CORE Usage of PI System Improves Curtailment Strategies and Increases Production

Presented by **Eva López & Maite Marín**
CORE (Renewable Energies Operation Center)

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Agenda

IBERDROLA´s Renewable Energies Business

CORE Toledo

- Energy Management
- PI Architecture

Improvement of Curtailment Strategies

- PI AF Deployment
- Adoption of New TSO´s Curtailment Strategy
- Results & Benefits

Our Company

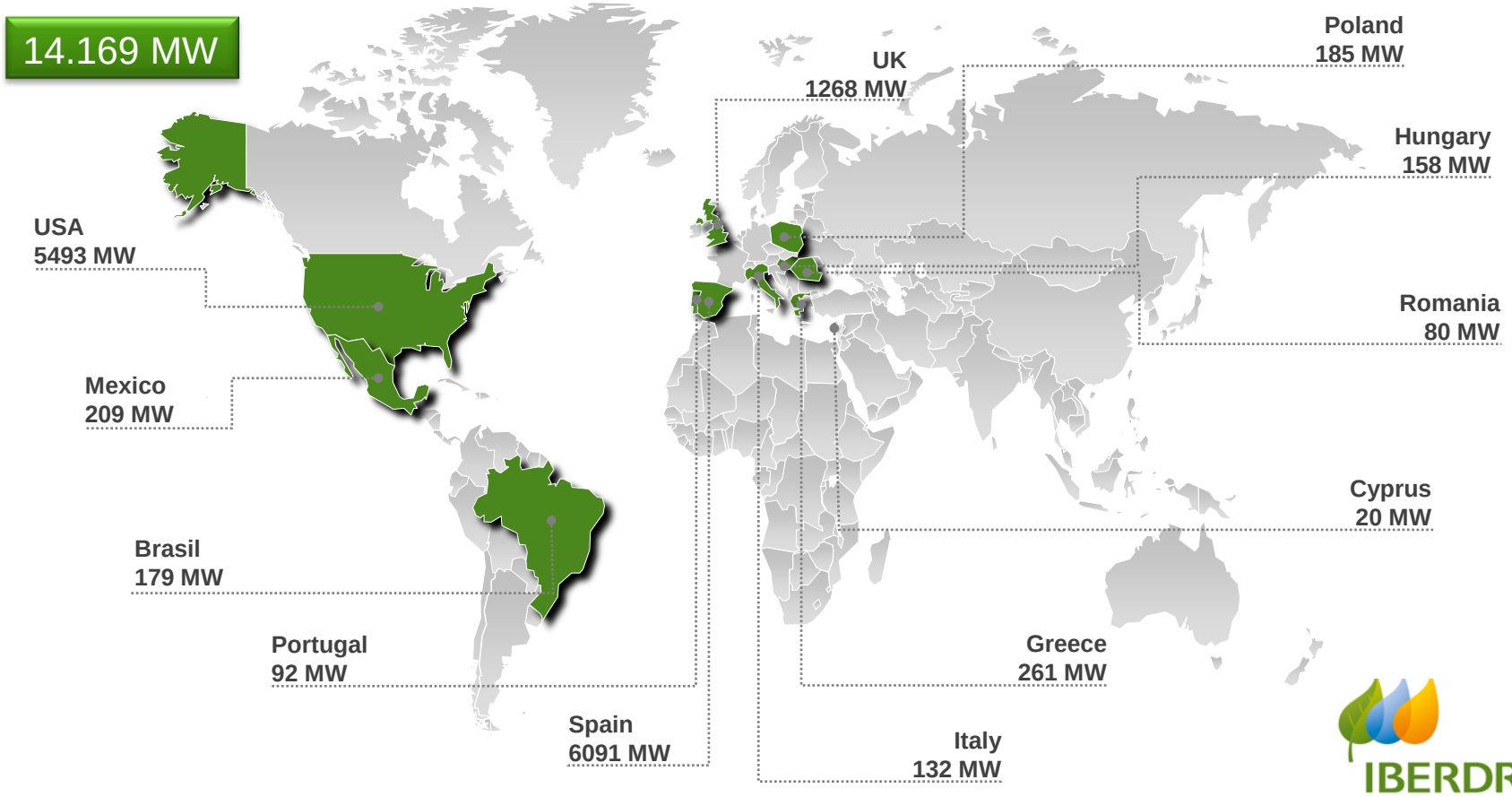
IBERDROLA (H1 2013)

