

The London Array: the world's largest offshore wind farm

As Britain strives to meet European renewable energy targets, the world's largest offshore wind farm is rising from the waves off the coasts of Kent and Essex.

By Edward Platt
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Ninety of the 175 turbines that make up the first phase of the London Array wind farm are in place in the outer Thames Estuary
CREDIT: Photo: Jason Orton

We left Ramsgate in bright sunshine on one of the hottest days of the year, but within minutes the mist had come down and we could barely see beyond the prow of the boat that was ferrying us towards the site of what will be the world's largest offshore wind farm.

When the first phase of the London Array is complete by the end of this year, it will generate 630 megawatts of electricity – enough power for more than 470,000 homes, or two thirds of the homes in Kent.

Onshore wind farms, heavily criticised for their visual impact on the landscape, have generated a great deal of vocal opposition in recent years. In 2010 32 out of 66 applications for onshore wind farms were rejected. Offshore wind power, however, is expanding rapidly. Britain's first offshore wind farm, near Blyth in Northumberland, opened in 2000, and since then another 14 farms (about 570 turbines and counting) have been built around the country, including three others in the Thames Estuary between the Kent and Essex coasts. Another six are under construction; a further seven have planning approval.

So far, Britain has made slow progress towards the goal set by the European Union of generating 15 per cent of our energy needs from renewable sources by 2020, and towards the target mandated in the Climate Change Act of 2008 of cutting carbon emissions by 80 per cent by 2050. Yet the government believes our reserves of wind, wave and tidal power will enable us to meet them. It estimates that offshore wind alone could meet Britain's current demand for electricity 10 times over, and environmental campaigners are urging the government to make the most of its potential.

'Forty years ago, we were discovering North Sea oil, and now, as we find ourselves on the cusp of a technological revolution, we are sitting on the most fabulous resource once again,' Andrew Pendleton of Friends of the Earth told me. 'It would be a tragedy if we didn't exploit it.'

The first turbine in the London Array was installed in January this year, and another 90 have been added since then. The 175 turbines that will make up the 630-megawatt capacity of the first of two phases are due to be in place by the end of the year, and Stephen Reynolds, London Array's offshore site manager, was pleased by the way the work was progressing. Reynolds, 58, had worked in offshore oil and gas in Qatar; in 2008 he started working on the Thanet wind farm, nine miles south of the London Array.

'I can't say that working in renewables was part of the plan – it just fell into my lap,' he said, above the noise of the engines as the boat drove on through the mist.

At the time, Thanet was the largest wind farm in the world: its capacity was 300 megawatts, and it was capable of generating enough power for 240,000 homes. It is testament to the industry's rapid growth that an even larger farm is being built in the same stretch of water. When he finished working on Thanet in 2010 Reynolds moved across to the London Array. He hopes to keep working in offshore wind power until he retires.

Reynolds lives in Brighton, but has bought a flat in Ramsgate, like many London Array employees. They have their own running group, a football team and a band in the town. Most are skilled itinerants, like Reynolds, yet the wind farms in the Thames Estuary have generated much-needed work for locals, too, including the crew of the boat, Towyn Bay, that was carrying us through the mist. Lea Hurst had been volunteering for the local lifeboat service before he joined Turbine Transfers, the company that transfers personnel and equipment between the shore and the turbines. 'This came up and I thought I'd try it,' he said. 'It's a good job – it's different, and I'm home every night.'

Like most of the Victorian resorts on the Kent coast, Ramsgate has been in steady decline since cheap air travel brought more exotic holiday destinations within reach, and Hurst told me that almost all of the locals are in favour of the development. 'If you go around now, there are no B&Bs free, the pubs and restaurants are full,' he said. 'Come the end of the year it will die down a bit, but there's still going to be some people working, so I think it's only going to be good for the area.' Turbine Transfers has been contracted for three years beyond the end of construction, and Hurst, 23, hopes there will be work beyond that.

The local fishermen, who fish the Thames Estuary for Dover sole and other catches, have less reason to welcome the wind farms. Merlin Jackson, the treasurer of Thanet Fisherman's Association, which represents about 30 vessels from Ramsgate and other harbours in the area, said that some fishermen were concerned by the loss of their traditional fishing grounds. 'Fishermen and wind farms seem to like the same places,' he said. 'We both like shallower areas, nice and close to the shore. We can understand why they want to be here, but it has cost us a lot of particularly fruitful ground. They have stepped on a lot of people's toes.'

Yet Jackson, 43, who started fishing the estuary with his father when he was four, says there have been benefits. He has now given up fishing to run a fuel company, and the fact that it supplies the wind farm's large fleet of craft has allowed him to keep his prices down for the fishermen. Though the fishermen will be permanently excluded from the London Array, Jackson maintains that they and the wind farm get on well. 'We have managed to cope with their arrival, and we have come up with solutions as we go along,' he said.

