



Improving the operational efficiency of your renewable assets with digitalization technologies



19 November 2020



AGENDA



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01

Challenges operating renewable energy assets

02

Benefits from good data quality

03

Advanced analysis

04

Operations and maintenance activities

Global technology provider

More efficient and profitable renewable energy plants

Making the most out of energy

Advanced technology for monitoring, control, and management of renewable assets



Renewables



Trading

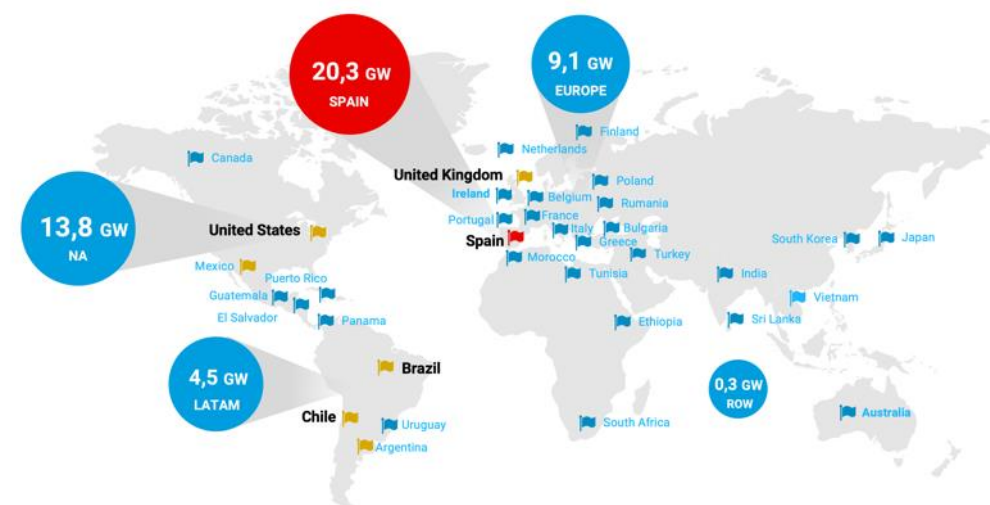


Grid Integration



+ 45 Gigawatts

GLENNMONT PARTNERS	PleniumPartners	EDF	Naturgy	enel Green Power	acciona	RED ELÉCTRICA DE ESPAÑA
saclayield	FRV	GRUPO MEXICO	IBERDROLA	edp	enel	viesgo
genieia La vida es energía	elawan	AES	finerge	Southern Company	Brookfield	



Data-led O&M for renewable assets

01 **Challenges operating renewable energy assets**

02 Benefits from good data quality

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Challenges

Equipment and Communications

- +Problems with network, cables, sensors, other equipment...
- +Lack of sensing installed
- Data recovery mechanisms and correct sensing design

Different OEMs

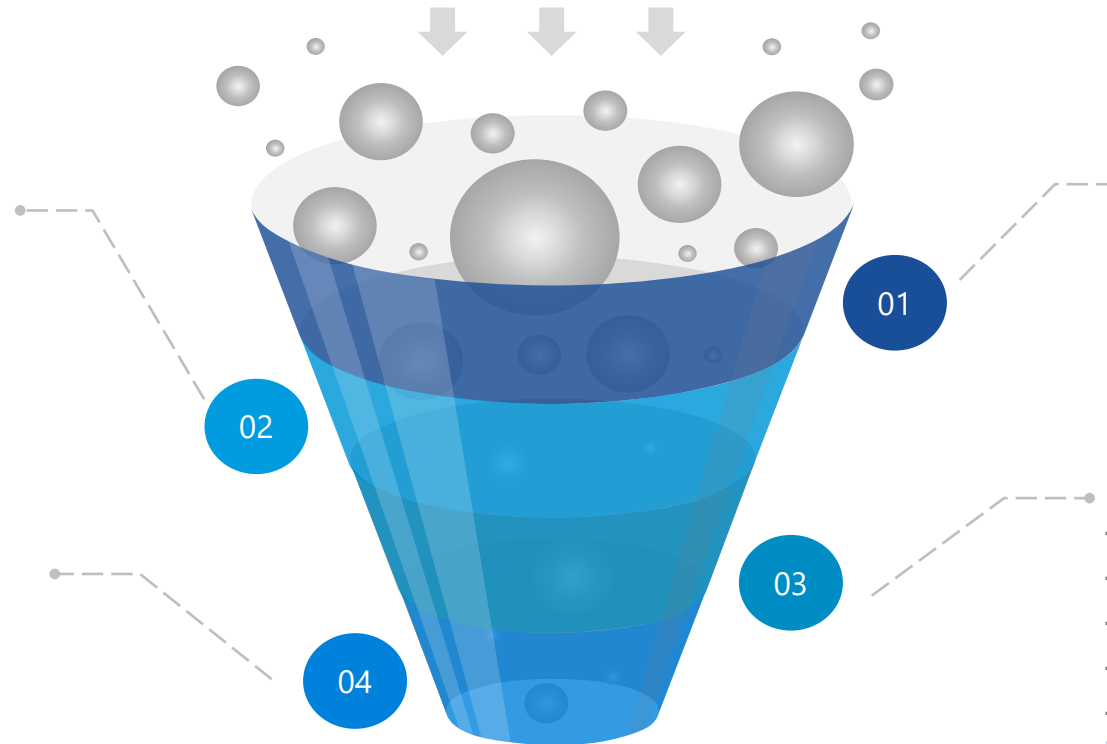
- +Lack of unified signal description/processing & KIPs calculation
- +Black boxes
- Industry standards and good practices agreement

