
Pallas Wind Farm
County Kerry

Wind Energy: Optimising Operations

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Wind energy is one of the key business sectors in the south west of Ireland – this article overviews Asset Management strategies for minimising downtime revenue losses and maximising profits through operational efficiency.

Preface: The Wind Direction in Ireland

Eirgrid, the Irish Transmission System Operator (TSO), released its 2010 Transmission Forecast Statement in December 2009 to give a snapshot of the rapidly moving energy sector in Ireland [1]. Through the Commission for Energy Regulation's (CER's) Gate directives, the TSO has allocated regional areas based on connection offers to implement transmission network upgrades. At present, the south west region, which represents Kerry and parts of Cork and Limerick, has over 700MW connected including some Gate 2 connections. Across the country, Gate 2 will see over 1,300MW of wind generation processed and Gate 3 will process a further 4,000MW by 2025, where the south west region will receive around 600MW and 800MW in each gate, respectively [1,2]. This will firmly establish wind energy as one of the key business sectors in the south west of Ireland.

Introduction: The Long Term Investment

With Ireland's wind energy future in place through the CER's Gate directives, wind farm developers need to ensure that their vision is beyond 2020 to mitigate risk and ensure a strong ROI. Pre-construction requirements, such as financing, planning, Power Purchase Agreements and grid connection offers, often consume more time and financial resources than originally allocated. As a result, provisions for Operation and Maintenance (O&M) are often overlooked, even though they can contribute up to 35 per cent of the total lifetime cost of a turbine and up to 49 per cent if a major failure occurs [3]. As the market matures, it is evident that appropriate consideration for lifecycle O&M costs at the outset will yield greater returns in the long term financial model of a wind farm portfolio.

O&M: The emerging focus of the Irish wind energy sector

Following the construction of a wind farm, there will be a combination of warranties and service contracts in place as the wind farm enters the operational lifecycle:

- **Availability** and **power curve warranties** from the turbine manufacturer to guarantee the future performance of the wind farm
- **Maintenance contracts** provided by the turbine manufacturer and/or independent service providers (ISP) for turbine and substation servicing
- An **operations management contract** to optimise wind farm performance, ensure farm compliance and manage

R&D in the region

Employment opportunities in the global energy sector are heading into the west of Ireland, evident from the recent announcement of the International Energy Research Centre (IERC) which is based in Cork. The centre is to receive €20 million in direct government funding and €15 million from United Technologies, a US-based global industrial heavyweight. This investment will see almost 90 jobs created for the highly-skilled workforces for the development of integrated, sustainable energy systems.

United Technologies, which traditionally supplies high-tech products and services for aerospace and building sectors, has also recently announced an investment deal of $270 million (€220 million) for a 49.5 percent stake in Clipper Windpower, a struggling Californian based turbine manufacturer. This move for United Technologies signifies their move into Europe and wind energy to follow the high-growth of the renewable energy sector.

