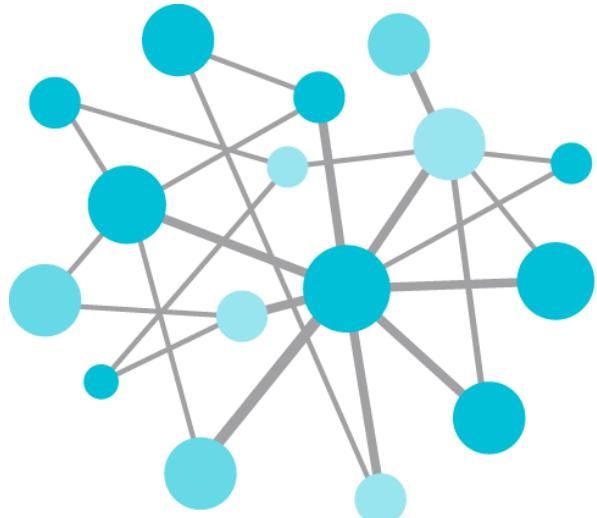


Power of Connection in Power industry

Presented by **Miguel Chavero**
EMEA Power & Utilities Industry Principal



OSIsoft®

REGIONAL SEMINAR 2014

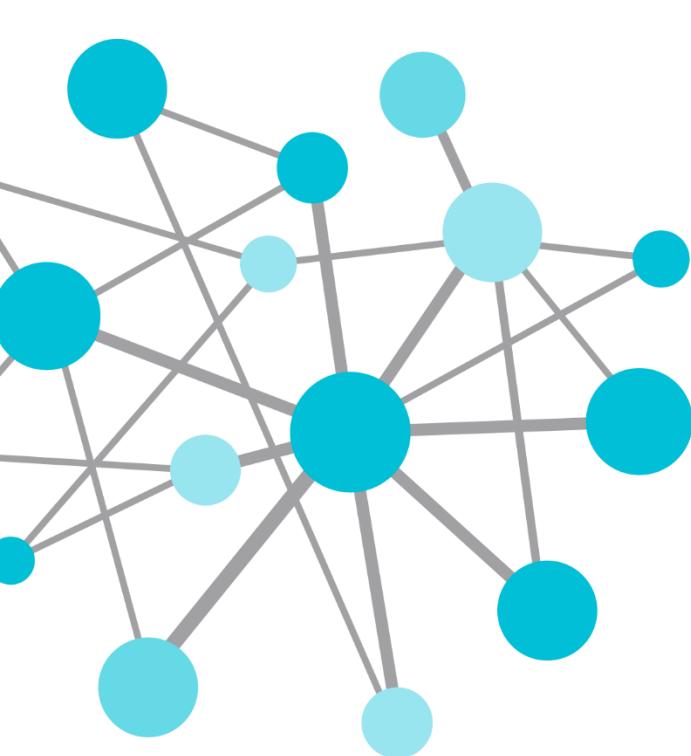
The Power of Data

E M E A

DECISION READY IN REAL-TIME

Agenda

- Introduction
- PowerGen Industry Pain Points
- PowerGen Industry Trends
- The Power of connection
- Showcases
- Q&A



Introduction

Selected European PowerGen Customers

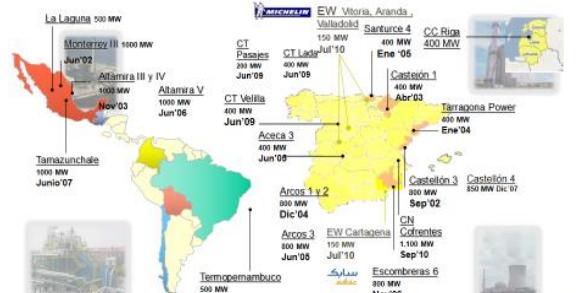
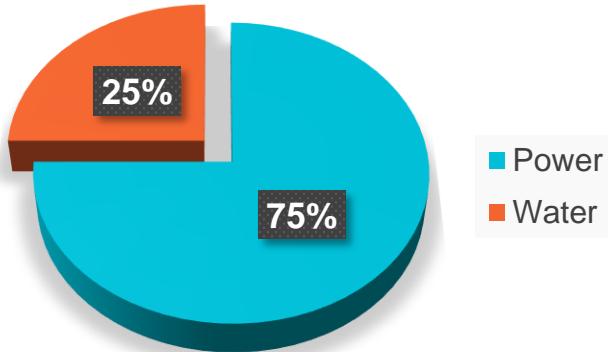


GDF SUEZ



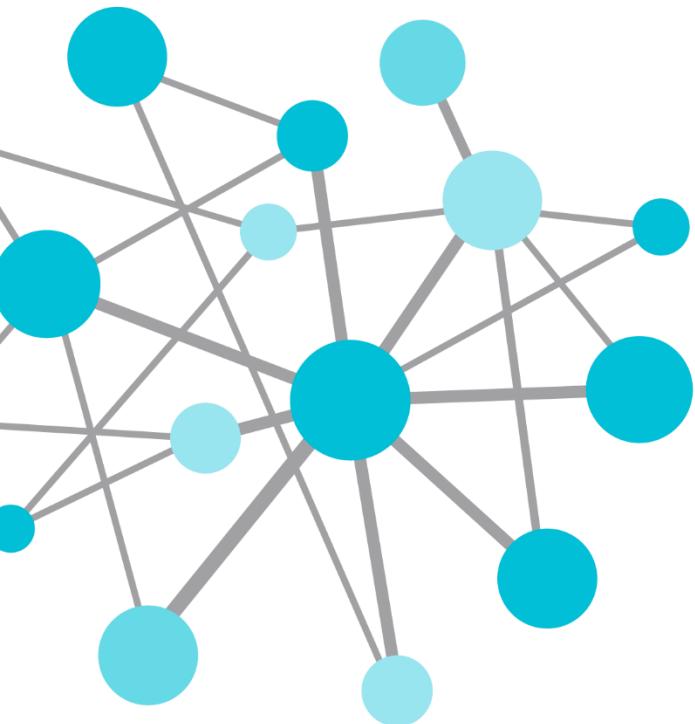
EMEA P&U Industry Principal

Experience (16 years)



OSIsoft. USERS CONFERENCE 2012

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Industry Pain Points

PowerGen Industry Pain Points



Climate Change and environmental concerns



Growth in renewable generation and distributed resources



Aging asset performance with increased expectations on reliability



Increased pressure on operational efficiency and workforce productivity



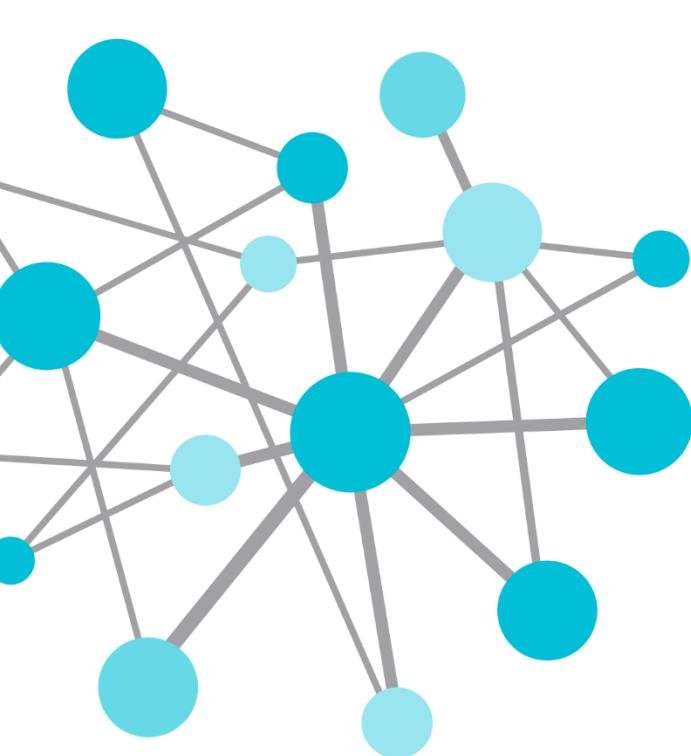
Demand reducing due to Global Crisis



Fuel costs keep rising

PowerGen Industry Pain Points

| CCGT | COAL | HYDRO | NUCLEAR | RENEWABLE |
|---|---|---|--|--|
| <ul style="list-style-type: none">• Low production landscape• A lot of start-up and shutdown just for some generation hours (even twice per day)• Gas costs still rising• Last technology on the market pool | <ul style="list-style-type: none">• Aging asset landscape• Low carbon initiatives across EU countries• Lack of automation in some systems / processes• Human resources reluctant to new technologies | <ul style="list-style-type: none">• Aging asset landscape• No new projects due to market collapse or investments constraints• New “Green taxes” reduce margin• New environmental regulations impact• Hydro resources management | <ul style="list-style-type: none">• FUKUSIMA disaster constrained or even stopped new developments and also forced new investments on existing ones• Safety, Safety and Safety• Compliance | <ul style="list-style-type: none">• Margin narrowing in some countries• Not homogenous regulation across EU• Rapidly growth impacts on grid stability• Large number and distributed assets difficult operations |



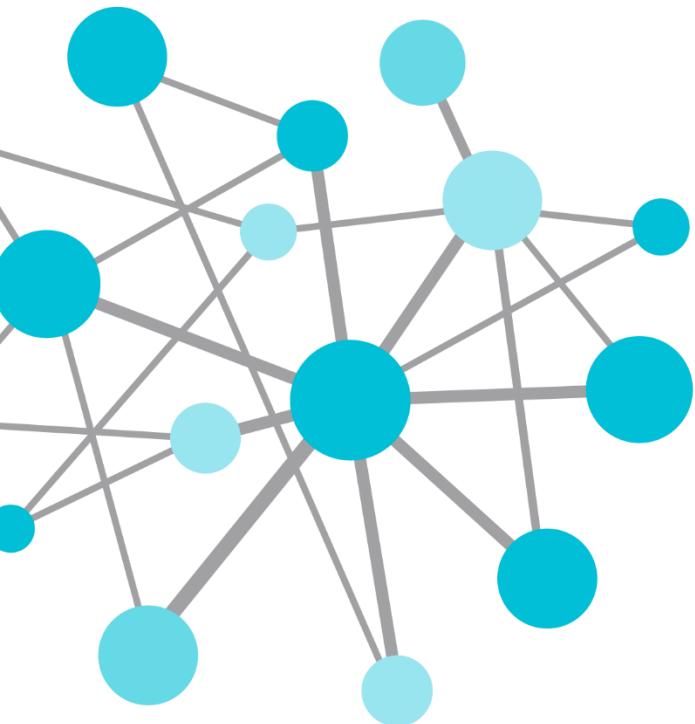
Industry Trends

PowerGen Industry Trends



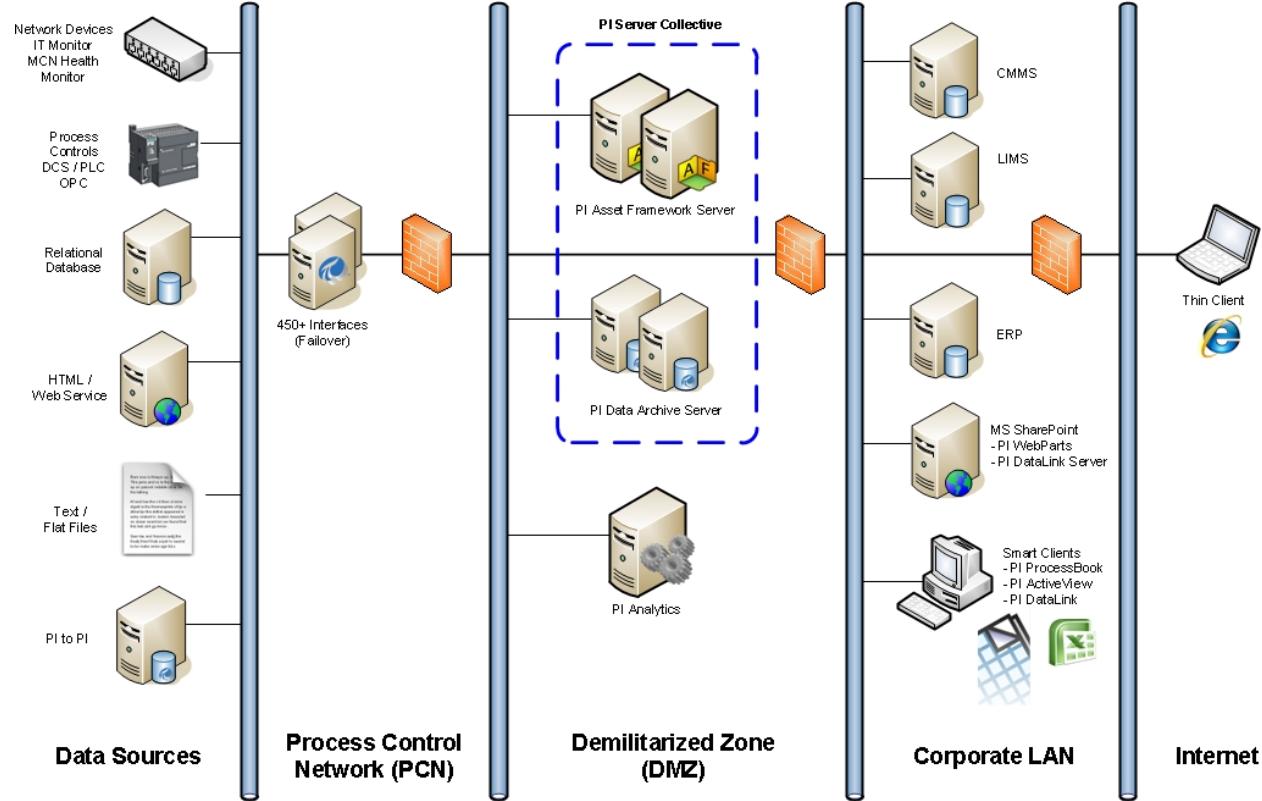
PowerGen Industry Trends

| CCGT | COAL | HYDRO | NUCLEAR | RENEWABLE |
|--|--|--|--|--|
| <ul style="list-style-type: none">From Base Load towards two-shifting operational mode (high impact on asset Lifecycle)Real-time training simulatorsAvailability and Efficiency is a mustIn some countries planning to shutdown or hibernate power stations | <ul style="list-style-type: none">Reducing CO2 emissions projects (FGD, CO2 capture,...)New automation projects to reduce operational costsControllable losses initiatives to maximize incomings | <ul style="list-style-type: none">New Pump Storage projects for balancing the system (peak mode)Environmental compliance being criticalDam monitoring refurbishment projectsNew systems deployment for Emergency response | <ul style="list-style-type: none">New refurbishment projects after FUKUSIMA disasterMoving from analog to digital systems. Cybersecurity is a mustOperational and reliability excellence programsEmergency preparedness and response programs | <ul style="list-style-type: none">New Off-shore deploymentsCBM programs across worldwide fleetNew curtailment strategies for maximizing revenuesPredictive analytics become critical (Production forecasting)GIS integration initiatives |

