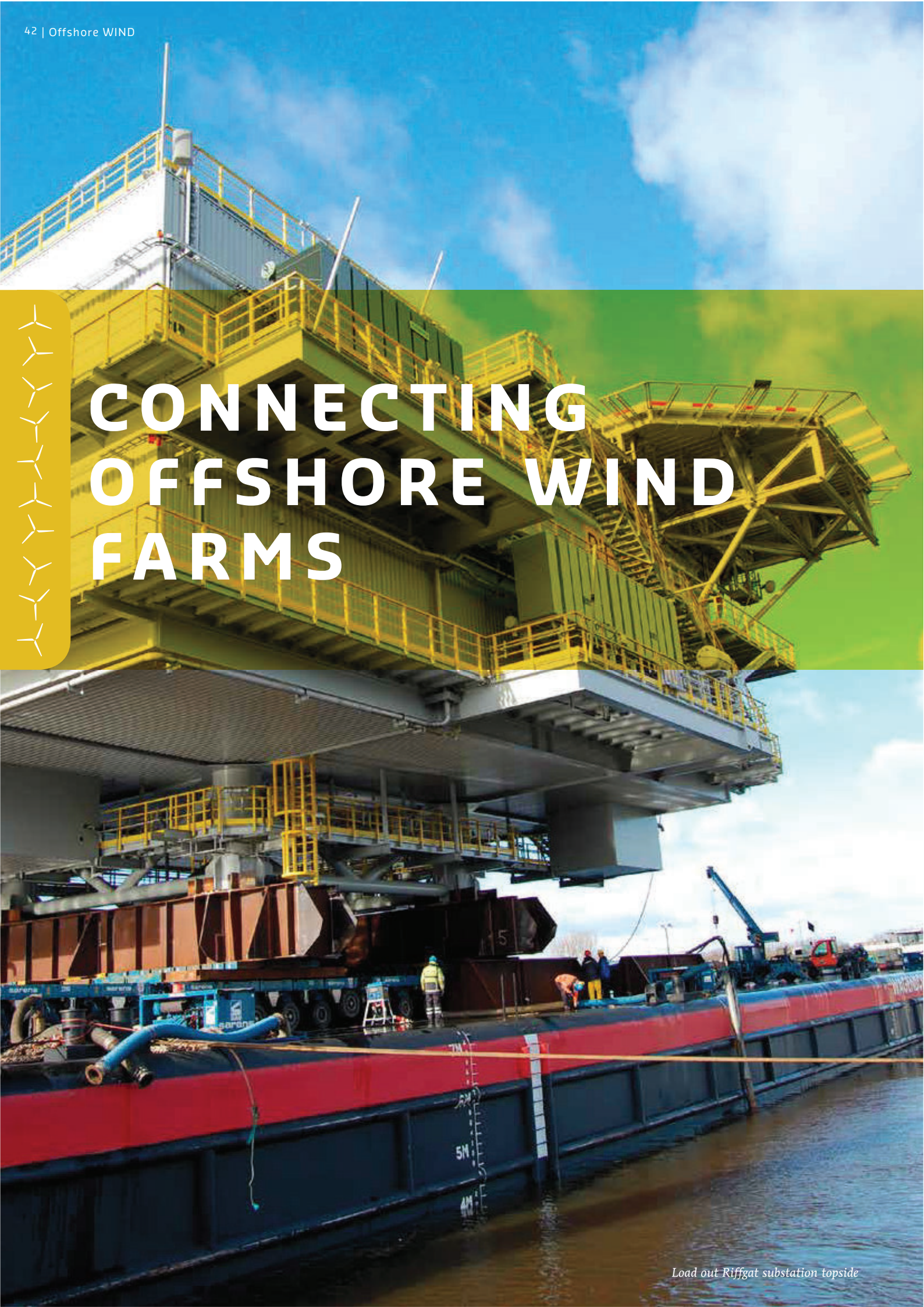
CONNECTING OFFSHORE WIND FARMS



Load out Riffgat substation topside

TSO TenneT uses German experience for Dutch offshore challenge

In the Netherlands, the government aspires to build new offshore wind farms with a combined output of 3,450MW by 2023. The Minister of Economic Affairs recently decided that Transmission System Operator (TSO) TenneT will have the responsibility of building the offshore grid to accommodate these wind farms. Offshore WIND asked Mel Kroon, the CEO of TenneT, whether the company is ready and in how far their experience in Germany has provided lessons learned.

Mel Kroon

The Dutch TSO had purchased the German TSO transpower from E.ON for €885m, in 2010, becoming the world's first transnational TSO. Only one year later the company suddenly found itself at the center of attention when the German Bundestag, in response to the nuclear disaster in Japan, decided to phase out all nuclear power plants by 2022 and to focus instead on renewables. TenneT could not have expected at that time, that due to this *Energiewende*, it would soon be responsible for laying the grid for 7,100MW of offshore wind capacity in Germany by 2020.

