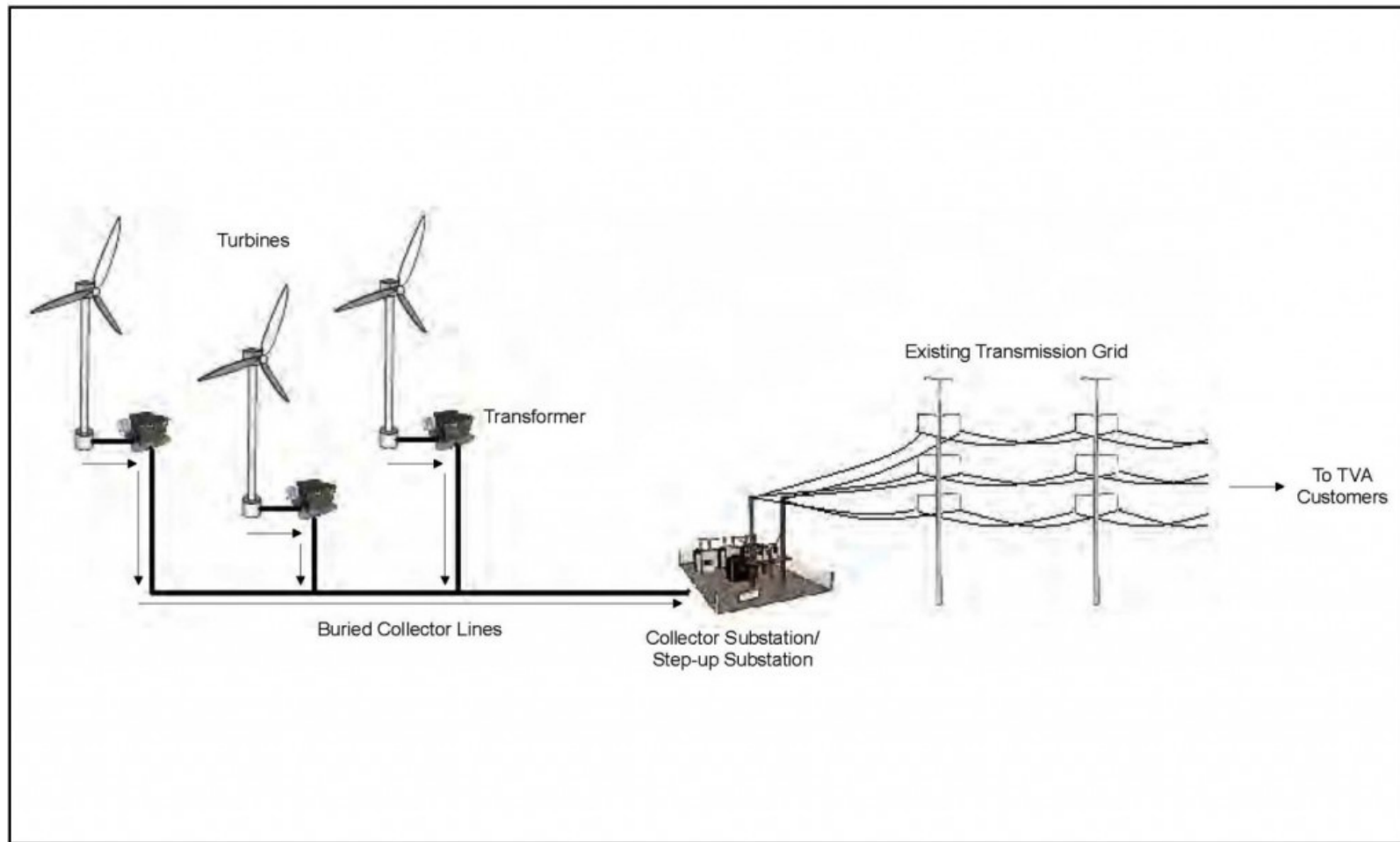




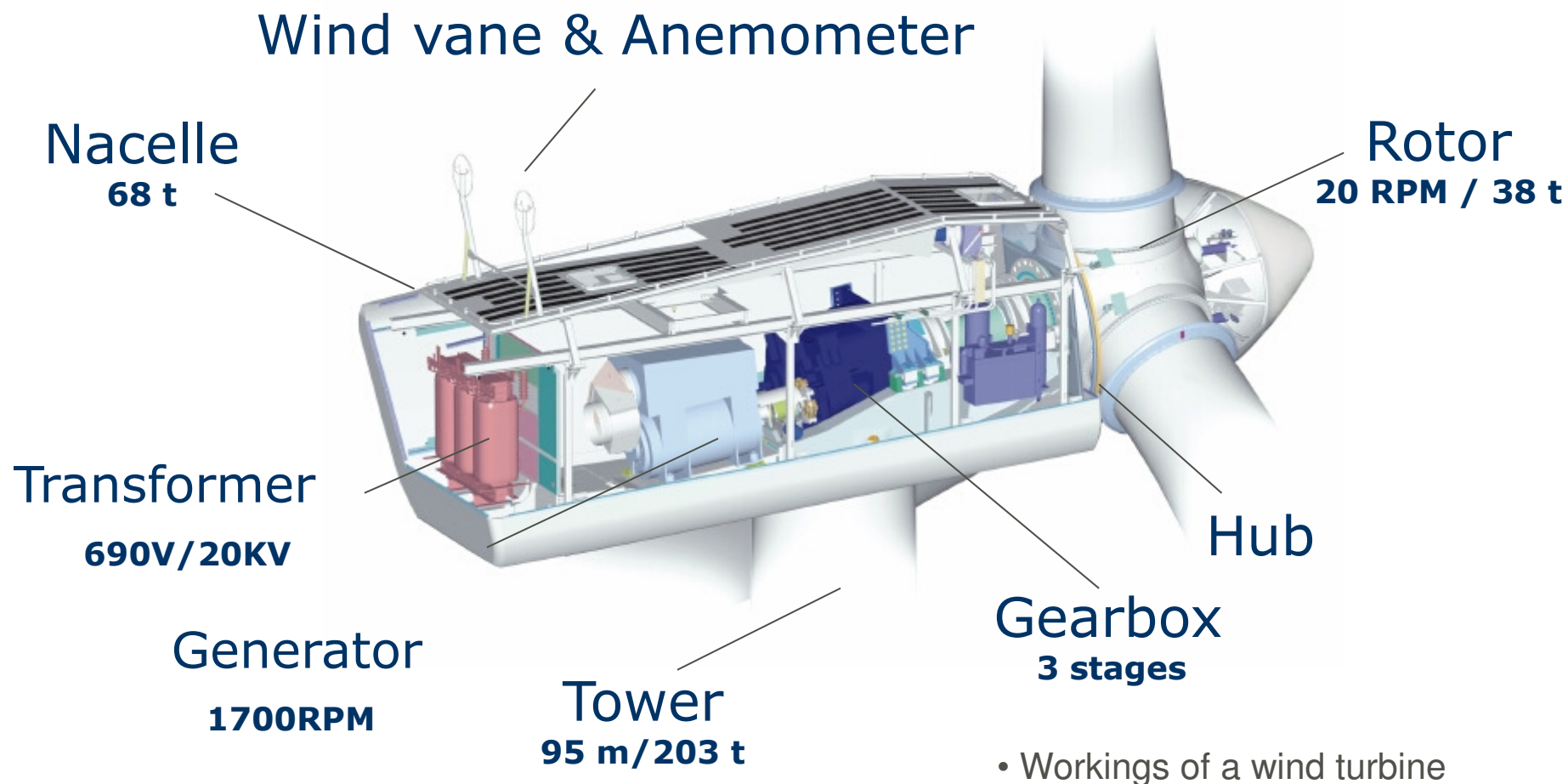
**Engineers Ireland Young Engineers Society**  
**UCC, 22<sup>nd</sup> October, 2012**  
**Eoin O'Donovan**