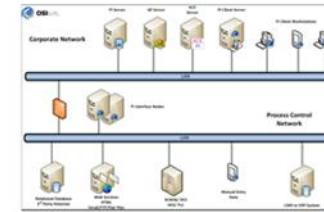
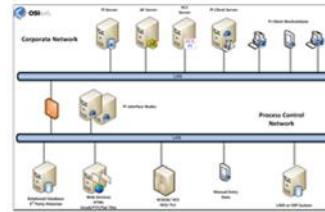
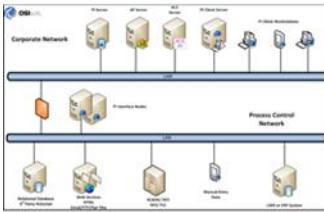
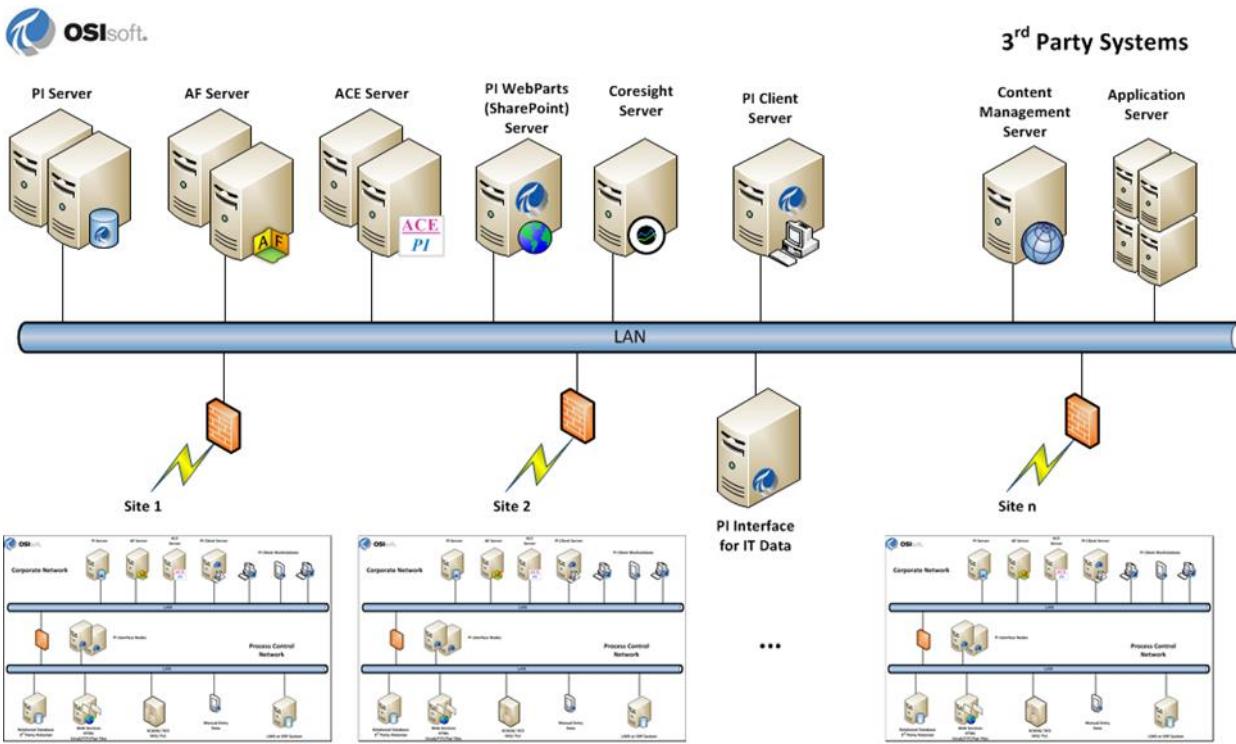


The Power of Connection

The Power of Connection



The Power of Connection



ENTERPRISE RESOURCE PLANNING

HS&E

Quality Mgmt.

Accounting

Planning

SCM

Asset Management

HR

HEALTH & SAFETY

ENVIRONMENTAL

QUALITY

PRODUCTION & OPERATION
MANAGEMENT

ASSET AVAILABILITY &
RELIABILITY

PEOPLE
EFFECTIVENESS

Unified Real-time Infrastructure



Level 1

COLUMNS



LIMS

FURNACES



PROCESS ANALYZERS

HEAT EXCHANGERS



DCS PLC/SCADA

TURBINES



ADVANCED CONTROL

COMPRESSORS



HISTORIAN

MOTORS



DIAGNOSTIC SYSTEMS

VALVES



MANUAL DATA

TRANSMITTERS



PLANT DATABASE

ACTUATORS



OTHER

TRANSFORMERS

OTHER

Time frame:
minutes, seconds
milliseconds, microsec

Sensing & Manipulating

Sensing and Manipulating the production process
10101
00110
10011

ENTERPRISE-WIDE VISIBILITY

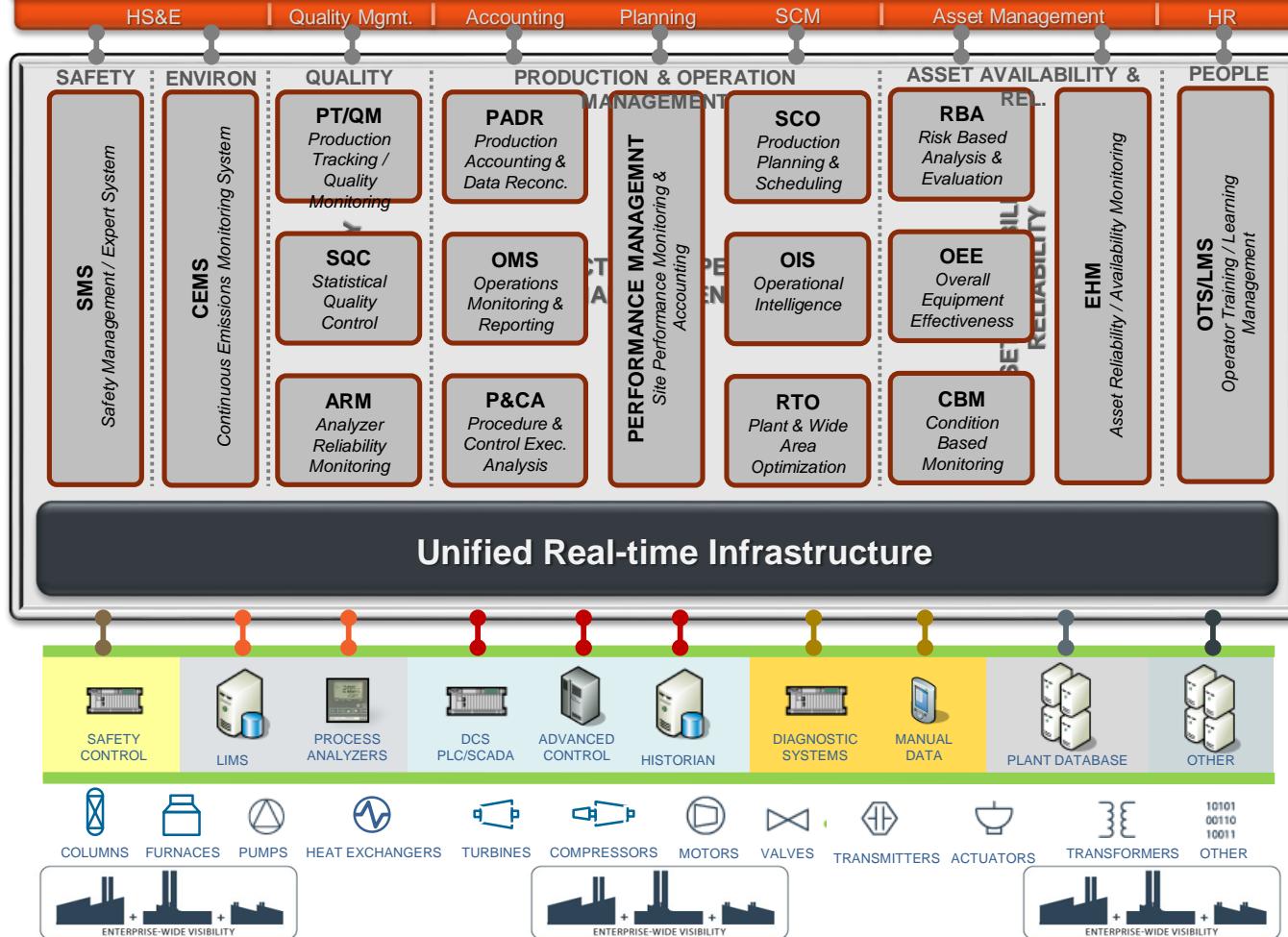
Time frame:
seconds
, microsec

ENTERPRISE-WIDE VISIBILITY

Heating, c
conversion

ENTERPRISE-WIDE VISIBILITY

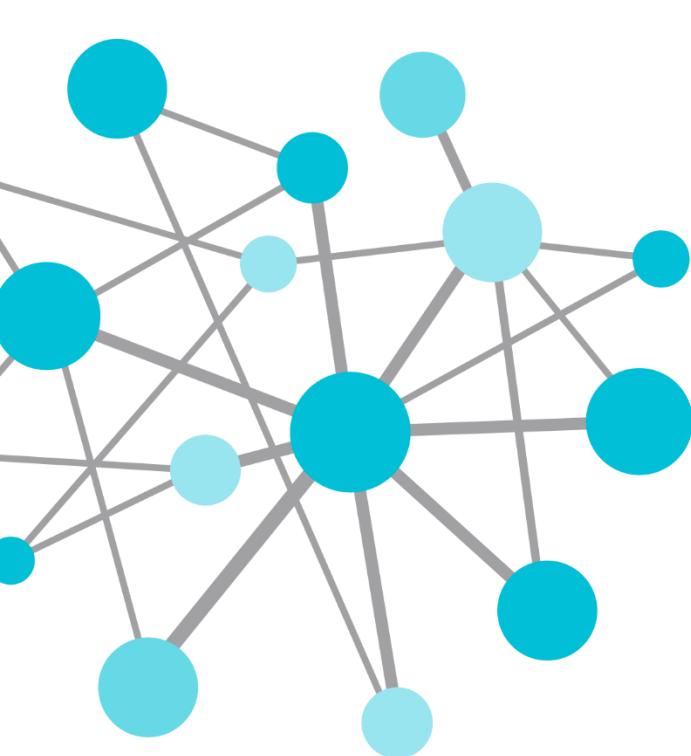
ENTERPRISE RESOURCE PLANNING



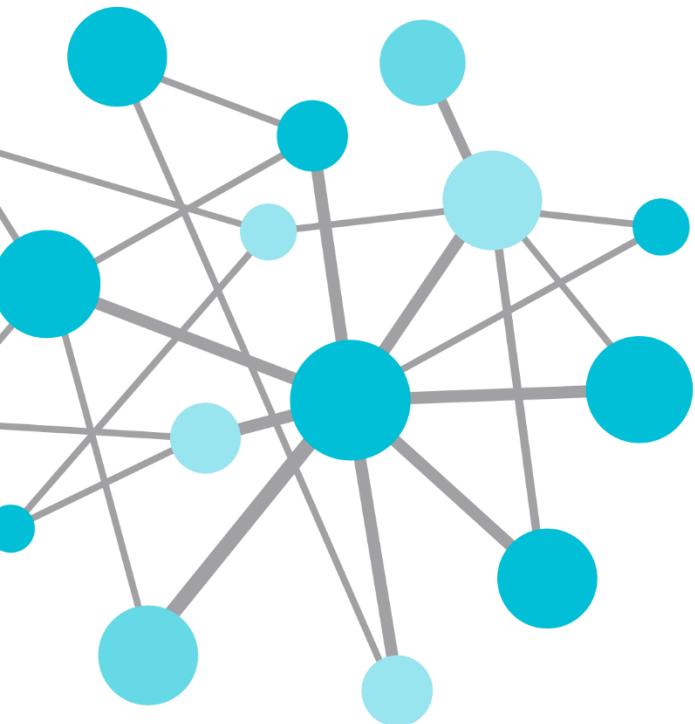
Addressing the Industry Challenges

PI System Supports Generation Core Processes

- Proactive and Condition Based Maintenance
- Operations (extend DCS beyond the Control Room)
- Controllable Losses
- Start Up / Shut Down
- Root Cause Analysis (RCA)
- Outage Planning (plan and spend on the right things)
- Vendor Performance (Pre and Post work review)
- Equipment / Manufacture Performance
- Plant System Performance & Efficiency
- Environmental (Compliance, emissions, limits, reporting)
- Water Chemistry monitoring (Steam-Water Cycle)
- Enterprise core metrics and KPIs
- Security- Passive access to Plant information
- Scheduling, Ancillary Services (AGC, regulation, voltage..), and Dispatch Optimization



Showcases



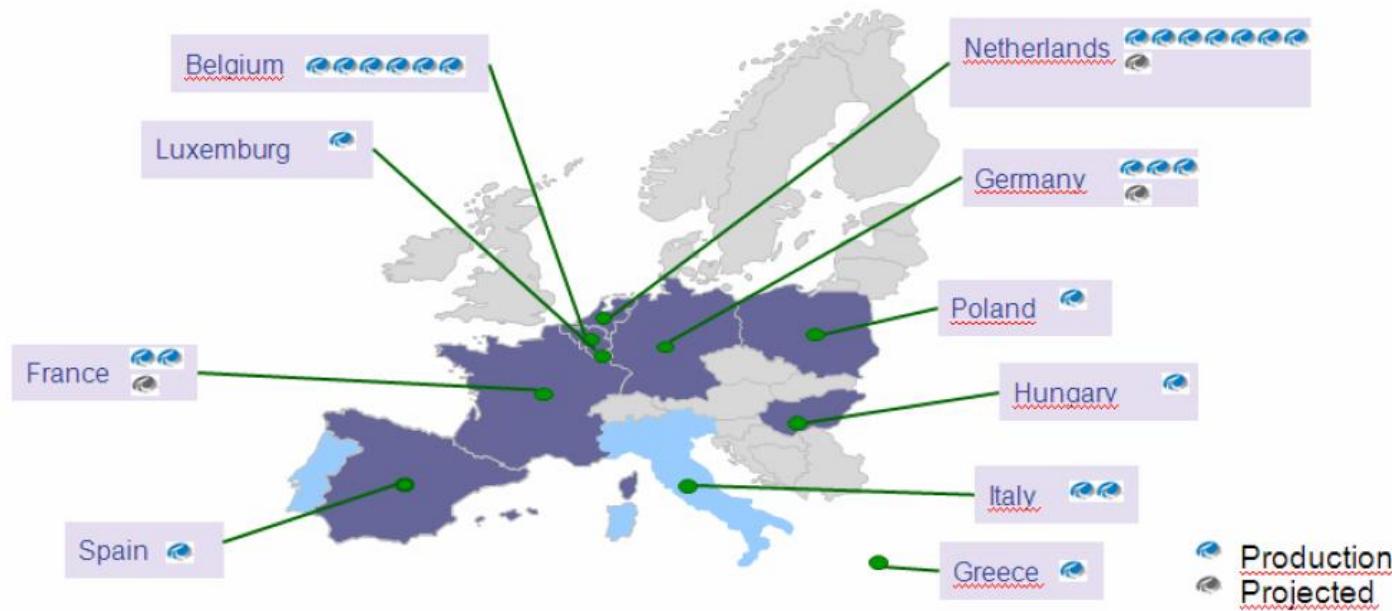
Enterprise Approach

Showcases

GDF SUEZ

GDF Approach

European PI Systems



GDF Approach



Information & Application platforms

EGENOSS

- Energy
- Generic
- Operational
- Support
- System

PIMS

- Process (Plant)
- Information
- Management
- System

KWIS

- KraftWerk
- Information
- System

....

