Operations and Maintenance – A Key Link in the supply Chain

Offshore wind Supply chain conference – Thursday 24th November 2011 – or is it 2031????

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Introduction

- Huge Potential for Offshore Wind
- Ireland Up to 27GW medium term
- UK 30GW round 3 Alone.... 48GW in development...
- Europe 110 to 120GW additional



Amounts and Volumes were Staggering....

- 150GW of offshore wind across Europe by 2031.
- 13,000 6MW Wind Turbines
- 6000 10-15MW Wind Turbines
- 9000 Fixed foundations, 10000 Floating foundations
- 30,000KM of array cable
- 300 Offshore AC substations
- 8-10 HVDC platforms per annum from 2015 a total of 150.
- 15,000KM of HVDC cable.

BUT THIS WAS JUST THE CONSTRUCTION STORY....







Resource Requirements – The early Days

- Scheduled Maintenance per machine is typically a single annual 3 day event for up to 7 persons...
- On a 50 turbine site (300MW) –1,050 scheduled days required (summer period)...
- 500MW wind farm Service (typical 3 month window)
 - Two windcats at 100% usage...
 - 28 Personnel full time
- Allowing for 25% Weather window these requirements increase..... AND THAT EXCLUDES UNSCHEDULED TURBINE WORK...









Annual Unscheduled Maintenance Events profile 50 Turbine Site - 2011





First Line "local" Events – 50 Turbine Site







Operations and Maintenance

- Older "UK round 2" type solutions were found to be inefficient.....
- 24m "Wind Cats" Approach:
 - Turbine Accessibility was restricted to 280 days per annum
 - Distances to site meant long travel times
 - Turbine access was restricted by metocean conditions
 - Working hours were constrained by daylight
 - Equipment transfers were weight limited
- Newer Approaches, using purpose built Service Operations Vessels (SOV's) were adopted...



Vessels

- Comfortable, Efficient Offshore Vessels were developed, to house enough personnel to operate and maintain up to 1GW of wind Turbines.
 - In 2011, "Senergy" and "Luckhide" developed vessels that could both house personnel and be used as transfer bases direct to turbines.
 - Maintenance offshore became a shift based activity.
 - Personnel spent periods of 2 weeks offshore and 2 weeks Onshore
 - Vessels returned to port for provisions and spare parts
 - Daughter Craft were launched and recovered from motherships
 - Specialised personnel transfer systems were developed
 - Mothership systems like "Plentymale"
 - Daughter craft also had less sophisticated systems



Vessel Classification – the new "Corporate Tax" advantage...

- Thinking ahead of its time, Irish Authorities introduced a new "Offshore Working Vessel" Classification.
- Without compromising safety, WTG technicians were no longer regarded as "passengers" on Service Vessels.
- This led to significant efficiencies for O&M service providers.
- The new classification meant that vessels rushed to operate under the Irish Flag.....
- From modest beginnings "SeaLingus" built an armada of 200 vessels, both Farshore SOV's and Intermediate SWATH craft.
- Service Industry to keep the flotilla operational flourished.
- Vessels operated throughout Europe under an Irish flag.



The Grid – an Operations perspective...

- The "Supergrid" led to:
 - Unified Transmission System Operation (UTSO) rules (regulatory framework).
 - Technical configuration, operational standards, communication protocols, etc.
 - Supply chain solutions....
- IreMesh was one of the first Transmission Operators to advocate:
 - Meshed, interlinked offshore network
 - Interconnectors between offshore generators as well as to onshore points
 - Combination of AC and DC offshore cable Networks



Grid Operations (contd)

- Offshore turbines were only useful if their intra array and transmission systems were reliable...
- Ireland, with early experience in HVDC on-shore operation, was quick to identify a "niche" role....
 - Universities, North and South, developed relationships with the main providers, based in Manchester, and focussed on R&D
 - Newer graphene based conductors again invented in Manchester - and new, ultra efficient power electronics began to come to the fore....
 - Superconducting Pipe Technology V Large Scale Long Distance transmission evolved...
 - HVDC Converters migrated from Silicon to Si-C Technology







Grid Monitoring

- Friends of the Supergrid Membership paid dividends for "Inlet".....
 - Known only for computer chips until 2015, Inlet's Irish Based R&D department identifies ways to improve the quality of communications between Supergrid Nodes.....
 - Spinoffs, monitoring grid stability and responding remotely to plant failure are set up in Ireland and UK – servicing Europe.
 - Grid communications networks also used for monitoring wind turbine condition and metocean data.
 - Health monitoring centres are set up to diagnose equipment condition, and advise Asset managers.



Grid Monitoring – Continued...

- New monitoring technologies were quickly developed..
 - Inlet's "Nano Implants" were introduced into Array & HVDC cables
 - Complementary communication in parallel with optical fibre, and also....
 - Monitoring of cable position and movement
 - Cable Capacitance and "sand" coverage
 - Impending sandwave movements
 - Vessel Interference with Cables.
 - Cable Insulation Degradation.
- Alliance with early Cable Vessel Companies allowed proactive maintenance strategies to be developed.



Cable maintenance

- Irish Seafarers recognised the need to shift from fishing for dwindling stocks, to other forms of activity...
 - Opportunities for experienced crews to survey cable routes
 - Vessels towing ROV's to inspect cables replaced trawlers netting fish.
 - Larger vessels carry out cable protection duties, including cable "mattressing".
 - Vessels, based in Ireland replace damaged Intra Array cables and later, to carry out "joint repairs".
 - Combination of survey capability and repair expertise, made large Irish based service providers the suppliers of choice...



Innovative new and reliable Designs...







Personnel....

- Renewable UK Skills report in 2010
 - "a requirement for 88,000 full time employees by 2021"....
- 15,000 of these personnel required training for offshore operations....
 - Working at heights...
 - Safe Electrical Isolation....
 - Safety at Sea...
 - Lifting at sea....
 - Inspection and maintenance of wind turbines....
 - On Shore Logistics, vessel and safety management....
 - Cable Inspection, protection and repair.....
 - HVAC and HVDC monitoring and repair.....



Skills Transfer:

- SOLAS, DELNI, identified and implemented training specifically for highly skilled Mechanical and Electrical technicians
- Eventually, four dedicated Operations and Maintenance training facilities were built in Ireland to cover the specific training needs for wind turbines.
- New information communications systems were developed to give information to personnel at site:





Logistics management

- The sheer number of WTG's offshore meant that operations had to be streamlined and simplified...
- Ding Power, beginning from Belfast, quickly built large operations teams.
- A number of Irish ports, including Belfast and Dublin, set up Purpose Engineered warehousing and re-provisioning facilities for the new Service and Operations Vessels.
- Over 5,000 Irishmen and Women, operating on a "shift basis" regularly rotated on and off shore, to operate and maintain wind farms.
- Offshore "Maintenance Berths" were built to service "shallow floating foundation" turbines.



Summary

- Opportunities are immense
- Offshore Wind is Coming
- Operations and Maintenance is a key factor to success
- Ireland still has significant opportunity and potential
- Let's not let it pass us by I don't want to have to rewrite history again!



Concluding Remark....



⁴ Imagination is more important than knowledge.³³

- Albert Einstein



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