Real-time Data Infrastructure Applied to the Monitoring of Renewables Assets

Presented by

Aurélie Nasse,
Operations Control Center Manager
EDF EN Services

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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

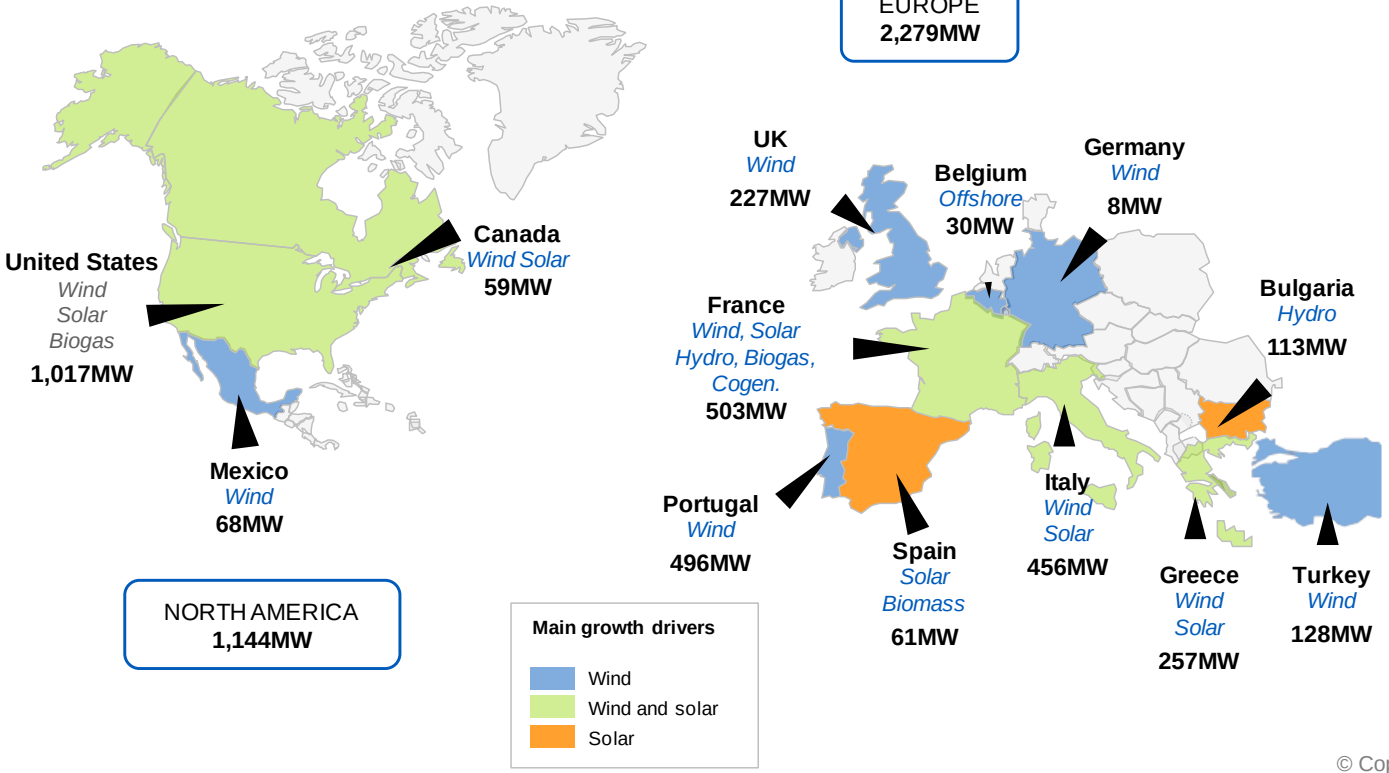
Potential new growth drivers

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:

