

Examples of findings when using data management software  
to increase profitability in wind farm operations

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**baze**<sup>®</sup>  
Technology

# Baze Technology AS

- Industrial IT company
- Clear and expansive company strategy
  - Global product company
  - Partners
- Large R&D activity
- Provided several groundbreaking solutions successfully implemented in energy, oil & gas, and maritime industry
- Strong growth
- Strong financial



Main office, Porsgrunn, Norway



Baze Marine and Offshore, subsidiary in Singapore

# Wind Energy

- BazeField<sup>®</sup> Wind Farm Management System was presented to the market four years ago.
- The system is in use by 3E, Natural Power, Statkraft, Outsmart, Etha, Fred. Olsen Renewables, WFSO, Arise, Skellefteå Kraft/BlaikenVind, OX2,, Parkwind, Statoil, Puhuri, Taaleritehdas, Fortech, Umeå Energi, Vasa Vind, Pori Energia , Etha among others.
- Servicing already close to 5 GW at more than 150 wind farms on a daily basis. Rapidly increase.
- Entered several new countries /markets in 2014



Fallago Rig (Natural Power, UK)



Jädderåsen Wind Farm (Arise, Sweden)

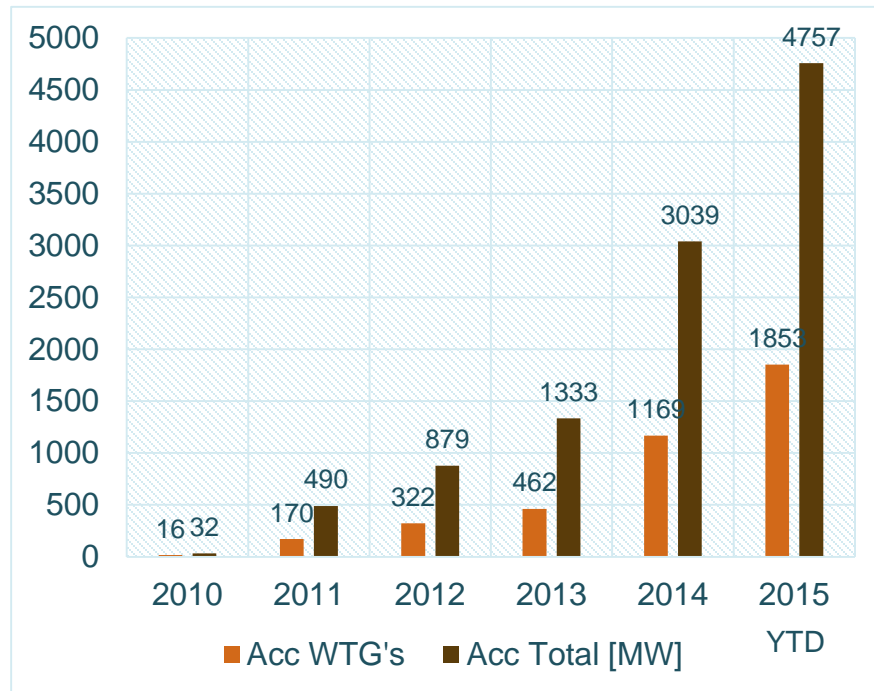


Havøygvælen Wind Farm (Artic Wind, Norway)



Sheringham Shoal (Statkraft, UK)

# Growth in installed capacity



Belwind I (Parkwind/3e)



Blaiken (Blaiken Vind, Sweden)

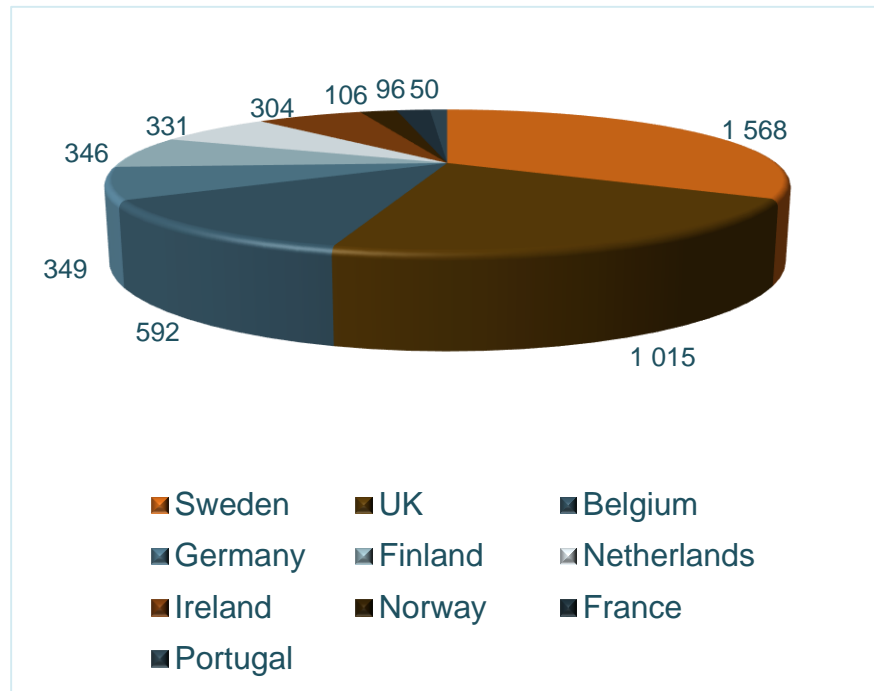


Carraig Gheal (Natural Power, UK)



Uljabuouda (Skellefteå Kraft, Sweden)

# Installed capacity in Europa



Lista (Fred Olsen Renewables)



Pori Wind Farm (Pori Energia, Finland)

