

Wind of Change

The announcement of 32GW of offshore wind energy for the UK will change the playing field dramatically for offshore wind.

All photos courtesy of International Paints



The winning bidders for the nine zones for offshore wind in the UK have been announced, setting the ball rolling on a decade of frantic expansion around off the UK coast. This equates to some 6000 offshore turbines and represents a massive long-term investment in marine renewable electricity.

This 32GW of offshore wind energy announced under the Crown Estates round three offshore wind programme ensures that the UK will continue to lead the world in this emerging technology. However, the programme ahead is incredibly ambitious and has both engineering and commercial challenges to overcome if it is to be a success.

The new breed of offshore wind turbines is much bigger weighing in excess of 1000 tonnes and much taller at 250m (three times the height of the statue of Liberty), which creates new challenges to develop innovative and cost effective foundations to support these structures. Coatings will also have to play their part in protecting these massive structures from the elements.

"Currently, Offshore wind still represents a small proportion of the total wind power market - the vast majority of wind power is still onshore," says Jamie O'Brien, WWPC power market manager and marketing services manager for International Paint.

However, this ramp up in offshore wind is going to create lots of new opportunities. "What we tend to find at the moment is that the offshore opportunity is basically dictated by the overall turbine manufacturer, says O'Brien. "For example, at the moment General Electric which is one of the biggest players worldwide does almost no offshore. They have focussed on onshore type C3 environments. Vestas who are still the marginal number one worldwide are a very large player offshore. They are currently still going for high performance systems because offshore maintenance and access is a large problem, so there is still a fairly significant level of caution in coatings selection when it comes to offshore."

In the early days of wind there were problems with towers being coated by the lowest cost coatings to save money but as O'Brien explains, "it has become a question of scale. If you go back certainly ten years the offshore stuff was a little bit experimental. As it is going forward now and it is a genuine commercial situation where you are talking about putting hundreds of towers offshore as opposed to one or two. I think they are giving it much more careful consideration."

"All wind energy is challenged by the cost per MW compared with fossil fuelled and nuclear energy," says Ron van den Broek, global market manager power for

PPG, "Experts in wind energy think that offshore wind projects are much more expensive than onshore. The higher costs are related to the wind turbine itself and the additional costs for foundation structures. The UK's Carbon Trust has recently run a competition for lower cost offshore wind farm designs. For large-scale employment of offshore wind energy the exploitation outlook is of paramount importance."

Things have changed as more experience has been gained. O'Brien says, "The major players are now looking at the coatings selection relatively sensibly. However, I would temper those comments by saying that there is still some interest in trying to drive down the number of coats that are applied as opposed to the quality of the product."

"The coating industry develops dedicated product ranges to compile coating systems in which each coat fulfils specific requirements to protect the structure from corrosion and loss of functionality, says van den Broek. "Turbine manufacturers, designers, engineers, contractors and operators are, based on the lessons of the past, aware of the essential role of coating systems in an offshore environment."

"The latest coating specifications for offshore wind farm projects, including foundations,

address these issues as well as life time expectation of the applied preservation.

"NORSOK M-501, ISO 20340 and 12944 are helpful to guide turbine manufacturers, designers and engineers to select efficient coating systems. Film thicknesses suggested in these standards are adopted in the coating specification."

However, as Dr Raouf Kattan, managing director of Safinah points out, "many of the established wind turbine manufacturers tend to subcontract the building of the towers and in turn the builders of the towers may subcontract the coating of those towers." This means that controlling coatings quality can be difficult.

"Of course the manufacturers do often stipulate a generic paint scheme, x coats of y microns dft, and in some cases specify a particular paint supplier, says Kattan. "What matters though is what is specified against what is delivered" he explains. It is not unusual for the applied generic specification to be regularly over or under applied. Over application can result in additional weight and costs, while under application can result in premature failure and costly repairs."

O'Brien also says, "as we have seen with normal oil and gas offshore it can be fraught

with its own dangers where selection of a perfectly suitable specification causes people problems because they have tried to do it in minimal coats. Obviously the lower the film thickness you apply, the greater the possibility of error during application."

"The increased demand for towers has seen pressure at production facilities to speed up the coating process and sometimes this is leading to shortcuts that result in poor application, agrees Kattan.

On the question of whether PPG has seen pressure to increase the performance of the coating system whilst reducing the number of coats to keep costs down van den Broek says: "Wind power is fast growing on a global scale. At the same time the turbine industry is under pressure to manage the build cost in order to reduce the kilowatt consumer price. Production speed and turnaround become also more important to meet tight delivery schemes. Tower fabricators are looking for coatings systems in less coats and shorter overcoat and drying times to meet both cost reduction and delivery speed. Technical performance of coating systems is standardized in ISO 12944 and ISO 20340. Additional requirements for long term gloss and colour retention are



challenging the coating industry.

The key area of concern is the transition zone. "This is the part between the foundation and the tower and incorporates an area that is partly submerged and partly exposed and the splash zone," explains Kattan. "It also often has the boat landing and access ladders. This area seems to be regularly presenting problems, in part because there are some small complex geometries and in part because the application of QA is possibly not as good as it should be.

