



20  
04

Transmission on Balance

tennet





# Full of Energy

In this brochure tenneT has drawn up the balance in respect of its main technical operating results for 2004. In addition to providing information on tenneT's national transmission grid, the brochure also elaborates on grid deployment for the purpose of power market facilitation.

## Full of Energy

In its capacity of Transmission System Operator and independent operator of the Dutch transmission grid, tenneT is in charge of the 'expressways' of the Dutch electricity grid that connects all regional grids as well as the European grid. The organisation seeks to ensure optimal service in support of a smoothly operating electricity market in the Netherlands and in Northwestern Europe, and as such devotes continuous attention to the strengthening of the Dutch electricity market within a European perspective.

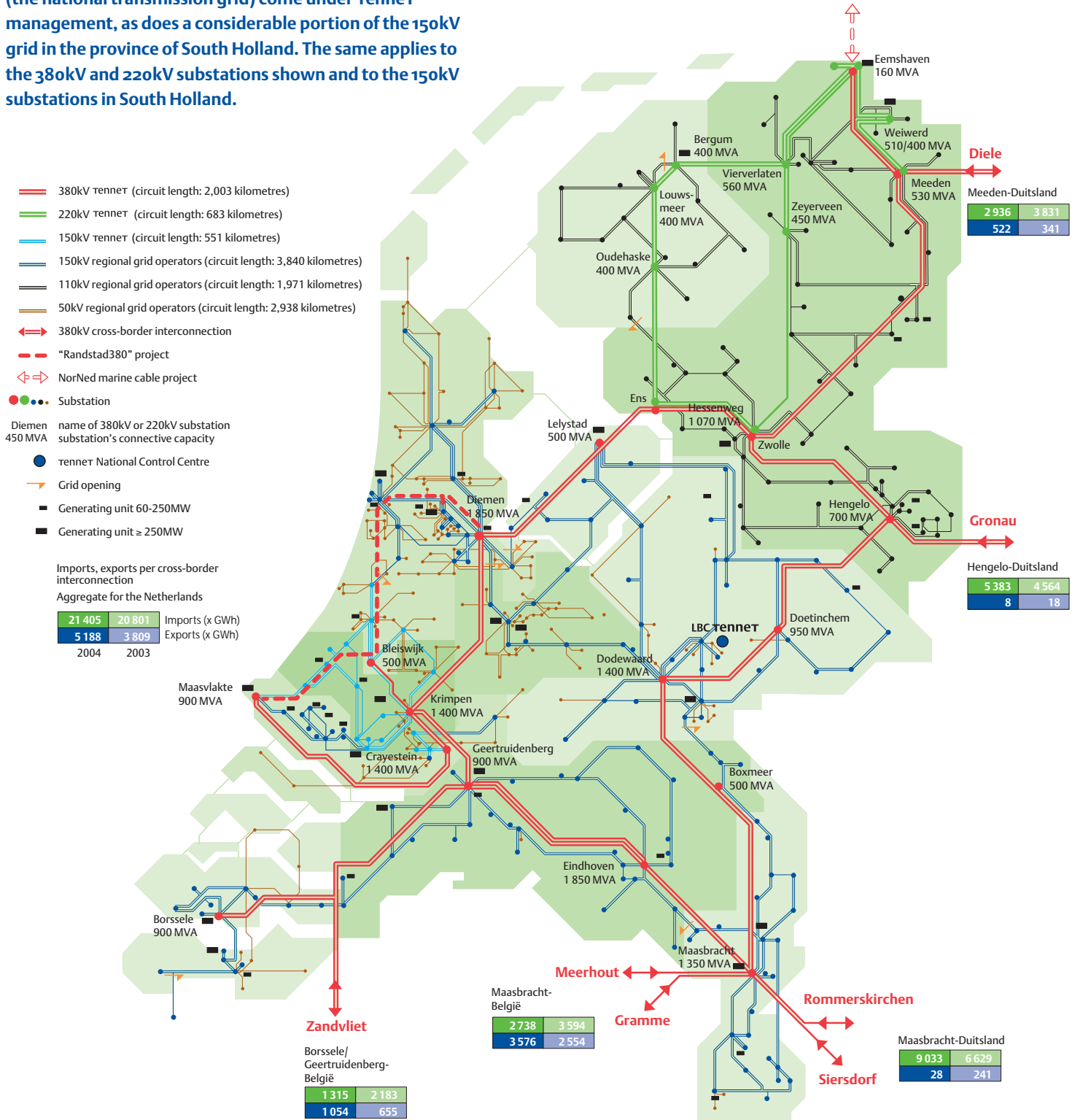
tenneT makes every effort to ensure an optimum operating performance across the board, supplying its customers with services and products in an efficient and professional manner, the guiding principle of its *modus operandi* being the safeguarding of a reliable top-quality electricity supply.