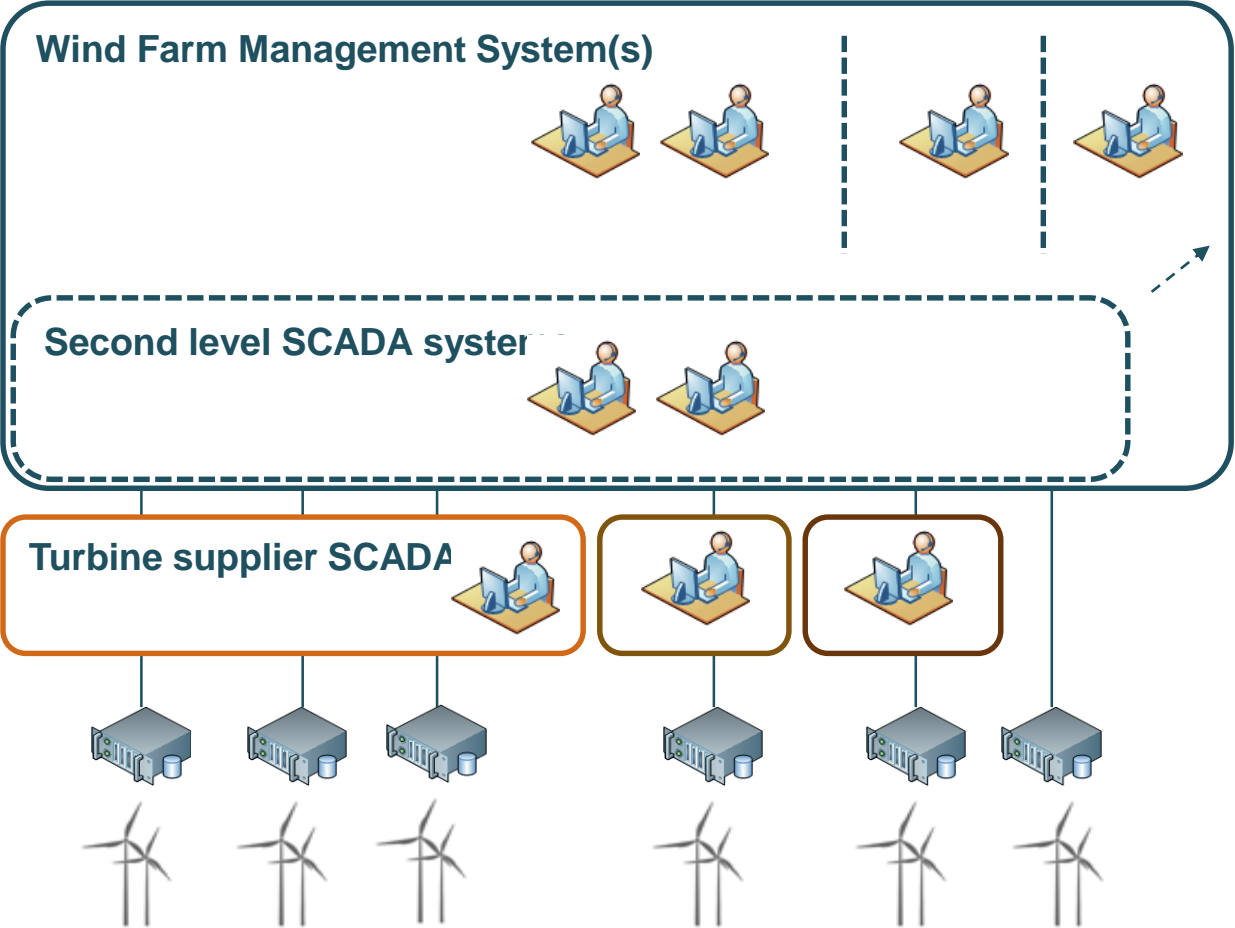


Hywind I Floating Turbine (Statoil, Norway)



Trianel Borkum West (OutSmart, Germany)

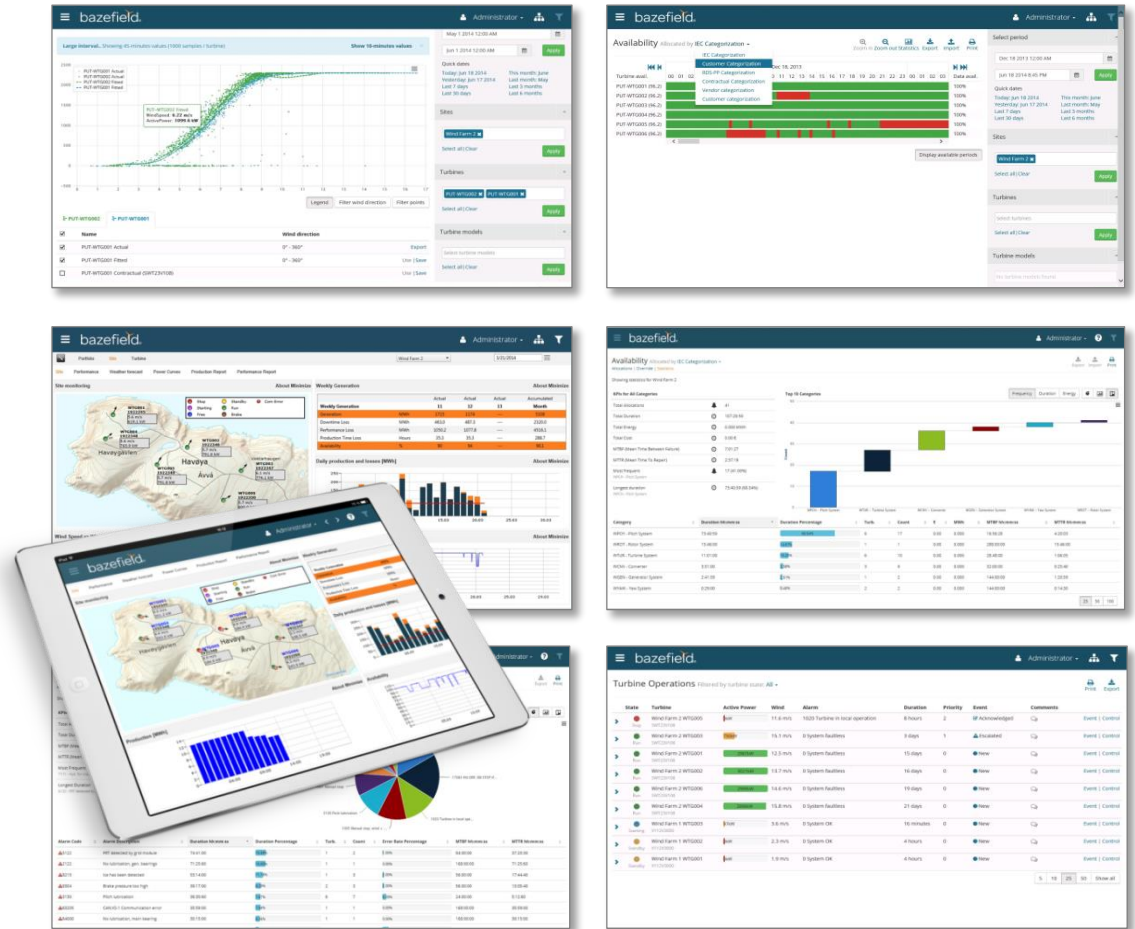
# Wind Power Operations Systems - functionality



- ✓ Power Management 
- ✓ Power trading 
- ✓ Production forecast 
- ✓ Production planning 
- ✓ Availability analysis and Mgt.
- ✓ Performance analysis
- ✓ (More) reporting
- ✓ Multi manufacturer turbine interfacing
- ✓ Reporting
- ✓ Trending
- ✓ Alarms and stops
- ✓ Monitoring and Control

# Profitability improvements

- Reduced downtime, improved availability and increased efficiency of assets
- Increased negotiation power toward suppliers in order to challenge OEM
- Better quality and reduced time spent on reporting and data management for analysis.
- Centralized and reduced resource usage for daily operation
- Increase energy value
- Increased confidence for all stakeholders



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# Examples of findings when using data management software to increase profitability in wind farm operations

# Performance alerting

● 24 of 30 turbines are running Sort by: [Operation state](#) / [Site](#) / [Duration](#) / [Power](#) / [Wind speed](#) / [Priority](#) / [Status](#)

▼ ● FARM115 E01 (NordexN100)  
Running for 3 days \*Underperforming

Showing latest 10 alarms from **Performance** sources.

