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How to Manage Effectively Wind Farms in Real Time

Presented by **Roberto Carlos Medrano**
Operation and Maintenance Manager

CEMEX | ENERGÍA

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Agenda

- About CEMEX Energia
- Business Challenge
- CEMEX Energia Connected Services RM&DC
- PI System® Products & Services applied
- PI ProcessBook®, PI DataLink® & Web Development
- RM&DC Architecture
- Results Obtained and Business Impact
- Demo
- Future plans & Next steps
- Conclusion

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About CEMEX | ENERGÍA

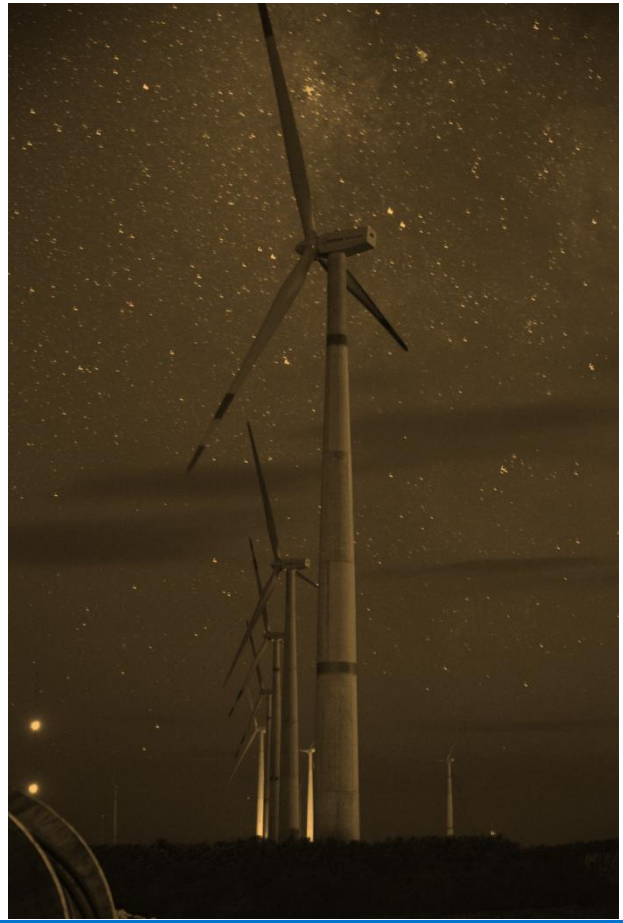
CEMEX has over 20 years participating in the Energy Industry. In 2014 creates its subsidiary - CEMEX Energia.

Mexico: Since 1998, 3 Power Plants developed (~1GW). Two of the largest wind farms in Latina America (+250MW each).

Abroad: Several projects developed in USA, Germany, Philippines, Latin America and Caribbean.

Objectives:

- Reduce electricity costs for cement production.
- Take advantage of opportunities that worldwide Energy Market offers.
- Since '90 reduction of CO_2 emissions and usage of alternative fuels in cement operations.
- Currently working in +20 projects around the world.



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About:

CEMEX | ENERGÍA

	TEG	EURUS	Ventika
Construction:	2001	2007	2014
Commercial Operation:	2004	2009	2016
Location:	Central Zone	South West	North East
CEMEX Role:	Owner of: 100% of Energy and Power output + Petcoke & Limestone supplier	Owner of: 100% of Energy and Power output	Partial Owner of Energy and A portion of Power output + Wind Farm Administrator
Technology:	1 x 230MW Coal-Fired Boiler with Pet Coke	250.5 MW 167 WTGs x 1.5MW	252MW 84 WTGs x 3MW

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Business Challenge

Acquire right data infrastructure that allows Real-time monitoring and process data analysis.

Establish a reliable process from data acquisition until storage.

Data management to support Energy Operational Platform.

Enabling a reliable Asset Management strategy to comply with contractual obligations.

24x7 monitoring of Performance and Guarantees compliances of each asset.

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CEMEX Energia & OSIsoft: Connected Services RM&DC

Connected Services RM&DC

- CEMEX Energia and OSIsoft entered into an agreement late 2015 in modality of “Connected Services”, which covers Power Plants (Renewable and Conventional) where CEMEX Energia provides Asset Management services – Ventika (wind).

Traditional License

- In late 2016 CEMEX Energia acquired a perpetual license with the aim to include into its “Operational Platform” mainly Electrical variables of TEG (Thermal), Eurus (Wind) and Cement Plants.