# Wind Farm Layout

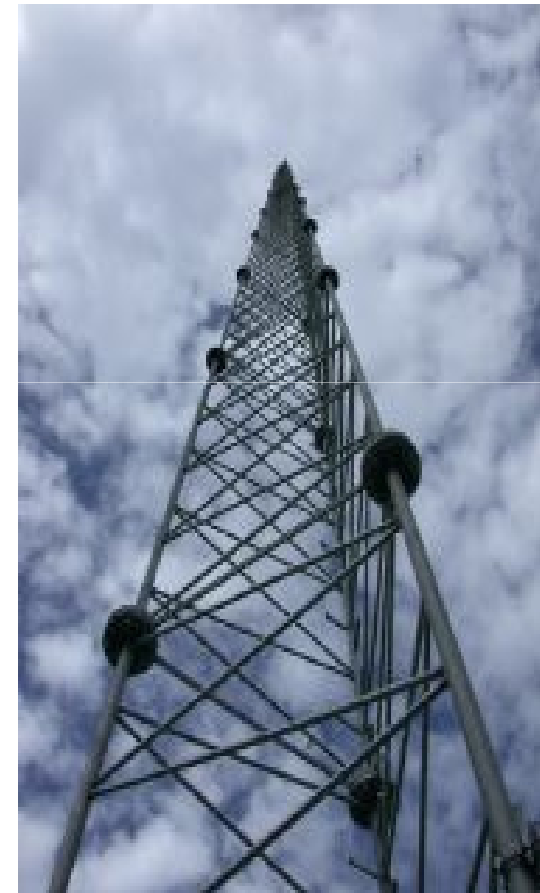


# Turbine Components – What's up there?



# Meteorological issues – Load of hot air

- Site classification
  - Class I 10 to 8.5 m/s
  - Class II 8.5 to 7.5 m/s
  - Class III 7.5 to 6.0 m/s
- Majority of BGE sites are Class I or II
- Wind measurement campaign
- 8% increase in output by increasing hub height from 80 to 95m





# Turbine foundations



- 55 loads of concrete
- 17m x 17m x 1.8m = 520m<sup>3</sup>
- 60 tonnes of steel



# Wind Farm Construction - Tower



- 95 metre to hub
  - 4 sections
  - 197 tonnes
  - Bottom dia: 4.15m





# Wind Farm Construction - Nacelle



# Wind Farm Construction - Blades



- 90m diameter
- 1.5 acre swept area
- 6.6 tonnes





# Wind farm locations



# Operational Wind Farm Portfolio



Wind Farm	Capacity (MW)	No. of WTG's	Size (MW)	Model	Manufacturer	COD
<b>Kilgarvan</b>	45	15	3	V90	Vestas	2007
<b>Lisheen</b>	36	18	2	V90	Vestas	2009
<b>Inchincoosh</b>	32.5	13	2.5	N90	Nordex	2009
<b>Knockawarriga</b>	22.5	9	2.5	N90	Nordex	2008
<b>Booltiagh</b>	19.5	13	1.5	GE1.5	GE	2005
<b>Gneeves</b>	9.35	11	0.85	V52	Vestas	2006
<b>Inish Wind</b>	9.2	4	2.3	E70	Enercon	2009
<b>Sillahertane</b>	8.5	10	0.85	V52	Vestas	2009
<b>Owenreagh 1</b>	5.5	10	0.55	Z40	Zond	1997
<b>Owenreagh 2</b>	5.1	6	0.85	V52	Vestas	2008
<b>Mienvee</b>	0.85	1	0.85	V52	Vestas	2004
<b>Sorne Hill</b>	38.9	19	16 x 2 & 3 x 2.3	E70	Enercon	2008