- One of the largest power generation companies in the world
- First energy group in Spain
- Total power installed: 44,950 MW
- Distributed energy: 107,097 GWh
- Consumers: 31.89 millions
- Employees: 30,583

RENEWABLE BUSINESS

- One of the world leaders in wind power generation
- Total installed capacity of 14,169 MW all over the world
- Leader in offshore wind energy development
- Other technologies: solar, hydro, marine (waves)

IBERDROLA RENEWABLE ENERGIES BUSINESS (H1 2013)



Agenda

IBERDROLA´s Renewable Energy Business

CORE Toledo

- Energy Management
- PI System Architecture

Improvement of Curtailment Strategies

CORE Toledo

Manages and controls assets all over the world

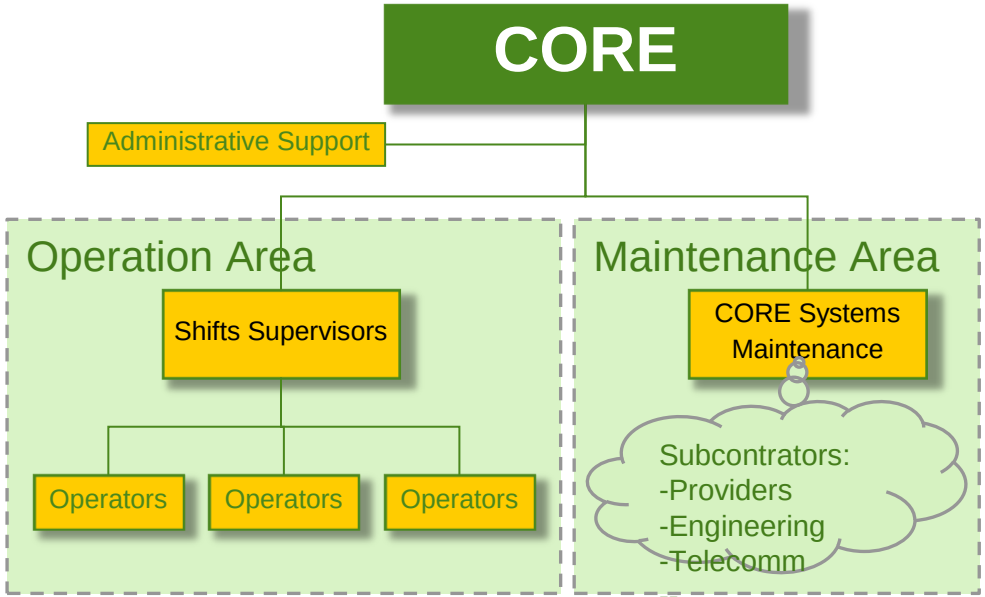
- > 6000 wind turbines
- > 200 wind farms in Spain and other countries
- About 200 electric substations
- About 60 small hydro plants
- 1 solar thermal plant

Optimizes efficiency and maximize the profitability of the facilities

- Reduction of operation and maintenance costs
- Maximize production through improved availability
- Centralized management of information in real time
- Centralized communication with other energy management centers
- Energy management delivered to the network

CORE Organization

Highly qualified personnel responsible for continuous monitoring of the operation, incident detection and alarm activation



Team of 35 people

- 28 in shifts 24h/7d
- 5 people in the IT area
- 1 Administrative Support
- 1 Manager

There are 3 shifts per day

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IBERDROLA´s Renewable Energy Business