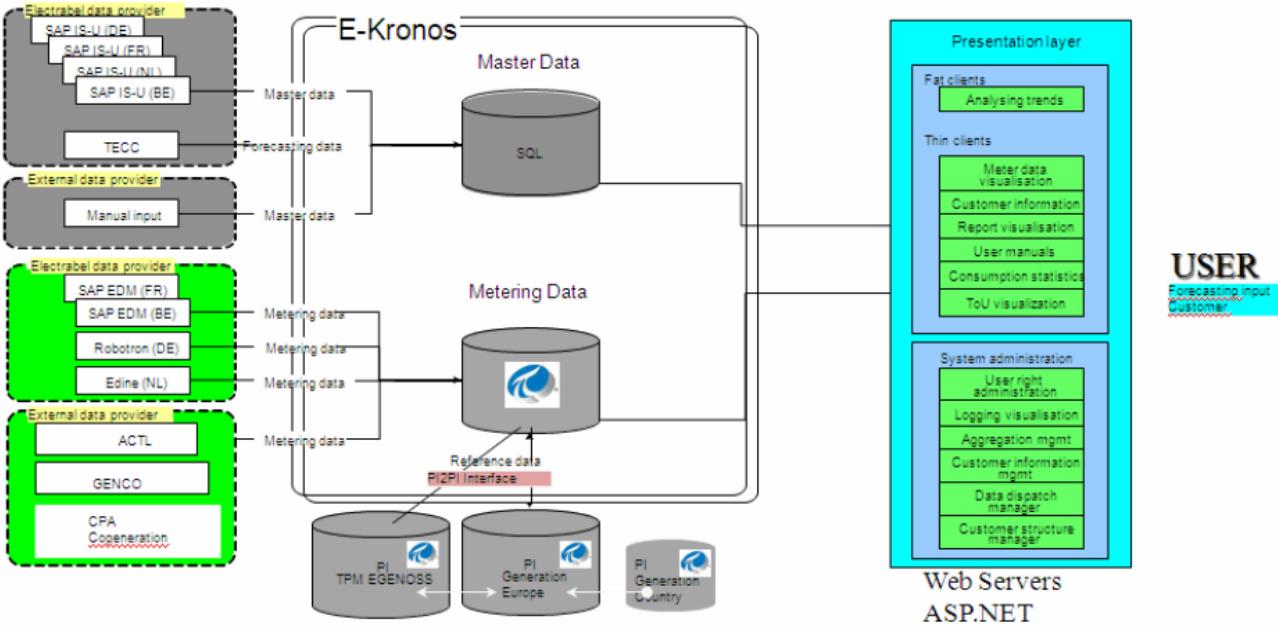
GDF Suez

(PI System in use since 1999)

GDF Approach



PI Server as 'Data Engine' in existing system architectures



GDF Approach



Platform core usage



Power Generation

- Generation Reliability coordination
- Production benchmarking
- Power plants installations supervision
- Generation statistics control
- Production deviation control
- Plants emission control
- Green certificates management
- Performance calculations

Trading & Portfolio Management

- Gas Nomination
- Gas stocks status
- Gas balancing management
- Fuel invoices control
- Fleet overview and control
- Production regulation control
- Network Ancillary Services regulation
- Spoc¹ of the transmission operator
- Customer short term evolution
- (Un-)Availabilities coordination

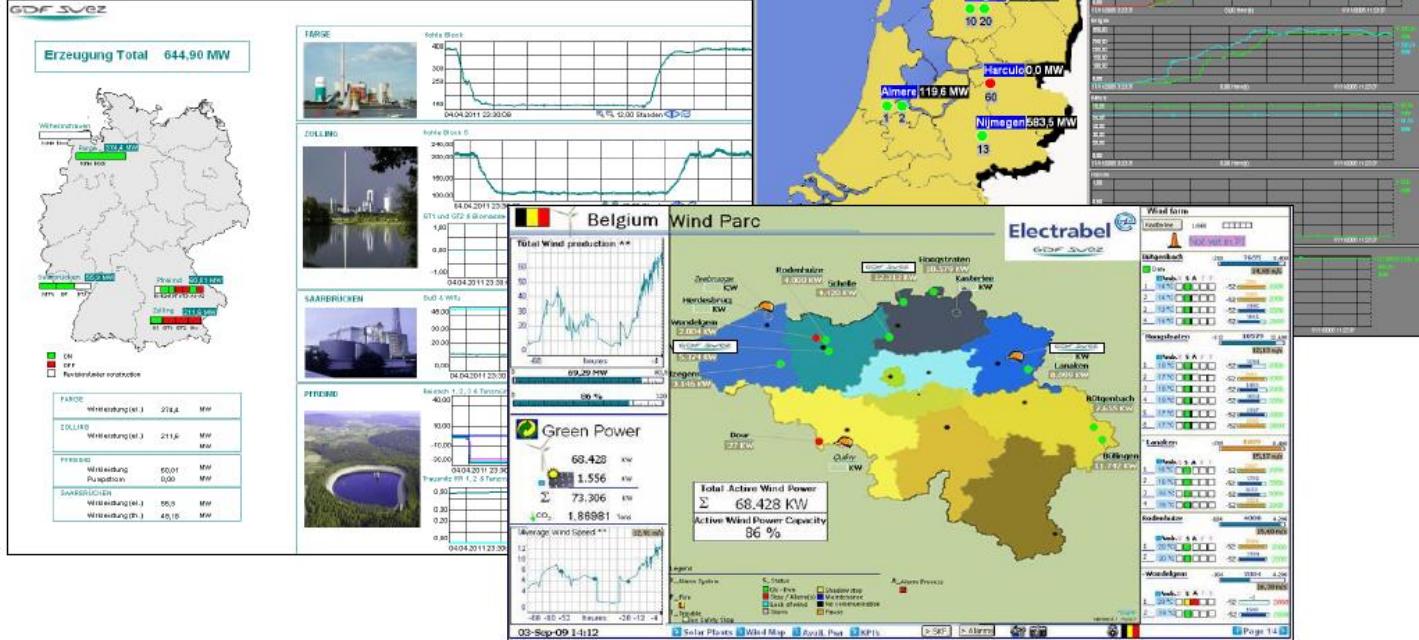
Marketing & Sales

- Client nomination management
- Clients on-line metering
- Clients deviation management
- Clients outages management

GDF Approach



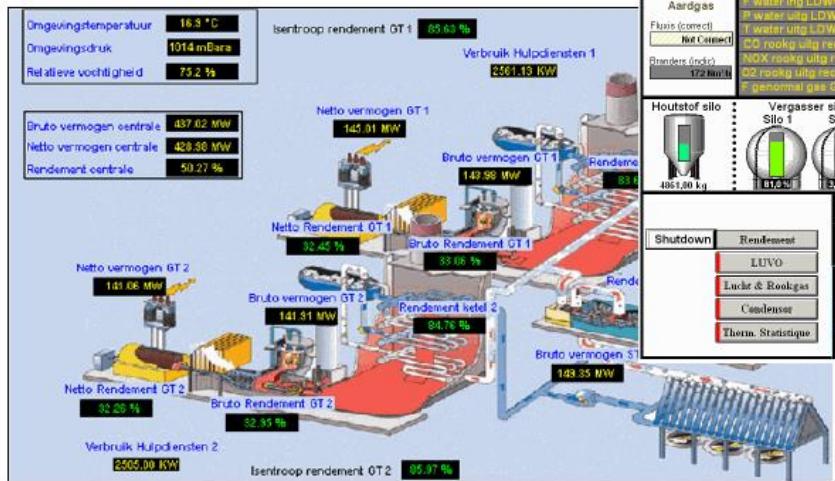
Dashboarding



GDF Approach

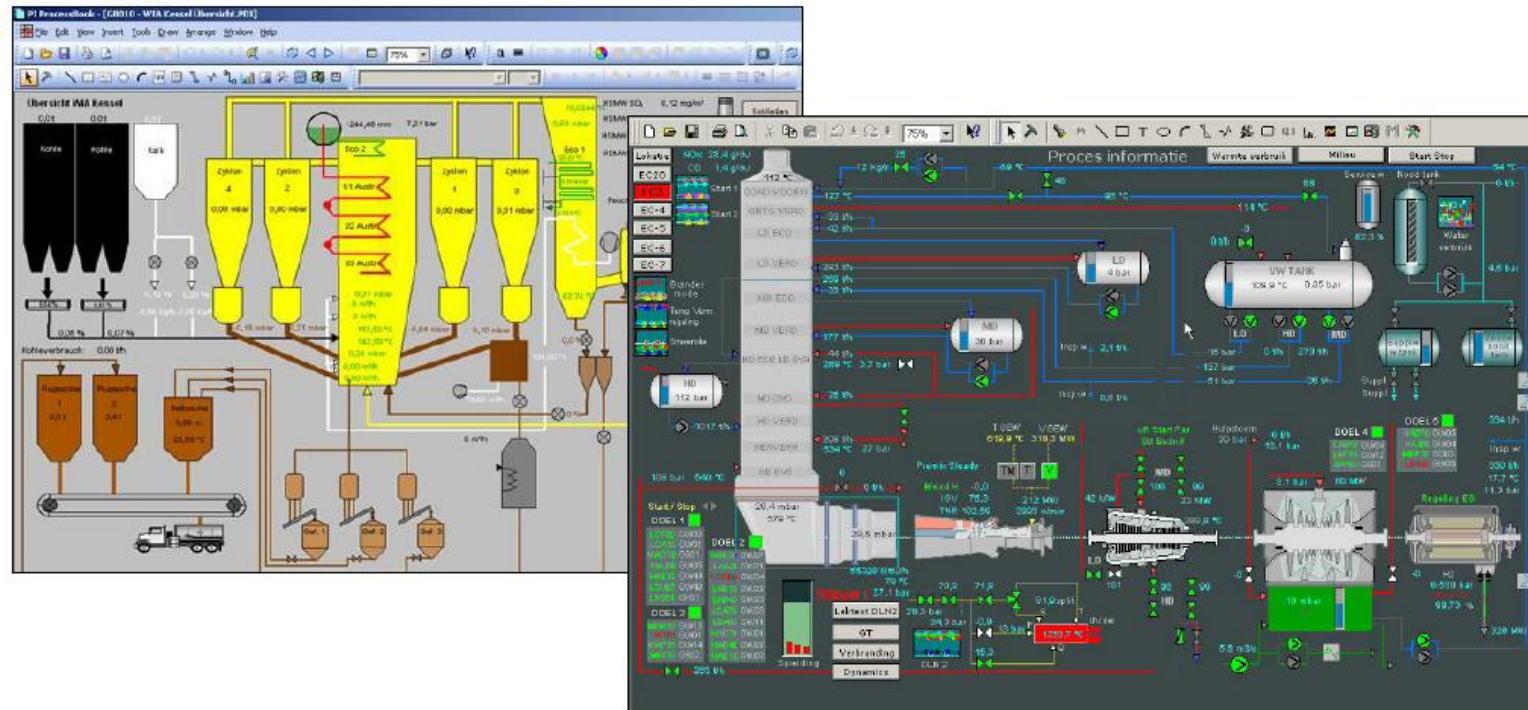


Plant operational 'Cockpits'