Type	Source	From	To
▲	Performance	ierperforming when compared to power curve based on historical data	2015-01-29 21:52:00
▲	Performance	ierperforming when compared to power curve based on historical data	2015-01-29 21:10:00
▲	Performance	ierperforming when compared to power curve based on historical data	2015-01-29 21:10:00
▲	Performance	ierperforming when compared to power curve based on historical data	2015-01-29 20:17:32
▲	Performance	ierperforming when compared to power curve based on historical data	2015-01-29 20:17:23
▲	Performance	401 Turbine is underperforming when compared to power curve based on historical data	2015-01-29 20:12:05
▲	Performance	402 Turbine is underperforming due to downrating	2015-01-29 20:07:24
▲	Performance	402 Turbine is underperforming due to downrating	2015-01-29 20:06:18
▲	Performance	401 Turbine is underperforming when compared to power curve based on historical data	2015-01-29 21:40:00
▲	Performance	401 Turbine is underperforming when compared to power curve based on historical data	2015-01-29 21:50:00

6.77568 kW  
Wind: 2.8 m/s

▲ TURBINE IS UNDERPERFORMING WHEN COMPARED TO POWER CURVE BASED ON HISTORICAL DATA @2015-01-29 21:52

[Comments](#)

[Go to alarm log](#)

- SCADA
- Performance
- Communication
- System
- Substation
- All

▶ ● FARM115 E25 (NordexN100)  
Running for 3 days

50 kW  
Wind: 2.8 m/s

▲ PITCHANGLE 3 DIFF.ACT-REDACT @2014-11-29 06:30

[Comments](#)

▶ ● FARM115 E27 (NordexN100)  
Running for 3 days

59 kW  
Wind: 3.8 m/s

▲ YAW MANUAL WITH AUTOOPERATION @2014-11-29 15:04

[Comments](#)

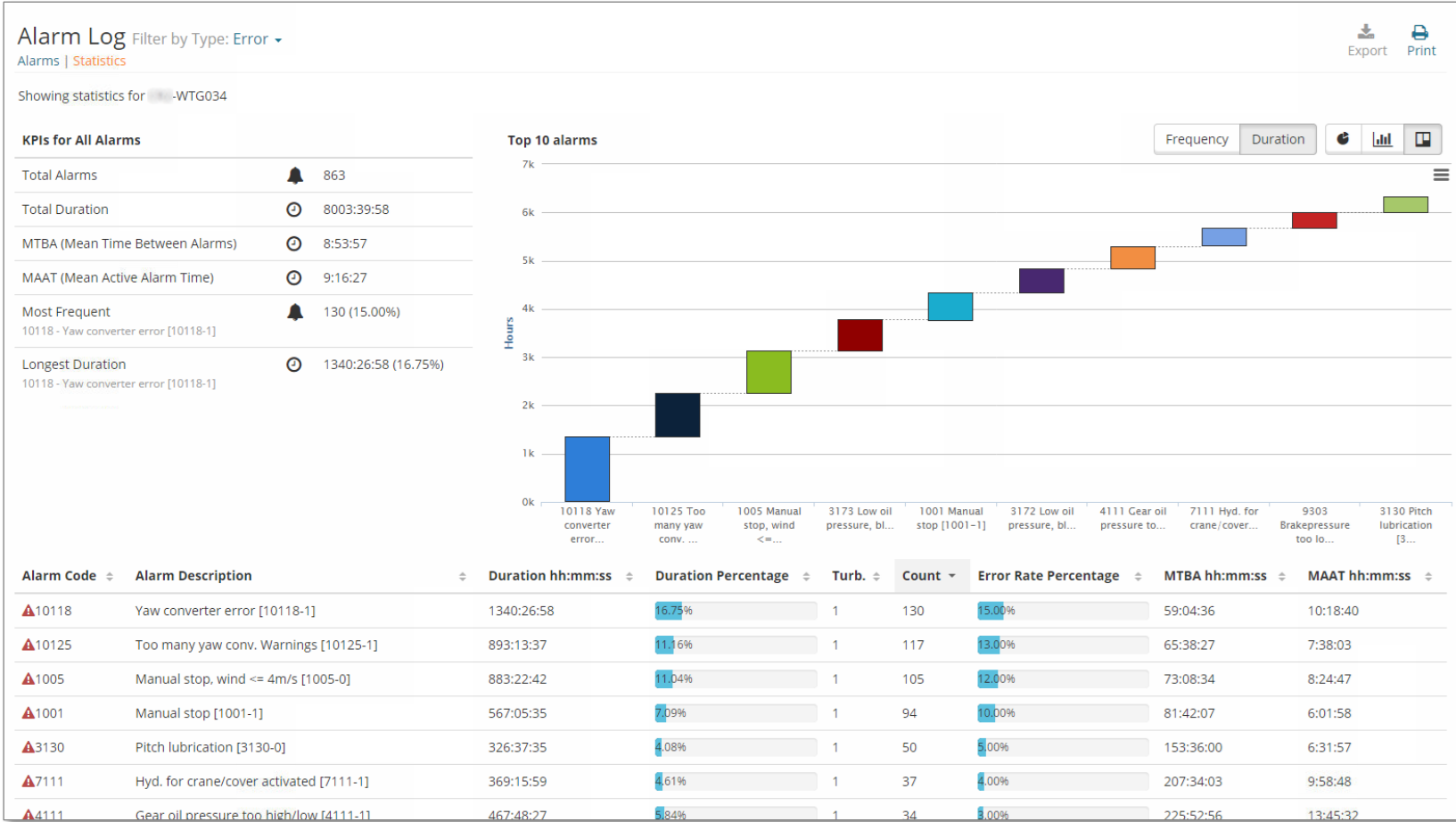
▶ ● FARM115 E06 (NordexN100)  
Running for 3 days

