Worldwide Fleet Management and Asset Optimization Using the PI System Infrastructure

Gregor Biering
OSIsoft Industry Forum 2015

e·on

Agenda

E.ON
- E.ON in numbers
- E.ON's business activities
- E.ON's structure

E.ON's PI System
- Conventional PI System
- Renewables PI System

Examples
- Monitoring
- Reporting
- Analysis
- Alerting

e·on

E.ON in numbers

29 billion KWh

electricity produced from renewable technologies[1], equivalent to demand of 3m homes

17m

grid customers in Europe

€26bn

regulated asset base in Europe

14 GW

generation capacity outside of Europe[3]

Global #3 in offshore wind[2]

40GW

conventional generation capacity in Europe

783,000km

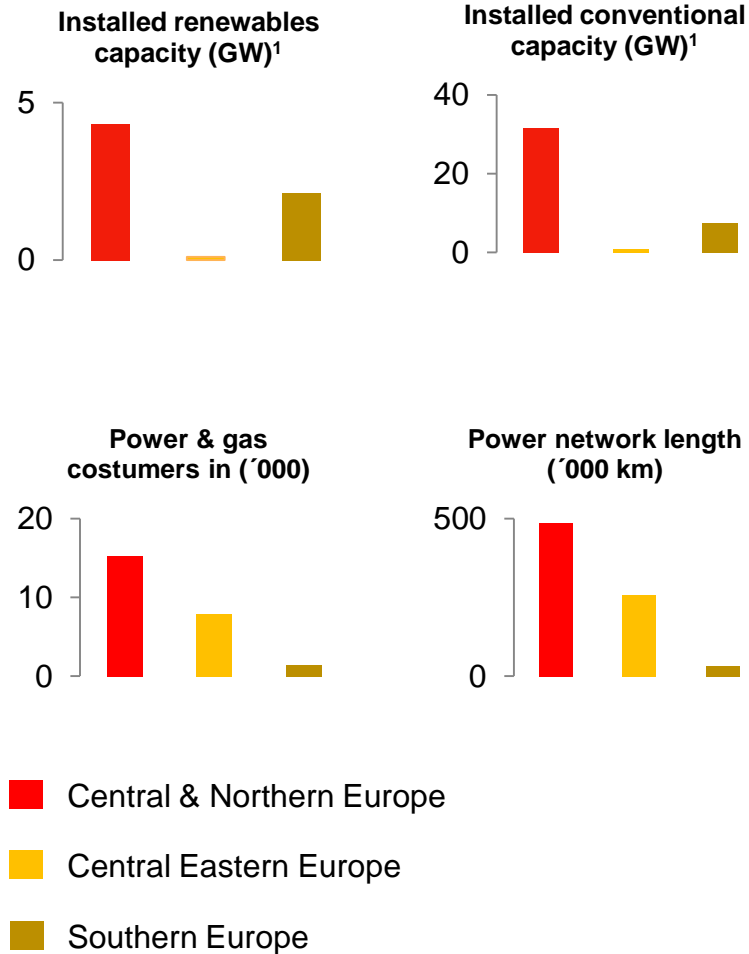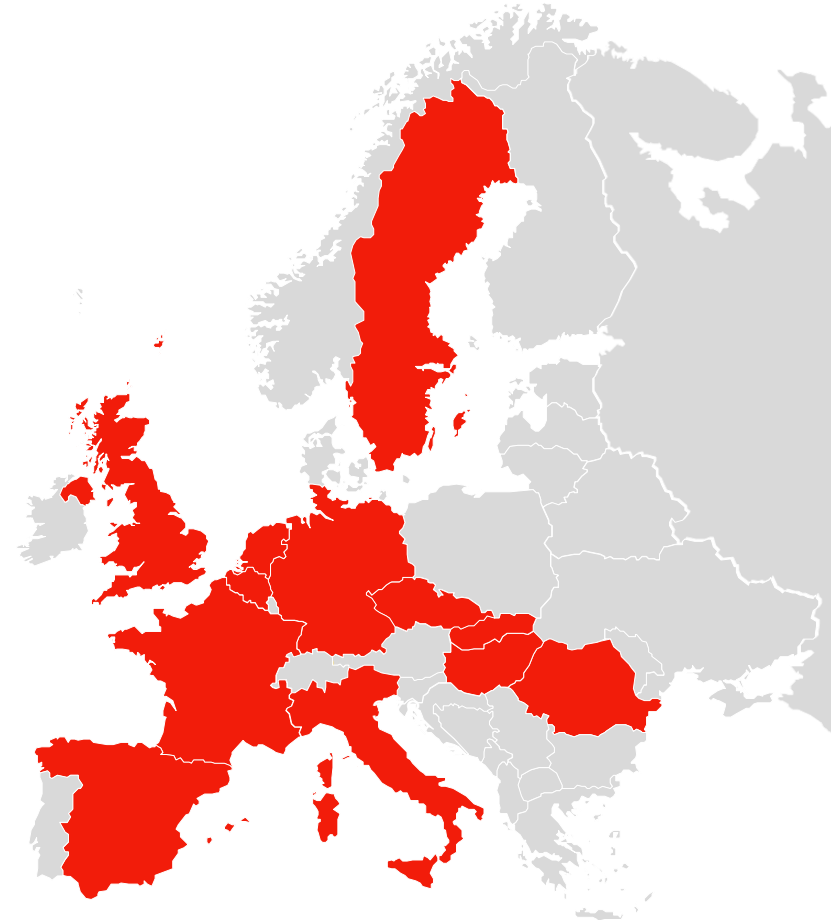power network length in Europe

35m

sales customers[4]

[1] Including electricity generation from hydro, wind, biomass and solar PV [2] Based on 2012 market data