CORE Toledo

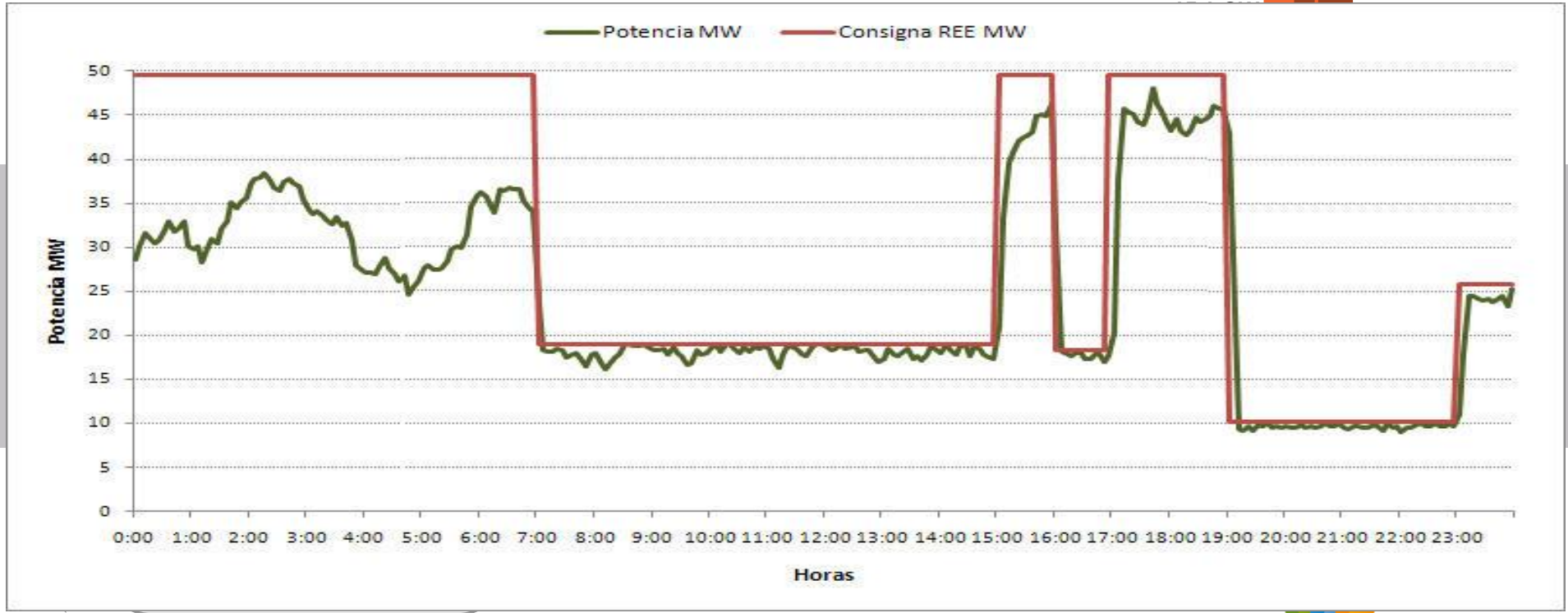
Energy Management

PI System Architecture

Improvement of Curtailment Strategies

Energy Management

20,7 GW



Active power regulation

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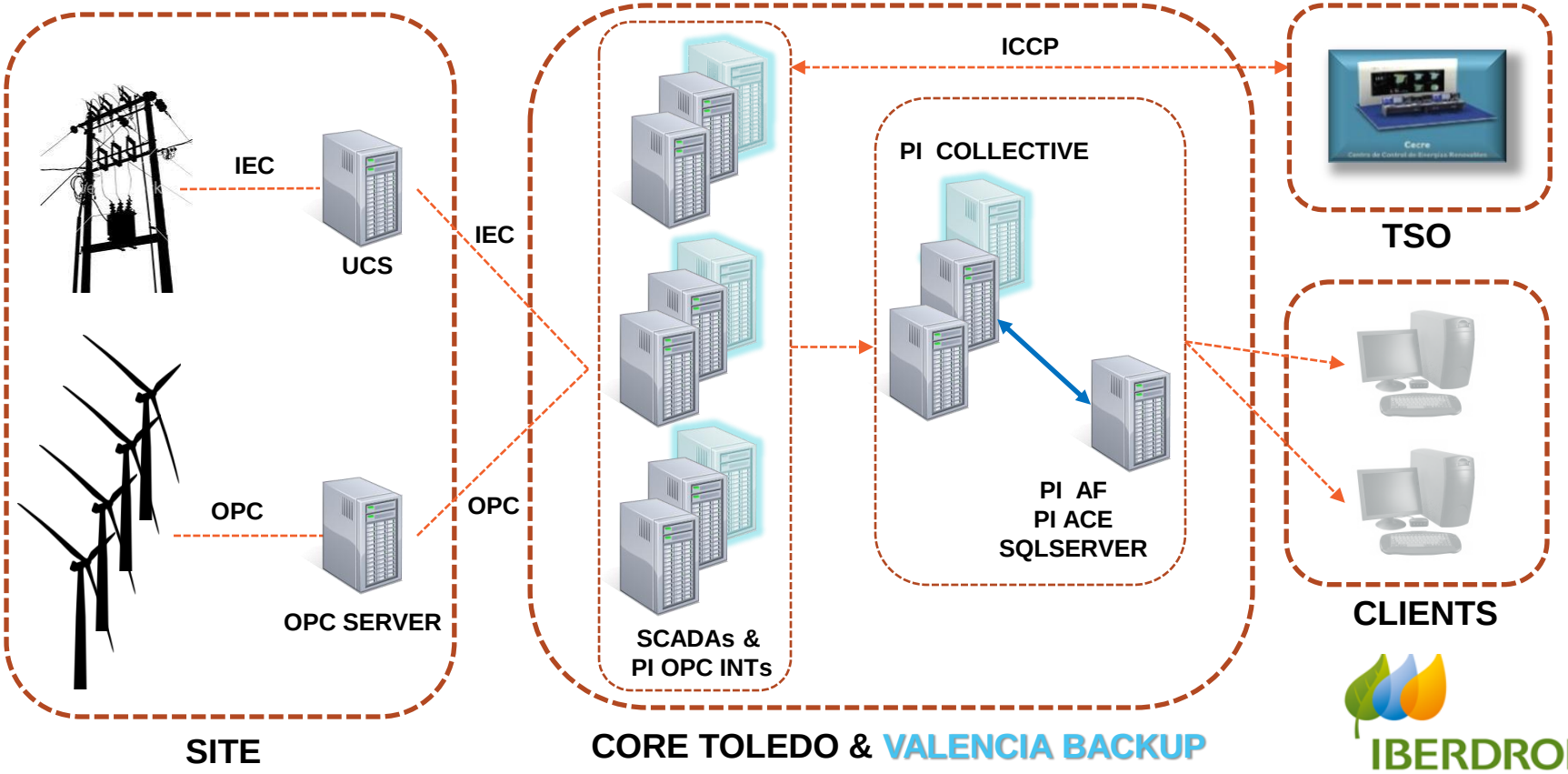
CORE Toledo

- Energy Management
- **PI System Architecture**