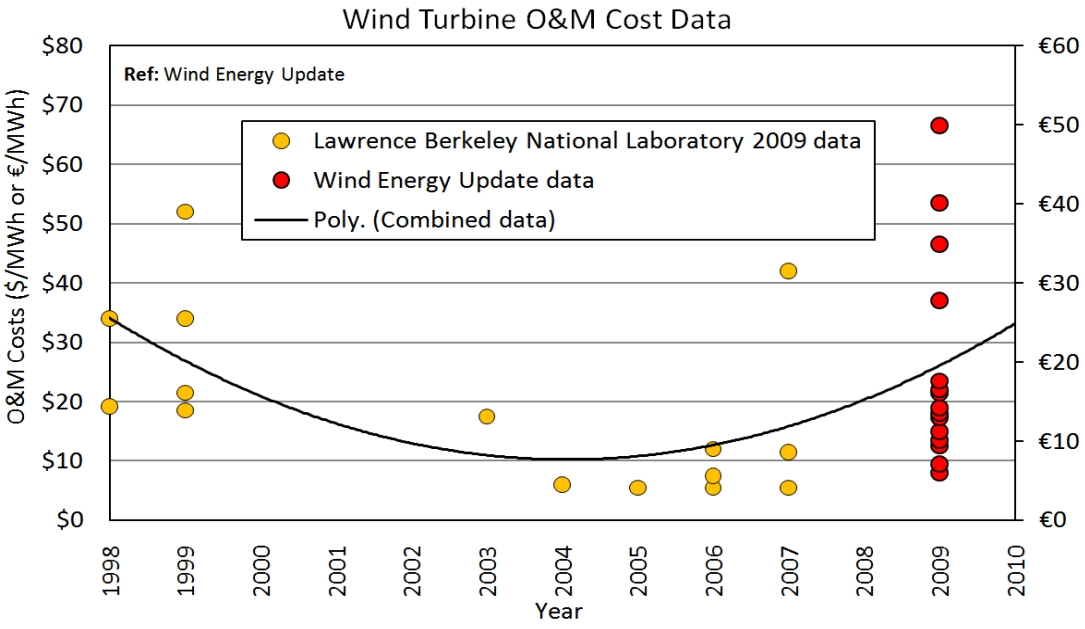
Reference:
Irish Times
New York Times

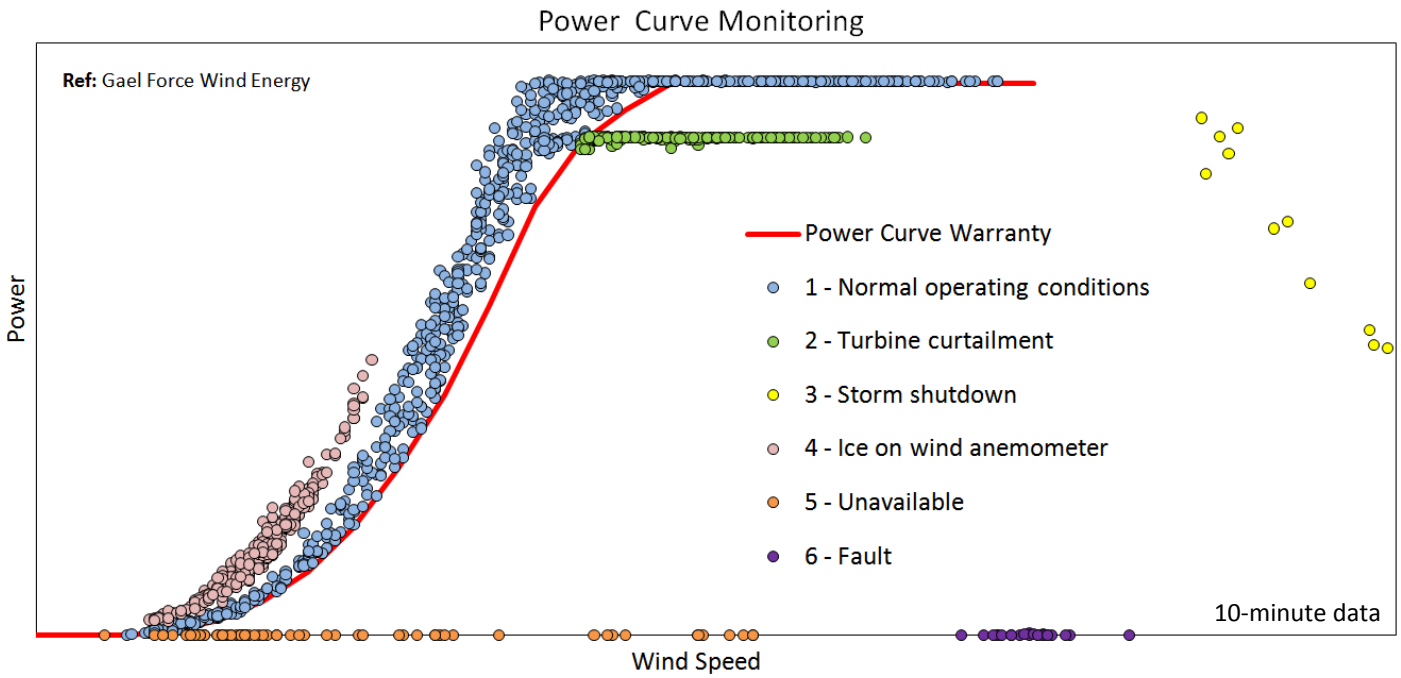
maintenance contracts and warranties

The **availability warranty** provided by turbine manufacturers typically specifies that the farm will be available to generate power for 97 per cent of the year. This essentially allows for 3 per cent of unscheduled turbine downtime due to faults. In an average modern 20MW wind farm, one per cent downtime would exceed €30,000 per annum in revenue losses, so tight monitoring of availability directly influences the bottom line profits. The **power curve warranty** puts in place a provision to check the performance of the turbine in accordance with international standards to ensure it is operating as specified. However, even with these warranties in place, the compensation for losses is uncommon, as the resources and time required to enforce the warranties generally do not justify proceeding with a claim. Therefore, it is proving necessary to ensure that the operating efficiency of the turbines is proactively monitored and maximised to maintain budgeted revenues [4].