[3] Including Russia, US Renewables, JV Enerjisa, ENEVA [4] Including 9m customers from JV Enerjisa in Turkey
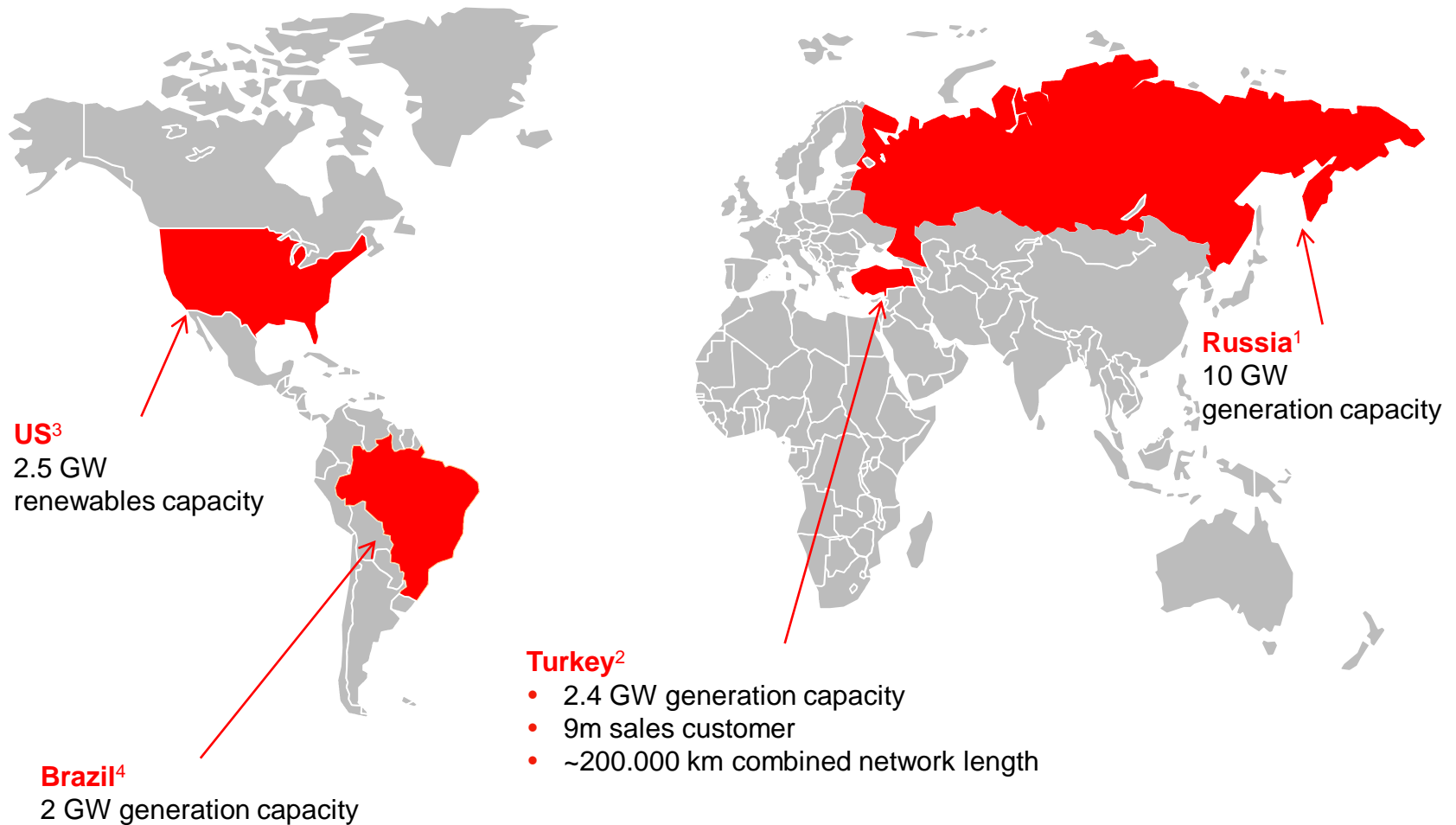
e·on

EU business activities

Installed renewables capacity (GW)[1]

Installed conventional capacity (GW)[1]

Power & gas costumers in (´000)

Power network length (´000 km)

- ■ Central & Northern Europe
- ■ Central Eastern Europe
- ■ Southern Europe

[1] Pro rata view

4

e·on

Non-EU business activities

US[3]
2.5 GW
renewables capacity

Brazil[4]
2 GW generation capacity

Turkey[2]
- 2.4 GW generation capacity
- 9m sales customer
- ~200.000 km combined network length

Russia[1]
10 GW
generation capacity

[1] E.ON Russia view [2] Enerjisa view [3] Accounting view [4] ENEVA view

e·on

Enerjisa[1] generation assets in Turkey

Enerjisa is a Joint Venture of Sabanci Holding and E.ON SE – both hold a 50% stake

In operation

Gas	1,306
Hydro	919
Wind	212
Total	**2,437**

Under construction

Gas	597
Hydro	779
Coal / Lignite	450
Total	**1,826**

Enerjisa´s[1] generation portfolio

🔴 In operation	2.4GW	H	=	Hydro
⚫ Under construction	1.8GW	L	=	Lignite
⚪ Under development	0.9GW	G	=	Gas (CCGT)
		W	=	Wind

Operational portfolio very clean with 54% CCGT, 37% hydro and 9% wind

E.ON´s structure

E.ON is separated into 4 main structures

- Group management
- Global units
- Regional units
- Support functions

One of the global units is the **E.ON Next Generation Unit** that oversees and coordinates the operations of the conventional and renewables generation portfolio. The **Asset Information System** is part of that unit and operates and manages the OSIsoft PI infrastructure and supports the plants in using the PI in the best way.

PI System Infrastructure

E.ON's PI System infrastructure is flexible enough to allow different architectures to meet different business needs.

Conventional
(Nuclear, Steam, CCGT, Hydro)

Renewables
(Wind, PV)

Different business needs

E.ON's PI System infrastructure is flexible enough to allow different architectures to meet different business needs.

Conventional
(Nuclear, Steam, CCGT, Hydro)

- Mostly big manned sites. Monitoring is performed at the site

- Big user group that needs access to the PI system at the site

- Many users that are familiar with their own signals

Renewables
(Wind, PV)

- Mix of manned and unmanned sites.

- Central control rooms US Wind, EU Wind, US PV that require remote access to the data

- High level of harmonisation needed to handle a big mix of non-standardised vendor technologies

e·on

Multiple conventional PI Servers

The OSIsoft PI Server is installed in most of the plants and enables users directly interact with their data through DataLink and ProcessBook.

All sites send a subset of their data to a central PI server, which currently has around 250.000 tags in the database.

