

# Standardizing on the PI System Infrastructure in Iberdrola Renewables' Business

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# Agenda

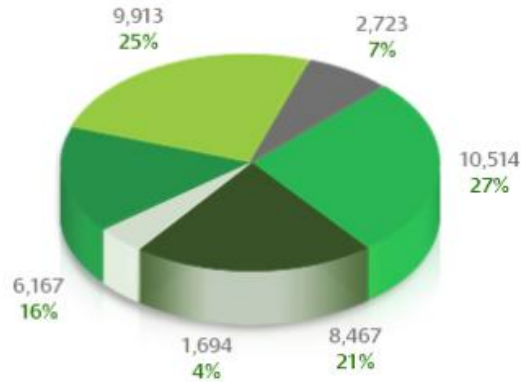


## *IBERDROLA OVERVIEW*

- *IBERDROLA*
- *IBERDROLA RENEWABLES*
- *ORGANIZATION, SCOPE AND OBJETIVES*

## *CHALLENGE*

- *PI SYSTEMS IN IBERDROLA RENEWABLES*
- *INICIAL SITUATION AND EVOLUTION*
- *WHAT IS THE PI COLLECTOR?*
- *PI COLLECTOR IN NUMBERS*
- *STANDARD*
- *GLOBAL INDICATORS, PROCESSES & TOOLS*
  - EXAMPLE 1: Potential Generation*
  - EXAMPLE 2: Global PI AF Infrastructure*
  - EXAMPLE 3: Global Dashboard*



- Renewables 27%
- Hydroelectric 21%
- Cogeneration 4%
- Nuclear 16%
- Gas combined cycle 25%
- Coal 7%



Net Production  
**39 477 GWh**



Installed Capacity  
**44 932 MW**



**61%** of installed capacity is **CO2 Free**

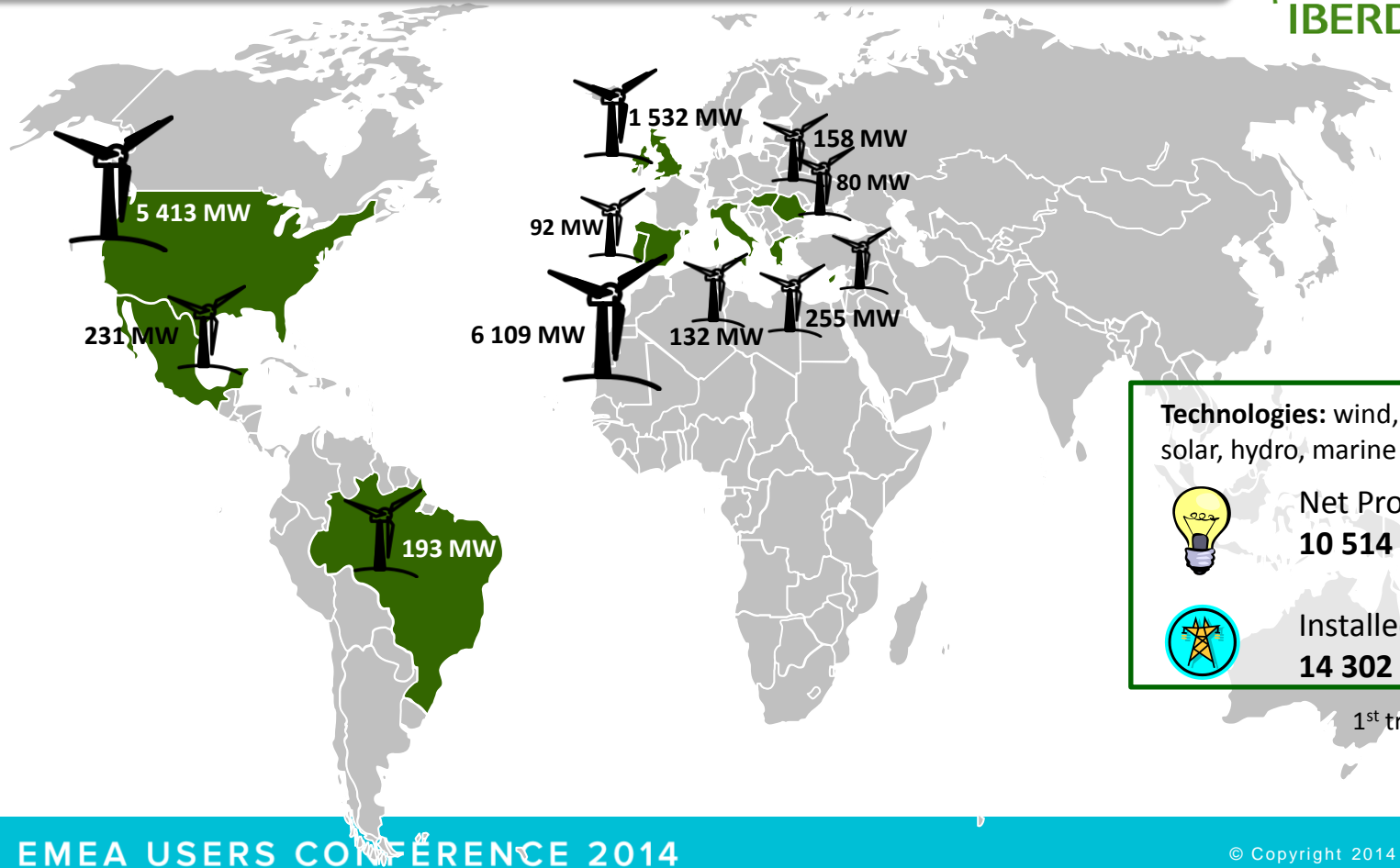


Supply points under management  
**28.5 Millions**



Iberdrola Employees  
**28 201**

1<sup>st</sup> trimester 2014



**Technologies:** wind, offshore, solar, hydro, marine (waves)



**Net Production**  
**10 514 GWh**



**Installed Capacity**  
**14 302 MW**

1<sup>st</sup> trimester 2014

# ORGANIZATION, SCOPE AND OBJETIVES

## RENEWABLES

Iberia & International  
Business

US  
Business

UK & Offshore  
Business

Business Services

Performance Analysis & Operations Tools

Technical Division

SIZE  
>14 000 MW

DIVERSIFICATED  
> 10 000 WT

Business Areas  
originally very  
differentiated

Global  
Spread



Operation Approach

New view

Globalization

Global Tools Supporting Operations

Main Tools: DOMINA & Meteoflow

Standardization: Reporting & Indicators

Good practices are identified.  
Transversal communication between  
the areas in a common language