50 kW  
Wind: 4.5 m/s

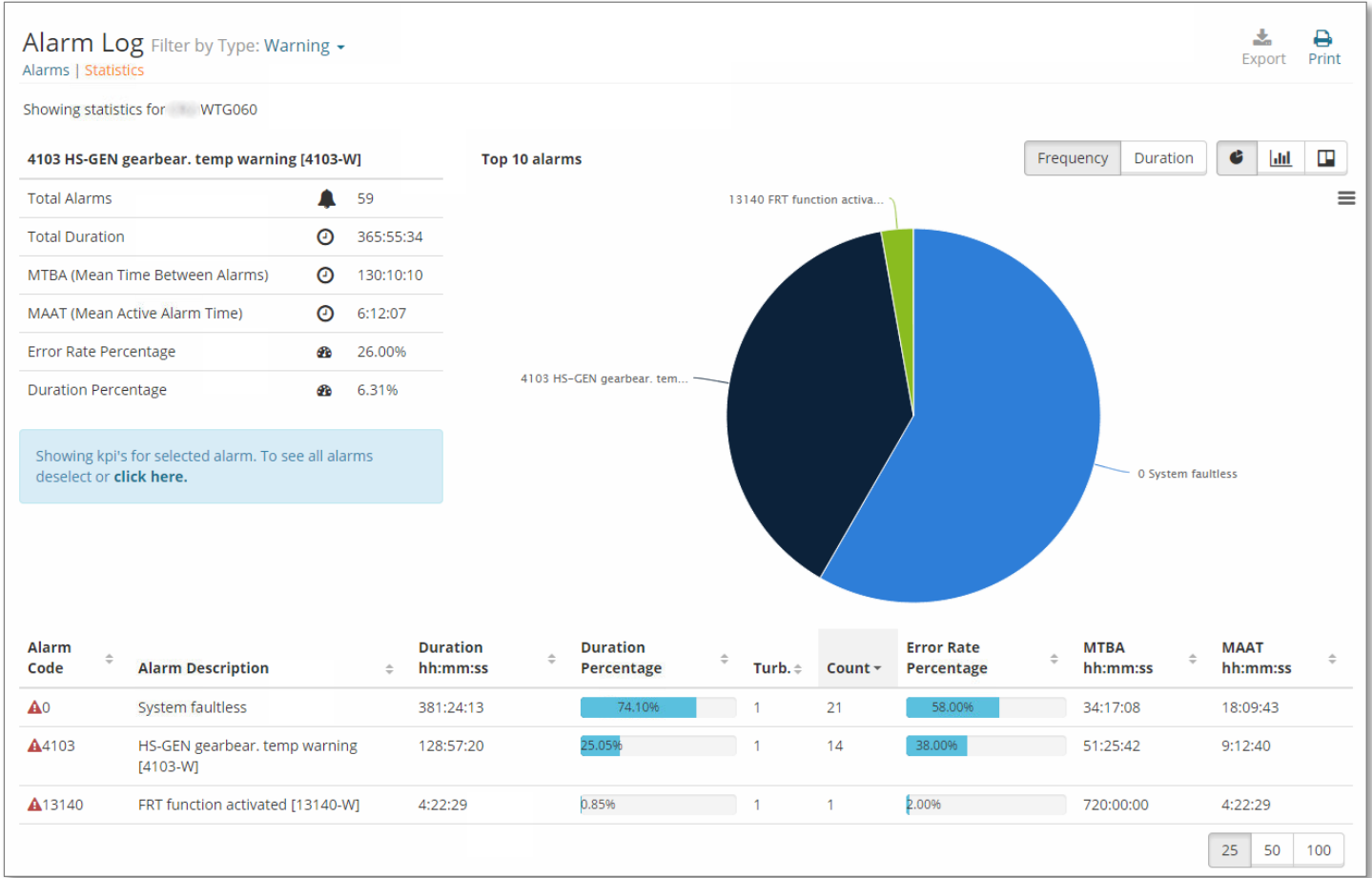
▲ PITCH MOTIONRUN ACTIVE @2014-11-29 13:58

[Comments](#)

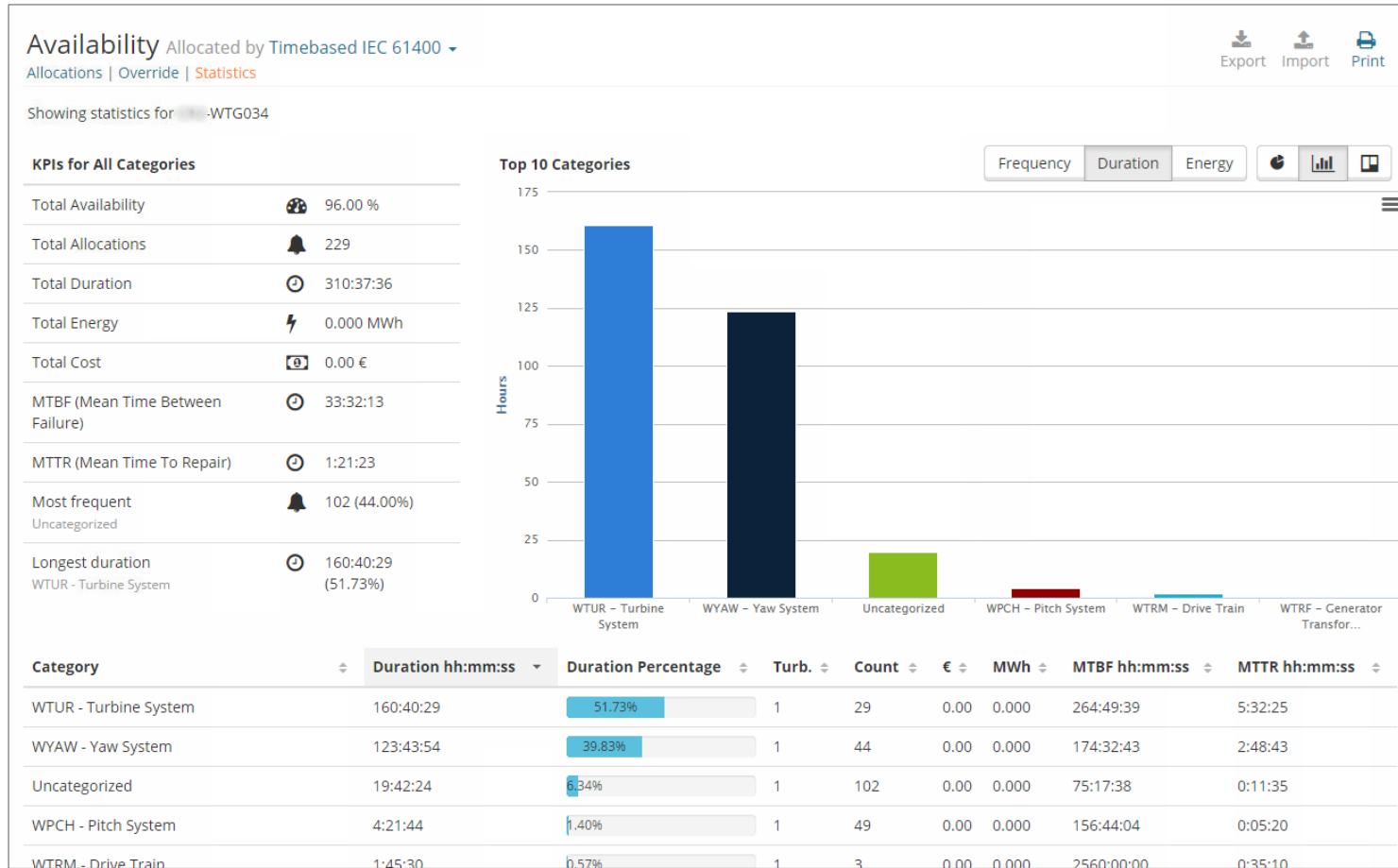
# Alarm frequency alerting for early detection of yaw motor failure