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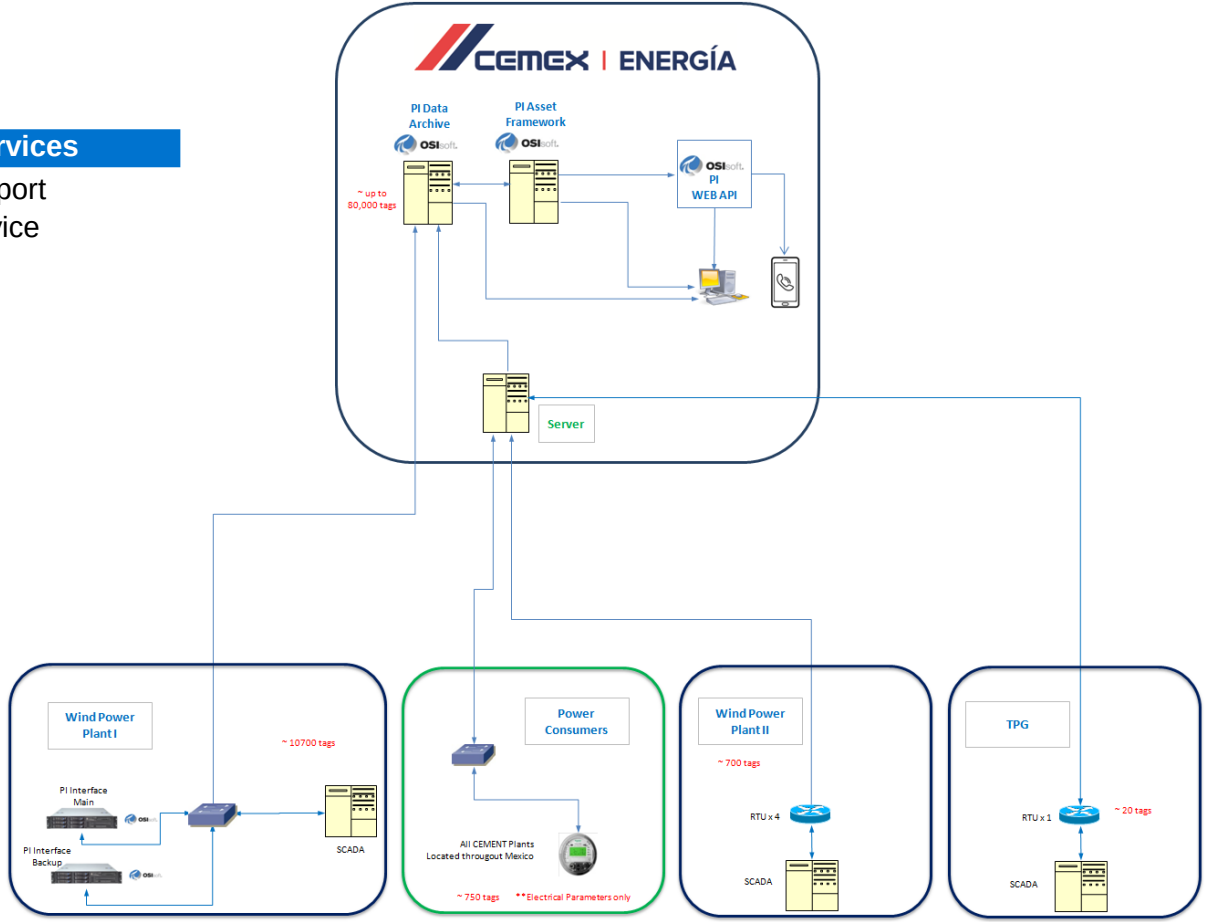
RM&DC Architecture

Products	Services
High Availability (HA) Data Archive	Tech Support
Asset Framework (AF)	Field Service
Notifications	Training
Event Frames	
PI ProcessBook	
PI DataLink	
PI System Access:	
(PI SDK, AF SDK, **PI WebAPI**)	



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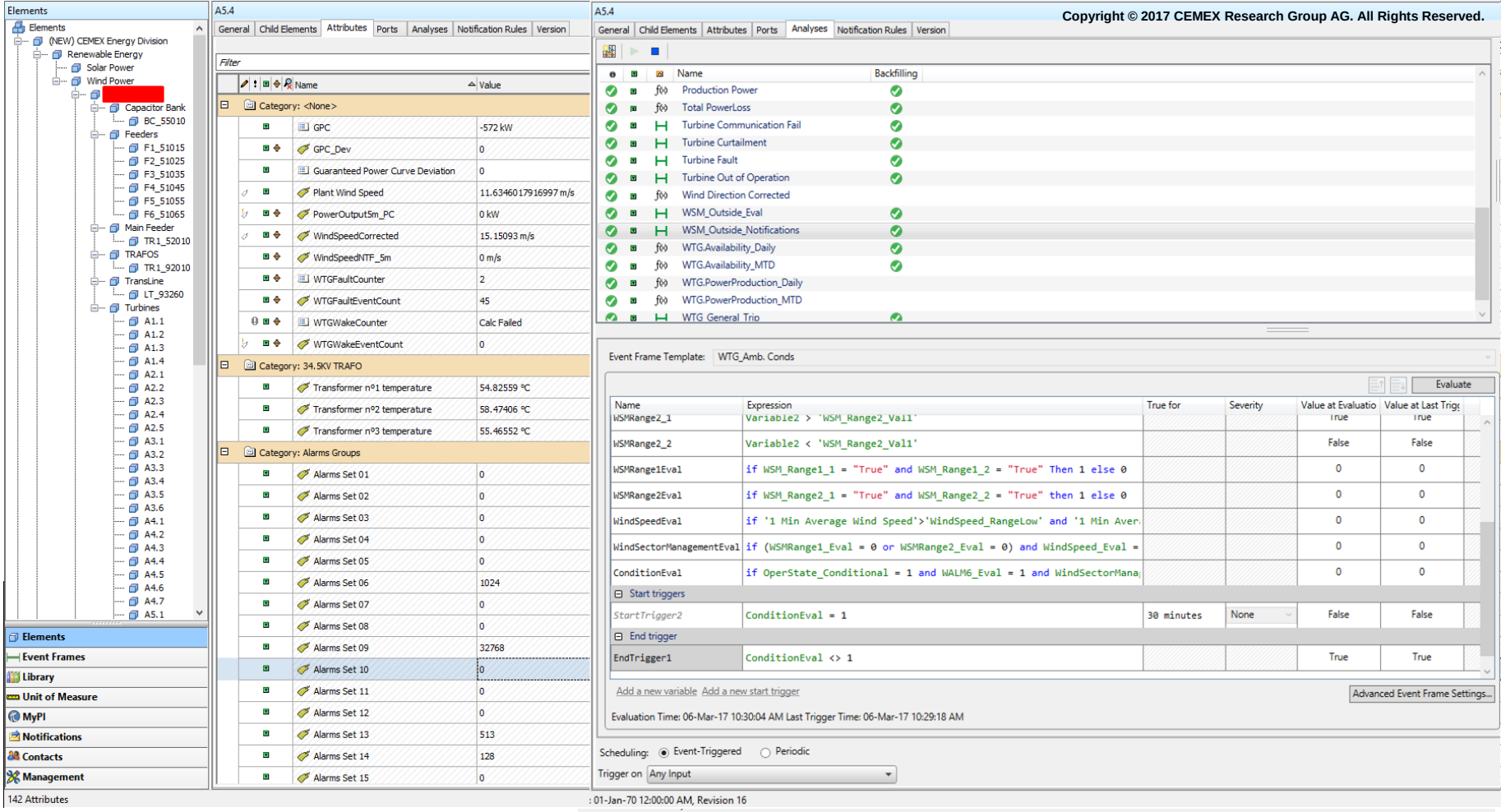
PI System® Products