Share experiences and know-how

Performance Analysis in a global way

↑ Income

↓ Costs



## PI SYSTEMS IN IBERDROLA RENEWABLES



### PI USA

4 PI Servers (HA)  
71 PI OPC Clients (23 HA)  
2 OPC Servers  
3 PI ACE Servers (HA)  
2 PI AF Server (HA)  
34 Other interfaces  
Disaster Recovery  
(3 PI servers in HA and  
1 PI Server standalone)  
**> 300K SIGNALS**

### PI IBERIA & INTERNATIONAL

3 PI Servers  
(HA, 1 server standalone)  
60 PI OPC Servers (HA)  
> 130 PI UFL Interfaces  
1 PI ACE Servers  
1 PI AF Server  
Disaster Recovery  
(2 PI servers in HA)  
1 PI Server + 1 PI OPC  
Server+ 1 PltoPI interface  
**near 600K SIGNALS**

### PI UK & OFFSHORE

2 PI Servers (HA)  
48 PI OPC Servers (HA)  
1 PI ACE Servers  
1 PI AF Server  
5 Other servers  
Disaster Recovery  
  
**> 20K SIGNALS**

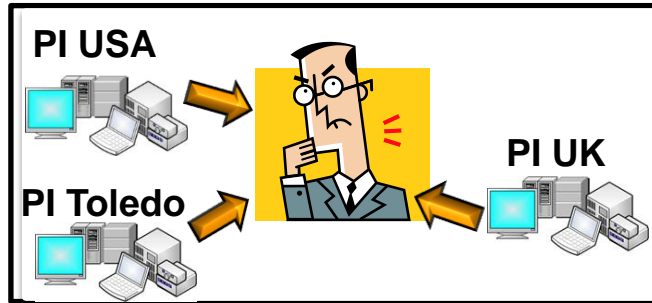
### PI COLLECTOR

2 PI Servers (HA)  
2 PI Node servers (HA)  
2 PI ACE Servers  
2 PI AF Server (HA)  
2 Other servers  
**> 200K SIGNALS**

### TOTAL

Near **1,2M signals**  
9 PI Servers in HA  
181 OPC Servers  
7 PI ACE Servers  
6 PI AF Servers  
3 Disaster recovery

## INITIAL SITUATION AND EVOLUTION



### Three independent PI Servers (COREs)

- Different PI System architectures
- Different standard
- Different purchase conditions
- Information is not stored under the same date base

*What about storing all relevant information under the same database?*



### Enterprise Agreement

- Normalize the architecture across the sites
- Fleet upgrades to latest versions of all PI System assets
- Develop High Availability and disaster recovery
- Ensure that maximum efficiency and reliability in the servers
- Training & guidance on best practices



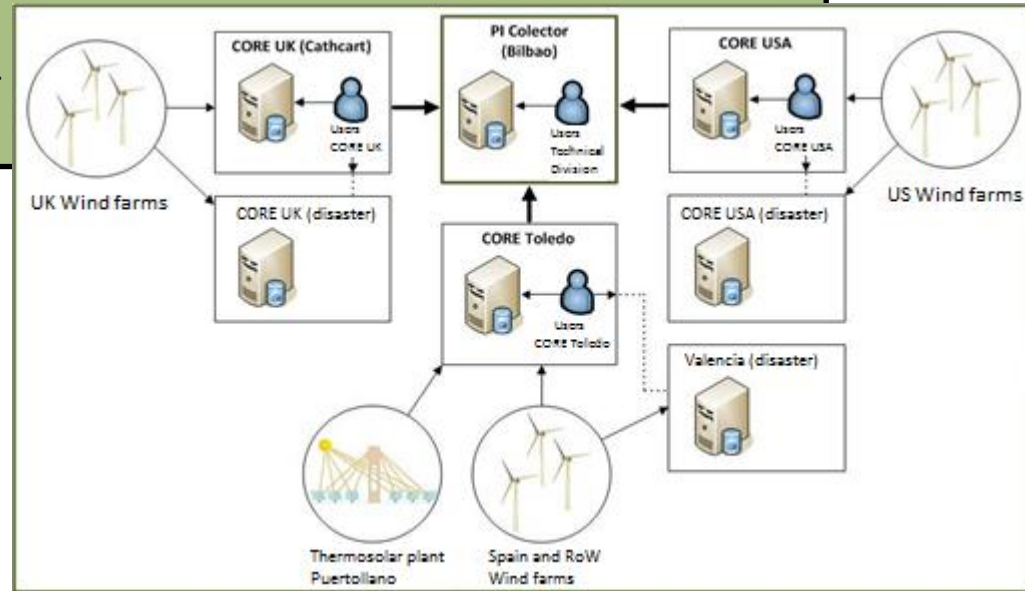
### Results

- PI Collector
- Global indicators calculations and tools developing are simple due to the standardization between PI System
- Relevant information is accessible and easy to find
- Taking advantage of our Know how
- Taking advantage of synergies
- Reinforce global use of PI System

