

**StormGeo**  
Freedom to Perform

**7** AFFORDABLE AND  
CLEAN ENERGY



**13** CLIMATE  
ACTION



# Ensuring a Secure and Continuous Electricity Supply for TenneT

*For TenneT, one of Europe's leading electricity transmission system operators (TSO), continuously monitoring the energy generated at offshore wind farms is key to maintaining the balance of the high-voltage grid and ensuring a future-proof renewable energy supply.*

## The Challenge

TenneT works to ensure an uninterrupted supply of electricity in their high-voltage grid for 41 million people by connecting and transporting electricity generated by offshore wind farms to the onshore high-voltage grid. This grid is the backbone of the electricity supply system, connecting electricity producers to consumers. In the Netherlands, TenneT is the sole TSO of the national high-voltage grid, while in Germany, they are the biggest TSO in the country—transporting the largest share of green energy in the country.

In Germany, a significant portion of the country's electricity is derived from renewable sources. Within TenneT's energy production, wind power capacity is 24.4 GW, while solar power capacity is 15.5 GW.

To ensure a secure and continuous supply of electricity, TenneT works 24/7 to maintain an equilibrium in the high-voltage grid, which keeps the grid stable. This means that the electricity generated must equal the electricity consumed to avoid a disruption to the balance of the grid, which could result in a power outage.

Continuously monitoring this balance includes seeing where the consumption of electricity is not equal to the feed-in, whereby TenneT would need

to use reserve energy to re-establish the balance.

While the large-scale transition to renewable energy is well underway, it is a challenging task that relies on an advanced understanding of the impacts of weather.

During storms, there can be a surplus of energy in the system locally that can't be transported efficiently, congesting the grid. Basic grid operations and interventions in the feed-in of electricity can help, but even more important is having an accurate prediction of the feed-in from wind turbines and solar systems. For this, advanced weather forecasting is vital.

For the offshore wind farms in the North Sea, TenneT must reliably estimate general wind power production as well as strong wind gusts to manage the automatic off-switch that can shut down production for security reasons, leaving an energy deficit that must be sourced elsewhere to stabilize the grid.

"When there's a storm coming and in five minutes you have four or five gigawatts of energy production go down, then we have a serious issue," said Freddy Van Halm, Process and Metering Specialist at TenneT. "We are working to mitigate that situation because we are responsible for a balanced system in our region."

“ [The portal] gives us a view into the future—a timely overview of what could happen to the wind farms. We know in advance when the transport will change in our grid so it can be mitigated.

Freddy Van Halm, Process and Metering Specialist, TenneT

## The Solution

To ensure a reliable cut-off prediction of offshore wind farms during storms, TenneT partnered with StormGeo to receive advanced weather risk assessments via a monitoring system portal.

“The monitoring portal shows us a ‘traffic light’ visualization of wind confidence levels, helping to explain the behavior of our grid and our balance system. When we are aware that a wind front is coming, then we know in advance to be alert,” said Van Halm.

The portal provides advanced forecasting graphs that predict wind gusts, wind speed and wind direction—taking into account the farm’s location and time of day. The threshold for wind speed and cut-off points are also calculated, allowing TenneT to predict a wind farm shut down.

“Knowing of a shut down in advance enables us to calculate the influence it will have on our grid. It could mean that there will be a lack of energy into our system over a long duration, so we know to ask the market to use other sources to fill in that gap,” said Van Halm.

With advanced notice of shut downs, TenneT can make informed decisions that ensure the equilibrium of their high-voltage grid. Alternative energy can be sourced in time and at a reasonable cost, and TenneT can continuously

supply consumers with a stable flow of electricity. This efficient and cost-effective solution also significantly reduces the annual costs to consumers.

“It gives us a view into the future—a timely overview of what could happen to the wind farms. We know in advance when the transport will change in our grid so it can be mitigated. Personally, I think that a system like this could be used by all wind farm owners and forecasters,” said Van Halm.

StormGeo’s online portal also shows the estimated wind power production of the farms. “We see the estimated wind power production and the specific amount of energy that will be generated,” said Van Halm. “We can then predict the amount of energy that will be delivered into our grid.”

Offshore wind farms are fast becoming a major player in global energy production. European offshore wind capacity grew 25% to 15.8 GW in 2017. This is partly due to a rapid decrease in associated costs. “The requests for renewable energy sources are growing rapidly across the world, and wind or wind turbines is a perfect method to fill in that gap,” Van Halm noted.

He concluded, “Europe is transitioning from fossil fuels to renewable sources. For renewable sources, understanding and planning for weather conditions is very important.” ♦

**25%**

Growth in  
European  
offshore wind  
in 2017

**5 GW**

Energy  
transported  
by TenneT  
offshore wind

**12.5 mil**

Homes will be  
powered by  
TenneT renewable  
energy by 2025