Human error

- +Errors in the different phases of identification, planning, executing, reporting & analyzing
- Have technology help in these areas

Local SCADA

- +Hardware and software failures
- +DQ
- +Early detection
- +Failures, root causes
- +Self-actions, recommendations
- Lack of robust SCADA system



+ Correcting bad data and early problem detection and recommendations
+ Reduce reaction times, increase availability and efficiency, reduce O&M costs

Data-led O&M for renewable assets

01 Data problems and value added solutions

02 **Benefits from good data quality**

03 Advanced analysis

04 Operations and maintenance activities

Benefits from good data quality



Quality of the information

Increasing the quality of the information provided based on better quality data



Early detection

Analyzing real time data and applying data quality algorithms allows us to identify unavailabilities immediately and more accurately



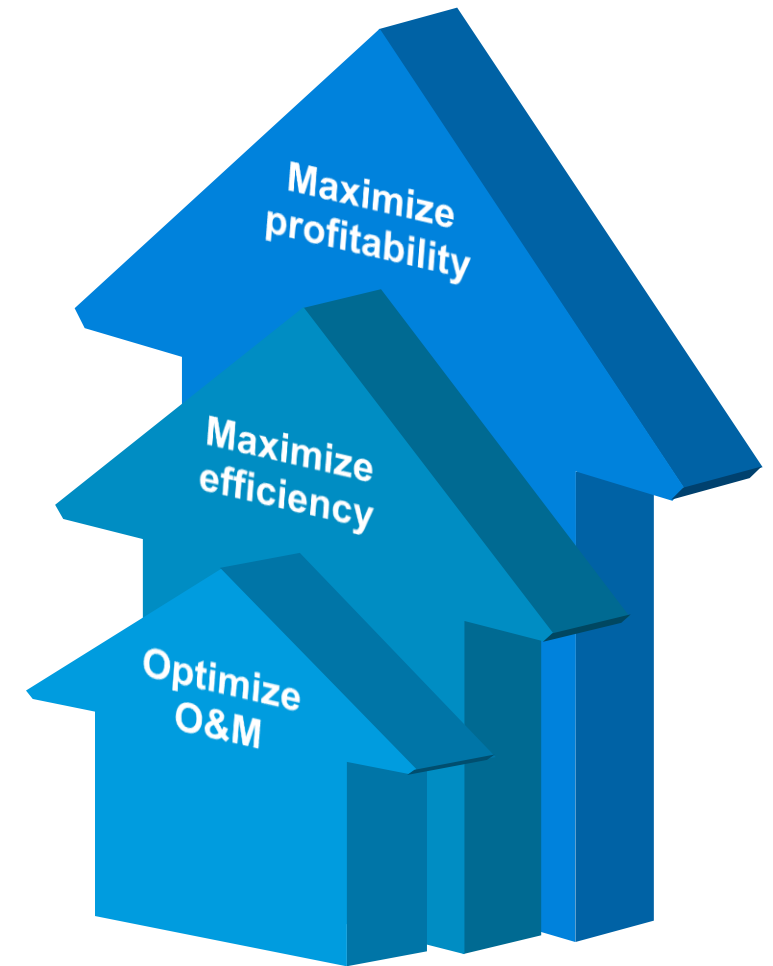
Speed up the decision making

Generate warnings and the needed information so that the user can analyze and decide fast and with the correct corrective actions



Increase the operational efficiency

Eliminate or reduce repairs and time invested in gathering and verifying data/information



Data-led O&M for renewable assets

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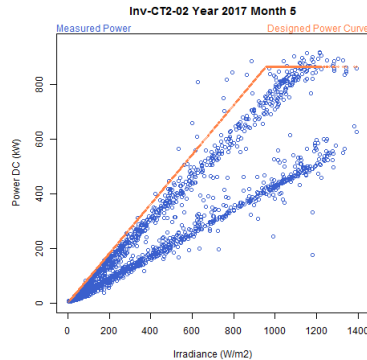
03 **Advanced analysis**

04 Operations and maintenance activities

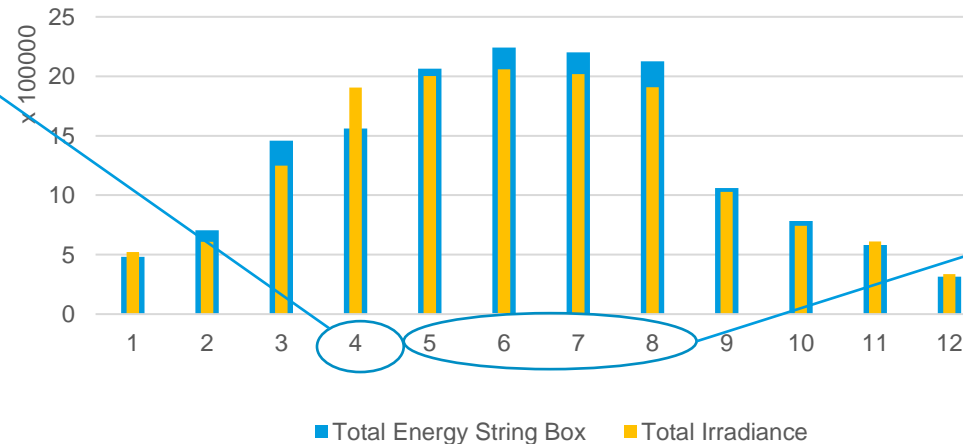
Advanced Analysis (Machine Learning)

- They help in early and automatic detection problems and out of normal operation behaviors
- They help identify and quantify root cause problems and provide a recommendation
- Loss of energy analysis. Detection and quantification of the lost energy. Recoverable and not recoverable.