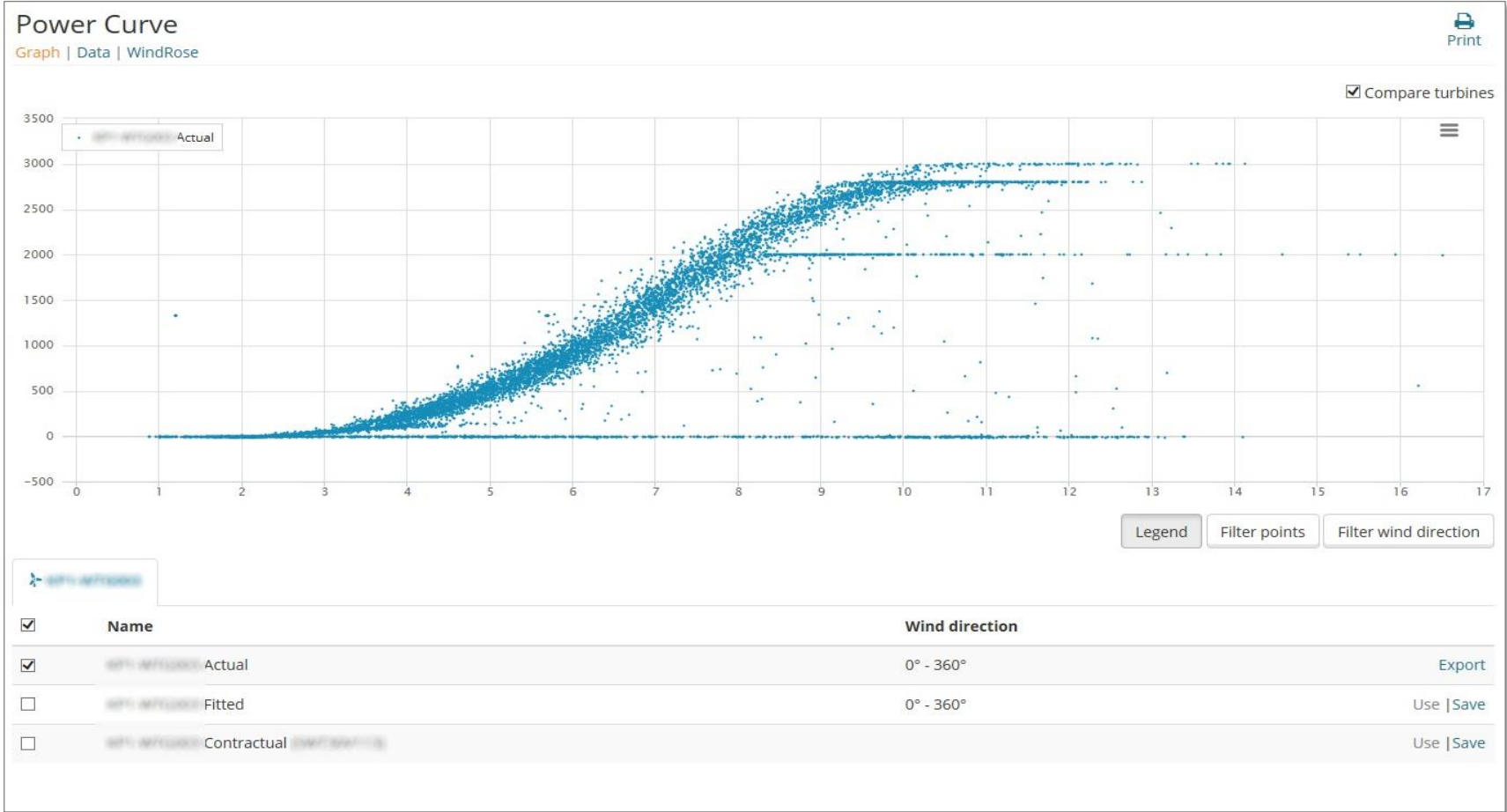
# Alarm frequency alerting for early detection of gearbox failure



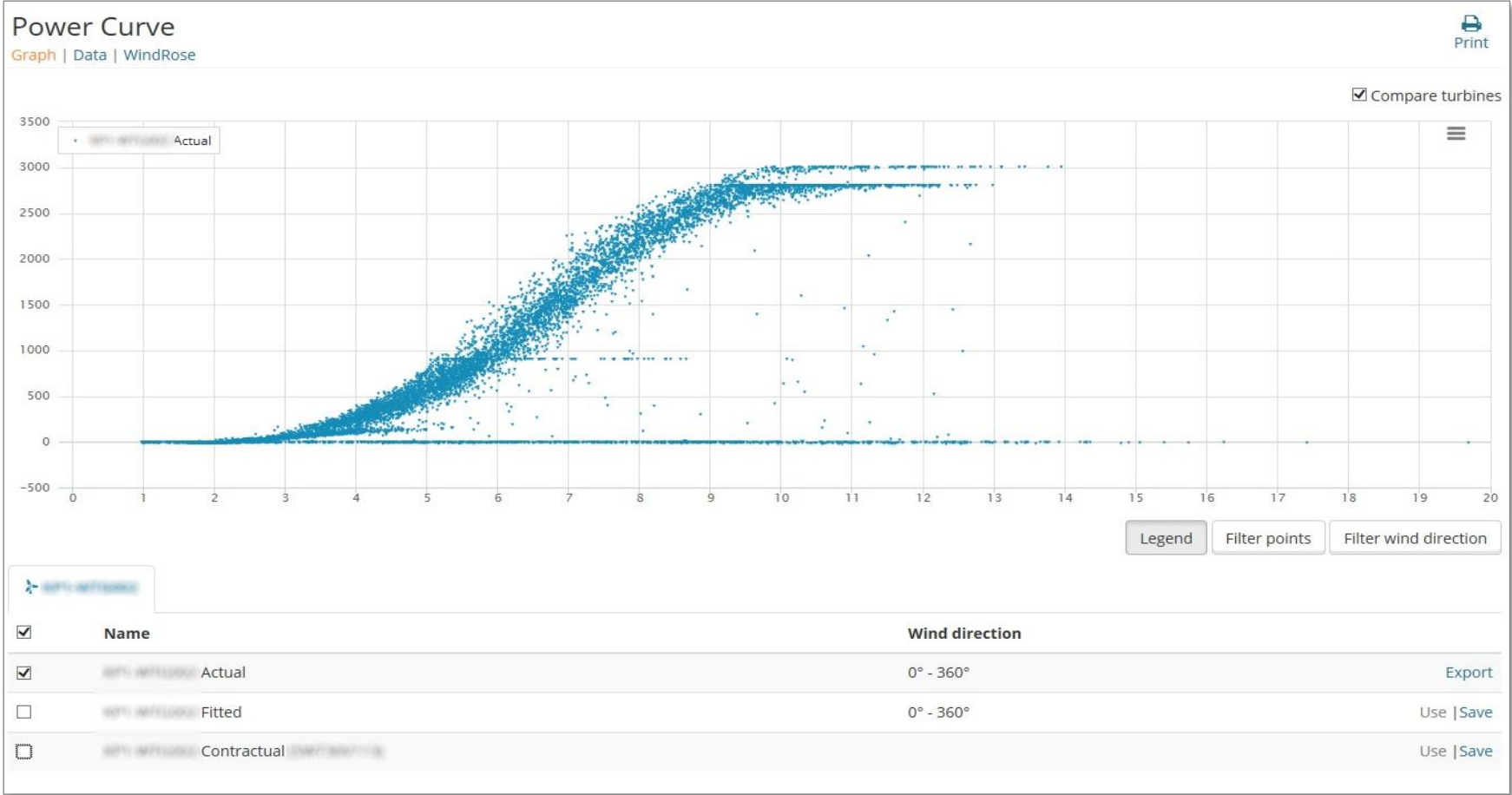
# Uncertainty in contractual availability due to new and unknown error codes