## WHAT IS THE PICOLLECTOR?

**The PI COLLECTOR is born as the central PI System which is fed by Local PI Systems:**

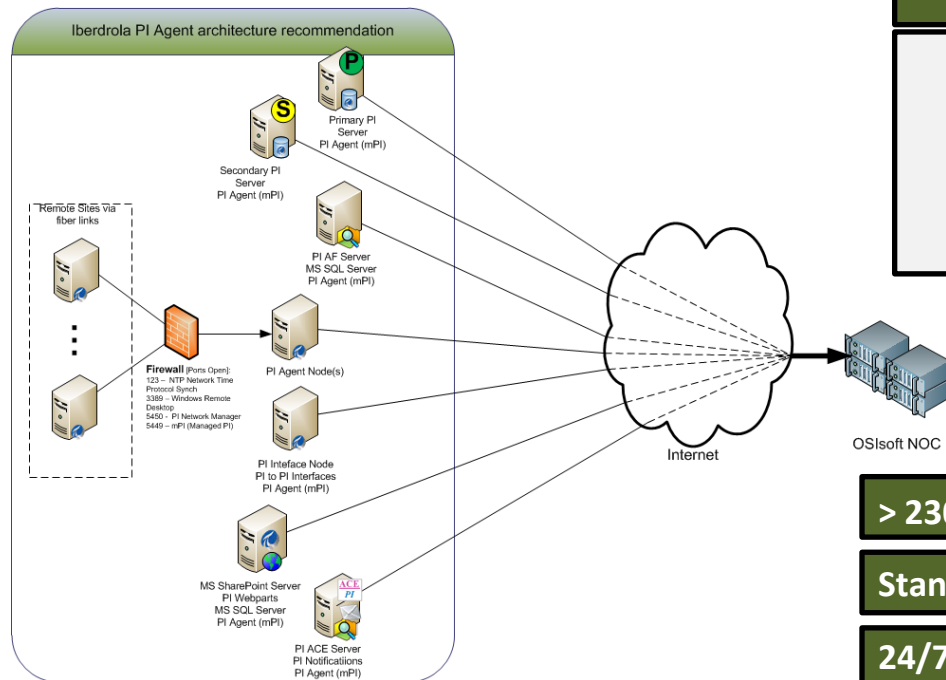
- Standardized information.
- Gathers the most relevant information independently from the country of the asset.
- Facilitates the calculation of global indicators.
- Orientated to Reporting and performance analysis.
- Feeds in-house tools.





## 10 Servers

PI Server in HA	2 x PI ACE server
PI Node in HA	2 x PI AF server
PI WebParts	2 x PI AF server
Development PI Server	



> 230 000 signals from assets all around the world.

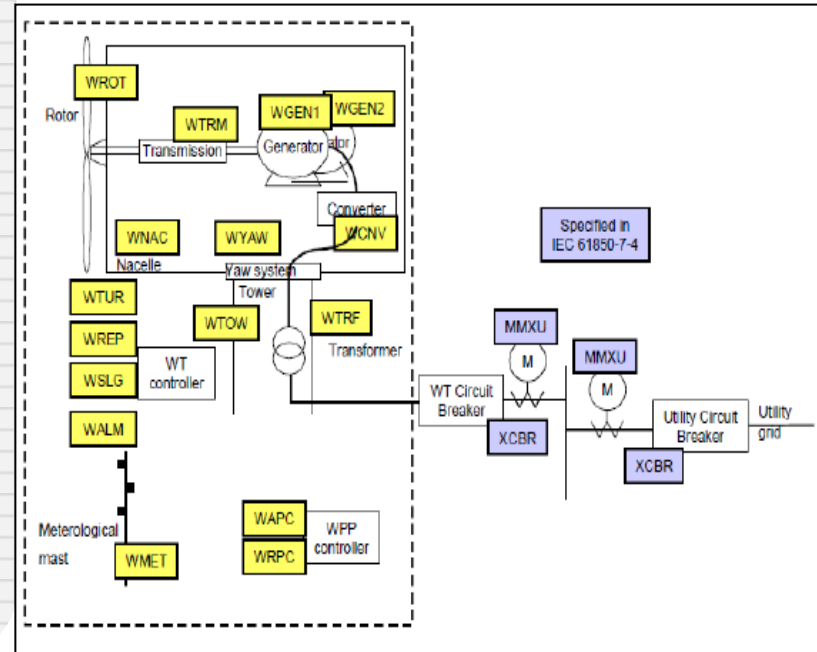
Standardization for all the Business Areas.

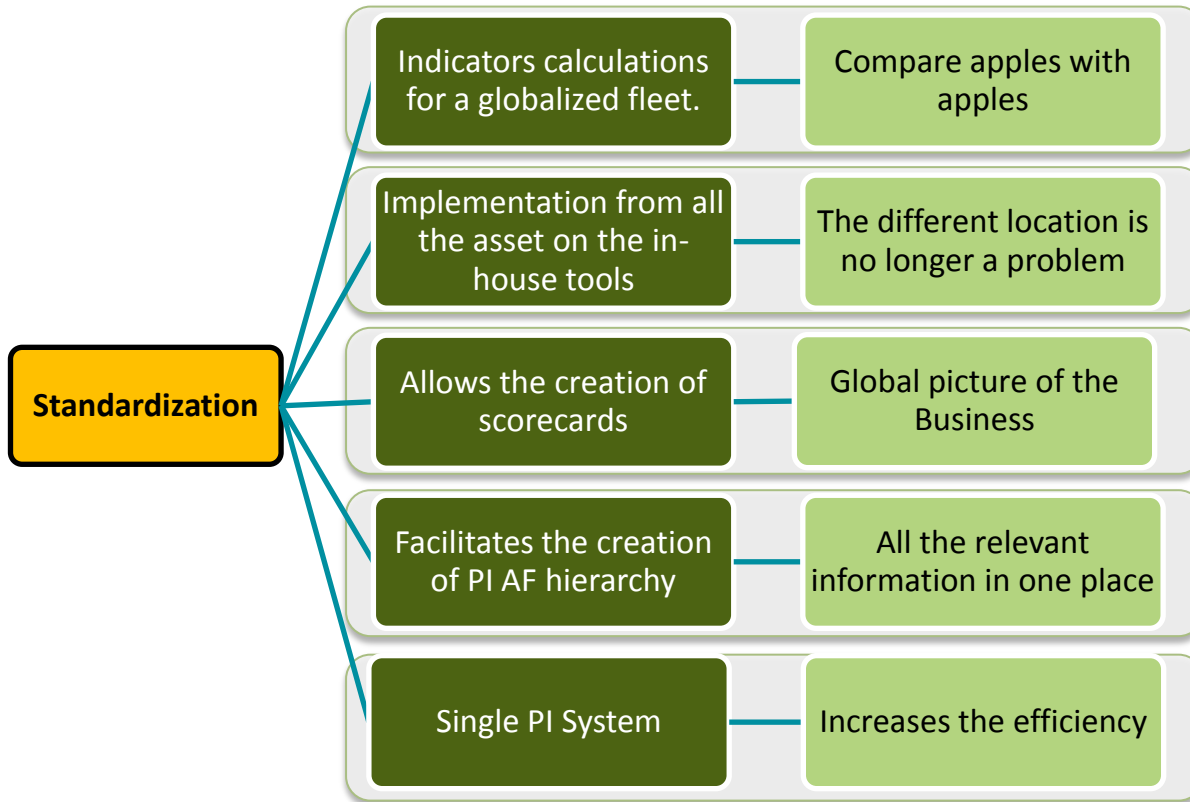
24/7 Support.

