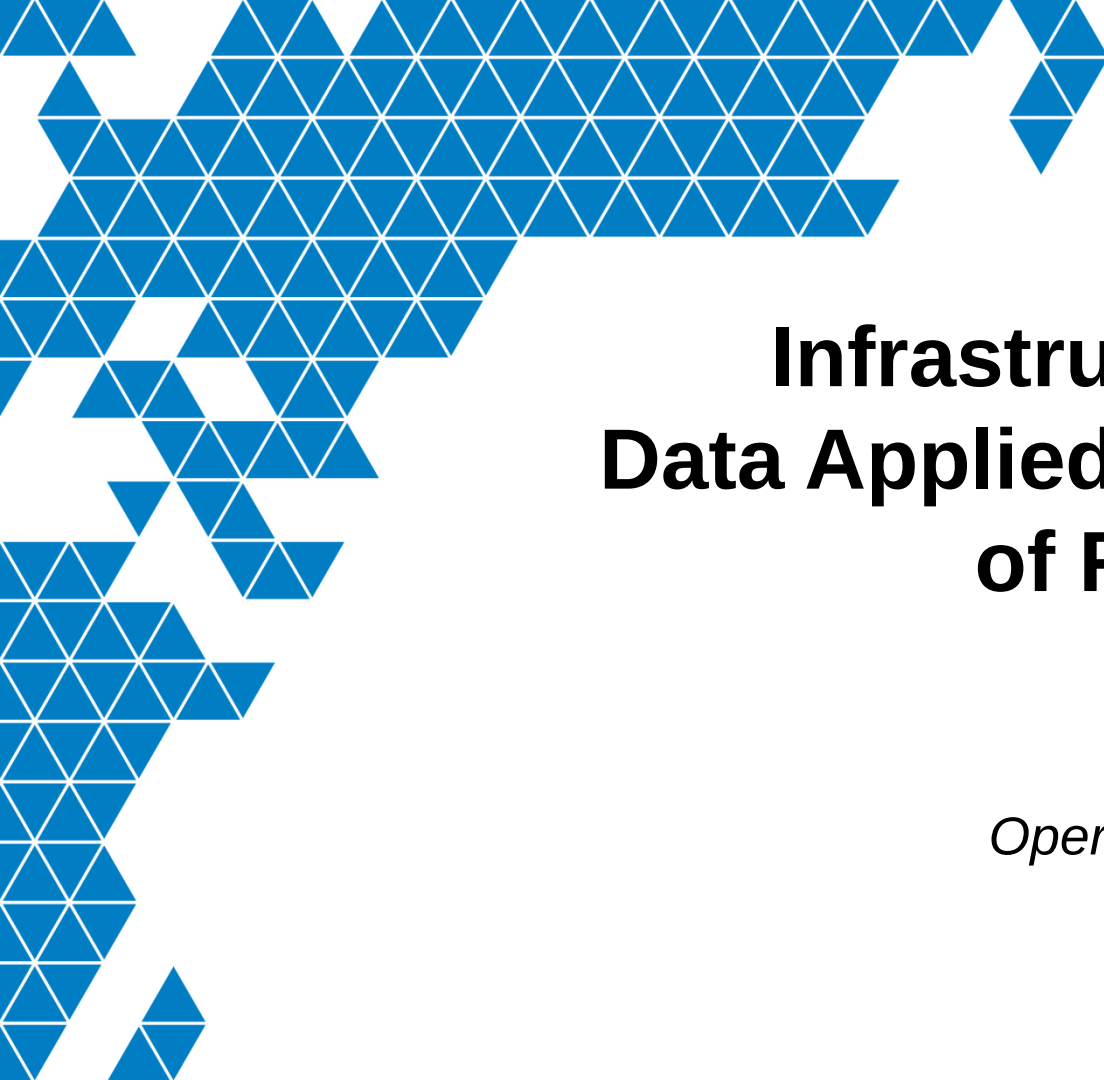




Infrastructure of Real-time Data Applied to the Monitoring of Renewable Energy

Presented by

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EDF EN Services

Disclaimer

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For further information about the Group, please visit its web site at www.edf-energies-nouvelles.com

Agenda

- Presentation of EDF EN
- Needs of EDF EN Services
- PI System architecture
- Project results