tenneT advocates the pooling of the various national transmission grids, which in the present situation are being managed in a 'fragmented' manner and which are largely owned by a number of different energy companies, as it considers pertinent from a perspective of supply reliability and efficiency that a single national transmission grid should be formed.

# The Dutch transmission grid

31 December 2004

This overview of the Dutch transmission grid shows the high voltage interconnections, of which the 380kV and 220kV sections including the cross-border interconnections (the national transmission grid) come under tenner management, as does a considerable portion of the 150kV grid in the province of South Holland. The same applies to the 380kV and 220kV substations shown and to the 150kV substations in South Holland.



# Connection for the future

It is crucial that the national transmission grid should be modified if the electricity supply is to be safeguarded into the future. A key modification concerns the expansion of the grid in the Randstad region as the most densely populated area in the west of the Netherlands, in a project which is being carried out under the name 'Randstad380: Connection for the future'. The 'Randstad380' project is aimed at putting in place a ring-shaped transmission grid to be hooked up to the national transmission grid. The reliability of supply stands or falls with an increase in transmission capacity locally and the new connections reinforce the infrastructure to provide for this. The 'Randstad380' investments are necessary in order to adequately meet the growing demand for power in the randstad region owing not only to the increase in industrial activity and residential construction, but also to the use of new assimilation lighting in the glasshouses in the Westland area and the growth of the ICT industry in the northern randstad.

## Randstad380

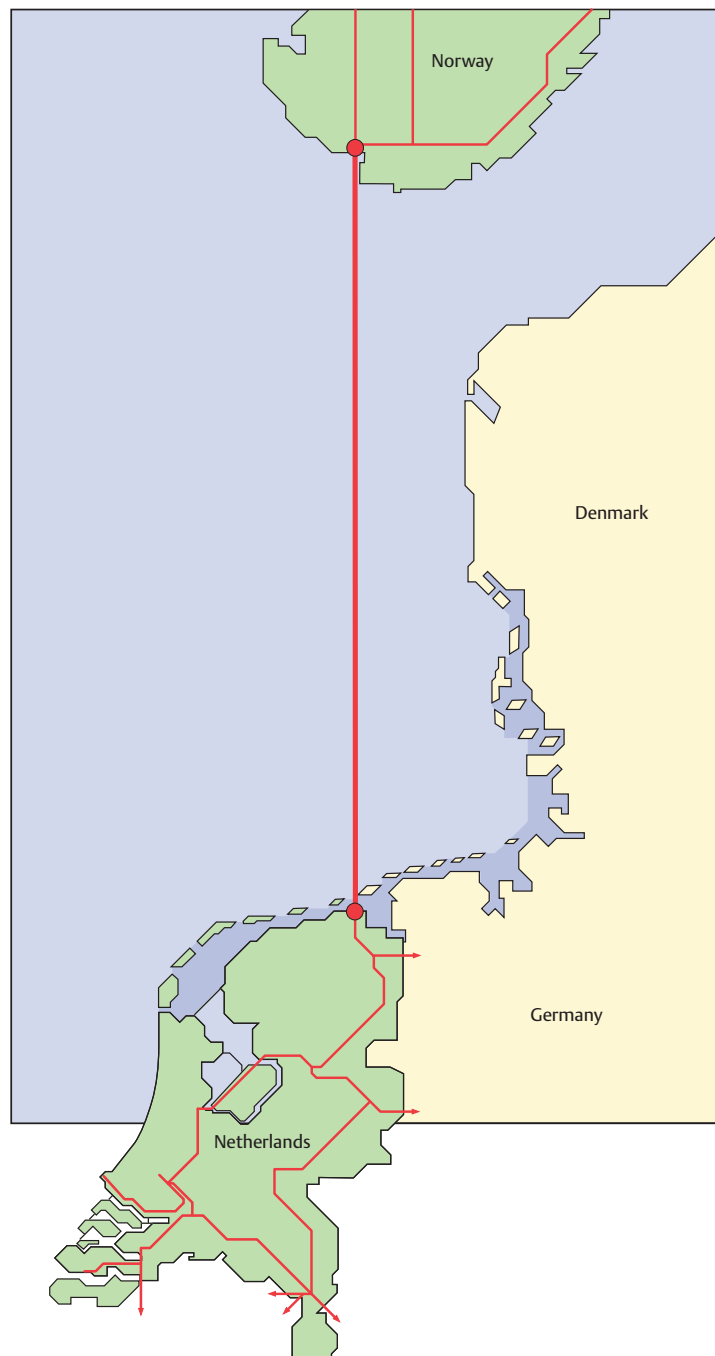
- 380kV high voltage interconnection
- 380kV high voltage substation
- 150kV high voltage substation