Even when construction is over, the London Array will generate work for local people: the purpose-built operations and maintenance base in Ramsgate harbour will employ 90 staff, including a number of apprentices who are being trained as wind turbine technicians, and the local MP, Laura Sandys, has said that she wants to see the area become 'a focus of renewable energy expertise'.

Other regions, including the North West and the North East of England, are keeping an eye on events in the Thames Estuary, having expressed similar ambitions themselves. There is a cluster of wind farms in the Irish Sea, including Walney, which is currently the largest in the world, with a capacity of 367 megawatts, and a group of the North East's leading energy companies have invested £100 million in an attempt to make the region a hub for offshore renewable energy.

The area around the Humber Estuary is also set to become a focal point for offshore wind. Earlier this year, Hull City Council granted planning permission for a facility called Greenport Hull, where the German electronics and engineering conglomerate Siemens plans to build an offshore wind turbine manufacturing facility. The man we picked up from another boat after an hour at sea was able to vouch for the city's need for such investment. 'Hull has been static for quite a while,' said Steven Nicholson, a health, safety and environment adviser for Siemens, which also manufactures vanes for the London Array.

Nicholson, who had spent the morning with technicians assembling on a turbine, started work on the London Array a year ago, and much of his time is spent helping to integrate new recruits to an industry that is short of experienced labour. 'There aren't many people coming over from oil and gas, mainly because that area is still busy, and quite a lot of people are new to offshore work,' he said. 'It's a big commitment to train people, and it's a challenge integrating them all.'

Nicholson was working in the North Sea on the oil rig next to the Piper Alpha platform when it blew up in 1988, killing 167 people, and he has seen safety standards improve dramatically since then. 'You're safer working in oil and gas now than you are on a building site in the UK. It has changed for the better and the wind industry will, as well. It is potentially dangerous – the same as any construction industry, partly because the technicians are very isolated. But it's an ongoing thing. You're just trying to educate people.'

We had reached the edge of the field, which lies 12 miles from the Kent and Essex coasts between two sandbanks, Long Sand and Deep Knock. The site is bounded to the west by Black Deep, the main approach to the Port of London. In 2001 a series of environmental studies confirmed the area as suitable for a wind farm, and two years later the Crown Estate, which owns the seabed within territorial waters, gave London Array Ltd a 50-year lease for a total area of 152 square miles.

The boat slowed in the choppy water and drew alongside a top-heavy platform that looked like an oil rig. It was one of the two substations that collect the power generated by the turbines and export it to the newly built substation on the mainland, via four export cables, 30 miles long. The substations are the wind farm's heart, and the cables its arteries: in total, more than 280 miles of cable will be required to bind the wind farm together and connect it to the national grid, and installing them is the most daunting technical challenge. They're large and heavily armoured, but they get damaged very easily if they're not put in correctly; Stephen Reynolds said.

On a clear day we would have been able to look through the rows and columns of the turbines, which stand 285ft above the water, to the other substation at the western edge of the field. Yet on this visit, visibility was at the limit of what is considered safe. 'Any worse than this, they would probably tell us to come back,' Reynolds said. 'Ideally, you want to be able to see from one turbine to the next, rather than relying on the VHS radio to communicate what's happening.'

Working on a building site at sea presents other difficulties: some parts of the site dry out entirely at low tide, but in other places the water is 75ft deep. The teams can't work in high winds or rough seas, and they have to wait until 'slack water', when the tides aren't running, before they can put divers in.

Environmental considerations are another constraint: the number of turbines in phase one was reduced from 258 to 175 in order to protect a population of red-throated divers in the Thames Estuary, and a further assessment of the wind farm's impact on the birds will be required before phase two (which will increase its capacity to 1,000 megawatts – one gigawatt, enough for a quarter of London's homes) proceeds.

The RSPB regards the harnessing of offshore wind as essential in the fight against climate change, but is also determined 'to protect important marine sites from adverse development impacts'. Earlier this month, an application to build a 540-megawatt wind farm at Docking Shoal, near the Lincolnshire and north Norfolk coasts, was refused because the potential impact on Sandwich tern seabirds in the Wash. It is not only birds whose welfare is an issue: the developers deploy 'marine mammal observers' to patrol the site. When the turbines' foundations are drilled into the seabed using a hydraulic hammer, the resulting high levels of underwater sound can be harmful to wildlife in the vicinity.