This data can then be viewed additional via the E-ON PI Portal Web pages.

e·on
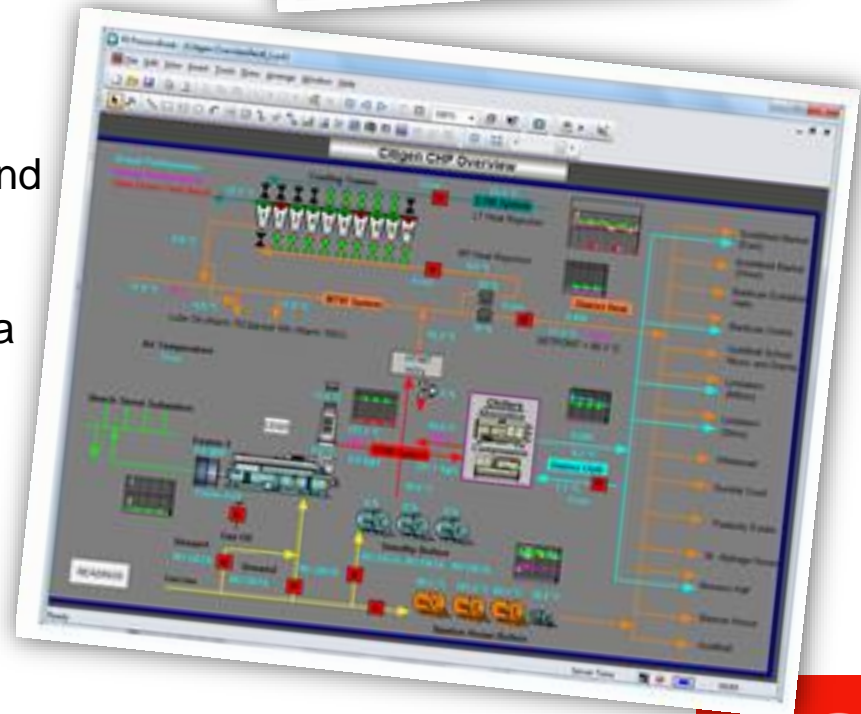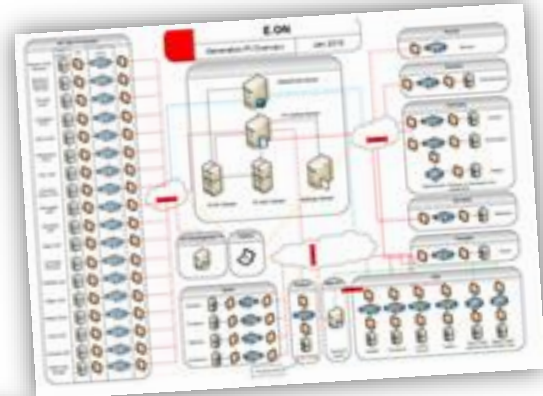
PI System as an Integration Layer

The central server not only collects data from the plants but also provides weather, pricing and nomination data back to the sites.

Additional it acts as interface to multiple third party applications for:

- Plant Management (SAP PM)

- Parts Tracking

- Advanced condition monitoring

- Performance monitoring

- Vibration Monitoring

e·on
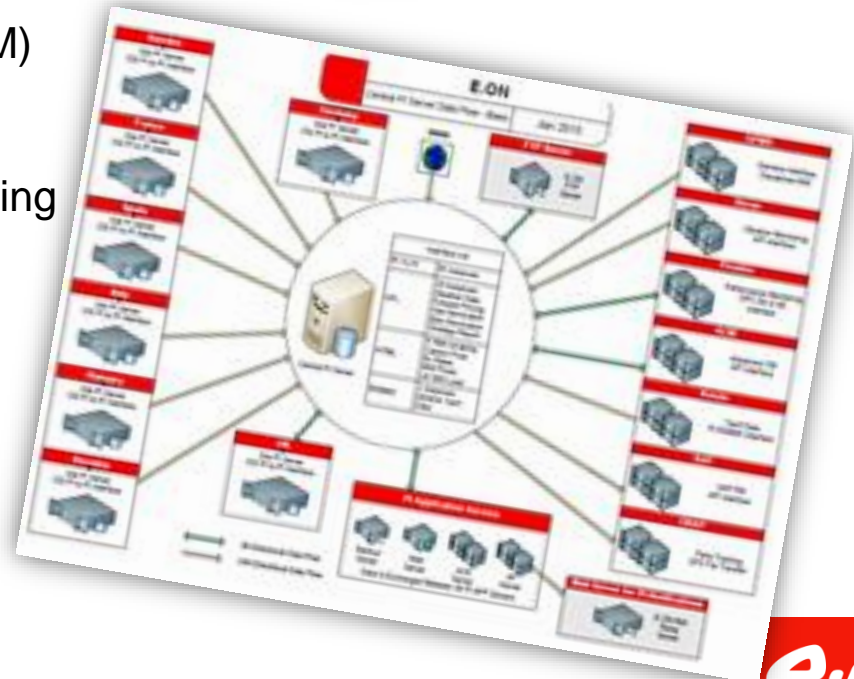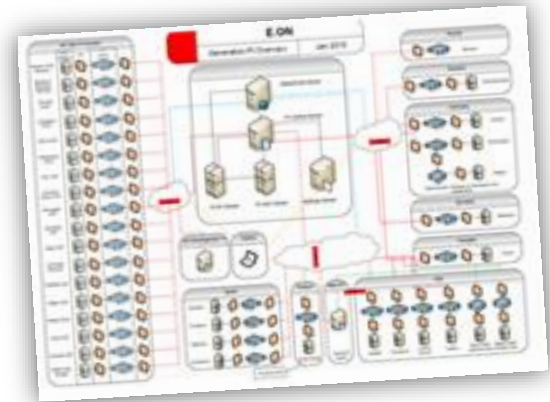
Renewables PI System

The renewables PI architecture contains 3 PI servers:

- EC&R Central (300k Tags)

- US Meter (5k Tags)

- Development (5k Tags)
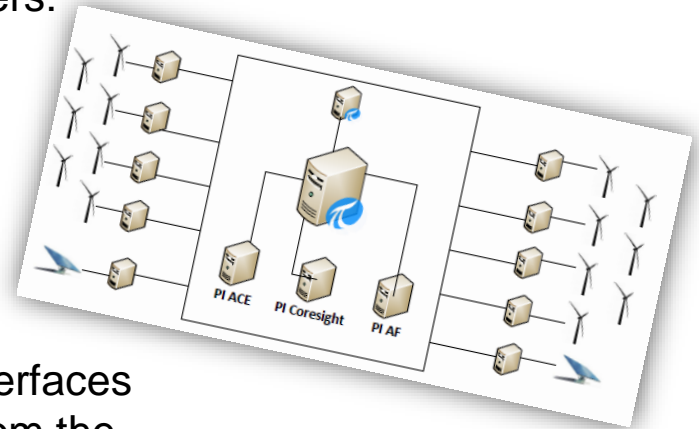
At more than 140 locations different types of PI Interfaces (OPC / PI to PI / RDBMS / Modbus) collect data from the OEM systems and send it to the central PI server.