&

Services applied

Asset Framework (AF)



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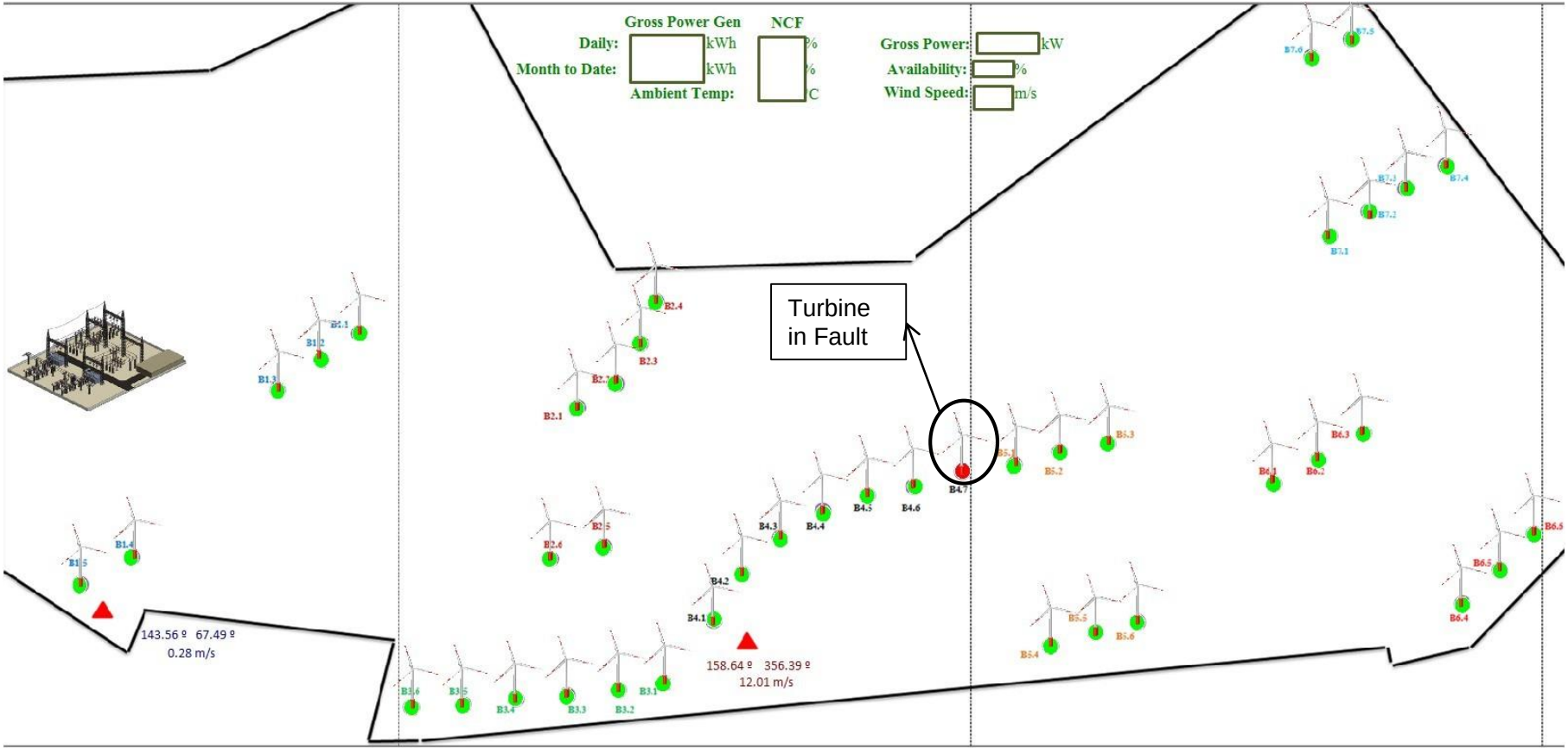
PI ProcessBook®