GDF Approach

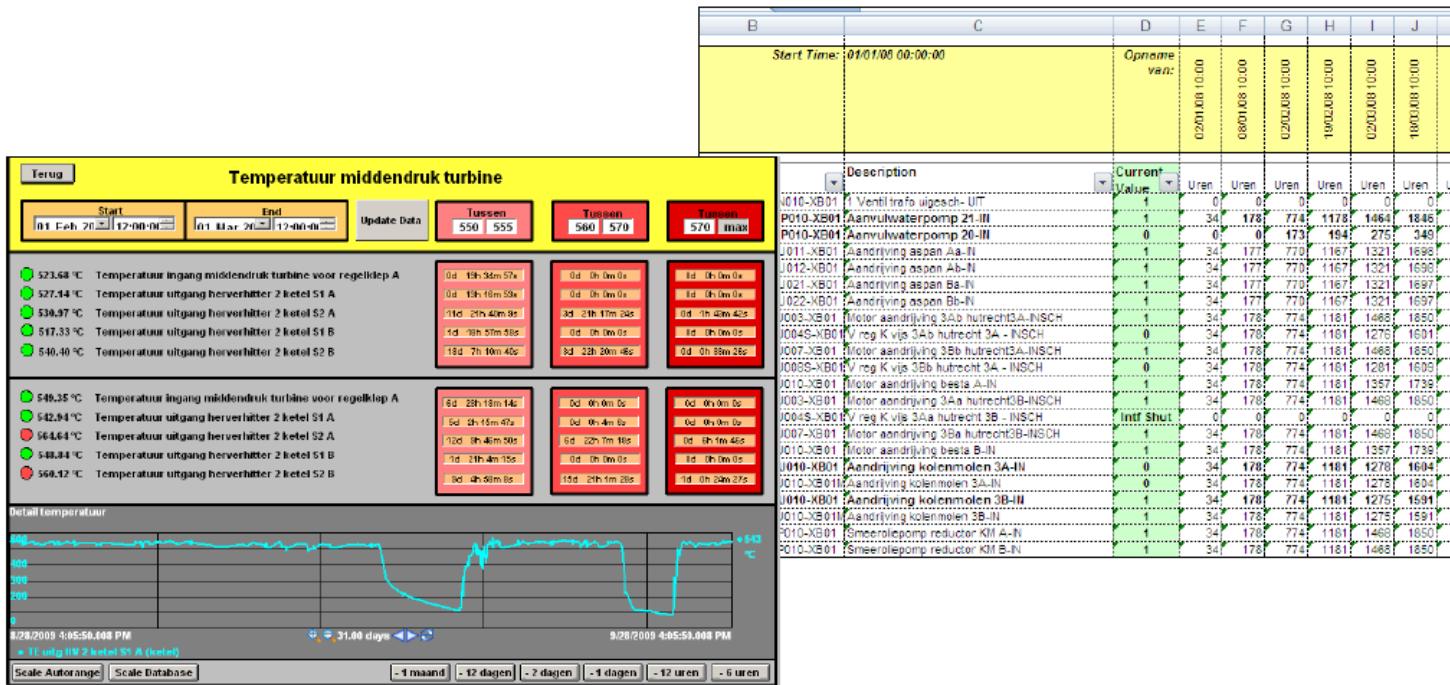
Detailed installation monitoring



GDF Approach

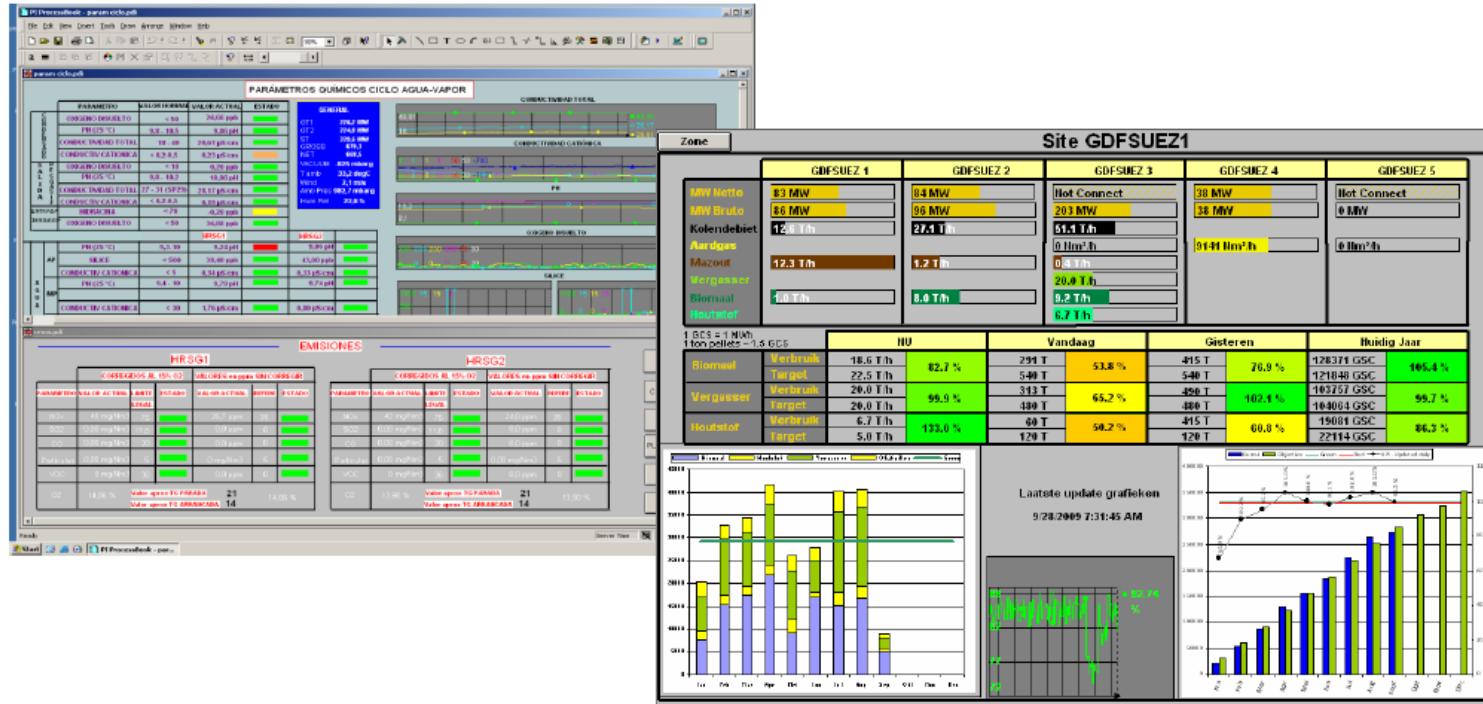


Lifetime monitoring



GDF Approach

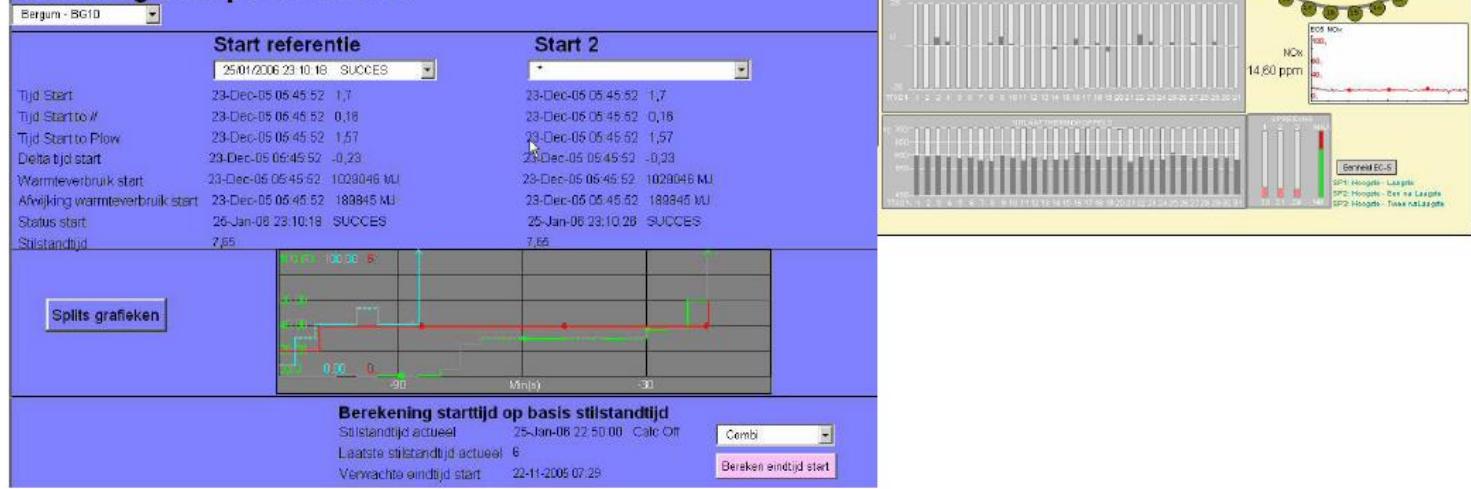
Target follow up for specific sub-processes



GDF Approach

Specialized tools

Bewaking startperformance



GDF Approach



Modeling: PI Asset Framework

Device List

The screenshot displays the PI System Explorer interface with two main windows:

- Device List:** A tree view under the "Elements" tab showing the hierarchy of assets. It includes nodes like BEA, BEDROGE, BEHBRUG, BEHRDE, BEHRPLUG, and BE. A specific node, BEHRDE_1GT_11AlternatorCurrentTransducer, is selected and shown in a detailed properties window.
- Measurement Devices:** A table view under the "Measurement Devices" tab listing various measurement devices with their KKS Device or Label, Brand, Model Type, and Location.

Device List Properties (Selected Node):

| Name | Value |
|--------------------|---|
| Accuracy | Class 0.2 |
| Brand | CEWE Instrument |
| Characteristics | Input: 10000/1A 50Hz;Range: D10s/A;Ausc: 110V/D |
| Documentation | CEWE Transducers Catalog |
| Location | Bruno Production Metering GT1,1MKY500H104 |
| Measurement device | Current Transducer |
| Model Type | Type: D1025/N-E110166 |
| Value | 110 |

Measurement Devices Table:

| Measurement Device | KKS Device or Label | Brand | Model Type | Location |
|-----------------------------|---------------------|-------|------------|------------|
| Current Transfo | GT405 | NA | | |
| Voltage Transfo | GT401 | NA | 150V/300V | |
| Energy Meter | | 99 | | (Post 150) |
| Voltage Transducer | 99 | 99 | | (Post 150) |
| Combined WattVar Transducer | 77 | 77 | | (Post 150) |

GT1 Bruto Metering 15,5kV (alternator) Details:

| Measurement Device | KKS Device or Label | Brand | Model Type | Location |
|--------------------|---------------------|-----------------|-----------------------------|---------------------------------|
| Current Transfo | GT407 | NA | 1000/1A | Bruto Production 15,5 |
| Voltage Transfo | GT408 | NA | 15,5kV/4,15kV/3,0,11/0,3 kV | Bruto Production 15,5 |
| Voltage Transducer | U8 | CEWE instrument | Type: DU 02 S/N: H11040 | Bruto Production 15,5kV/200 GHz |

GDF Approach

Modeling: PI Asset Framework

- Templates: site, unit, emission point, pollutant/concentration measurement, fuel components
- Calculations: PI PE syntax in attributes, with PI ACE Scheduler

The screenshot displays the PI Asset Framework interface with three main panes:

- Left Pane:** A tree view of PI elements, including Categories like Elements, Calculators, and Calculators_reuseAcceptance; Sub-categories like Logics, PHE, F, NDK, D2, PU, and others; and specific items like EIPMeasurements_01.1, EIPMeasurements_02.2, Test_Ben, Test_Model, Test_Peter, and Test_Notification.
- Middle Pane:** A table view of attributes for a selected item. The table has columns: Name, Value, and Data Reference. Key rows include:
 - 1DAPlanStatus: 864, Data Reference: <None>
 - 1HPPPlanStatus: 0, Data Reference: <None>
 - 1N0PlantStatus: 0, Data Reference: <None>
 - 1YRPlanStatus: 0, Data Reference: <None>
 - 10NGOnFlag: 1, Data Reference: Rollup_Dev
 - 10PC: 1.5, Data Reference: <None>
 - 10sSmokeVal: 0.5951962 kNm3, Data Reference: PEDCalculation_Dev
 - 30sSmokeVal: 0.1Nm3, Data Reference: AverageCalculation_Dev
 - conflict: 0.1, Data Reference: <None>
 - EPMW: 3.063427441972871, Data Reference: Rollup_Dev
 - GI: 3.063427, Data Reference: Rollup_Dev
 - lowSteadyFlag: False, Data Reference: <None>
 - LTADutCal: 0.33393, Data Reference: <None>
 - LTARel: 0.25, Data Reference: <None>
 - LTASar: 0.33383, Data Reference: <None>
 - LTAVar: 0.075, Data Reference: <None>
 - name: , Data Reference: <None>
 - PS: 0, Data Reference: <None>
 - refD2: 15, Data Reference: <None>
 - SmokeEmission: 2.70036407911666, Data Reference: Rollup_Dev
 - STADactual: 0.33383, Data Reference: <None>
 - STAPeriod: 1800, Data Reference: <None>
 - STADVal: 0.66688, Data Reference: <None>
- Right Pane:** A code editor window titled "PIAttribute" showing the PE syntax for the "10NGOnFlag" attribute. The code uses IF-THEN-ELSE logic to calculate the value based on various plant status and configuration parameters.

Ecological Data

GDF Approach



Web publishing

Pages - Doel 1 - TRT - Hydran - Windows Internet Explorer
http://10.10.10.10/OnlineMonitoringDoel/Pages/Doel%20%20-%20TRT%20-%20Hydran.aspx

File Edit View Favorites Tools Help
Links Google GDF SUEZ Energy International KelmanTransfix Web - Herderdrug-Kelman Yahoo! www.routenet.be Euro Conversion EuroBank Tech Support OsirisHelpdesk
Diagnostic Center
LABORELEC Doel
Diagnostic Center
Doel Eens Grid Henderbrug Langerlo Les Ander Rulen Thinge
PKD
Doel Pages
Doel 1 - TRT - Hydran
Doel 2 - TRA - Hydran
Doel 2 - TRB - Hydran
Doel 3 - TRA - Hydran
Doel 3 - TRB - Hydran
Doel 4 - TRA - Hydran
Home
Online Monitoring SmartSignal Search
Doel > Doel > Pages > Doel 1 - TRT - Hydran
ydran
Doel 1 - TRT:
Phase 4 Phase 8 Phase 12
Doel 1P4 H2 RH (open) = 45 ;
12/06/2009 15:03:00
Doel 1P8 H2 RH (open) = 17 ;
12/06/2009 15:03:00
Doel 1P12 H2 RH (open) = 41 ;
12/06/2009 15:03:00
Alarm levels H2O RH
Phase 4 Phase 8 Phase 12

Electrabel GDF Suez Meuse | Rapport journalier: Bilan du jour 28/09/2009 Auto Refresh

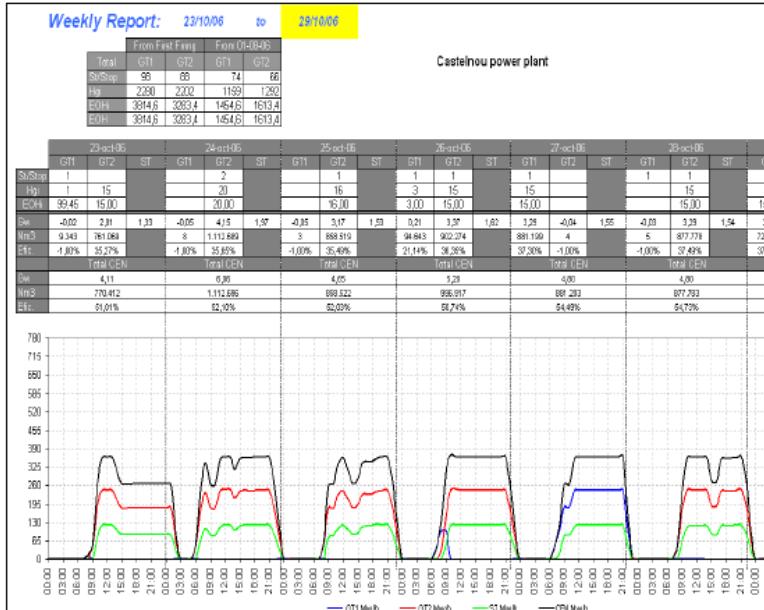
Valeurs brutes | Valeurs validées | Valeurs moyennes 3 heures | Valeurs d'échauffement | Bilan du jour | Hebdomadières | Mensuels | Annuels | Manual Inv.

| Date Heure | Tihange Echauffement moyen journée °C | Amay Débit moyen journée m ³ /s | Huy Température moyenne journée °C |
|--------------------|---------------------------------------|--|------------------------------------|
| 0 28/09/2009 00:15 | 4,084 | 81,396 | 17,816 |
| 1 28/09/2009 00:30 | 4,097 | 81,687 | 17,806 |
| 2 28/09/2009 00:45 | 4,094 | 81,314 | 17,295 |
| 01:00 | 4,089 | 81,870 | 17,289 |
| 01:15 | 4,081 | 82,184 | 17,286 |
| 01:30 | 4,079 | 82,132 | 17,279 |
| 01:45 | 4,078 | 82,272 | 17,272 |
| 02:00 | 4,066 | 82,398 | 17,268 |
| 02:15 | 4,061 | 82,467 | 17,263 |
| 02:30 | 4,060 | 82,511 | 17,266 |
| 02:45 | 4,066 | 82,468 | 17,260 |
| 03:00 | 4,080 | 82,506 | 17,244 |
| 03:15 | 4,044 | 82,479 | 17,237 |
| 03:30 | 4,087 | 82,471 | 17,231 |
| 03:45 | 4,081 | 82,456 | 17,224 |
| 04:00 | 4,026 | | 17,217 |
| 04:15 | 4,016 | 82,456 | 17,212 |
| 04:30 | 4,009 | 82,474 | 17,206 |

GDF Approach



Reporting



Invullen: alleen beginperiode invullen

[vul datum in gele veld en/of ESt b.v. calculatie]

Beginperiode **01-01-2008**

Eindperiode (t/m) **31-01-2008**

Jaar **2008**

Versie 1.0

| Locatie | Eenheid | Soort eenheid | Emissie in de periode [ton] | Emissie heel jaar t/m de periode [ton] |
|-------------------|--|---------------|-----------------------------|--|
| Almere | AL-1 | 1 | 22.904 | 22.904 |
| | AL-2 | 4 | 18.264 | 18.264 |
| | IHA16 | 2 | 0 | 0 |
| | IHA26 | 2 | 0 | 0 |
| | ALD1 | 2 | 325 | 325 |
| | ALD2 | 2 | 1.173 | 1.173 |
| | ALD3 | 2 | 2.462 | 2.462 |
| | WKC Almere totaal (fossiel) | | 15.129 | 15.129 |
| Almere | HWC Totaal (fossiel) | | | |
| Bergum | BG10 | 1 | 26.664 | 26.664 |
| | BG20 | 1 | 43.063 | 43.063 |
| | BC HW | 3 | 283 | 283 |
| | Centrale Bergum totaal (fossiel) | | 70.010 | 70.010 |
| Eemscentrale | EC-20 | 1 | 72.111 | 72.111 |
| | EC-3 | 1 | 56.000 | 56.000 |
| | EC-4 | 1 | 57.259 | 57.259 |
| | EC-5 | 1 | 75.065 | 75.065 |
| | EC-6 | 1 | 79.836 | 79.836 |
| | EC-7 | 1 | 50.997 | 50.997 |
| | OHY16 | 3 | 487 | 487 |
| | OHY26 | 3 | | |
| | Centrale Eems totaal (fossiel) | | 391.754 | 391.754 |
| Flevocentrale | FL36 | 1 | 0 | 0 |
| Gelderland | G-13 kolen | 1 | | |
| | G-13 HBO | 1 | | |
| | G-34 | 2 | | |
| | GSSK | 2 | | |
| | Centrale Gelderland totaal (fossiel) afkomstig van biomassa | | 0 | 0 |
| Centrale Harsculo | HC60 | 1 | 64.442 | 64.442 |
| | HC1K6 | 3 | 257 | 257 |
| | Centrale Harsculo totaal (fossiel) afkomstig van biomassa | | 64.699 | 64.699 |

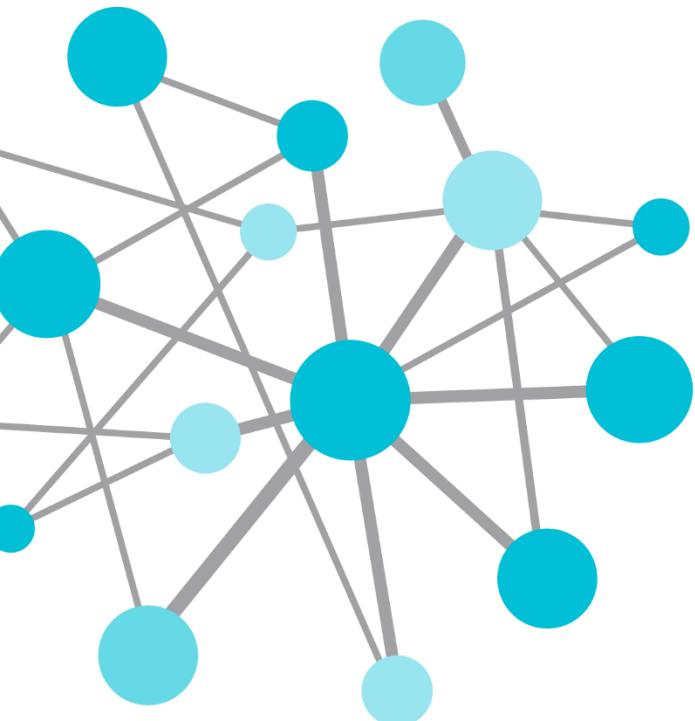
GDF Approach



Benefits: 'Can you make money with the PI System?'

