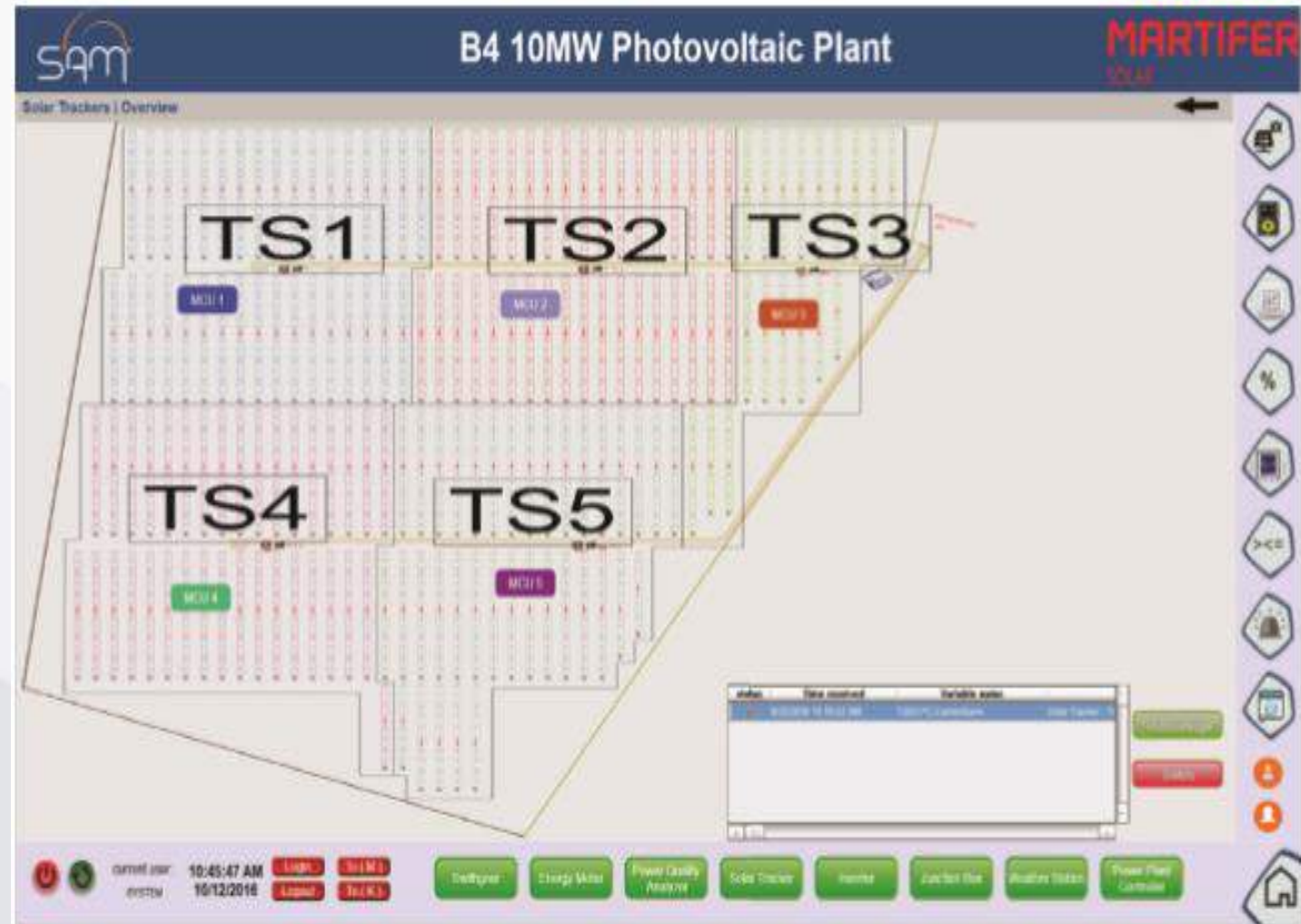


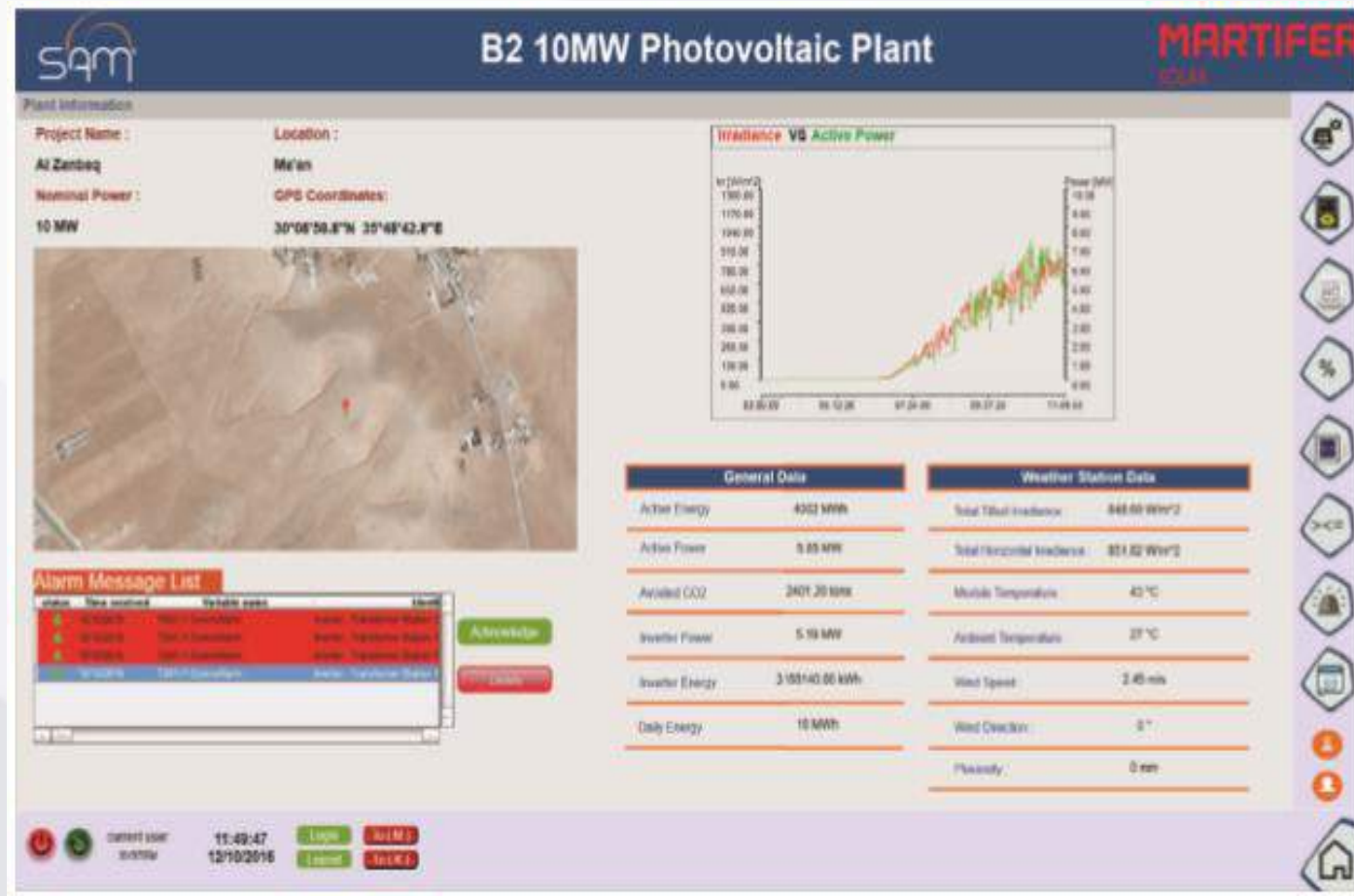
# zenon – NEPCO

- ✓ zintegrowany soft PLC zenon, zenon Logic, umożliwia precyzyjne obliczenia
- ✓ zenon Web Client zapewnia inwestorom projektu możliwość zdalnego monitorowania wydajności
- ✓ scentralizowane zarządzanie alarmami



# zenon – NEPCO

- ✓ natywna obsługa protokołów energetycznych, takich jak: IEC 61850, IEC 60870, IEC 61400-25, DNP3, ICCP/TASE.2, DLMS, Modbus Energy, SNMP oraz przemysłowych, takich producentów jak np.: Mitsubishi, Beckhoff, Siemens, Omron, Schneider, ABB, Areva, Allen-Bradley, GE, Festo, Phoenix Contact, Rockwell, Schiele, Sprecher Automation, Texas Instruments, Vipa ..., a także MS AZURE Cloud.