The data can be access by PI ProcessBook, DataLink and Coresight. The most extensive usage happens through the PI SDK and PI OLEDB Interface.
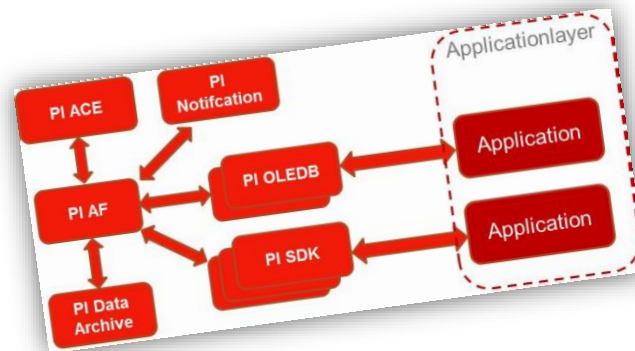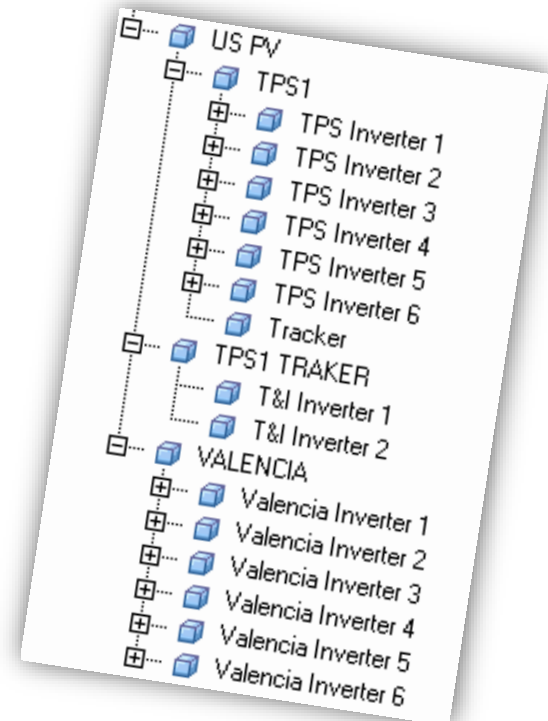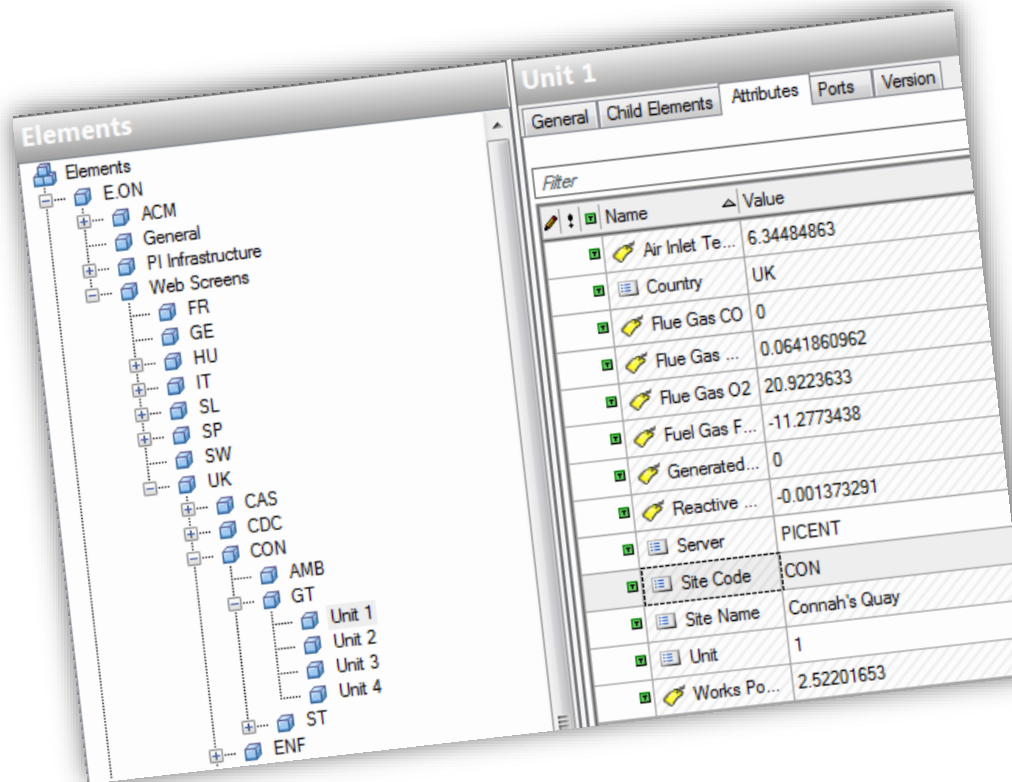
Application layer