Updated software to the latest release.

## Standard

- *Due to the globalization from the company in the different Business Areas, the definition of a standard which unify criteria and allow to evaluate the assets in a same way has become necessary.*
- *Based on the IEC 61400-25 and 61850.*
- *The standard makes easier the indicator analysis, lets the unification of evaluation criteria and improves the efficiency when evaluating the assets of IBR.*
- *Facilitates the automatic tools development for manage the assets.*





Some examples:

- Global PI AF Infrastructure
- Actual Production, Potential Generation, Effective Forecast...
- Global Dashboard

### Main characteristics

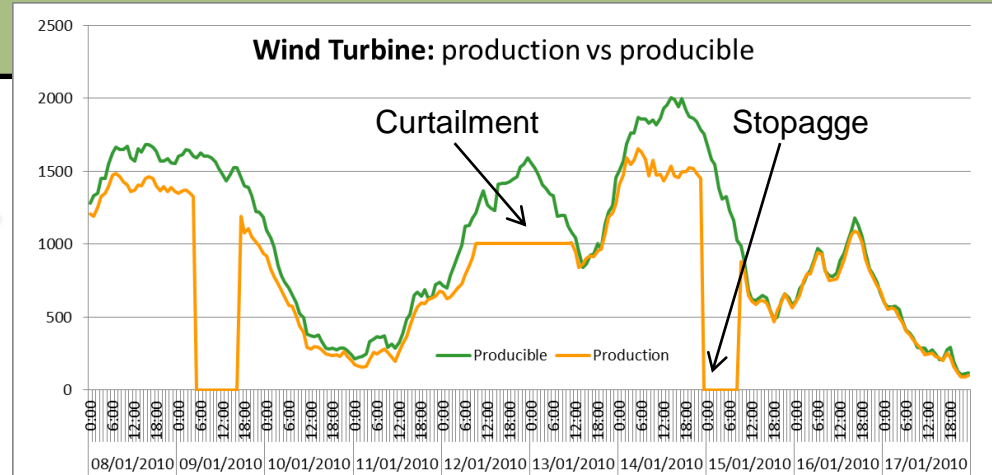
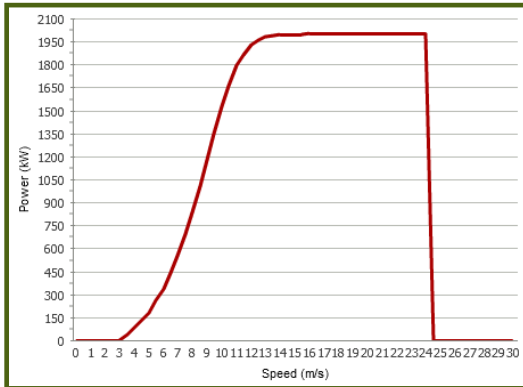
- Calculated on **Real Time**.
- For more than **14 000 MW**.
- Accessible **worldwide**.
- **Standard** indicators for all the assets.
- Used by all the Business Areas.



## EXAMPLE 1: Potential Generation

### Potential generation:

- It is the indicator which calculates the **potential generation energy which can be produced in a facility at a 100% availability.**
- It is calculated in a **10 minute basis in real time.**
- The WTG wind speed and the power curve are the base to calculate real time potential generation.
- Every time there is better wind speed data (communication failures recoveries, etc.), it is updated.
- It is calculated at both wind farm level and wind turbine generator level.
- PI AF helps this calculation to improve efficiency.



## EXAMPLE 2: Global PI AF Infrastructure



PI AF has allowed us to:

- Gather **relevant information** from the assets in one **single place**.
- Have all the fleet organized hierarchically.
- **Improve the performance** from the indicators calculation.
- Use **new tools** to take more advantage from the PI System data.
- **Standardize** the organization and data requirements from our assets.

The screenshot displays the PI System Explorer application. On the left, a hierarchical tree shows the structure of assets, starting from 'Elements' and branching into 'Business', 'ESPAÑA', 'Castilla La Mancha FV', 'Castilla y Leon', 'BURGOS', and various plants like 'BUREBA (PLANT)', 'CERRO BLANCO (PLANT)', etc. The main pane shows the 'A01 (GU)' asset details. The 'General' tab is active, displaying a table of attributes and their values. The right pane shows configuration options for the selected attribute, 'Gearbox Temperature'.

Name	Value
GBX HLA	50
GBX LLA	25
GBX MIN PCT GOOD	75 %
GBXS HLA	30 %
GBXS LLA	15 %
Gearbox Alarm	OK
Gearbox Alarm Counter	0 count
Gearbox Status	OK
Gearbox Temperature	65,5 °C
High CF	OK
High Level HCF Counter	0 count
High Level LCF Counter	6 count
High Level MCF Counter	2 count
High Wind	Inactive
LastExecution	01/01/1970 0:00:00
Latitude	42.51925
Longitude	-3.40945
Low CF	OK
Low Level HCF Counter	1 count

Configuration for 'Gearbox Temperature':

- Name: 24h Gearbox Temperature Average
- Description:
- Configuration Item:
- Categories:
- Default UOM: degree Celsius
- Value Type: Double
- Value: 65,0015341732267 °C
- Data Reference: PI Point
- Settings...
- Gearbox Temperature; TimeMethod=TimeRange; RelativeTime=24h; TimeRangeMethod=Average; TimeRangeMinPercentGood=0; UOM=°C