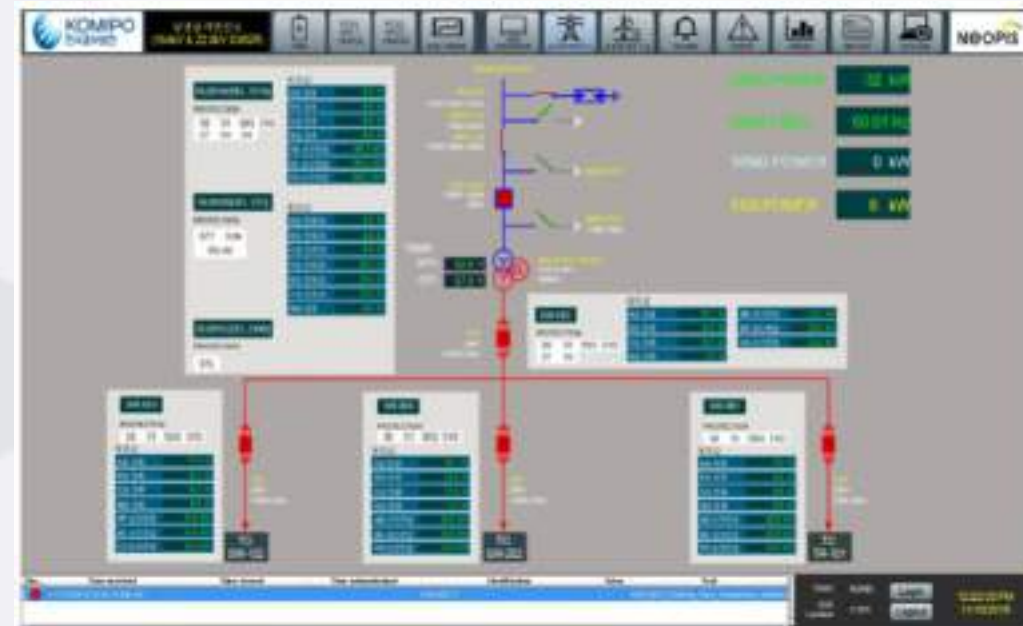
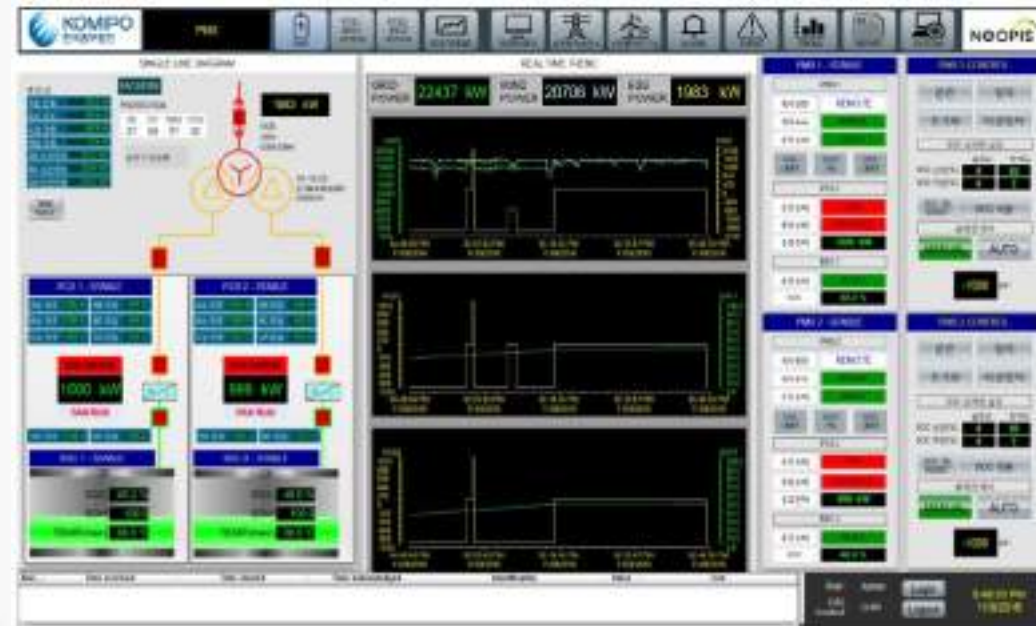
**zenon – KOMIPO**

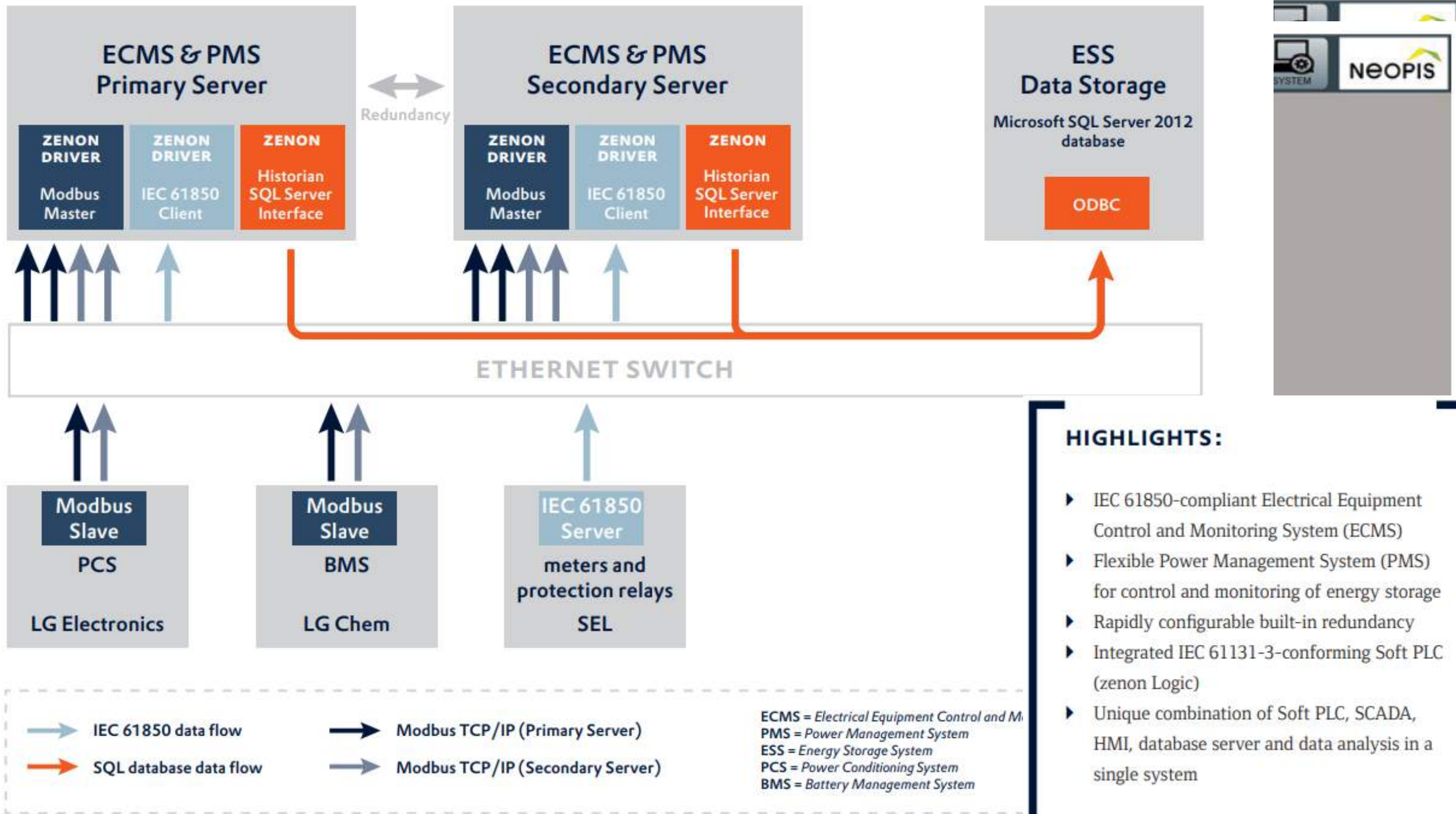




# zenon – KOMIPO

- ✓ system kontroli i monitorowania urządzeń elektrycznych zgodny z IEC 61850 (ECMS)
- ✓ elastyczny system zarządzania energią (PMS) do kontroli i monitorowania magazynowania energii
- ✓ szybko konfigurowalna wbudowana redundancja
- ✓ zintegrowany Soft PLC zgodny z IEC 61131-3 (zenon Logic)
- ✓ unikalne połączenie Soft PLC, SCADA, HMI, serwera bazy danych i analizy danych w jednym systemie





# And Smart City

*Wsparcie dla Samorządów i mieszkańców*

## Elastyczność

- Łączność z istniejącymi sieciami
- Monitorowanie i kontrola np. koleje, dworce, stacje energetyczne, przepompownie, wodociągi, gaz, oczyszczalnie ścieków, śluzy, tamy, OZE, itp.
- Raportowanie
- Ready for SIL 2





# SmartCity Dashboard Barcelona





Current Energy  
Consumption

453.75 kW

Total Energy  
Consumption

2494 MWh

Benchmark (year, 2014) Energy  
Consumption per student

- |                                               |   |
|-----------------------------------------------|---|
| 1. University of Barcelona                    | ⊖ |
| <b>2. Polytechnic University of Catalonia</b> | ⊕ |
| 3. Pompeu Fabra University                    | ⊖ |
| 4. Ramon Llull University                     | ⊖ |
| 5. Open University of Catalonia               | ⊖ |
| 6. International University of Catalonia      | ⊖ |
| 7. Abat Oliba CEU University                  | ⊖ |
| 8. Autonomous University of Barcelona         | ⊖ |