EC&R developed several applications using the capabilities of PI SDK, OLEDB and Asset Framework.
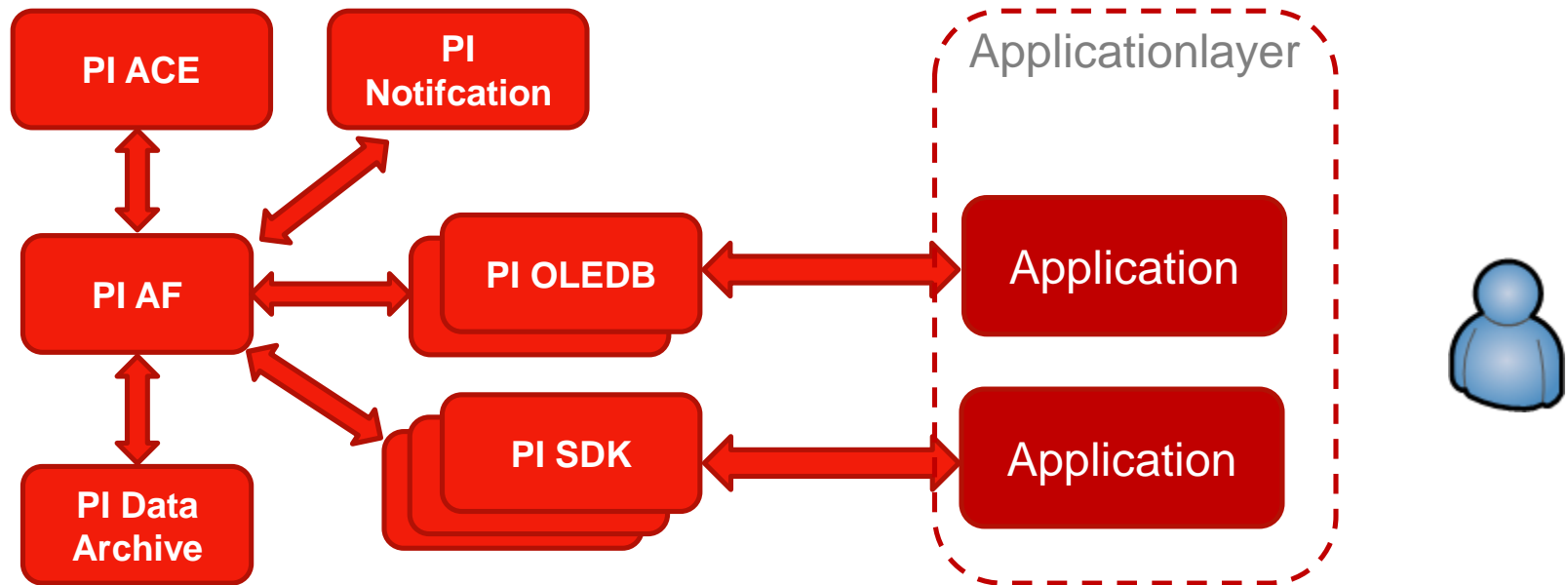
PI Server as standardization layer

By using the Asset Framework E.ON standardized the individual signals from the plant to a global standard.

PI System infrastructure summary

Conventional
(Nuclear, Steam, CCGT, Hydro)

- 33 PI Server
- 1 PI ACE Server
- 1 PI Asset Framework Server
- > 400.000 Tags
- 35 PI to PI Interfaces
- 5 HTML Interfaces
- 26 UFL Interfaces
- 3 RDBMS Interfaces
- > 160 individual PI ProcessBook views

Renewables
(Wind, PV)

- 3 PI Server
- Over 310.000 Tags
- ~ 250 PI Interfaces (OPC, Modbus, RDBMS,PI to PI)
- > 20 PI UFL Interfaces
- 2 PI ACE Server
- 1 PI AF Server

(Nuclear, Steam, CCGT)

e·on

PI Server data is used in different ways

The collected data is used for:

- Online monitoring
- Automated / Manual reporting
- Alerting
- Analysis

The following slides provide examples of this usage.

Example: Global Dashboards

Dashboards in plants and office locations provide at any time access to the actual production and various metrological conditions.
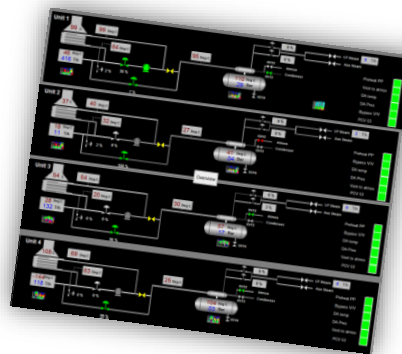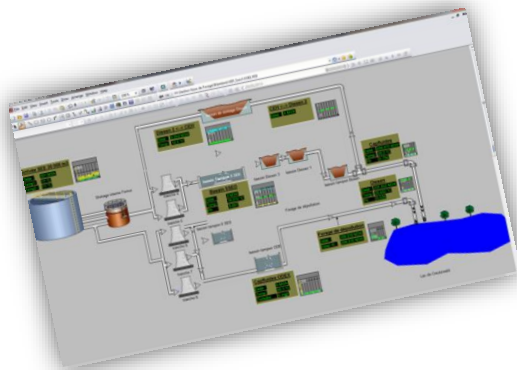
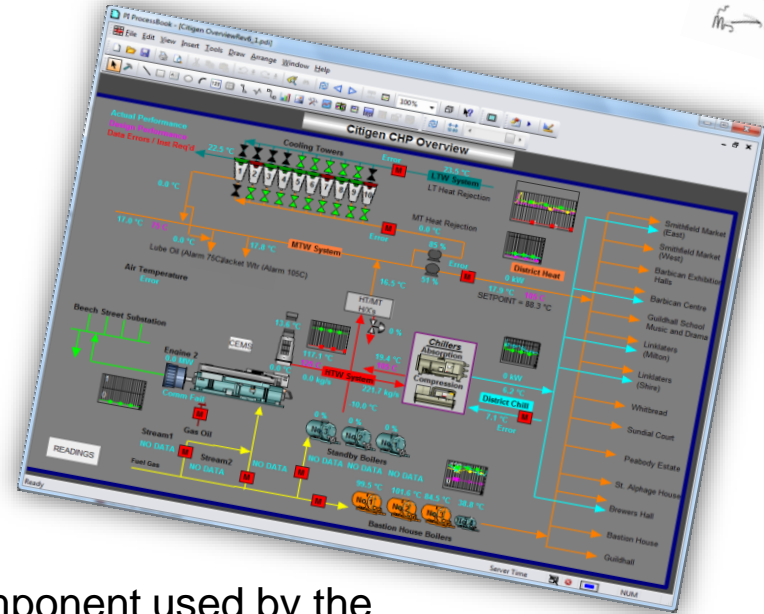Web application based on PI WebParts and HTML5.
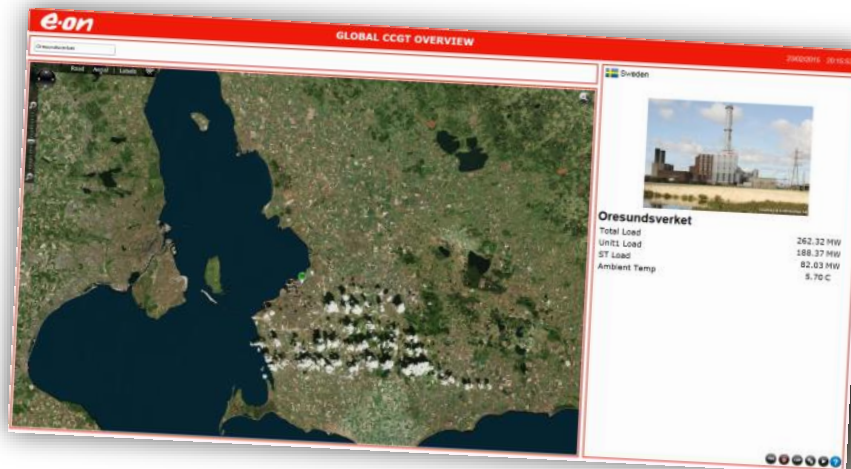
Example: Monitoring