EDF EN: a multi-segment player

1

Growth drivers



**Wind
energy**

**85% of the EDF EN group's
total installed capacity**



**Solar PV
energy**

**Objective: 500 MWp net in service by
year-end 2012**

2

**Potential new
growth drivers**



**Distributed
solar***

Biomass

Biogas

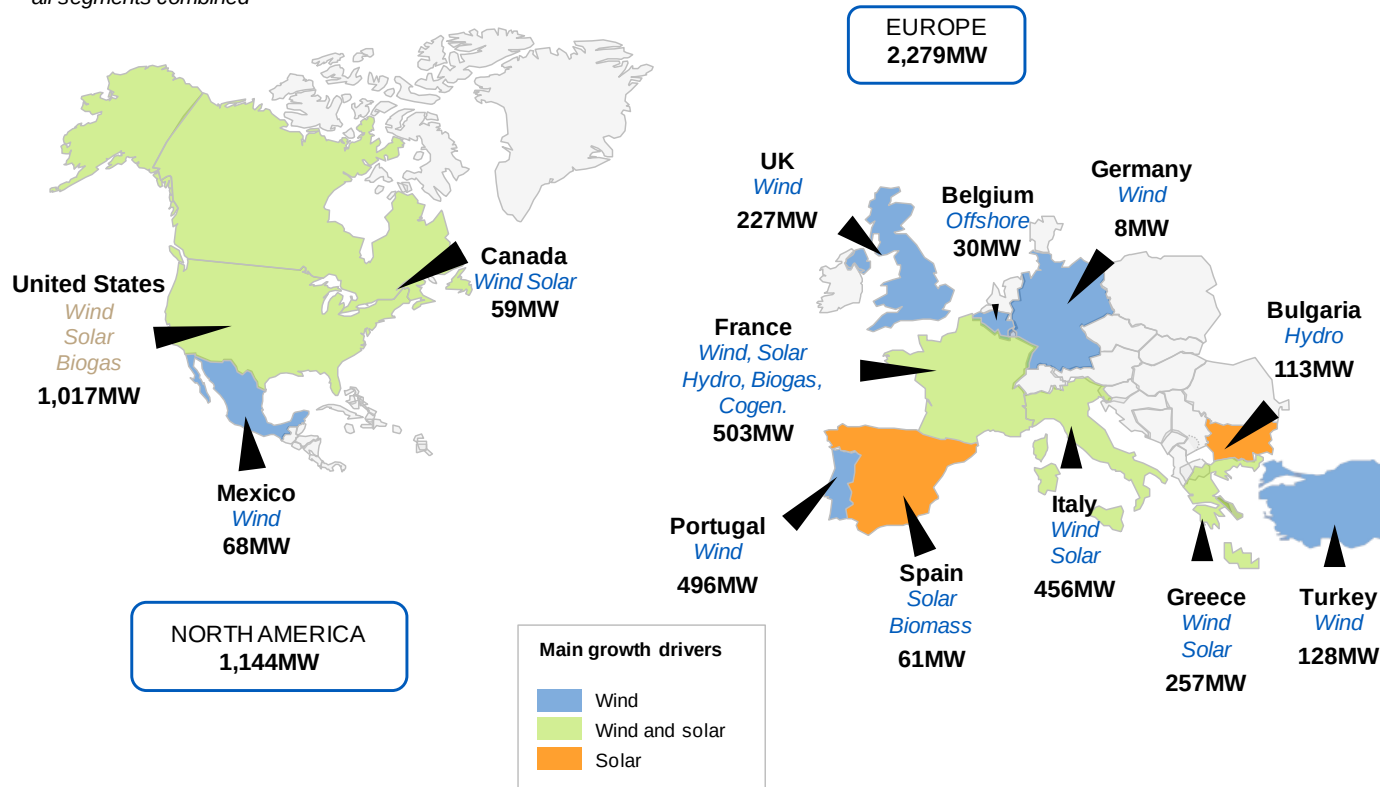
**Marine
Energies**

Offshore

**Selective developments to
prepare for the future**

An international footprint: 3,423MW installed in 13 countries

Gross figures by country at 12/31/2010
all segments combined



An integrated operator

Green electricity generation is our core business

Development

Construction

Generation/
Sale of assets (DSSA)

Operations &
Maintenance



- Prospecting for land
- Environmental impact studies
- Project management (administrative, economic and technical coordination)
- Electricity production yield assessment

- Engineering (electrical, acoustics, etc.)
- Construction works (project contracting)
- Procurement
- Logistics

- Asset management
 - Relationships with contractors
 - Production tracking
- **DSSA** (Development and sale of structured assets)

- Scheduled maintenance
- Corrective maintenance
- Purchasing/management of spare parts

- Non-recourse project financing
- Tax, treasury and financing and accounting
- Legal affairs, insurance
- Research and development

EDF EN Services

EDF EN Services is a EDF Energies Nouvelles company in charge of the operation and maintenance of wind parks and solar parks in Europe.

