Businesses are lining up to build wind farms off the Belgian coast. The C-Power Consortium is the frontrunner, constructing 60 enormous turbines over the next few years. 'A complex project that few can pull off.'

The challenges of a Belgian offshore wind park

'Water is the driver, not wind'

The "Half Moon" construction site in Ostend. Photo: by C-Power

by Remco de Jong

The skyline of Belgian seaside resort Ostend has been dominated in recent months by six concrete foundation structures, each measuring 44 m in height. Over the next few years, a total of sixty of these foundations will be built at a construction site in the harbour area. Eventually, they will be fitted with enormous wind turbines. In order to carry the substantial weight of the structures, the construction site has been built on extra long piles.

Wendy Goossens, an engineer at C-Power – the consortium that is the first to build a wind farm off the Belgian coast – points out the features of the foundations. They each have a diameter of 30 m and look very much like a gigantic empty basilica on the inside. Pouring the concrete was made difficult by the enormous amount of reinforcing steel that gives the construction the strength required to resist stormy weather. Two large holes have been left open on either side of the foundations to leave room for the electricity cable that will run from the seabed to the turbine on top of the structure. Each foundation stands on a concrete platform, so that hydraulic loading devices can be rolled underneath to lift the giant structure off the ground and transport it to the wharf, where an enormous crane lifts it into the water. 'The foundations are partly submerged and transported to a sandbank where they are placed onto the seabed,' Goossens explains. Prior to being transported to the quay side, the foundations are weighed to determine whether the giant crane will be able to handle their weight. 'The crane has just enough capacity,' says Goossens, 'However, if we get too close to the maximum weight we will take no chances and reduce the load.'

Enormous moulds stand around the harbour site. They will be used over the next few years to pour dozens more concrete foundations. Work on the concrete structures was in full swing in late April when C-Power treated guests to champagne in an elegant marquee while the first foundation was transported across to Thorntonbank. The baptism of that first foundation was surrounded with glamour, which goes to show that wind power is sexy in Belgium. Shuttle buses carried guests to and from the construction site. Hostesses equipped with earphones received the guests, who entered the marquee on a red carpet. Inside, a well-presented trilingual master of ceremonies led proceedings with appropriate music, a light show, elegant catering and fresh oysters. 'We have been working on this for ten years. Now that the moment has finally arrived it is time to celebrate,' Flemish project leader and general manager of C-Power Filip Martens explained. One of those attending was Johan Vande Lanotte, socialist politician and Ostend resident. He and his political party, the SP.A, are fervent supporters of the construction of wind farms. His party is one of a small minority in the Belgian political scene to demand closure of the two nuclear power plants in Belgium and therefore he feels there is an urgent need to establish alternative production capacity.

> *Our wind farm will end up costing Belgian electricity consumers €10 per person per year*

Knokke

It took ten years before the first wind turbine could be placed off the Belgian coast. Belgian legislation did not contain any provisions for construction in the sea, 30 km offshore. Previous attempts to construct wind turbines closer to shore met with resistance from residents of seaside towns. One elderly woman in Knokke successfully managed to prevent the construction of a wind farm because it would have ruined her view. The Belgian government then decided to designate an area where concessions would be given. Due to their considerable distance from shore, the wind turbines are out of view. 'This project is unique in three ways,' says Martens. 'Each wind turbine has a capacity of 5 MW and this is the first time a generator with such a large capacity has been placed offshore.' From a technical perspective, the long distance from the shore and the 30 m depth of the sandbank also presented complexities that have been overcome in the past few years.

Wind energy is all the rage in Belgium. This spring, another two candidates wishing to exploit wind energy off the Belgian coast presented themselves, bringing the total number of candidates to five (see insert). After many years fraught with problems, the Belgian government is now supporting the wind energy projects because they present one of the few options available for generating renewable energy in Belgium. According to the target set by the European Commission, Belgium needs to obtain 13% of its production from renewable sources by the year 2020. The current projects supply only 7%. The Belgian government supports producers by awarding a Green Energy Certificate for every MWh hour of power generated. At the moment these certificates are worth around €110 on the green energy market (11 eurocents per kWh). In addition, C-Power has managed to get the Belgian government to agree that it will receive a minimum of €107 per MWh for the certificates. If the price drops below this, the government will pay the difference.