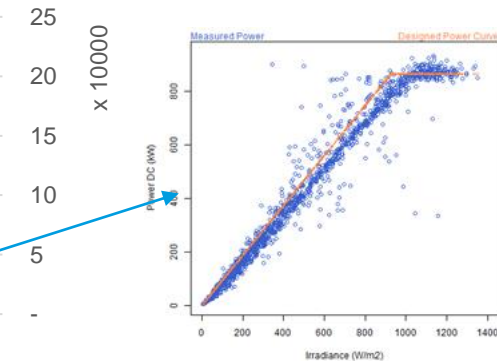
Under performance



Energy resource Vs Plant production

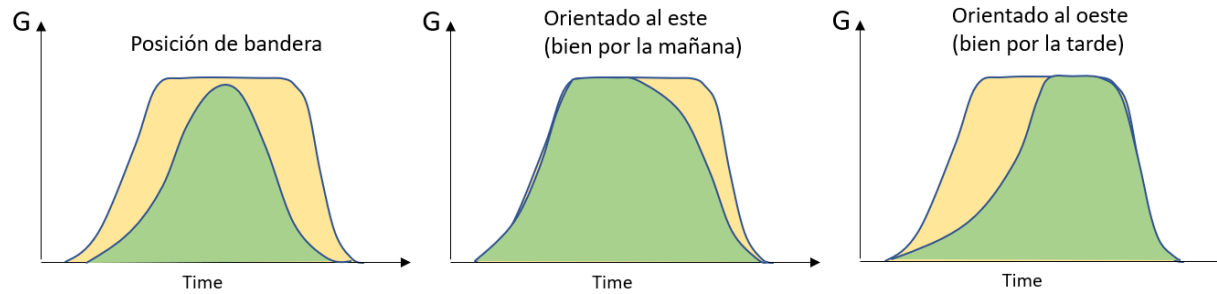


Optimal production

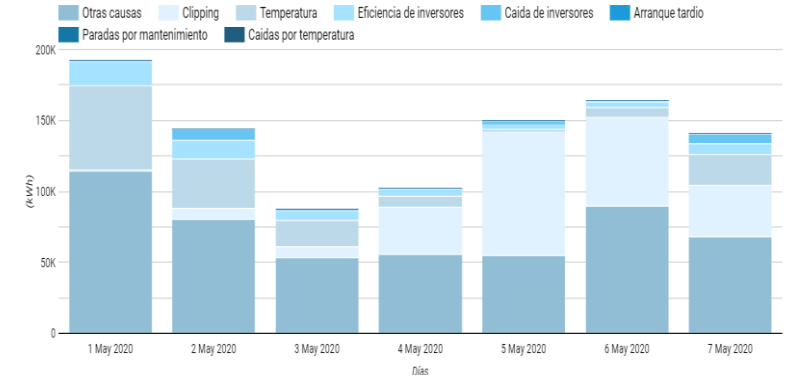


Advanced Analysis (Machine Learning)