# Connection for the future

## NorNed

Joining forces with other European countries is one way of enabling us to enhance our service to the market. We made tangible headway in 2004 with our plans aimed at upgrading the energy infrastructure at a European level by launching the NorNed project, among other things. Prior to proceeding with a particular investment in the expansion of interconnective capacity, tennet looks closely into the extent to which the relevant project would benefit the Dutch energy market by bolstering the reliability of supply and improving market operations, as well as performing a cost-benefit analysis for the market. This exercise has turned out positive for the NorNed project, which involves the installation along the sea bed between Norway and the Netherlands of a high voltage interconnection with a capacity of 700MW, to come in service in 2007. In Norway, 99 percent of all electricity is generated using sustainable hydropower, whereas Dutch generating units are mainly gas- and coal-fired. Once the NorNed interconnection has been completed, Dutch generating units will be able to supply power to Norway during the night, when the Dutch demand is significantly lower, so as to ease the use of the Norwegian reservoirs, which in turn can be used during the expensive peak hours during the day to supply power for the Dutch customers. It is partly owing to this mechanism that expectations are that the new interconnection will result in more stable and lower prices for the Dutch market. The anticipated return owing to price differences between the two markets will make the NorNed interconnection a profitable venture, in addition to which the NorNed cable will make a positive contribution to the reliability of supply in both countries and to market operations and the liquidity of the Dutch market.



# The 380kV/220kV Transmission Grid

In 2004 neither unplanned non-availability (failure) nor planned non-availability resulted in the interruption of transmission service to a connected grid administrator on a single occasion. The availability of the transmission elements on the connections totalled 98.9% for the connected grid companies, against 98.5% for the cross-border interconnections. Unavailability of transformers exceeded the internal standard due to two failures, whereas the internal standard for planned non-availability in the category of cross-border interconnections was missed owing to projects being under way both in Belgium and in Germany. These unavailability figures are included in our registration of these connections.

## Availability of 380kV/220kV high voltage grid

	Number of connections	UNA/PNA standard	UNA/PNA realised
Domestically	56	0,6 / 0,03 %	0,9 / 0,2 %
Cross-border	10	0,8 / 0,03 %	1,5 / 0,02 %

UNA = unplanned non-availability

PNA = planned non-availability

% = percentage of time during which unavailable for transmission

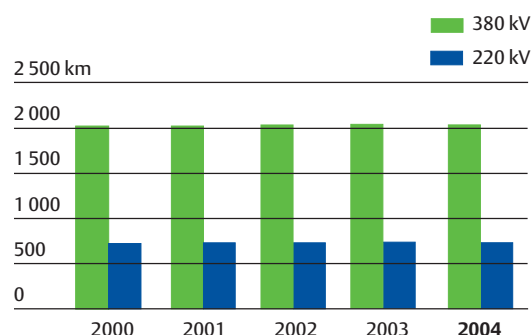
## Connective capacity of transformer circuits (including industrial users)

A defective transformer at Zeyerveen was replaced by a spare unit in 2004, increasing the connective capacity by 50MVA.