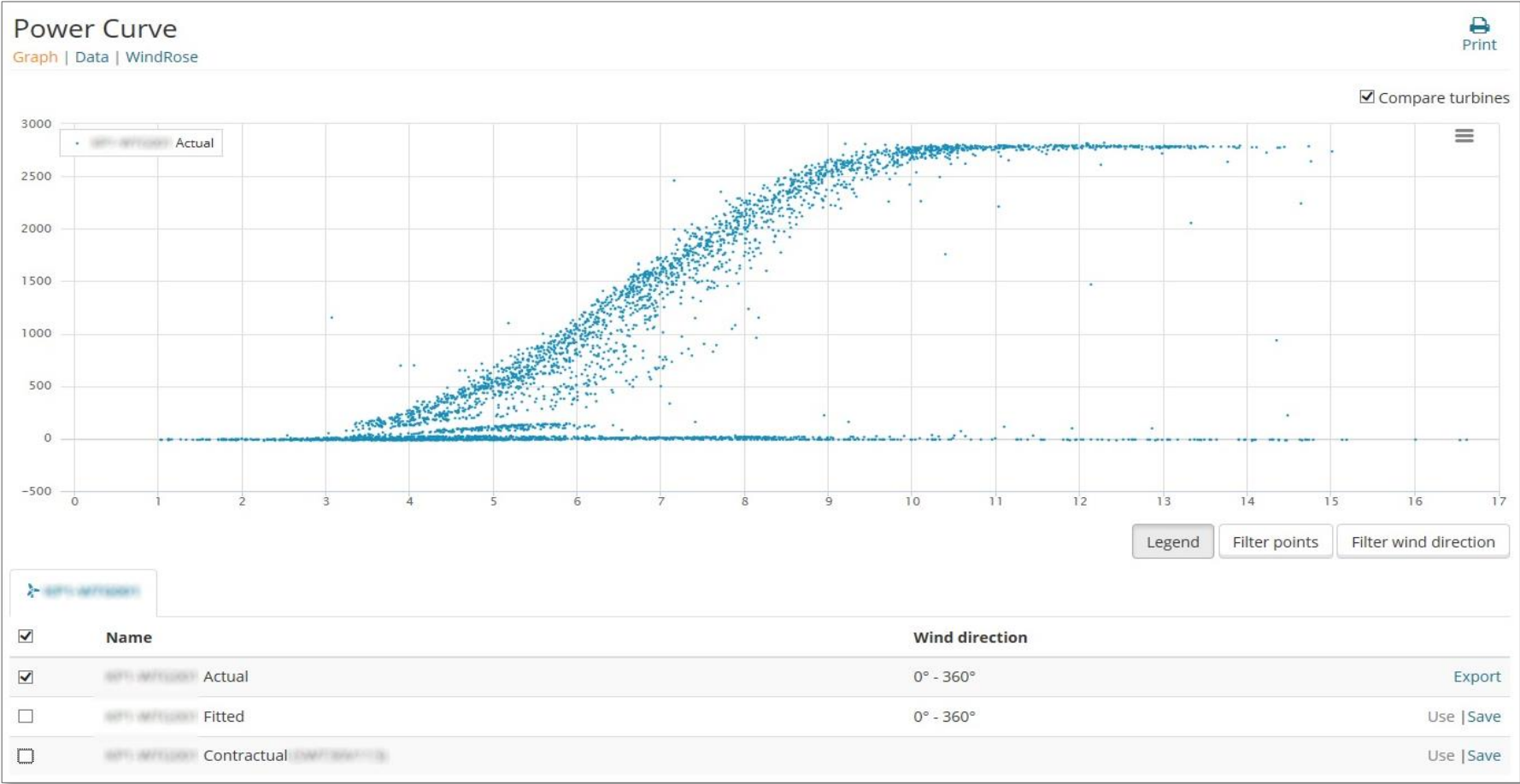
# Algorithm based detection and alerting - Unexpected curtailment



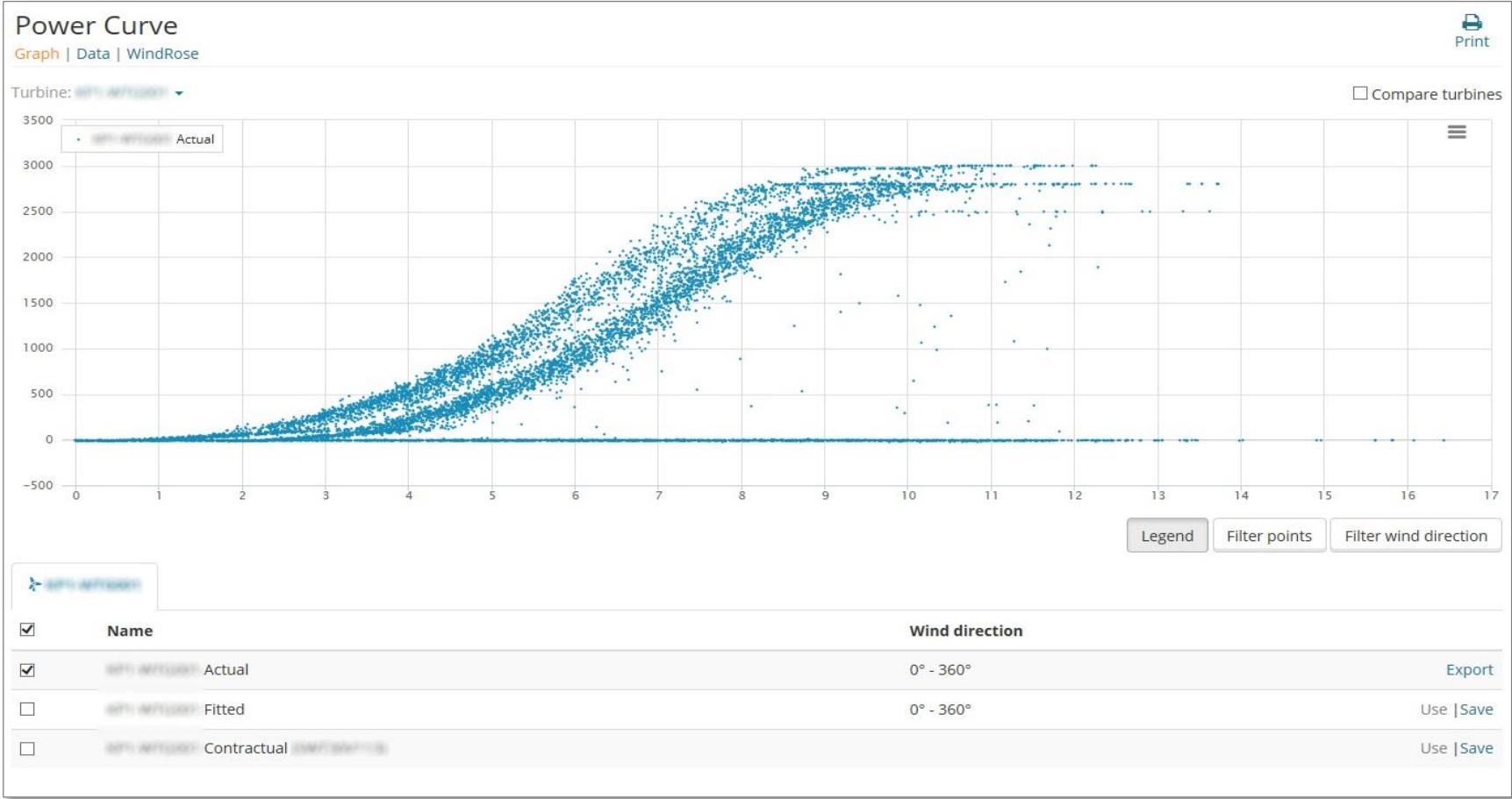
# Algorithm based detection and alerting - Unexpected curtailment (2)