Katowice





# Energy Dashboard



Basztowa 3

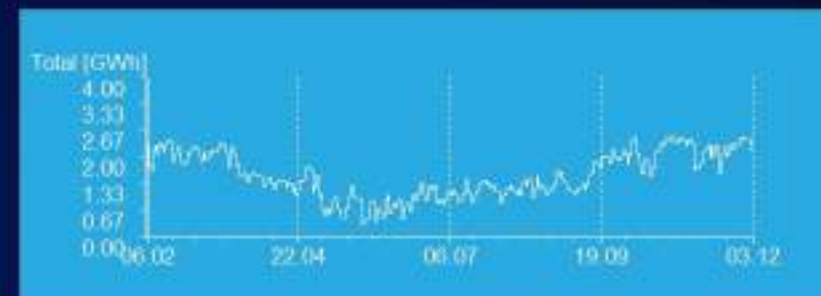
3.81 MW  
Current  
19.95 GWh  
Total

Karmelicka 27

4.89 MW  
Current  
21.41 GWh  
Total

Kremerowska 17

3.98 MW  
Current  
13.62 GWh  
Total



Lubelska 29

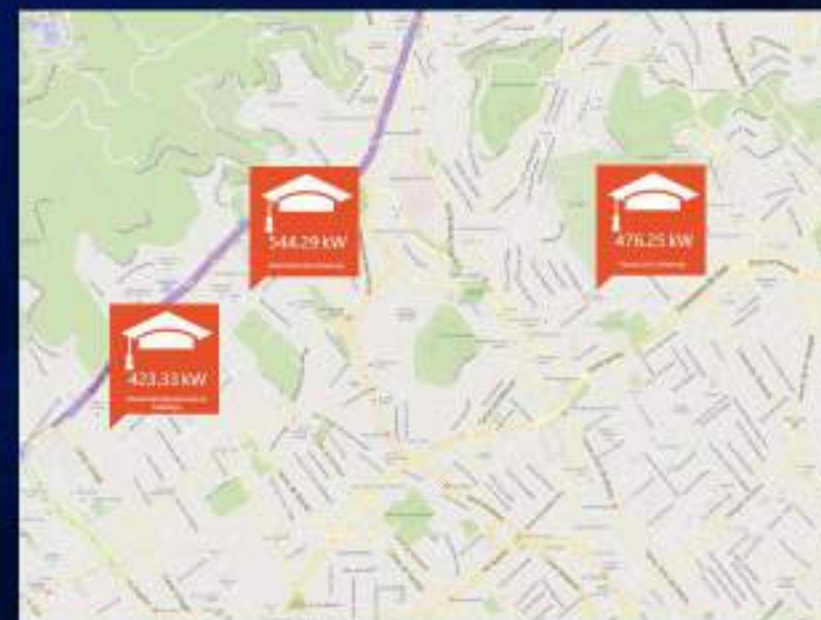
8.09 MW  
Current  
21.51 GWh  
Total

Prądnicza 4

5.57 MW  
Current  
16.11 GWh  
Total

Prądnicza 20

3.72 MW  
Current  
14.59 GWh  
Total



Prądnicza 20A  
Regent Office

6.22 MW  
Current  
23.52 GWh  
Total

Słowackiego 64

2.38 MW  
Current  
22.58 GWh  
Total

Słowackiego 66

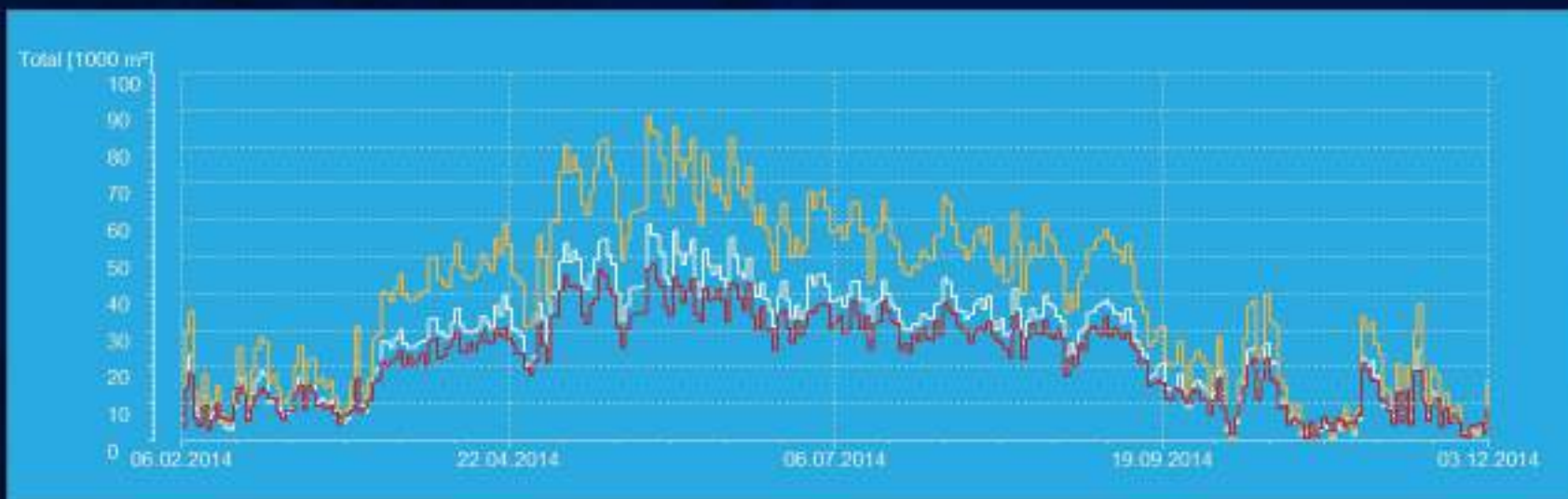
7.92 MW  
Current  
16.26 GWh  
Total

Total Consumption

169.55 GWh



# Water Dashboard



Absolute  
Consumption  
in 1000m<sup>3</sup>

24215

Relative  
Consumption

26.91 %

Ciutat Vella

Eixample

Gràcia

Horta -  
Guinardó

Les Corts

Nou Barris

Sant Andreu

Sant Martí

Sants -  
Montjuïc

Sarrià - Sant  
Gervasi



# Parking Dashboard



Free Parking  
Lots

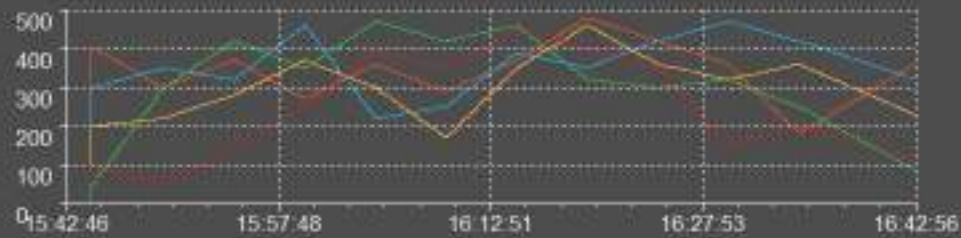
1389

Occupied  
Parking Lots

1111

Free Capacity

56 %





# **zenon PV Management System**



em Login Logout

082-800

Sopot



|                          |
|--------------------------|
| <b>GHTS 62-1200x4000</b> |
| Name                     |
| <b>2204010</b>           |
| Serial number            |
| <b>1700</b>              |
| Investment number        |
| <b>REZ</b>               |
| Standard                 |



Turn 365

Maxxturn 45

Maxxturn 65 I

Maxxturn 65 II

Turn E65

TNA 500 I

TNA 500 II

TNA 500 III

NBH 500+

E70

E50

Leonard 70/2000-  
CNC

MX5-RAM

GHT5  
G2-1000x4000GHT5  
G2-1200x4000

HFS0 CNC

FT45-S CM973

FT45-S CM982

PB2-800

PB2-800

Lokalizacja: 1

Übersicht

Bearbeitungs-  
ArchivStörungen  
ArchivProgramme  
Archiv

Diagramm

Datenverwaltung



nicht verfügbar

Fehlensensor

nicht verfügbar

Aktuelles Programm

| Zeit kommt          | Bezeichnung       | Variablenname         |
|---------------------|-------------------|-----------------------|
| 18.11.2012 15:40:57 | Hilfsantriebe Ein | m001.HilfsantriebeEin |
| 19.11.2012 06:44:39 | Automatik         | m001.Automatik        |

Aktualisieren

## General Data

|                 |                |
|-----------------|----------------|
| Active Energy   | 4002 MWh       |
| Active Power    | 5.95 MW        |
| Avoided CO2     | 2401.20 tons   |
| Inverter Power  | 5.19 MW        |
| Inverter Energy | 3188140.00 kWh |
| Daily Energy    | 16 MWh         |