	2000	2001	2002	2003	2004	
380 kV	14 100	14 600	14 600	15 100	15 100	MVA
220 kV	4 540	4 810	4 810	4 810	4 860	MVA

## Circuit length

The aggregate 380kV circuit length amounts to 2,003 kilometres. The aggregate 220kV circuit length amounts to 683 kilometres.



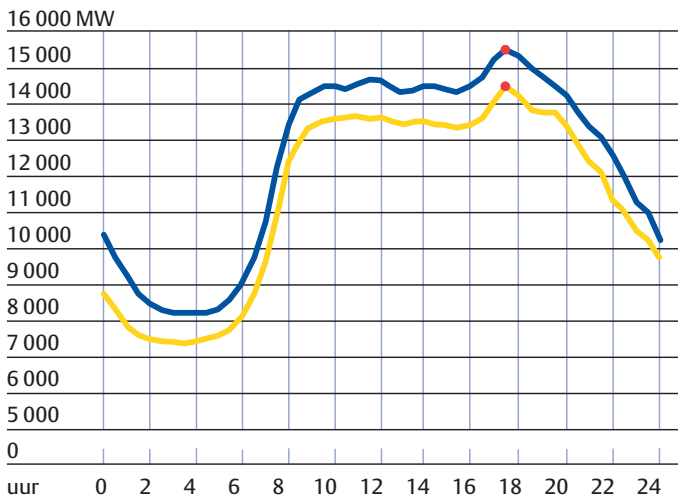
## Connective capacity of generating units

The generating units' 380kV and 220kV connective capacities remained unchanged in 2004.

	2000	2001	2002	2003	2004	
380 kV	3 963	3 963	3 963	3 963	3 963	MVA
220 kV	3 076	3 076	3 076	3 076	3 076	MVA

# Peak Load

The year's peak load to date has always occurred during the month of December around 5.30 p.m., when intensive use is made of heating and (Christmas) lighting all over the country. However, the increasing use of air conditioners during hot spells could at some point in the future result in the annual peak load shifting to the summer months (late June or late August, as the load tends to be lower in July and August owing to large numbers of people being away on holiday). Dutch society as a whole runs up a total of some 15,000MW in electricity used at peak load instants.



