New Approaches to Providing Offshore Power – Reducing Risk, Reducing Cost

Want to learn how to reduce the risks and costs of providing offshore power? Read on…

Trident Energy has spotted an opportunity to reduce the risks and costs of providing offshore power. Offshore wind farms are being built in ever deeper, harsher waters. Diesel generators are used to provide power when these are without grid connection – but access for refuelling in this challenging environment is increasingly uncertain. Turbines without power are not an option. Turbine warranties are invalidated, with major implications for insurance and financing. Diesel refuelling costs are very high because of the costs of getting the fuel to the wind farm.

The solution is to use the sea to provide the power. A small wave device attached to the wind turbine provides the primary source of power backed up by a diesel generator. This gives a diverse source of auxiliary power to protect turbine warranties and reduces refuelling costs.

A future where our power stations are offshore

Imagine thousands of wind turbines far out at sea. Small, lonely power stations generating clean electricity for our busy lives back on land. Like power stations, each wind turbine needs to be well looked after. Unlike today's power stations, they are difficult and costly to access. The equivalent of the man in a white van becomes a logistics challenge involving ports, boats, fuel, crew and long journeys in heavy seas. Get there and the waves may be too high to transfer personnel from the boat onto the wind turbine. New solutions are being considered, from helicopters, to offshore accommodation blocks and motherships. All are complex and costly. Ingenious solutions are required to make offshore wind turbines more autonomous, reducing cost and making a vital contribution to this new, low carbon, offshore industry.

Most offshore wind turbines are installed with an on-board diesel generator to provide auxiliary power

One of the basic needs of a wind turbine is the provision of auxiliary power, especially before it is connected to the onshore electricity grid. Power is required for cranes mounted on foundations. Once the wind turbine is installed, further power is needed to provide lighting, heating, clean air systems and to turn over sensitive equipment. Typically, this power is provided by small diesel generators; the London Array, the world's largest offshore wind farm, had a diesel generator located on each of its 175 turbines. If the connection to the onshore electricity grid is delayed then the diesels may need to provide continuous power for many months. The Riffgat wind farm off the German coast is fully installed apart from the grid connection, delayed for at least 2 years due to the discovery of munitions on the sea bed. This had led to unhelpful headlines such as "Windpark to nowhere … 22,000 litres of diesel burned each month to keep windpark from rusting away".

Auxiliary power key to risk management and warranty protection for operational wind farms

A robust source of auxiliary power is also required to manage risk in operational wind farms. Wind turbine warranties can be voided if the turbine is without power for more than a few days, radically

altering the risk profile and hence insurance requirements of the wind farm. This is reinforced by increasing regulatory pressure - the German regulator requires auxiliary power to be supplied within 12 hours of disconnection from the grid.

Reducing diesel usage reduces the high costs of offshore refuelling and reduces HSE risk

Diesel generators are reliable, proven technology and a trusted solution to the provision of offshore auxiliary power. However, the logistic costs of refuelling and maintaining the diesels are high. This opex cost can account for over 90% of the cost of providing auxiliary power. Limited space on the wind turbine means that fuel tanks are small and refuelling frequent. The equivalent cost of diesel for an offshore wind turbine can be more than five times what it is onshore. Offshore refuelling also carries the risk of an accident when personnel transfer from boat to turbine, or a fuel spill during refuelling. It is clear that new solutions that reduce diesel usage can significantly cut costs and minimise HSE risks associated with refuelling.

Diverse sources of auxiliary power reduce asset risk and protect turbine warranties

If a wind turbine is disconnected from the grid, it becomes reliant on its auxiliary power supply to protect the asset and its warranty. Poor weather can make access for refuelling impossible, leading to the risk of running out of fuel and hence a failure of auxiliary power supplies. Diverse sources of auxiliary power can reduce this risk. In particular, renewable solutions offer diversity as they are not dependent on refuelling and the associated access constraints.

The costs and risks associated with auxiliary power increase as development moves further offshore

The costs and risks associated with auxiliary power increase as development moves further offshore. The London Array is around 20kms from shore, whereas North Sea projects due for development over the next decade are up to 290kms from shore. Transit times from the shore-side logistics base will increase, greatly increasing the costs of existing refuelling solutions, or requiring the adoption of higher cost logistic solutions such as helicopters or motherships. Wave conditions will be more onerous, reducing the weather windows during which access for refuelling is possible and increasing the risk of running out of fuel and losing auxiliary power.

Diesel / renewable hybrid solutions – the future of offshore auxiliary power?

So what does a solution look like? The developers of offshore wind farms are creating amazing projects in a challenging environment and are understandably risk adverse. Diesel generators are proven technology. It is inevitable that diesel generators will continue to be deployed to provide auxiliary power. Rather, solutions should focus on reducing the costs and risks associated with refuelling and maintaining the diesels. In particular, the adoption of hybrid diesel / renewable solutions provides increased diversity and autonomy to the provision of auxiliary power. The renewable technology minimises the cost and risks of refuelling logistics, whilst the diesel remains to back-up the renewable technology and ease adoption amongst project developers.

The advantages of co-located wave generation

Co-located wave generation – a small wave device attached to the wind turbine – offers specific advantages. In particular, during periods of stormy weather when wave height precludes access for refuelling the diesel, the wave device will be producing most power. This minimises the risk of losing auxiliary power, voiding warranties and exposing the asset to damaging conditions. Such solutions need to be tested now so that the lonely, far offshore wind farms that will be developed over the next decade can be more autonomous, reducing the risk and cost of their development and operation.

Trident Energy's linear generator technology

Trident Energy is developing such an auxiliary power solution, using its proven direct drive linear generator technology. This coverts the up-down motion of waves directly into electricity without the need for intermediate systems such as gearboxes or hydraulics. This makes it simple and reliable. Results from Trident Energy's recent test programme have also demonstrated the capability to control the generator in real-time, opening the way for energy extraction to be optimised for each individual wave. This low cost, high performance generator enables cost effective autonomous offshore power solutions, reducing the risks and costs of the next decade of offshore wind farm development.

About Trident Energy

Trident Energy was founded in 2003 and has undertaken extensive research and development on linear generator design for wave energy conversion. The company has assembled a highly experienced management team with a history of building technology businesses, raising capital, innovative engineering design, manufacturing and creating shareholder value.

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