Hard to quantify.. But we are sure we do:

- **By monitoring performance of our installation components in detail**
 - Unhide opportunities to improve performance
- **By counting running hours, switching operations, pressure losses in time**
 - Enable proactive maintenance & avoid possible incidents
- **By using PI System data during commissioning of new installations**
 - Compare supplier performance data with ours (force performance improvements or refunds)



Enterprise Approach

Showcases

e-on

E-ON Approach

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



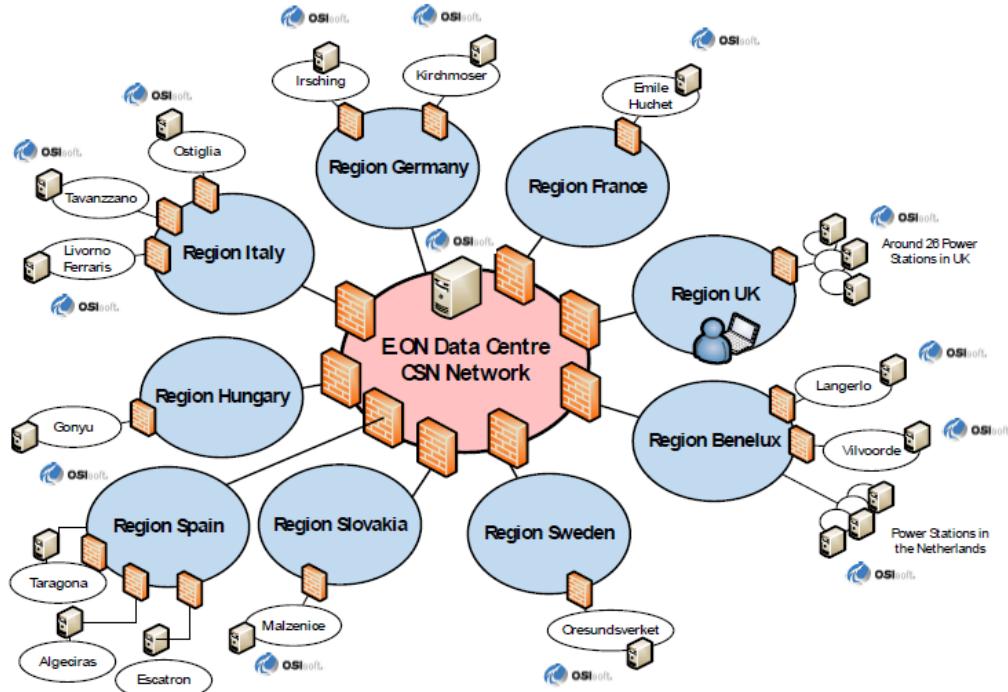
E-ON Approach

E.ON CCGT & CHP fleet



E-ON Approach

European roll out



E-ON Approach

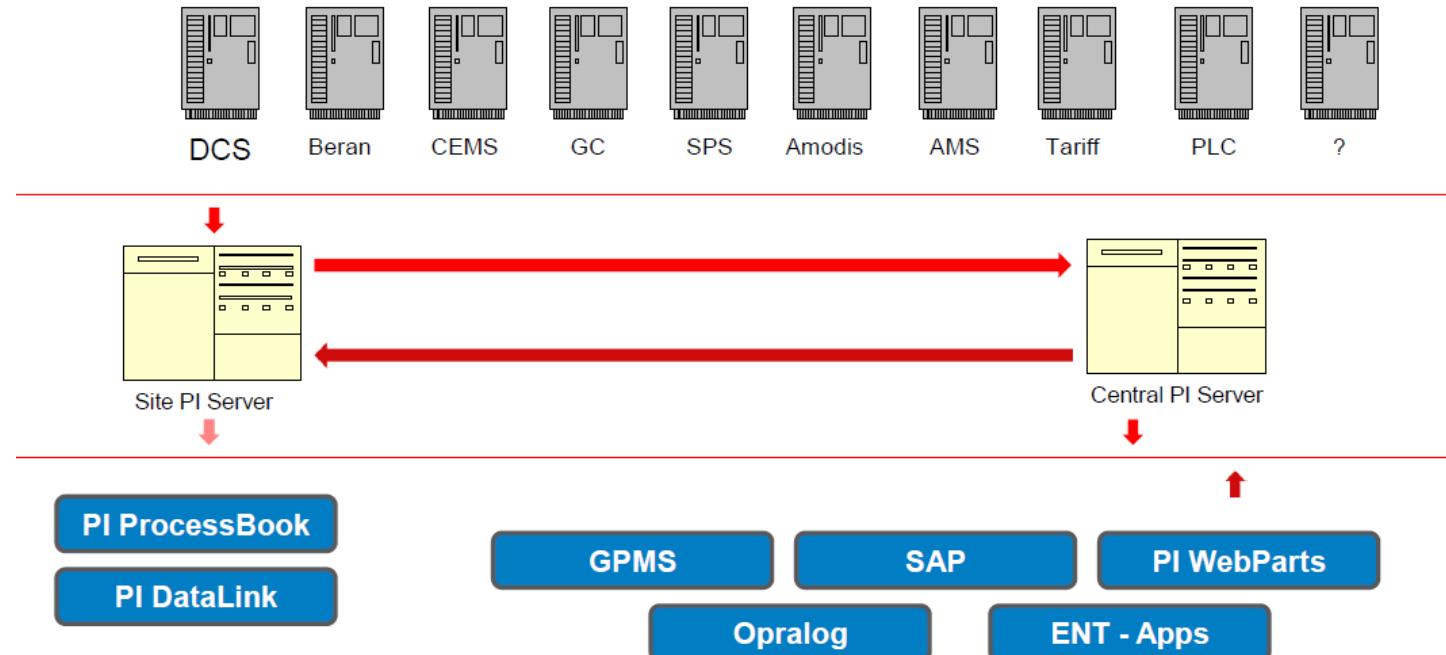
E.ON (CCGT fleet)

- 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 Approach

Evolving system



E-ON Approach

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**.

E-ON Approach



Main LMW screens

Load Management Watchdog Manual Entry - CQU3

| | | | |
|--|---|---|--|
| LMW_CQ_U3_Alert tolerance on closeness of load set-point to PN | New Value (typed in box) <input type="text" value="3"/> | Button sends value to PI <input type="button" value="Update Value"/> | Latest Value 2/2/2010 10:55:58 AM 2 |
| Tag Name LMW_CQ_U3_Alert tolerance on imbalance | New Value (typed in box) <input type="text" value="2"/> | Button sends value to PI <input type="button" value="Update Value"/> | Latest Value 2/2/2010 10:56:10 AM 3 |
| Tag Name LMW_CQ_U3_Alert tolerance on imbalance volume | New Value (typed in box) <input type="text" value="1"/> | Button sends value to PI <input type="button" value="Update Value"/> | Latest Value 12/10/2009 2:20:22 PM 1 |
| Tag Name LMW_CQ_U3_Alert tolerance on imbalance cost | New Value (typed in box) <input type="text" value="100"/> | Button sends value to PI <input type="button" value="Update Value"/> | Latest Value 12/10/2009 2:20:23 PM 100 |
| Tag Name LMW_CQ_U3_Unit capacity | New Value (typed in box) <input type="text" value="390"/> | Button sends value to PI <input type="button" value="Update Value"/> | Latest Value 1/26/2010 12:52:36 PM 345 |
| Tag Name LMW_CQ_U3_Permitted % load deviation from PN | New Value (typed in box) <input type="text" value="0.75"/> | Button sends value to PI <input type="button" value="Update Value"/> | Latest Value 12/10/2009 2:20:25 PM 0.75 |

Return To Main Screen

You Must Be Logged Into PI With The LMWAdmin Account To Write Values To PI

E-ON Approach

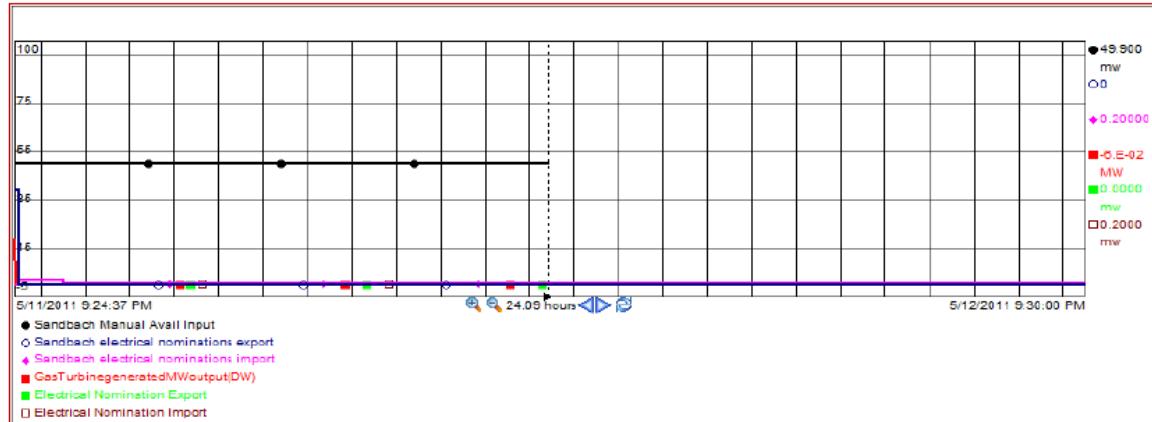
Real-time and future data display



SANDBACH ELECTRICAL EXPORT NOMINATION - IMBALANCE

12-May-11
10:24:37

To Set Stations Daily MW Availability
Limit. Click The 'MW Limit' Button >>



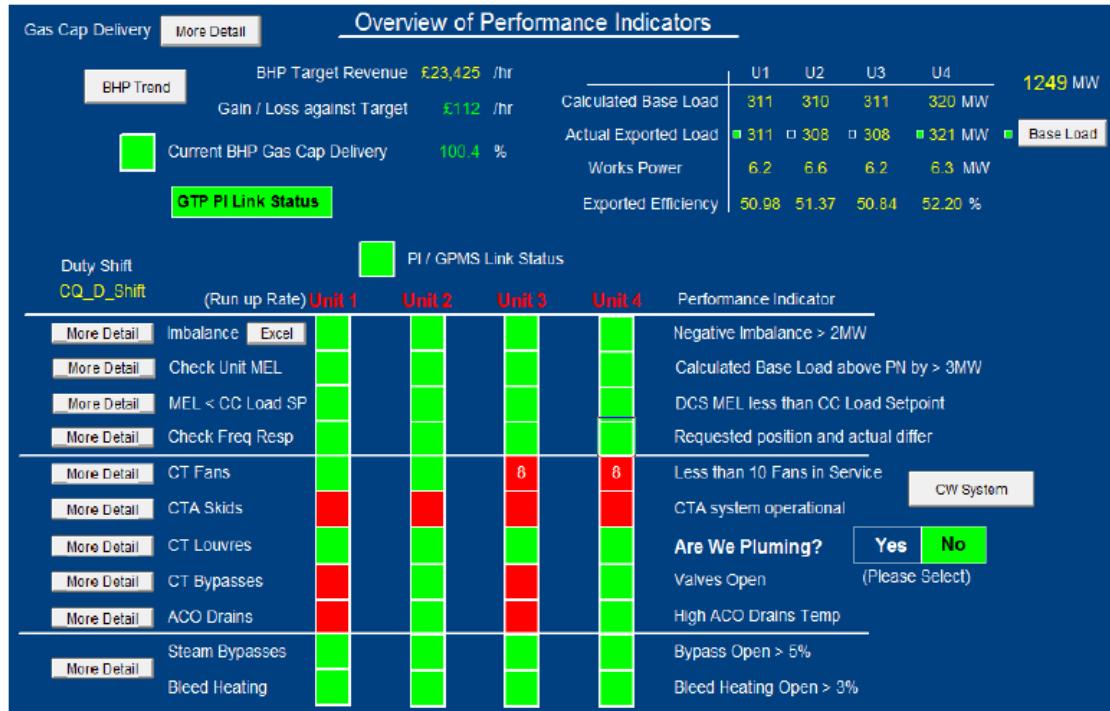
This Screen Displays:

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



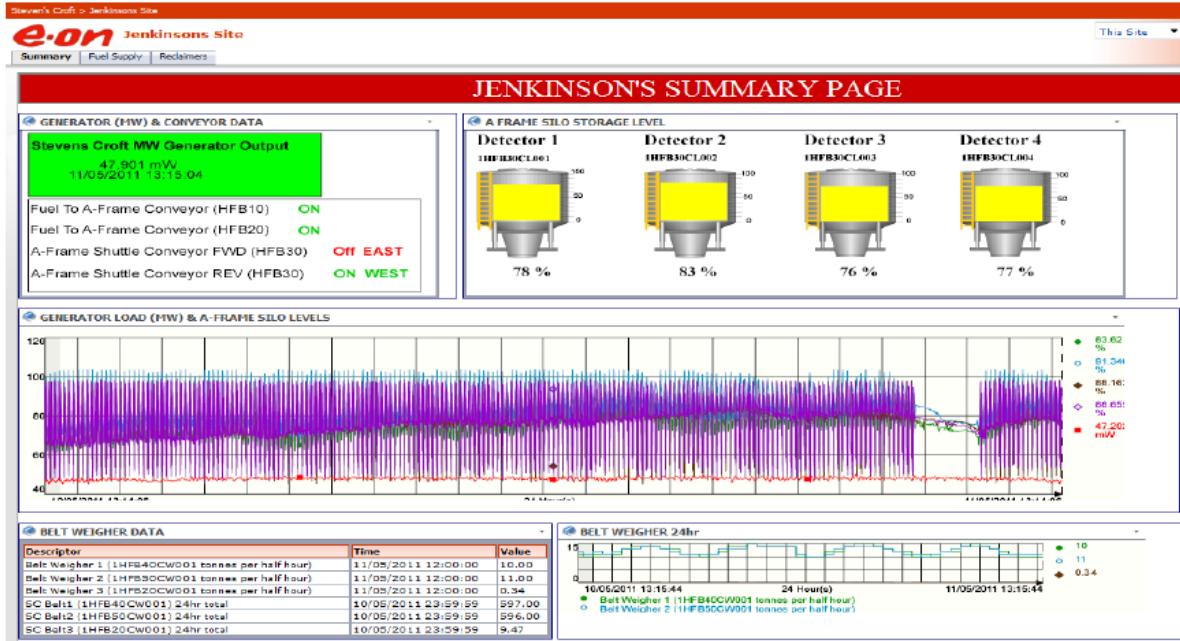
E-ON Approach

CQ – performance watchdog



E-ON Approach

Steven's Croft web page



E-ON Approach

Web-based high level plant information



UK GENERATION TOTAL MW
5553.77



CCGT TOTAL MW GENERATED
1699.93



STEAM TOTAL MW GENERATED
3608.31



CHP TOTAL MW GENERATED
245.53



Elec Buy Price (£/MWh)
61.90

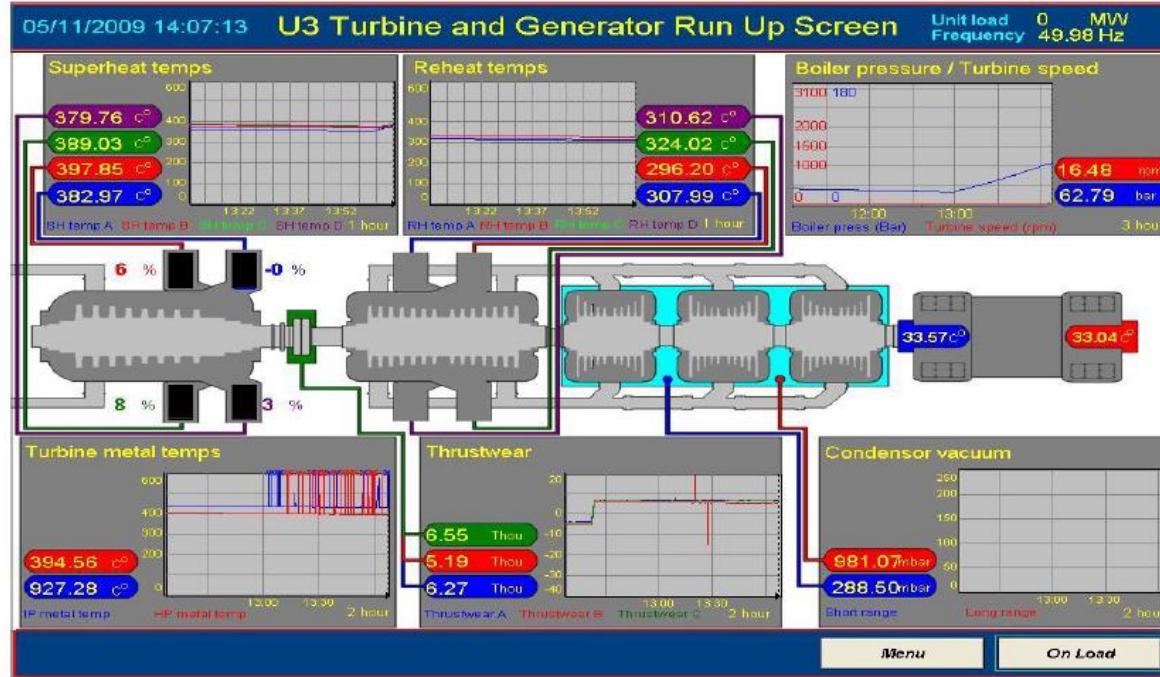
Elec Sell Price (£/MWh)
42.58

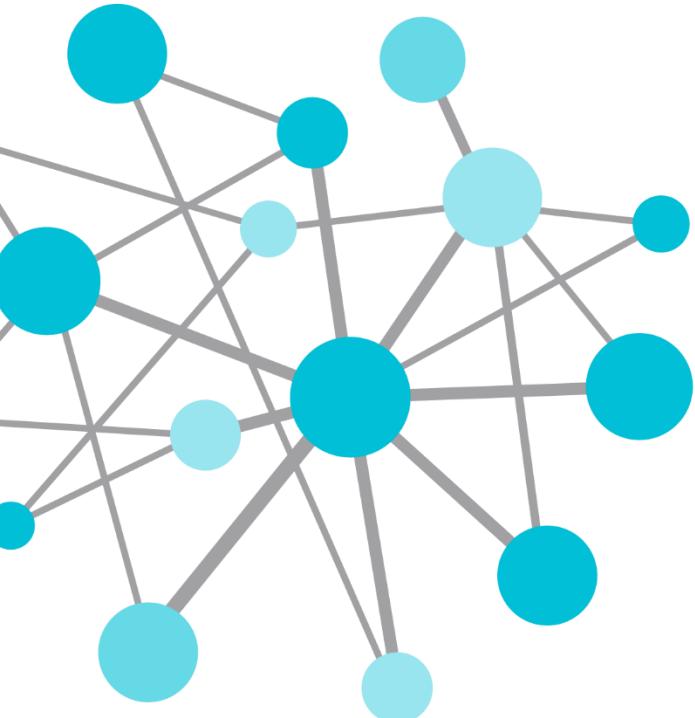
Market Price (£/MWh)
40.36

[CCGT Generation](#) | [Steam Generation](#) | [CHP Generation](#)

E-ON Approach

Obsolete equipment replacement



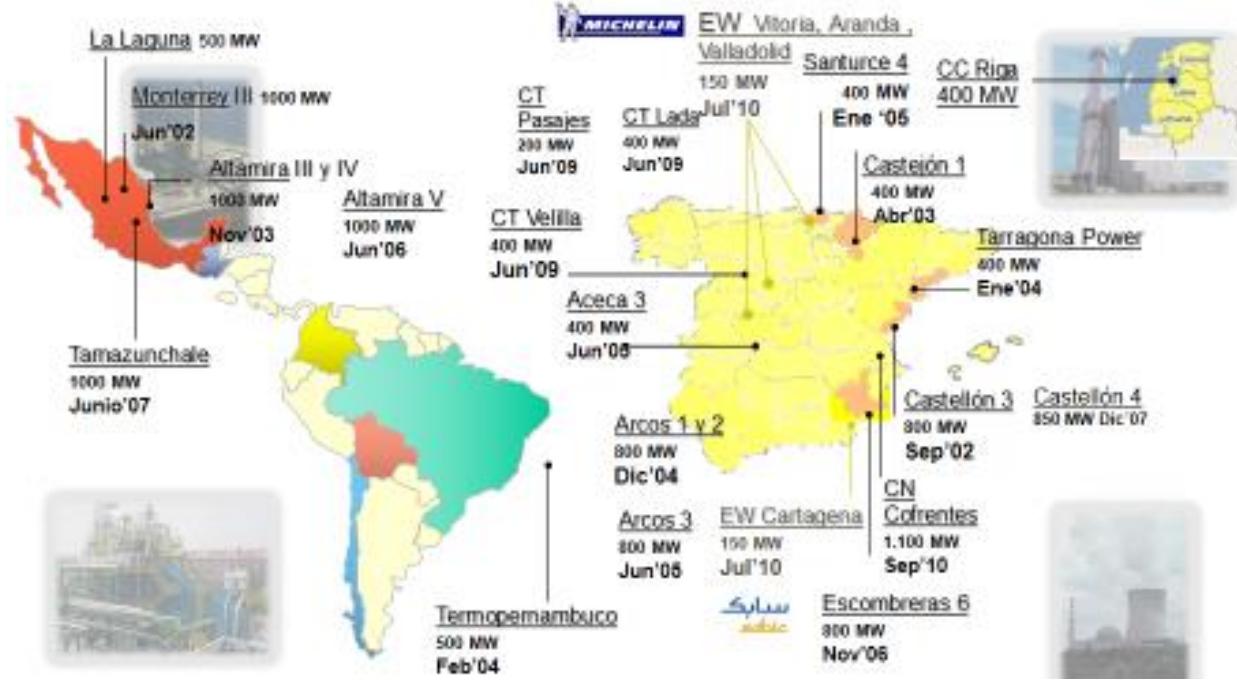


Enterprise Approach

Showcases



Iberdrola Approach



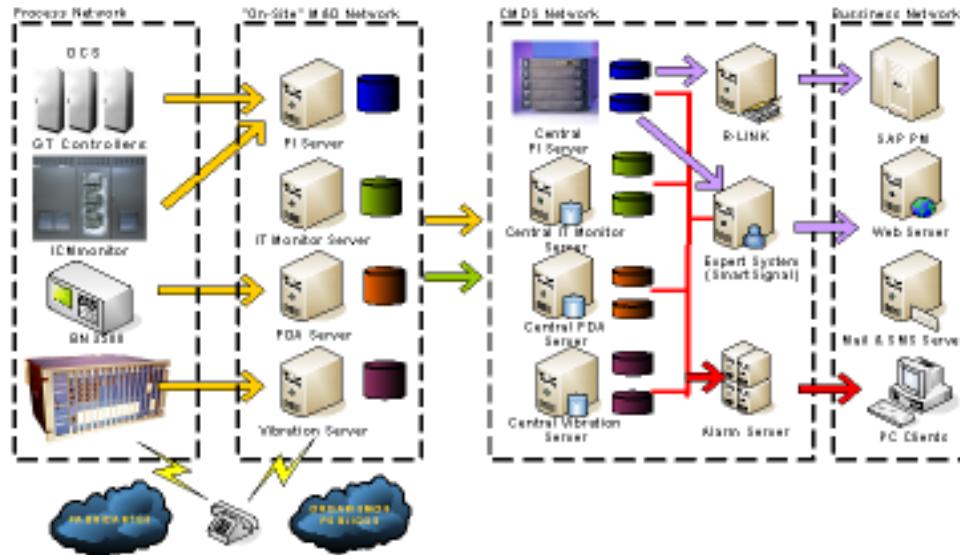
Iberdrola Approach

PI System History

- Started on 2002.
- Actual Installations:
 - 8 PI Systems in Spain's Combined Cycle
 - 5 PI Systems in Mexican's Combined Cycle
 - 1 PI System in Latvia's Combined Cycle
 - 3 PI Systems in CMDS
 - 1 PI System in Distribution Business
 - 4 PI System in Renewable Business
 - 3 PI Systems in Spain's Coal Power Plants
 - 1 PI System in Spain's 100% Owned Nuclear Power Plant
 - 4 PI Systems in Spain's Cogeneration Plant

Iberdrola Approach

Combined Cycle & Coal Strategy

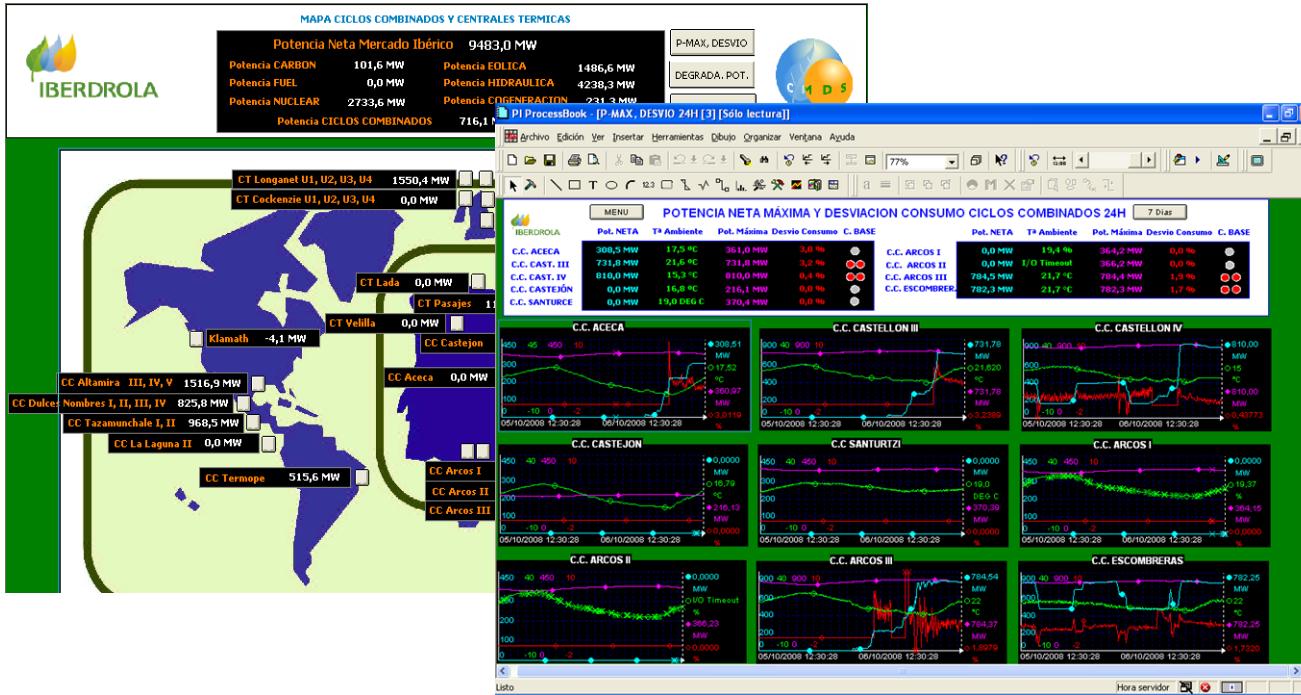


Iberdrola Approach

Developed Applications

- Performance Tracking
- Contract Tracking
- System Advisor
- AEM (Advanced Equipment Monitoring)
- IT Doctor
- GE M&D Connection
- SAP Connection (PM & BW Module)
- EMS Connection (Dispatching Center)
- Daily Inspections
- Others.....

Iberdrola Approach



Iberdrola Approach

Developed Applications

- Performance Tracking
 - Expected Output Power
 - Gas Consumption Deviation (from Expected)



Iberdrola Approach

Developed Applications

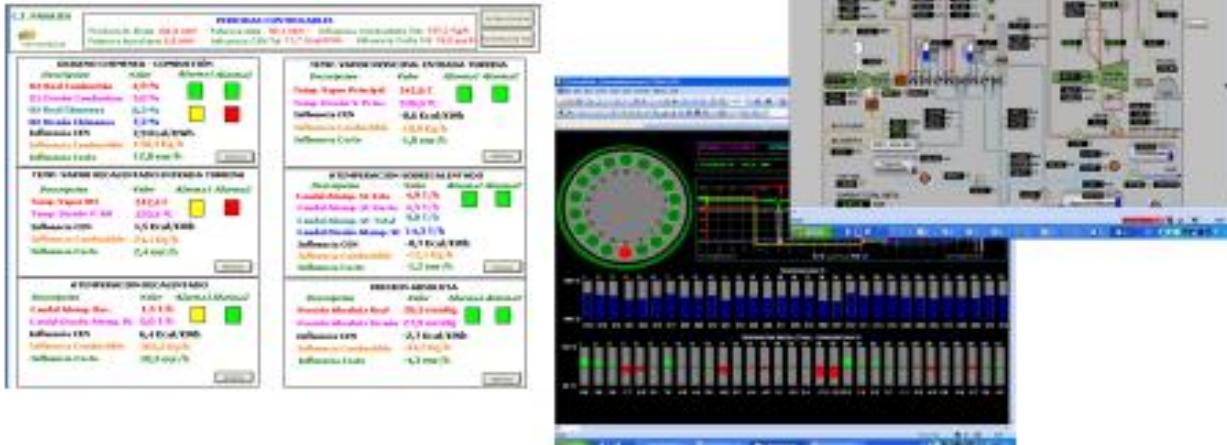
- Performance Tracking
- Power Degradation (from Base Line)
- Heat Rate Degradation (from Base Line)



Iberdrola Approach

Developed Applications

- AEM (Advanced Equipment Monitoring)