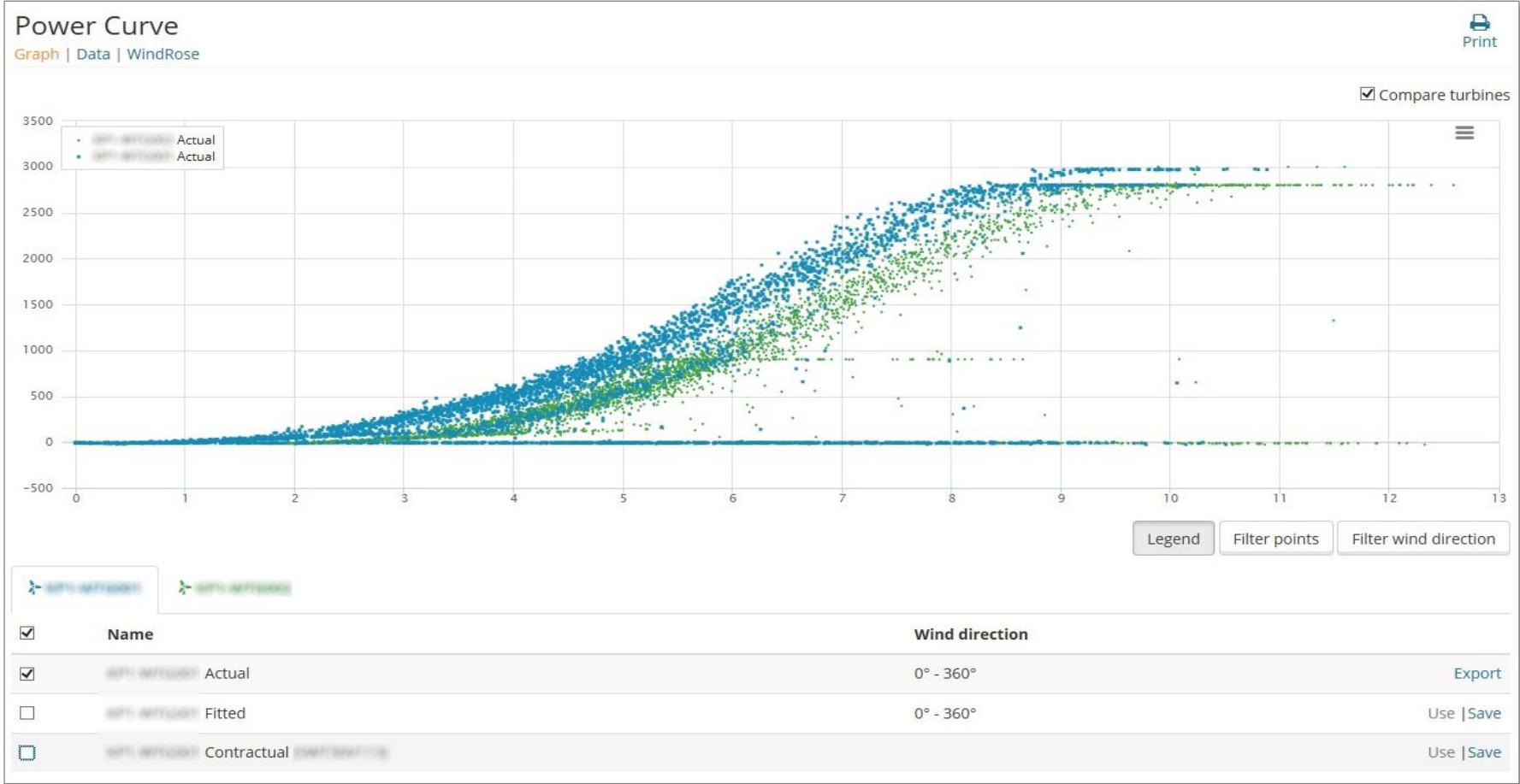
# Algorithm based detection and alerting - Icing conditions



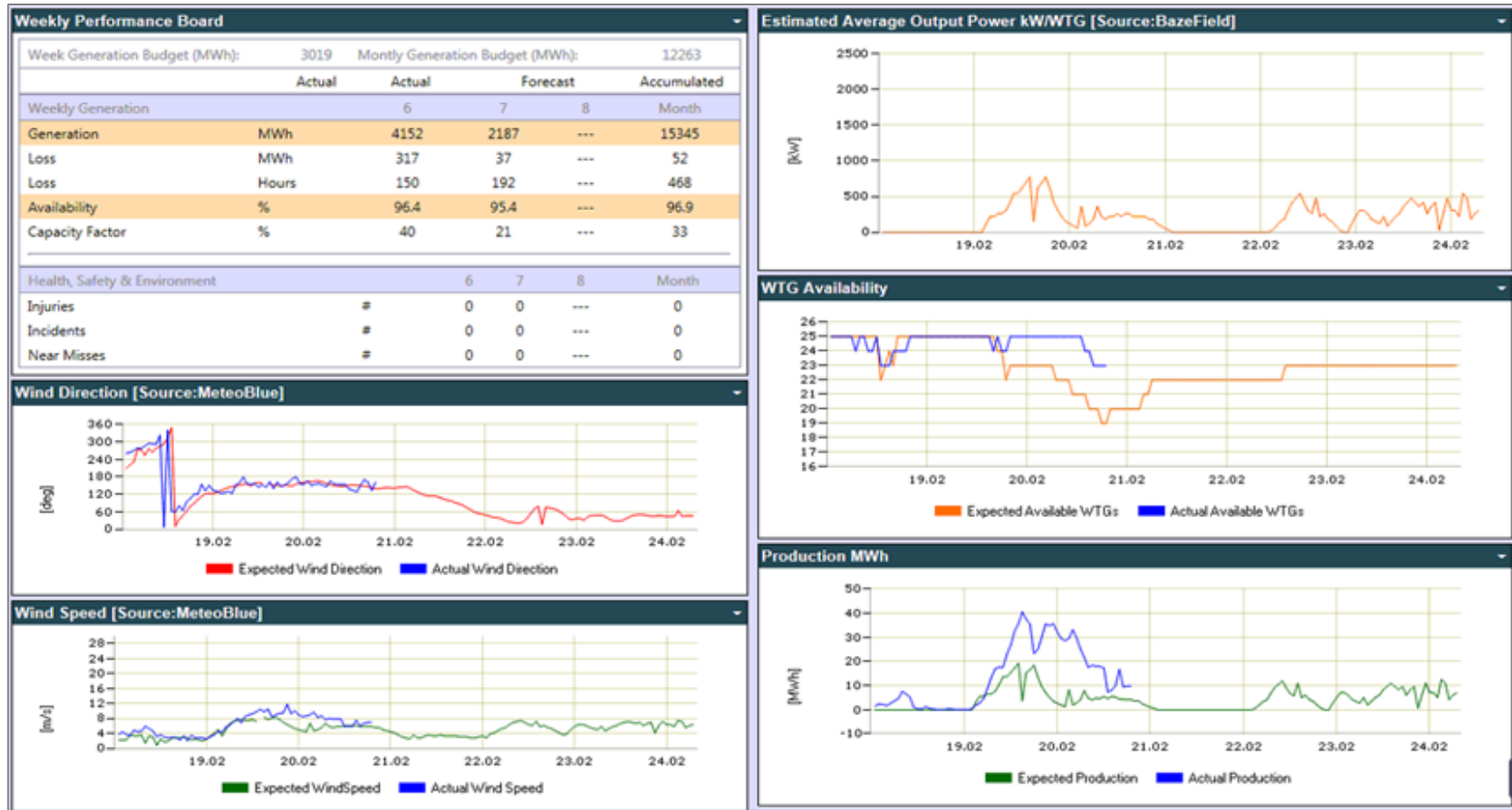
# Algorithm based detection and alerting - Manufacturer updated turbine software