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A5.4 Emergency

Power Output: 0 kW | Daily Production: [redacted] kWh | Monthly Production: [redacted] kWh | Availability_Daily: [redacted] % | Availability_Montly: [redacted] %

Electrical Parameters	
Reactive Power:	0.0 kVAr
Voltage:	12,104.0 V
Current:	Calc Failed
Frecuency:	60.00 Hz
Power Factor:	Calc Failed

Generator Parameters	
Cooler Temp:	32.6 °C
GBX-GEN Brg Temp:	68.00 °C
GEN Free Brg Temp:	60.2 °C
Generator Speed:	-0.3 rpm
Gen Winding U Temp:	106.2 °
Gen Winding V Temp:	106.9 °
Gen Winding W Temp:	107.1 °
Generator Rings Temp:	30.4 °C

Gearbox Parameters	
Oil Pressure:	-1.5 bar
Oil Temperature:	57.6 °C
Bearing temp:	60.9 °C
High Speed temp:	NO DATA
HighSpeed shft Press:	1.3
HighSpeed Accum Press:	NO DATA

Main Shaft	
Front bearing temp:	32.0 °
Rear bearing temp:	34.7 °
Rotor Speed:	0.2 rpm

Yaw System	
Hyd Pressure Yaw:	157.9 bar
Yaw turns number:	1.39

34.5KV Trafo	
Phase R Temp:	56.6 °C
Phase S Temp:	60.0 °C
Phase T Temp:	57.2 °C

Power Converter	
Coolant Temp:	33.0 °
DC Bus Voltage:	0.0 V

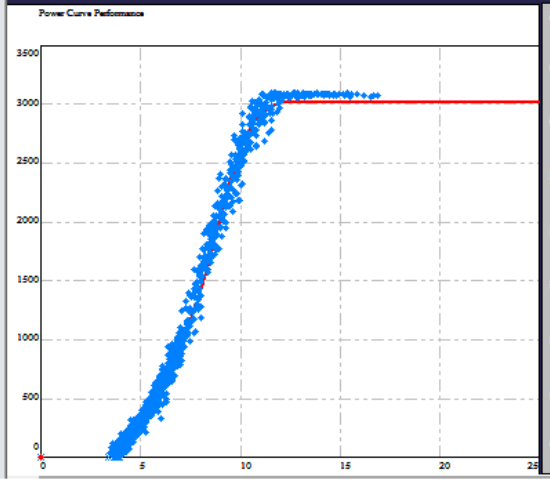
Pitch System	
Blade 1 Pressure:	219.48 bar
Blade 2 Pressure:	218.99 bar
Blade 3 Pressure:	220.07 bar
Blade 1 Position:	91.07 °
Blade 2 Position:	91.27 °
Blade 3 Position:	91.28 °

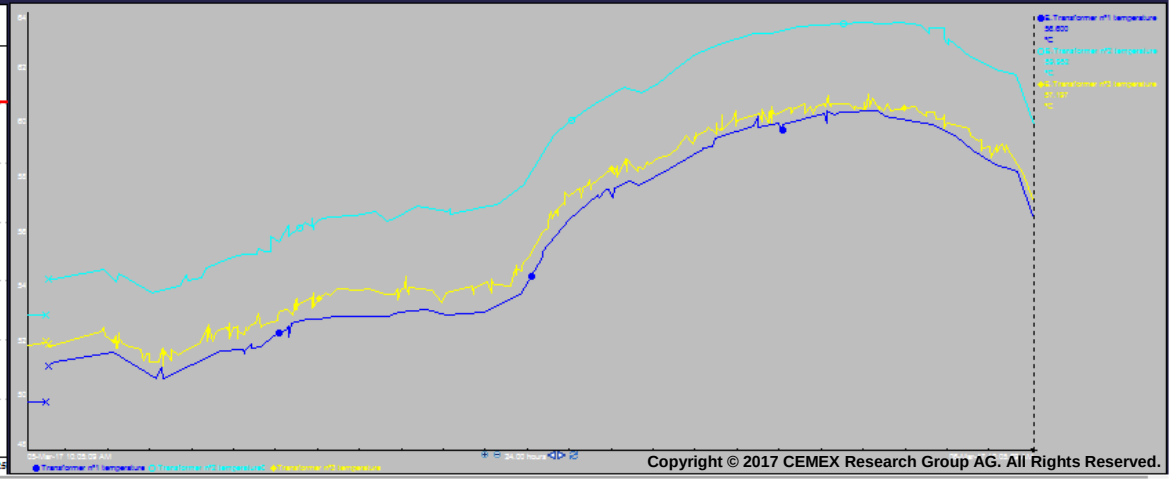
Hydr. Group Oil Temperature 44.34 °C | Nacelle Temperature 31.55 °C | Ambient Temperature 25.01 °C

Wind Speed 13.29 m/s | Wind Direction 11.96 ° | Turbulence Index 24.24 % | Vibration Level 1.99 %

Place for Turbine Manufacturer

Hydr group Pressure 152.6 bar | Back to main | Alarm Panel





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PI ProcessBook®

For every Turbine, SCADA system provides 33 alarms that consists of 16 bit word each one.

