Position Paper

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Subject Offshore wind energy

The Netherlands is committed to developing 6000 megawatts (MW) of offshore wind energy capacity. This ambitious target is an elaboration of the theme 'The North Sea as a source of energy' introduced in the 2008 Energy Report[1] published by the Dutch Ministry of Economic Affairs. Linking up 6000 MW of offshore production capacity will have a major impact on the transmission grid managed by TenneT. Achieving our sustainability targets will require substantial investments in the grid infrastructure. TenneT wants to make an active contribution to developing the North Sea as a source of energy – by investing in the construction of an offshore electricity grid, and by ensuring, in its capacity as national grid administrator, that electricity generated by wind turbines can be transported to landside consumers. Connecting offshore wind farms to the grid in an efficient and timely manner is an integral part of TenneT's core business and its responsibility to society. TenneT has therefore set up a project to prepare for the construction of an offshore grid that will be used to connect wind turbine farms to the landside grid.

The Dutch government has set itself an ambitious target: 20% of the Netherlands' energy is to be sustainable by 2020, and CO_2 emissions are to be reduced by 30% over the same period. The Cabinet has started the 'Clean and Economical' programme in order to realise these objectives.

In the spring of 2008, Parliament adopted a motion calling on the government "to amend relevant legislation in order to give the national grid administrator responsibility for connecting all offshore wind farms to the existing electricity grid, including laying transmission cables along the sea bed." (Parliamentary Document 31239, No. 17, commonly known as the 'Samsom motion' after Diederik Samsom, Member of the Lower House for the Dutch Labour Party). In preparation for the implementation of this resolution, the Ministry of Economic Affairs is currently working to obtain a better picture of the technical possibilities for such a project, as well as the financial and legal implications. TenneT is assisting the Ministry with its expertise and experience in the area of electricity cables and the integration of sustainably produced electricity.

Pending amendment of the relevant legislation, TenneT has begun to investigate the implications of this expansion in the scope of our activities. An initial analysis has revealed that TenneT is more than capable of connecting 6000 MW of offshore wind farm capacity to the grid in the period up to 2020. In doing so, TenneT will make every effort to optimise the benefits of a coordinated approach.

[1] See http://appz.ez.nl/publicaties/pdfs/08ET20.pdf.

Advantages of a single offshore grid manager

- Plug & Play: the availability of offshore cables, grids and connections enables wind farm operators to 'plug in' directly in order to supply electricity to the grid. This provides developers and financial backers with more assurances in advance, allowing national and international objectives to be achieved more quickly.
- Innovative solutions will make it possible to supply sustainable energy directly to those landside locations where demand is highest. In this way, TenneT intends to contribute to the development of the North Sea as a source of energy.
- Compared with separate private connections to the landside grid, a centralised approach by the grid administrator yields significant advantages in terms of spatial planning. For instance, there is less disruption to sea and coastal locations because transsections of dykes and dunes are kept to a minimum.
- Furthermore, the fact that a single party manages the high-voltage grid both at sea and on land will enable optimum integration of the planned offshore capacity into the larger Dutch and north-west European grid. This is of paramount importance given the effects that 6000 MW of additional feed will have on the (international) demand for transmission capacity and the maintenance of the energy balance between supply and demand.

Ready to go

Before TenneT can start realising offshore grid connections, the Electricity Act will have to be amended. For instance, the Act currently does not apply to the Dutch Exclusive Economic Zone (EEZ). This would be required in order for TenneT to be designated as the TSO responsible for constructing and managing an offshore electricity grid.

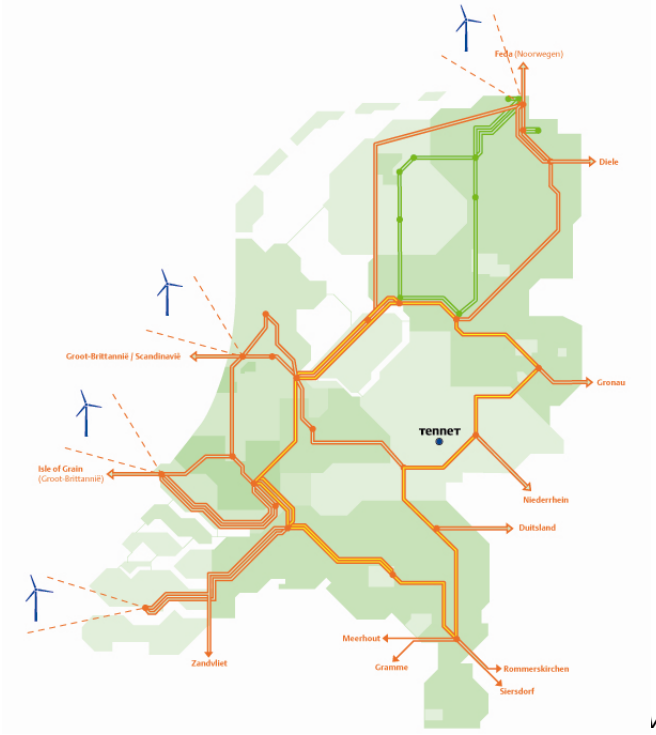
Because most of the electricity produced offshore will not be used at sea, the offshore grid differs in character from the landside grid, where production sites, consumers and regional grids are all connected to the transmission grid. The special nature of an offshore grid requires a different regulatory regime than the one applicable to the existing national grid. The technical and infrastructural risks demand a regime that is geared specifically towards the construction and management of an offshore grid.