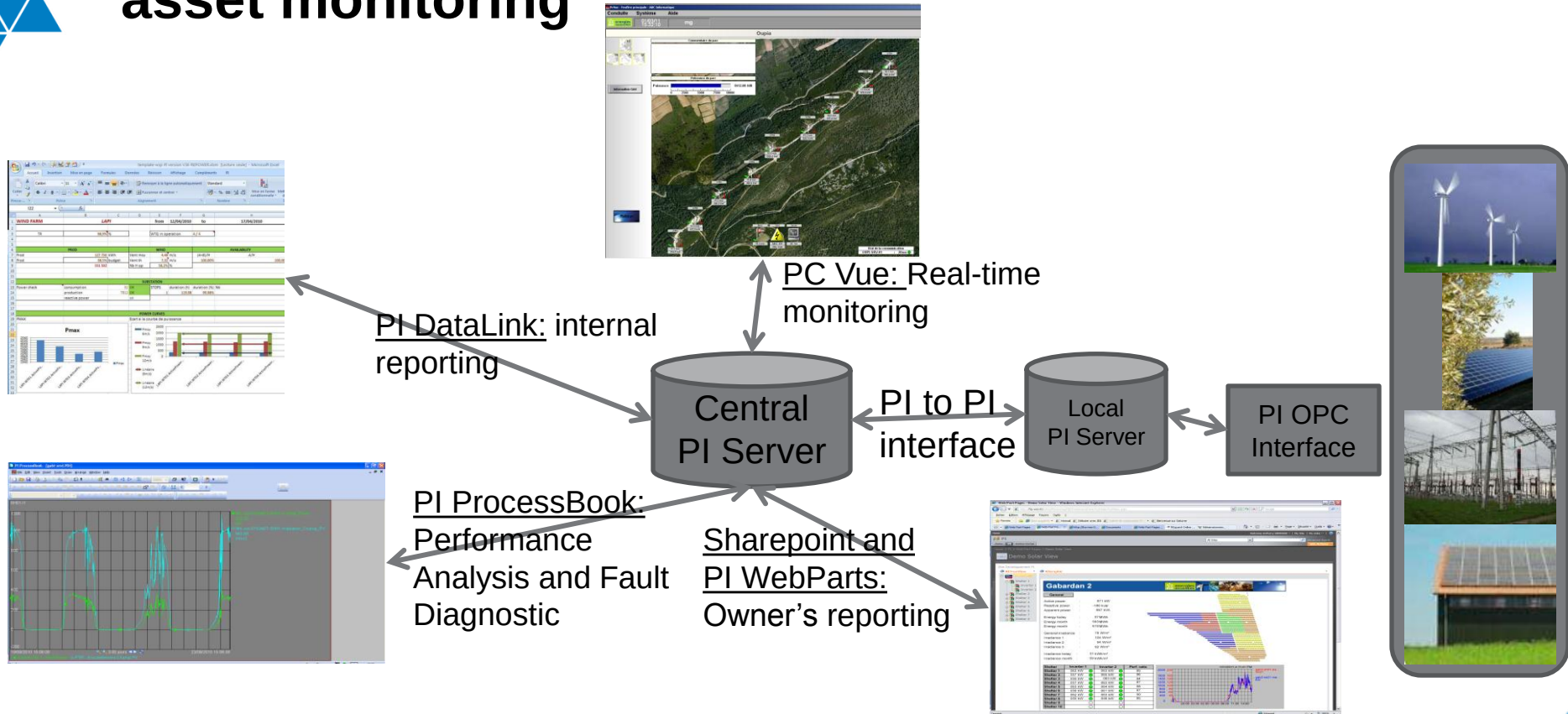
Today under O&M contracts on 31st of March 2011:

- Wind parks connected to the very high voltage grid **200 MW**
- Wind parks connected to the medium voltage grid **300 MW**
- Solar parks connected to the medium voltage grid **131 MW**
- Industrial roof tops connected to the medium voltage grid **6 MW**
- Roof tops connected to the low voltage grid **6 MW**