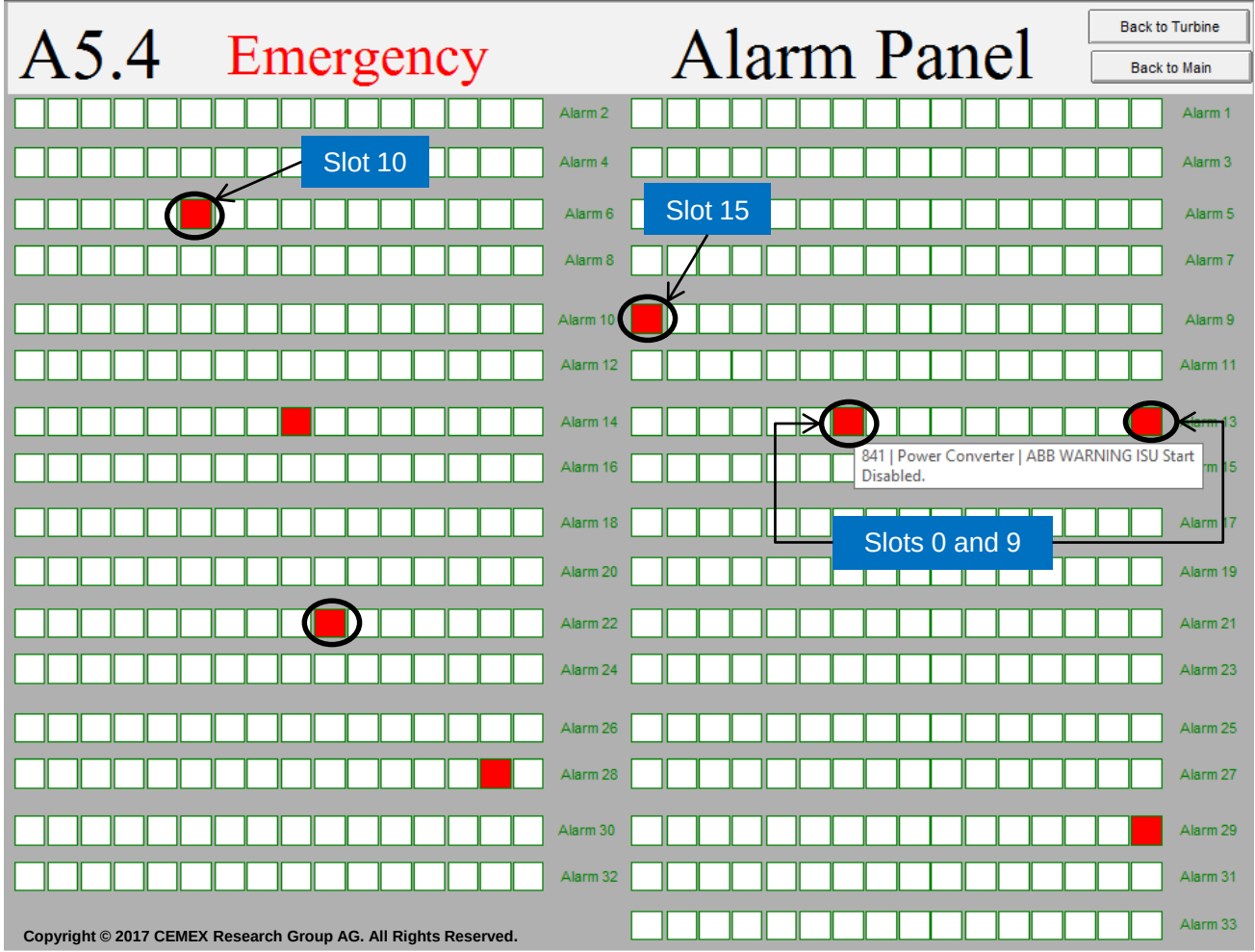
¡Big functionality!: placing above each red square it will show a tooltip with the description of activated alarm, as shown in picture.

Examples:

(*) Alarm 6 has "***on***" slot 10 equivalent to 1024.

(*) Alarm 9 has "***on***" the slot 15 equivalent to 32768

(*) Alarm 13 has "***on***" the slots 0 (1) and 9 (512), equivalent to number 513.