Ensuring proper access to offshore wind farms requires substantial investments. The amount that will eventually be invested depends on a range of factors. Key among these is the location at sea and the distance to the coast. The usefulness of and need for investments will be decided by the Minister of Economic Affairs. The Ministry is currently preparing an amendment to the Electricity Act to that effect. At the moment, TenneT does not have the prior assurances needed to finance these major investments. TenneT is currently in talks with the Ministry and the Office of Energy Regulation regarding the efficiency targets and arrangements to be entered into before any project is carried out.

Specific areas must be designated for wind energy development, so that TenneT can work out in detail how to ensure access to these areas and integrate them into the grid. In the Cabinet meeting of 12 December 2008, the Ministry of Transport, Public Works and Water Management put forward an initial proposal designating development areas off the coast at Borssele and IJmuiden. The final locations will be determined in the course of 2009.

Integration and technology

One of the points of departure for any long-term grid plan (also see TenneT's 'Vision 2030' report[2]) is that electricity (including wind energy), once produced, must be transmitted as directly as possible to the centres where it is consumed. In the Netherlands, the main centre of consumption is the Randstad conurbation. As far as the location of offshore wind energy capacity is concerned, this means that the 'centre of gravity' should ideally be located as near as possible to the west coast of the Netherlands. Should the cables reach the shore at Borssele or Eemshaven, for instance, significant additional investment will be required in order to upgrade the grid.



Vision 2030 grid concept

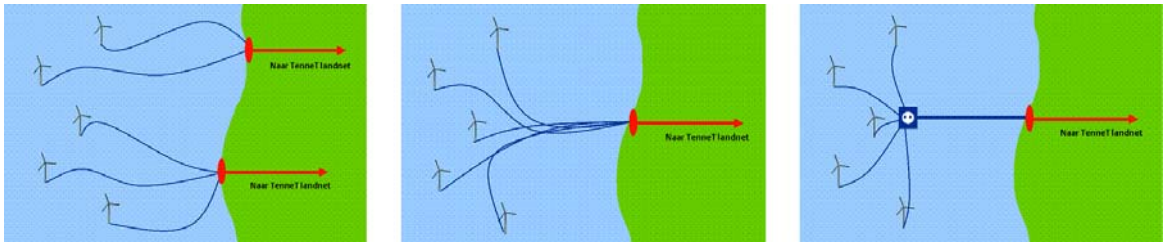
Configurations

Several technical solutions are possible to connect the wind farms to the national grid. For instance, alternating current (AC) can be used for connections up to a certain length. Capacities in excess of 200 MW require multiple cables to transmit the total capacity.

[2] See http://www.tennet.org/english/tennet/publications/technical_publications/index.aspx

Direct-current (DC) connections are needed to transmit greater amounts of capacity over longer distances (the current maximum being 600 MW or 1200 MW per cable circuit). Currently, the largest capacity of an offshore commercial converter station is 400 MW[3]. The feasibility of a 1000 MW offshore converter station still needs to be demonstrated. Such converter stations are expected to become commercially available from 2012.

Depending on the location and size (expressed in megawatts) of the wind energy development areas, the required access and integration into the high-voltage grid will be designed.



Operational aspects

One aspect specific to electricity generated by means of wind energy is that the production process is supply-driven, and therefore not (fully) adjustable. This has certain consequences for maintaining the balance between supply and demand, which is one of TenneT's principal tasks. In addition, the regulations applicable to the transmission of sustainably produced electricity are set to change in the coming years. The Ministry of Economic Affairs is currently preparing new legislation aimed at assigning priority to sustainable energy on the electricity grid.

In order to achieve optimum grid integration, TenneT will examine not only the adjustability of the offshore grid, but will also call on the various parties within the landside grid to make a contribution. The following developments may play a role in this:

- increasing demand flexibility, e.g. by means of intelligent (virtually linked) demand control mechanisms. In the long term, this could include developments like the plug-in electric car, micro CHP units and CHP units with heat storage capabilities;
- increasing the flexibility of production capacity in the Netherlands;
- use of buffer options.

International dimensions

Should these options become available, implementing them in the Dutch grid alone will not be sufficient to incorporate sustainable, supply-driven production capacity into the system. In view of the ambitions of neighbouring countries bordering the North Sea, an integral European approach is essential. In practice, this entails:

- an increase in adjustable imports and exports by means of interconnectors;

[3] 400 MW ± 150 kV HVDC VSC connection from Borkum I wind farm off the German coast (capacity 400 MW).

- international trading systems that operate efficiently and joint efforts to assure grid safety and security for electricity exchanged between neighbouring countries, also when looking ahead for several years;
- exchanging information with suppliers, market parties and other TSOs about the development of offshore grids, with a view to sharing knowledge and experiences efficiently and coordinating grid concepts. The Pentalateral Energy Forum provides a suitable platform for such exchange.

Conclusion

TenneT is making an active contribution to a more sustainable energy supply system by working to develop the best possible infrastructure. That is why we are happy to take on the responsibility of developing and realising an offshore grid, since it is part of our social responsibility to facilitate the transition to a more sustainable energy landscape. An offshore grid would also be in line with TenneT's ambitions to help develop the North Sea as a source of energy for the Dutch and north-west European market. With a statutory task to achieve reliable grid management at sea, TenneT intends to start building the infrastructure needed to ensure access to the North Sea as an energy source, and to transmit sustainable electricity produced offshore to landside consumers.