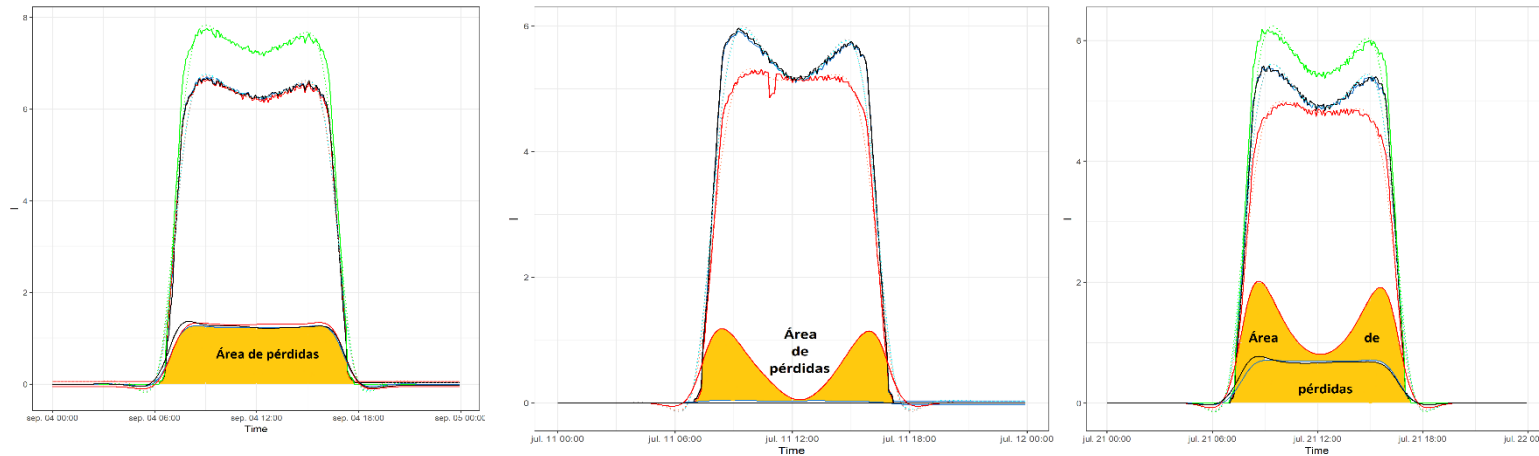
Problem detection in PV plants



Theoretical behavior of trackers

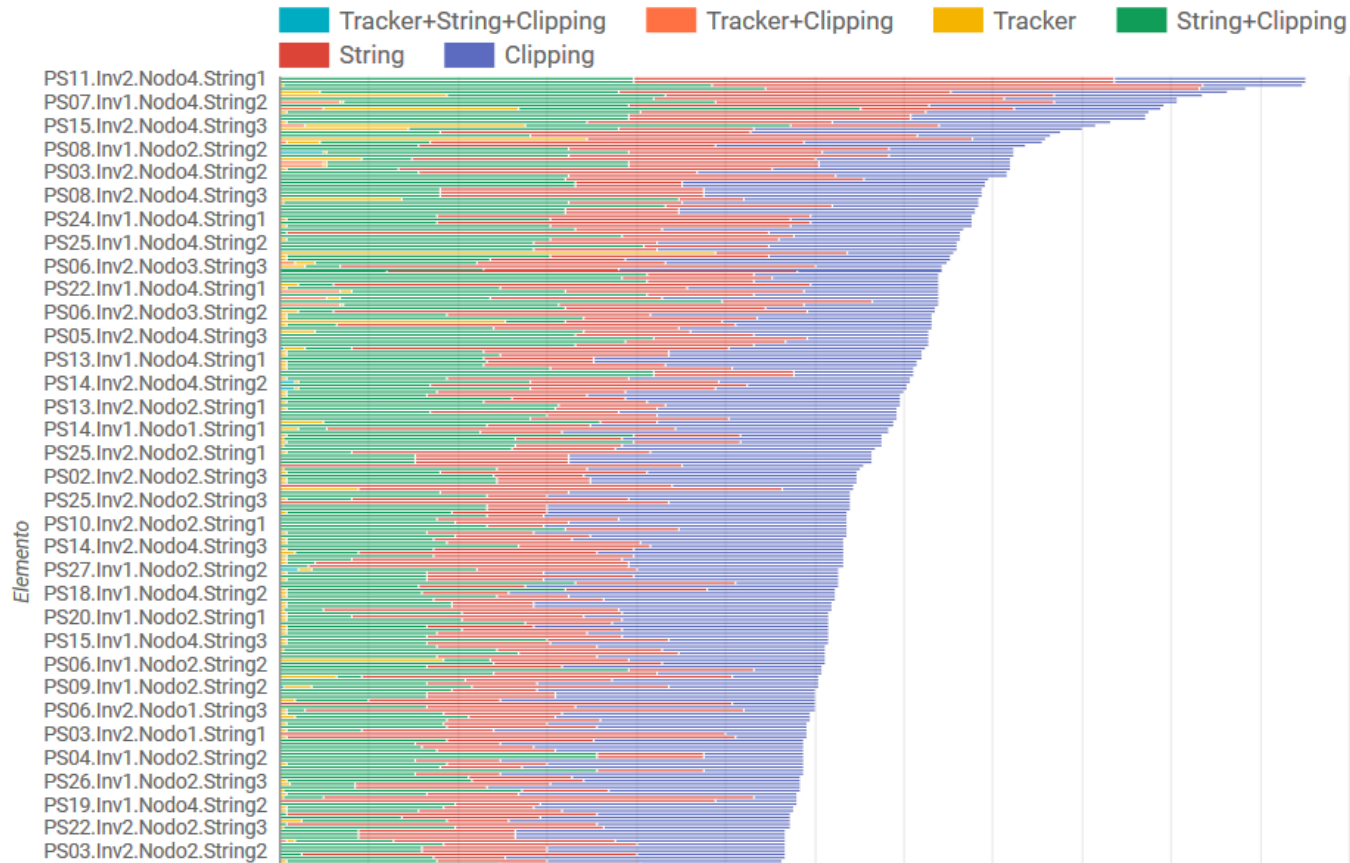


Energy loss analysis



Combination of tracker misalignment/blockage and string disconnection/failure

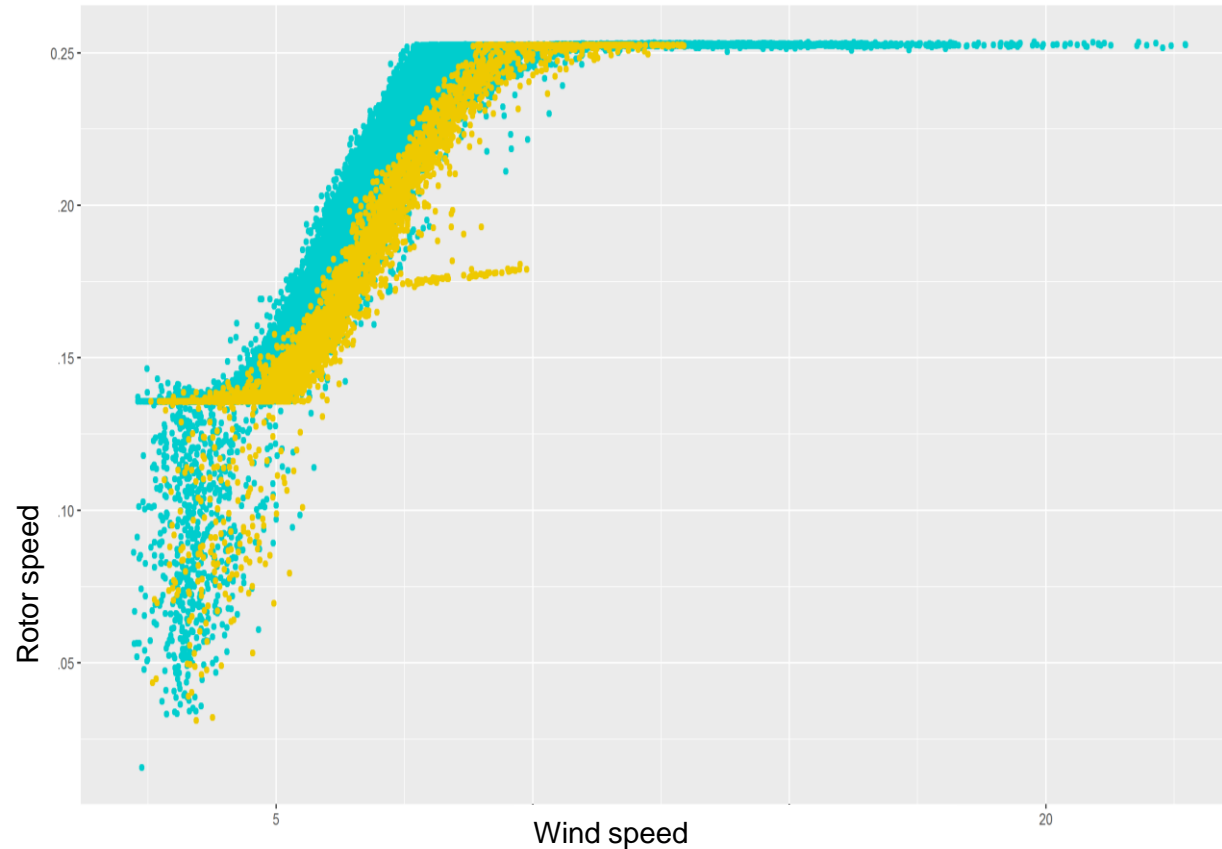
Other PV problems



- Clipping
- Soiling