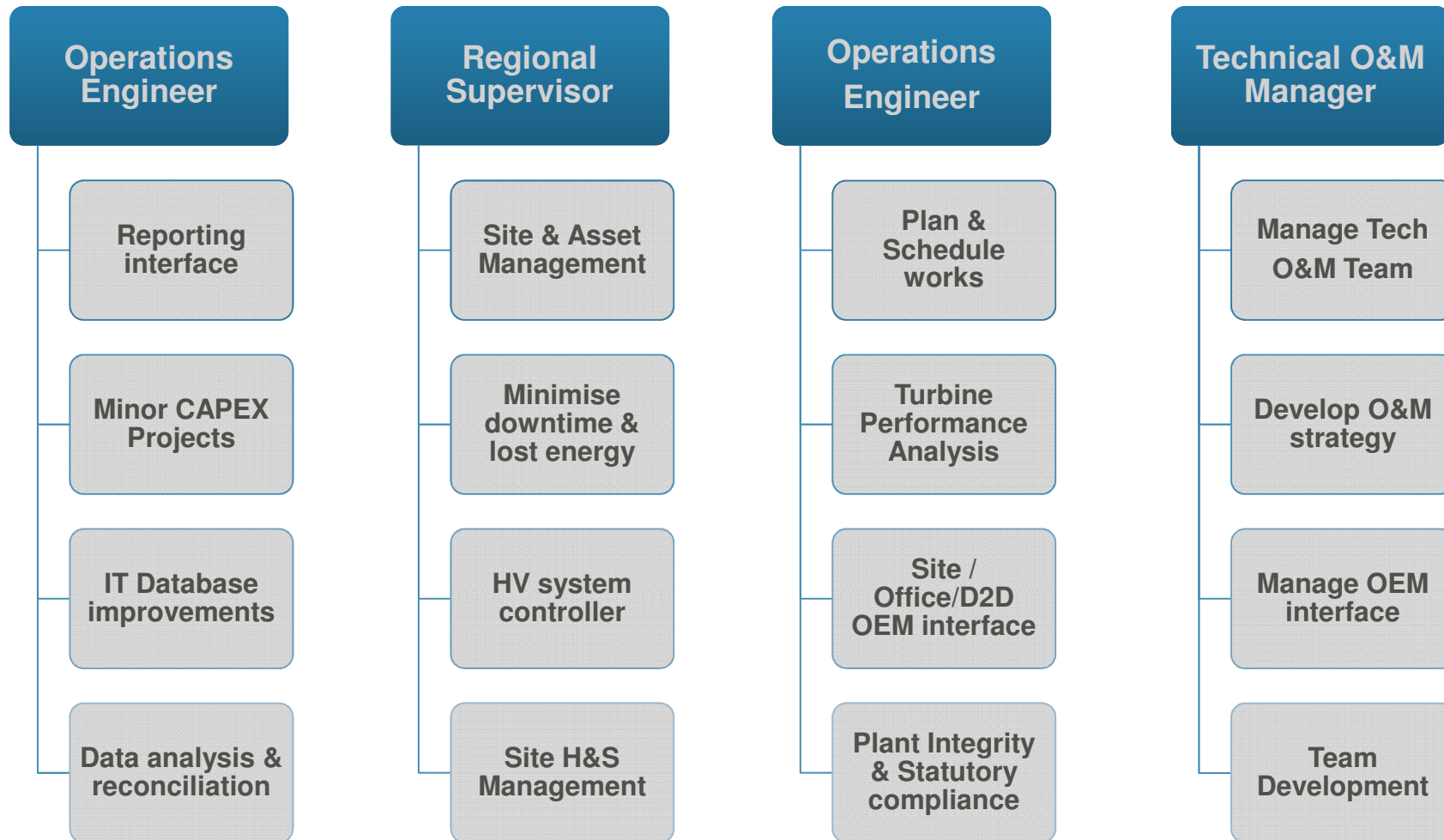
# Types of turbine O&M contracts



- Long term – 5/10/15 years
- Guaranteed availability levels – typically 97%
- SCADA
- 24/7 Remote surveillance
- 1 or 2 services per year
- Spare parts and technical support
- Condition monitoring systems