The German case: too fast too soon?

With hindsight, one could conclude that the Bundestag's decision was a bit rash. Mr Kroon: "The past four years in Germany were complex, and there was an incredible pace. We had to build one to three offshore projects every year. That was too much, for all of the players involved."

TenneT was not prepared for the *Energiewende*, nor were suppliers such as ABB and Siemens. He explains: "Back then, Germany had almost no offshore experience; not with wind, but also not with oil or gas. The *Bundesnetzagentur* asked the suppliers: 'How long will it take to build an offshore substation?' '30 months' they said. So, that timescale became official policy. But actually, the suppliers didn't really know how long it would take to build such a station. It was – and still is – new technology, unexplored territory. It turned out that around 53 months was more realistic. It is quite surprising when you add the 'delay' for the first connections (BorWin, 1 for example) to these 30 months, that the actual building time was almost the same as this somewhat 50 months.

Not only the suppliers lacked experience. Even the German authorities had to learn by trial and error. "They didn't quite know how to treat offshore substations. In the permits, for example, they considered a helideck to be an airstrip. They actually had to skip some wind turbines because of the supposed flight path."

Two years ago, TenneT sent an urgent letter to the German government. They had to go from a demand driven model, to a model with a more planned approach. The government acknowledged this. Now there is a network development plan which gives assurance to all parties involved. Mr Kroon: "This plan allowed us to create the possibility of standardisation. We now strive for a standard size of 900MW for each offshore substation."

TenneT secured finances in Germany with the first participation of the Japanese Mitsubishi and later the Danish pension fund PensionDanmark. What won them over? "Our substations and cables are in the regulated domain, so we have a predictable income and low risk profile. Mitsubishi invests because they want to learn. They realise that sooner or later, Japan will go offshore too. But it took a while before the system allowed external equity participation. We had to create a mini-TSO for each project, to make sure that the revenues could be divided between our two companies."

Another issue was the liability. In the amended German Energy Act, there is a liability cap of €17.5 million. Once these issues were solved, Mitsubishi was in.

SylWin alpha offshore substation, courtesy of TenneT

Now they participate in four offshore projects. PensionDanmark, Mitsubishi and TenneT share the same vision 'We are all in this for the long run'.

The Dutch case: benefiting from previous experience?

Today, TenneT moves in somewhat calmer German waters. Mr Kroon: "Now, we will develop one project every two years. That will enable us to profit from the learning curve." The Dutch TSO can learn some lessons from the German case as it now faces new challenges in the Netherlands: to accommodate 3,450MW in offshore wind capacity before 2023.

German Projects	Capacity MW	Operational/ planned
alpha ventus	60 (AC)	2009
BorWin1	400 (DC)	2010
Riffgat	108 (AC)	2014
BorWin2	800 (DC)	2015
DolWin1	800 (DC)	2014
DolWin2	900 (DC)	2015
DolWin3	900 (DC)	2017
HelWin1	576 (DC)	2014
HelWin2	690 (DC)	2015
SylWin1	864 (DC)	2015
Nordergründe	111 (AC)	2016
BorWin3	900 (DC)	2019
Total	7,109	
BorWin4 (To be determined)	900 (DC)	

Before the announcement by the Dutch Minister of Economic Affairs, Henk Kamp, the wind farm operator was responsible for bringing the electricity to the shore. So what can we expect from TenneT? "The Minister says he wants to bring down the cost of offshore wind energy by 40 per cent. TenneT can help achieve this goal by creating an economy of scale. Instead of ordering just tens of kilometers of cable, we now can order hundreds of kilometers at the same time. And this will of course reduce the price significantly." Mr Kroon explains.

The company has learned from its German offshore experience that the liability should be secured by law. In the Netherlands, the company has made this point from the beginning and now there is a draft decision about a deductible of €10 million. "This is lower than in Germany, but that is because the national regulator decides on the tariffs, which are also lower than in Germany, which in turn affects our return on investment. We strive for tariffs that are in line with those in Germany, and we continue to lobby for that."

In the Netherlands, the state is by law the sole shareholder of the TSO. This does not allow investing partners, as is the case in Germany. Mr Kroon: "We are now discussing if offshore projects should be exempted from this law. We would still have the majority in these projects, and it could save the government a lot of money."