Improvement of Curtailment Strategies

PI System Architecture



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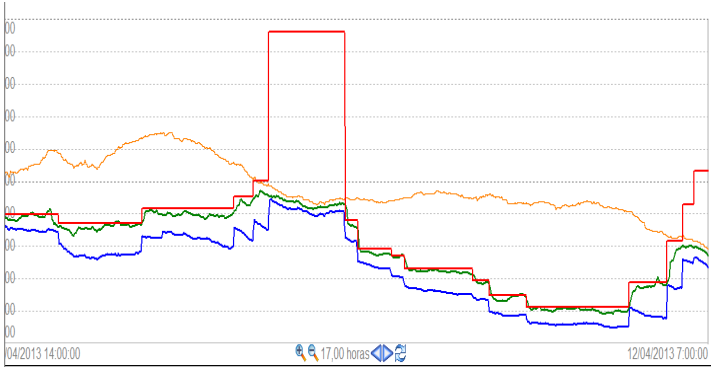
PI System usage to improve Curtailment Strategies

"… 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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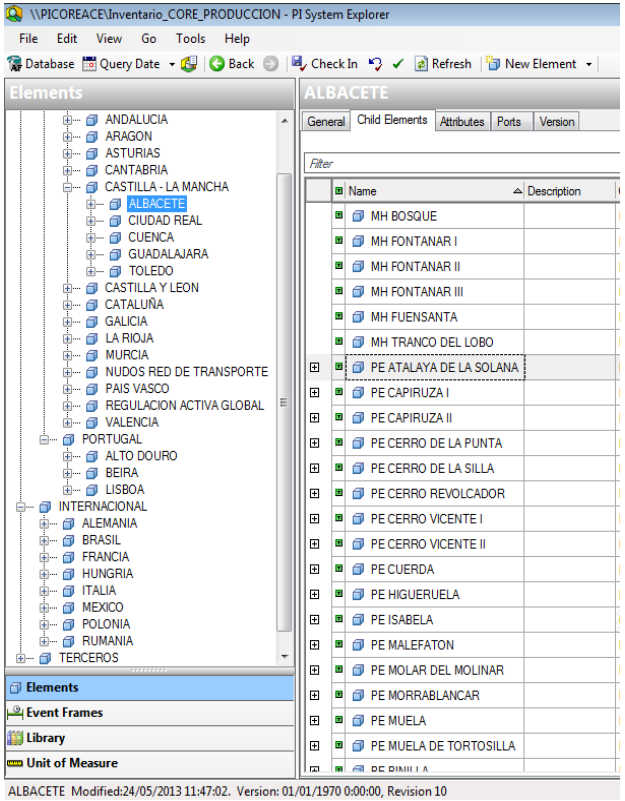
PI AF Deployment