Aktualisieren

## Weather Station Data

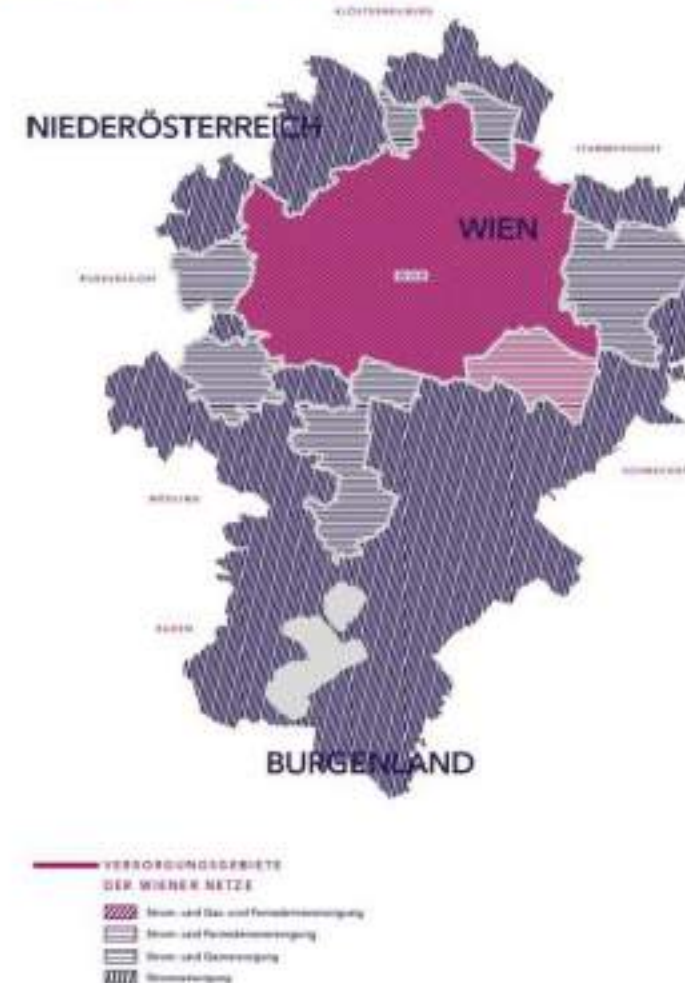
|                             |             |
|-----------------------------|-------------|
| Total Tiled Irradiance      | 848.69 W/m² |
| Total Horizontal Irradiance | 851.82 W/m² |
| Module Temperature          | 43 °C       |
| Ambient Temperature         | 27 °C       |
| Wind Speed                  | 2.45 m/s    |
| Wind Direction              | 9 °         |
| Pluviosity                  | 0 mm        |





Wiener Netze powstała w sierpniu 2013 r. z połączenia trzech spółek podporządkowanych: sieci energetycznej Wien Energie, sieci ciepłowniczej Wiedeń i sieci gazowej Wien Energie. Ponadto do spółki zostały włączone główne linie energetyczne Fernwärme Wien i pasywna sieć telekomunikacyjna Wien Energie.

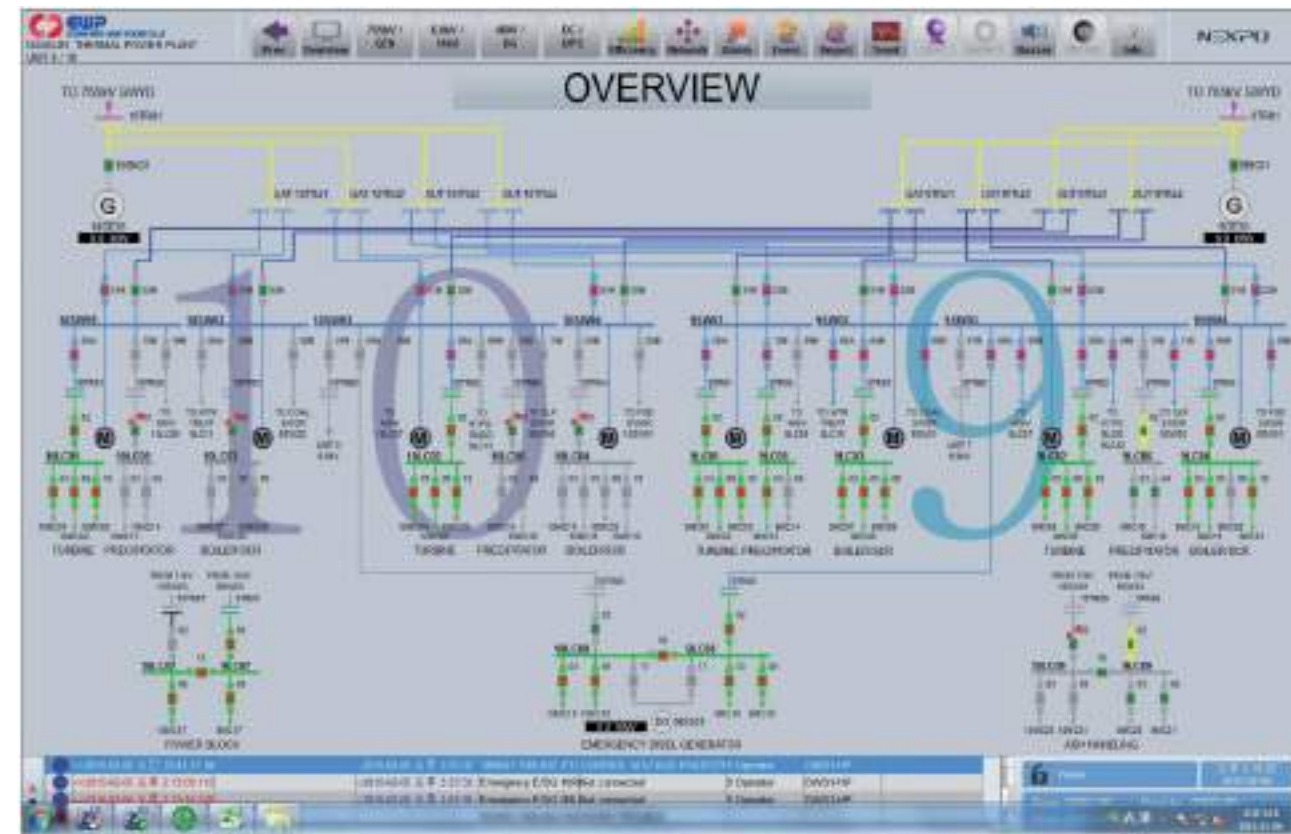
- **Wiener Netze GmbH** is a subsidiary of Wiener Stadtwerke, the municipal utilities of Vienna.
- They covers a power grid of 23,550 km
- a gas grid of over 4,500 km as well as
- 46 substations and more than 10,000 transformer stations.