Inside a site office, Martens almost waxes lyrical about his consortium's 'incredible precision work'. 'We have prepared foundation bases for the concrete

Queuing up

Five operators are either planning to generate wind energy off the Belgian shore or are already in the process of doing so.

C-Power is a consortium that includes – amongst other entities – the Deme dredging company, French company EDF, two Walloon investment companies and a group of Flemish local councils. C-Power is the first producer of wind energy off the Belgian coast. In the next few years C-Power will install sixty wind turbines with a combined capacity of 300 MW, enough to provide for the energy needs of 600,000 people.

Belwind hopes to install the first turbines next year. Belwind is the project name that Evelop chose for the installation of wind turbines with a total capacity of 330 MW. Evelop is a division of Dutch company Econcern that also has offshore projects in the Netherlands, Great Britain, Germany and Poland.

Eldepasco is a consortium consisting of Belgian company Electrawinds, Aspiravi, a group of Belgian municipal utility companies, construction company Depret and retailer Colruyt. Eldepasco is hoping to install thirty wind turbines with a capacity of 5 MW each.

Aspiravi has also independently submitted a proposal for a fourth wind farm, but these plans have not yet become concrete.

Air Energy is the fifth and final candidate for the time being. This company was recently sold to Dutch company Eneco and has the most ambitious plans of all. It wants to invest €1.5 billion in the construction of a wind farm with a capacity of 420 to 630 MW.
It is estimated that there is room off the Belgian coast for enough wind turbines to generate a total of 2,000 MW of electricity.

foundation structures out there in the middle of the sea. You have to picture us dumping gravel off a ship onto the seabed 25 m below on top of a foundation that has to be perfectly horizontal. So then, what is a deviation of 8cm?' Aside from dealing with the technical complexities, Martens has been negotiating with the various levels of government in Belgium. 'When we started, back in 1998, there was no legal framework whatsoever. Since then two legal amendments have gone through, eleven Royal Decrees have been passed and a total of 24 permits have been issued by 27 government departments.' One factor of great importance was solidifying the legal certainty of Green Energy Certificates, which producers of green energy receive from the government and that are of monetary value in the electricity market. 'We now have the certainty that the system will be left intact for the next twenty years.' He is aware of criticisms that the costs of these certificates will eventually be passed on to the Belgian end-users. 'Our wind farm will end up costing Belgian electricity consumers €10 per person per year. Last year everyone was presented with a power bill that was €150 higher than the previous year, due to rising prices, without any benefit to the consumer. Now Belgians will be paying €10 and in doing so they will help Belgium achieve the Kyoto aims.'

Special carrier "the Rambiz" lowers the foundations of the windmills on Thornbank. Photo: by C-Power

No experience

Martens shrugs off the arrival of at least another four consortiums wishing to exploit wind turbines. 'They are competitors who literally want to take the wind out of our sails. I wonder just what some of them want here. All of the problems we encounter around the world in the offshore generation of wind energy have been caused by contractors who have no experience in working with water. You have to approach a project like this as an offshore project that happens to involve the installation of a wind turbine. Water is the "driver", not wind and that changes everything.' C-Power would have been happy to collaborate with other operators, for example in order to bring the generated power onshore through shared infrastructure. 'But our colleagues

are simply not as far in the process as we are and we couldn't wait any longer. When you order a cable like that, you have to count on a lead time of two years. It took our cable producer (ABB, ed.), the biggest in the world, a quarter of his annual capacity in one factory to construct the cable for us.'
Martens also questions the competitors' plans. 'The plans of the first three consortiums, C-Power, Eldepasco and Belwind, add up to a capacity of around 800 megawatts. That amounts to the exact injection capacity of the Belgian high-voltage grid. If more electricity is brought ashore I am not sure how my colleagues will solve that issue. It will cost a lot of time and money to expand the high-voltage grid capacity.'