## EXAMPLE 2: Global OU AF Infrastructure



\\FREPI\ARAF2\Iberdrola Renovables - PI System Explorer

File Edit View Go Tools Help

Database Query Date Refresh New Element New Attribute

Elements

- IBR Renovables
  - Business
    - ESPAÑA
      - Castilla La Mancha FV
      - Castilla y Leon
      - CLM - Campollano
      - Cordubente
      - CORDUENTE (PLANT)
      - DUERO-TAJO
      - EBRO-CANTÁBRICO
      - Galicia - Sotavento
      - Galicia FV
      - IB NORTE
      - IB ORIENTAL
      - IB SUR
        - CADIZ
          - ALBUREJOS (PLANT)
          - BOLAÑOS (PLANT)
          - CHORREADEROS ALTOS (PLANT)
          - CHORREADEROS ALTOS II (PLANT)
          - CHORREADEROS BAJOS (PLANT)
          - DOÑA BENITA (PLANT)
          - ISLETES (PLANT)
          - VENZO (PLANT)
          - ZORRERAS (PLANT)
        - GRANADA
        - HUELVA
        - MÁLAGA
        - JÚCAR-SEGURA
        - Puertollano
        - Rioja no Gest
        - INTERNATIONAL
        - UNITED KINGDOM
        - UNITED STATES

- Geography
- Meteo Masts
- Substations
- Technology
  - Biomass Plant
  - Mini Hidro Plant
  - Offshore Wind Farm
  - Onshore Wind Farm
  - Sea Power Generation Plant
  - Solar Farm
  - Thermosolar Plant

Element Searches

Elements

Event Frames

ALBUREJOS (PLANT)

General Child Elements Attributes Ports Analyses Version

Filter

Name	Value
Active Power in ST	0 kW
Active Power Set Point	10 kW
Active Power Set Point Code	0
Business Unit	ESPAÑA
Children Errors	A01 (GU): ERROR A02 (GU): ERROR
Commercial Operation	10000 kW
Commissioned	10000 kW
Company	Ibernova Promociones
Consolidated	100 %
Country	ESPAÑA
Decommission Date	31/12/9999 0:00:00
Domina ID	237
Effective forecast	0 kWh
Effective production	0 kWh
Effective Wind Speed	Bad
Full Load	10000 kW
GBXS Gearbox Temperature Average	No se ha encontrado ningún atributo hijo según las condiciones
GBXS Pct Good	0 ppu
IBR_PI_Code	ALBUR
Installed	10000 kW
LastExecution	01/01/1970 0:00:00
Legally Registered	10000 kW
Local PI Code	ALBUR
Maintenance Area	CADIZ
Maintenance Region	IB SUR
Managed	True
MVG Loss Coefficient	0,97 %
Operating	10000 kW
Participated	100 %

PI Tags

Asset general information

PI ACE Tags

Alarms

Asset general information

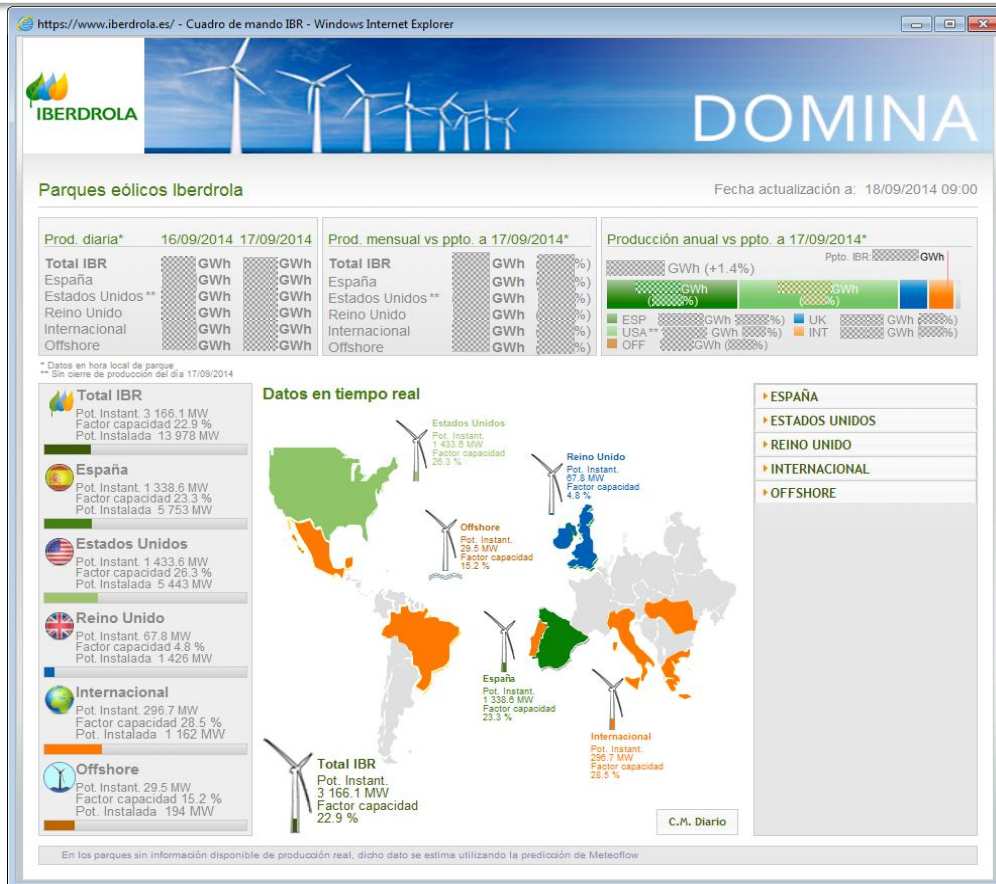
### Global Dashboard:

- A web based tool **developed in-house** which gives the **big picture of the Business**.
- **Gathers the most relevant KPIs and assets information.**
- Facilities well organized.
- **Flexible tool.** The displayed data can vary depending on the user needs.
- **Historical data available.**
- Easy to use.
- Nice design.