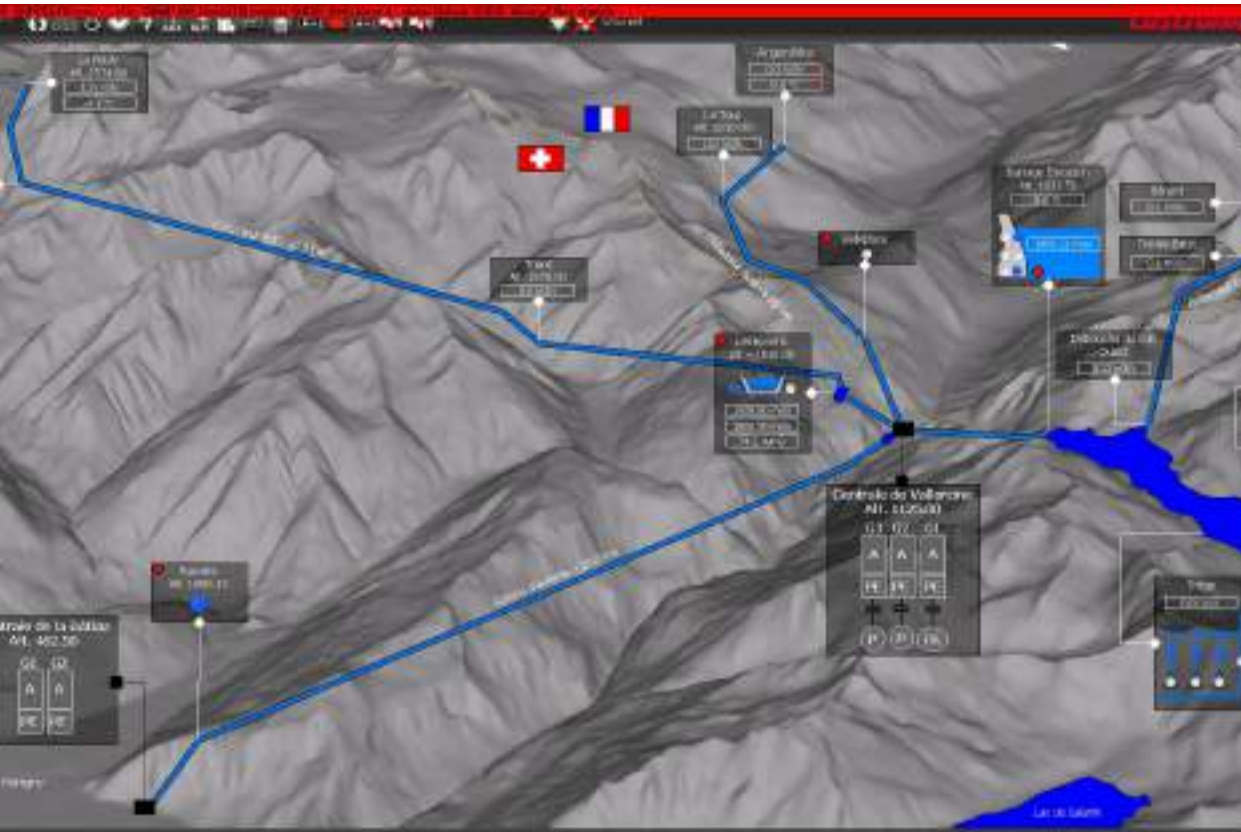


# Control Center | Dangjin Thermal Power Plant | 5000 MW





## Control Center | Hydro Power Plant | Emosson | 390 MW



# zenon – System na miarę potrzeb energetyki !



**zenon**

by COPA-DATA





WF4

296 GWh  
186.96 GWh  
45 %  
14.8 MW  
206 TWh

138 MW



55/65  
4/65  
6/65

WF3

92 GWh  
152.69 GWh  
46 %  
16.9 MW  
203 TWh

42 MW



17/20  
1/20  
2/20

15:58

23.10.2019

WF2

69 GWh  
191.12 GWh  
48 %  
7.4 MW  
222 TWh

32 MW



12/15  
2/15  
1/15

WF1

229 GWh  
170.88 GWh  
42 %  
14.4 MW  
216 TWh

106 MW



37/50  
0/50  
13/50

WF5

67 GWh  
125.47 GWh  
45 %  
8.1 MW  
203 TWh

26 MW



10/12  
1/12  
1/12

WF6

205 GWh  
178.59 GWh  
49 %  
10.8 MW  
39 TWh

95 MW



38/45  
3/45  
4/45

WF7

137 GWh  
167.36 GWh  
51 %  
4.2 MW  
57 TWh

63 MW



25/30  
2/30  
3/30

WF8

183 GWh  
149.25 GWh  
45 %  
9.6 MW  
20 TWh

85 MW



34/40  
2/40  
4/40

WF9

275 GWh  
155.75 GWh  
51 %  
7.5 MW  
179 TWh

127 MW



51/60  
3/60  
6/60

WF10

344 GWh  
188.59 GWh  
44 %  
15.5 MW  
183 TWh

159 MW



63/75  
5/75  
7/75

WF11

34 GWh  
128.34 GWh  
41 %  
20.7 MW  
323 TWh

16 MW



5/7  
2/7  
0/7

WF12

481 GWh  
149.69 GWh  
48 %  
3.9 MW  
254 TWh

222 MW



88/104  
6/104  
10/104

WF15

848 GWh  
168.81 GWh  
46 %  
7.3 MW  
78 TWh

392 MW



157/185  
10/185  
18/185

WF14

435 GWh  
135.05 GWh  
48 %  
7.7 MW  
101 TWh

201 MW



80/95  
6/95  
9/95

WF13

103 GWh  
136.37 GWh  
37 %  
10.7 MW  
277 TWh

48 MW



18/22  
2/22  
2/22





15:58

 37WF1  
(UK) 0 13 1

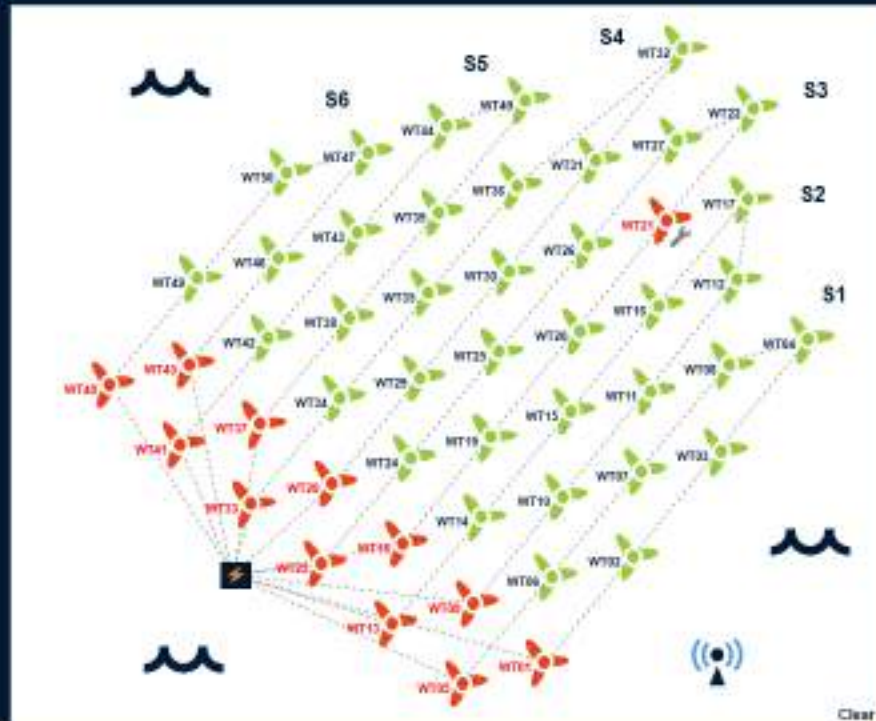
## ELECTRICAL VARIABLES



## ENVIRONMENTAL CONDITIONS

**P**  
76 MW**Q**  
37 MVar**PF**  
  
0.90**V**  
Phase 1 19054 kV  
Phase 2 19004 kV  
Phase 3 19073 kV**I**  
Phase 1 1425 A  
Phase 2 1400 A  
Phase 3 1404 A**WIND**  
6.1 m/s**WAVE**  
2.6 m**WD**  
  
216 °N**T°**  
13 °C

| TURBINE | POWER   | EXPECTED | PWR / EXP | WIND SPEED | WIND DIR. | ENERGY  | CF   | AVB  | SERVICE |
|---------|---------|----------|-----------|------------|-----------|---------|------|------|---------|
| WT01    | 0 kW    | 0 kW     | 100 %     | 25.2 m/s   | 212 °N    | 4.1 MWh | 38 % | 84 % | 24.1 h  |
| WT02    | 1391 kW | 764 kW   | 182 %     | 6.1 m/s    | 223 °N    | 5.0 MWh | 46 % | 83 % | 37.6 h  |
| WT03    | 282 kW  | 295 kW   | 96 %      | 4.6 m/s    | 213 °N    | 4.6 MWh | 43 % | 83 % | 36.7 h  |
| WT04    | 3795 kW | 5000 kW  | 74 %      | 11.4 m/s   | 214 °N    | 5.2 MWh | 48 % | 81 % | 37.4 h  |
| WT05    | 0 kW    | 0 kW     | 100 %     | 25.2 m/s   | 212 °N    | 4.8 MWh | 44 % | 81 % | 26.1 h  |
| WT06    | 1220 kW | 764 kW   | 160 %     | 6.1 m/s    | 212 °N    | 4.3 MWh | 40 % | 91 % | 41.8 h  |
| WT07    | 312 kW  | 295 kW   | 106 %     | 4.6 m/s    | 226 °N    | 4.4 MWh | 41 % | 91 % | 45.7 h  |
| WT08    | 4799 kW | 5000 kW  | 96 %      | 11.4 m/s   | 224 °N    | 4.9 MWh | 45 % | 83 % | 41.2 h  |
| WT09    | 0 kW    | 0 kW     | 100 %     | 25.2 m/s   | 219 °N    | 4.4 MWh | 41 % | 81 % | 29.4 h  |
| WT10    | 1380 kW | 764 kW   | 181 %     | 6.1 m/s    | 221 °N    | 4.4 MWh | 41 % | 93 % | 18.5 h  |
| WT11    | 333 kW  | 295 kW   | 113 %     | 4.6 m/s    | 227 °N    | 3.8 MWh | 35 % | 89 % | 44.5 h  |
| WT12    | 3756 kW | 5000 kW  | 75 %      | 11.4 m/s   | 213 °N    | 5.1 MWh | 47 % | 88 % | 52.6 h  |





Overview

Substation

Met Mast

Power Management

S1



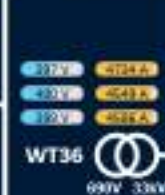
S2



S3



S4



S5



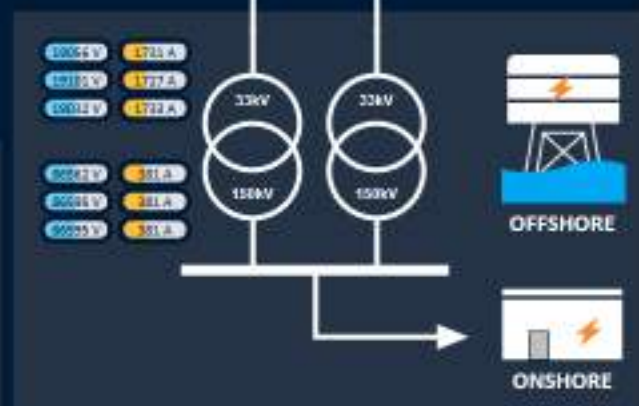
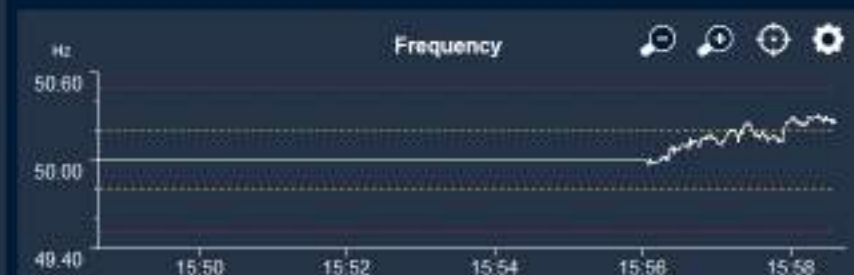
S6



WF1 (UK)



15:58





S1

|          |       |
|----------|-------|
| P (MW)   | 17    |
| Q (MVar) | 8     |
| S (MVA)  | 19    |
| PF       | 0.90  |
| WT OK    | 100 % |

S4

|          |       |
|----------|-------|
| P (MW)   | 22    |
| Q (MVar) | 11    |
| S (MVA)  | 25    |
| PF       | 0.90  |
| WT OK    | 100 % |

S2

|          |       |
|----------|-------|
| P (MW)   | 21    |
| Q (MVar) | 10    |
| S (MVA)  | 23    |
| PF       | 0.90  |
| WT OK    | 100 % |