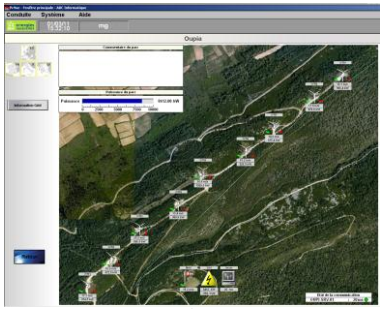
- Wind parks connected to the very high voltage grid 200 MW
- Wind parks connected to the medium voltage grid 300 MW
- Solar parks connected to the medium voltage grid 131 MW
- Industrial roof tops connected to the medium voltage grid 6 MW
- Roof tops connected to the low voltage grid 6 MW

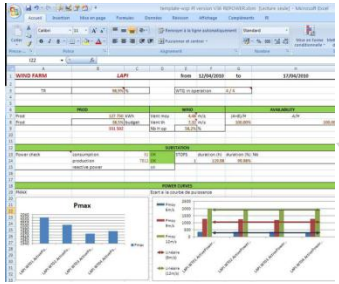
EDF EN Services' centralized monitoring

- **Goal:** real time monitoring of the wind / solar / substation assets
- **Means:** PI System of OSIsoft / PCVUE
- **Project start date:** January 2009
- **Team:** Pilot: Operating Control Center Manager
  Team members: 2 PI System experts, 2 technicians
  IT support

- **Why the PI System from OSIsoft?**
  - Archival performance
  - Multiple interfaces to data sources
  - Associated tools (Microsoft environment)

PI System from OSIsoft: a single tool for our asset monitoring





PC Vue: real time monitoring

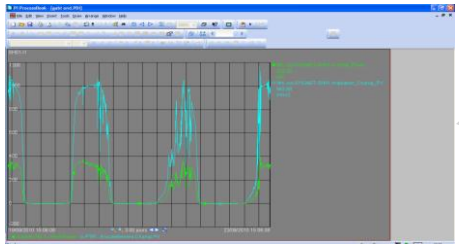
PI DataLink: internal reporting

Central PI Server

PI to PI interface

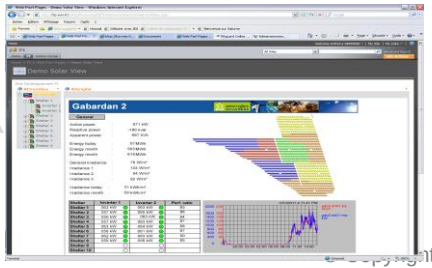
Local PI Server

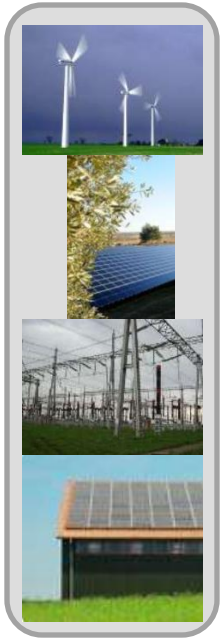
PI OPC interface



PI ProcessBook: Performance analysis and fault diagnostic

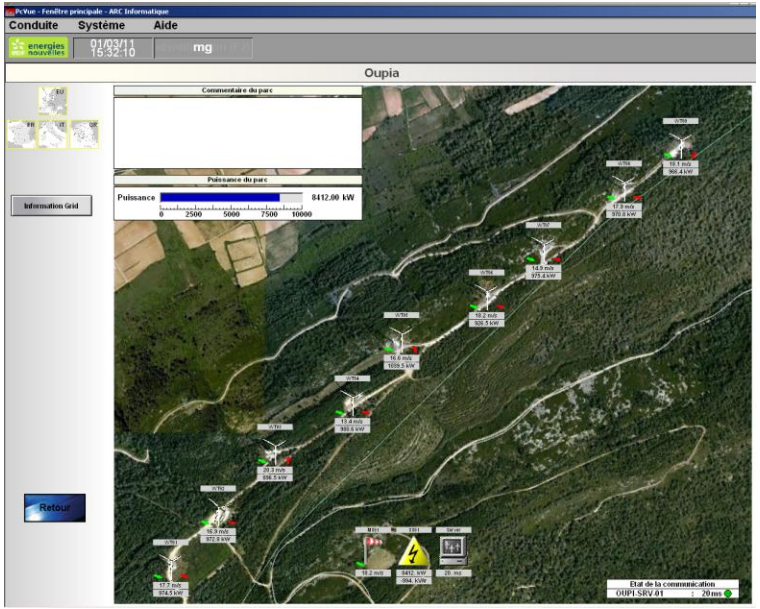
Sharepoint and PI WebParts: Owner's reporting