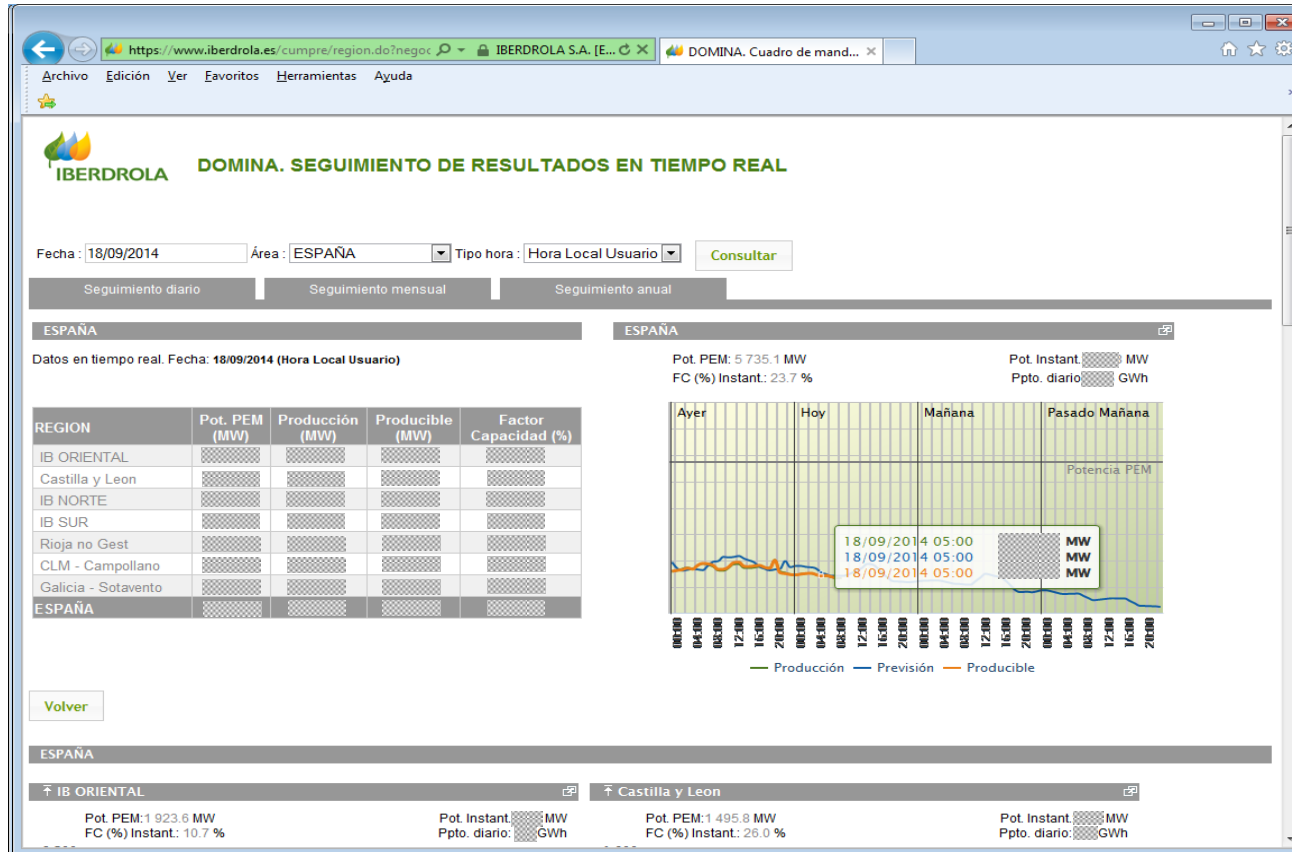




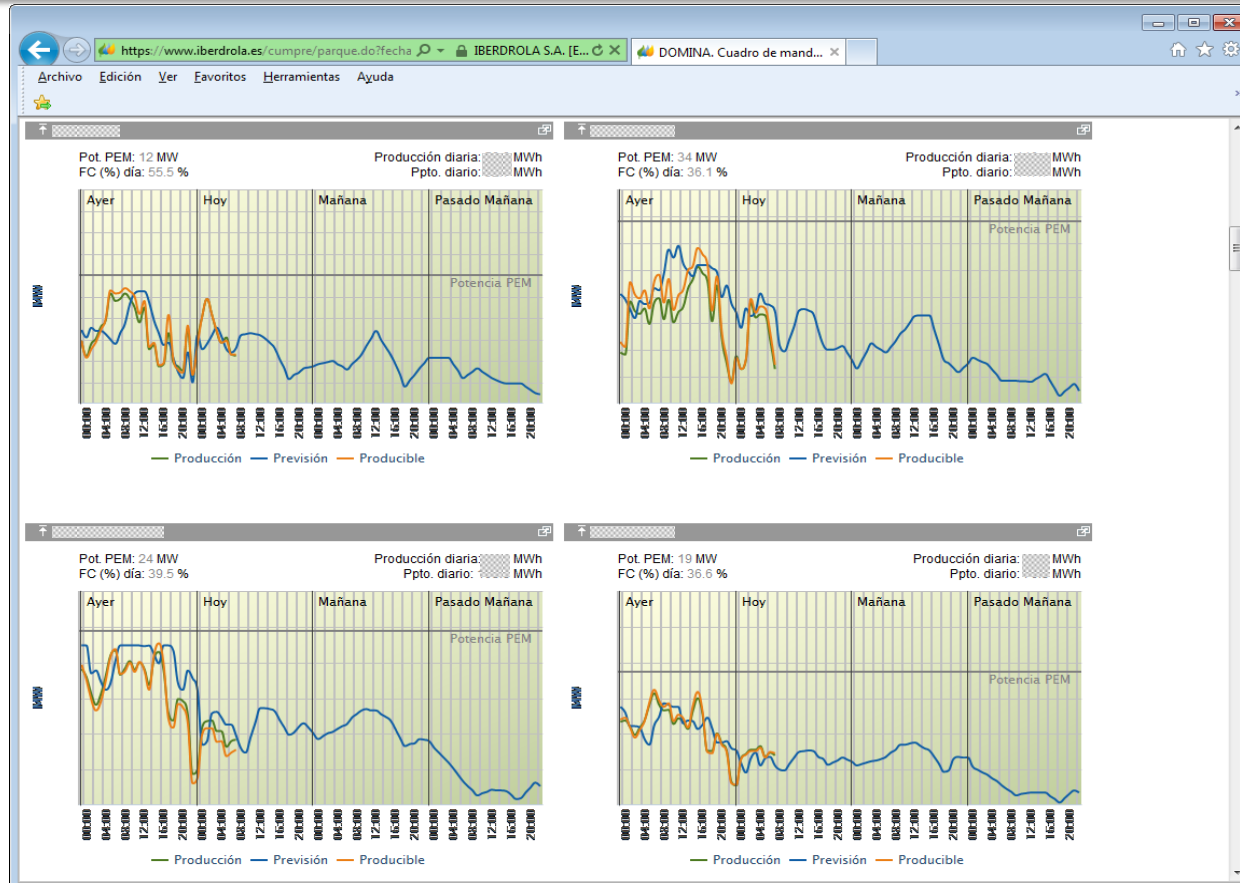
## EXAMPLE 3: Global Dashboard



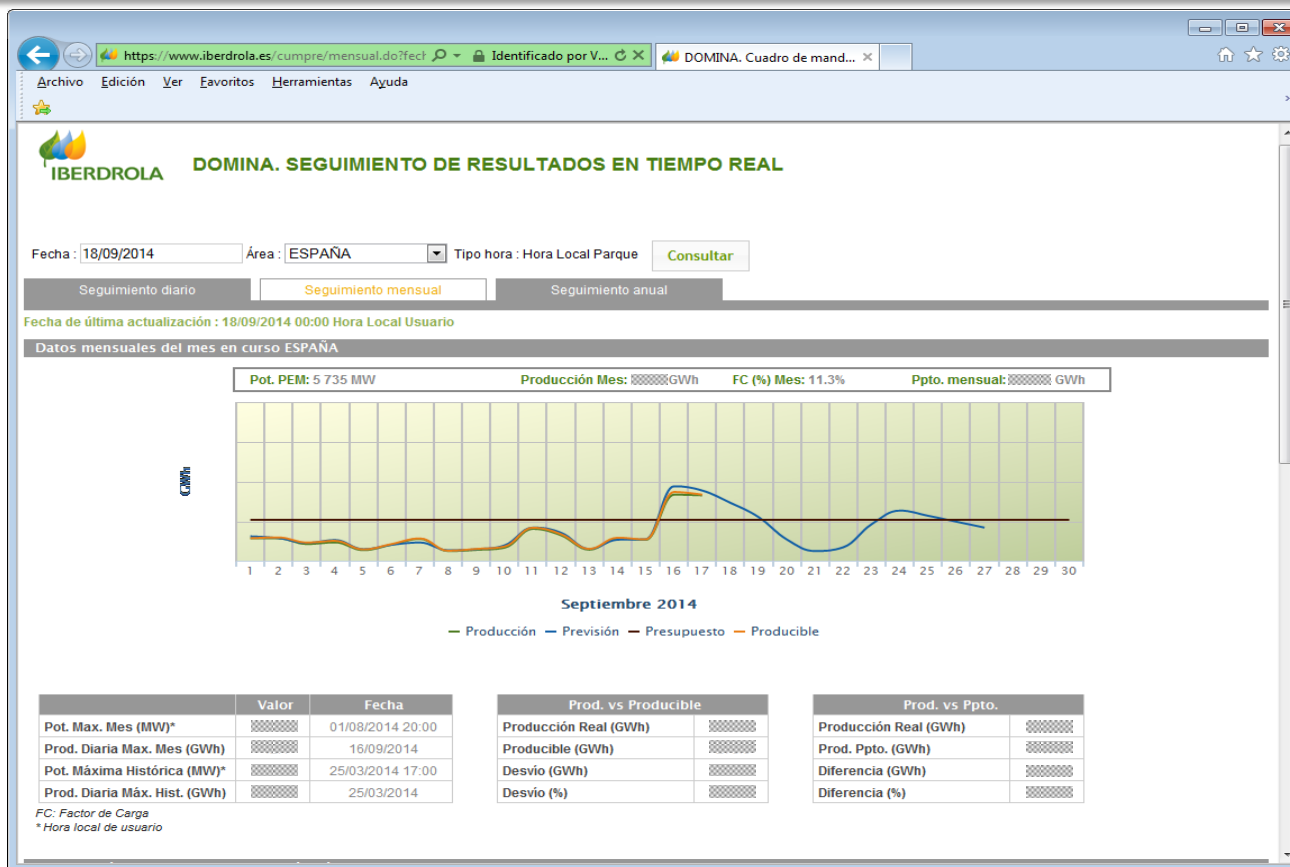
## EXAMPLE 3: Global Dashboard



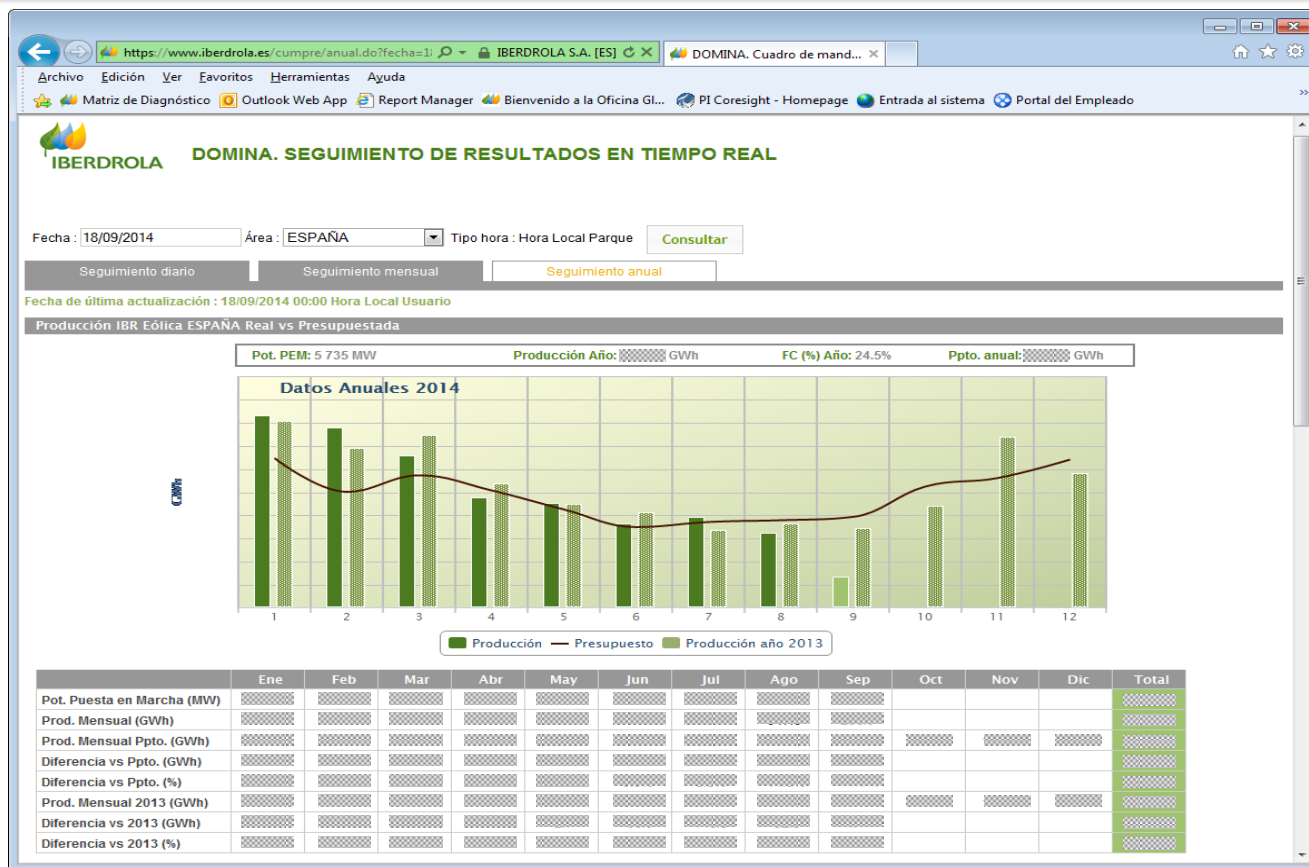
## EXAMPLE 3: Global Dashboard



## EXAMPLE 3: Global Dashboard



## EXAMPLE 3: Global Dashboard



# PI System standardization in the Iberdrola Renewables Business

*“...standardization and the PI COLLECTOR approach have allowed us to deliver worldwide