- Panel degradation
- Cooling faults
- Lack of sensing, bad data (gaps, no RT data, no data recovery...)
- Lack of standardization (variables, algorithms...), multiple OEMs
- Blackboxes

Advanced Analysis (Machine Learning)

Problem detection in Wind Farms

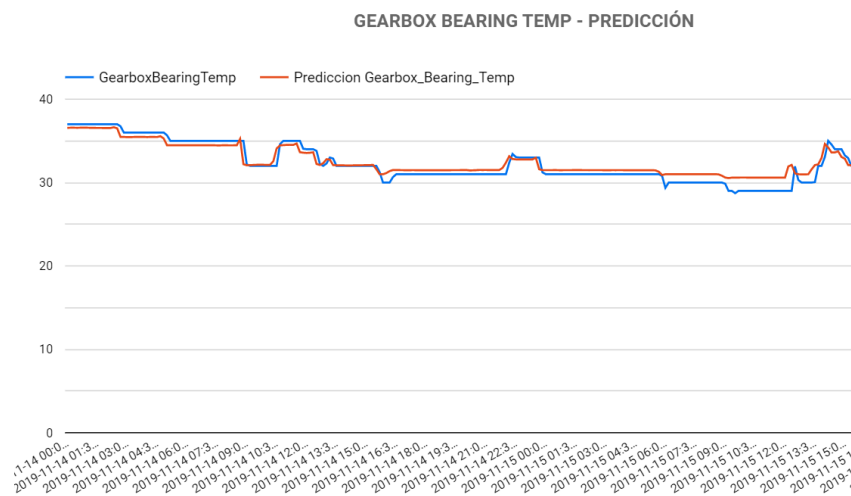
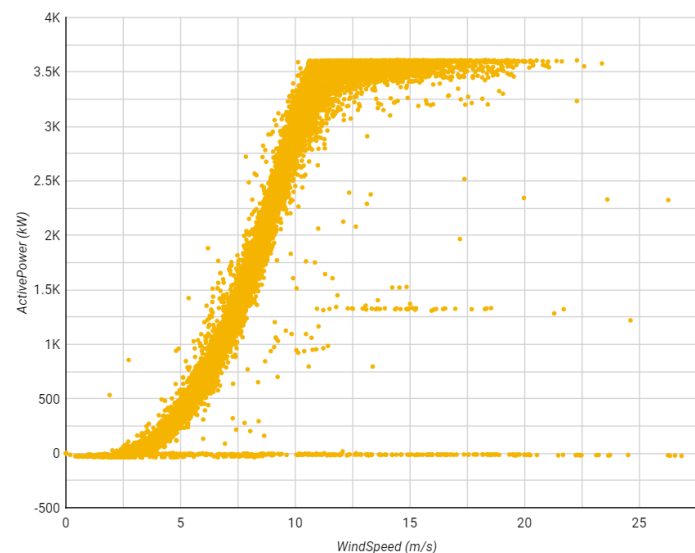