S5

|          |       |
|----------|-------|
| P (MW)   | 17    |
| Q (MVar) | 8     |
| S (MVA)  | 19    |
| PF       | 0.90  |
| WT OK    | 100 % |

S3

|          |      |
|----------|------|
| P (MW)   | 25   |
| Q (MVar) | 12   |
| S (MVA)  | 28   |
| PF       | 0.90 |
| WT OK    | 90 % |

S6

|          |       |
|----------|-------|
| P (MW)   | 13    |
| Q (MVar) | 6     |
| S (MVA)  | 14    |
| PF       | 0.90  |
| WT OK    | 100 % |

## P-Control

AUTO

MANUAL

| Active Power Control                                 | Feedback | Setpoint |
|------------------------------------------------------|----------|----------|
| Maximum active power set point from Direct Marketing | 180 MW   | X        |
| Gap from Direct Marketing                            | -54 MW   | X        |
| Maximum active power set point from TSO              | 165 MW   | X        |
| Gap from TSO                                         | -49 MW   | X        |
| Maximum active power set point OSS                   | 116 MW   | 250 MW   |

## Q-Control

| Power Factor Control  | Feedback | Setpoint |
|-----------------------|----------|----------|
| Reactive Power        | 56 MVar  | X        |
| Power factor setpoint | 0.90     | 0.90     |

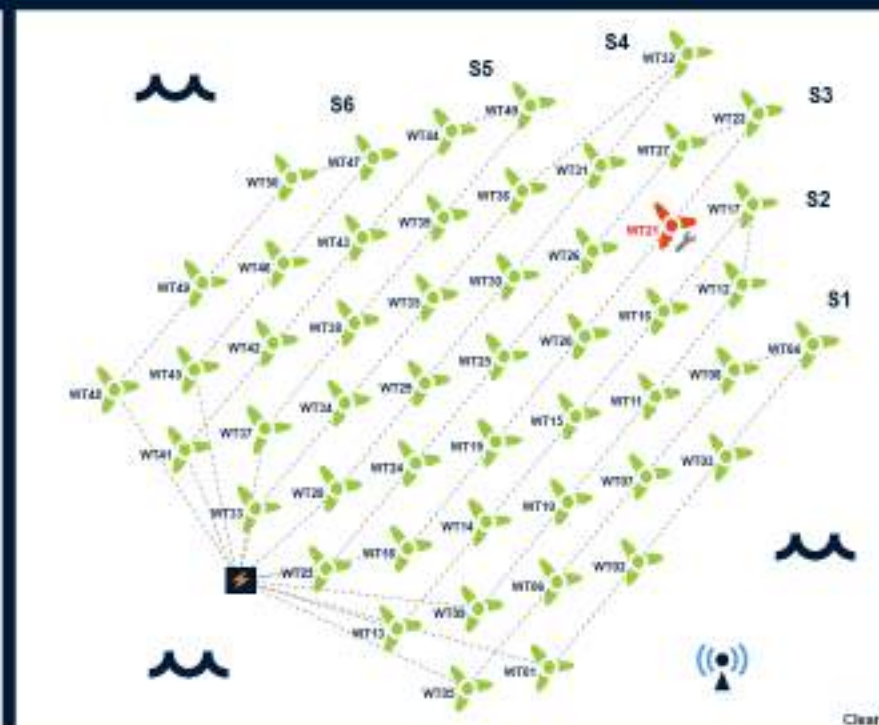
## Park Status

| Variable                     | Value    |
|------------------------------|----------|
| Average wind speed           | 10.7 m/s |
| Average wind direction       | 219 °N   |
| Average temperature          | 17 °C    |
| Number of WTs running        | 49       |
| Number of WTs starting-up    | 0        |
| Number of WTs shutting-down  | 0        |
| Number of WTs not generating | 1        |
| Wind farm availability       | 86 %     |
| Total active power           | 116 MW   |
| Total reactive power         | 56 MVar  |
| Total apparent power         | 129 MVA  |
| Power factor                 | 0.90     |

15:59

WF1  
(UK)

| TURBINE | POWER   | EXPECTED | PWR / EXP | WIND SPEED | WIND DIR. | ENERGY  | CF   | AVB  | SERVICE |
|---------|---------|----------|-----------|------------|-----------|---------|------|------|---------|
| WT01    | 4859 kW | 5000 kW  | 97 %      | 16.8 m/s   | 221 °N    | 4.1 MWh | 38 % | 84 % | 24.1 h  |
| WT02    | 415 kW  | 1560 kW  | 27 %      | 7.7 m/s    | 226 °N    | 5.0 MWh | 46 % | 83 % | 37.6 h  |
| WT03    | 1220 kW | 1801 kW  | 68 %      | 8.1 m/s    | 219 °N    | 4.6 MWh | 43 % | 83 % | 36.7 h  |
| WT04    | 2082 kW | 2396 kW  | 87 %      | 8.9 m/s    | 211 °N    | 5.2 MWh | 48 % | 81 % | 37.4 h  |
| WT05    | 4841 kW | 5000 kW  | 97 %      | 16.8 m/s   | 219 °N    | 4.8 MWh | 44 % | 81 % | 26.1 h  |
| WT06    | 416 kW  | 1560 kW  | 27 %      | 7.7 m/s    | 225 °N    | 4.3 MWh | 40 % | 91 % | 41.8 h  |
| WT07    | 1302 kW | 1801 kW  | 72 %      | 8.1 m/s    | 224 °N    | 4.4 MWh | 41 % | 91 % | 45.7 h  |
| WT08    | 2092 kW | 2396 kW  | 87 %      | 8.9 m/s    | 218 °N    | 4.9 MWh | 45 % | 83 % | 41.2 h  |
| WT09    | 4858 kW | 5000 kW  | 97 %      | 16.8 m/s   | 224 °N    | 4.4 MWh | 41 % | 81 % | 29.4 h  |
| WT10    | 402 kW  | 1560 kW  | 26 %      | 7.7 m/s    | 218 °N    | 4.4 MWh | 41 % | 93 % | 18.5 h  |
| WT11    | 1258 kW | 1801 kW  | 70 %      | 8.1 m/s    | 221 °N    | 3.8 MWh | 35 % | 89 % | 44.5 h  |
| WT12    | 2100 kW | 2396 kW  | 88 %      | 8.9 m/s    | 219 °N    | 5.1 MWh | 47 % | 88 % | 52.6 h  |