Scaling Up

"One of interesting things that we are starting to see is the actual fabrications shops for the towers have become tremendously sophisticated now and the quality of surface preparation - I wouldn't say it is automotive standard - but I would say it is starting to get to pretty good quality application and the processes are becoming fairly robust," says O'Brien. "The dangers of the application errors that you would have seen with cheaper products a few years ago probably don't manifest themselves as often now. And you can get away with slightly - I won't say lower quality - but we can push the envelope a little further now than you did before."

On the question of what specification should be applied it is interesting to note what is being applied. "The generic coating specification refers to products and coating systems defined in terms of binder type," says van den Broek. "The coating manufacturer translates the generic specification into manufacturer specific systems suitable for the performance requirements. Standard tests and proven performance supported by track records are essential evidence."

"Safinah has seen some poor specifications, but lessons certainly are being learnt and in general people are moving toward better specifications (although as

ever looking to manage costs)," says Kattan.

Coating Specifications

ISO 12944 suggests coating systems for atmospheric, splash zone and submerged areas. Tower sections exposed to severe atmospheric conditions, categorized as C5-M, will benefit from proven technology in 2-coat and 3-coat systems.

Splash zone and submerged areas, Im2 category, need 2-coat or 3-coat systems in thickness above 350 micron.

When it comes to the minimum requirements van den Broek says: "NORSOK M-501, ISO 20340 and ISO 12944 indicate the minimum requirements coating systems should comply to related to eg exposure conditions and expected service lifetime. Until today those standards and requirements are in use as the common practical tool."

He explains, "balancing performance and cost should be based on predicted service conditions, expected service life time and maintenance intervals. Future maintenance might be restricted due to access to the structure and weather conditions. The less feasible a regular maintenance scheme is the higher durability is required."

"There is probably no doubt that the coatings that are available can meet the needs of the environment but if application is poor then it should be no surprise to see failures," says Kattan.

He goes on to say, "for the vast majority of the tower (that above the splash zone) performance does not appear to be a great issue, it is very much this transition zone that causes the problems and needs to have attention paid to it."

There is alternatives to standard coatings systems being looked at for these areas but as Kattan explains; "There has been discussions to look at using non-liquid

coatings (films) to protect the transition areas but no one has yet applied this in practice to our knowledge.

Damage in Transit

One of the areas that has been noted as a problem is that of damage in transit. "There is considerable evidence of damage in transit and during installation and although the areas are quite small the ability to carry out in field repairs is limited and procedures are quite basic," explains Kattan. "This in turn can result in localised coating failure."

He says, "to overcome this in part structural design makes allowances by increasing steel thicknesses, but this of course adds cost and increase weight (and hence foundation/mooring needs)."

He believes that "there is a need for better control and perhaps at least a record of how the systems are performing in service to try an enable designers to hone down to an appropriate system that is specified by taking into account more of the functional needs of the location of the installation and the production process as well as the capability of the coating applicator."

Inspection Difficult

O'Brien explains that "inspection is currently dictated almost more by the maintenance requirements for the mechanical and electrical operation of the turbine. So when it stops generating power or they encounter other issues in the equipment they will do the inspection while they are out there but in terms of conducting stand alone coatings inspections, I think there is still a way to go before that becomes a concept.

In terms of doing a bespoke inspection just in terms of the paint performance is not the highest of priorities. When you think about the gauge of steel they are using for the fabrication of these towers - the danger of them falling over in the short term is probably fairly slim, so if you miss an inspection by six months it is probably not the end of the earth. The product might not be looking too good but the requirements to inspect for other reasons mean they are probably going to get out there at reasonable intervals.

Warranty Required

"I think there is a growing awareness with the major players of the need to have some level of warranty support and I think they are reflecting that in coatings selection now," says O'Brien. "The specification for the wind turbine tower is nothing special, just zinc rich epoxy intermediate with an aesthetic finish whether it is polyurethane or similar and you are typically looking at three to four coat systems currently."

"Where there is a fair bit more difference of opinion is where we start to look at the offshore foundations and the various routes that you can go down for coatings selection there. There probably is no simple answer as to what the preferred coating specification is from the foundation perspective."



Extended Life

In the early days of offshore wind nobody was sure exactly how long the towers would need to be out there. "In the early days the expectation was that you would get ten years out of one and that would be it," says O'Brien. "The other thing that we are starting to see now is that a turbine that was erected five years ago generates a tenth of the electricity you would get if you put in a new one - so you are starting to see repowering."

"We are seeing towers being taken down and shipped off to other countries where wind power is not so well developed. Some towers that were put in were expected to last 20 years and have been taken down after ten and some which we thought were only going to last five years have been repowered with a bigger turbine, so it certainly a changing dynamic," says O'Brien.

"ISO 12944 suggests coating systems for high durability (> 15 years) which are specified by turbine manufacturers," say van den Broek. "Tower sections exceeding the planned standard lifetime carrying turbines will probably need a repaint. To what extent wear and tear has effected the coating needs to be inspected in order to define the maintenance programme."

However, as Kattan warns, "the cost of failure can be very large simply because of the problems of access to carry out the work and certainly the more care that is taken on the first time application the better." ■