EDF EN Services' centralized monitoring

- **Goal:** Real-time monitoring of the wind / solar / substation assets
- **Means:** OSIsoft's PI System / PCVUE
- **Project start date:** January 2009
- **Team:**
 - Pilot: Operating Control Center Manager
 - Team Members: 2 PI System experts, 2 technicians
 - IT Support
- **Why OSIsoft's PI System?**
 - Archival performance
 - Multiple interfaces to data sources
 - Associated tools (Microsoft environment)

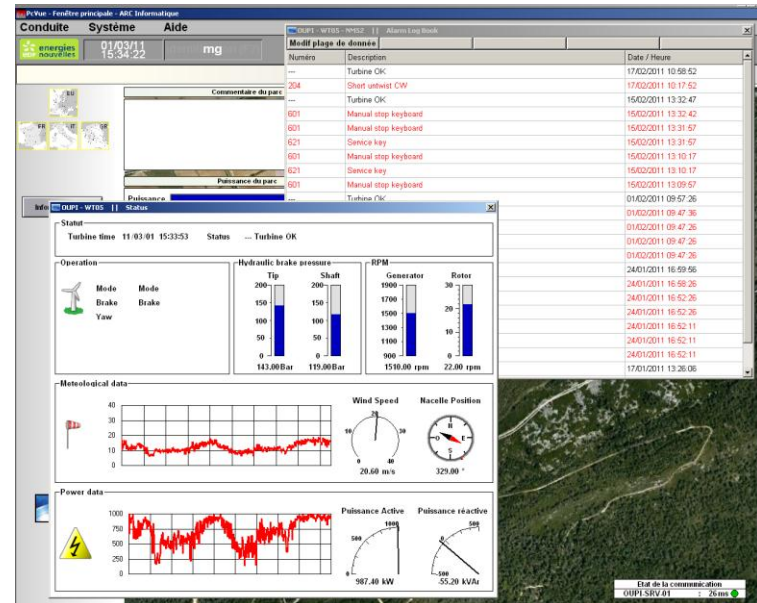
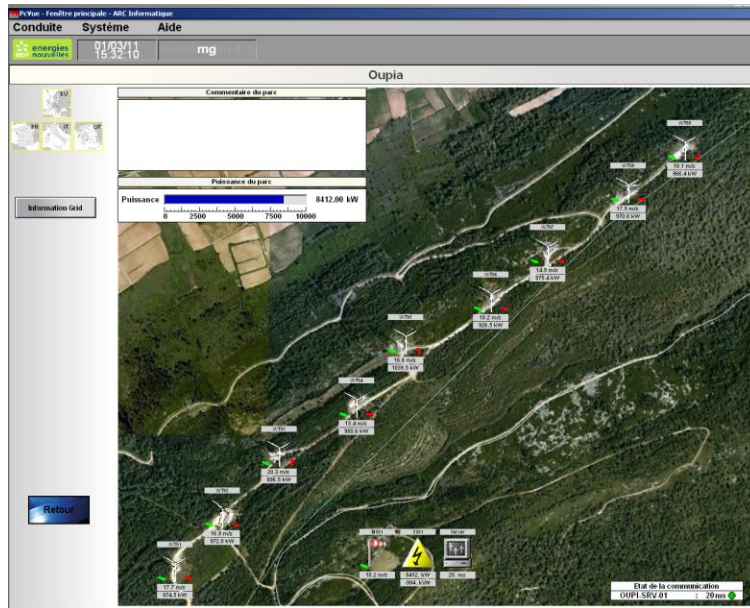
OSIsoft's PI System: a single tool for our asset monitoring