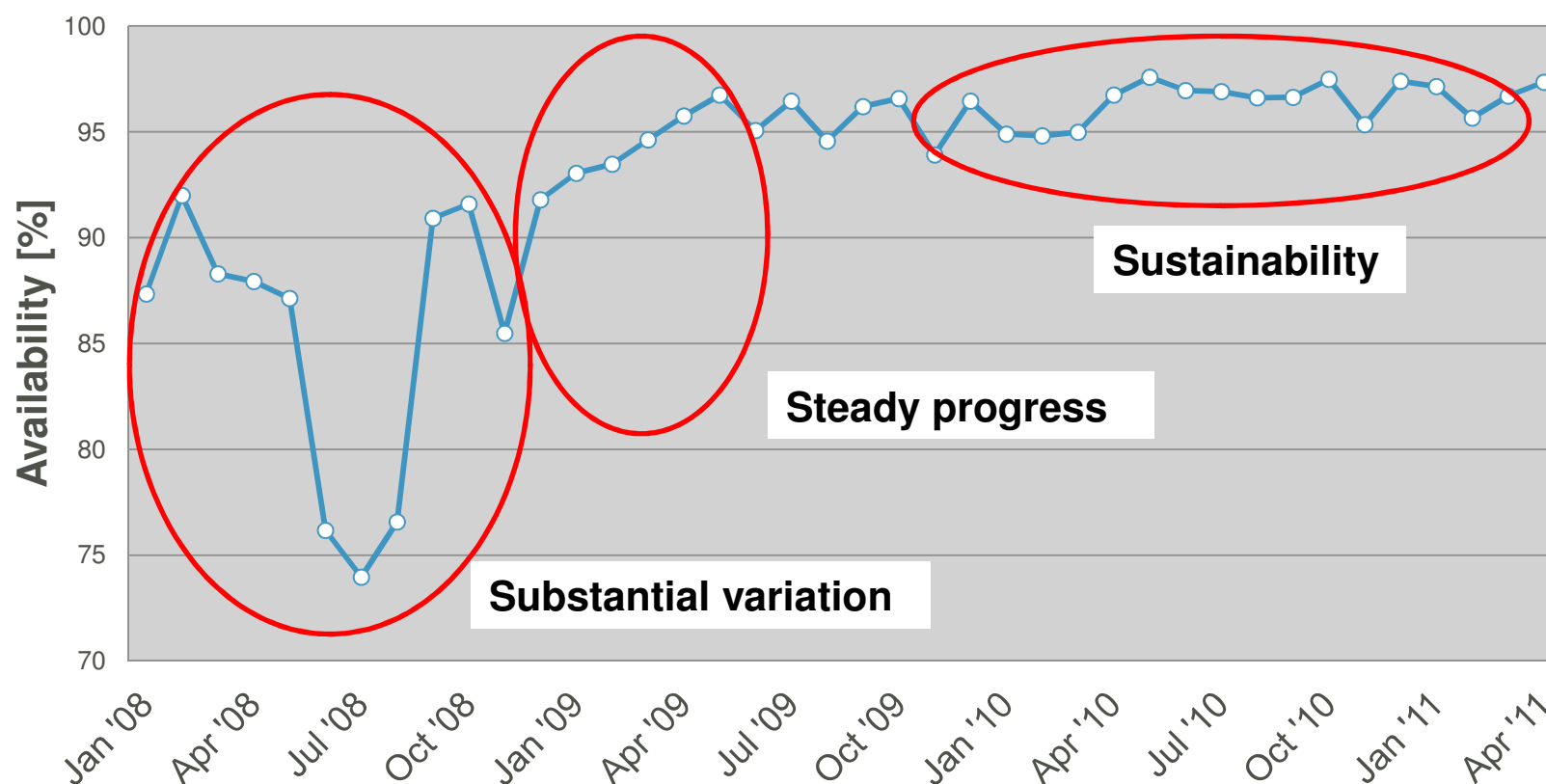
# Tech O&M Team - Roles & Responsibilities