In Ireland, and across the EU, turbine manufacturers have traditionally provided the **maintenance contracts** due to the specific technologies and parts used in the turbines. As the sector is growing, ISPs are also entering the marketplace, which provides competition to reduce the monopoly in the services market. However, in projects backed by financial institutions, the preferred route is to sign long term service contracts with the manufacturers to reduce risks in the project [3]. The structure of maintenance contracts varies between providers and ranges generally from 2 to 5 years in duration, where it is commonplace to have these extended to 10-12 years.

Finally, the **operations management** contract is what keeps the warranties and maintenance contracts in effect. Recent international studies have revealed that O&M costs are on average 1-2c€/kWh, and are double or triple than those originally estimated, so staying informed and up to date with O&M advancements is essential in establishing lean O&M strategies [5,6].





The Goal: Operational Intelligence

Operations Management is becoming a key focus of experienced wind farm owners, especially here in Ireland, where the market is saturated in terms of new grid connection offers. Wind farm owners are recognising the benefits of optimising profits from existing projects through lean operations and performance monitoring, or Asset Management, as it is known in the sector [4].

By the very nature of a wind farm development cycle, the strengths of owners and developers are in the traditional engineering services, such as civil, electrical, project management and planning. For the effective asset management of a wind farm portfolio, experience in turbine technology and data analysis from SCADA systems is also essential to ensure maximum production and thus revenues. With the right analysis tools and software systems in place, effective operations management can perform:

- Continuous power curve monitoring to adapt to the characteristics of each turbine and identify any potential deficiencies or arising problems as they happen. Pitching problems, turbine power constraint and underperformance are just some of the metrics that can be identified when they occur.
- Availability warranty monitoring to ensure that if a turbine is down, the availability clock is counting. It is known amongst operators in the industry that vague definitions in warranties can lead to incorrect allocation of availability percentages.
- Condition monitoring (CM) systems such as vibration monitoring of bearings, oil sampling for gearbox wear and loading on turbine blades.

Asset Management: A heads up

The bottom line is that even if a turbine is available, it does not mean it is running at optimal efficiency - turbines can sometimes experience up to 30 per cent reduction in efficiency and still be classified as “available”. Traditional operations management providers will effectively deal with grid code compliance and liaise with lenders and third party contractors, where some providers also offer monitoring and reporting. However, wind farm owners must take due diligence in ensuring that their operations providers are not only dealing with compliance but also taking the necessary measures for effective asset management.

The amount of service providers and CM systems available on the market today can make it a daunting task to justify investment into a

Employment in the region

ENERCON, a German wind turbine manufacturer, has also recently set up a maintenance base in Kerry amidst a collection of wind farm developers, consulting engineers and operations providers that are also established in the resource rich county. The strategic move for ENERCON was based on their strong presence in the south west and Ireland in general, where they have almost 200 turbines installed on the island in over 30 wind farms totalling almost 300 MW of capacity. Christoph Klimek of ENERCON Windfarm Services, who is consolidating the maintenance company in Kerry, has stated that they hope to build a technical workforce of over 20+ people in Kerry to cope with the demands of their maintenance contracts in the region. This base will complement the 34 people that are already employed in regional hubs around the country.

particular O&M strategy. And while it is not economically viable to implement all available optional extras and CM systems, it is a good approach to stay well informed so as that the right investment is made at the right time. Appropriate consideration for O&M will prove to be the longest investment made on any wind farm project, and making informed decisions are crucial for the milestones throughout the lifecycle of a wind farm:

- Signing warranties and maintenance contracts prior to operation
- Detecting and eliminating teething problems during the first 2 years of operation
- Maintaining optimal production efficiencies through real-time performance monitoring
- Providing for end of warranty quality assurance
- Implementing out of warranty CM systems to reduce unscheduled downtimes and revenue loss

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