Four day training on PI AF as an advantage of our Enterprise Agreement

All our premises defined through a few templates

Every new functionality easily aggregated to the different levels

Good to see at a glance regional totals: power, turbine states, curtailment setpoints, …

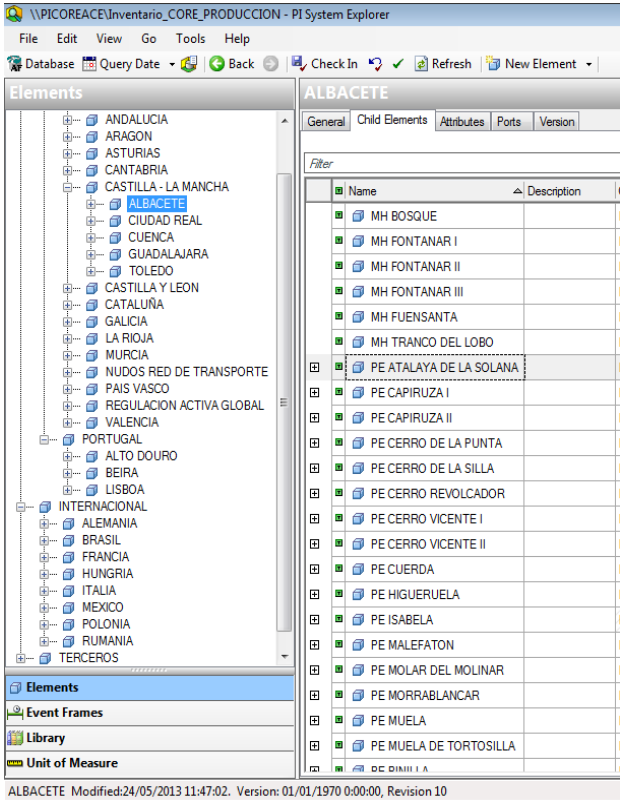
Great to have an expected power in real time

Next step was to use this for energy management

First we draw a few displays with PI ProcessBook and a few templates with PI DataLink

Not enough to manage millions of data

PI AF Deployment



Thanks to Enterprise Agreement, the OSISoft Center of Excellence came to our rescue

Through PI ACE they developed a solution that inserts PI AF calculations into PI Tags

They are available as quick as any other value in PI Server

We can use real time calculated data: expected power, total power,… to improve our energy management strategies

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Adoption of New TSO´s Curtailment Strategy

Different types of global setpoints defined by REE (Spanish TSO)

- Technological: when wind turbines support voltage dip regulation
- Economical: a few wind farms with special conditions

Data taken into account by CORE calculated by PI AF

- Total expected power calculated in real time depending on wind conditions
- Total current production also in real time
- Particular operating conditions in wind farms

CORE changed criteria to manage curtailments taking maximum advantage of wind conditions

- We used to curtail or stop many turbines in different wind farms
- Now we stop a few wind farms and leave the rest uncurtailed