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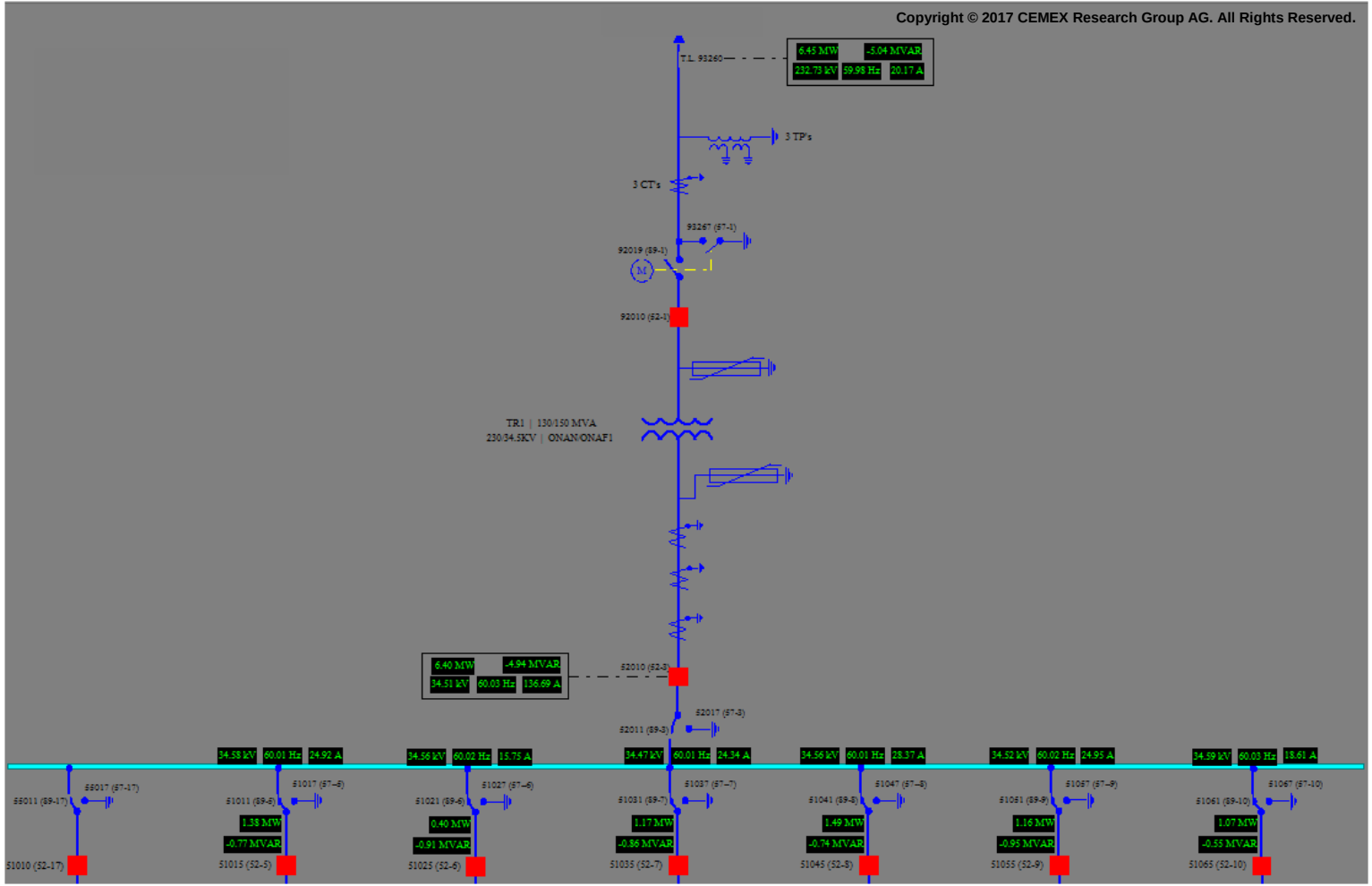

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PI DataLink®

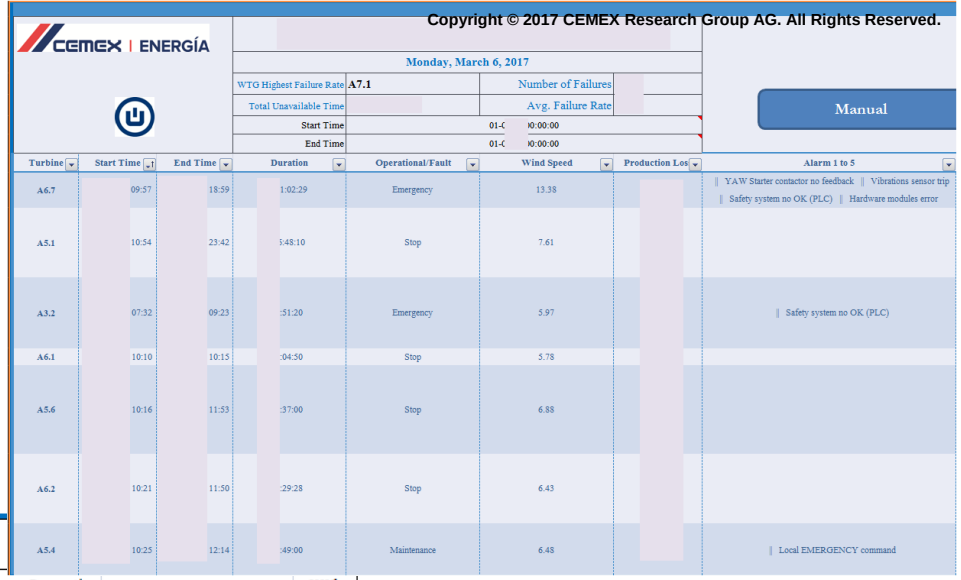
Event Reports:

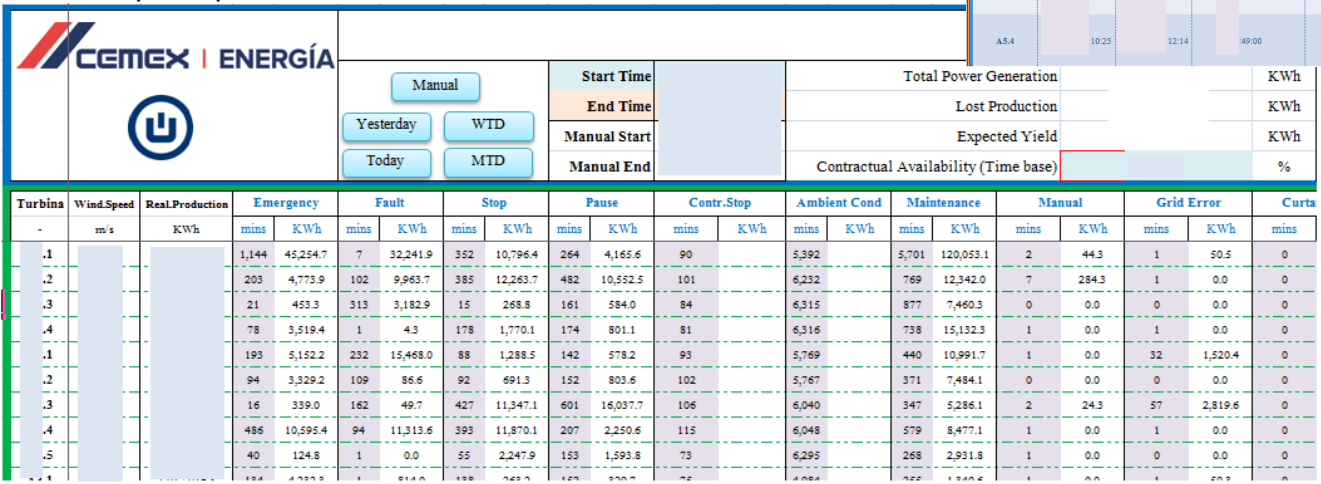
•Based in PI Event Frames ®. Allowing us to focus in assets with high frequency of failure to stablish action plans.

•Allow us to track KPIs such as: MTBF and MTTR.

•Detect the cause of failures (Alarms) through the conversion from each 16bits to alarm descriptions.

•Allow us to calculate Lost Production and its related wind speed per event with aim to monetize.





Turbina	Wind.Speed	Real.Production	Emergency		Fault		Stop		Pause		Contr.Stop		Ambient Cond		Maintenance		Manual		Grid Error		Curta
-	m/s	KWh	mins	KWh	mins	KWh	mins	KWh	mins	KWh	mins	KWh	mins	KWh	mins	KWh	mins	KWh	mins	KWh	mins
.1			1,144	45,254.7	7	32,241.9	352	10,796.4	264	4,165.6	90		5,392		5,701	120,053.1	2	44.3	1	50.5	0
.2			203	4,775.9	102	9,963.7	385	12,263.7	482	10,552.5	101		6,232		769	12,342.0	7	284.3	1	0.0	0
.3			21	453.3	313	3,182.9	15	268.8	161	584.0	84		6,315		877	7,460.3	0	0.0	0	0.0	0
.4			78	3,519.4	1	4.3	178	1,770.1	174	801.1	81		6,316		738	15,132.3	1	0.0	1	0.0	0
.1			193	5,152.2	232	15,468.0	88	1,288.5	142	578.2	93		5,769		440	10,991.7	1	0.0	32	1,520.4	0
.2			94	3,329.2	109	86.6	92	691.3	152	803.6	102		5,767		371	7,484.1	0	0.0	0	0.0	0
.3			16	339.0	162	49.7	427	11,347.1	601	16,037.7	106		6,040		347	5,286.1	2	24.3	57	2,819.6	0
.4			486	10,595.4	94	11,313.6	393	11,870.1	207	2,250.6	115		6,048		579	8,477.1	1	0.0	1	0.0	0
.5			40	124.8	1	0.0	55	2,247.9	153	1,593.8	73		6,295		268	2,931.8	1	0.0	0	0.0	0

Operational Report:

• Count the time that turbines have in each operational state (run, fault, emergency, maintenance, ambient conditions, etc.).

•According to relative time, calculates contractual availability per turbine and entire Wind Power Plant.

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Notifications

(i) Turbine trips
(ii) Circuit Breakers Operations (MV/HV)
(iii) Communication issues.
(iv) Wind Sector Management (Turbines in Wake Effect).
(v) Ambient temperature above safe operation.
(vi) Reactive Power as Power consumer.
(vii) Data freeze.
(viii) Power Curve performance

B3.2 | Turbine in Wake Effect_Outside of WSM Limits | System: Turbines | Plant: Plant name | Ambient Cond |
PINotifications to: robertocarlos.medrano

TURBINE B3.2 | Turbine in Wake Effect_Outside of WSM | Ambient Cond

Plant Name: Plant name

Turbine: B3.2

Stoppage Reason: [64 - *Turbine in Wake Situation*] (The value 64 comming directly from SCADA and its processed in our system).