Iberdrola Approach

CONTROLLABLE LOSSES FOR COAL FLEET

| C.T. PASAJES | | PERDIDAS CONTROLABLES | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---------------|---|------------------------------|---|---|-------------|-------|---------|---------|-----------------------|-----------|--|--|-------------------------|-----------|--|--|------------------------|---------------|--|--|-------------------------|------------|--|--|------------------|---------------|--|--|--------------------------|------------|--|--|------------------|------------|--|--|--------------------------|--|--|--|
|  | | Producción Bruta 104,5 MW | Potencia Neta 99,1 MW | Influencia Combustible Tots 193,2 Kg/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Potencia Auxiliares 5,5 MW | | Influencia CEN Tot 11,7 Kcal/KWh | Influencia Coste Tot: 19,0 eur/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Ver Datos Variables Ver Influencia Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OXIGENO CHIMEEA - COMBUSTIÓN <table border="1"> <thead> <tr> <th>Descripción</th> <th>Valor</th> <th>Alarma1</th> <th>Alarma2</th> </tr> </thead> <tbody> <tr> <td>O2 Real Combustión</td> <td>4,9 %</td> <td></td> <td></td> </tr> <tr> <td>O2 Diseño Combustion</td> <td>5,0 %</td> <td></td> <td></td> </tr> <tr> <td>O2 Real Chimenea</td> <td>8,3 %</td> <td></td> <td></td> </tr> <tr> <td>O2 Diseño Chimenea</td> <td>7,3 %</td> <td></td> <td></td> </tr> <tr> <td>Influencia CEN</td> <td>7,9 Kcal/KWh</td> <td></td> <td></td> </tr> <tr> <td>Influencia Combustible</td> <td>130,3 Kg/h</td> <td></td> <td></td> </tr> <tr> <td>Influencia Coste</td> <td>12,8 eur/h</td> <td></td> <td></td> </tr> <tr> <td colspan="4">Gráficas</td> </tr> </tbody> </table> | | | | | | Descripción | Valor | Alarma1 | Alarma2 | O2 Real Combustión | 4,9 % | | | O2 Diseño Combustion | 5,0 % | | | O2 Real Chimenea | 8,3 % | | | O2 Diseño Chimenea | 7,3 % | | | Influencia CEN | 7,9 Kcal/KWh | | | Influencia Combustible | 130,3 Kg/h | | | Influencia Coste | 12,8 eur/h | | | Gráficas | | | |
| Descripción | Valor | Alarma1 | Alarma2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O2 Real Combustión | 4,9 % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Gráficas | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TEMP. VAPOR PRINCIPAL ENTRADA TURBINA <table border="1"> <thead> <tr> <th>Descripción</th> <th>Valor</th> <th>Alarma1</th> <th>Alarma2</th> </tr> </thead> <tbody> <tr> <td>Temp. Vapor Principal</td> <td>541,6 °C</td> <td></td> <td></td> </tr> <tr> <td>Temp. Diseño V. Princ.</td> <td>538,0 °C</td> <td></td> <td></td> </tr> <tr> <td>Influencia CEN</td> <td>-0,6 Kcal/KWh</td> <td></td> <td></td> </tr> <tr> <td>Influencia Combustible</td> <td>-10,0 Kg/h</td> <td></td> <td></td> </tr> <tr> <td>Influencia Coste</td> <td>-1,0 eur/h</td> <td></td> <td></td> </tr> <tr> <td colspan="4">Gráficas</td> </tr> </tbody> </table> | | | | | | Descripción | Valor | Alarma1 | Alarma2 | Temp. Vapor Principal | 541,6 °C | | | Temp. Diseño V. Princ. | 538,0 °C | | | Influencia CEN | -0,6 Kcal/KWh | | | Influencia Combustible | -10,0 Kg/h | | | Influencia Coste | -1,0 eur/h | | | Gráficas | | | | | | | | | | | |
| Descripción | Valor | Alarma1 | Alarma2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temp. Vapor Principal | 541,6 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temp. Diseño V. Princ. | 538,0 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influencia CEN | -0,6 Kcal/KWh | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influencia Combustible | -10,0 Kg/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influencia Coste | -1,0 eur/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gráficas | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TEMP. VAPOR RECALENTADO ENTRADA TURBINA <table border="1"> <thead> <tr> <th>Descripción</th> <th>Valor</th> <th>Alarma1</th> <th>Alarma2</th> </tr> </thead> <tbody> <tr> <td>Temp. Vapor RH</td> <td>512,4 °C</td> <td></td> <td></td> </tr> <tr> <td>Temp. Diseño V. RH</td> <td>520,4 °C</td> <td></td> <td></td> </tr> <tr> <td>Influencia CEN</td> <td>1,5 Kcal/KWh</td> <td></td> <td></td> </tr> <tr> <td>Influencia Combustible</td> <td>24,1 Kg/h</td> <td></td> <td></td> </tr> <tr> <td>Influencia Coste</td> <td>2,4 eur/h</td> <td></td> <td></td> </tr> <tr> <td colspan="4">Gráficas</td> </tr> </tbody> </table> | | | | | | Descripción | Valor | Alarma1 | Alarma2 | Temp. Vapor RH | 512,4 °C | | | Temp. Diseño V. RH | 520,4 °C | | | Influencia CEN | 1,5 Kcal/KWh | | | Influencia Combustible | 24,1 Kg/h | | | Influencia Coste | 2,4 eur/h | | | Gráficas | | | | | | | | | | | |
| Descripción | Valor | Alarma1 | Alarma2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temp. Vapor RH | 512,4 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temp. Diseño V. RH | 520,4 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influencia CEN | 1,5 Kcal/KWh | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influencia Combustible | 24,1 Kg/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Influencia Coste | 2,4 eur/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gráficas | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ATEMPERACION SOBRECALENTADO <table border="1"> <thead> <tr> <th>Descripción</th> <th>Valor</th> <th>Alarma1</th> <th>Alarma2</th> </tr> </thead> <tbody> <tr> <td>Caudal Atemp. SC Este</td> <td>4,9 T/h</td> <td></td> <td></td> </tr> <tr> <td>Caudal Atemp. SC Oeste</td> <td>4,3 T/h</td> <td></td> <td></td> </tr> <tr> <td>Caudal Atemp. SC Total</td> <td>9,0 T/h</td> <td></td> <td></td> </tr> <tr> <td>Caudal Diseño Atemp. SC</td> <td>14,3 T/h</td> <td></td> <td></td> </tr> <tr> <td>Influencia CEN</td> <td>-0,7 Kcal/KWh</td> <td></td> <td></td> </tr> <tr> <td>Influencia Combustible</td> <td>-12,1 Kg/h</td> <td></td> <td></td> </tr> <tr> <td>Influencia Coste</td> <td>-1,2 eur/h</td> <td></td> <td></td> </tr> <tr> <td colspan="4">Gráficas</td> </tr> </tbody> </table> | | | | | | Descripción | Valor | Alarma1 | Alarma2 | Caudal Atemp. SC Este | 4,9 T/h | | | Caudal Atemp. SC Oeste | 4,3 T/h | | | Caudal Atemp. SC Total | 9,0 T/h | | | Caudal Diseño Atemp. SC | 14,3 T/h | | | Influencia CEN | -0,7 Kcal/KWh | | | Influencia Combustible | -12,1 Kg/h | | | Influencia Coste | -1,2 eur/h | | | Gráficas | | | |
| Descripción | Valor | Alarma1 | Alarma2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Caudal Atemp. SC Este | 4,9 T/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Caudal Atemp. SC Oeste | 4,3 T/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Influencia Combustible | -12,1 Kg/h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Descripción | Valor | Alarma1 | Alarma2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Gráficas | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRESIÓN ABSOLUTA <table border="1"> <thead> <tr> <th>Descripción</th> <th>Valor</th> <th>Alarma1</th> <th>Alarma2</th> </tr> </thead> <tbody> <tr> <td>Presión Absoluta Real</td> <td>26,5 mmHg</td> <td></td> <td></td> </tr> <tr> <td>Presión Absoluta Diseño</td> <td>27,9 mmHg</td> <td></td> <td></td> </tr> <tr> <td>Influencia CEN</td> <td>-2,7 Kcal/KWh</td> <td></td> <td></td> </tr> <tr> <td>Influencia Combustible</td> <td>-44,2 Kg/h</td> <td></td> <td></td> </tr> <tr> <td>Influencia Coste</td> <td>-4,3 eur/h</td> <td></td> <td></td> </tr> <tr> <td colspan="4">Gráficas</td> </tr> </tbody> </table> | | | | | | Descripción | Valor | Alarma1 | Alarma2 | Presión Absoluta Real | 26,5 mmHg | | | Presión Absoluta Diseño | 27,9 mmHg | | | Influencia CEN | -2,7 Kcal/KWh | | | Influencia Combustible | -44,2 Kg/h | | | Influencia Coste | -4,3 eur/h | | | Gráficas | | | | | | | | | | | |
| Descripción | Valor | Alarma1 | Alarma2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Presión Absoluta Real | 26,5 mmHg | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Gráficas | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Iberdrola Approach

WEB KPIs DASHBOARD (FLEET APPROACH)

Developed Applications

- Web Access



Iberdrola Approach

Conclusions

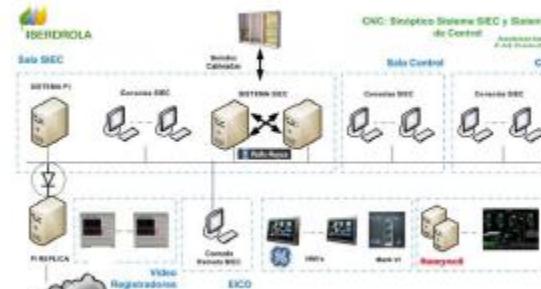
- 10 years PI System experience over Combined Cycle Technology:
 - *ROI ≈ 2,5 Years*
 - Increasing efficiency → 1%-2%
 - Increasing availability → 0,1%-0,5%
 - Easily exportable to another business
- Opening the platform for all users = A lot of value
- Focus on business drivers (take your time!!!)
- Event based monitoring
- Success requires cooperation between operations, maintenance and engineering



Iberdrola Approach

Iberdrola: Modernization of Control Systems at CN Cofrentes

"Cofrentes was built on late 80's with more than 1.000 MW of installed capacity. After more than 25 years of operation the modernization of control systems is required for reaching the excellence in safe and reliable operation and maintenance of the station. To integrate all the data coming from the different digital systems in a secure way is critical for improving the business"



Business Challenge

- To integrate all data sources in one system
- To integrate with the digital systems in a secure way
- To reach the excellence in O&M

Solution

- Two Cascade PI Systems collecting data from different vendors
- One Waterfall Data Diode equipment for secure deployment
- PI-PB/PI-ACE developments

Results and Benefits

- One version of the truth. One single point with consolidated information
- Securely protected against cyber threats.
- Foundation for O&M optimization

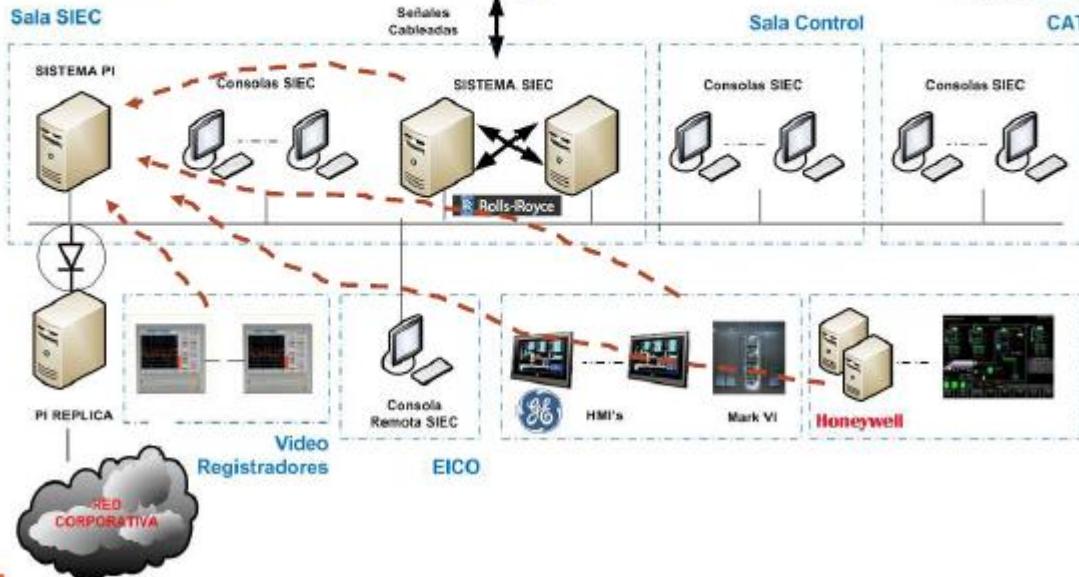
Iberdrola Approach

CN Cofrentes I&C Modernization Project



CNC: Sinóptico Sistema SIEC y Sistemas de Control

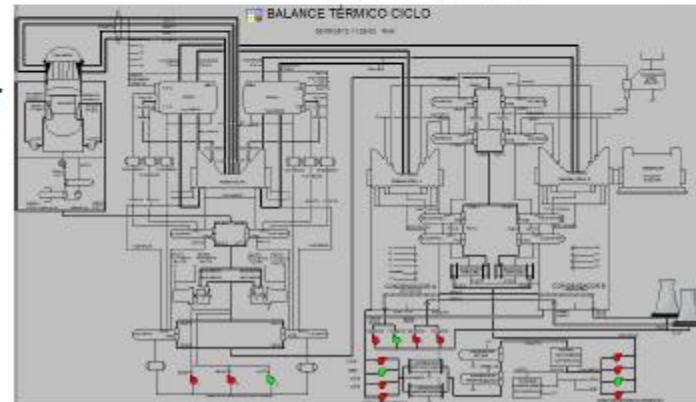
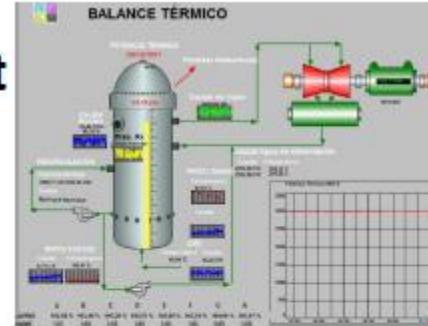
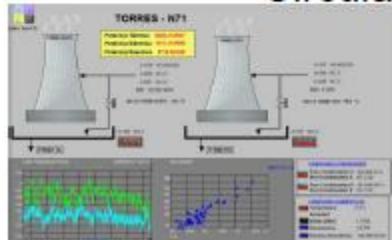
Arquitectura Actual
F. Act: 25-Julio-2012



Iberdrola Approach

CN Cofrentes I&C Modernization Project

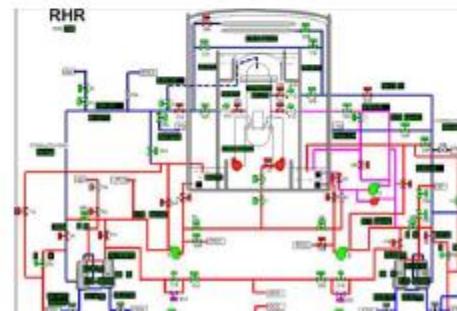
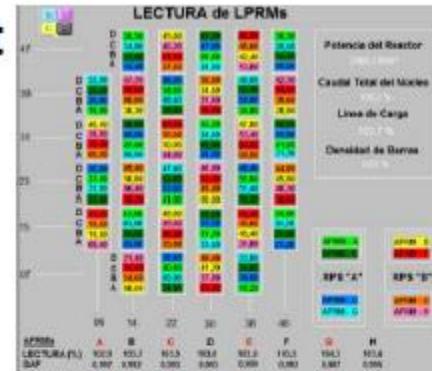
- PI Processbook developments
 - +61 screens developed
 - BOP systems trending
 - Chemistry
 - Condensate and Feedwater
 - Circulation water



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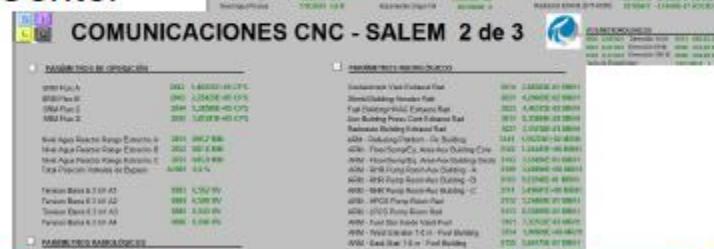
- PI Processbook developments
 - +61 screens developed
 - Reactivity Supervision
 - Cooling Systems



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CN Cofrentes I&C Modernization Project

- PI Processbook developments
 - +61 screens developed
 - Emergency Preparedness
 - Meteorological Data
 - Data for Outer Emergency Center



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- PI ACE developments
 - Emergency Diesel Group Test



Daily Test:

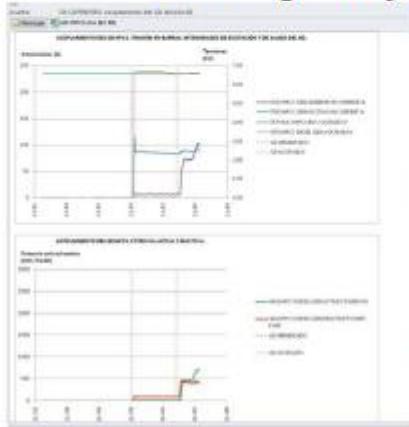
- Event #1: Group starts (there are 3 Divisions of Tandem-Diesel-Generators). The application sends an email.
 - TEST STARTS!!!



Iberdrola Approach

CN Cofrentes I&C Modernization Project

- PI ACE developments
 - Emergency Diesel Group Test



Daily Test:

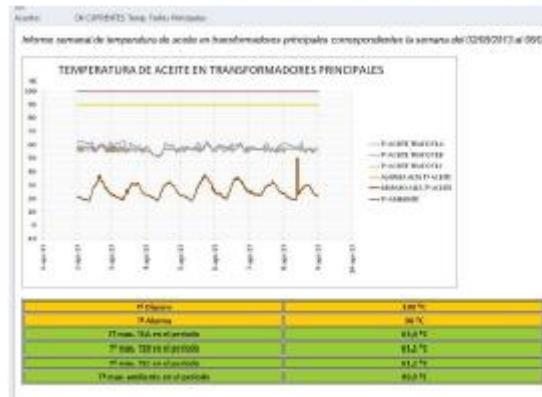
- Event #2: Group connects to the grid. The application sends another email.
- TEST OK!!!!