Frank Coenen, project leader for Belwind, a company that is also on the verge of building wind turbines off the coast of Belgium, agrees with Martens in this respect. 'The government should oblige Elia, the grid operator, to install a power outlet at sea, so that we can all plug in to that outlet. It's absurd that power plants are automatically connected on land but that different rules apply out at sea!' Coenen hopes that Belwind's mother company, Dutch Econcern, will make the final decision this spring to start up the project once the last permits are in. He finds Marten's "pioneer stories" quite amusing. 'We currently exploit the offshore farm that is the furthest from land, namely Q7, off the Dutch coast. This autumn, C-Power will break that record and then it will be our turn again a few years later.' Belwind's wind farm will be at an even greater depth and even further off the coast. 'Once we start we will advance much quicker than C-Power. We use steel foundations that we can install in a day and a half. This enables us to install 55 to 60 turbines a year.'

Wait and see

Rick Van de Walle, general manager of Aspiravi, one of the partners in the Eldepasco consortium, which also has construction plans, stresses that his consortium is not in any rush. 'We want to get the maximum benefit from knowledge gained by offshore parties.' He will be a happy man if the first wind turbines are operational by 2011. 'Our approach is definitely not to want to be first. Not many of those new offshore 3 or 5 MW turbines have been installed yet. Let's wait and see how they go.' He agrees that Aspiravi will have a problem in getting the electricity on to the high-voltage grid. 'We assume that the government will make arrangements for that. If the Belgian government recognises the importance of offshore wind energy, it will have to facilitate it.' The government currently subsidises the laying of cables from sea to shore up to a maximum amount of €25 million. Van de Walle hopes that if this amount has to be paid out four or five times, it may prove more efficient to install a power outlet at sea. Aspiravi is a consortium of municipal councils in Belgium that through such investments 'wish to make a contribution to the environmental aims of the Belgian government,' says Van de Walle.

C-Power aims to play a key role in offshore wind energy worldwide. 'We want to sell any knowledge that we gain. Our home market is a demonstration project,' says Martens. 'This is to be the ultimate point of reference, worldwide. Wind energy no longer belongs to the environmentally conscious sandal-wearing brigade. Those advocates of love and peace got us moving. It is now turning into a real industry.'
Coenen agrees. 'Econcern has thirteen different projects in the pipeline. It is becoming a very professional industry. Some people complain about the high price we have to pay for the production of green power but does anyone ever ask how much the first nuclear power plant cost and what return we got on that? If polluting energy producers had been made to pay an environmental tax in earlier days there would have been more of a drive to search for clean energy.' Financiers are keen on getting involved. 'We are not affected by the financial crisis in the global market.' Coenen says that even power suppliers are now showing a lot of interest. 'The growth of green energy has been going on for a couple of years now. Obstacles have long been put in the way of green energy, even by employer organisations that feared power would become too expensive. Now people are looking for stable, fixed prices and green power can give them that.' ■

As big as the Atomium

C-Power likes to portray itself as the pioneer; the first in the world to succeed in building wind turbines 30 km offshore and anchoring them in a sandbank located approximately 30 m below sea level. C-power opted for a system of gravity-based foundations. These foundations weigh 3,000 tons and are placed on the seabed – which has been levelled – and then filled with sand. A 77 m high column is placed on top of the foundation structure and a turbine, weighing 316 tons, is then mounted on to the column. The three rotor blades have a diameter of 126 m and can continue operation in winds of up to gale force eleven. The total height of each wind turbine is 184 m. 'It is like placing a structure as big as the Atomium in Brussels on the seabed and having a couple of soccer pitches rotate around on top of that,' says Filip Martens, general manager of C-Power.
The first six wind turbines will be installed this year, in the months of May and June, when weather conditions are favourable. This autumn the wind turbines will deliver their first electricity to the Belgian high-voltage grid. Connecting the wind turbines on to the grid will involve a massive cost, which will be borne by C-Power itself. The electric cable that will be laid on the seabed will be 22 cm in diameter.