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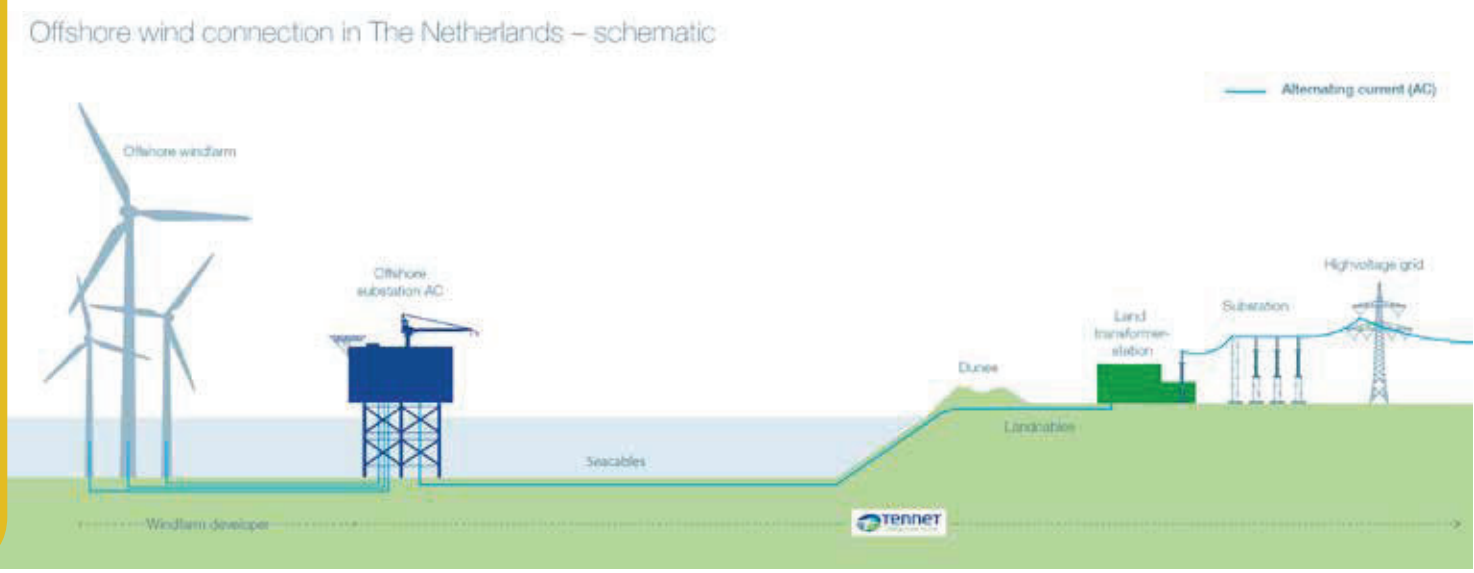

Another lesson that the company learned is that the industry should strive to standardise the cables and offshore substations. In Germany TenneT went for offshore 900MW DC-substations. In the Netherlands it will go for five 600 to 700MW AC substations. The Dutch Government confirmed three large zones for offshore wind farm development on 26 September; one off Borssele, off the coast of Zeeland, south west Netherlands, one off the coast of South Holland and one off the coast of North Holland. The first substation will probably be installed off Borssele which is likely to start operation first.

Optimising efficiency

According to Mr Kroon the industry should also think about the optimal size for offshore substations. "It probably isn't necessary to accommodate the maximum output of wind farms, because they usually don't produce at 100 percent. So we could for example connect 800MW wind farms to a 700MW substation. On the rare occasions that they really produce at their maximum output, other turbines in Northwestern Europe will do the same. That results in a very low electricity price in which case it won't be such a problem to shut some turbines off. This kind of capacity optimisation could reduce the cost of infrastructure by as much as 10 percent. I think in Germany we will soon discuss these optimisations too."

TenneT also invests in interconnectors. The TSO built the 700MW NorNed to Norway with Norwegian TSO Statnett, as well as the 1000MW BritNed to Britain together with the UK TSO National Grid. Recently, TenneT and its Danish counterpart Energinet.dk announced Cobra, a 700MW interconnector between the Netherlands and Denmark. This cable will cross the North Sea past German wind farms. So is it not common sense to plug these wind farms onto this Cobra-cable? Mr Kroon;"Yes, it seems, but there are some obstacles. Not only technical, but mainly regulatory obstacles.

In this case these German wind farms receive German subsidies, whereas the electricity would flow to the Netherlands or Denmark. The same goes for some German offshore wind farms that are close to the Dutch coast. It is cheaper to connect them there, and for TenneT it really does not matter, because they are on both sides of the border. But how would this work with the German subsidies?

The *Bundesnetzagentur* is now studying these dilemmas, because it knows that some regulations have to be adapted. That is good news. But connecting a wind farm with interconnectors also gives commercial issues.

Interconnectors are used to level out price differences between countries. But if you plug in a wind farm, then you cannot use the interconnector for its original purpose at moments when the wind is blowing."

Tijdo van der Zee