Performance curves can be under the theoretical curves for a number of reasons:

- External/internal regulation
- External/internal problems
- Stops
- Yaw, pitch misalignment
- Wake effect
- Resource variability
- Power curve deviation

Advanced Analysis (Machine Learning)

Problem detection in Wind Farms



Elemento	Subsistema	Recomendacion	Primer día	Nº días	Criticidad...
ag24	Global	Chequeo del aerogenerador por presentar una energía perdida superior al 25%, siendo tanto las pérdidas por regulaciones como el total de pérdidas por viabilidad del recurso y emplazamiento superiores al 15%	28 Nov 2019	2	
ag25	Global	Chequeo del aerogenerador por presentar una energía perdida superior al 25%, siendo tanto las pérdidas por regulaciones como el total de pérdidas por viabilidad del recurso y emplazamiento superiores al 15%	28 Nov 2019	2	
ag19	Generador	Chequeo del subsistema Generador por comportamiento anómalo de la señal ReactivePower (WARNING por el análisis de Outliers)	13 Nov 2019	3	
ag19	Generador	Chequeo del subsistema Generador por comportamiento anómalo de la señal ActivePower (ALARMA por el análisis de Outliers)	13 Nov 2019	3	
ag19	Generador	Chequeo del subsistema Generador por comportamiento anómalo de la señal Current (WARNING por el análisis de Outliers)	13 Nov 2019	3	
ag01	Global	Chequeo del aerogenerador por presentar una energía perdida entre el 15% y el 25%, siendo tanto las pérdidas por regulaciones como el total de pérdidas por viabilidad del recurso y emplazamiento superiores al 15%	15 Nov 2019	1	
ag03	Global	Chequeo del aerogenerador por presentar una energía perdida superior al 25%, siendo tanto las pérdidas por paradas como el total de pérdidas por viabilidad del recurso y emplazamiento superiores al 15%	29 Nov 2019	1	
ag03	Global	Chequeo del aerogenerador por presentar una energía perdida entre el 15% y el 25%, siendo tanto las pérdidas por regulaciones como el total de pérdidas por viabilidad del recurso y emplazamiento superiores al 15%	15 Nov 2019	1	
ag03	Global	Chequeo del aerogenerador por presentar una energía perdida superior al 25%, siendo tanto las	28 Nov 2019	1	

Early detection of problems and corrective action recommendation

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Operations and maintenance activities

Operations and maintenance activities

Why digitalize?



O&M in renewable activities is changing.
Remote maintenance? Covid-19?

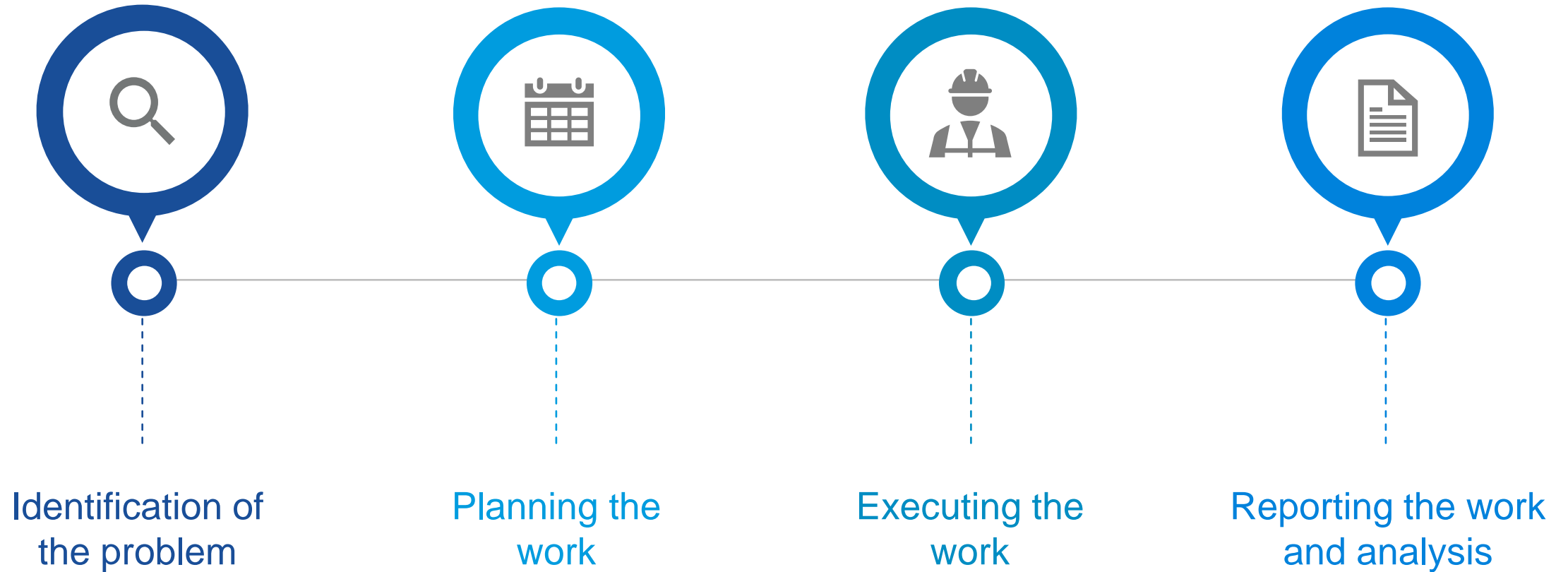


Evolution of performance indicators



Need to have all the data/information in a
centralized platform

Activity timeline



Planning phase

Prioritize the activities

01

Severity

Failure type, criticality, impact...