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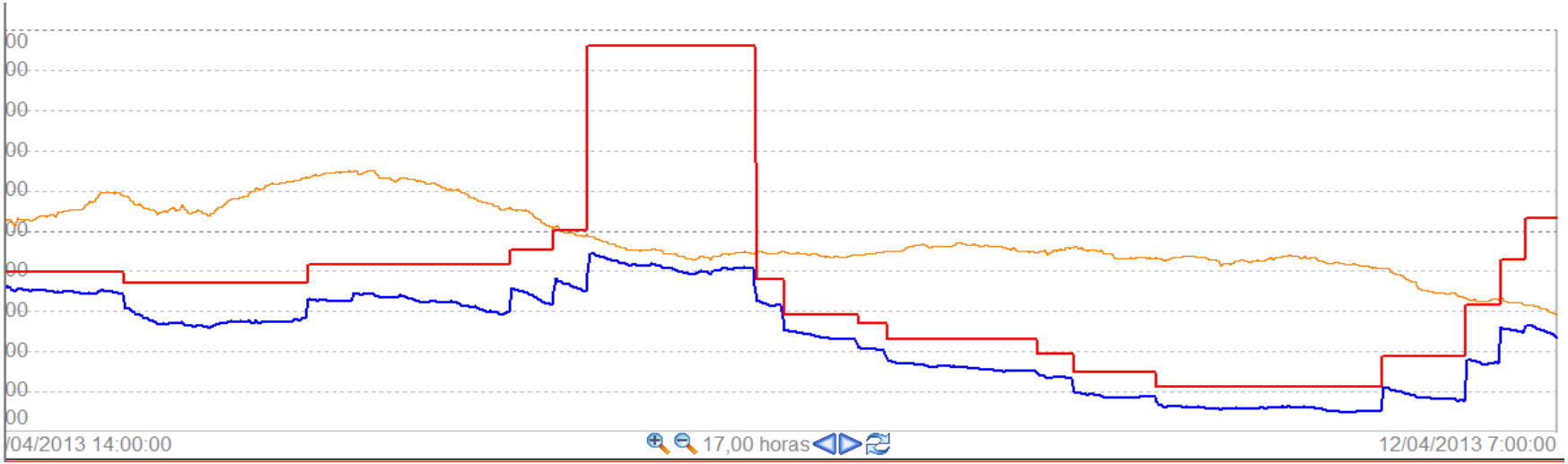
BEFORE: Curtailment with Individual Setpoints



Total setpoint

Expected Power

Estimated power with individual curtailment

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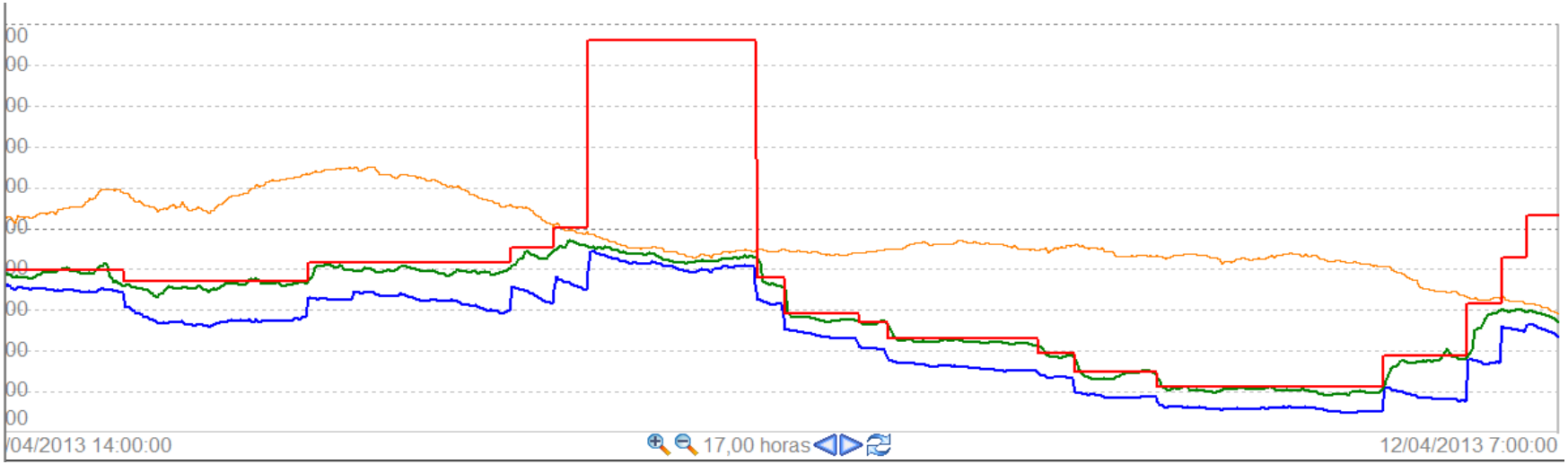
CURRENTLY: Global Setpoint Curtailment



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

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Eva López & Maite Marín

elopez@iberdrola.es

maite.marin@iberdrola.es

CORE IT Systems Engineers

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