WT01

Wind and Power Data



START STOP RESET

WIND FARM

WF1

TURBINE

WT01

TURBINE TYPE

NREL Offshore Baseline

RATED POWER

5 MW

STATUS

Operating

ON

Power

3434 kW

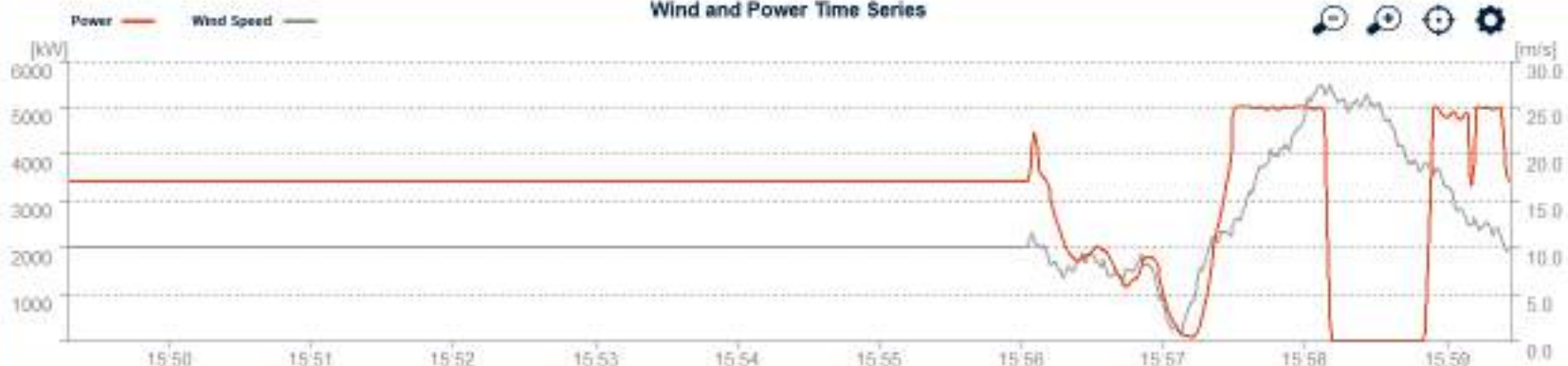
69 %

Wind speed

9.5 m/s

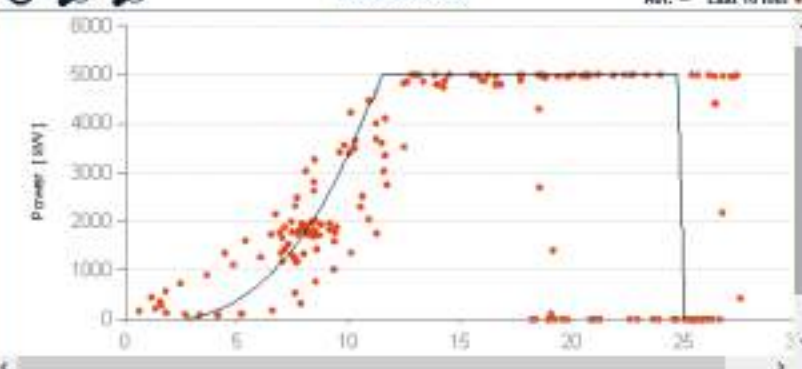
215 °N

Wind and Power Time Series



Power Curve

Ref. — Last 10 min



Turbine Misalignment



Nacelle Yaw



Blade Pitch



CF Day



Energy Day



Avb. Day



CF Year



Energy Year



Avb. Year



Operation / Service

Annual Operating Hours

1814 h

Annual Service Hours

24.1 h

Turbine Status

ON

Active / Reactive Power



3434 kW



1663 kVar



0.90

Voltage



Current



Generator Speed



1102 rpm

Rotor Speed



11.4 rpm

WIND FARM

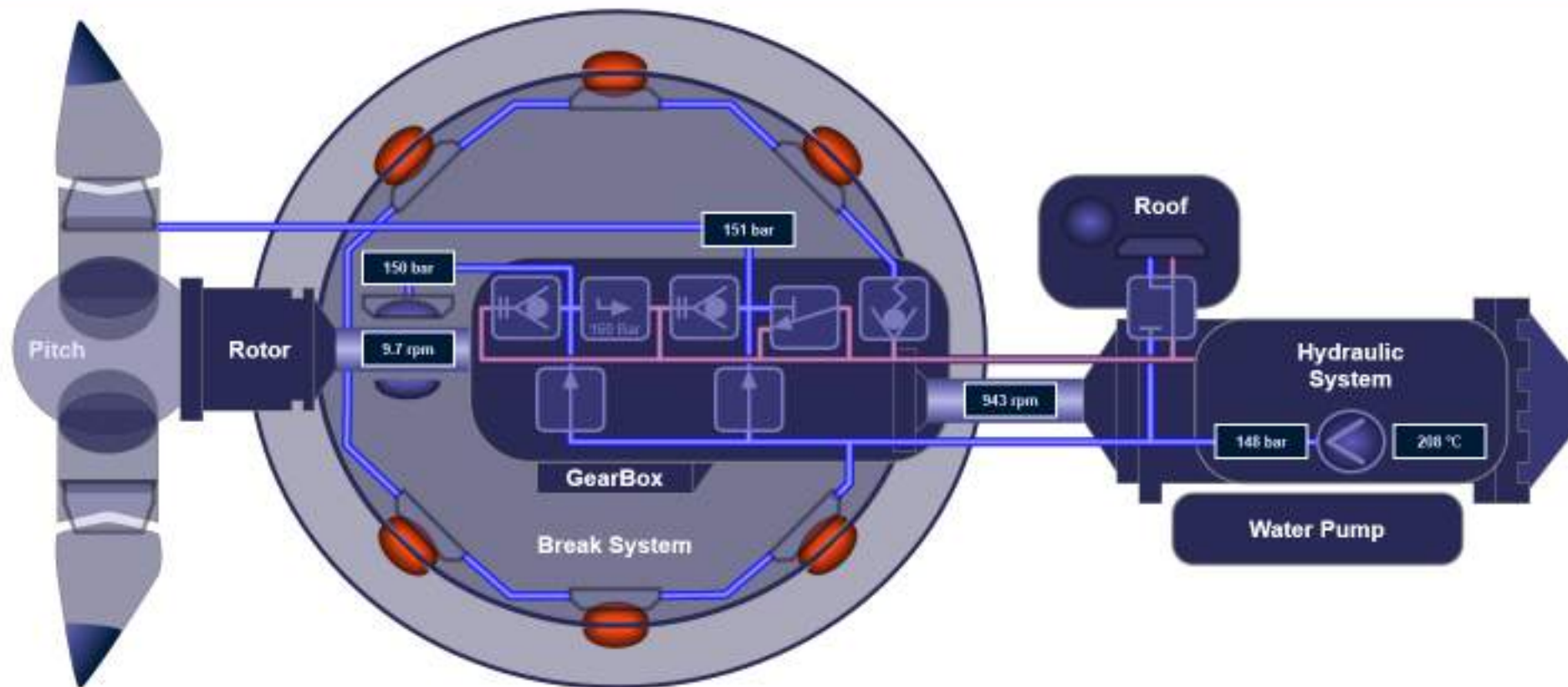
WF1

WIND TURBINE

WT01



WT01



Yaw Control



Alignment



Wind

212 °N

Nacelle

229 °N

Yaw Error

17.2 °

Yaw Rate

0.0 °/s

Avg Yaw Error

Yaw Error

Wind Direction

Nacelle Direction





## WIND FARM

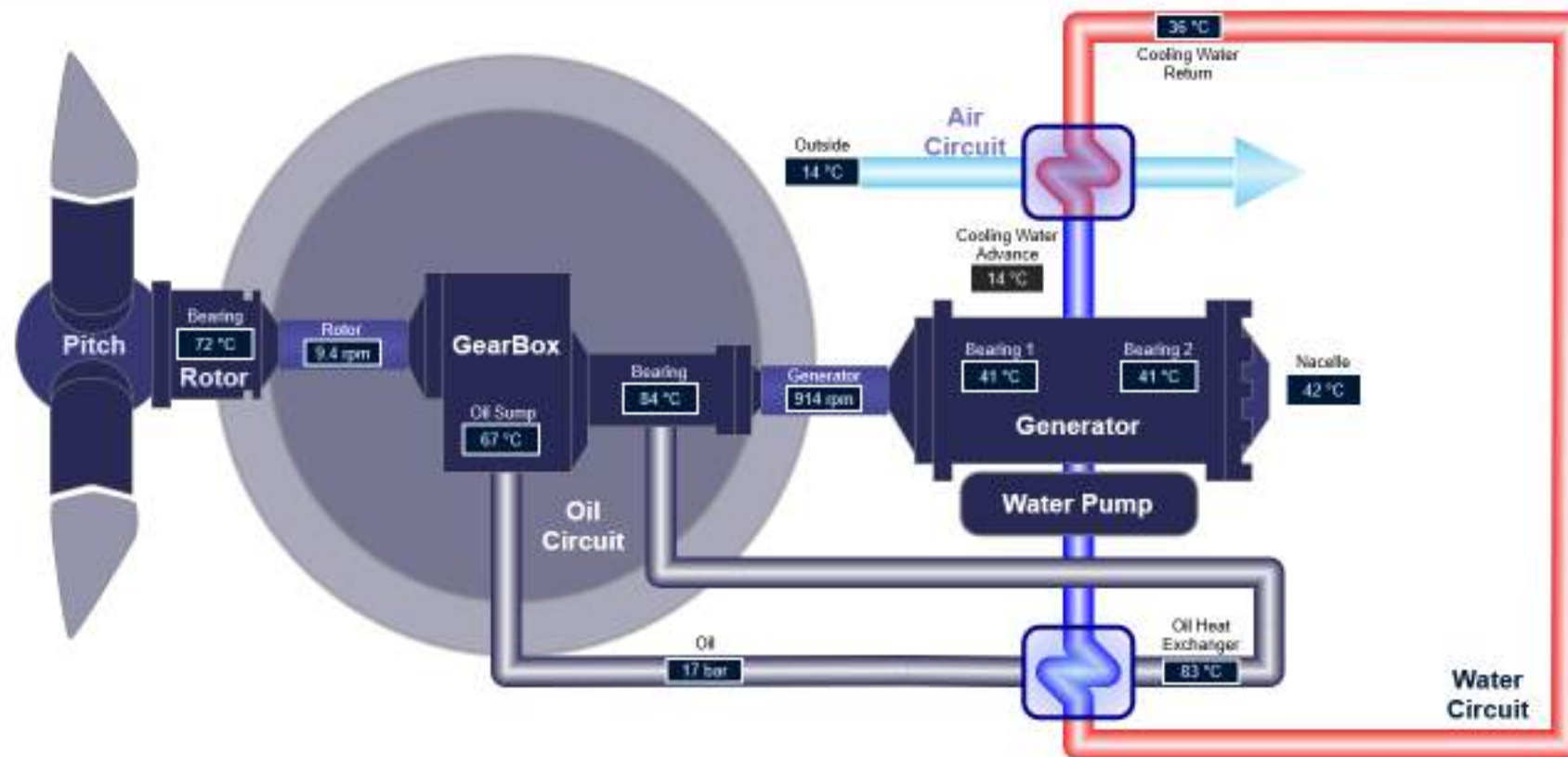
WF1

## WIND TURBINE

WT01



WT01



## Rotor Bearing



## Gear Box Bearing



## Oil Sump



## Generator Bearing 1



## Generator Bearing 2



## Nacelle





## WT01



|                                    |                                                                                               |           |
|------------------------------------|-----------------------------------------------------------------------------------------------|-----------|
| Turbine type:                      | NREL Offshore Baseline                                                                        |           |
| Rated power:                       | 5 MW                                                                                          |           |
| Date commissioning:                | 13/08/2016                                                                                    |           |
| Coordinates:                       | Lat = 57.121, Lng = -1.827                                                                    |           |
| Operating status:                  |  Operating |           |
| Energy production:                 | 4.1 MWh                                                                                       |           |
| Availability:                      | 84 %                                                                                          |           |
| Capacity factor:                   | 38 %                                                                                          |           |
| Operating time:                    | 1814 h                                                                                        |           |
| Service time:                      | 24.1 h                                                                                        |           |
| Failure rate:                      | 2.08 /year                                                                                    |           |
| Last "operating time" maintenance: | 26.11.2018                                                                                    | -330 days |
| Last periodic maintenance:         | 19.11.2018                                                                                    | -337 days |
| Next periodic maintenance:         | 29.11.2018                                                                                    | -327 days |

