TenneT is Europe’s first cross-border grid operator for electricity. With approximately 20,000 kilometres of (extra) high voltage lines and 35 million end users in the Netherlands and Germany we rank among the top five grid operators in Europe. Our focus is to develop a Northwest European energy market and to integrate renewable energy.

Taking power further

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Overhead line monitoring

Optimum use of the transmission capacity of overhead power lines

Using meteorological data and network control centers calculate real-time the dynamic loadability of the high voltage line. The calculated extra transmission capacity can then be used.

Although it all sounds fairly simple, this system requires complex calculations and expensive infrastructural modifications, especially in transformer substations. This is because all parts of the grid must be capable of withstanding the higher power loads. And the supply of electricity must not be jeopardized at any time while the necessary work is in progress. Consequently, only a small number of lines may be switched off simultaneously. It means the system can be introduced to the network only step-by-step and that it will take a considerable time before it is possible to monitor overhead lines in a large area.

Wind Sun Temperature

The transmission capacity of an overhead line is limited by the maximum temperature of the line (80°C) and the minimum distance to the ground, which must be maintained for safety purposes.

Distance to the ground

Temperatures of 60°C and 80°C are possible on an overhead line in the summer months. In the winter months temperatures of 60°C and 75°C are possible. The lower temperatures are due to the significantly lower wind speeds in the winter months.
Monitoring the transmission capacity of overhead power lines

TenneT is the first cross-border grid operator optimizing the overhead high-voltage lines (220/380 kV) by using a dynamic monitoring system. What makes the system special is that the network control centre calculates real-time the maximum loadability of the high-voltage lines, which is dependent upon the prevailing weather conditions. Meteorological data available online are used for this purpose.

Growing demand for transmission

The demand for transmission of large volumes of energy has increased sharply as a result of the growing supply of wind energy on land and the construction of new offshore windfarms. The transmission capacity of existing lines is insufficient at several places, including wind energy transmission from north to south Germany. It is extremely important for TenneT to carry out the planned expansion of the grid in the most environmentally-friendly and most efficient way possible. The company plans new lines only at places where the existing grid can no longer be optimised and strengthened.

Optimizing overhead lines is the ideal solution for using unutilised weather-dependent transmission lines. TenneT has a specific system for that. The network control centre calculates the real-time the maximum loadability of the high-voltage lines, which is dependent upon the prevailing weather conditions. Meteorological data available online are used for this purpose.

More electricity thanks to wind

The transmission capacity of overhead lines can be significantly increased – depending on the weather – by using the monitoring system. The distance from the line to the ground is a hint on the transmission capacity of an overhead line. The temperature level of the ice influences the distance because lines swell at higher temperatures. This makes them sag more and shortens the distance to the line.

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A first in the German high-voltage grid

TenneT will introduce the monitoring system in its German high-voltage grid as soon as the test power has been completed successfully. The system will substitute for lines subjected to exceptionally heavy loads because of the feeding in of wind energy and intensive usage. More than 900 kilometres of high-voltage lines and 20 transformer substations are going to be made suitable for the new system. The expenditure will amount to approximately EUR 55 million. But the system will be worthwhile, since among other things it will be possible to increase the transmission capacity of lines in northern Germany by up to 10% to 20%.

An additional advantage of the system is that the higher transmission capacity of wind-powered high-voltage lines will become available particularly at times when a bigger supply of wind energy is available, thus increasing grid flexibility. The system is currently being carried out into the possibility of using the system in the Netherlands as well.