Start Time: 8:47:54 PM Central Standard Time (Mexico) (GMT-06:00:00)

Notification Time: ' 9:18:01 PM Central Standard Time (Mexico) (GMT-06:00:00)

End Time: 12/31/9999 11:59:59 PM Central Standard Time (Mexico) (GMT-06:00:00)

* * * \

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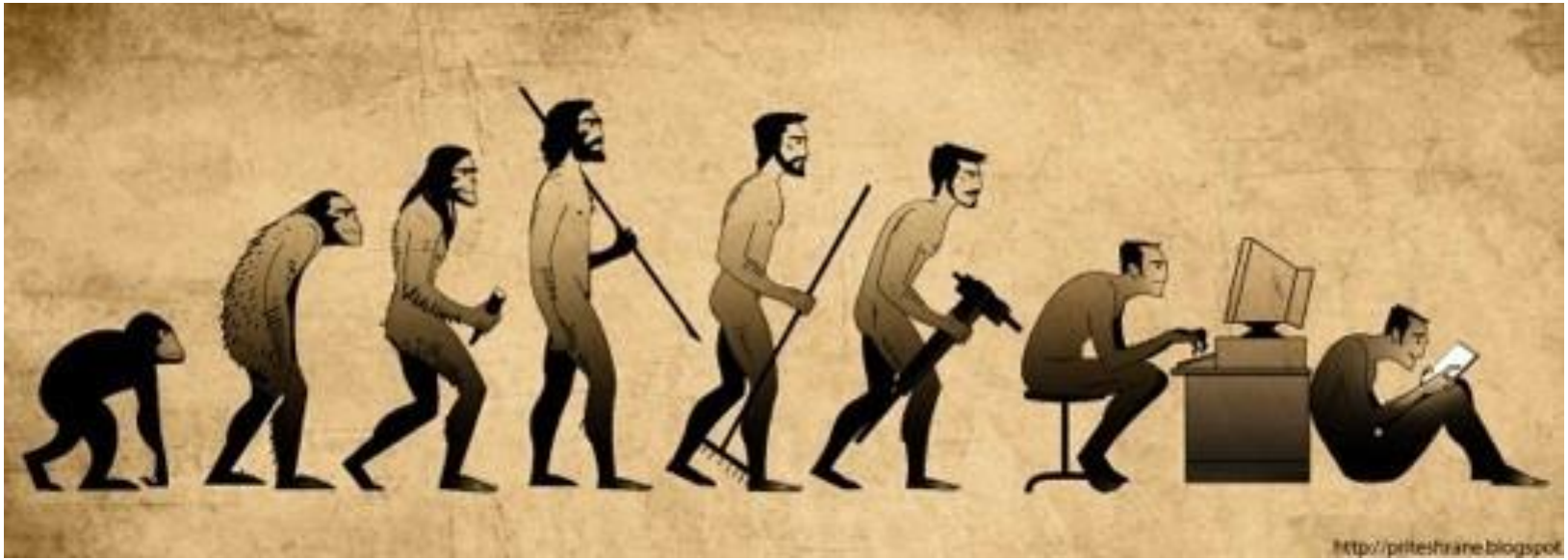
¡TIME TO EVOLVE!



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DEMO

ENERGY OPERATIONAL PLATFORM

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Timely detection of Turbines with underperformance – Power Curve

COMPANY and GOAL

CEMEX Energia is aware about underperformance in WTGs, due to this impacts directly in its KPIs (technical, contractual and economics).

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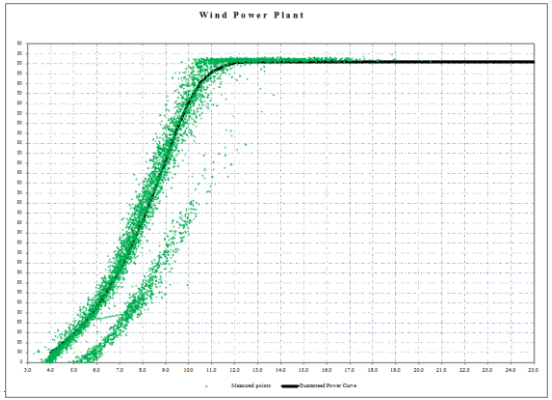

CHALLENGE

Maximization of Wind Resource available in Wind Farm.

- Meet the Power Generation and incomes budget.
- Compliance of Contractual guarantees

SOLUTION

Creation of a specialized and reliable Analysis Tool which measures deviations of Real vs Guaranteed behavior in real time.

- Through PI System we gathered key information of every turbine to build algorithms.
- Realtime visualization of every turbine. Each deviation is detected quickly

RESULTS

Avoidance of Lost Production due to inefficiencies in turbine performance.

- Timely detection of turbines with bad performance.
- Diligent reparations and turbines with high performance in long term.
- Contractual guarantees under compliance.

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Future Plans & Next Steps

Monitoring

- Include TEG (Thermal – CFB) and Eurus(Wind Farm) to Operational Platform.

Grid Code

- Attach Electrical Parameters of Cement Plants to manage the compliance of grid code.

Metering

- CEMEX Energia manages power meters (~3000). Under evaluation to use OSIsoft in upcoming projects.

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Conclusions

- The high reliability of OSIsoft products, specially PI System and all its functionalities enabling us to provide: (i) effective asset Management, (ii) High Quality Services, (iii) Trust and credibility, (iv) Value added, and (v) Anticipation and Timely reaction in favor to our final Customers.

“No PI then NO Gain”

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Contact Information

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Please wait for the **microphone** before asking your questions

State your **name & company**

Please remember to…

Complete the Online Survey for this session

http://bit.ly/uc2017-app

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado

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