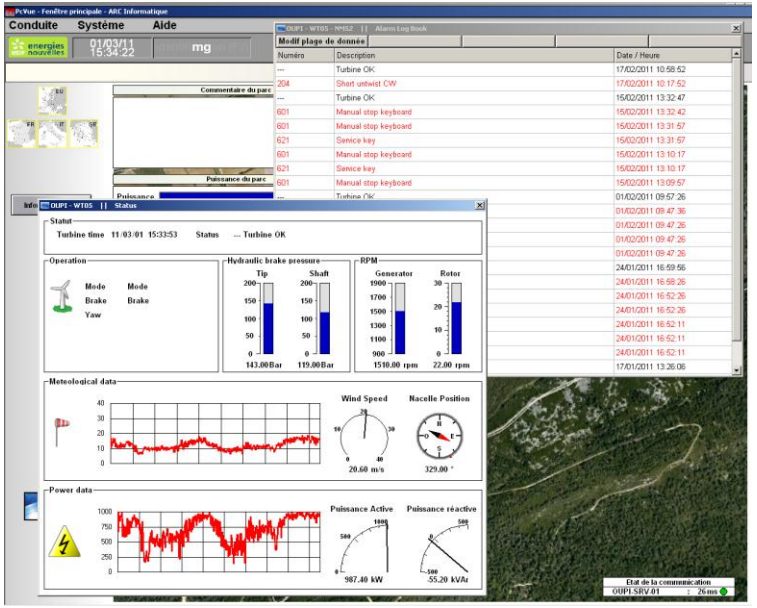




Interfaces

Real-time monitoring by the OCC: Wind parks



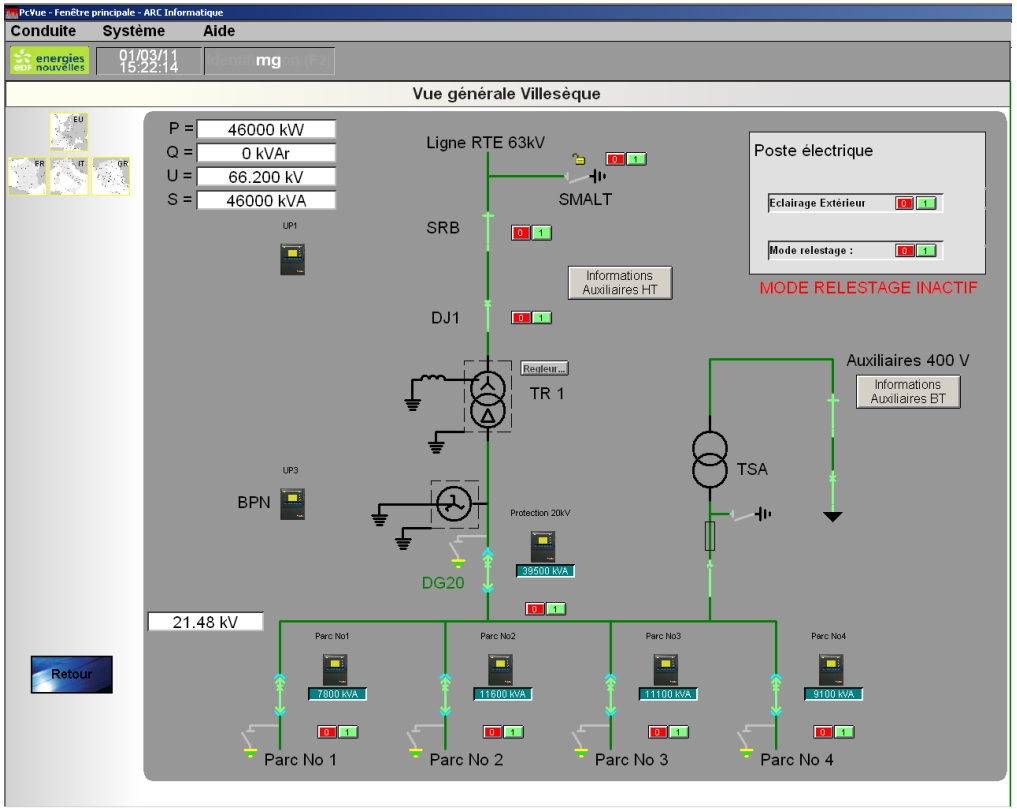


Created a « second level SCADA system » able to communicate with any kind of wind turbines, substations, or solar parks

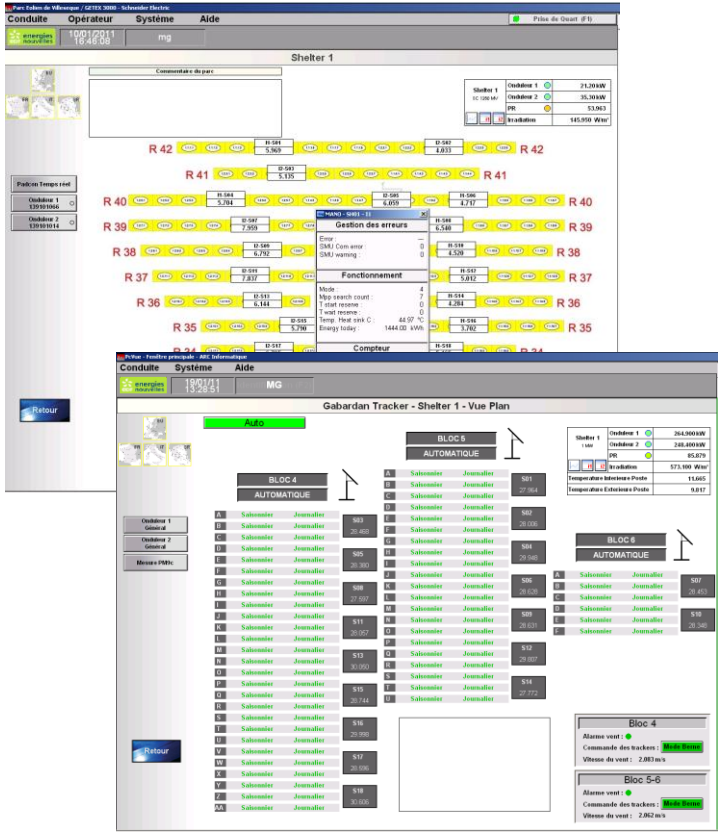
Real-time monitoring by the OCC: High voltage substation

Grid operator requirements:

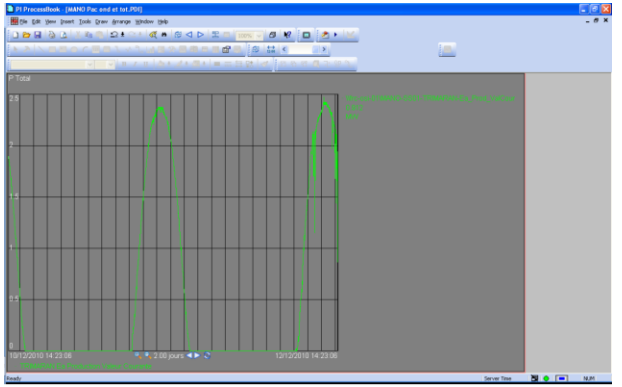
- 20 minutes response time to open or close any breaker
- Visual confirmation that the command has been working
- Voltage regulation or manual change of active or reactive power on demand