Interfaces



Real-time monitoring by the OCC: Wind parks

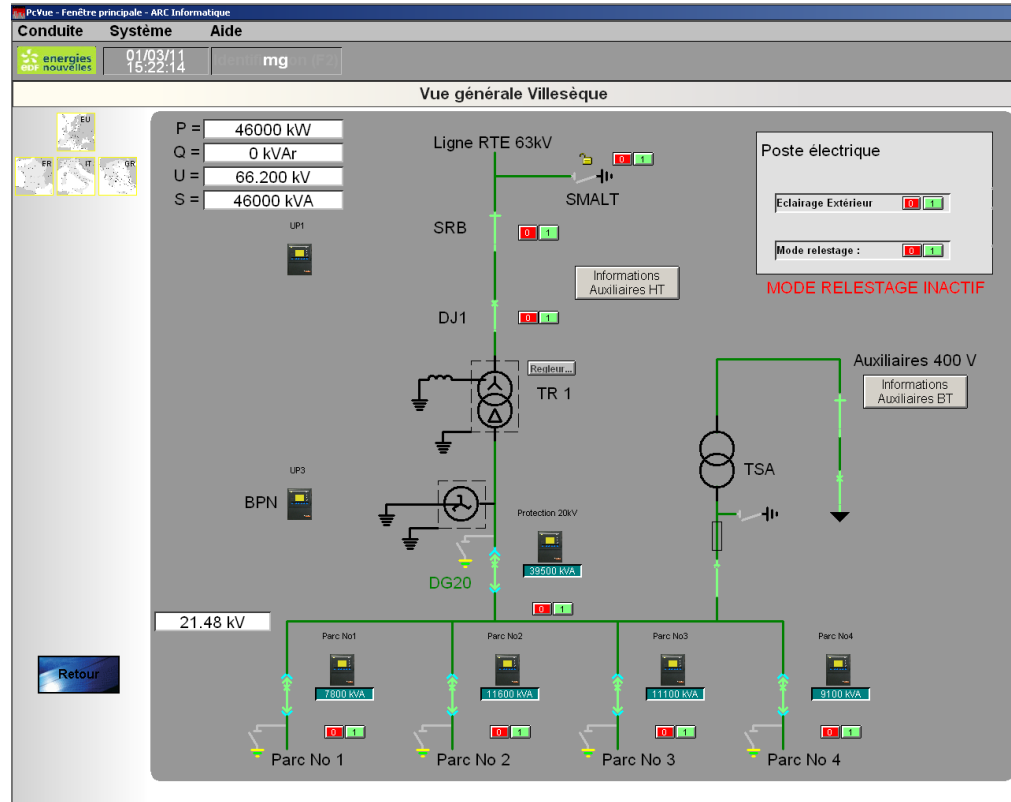


Created a « second level SCADA system » able to communicate with any kind of wind turbines, substations, or solar parks

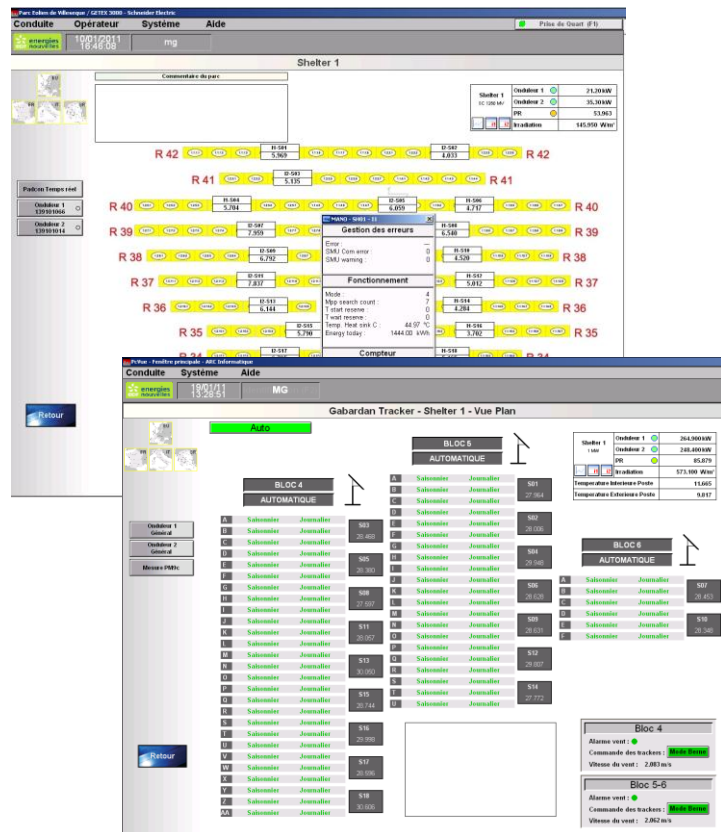
Real-time monitoring by the OCC: High voltage substation

Grid operator requirements:

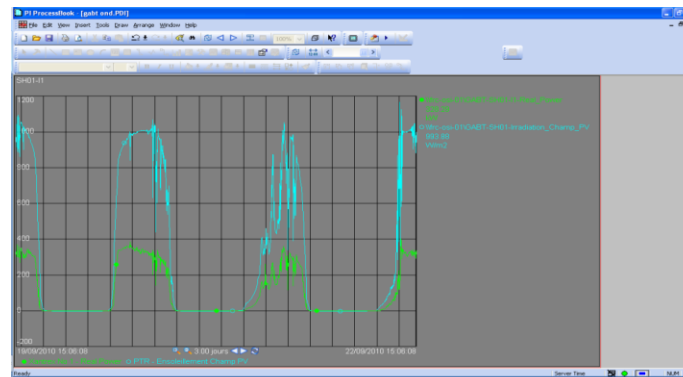
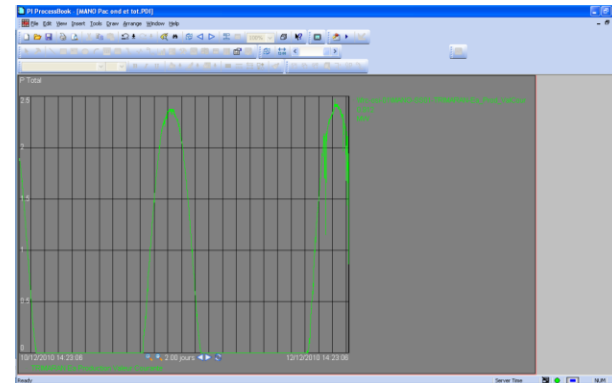
- 20 minutes response time to open or close any breaker
- Visual confirmation that the command has been working
- Voltage regulation or manual change of active or reactive power on demand



Real-time monitoring by the OCC: Solar parks

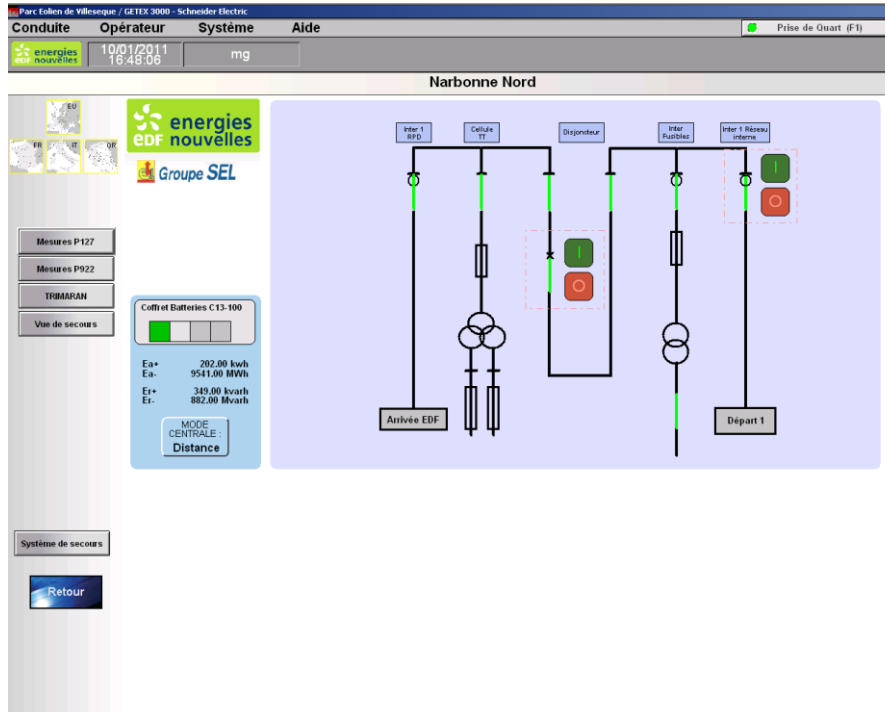


Manosque
PV farm



Gabardan
Tracker
PV farm
P/irradiation

Real-time monitoring by the OCC: Medium voltage substation



View created by the O&M IT team.

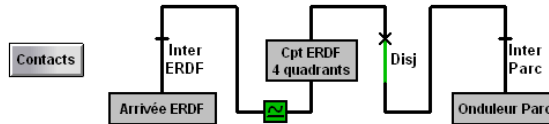
This view gives us access to:

- Alarm logs
- Different data P/U and I

Real-time monitoring by the OCC: Solar barns

H0780.01-1 - 018 ond - LABORDE - 144 kW

Irradiation	61 W/m ²	
Horodate IO	5-Jan-11 15:00:00	
Puissance Active	7 kW	
Horodate TIC	5-Jan-11 15:00:00	