consistent best practice in the way we operate. We now have the necessary tools to keep on redefining excellence and to continuously improve...”*



## Business Challenge

- Huge fleet
- Assets all around the globe and different organizations.
- Standard procedures needed.
- Benchmark between countries.
- Need to potentiate the know-how and synergies.

## Solution

- Standardization across sites
- Creation of PI COLLECTOR
- Enterprise Agreement
- Ensure maximum efficiency and reliability



## Results and Benefits

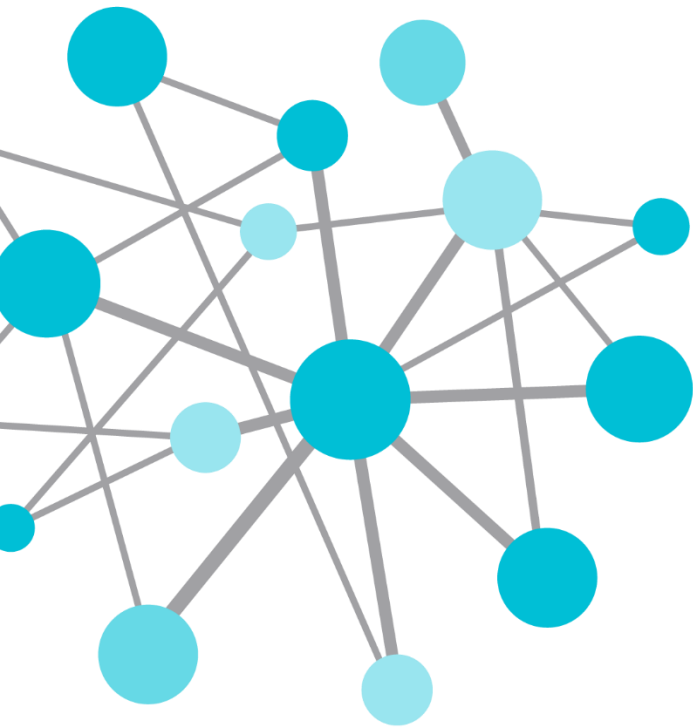
- Reliable indicators and processes at real time
- Web scorecard
- Improve in forecast accuracy
- Increase in efficiency

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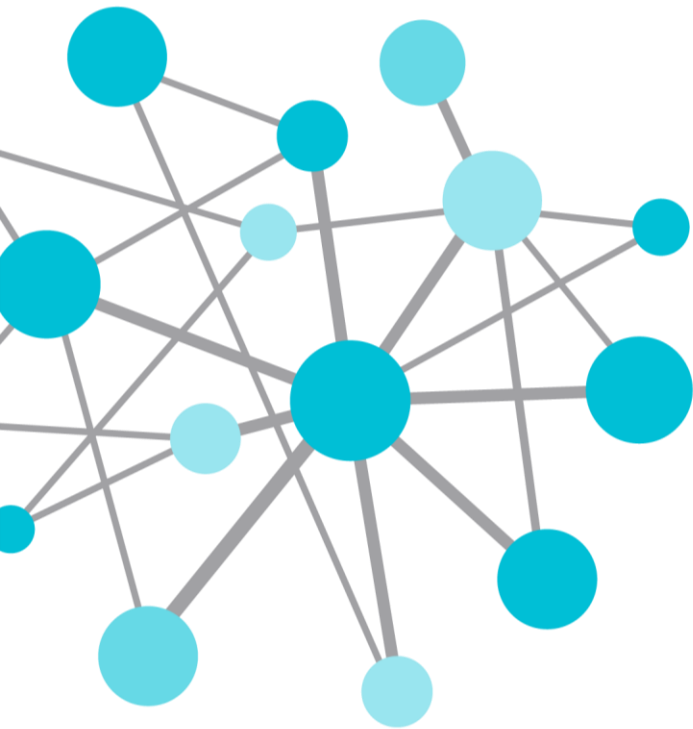
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the **microphone**  
before asking  
your questions



State your  
**name &  
company**





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