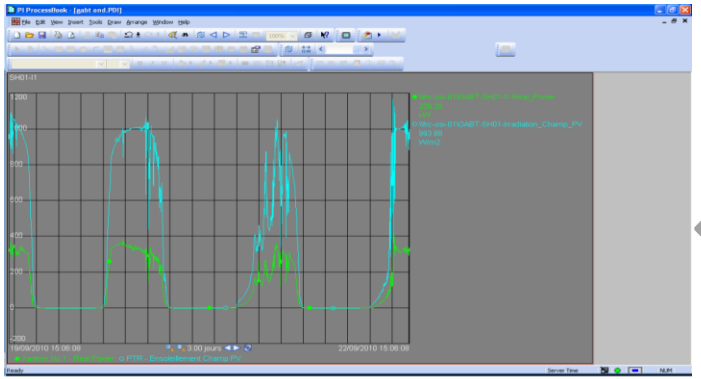


Real-time monitoring by the OCC: Solar parks



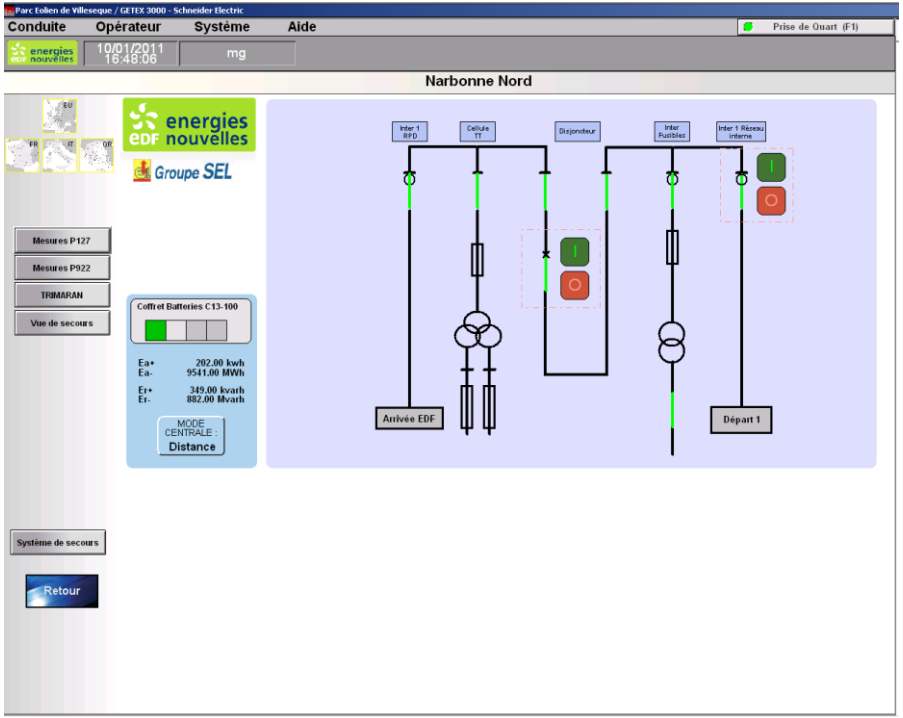
Manosque PV farm





Gabardan Tracker PV farm P/irradiation

Real-time monitoring by the OCC: Medium voltage substation



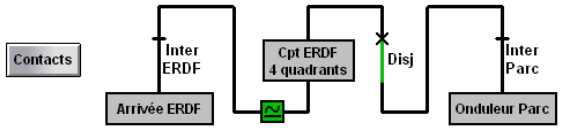
View created by the O&M IT team.
This view gives us access to:

- alarm logs
- different data P/U and I

Real-time monitoring by the OCC: Solar barns

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

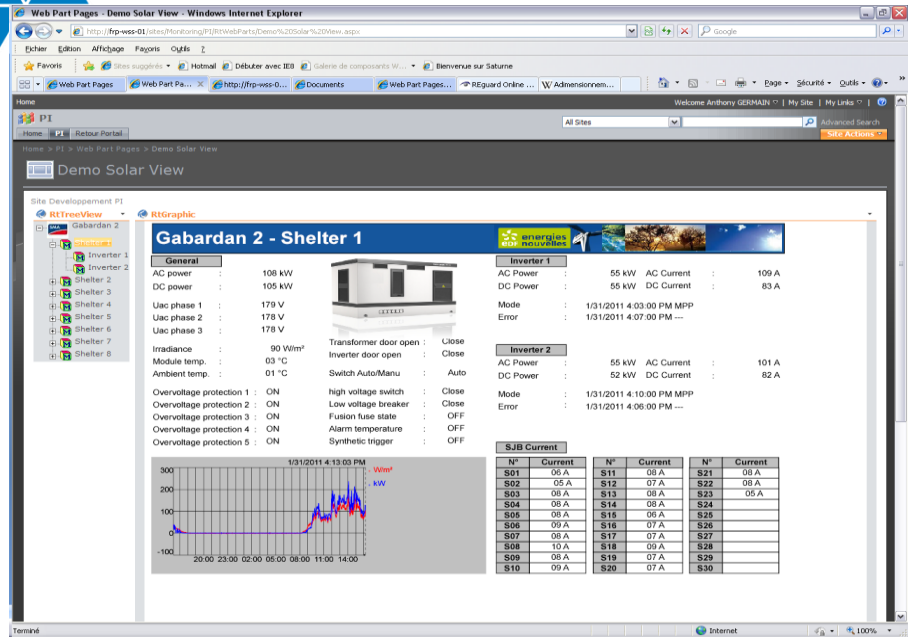
Irradiation	61 W/m²
Horodate IO	5-Jan-11 15:00:00
Puissance Active	7 kW
Horodate TIC	5-Jan-11 15:00:00

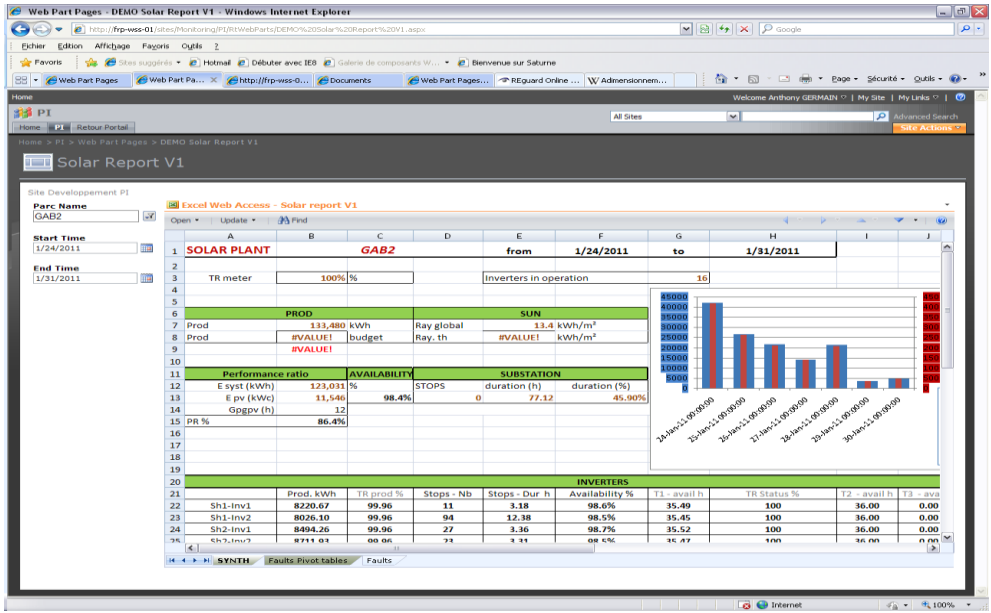


N° Ond	S/N Ond	Puissance	Status	Alarmes	Horodate
Ond 1	2000959608	394W	MPP	-----	5-Jan-11 15:00:00
Ond 2	2000959877	379W	MPP	-----	5-Jan-11 15:00:00
Ond 3	2000959294	375W	MPP	-----	5-Jan-11 15:00:00
Ond 4	2000959888	404W	MPP	-----	5-Jan-11 15:00:00
Ond 5	2000959619	405W	MPP	-----	5-Jan-11 15:00:00
Ond 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