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- PI ACE developments
 - Transformer Oil Temperature Tracking



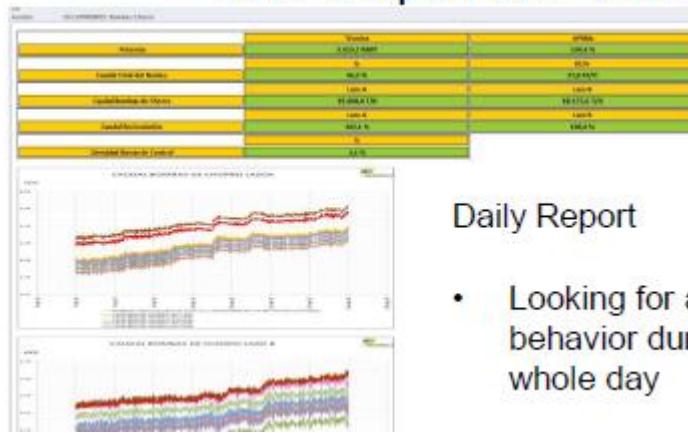
Weekly Report

- Looking for abnormal behavior during a whole week.

Iberdrola Approach

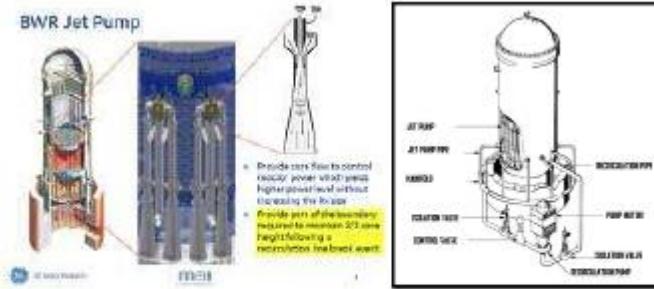
CN Cofrentes I&C Modernization Project

- PI ACE developments
 - Jet Pumps Flow Tracking



Daily Report

- Looking for abnormal behavior during a whole day



Iberdrola Approach

CN Cofrentes I&C Modernization Project

- PI ACE developments
 - Drain System Tracking

| SUMINISTROS DE QUÍMICOS | | | | |
|-------------------------|---------------------------------|----------------------------|----------------------------|----------------------------|
| CATEGORÍA | FACULTAD ESTADÍSTICA (ESTIMADO) | Volumen Acumulado (M3) (a) | Volumen Acumulado (M3) (b) | Consumido Diariamente (m3) |
| Pintura Verde | 48,54 (2) | 0 | 0 | 0 |
| Fluorocloro | 0,00 (2) | 0,5 | 0,5 | 0,72 |
| Tin Oxide Verde | 0,173 | 0 | 0 | 0,16 |
| Residuos metálicos | 0,108 | 0 | 0 | 0,10 |
| Acetato de zinc | 0,001 | 0 | 0 | 0,001 |
| Acetato de cinc | 0,001 | 0 | 0 | 0,001 |
| Acetato de hierro | 0,001 | 0 | 0 | 0,001 |
| Cianuro de zinc | 0,001 | 0 | 0 | 0,001 |
| Cobre sulfato | 0,108 | -0,001 | 0,34 | 0,11 |
| Sulfato de zinc | 0,002 | 0 | 0 | 0,1 |
| Total consumo químicos | 48,85 (2) | 0,173 | 0,173 | 0,17 |

Daily Report

- Looking for abnormal behavior during a whole day

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CN Cofrentes I&C Modernization Project

- PI ACE developments
 - Next Steps – AEM Concept (Advanced Equipment Monitoring)



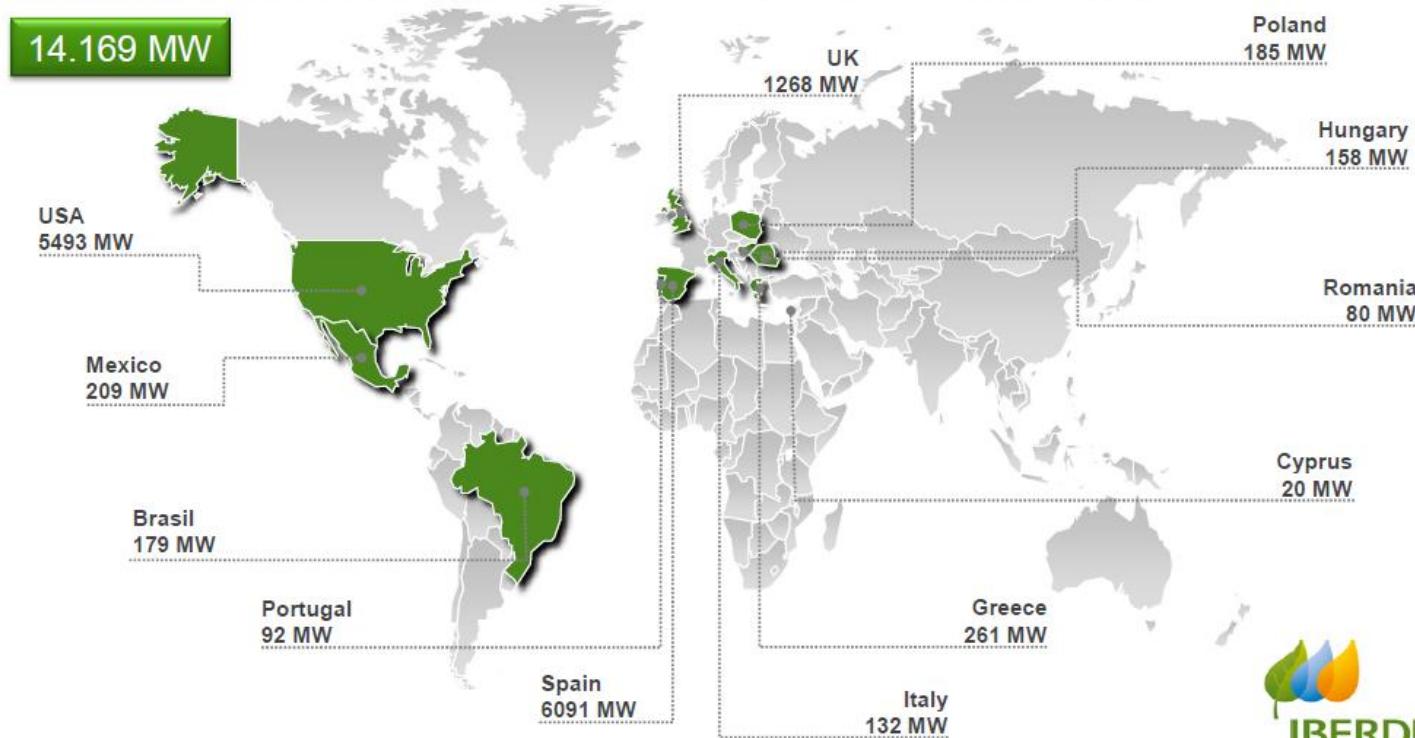
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Conclusions & key lessons learned

- Integration of multiple data sources
 - Different sources through one shared channel
 - New ideas for Operation optimization
- Securing the connection
 - Isolated from outside cyber threats
- Developing applications
 - Foundation for O&M optimization
 - Using existing know-how speed-up the process

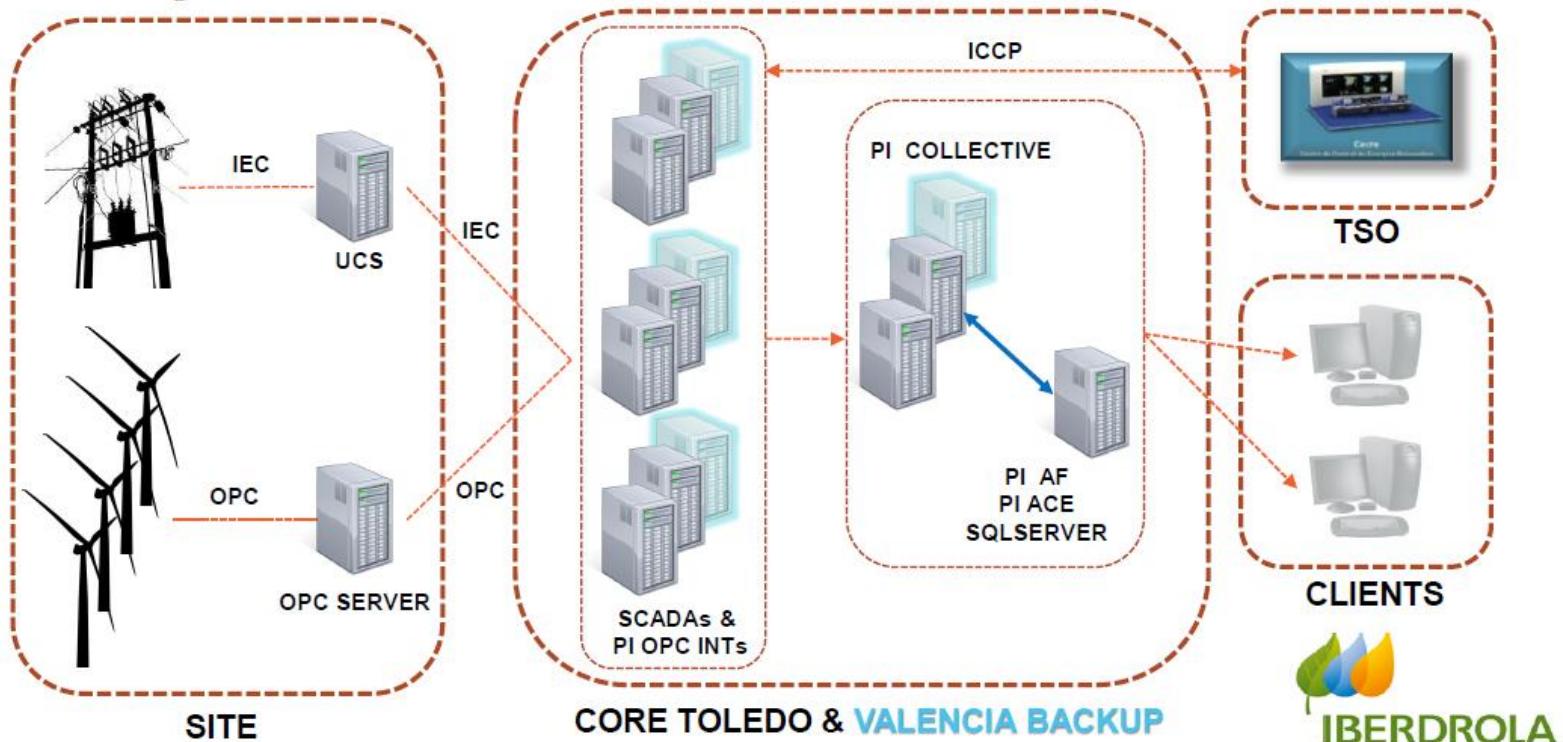
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IBERDROLA RENEWABLE ENERGIES BUSINESS (H1 2013)



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PI System Architecture



Iberdrola Approach

PI System usage to improve Curtailment Strategies

“... Along this month generation has been increased in more than 50 GWh, which would not have been generated if we had followed the former curtailment strategies.”

“This means an important benefit to our company. And also a few other facts such as less mechanical wear of our turbines, less urgent works on site, ... which are more difficult to quantify”

Gustavo Moreno
CORE Manager



Business Challenge

- Reduce inefficiencies
- To use aggregate real time data for real time decision making during curtailment issued by TSO

Solution

- PI AF training, design, planning and deployment
- CoE help with PI ACE deployment
- Calculated data inserted in PI Servers

Results and Benefits

- Average increase in energy generation: 30% with peaks above 60%
- Other benefits not quantified yet



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BEFORE: Curtailment with Individual Setpoints



— Total setpoint

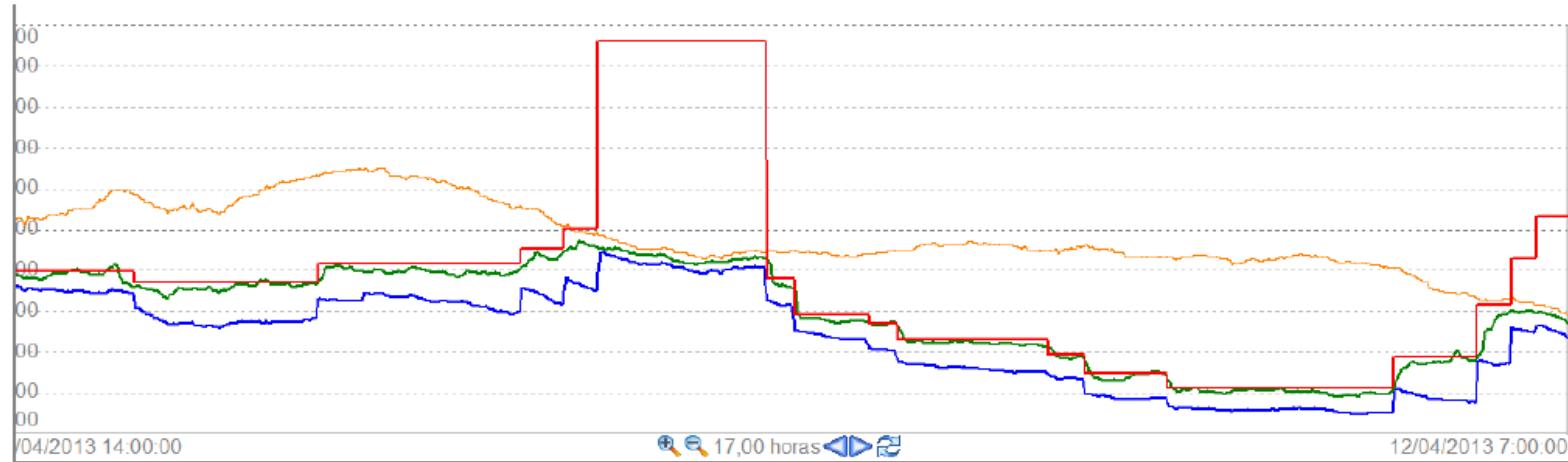
— Expected Power

— Estimated power with individual curtailment



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CURRENTLY: Global Setpoint Curtailment



— Total setpoint — Expected Power — Estimated power with individual curtailment — Total Actual Power

Average increase in energy generation: 30% with peaks above 60%



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Summary

- PI AF + PI ACE provided us with reliable tools for quick decision making
- In terms of income: significant increase in production
- Other intangible benefits:
 - Less mechanical wear out of turbines
 - Less local and urgent calls on site
 - Better adjustment to setpoints
 - Easier to manage for operation shifts: more secure and less errors



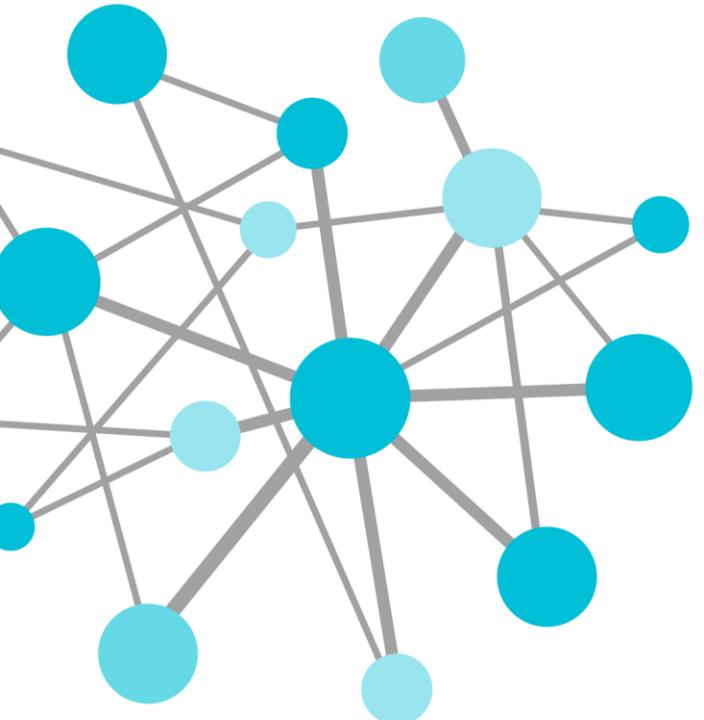
Q&A



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EMEA P&U Industry Principal
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