The bulk of the construction is done by a very special boat, the MPI Adventure, which was the next structure to emerge from the mist – it is one of two purpose-built 'wind turbine installation vessels' working on the London Array. It looks like a barge crowned by a high superstructure and a towering crane. Yet its most distinctive feature is the six steel 'jack-up legs' that it sinks into the seabed. Once the legs are firmly planted, the MPI Adventure can raise its hull above the waves to form a solid working platform. We circled it, foghorn blowing.

The turbines are shipped by barge from Denmark to Harwich in Essex, where they are loaded on to the Adventure. Construction is in three phases: a cylindrical column – monopile – is lifted into place by the onboard crane and hammered into the seabed to form the foundation, and the 'transition piece', which will house the turbine tower itself, is grouted into place. The process takes up to 18 hours, and the grout is left to harden for seven days before another boat attaches the tower and blades, and fits the cables.

Given the complexity of the task, it is not surprising that offshore wind is so expensive. Shell was one of the original partners in the London Array, but it pulled out in May 2008, believing that the costs were mounting, but the other two partners, Denmark's Dong Energy and Germany's E.on, bought out its stake, and the current consortium came together in October 2008 when E.on sold 40 per cent of its 50 per cent share to Masdar, Abu Dhabi's renewable energy company. The consortium is investing £1.95 billion in phase one, though the project's long-term profitability will depend on the public subsidy it receives.

The government estimates that the Renewables Obligation, which requires British electricity suppliers to provide a proportion of their sales (12.4 per cent in 2012/13) from renewable sources or pay a penalty, generates £1.3 billion a year in subsidies for the renewables industry. The wind industry receives approximately 50 per cent of the total, weighted two to one in favour of offshore wind. Yet Andrew Pendleton maintains that, in the long run, offshore wind will be cheap as well as clean. 'The wind industry is an unrivalled opportunity for UK plc,' he says. 'There is a genuine opportunity for us to be at the forefront of some very exciting 21st-century industries.'

Already there are concerns that we are slipping behind our international competitors. At the end of 2011 Denmark was generating 26 per cent of its power from wind, compared with Britain's four per cent. Britain has installed 6.5 gigawatts of capacity in offshore wind, while Germany has 29-gigawatt capacity and Spain 21 gigawatts, although we are rapidly increasing our capacity after a slow start.

But little of the money in the British offshore wind industry is going to British businesses: London Array says it is working with 100 local companies, but the £14 million in contracts they have received represents only a fraction of the project's cost. Although JDR Cable Systems, which is producing the London Array cables, is a British company, and the electrical systems contractor is part of the Siemens Group, based in Manchester, the main suppliers are German, Swedish or Norwegian. The pattern is replicated elsewhere: the vast majority of Britain's offshore wind farms are built, owned and operated by foreign companies.

Another concern is the intermittency of supply, and how it can be stored efficiently, given that wind power is highly non-dispatchable – output cannot easily be increased on demand. A House of Lords select committee report in 2008 concluded that 'a breakthrough in cost-effective electricity storage technology would help solve the problem of intermittency and remove a major stumbling block to wider use of renewable energy', recommending that the government 'should as a matter of urgency encourage more research, development and demonstration in energy storage technologies'.

Pendleton points out that the great difference between Britain and Germany is that we have lost faith in our engineers and innovators. He believes that we need to invoke the spirit of great British pioneers, such as Michael Faraday and Isambard Kingdom Brunel, to help us address the technical and commercial challenges inherent in offshore wind power, such as the intermittency of supply. Pendleton says that we have 'two or three of the best researchers in the world in the field of battery technology' and points out that their attempts to find ways of storing power to be used on windless days will be complemented by the increasing scale and geographical diversity of the wind industry: 'The more you have, the less likely you are to have a problem with intermittency – if you have wind turbines in the Thames Estuary, the Atlantic Array, the North Sea and around Scotland, you're increasingly unlikely to have a still day everywhere.'

Turbine technology is also improving: the ones installed in phase one of the London Array generate 3.6 megawatts, but the next generation will generate 5.6 megawatts. By the time the developers replace all the turbines in about 25 years' time, Reynolds predicts they will be more productive.

He does not believe that renewables will meet all our power generation needs, but he believes the emerging industry has a part to play. 'I'm a great believer in renewables,' he said. 'I think it's a great way to go. I don't think we can put all our eggs in one basket – we will need nuclear power and other forms of energy – but this has got to be a section of the electrical supply.'

On our way back to Ramsgate, we reached one of the turbines. They are taller than the London Eye and the tips of their vanes were hidden in the mist. Steven Nicholson, who had been inside one earlier in the day, climbing the ladder that scales the shaft, preferred the view from the shifting deck of the ship. 'When you see them from the inside, they're very industrial, but when you see them from the outside, they're quite pleasing,' he said. 'I think they're quite attractive to look at, wherever they are. But the best place for them is out here.'

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