Monitoring of:

- Plant
- Availability
- Emissions
- Process safety
- Unit energy consumption

Individual screens for each plant / unit / component used by the plant based on PI ProcessBook.
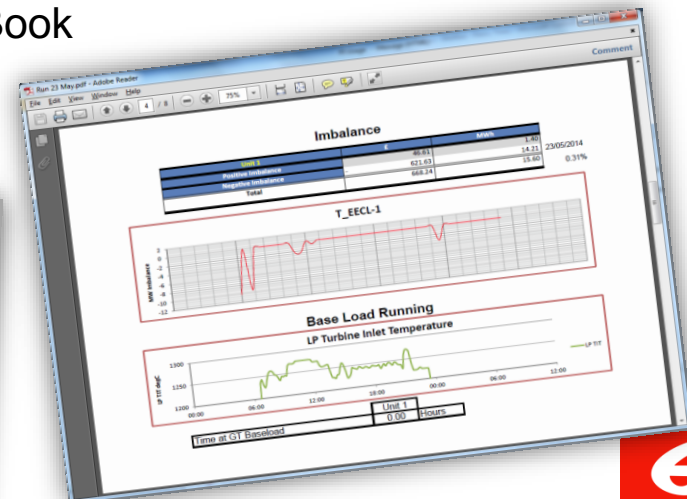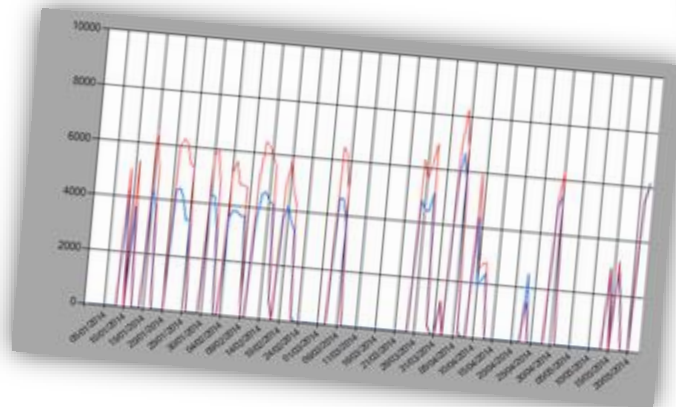
Example: Performance Analysis

Analysis of:

- Availability
- Components
- Imbalance
- Comparative trending between units and components
- Trends

Individual reports for each plant / unit / component used by site operations based on PI ProcessBook and Asset Framework
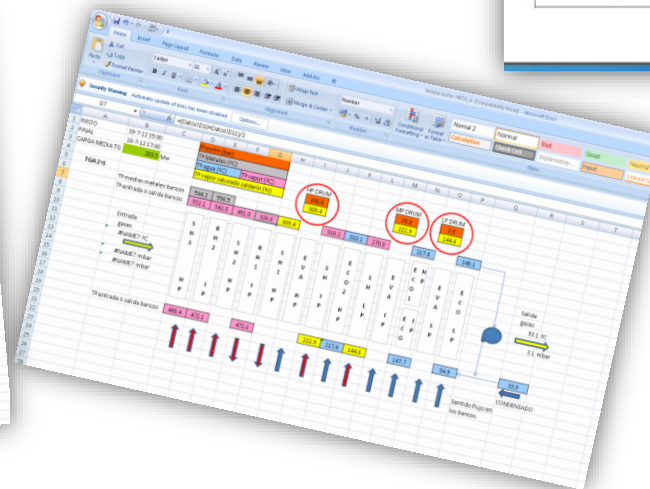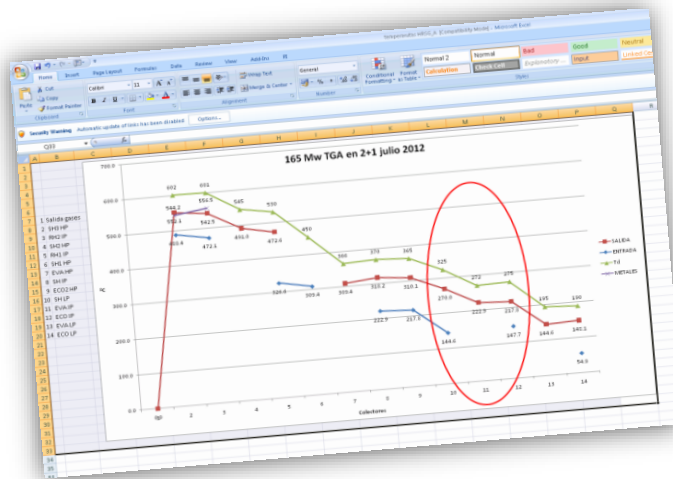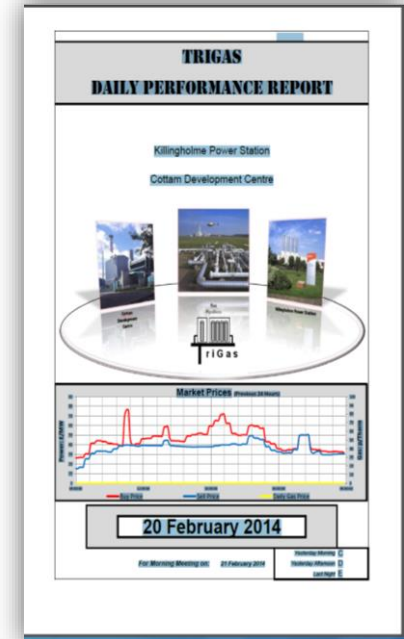
Example: Reporting