# Algorithm based detection and alerting – Underperforming turbine



# Use of real-time performance boards



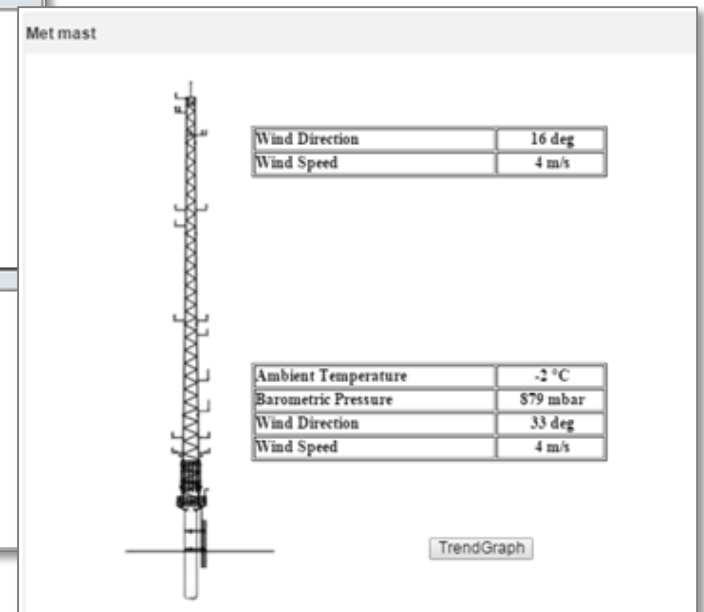
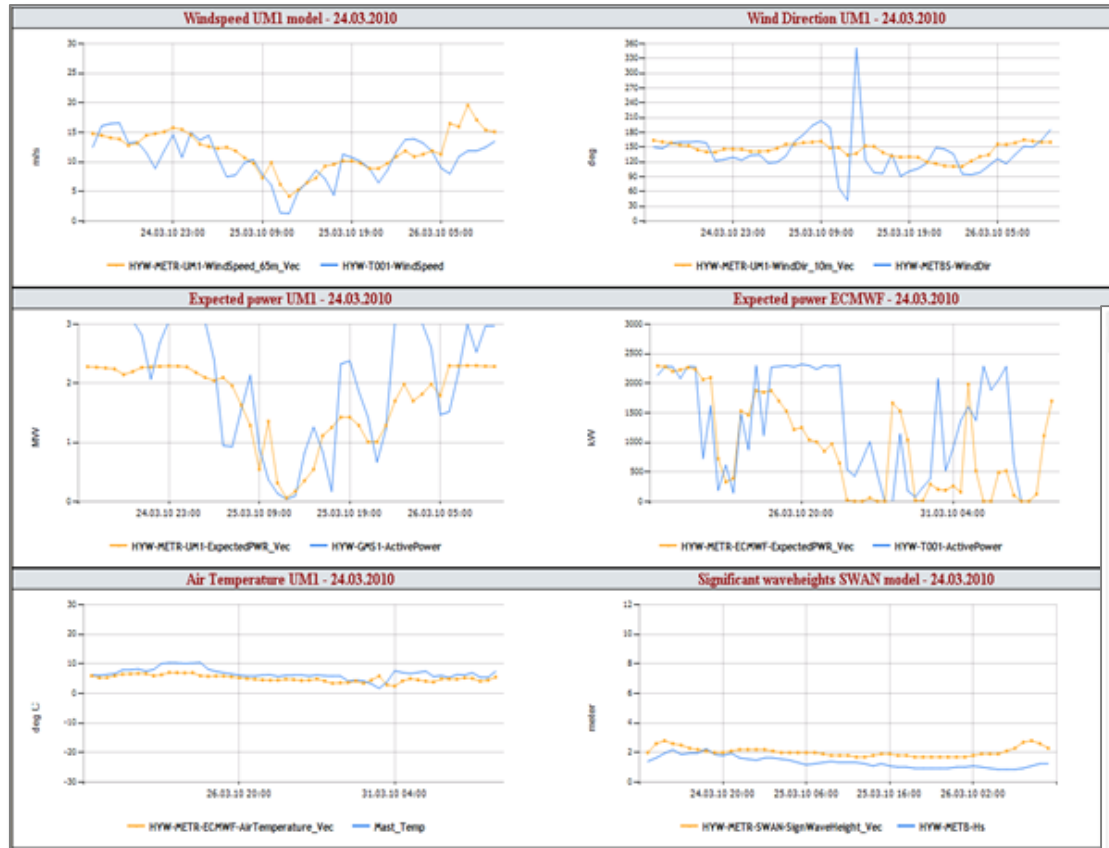
# Improved availability planning and production forecasts



Nomination report DAY + 1 Onshore1																
Week Number: 9																
Hour	Nomination MW	Produced MW	Error %	Forecast MW	Planned WTC	Available WTC	Pcurve MW	Matlab MW	Wind Forecast	Wind	Error %	Q5	Q10	Q25	Q50	Q75
00	21,4	14,65	31	21,41	15	---	28,47	---	11	13,7	-21,9	4,5	7,2	13	21,4	27,3
01	26,8	10,85	59	26,77	15	---	20,92	---	12	12,3	-0,9	10,3	13,3	20,7	26,8	29,7
02	25,7	15,71	39	25,65	15	---	15,21	---	12	25,1	-53,4	8,9	11,8	18,3	25,7	29
03	25,2	17,89	29	25,16	15	---	20,37	---	12	17,5	-34,2	8,3	11,3	17,4	25,2	28,7
04	24	16,67	30	23,96	15	---	22,89	---	11	13,4	-15,4	7,2	10,2	15,8	24	28,2
05	22,2	9,89	55	22,20	15	---	14,25	---	11	3,1	-85,1	5,9	8,9	13,9	22,2	27,4
06	22,3	10,79	51	22,27	15	---	16,48	---	11	5,2	-74,4	6	8,9	14,1	22,3	27,4
07	22,9	13,27	42	22,95	15	---	15,48	---	11	4	-82,7	7,5	10,4	14,9	22,9	27,9
08	22,7	16,08	29	22,73												
09	23	17,80	29	23,03												
10	22,1	13,10	41	22,12												
11	19,3	10,72	44	19,27												
12	15,2	10,63	29	15,19												
13	8,4	10,35	-19	8,40												
14	9,7	8,81	10	9,67												
15	10,9	12,20	-10	10,95												
16	18,6	13,29	28	18,60												
17	24,3	22,63	8	24,34												
18	24,8	25,72	-4	24,79												
19	25,4	26,10	-3	25,39												
20	25,5	14,26	44	25,46												
21	26,3	19,92	24	26,29												
22	30,6	19,48	36	30,60												
23	31,6	19,75	37	31,65												
<b>Sum</b>	<b>529</b>	<b>371</b>		<b>529</b>												



# Power and met forecast and validation



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# Treat the data as an asset itself to



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