# A Performing Team



## Bord Gáis Energy Wind farm Availability



# The DMAIC Performance Cycle

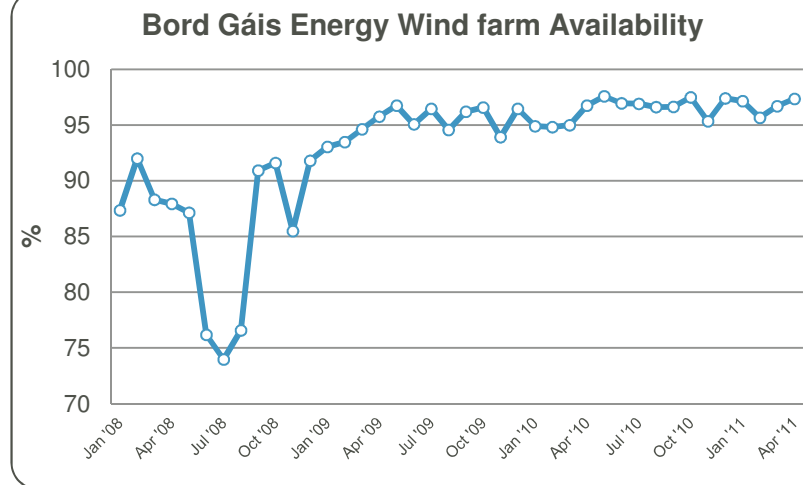


Superior object/category	Root Cause	Corrective Actions	Action by	Close by	Comment
Service	6 month service	5 WTs's remaining when weather conditions allow	GH	31.01.10	-
Oilbox	Low oil level across all turbines	New oil level sensor developed by Vestas in test in 4 no. Turbines in Greaves - Rollout	GH	31.01.10	-
Grid	1. Grid code testing 2. Constrained to extremely low output	2. To be discussed with Engrid	AE	9.01.10	-
Hydraulic system	Low hydraulic oil level, TS	Hope upgrade - CMI case being implemented in service	GH	15.01.10	-

**Define:**  
Step change in availability performance

Date	Windfarm	Turbine #	Fault code	Fault text	Superior Object	Downtime (mins)
Tue 7 Apr 09	Kilgaran	T17	FC-V90-618	Defect Pitch Accumulator A	Hydraulic System	159.6
Tue 7 Apr 09	Kilgaran	T6	FC-V90-84	C Oil	Pitch System	67.8
Tue 7 Apr 09	Kilgaran	T21	FC-V90-555	Lubrication error & res. empty	Control Unit	13.8
Tue 7 Apr 09	Kilgaran	T18	FC-V90-735	Pitch Deviation	Pitch System	13.8
Tue 7 Apr 09	Kilgaran	T4	FC-V90-329	DC Overvoltage	Power Converter system	2.7
Tue 7 Apr 09	Kilgaran	T1	FC-V90-338	Stop	Power Converter system	3.0
Tue 7 Apr 09	Knockavanga	T9	n/a	n/a	Hydraulic System	142.0
Tue 7 Apr 09	Boothagh	T1	FC-GE1 5-541	Rotor CCU collective fault	Power Converter system	90.0

**Control:**  
Weekly meetings/remote monitoring



**Measure:**  
Downtime per fault - SCADA error logs

Item	Priority	Due Date	Status	Owner	Comments
1	High	15/04/09	Open	GH	Check status of all turbines
2	Medium	30/04/09	Open	GH	Check status of all turbines
3	Low	15/05/09	Open	GH	Check status of all turbines
4	High	30/05/09	Open	GH	Check status of all turbines
5	Medium	15/06/09	Open	GH	Check status of all turbines
6	Low	30/06/09	Open	GH	Check status of all turbines
7	High	15/07/09	Open	GH	Check status of all turbines
8	Medium	30/07/09	Open	GH	Check status of all turbines
9	Low	15/08/09	Open	GH	Check status of all turbines
10	High	30/08/09	Open	GH	Check status of all turbines

**Improve:**  
Actions tracker, QPR's, Data sharing & Vendor score cards

**Analyse:**  
Pareto & Root Cause Analysis