Automated daily, weekly and monthly reporting

- Emission monitoring and reporting
- Electrical generation
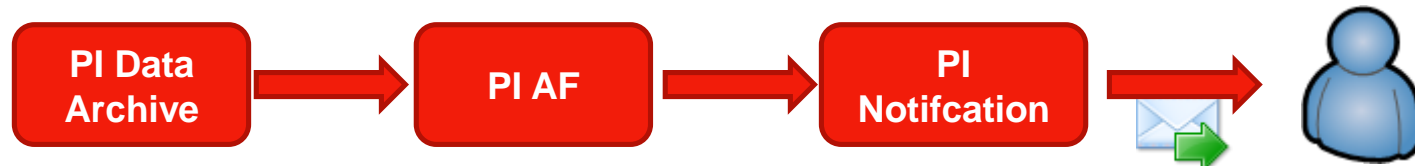- Imbalance reporting
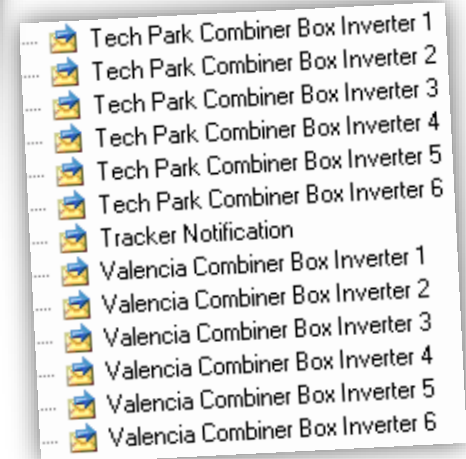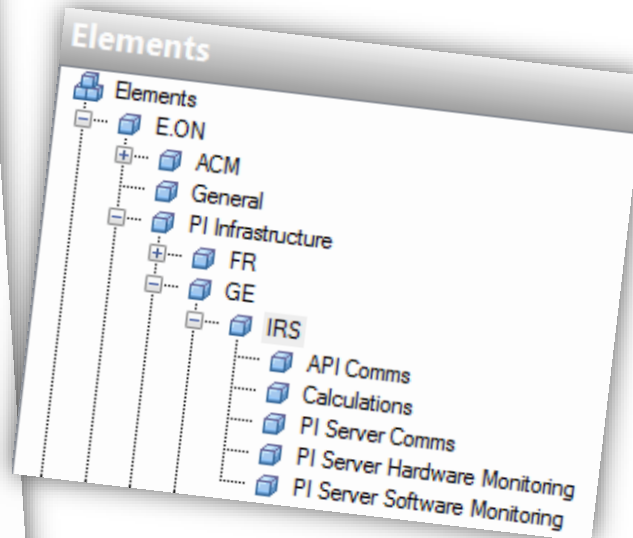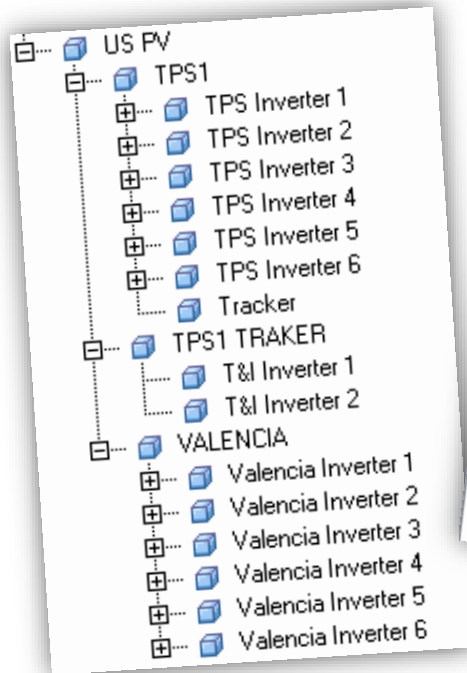- Plant performance reporting
- Shift Reports

Ad hoc and automated reports using PI DataLink and Asset Framework

Example: Alerting

PI Notifications is used to alert on defined conditions.

Example: Windfarm Monitoring

Visualization of various real time data, historical data and alerts about sites, turbines and generators in the same way independent from the vendor or turbine model.

Used by the central control room in UK and US for remote monitoring

HTML5 web application connected to the PI Server using PI SDK.
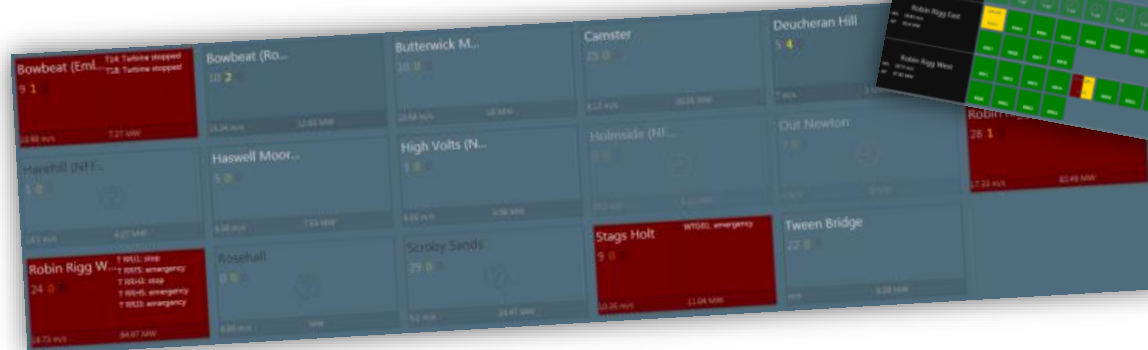
Example: Mobile application

Basic information of each site: technology, country, site name and real time data

Technician section for maintenance & navigation

Available for both wind and non-wind sites.

Native android application with a REST webservice connect to the PI Server using PI SDK

Example: Daily KPI Reporting

Report is specifically for site operations and fleet analyst.

It contains operational information, and is used to highlight current performance, turbine issues and other site technical markers

Daily report with data from the PI Server using the PI OLEDB Provider.

Example: Performance Analysis

Perform high quality turbine analysis by using various analytical techniques and methodologies.

Efficient and effective identification of any relative over performing or under performing turbines within the Renewables Fleet.