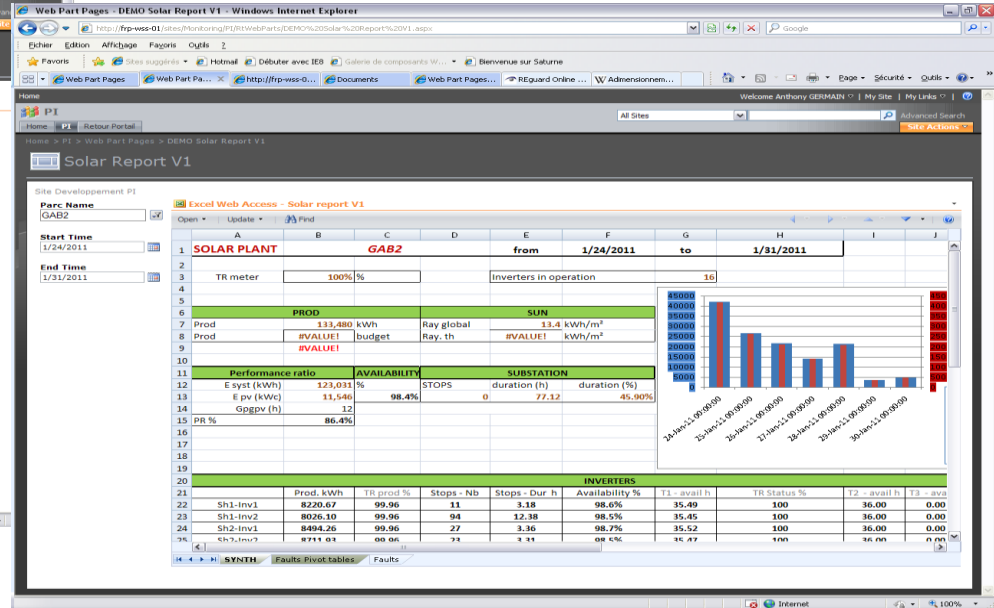
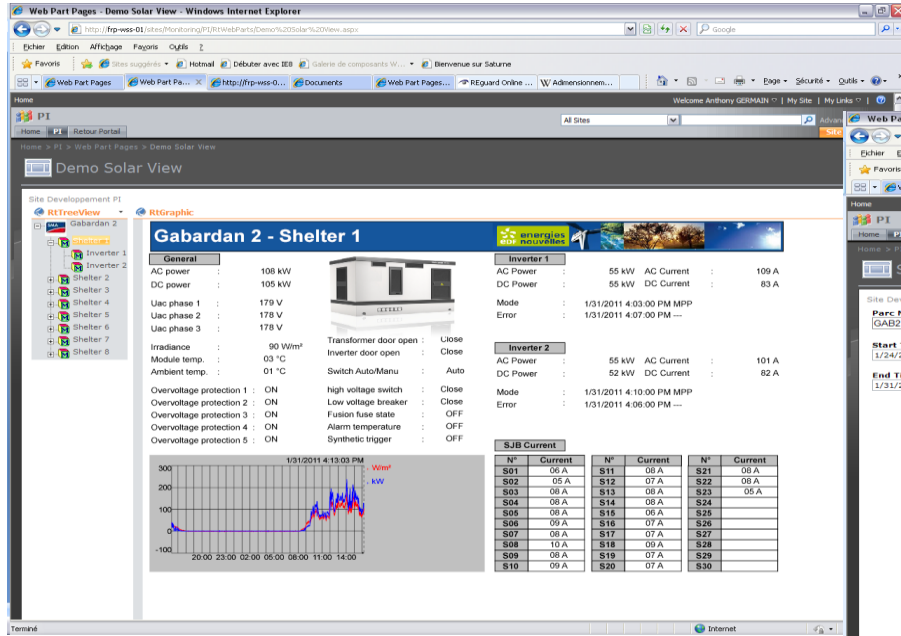


N° Ond	S/N Ond	Puissance	Status	Alarmes	Horodate
Ond 1	2000959608	394W 	MPP	-----	5-Jan-11 15:00:00
Ond 2	2000959877	379W 	MPP	-----	5-Jan-11 15:00:00
Ond 3	2000959294	375W 	MPP	-----	5-Jan-11 15:00:00
Ond 4	2000959888	404W 	MPP	-----	5-Jan-11 15:00:00
Ond 5	2000959619	405W 	MPP	-----	5-Jan-11 15:00:00
Ond 6	2000959829	416W 	MPP	-----	5-Jan-11 15:00:00
Ond 7	2000959323	420W 	MPP	-----	5-Jan-11 15:00:00
Ond 8	2000960382	436W 	MPP	-----	5-Jan-11 15:00:00
Ond 9	2000960375	389W 	MPP	-----	5-Jan-11 15:00:00
Ond 10	2000960372	396W 	MPP	-----	5-Jan-11 15:00:00
Ond 11	2000959872	404W 	MPP	-----	5-Jan-11 15:00:00
Ond 12	2000960809	387W 	MPP	-----	5-Jan-11 15:00:00
Ond 13	2000960674	366W 	MPP	-----	5-Jan-11 15:00:00
Ond 14	2000960665	348W 	MPP	-----	5-Jan-11 15:00:00
Ond 15	2000960677	378W 	MPP	-----	5-Jan-11 15:00:00
Ond 16	2000959873	321W 	MPP	-----	5-Jan-11 15:00:00
Ond 17	2000960812	337W 	MPP	-----	5-Jan-11 15:00:00
Ond 18	2000960673	383W 	MPP	-----	5-Jan-11 15:00:00

