System Infrastructure,** migration of central server and cross-boundary communication
- **Implement new technologies** to allow us to leverage the investment for the business i.e PI Analysis Framework , PI Notifications & PI ACE
- **Develop Top 5 screens** for all CCGT sites to allow benchmarking.
- **Establish European CCGT Web Page Displays**
- **CHP Gross Margin/Availability and KPI reporting**
- **Automation of Availability (MEL Shortfall/KPI) Reporting -** Investigating ways to utilise the PI System & Opralog to capture MW export limit re-declaration
- **SAP Plant Run Hours –** develop system to capture plant data according to sites requirements, reducing maintenance costs
- **Interface Failover –** Employ the failover configuration to minimise any data loss from critical systems i.e. CDAS emissions monitoring

European roll out



Summary of the key benefits and testimonial

- Central repository for Plant Data.
- Interfaces to all forms of data sources.
- Online storage of large quantities of data.
- Data is easily accessed through PI System Client Tools.
- Define the views that are relevant to your plant, Customise the data allowing information to be displayed that is not readily available from the DCS.
- Plant data available throughout the whole of the business.

“It allows easy, quick and powerful access to plant information , allowing users in a number of areas to drill down to root cause. It helps us make better, more informed decisions more quickly. It also supports longer term projects that require a good degree of data collection and analysis. It has also enabled us to put several data sources into one powerful package (SCADA, CDAS, GPMS and manually entered lab data). Used in the correct way I believe it has also brought operations and maintenance a little closer together. “

-Shaun Sanders Ratcliffe

Thank you