Webportal with data from the PI Server using the PI OLEDB Provider.
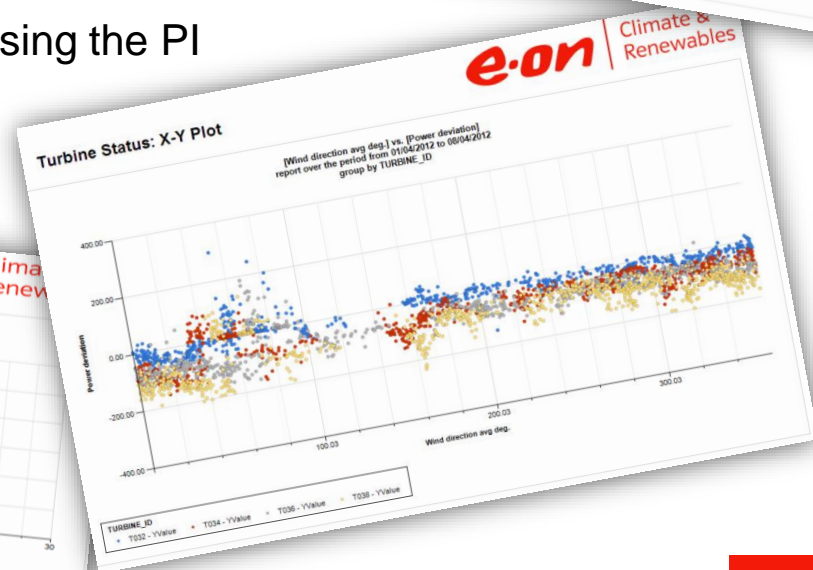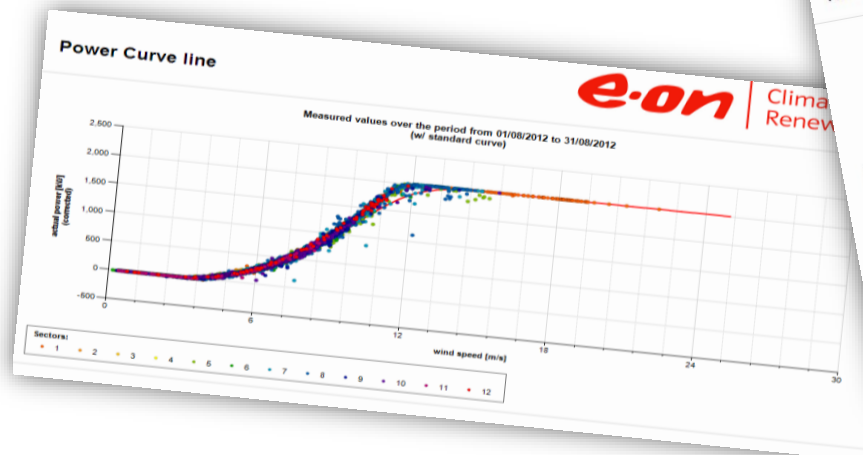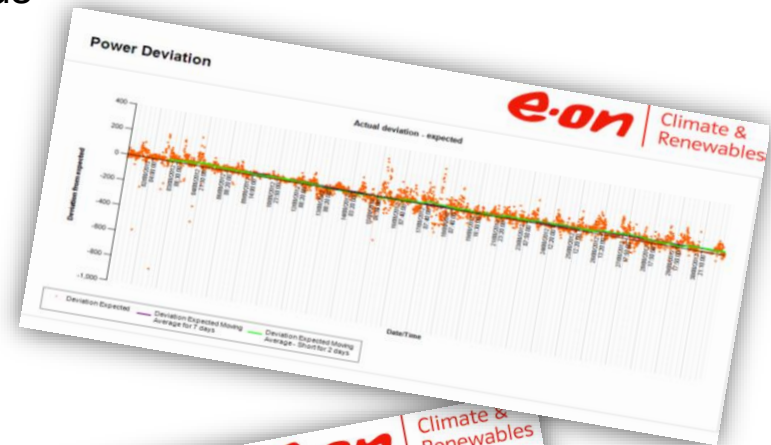
Users working with PI System about the value...

"…PI is an essential part of our routine maintenance and plant operation routines. Without PI this plant would fall back to looking at maintenance using DCS HDSR taking us back many years…."

"…We use PI on a daily basis to watch run ups and monitor plant issues. We use it for root cause analysis and advanced condition monitoring…."

"…PI is mainly used as a data historian, some people use it to develop process book screens but its main usage is to retrieve data for monthly reports…"

"…Before the implementation of PI, all the maintenance data needing were downloaded via DCS by operation team, right now the maintenance people are able, from their PCs, to create customized data collection, saving time and giving more efficiency to the process..."

e·on

Summary

"… applying the different requirements for both worlds enabled us to use the PI System in the most valuable way. We now have the necessary tools to get more out of the data and to continuously improve…"
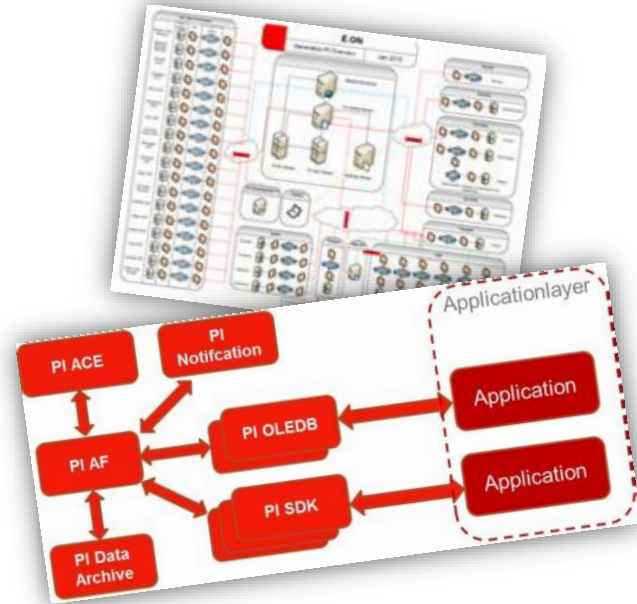
Business Challenge

- Applying business needs for the renewable and conventional world by taking the individual requirements into account.

Solution

- Conventional: Install a PI Server in each plant and grant access to the plant operations

- Renewables: Implement a global architecture and provide customized solutions based on PI Tools

Results and Benefits

- Reliable indicators and processes in real time

- Improved accessibility and sharing of information

- One consistent system across all plants for renewables and conventional

e·on

THANK YOU FOR YOUR ATTENTION

ANY QUESTIONS?

e·on

This presentation may contain forward-looking statements based on current assumptions and forecasts made by E.ON Climate & Renewables management and other information currently available to E.ON. Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future results, financial situation, development or performance of the company and the estimates given here. E.ON Climate & Renewables does not intend, and does not assume any liability whatsoever, to update these forward-looking statements or to conform them to future events or developments.