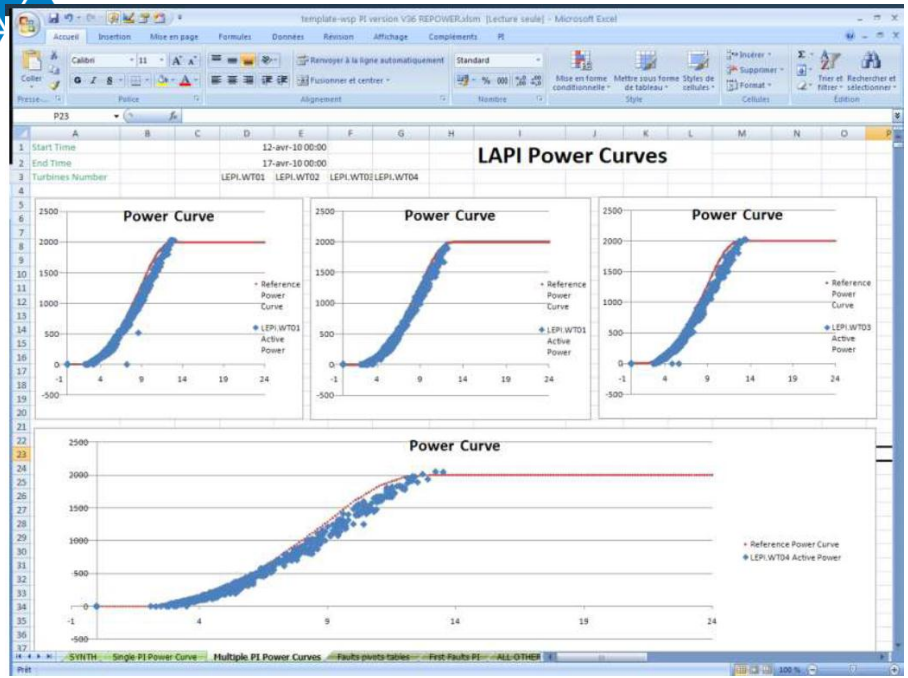
Data sent every 2 hours. Entered into PI System with PI UFL interface.

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





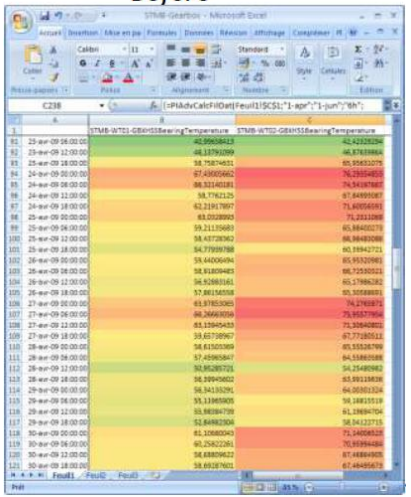
Performance analysis: PI DataLink



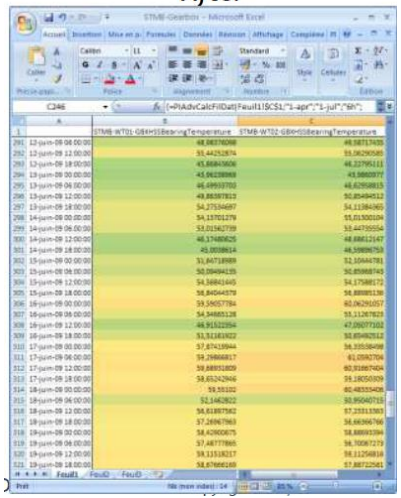
Wind turbines power curves

Gearbox oil temperature validation before and after replacement

Before



After



Future Plans and Next Steps

Management scorecard

Data models with PI AF

Continue deploying PI System on all of our assets

Questions

- Aurélie Nasse
- aurelie.nasse@edf-en.com

Thank you