04

Available resources

Team coordination

02

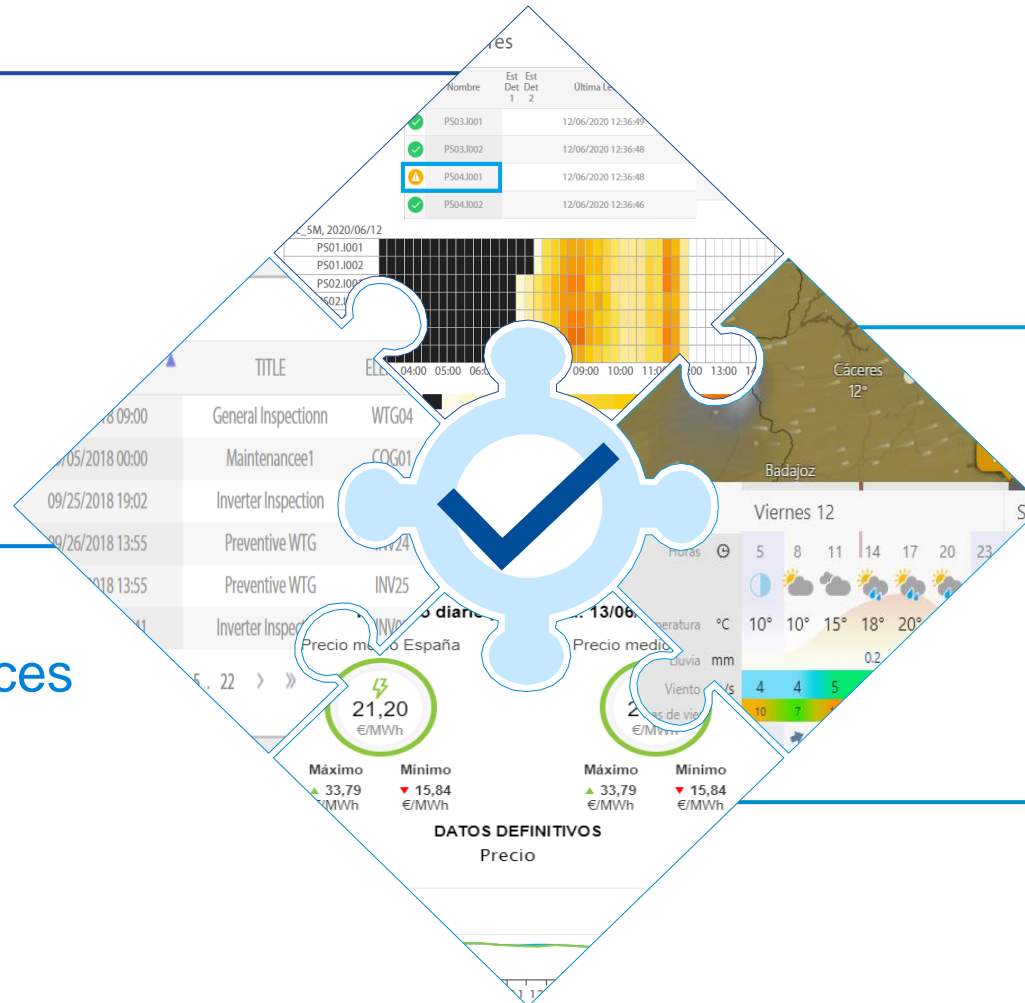
Available resource

Forecast data

03

Energy price prediction

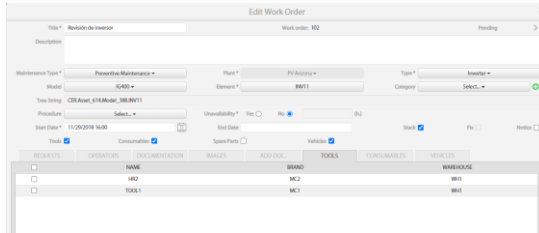
Trading? Market prices



Execution phase

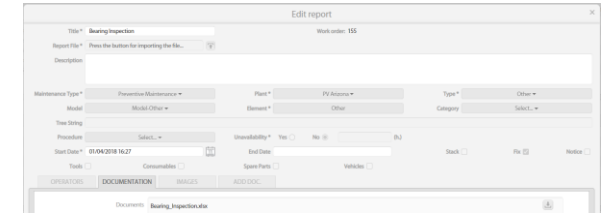
Execution cycle

Generation and sending of WOs

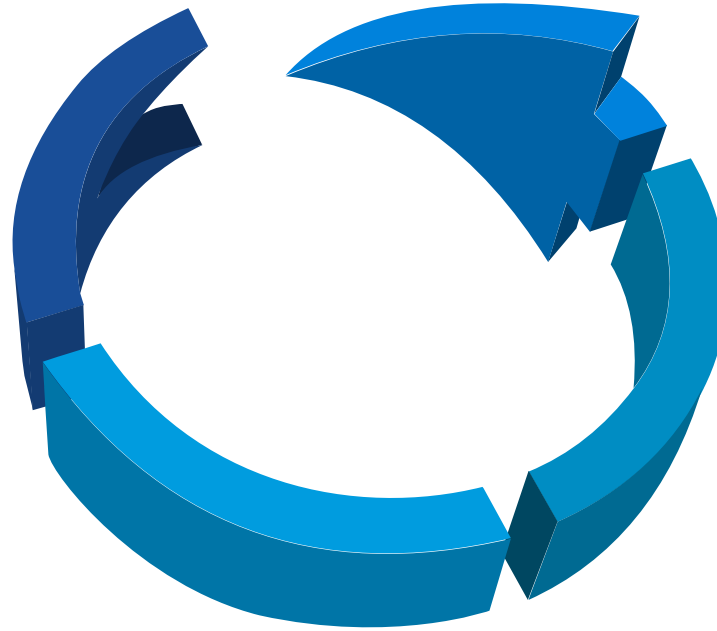


- Automatic for preventive maintenance
- Security control
- Warehouse and spares control

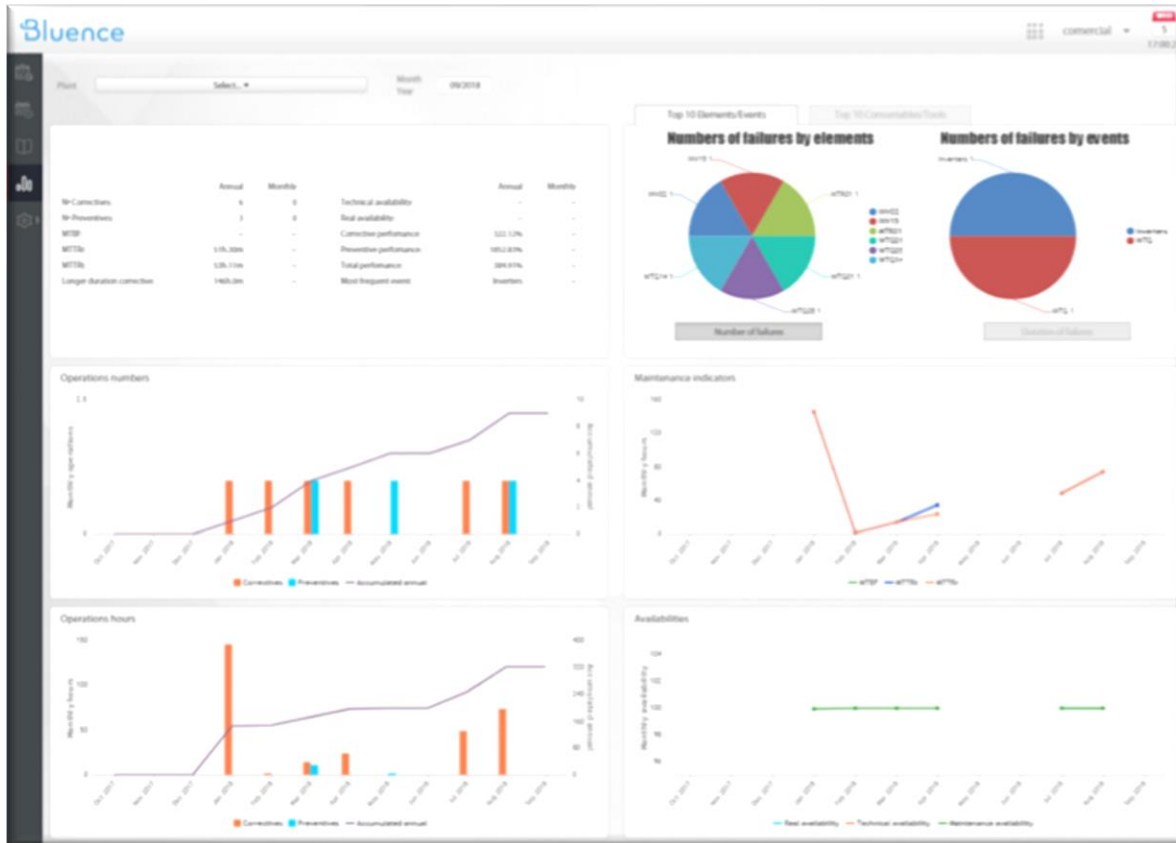
Generation of WRs



- Validation process
- Control of generated information



Data analysis



Operational data

% corrective, predictive, average duration, nature and time associated with events and failures



Performance data

Type of failures, affected sub elements, performance indicators before and after the O&M works...



O&M management data

Response times, compliance with maintenance contracts, warehouse and spare parts usage

Value added solutions

O&M digitalization benefits

- ✓ Optimization of the site works and work coordination
- ✓ Visibility and control of the entire O&M cycle
- ✓ Generation of a know-how database for preventive maintenance and future actions



Reduction of losses



Improvement of operational efficiency



Process optimization



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Thank you