## WF1 - Aberdeen (UK)



|                    |                            |                  |         |
|--------------------|----------------------------|------------------|---------|
| Country:           | Scotland                   | Capacity:        | 250 MW  |
| Coordinates:       | Lat = 57.15<br>Lng = -1.84 | Turbines:        | 50x 5MW |
| Area:              | 16.63 km²                  | Availability:    | 86 %    |
| Distance to shore: | 11 km                      | Capacity factor: | 42 %    |



Refresh

Devices

Discover new

Edit device

Reassign turbine

Maintenance/Repair

Edit maintenance

Execute maintenance

Execute repair

Exchange

Download exchange

Counter exchange

Copy/Paste

Copy

Paste

Print

Print list

Print details

Upstream

Maintenance

Today

50

Tomorrow

50

This week

50

Next week

50

Update all

Equipment Modeling

WF

- ☒ WF01
- ☒ WF02
- ☒ OSS
- ☒ WT
- ☒ WF03
- ☒ WF04
- ☒ WF06
- ☒ WF08
- ☒ WF07
- ☒ WF08
- ☒ WF09
- ☒ WF10
- ☒ WF11
- ☒ WF12
- ☒ WF13
- ☒ WF14
- ☒ WF15

History

- ☒ this week
- ☒ this month
- ☒ this year
- ☒ free filter

Maintenance

- ☒ today
- ☒ tomorrow
- ☒ this week
- ☒ next week
- ☒ free filter

| Device            | Serial number | Equipment identification | Manufacture            | Type        | Operating hours counter | Time        |
|-------------------|---------------|--------------------------|------------------------|-------------|-------------------------|-------------|
| Filter text       | Filter text   | Filter text              | Filter text            | Filter text | Filter text             | Filter text |
| Wind Turbine WT11 | 010011        | WF-WF01.WT.WT11          | NREL Offshore Baseline | 5 MW        | 13247                   | 338 d.      |
| Wind Turbine WT32 | 010032        | WF-WF01.WT.WT32          | NREL Offshore Baseline | 5 MW        | 13161                   | 338 d.      |
| Wind Turbine WT03 | 010003        | WF-WF01.WT.WT03          | NREL Offshore Baseline | 5 MW        | 13117                   | 338 d.      |
| Wind Turbine WT44 | 010044        | WF-WF01.WT.WT44          | NREL Offshore Baseline | 5 MW        | 13117                   | 338 d.      |
| Wind Turbine WT43 | 010043        | WF-WF01.WT.WT43          | NREL Offshore Baseline | 5 MW        | 12975                   | 338 d.      |
| Wind Turbine WT45 | 010045        | WF-WF01.WT.WT45          | NREL Offshore Baseline | 5 MW        | 12975                   | 338 d.      |
| Wind Turbine WT47 | 010047        | WF-WF01.WT.WT47          | NREL Offshore Baseline | 5 MW        | 12983                   | 338 d.      |
| Wind Turbine WT24 | 010024        | WF-WF01.WT.WT24          | NREL Offshore Baseline | 5 MW        | 12983                   | 338 d.      |
| Wind Turbine WT30 | 010030        | WF-WF01.WT.WT30          | NREL Offshore Baseline | 5 MW        | 12873                   | 338 d.      |
| Wind Turbine WT28 | 010028        | WF-WF01.WT.WT28          | NREL Offshore Baseline | 5 MW        | 12855                   | 338 d.      |
| Wind Turbine WT42 | 010042        | WF-WF01.WT.WT42          | NREL Offshore Baseline | 5 MW        | 12833                   | 338 d.      |
| Wind Turbine WT22 | 010022        | WF-WF01.WT.WT22          | NREL Offshore Baseline | 5 MW        | 12799                   | 338 d.      |
| Wind Turbine WT13 | 010013        | WF-WF01.WT.WT13          | NREL Offshore Baseline | 5 MW        | 12755                   | 338 d.      |
| Wind Turbine WT15 | 010015        | WF-WF01.WT.WT15          | NREL Offshore Baseline | 5 MW        | 12752                   | 338 d.      |
| Wind Turbine WT23 | 010023        | WF-WF01.WT.WT23          | NREL Offshore Baseline | 5 MW        | 12730                   | 338 d.      |
| Wind Turbine WT09 | 010009        | WF-WF01.WT.WT09          | NREL Offshore Baseline | 5 MW        | 12712                   | 338 d.      |
| Wind Turbine WT05 | 010005        | WF-WF01.WT.WT05          | NREL Offshore Baseline | 5 MW        | 12712                   | 338 d.      |
| Wind Turbine WT36 | 010036        | WF-WF01.WT.WT36          | NREL Offshore Baseline | 5 MW        | 12709                   | 338 d.      |
| Wind Turbine WT01 | 010001        | WF-WF01.WT.WT01          | NREL Offshore Baseline | 5 MW        | 12857                   | 330 d.      |
| Wind Turbine WT34 | 010034        | WF-WF01.WT.WT34          | NREL Offshore Baseline | 5 MW        | 12610                   | 338 d.      |
| Wind Turbine WT04 | 010004        | WF-WF01.WT.WT04          | NREL Offshore Baseline | 5 MW        | 12592                   | 338 d.      |
| Wind Turbine WT06 | 010006        | WF-WF01.WT.WT06          | NREL Offshore Baseline | 5 MW        | 12587                   | 327 d.      |
| Wind Turbine WT17 | 010017        | WF-WF01.WT.WT17          | NREL Offshore Baseline | 5 MW        | 12587                   | 338 d.      |
| Wind Turbine WT39 | 010039        | WF-WF01.WT.WT39          | NREL Offshore Baseline | 5 MW        | 12489                   | 338 d.      |
| Wind Turbine WT27 | 010027        | WF-WF01.WT.WT27          | NREL Offshore Baseline | 5 MW        | 12471                   | 338 d.      |
| Wind Turbine WT35 | 010035        | WF-WF01.WT.WT35          | NREL Offshore Baseline | 5 MW        | 12459                   | 338 d.      |
| Wind Turbine WT07 | 010007        | WF-WF01.WT.WT07          | NREL Offshore Baseline | 5 MW        | 12448                   | 338 d.      |
| Wind Turbine WT20 | 010020        | WF-WF01.WT.WT20          | NREL Offshore Baseline | 5 MW        | 12438                   | 338 d.      |
| Wind Turbine WT29 | 010029        | WF-WF01.WT.WT29          | NREL Offshore Baseline | 5 MW        | 12373                   | 338 d.      |
| Wind Turbine WT21 | 010021        | WF-WF01.WT.WT21          | NREL Offshore Baseline | 5 MW        | 12330                   | 338 d.      |
| Wind Turbine WT48 | 010048        | WF-WF01.WT.WT48          | NREL Offshore Baseline | 5 MW        | 12330                   | 338 d.      |
| Wind Turbine WT02 | 010002        | WF-WF01.WT.WT02          | NREL Offshore Baseline | 5 MW        | 12273                   | 327 d.      |
| Wind Turbine WT41 | 010041        | WF-WF01.WT.WT41          | NREL Offshore Baseline | 5 MW        | 12230                   | 338 d.      |
| Wind Turbine WT16 | 010018        | WF-WF01.WT.WT16          | NREL Offshore Baseline | 5 MW        | 12230                   | 338 d.      |
| Wind Turbine WT50 | 010050        | WF-WF01.WT.WT50          | NREL Offshore Baseline | 5 MW        | 12219                   | 338 d.      |
| Wind Turbine WT19 | 010019        | WF-WF01.WT.WT19          | NREL Offshore Baseline | 5 MW        | 12119                   | 338 d.      |
| Wind Turbine WT49 | 010049        | WF-WF01.WT.WT49          | NREL Offshore Baseline | 5 MW        | 12110                   | 338 d.      |
| Wind Turbine WT12 | 010012        | WF-WF01.WT.WT12          | NREL Offshore Baseline | 5 MW        | 12020                   | 338 d.      |
| Wind Turbine WT14 | 010014        | WF-WF01.WT.WT14          | NREL Offshore Baseline | 5 MW        | 12011                   | 338 d.      |
| Wind Turbine WT10 | 010010        | WF-WF01.WT.WT10          | NREL Offshore Baseline | 5 MW        | 12007                   | 338 d.      |
| Wind Turbine WT38 | 010038        | WF-WF01.WT.WT38          | NREL Offshore Baseline | 5 MW        | 11791                   | 338 d.      |
| Wind Turbine WT08 | 010008        | WF-WF01.WT.WT08          | NREL Offshore Baseline | 5 MW        | 11671                   | 338 d.      |
| Wind Turbine WT26 | 010026        | WF-WF01.WT.WT26          | NREL Offshore Baseline | 5 MW        | 11650                   | 338 d.      |
| Wind Turbine WT37 | 010037        | WF-WF01.WT.WT37          | NREL Offshore Baseline | 5 MW        | 11646                   | 338 d.      |
| Wind Turbine WT25 | 010025        | WF-WF01.WT.WT25          | NREL Offshore Baseline | 5 MW        | 11594                   | 338 d.      |