Data sent every 2 hours.
Entered into PI System with PI UFL interface.

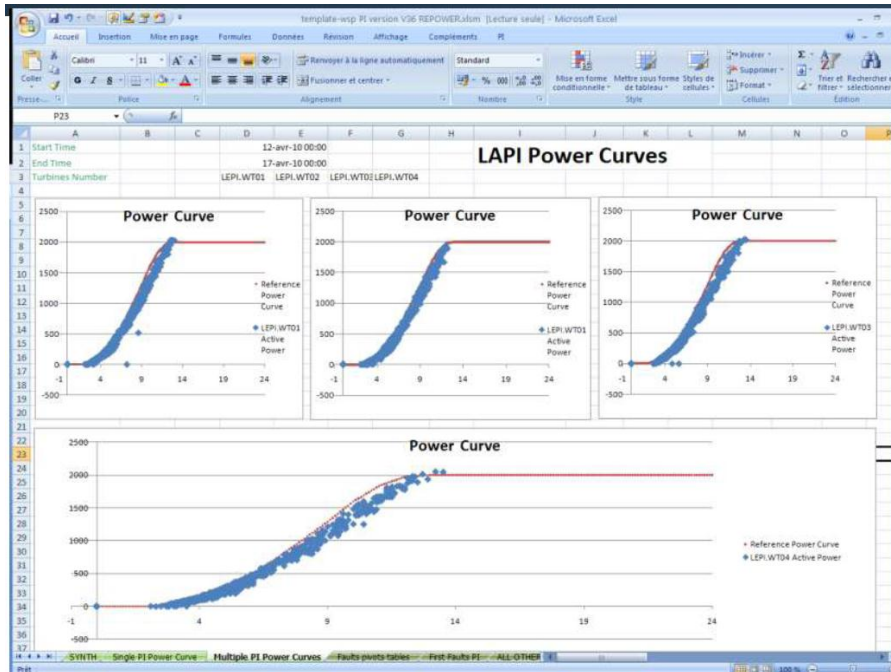


Data retrieval and validation by the owner: Sharepoint and PI WebParts



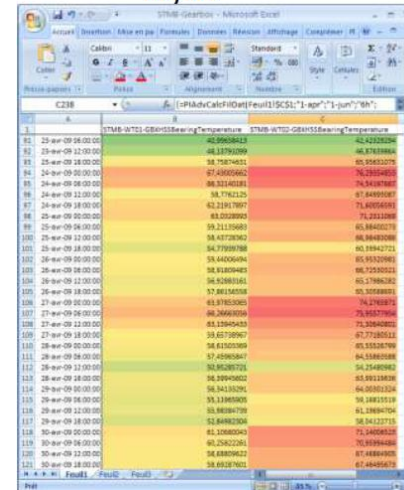
Performance analysis: PI DataLink

Gearbox oil temperature validation before and after replacement

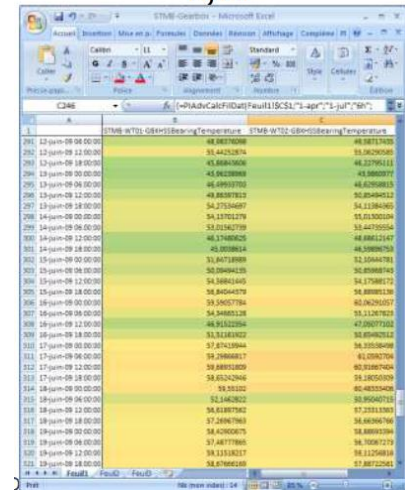


Wind turbines power curves

Before



After



Future plans and next steps

Management scorecard

Data models with PI AF

Continue deploying PI System on all of our assets

Questions

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Thank you