## Peak load

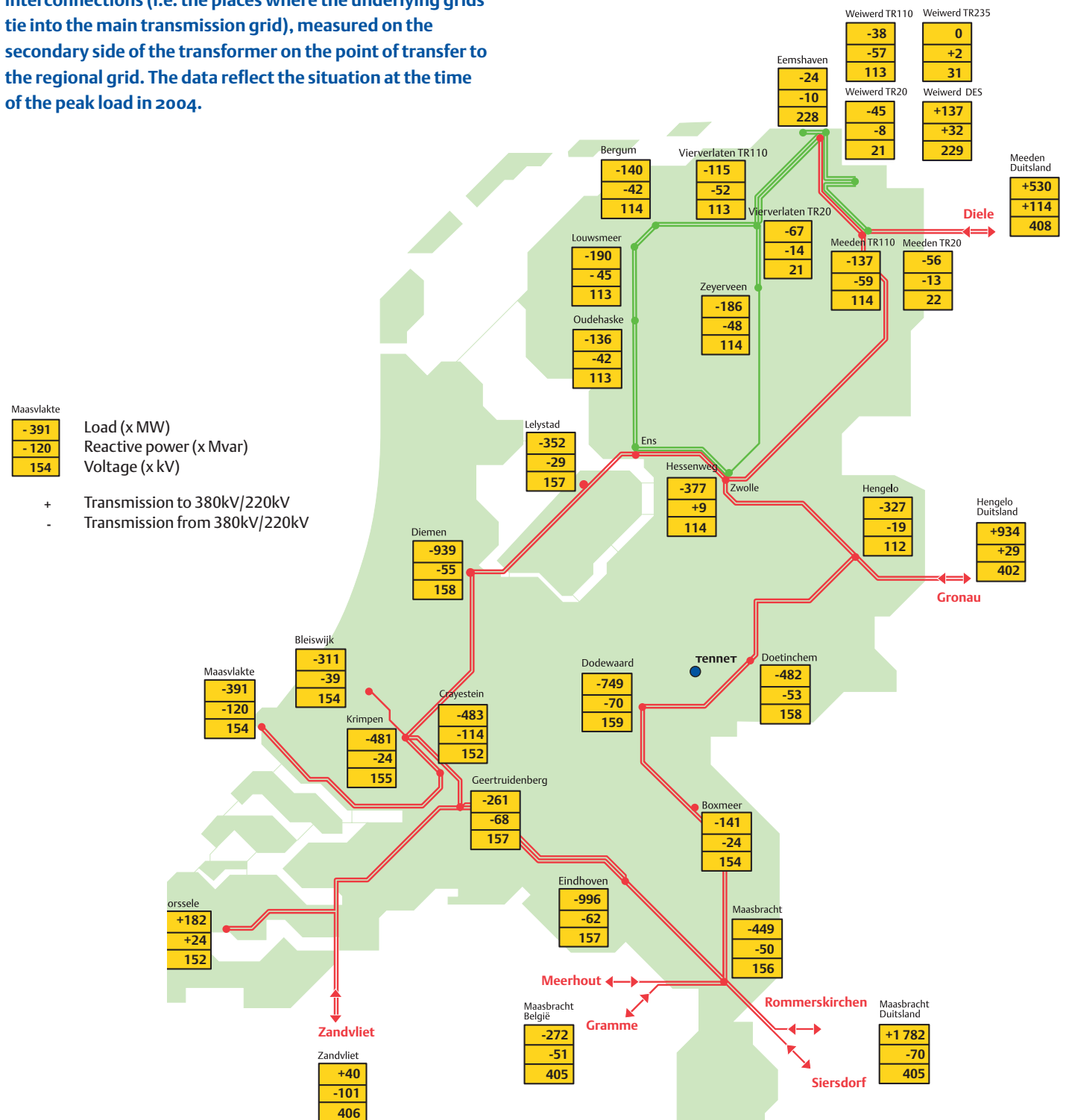
The peak load of generating power plus imports which TenneT recorded for 2004, in the amount of 15,601MW, occurred between 5.15 and 5.30 p.m. on 21 December 2004, representing a 1,132MW (+7.8%) increase compared with the previous year's high and topping the 2002 record by 555MW (+3.7%).

- 21 December 2004, 5.15 – 5.30 p.m. (15,601MW)
- 8 December 2003, 5.25 – 5.35 p.m. (14,469MW)
- Peak load instant

# Peak Load

Substation statistics on peak load day  
21 December 2004, 5:30 p.m.

The diagram shows the power exchanges on the interconnections (i.e. the places where the underlying grids tie into the main transmission grid), measured on the secondary side of the transformer on the point of transfer to the regional grid. The data reflect the situation at the time of the peak load in 2004.

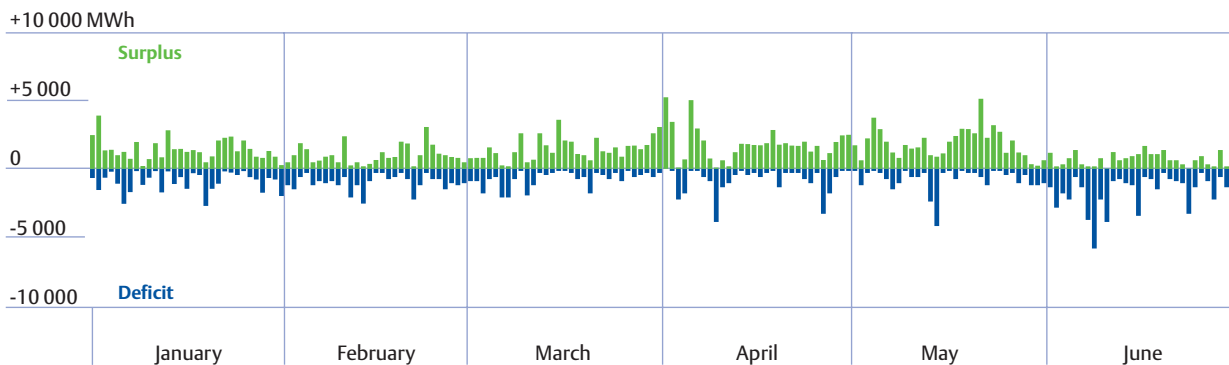


# Imbalance Control

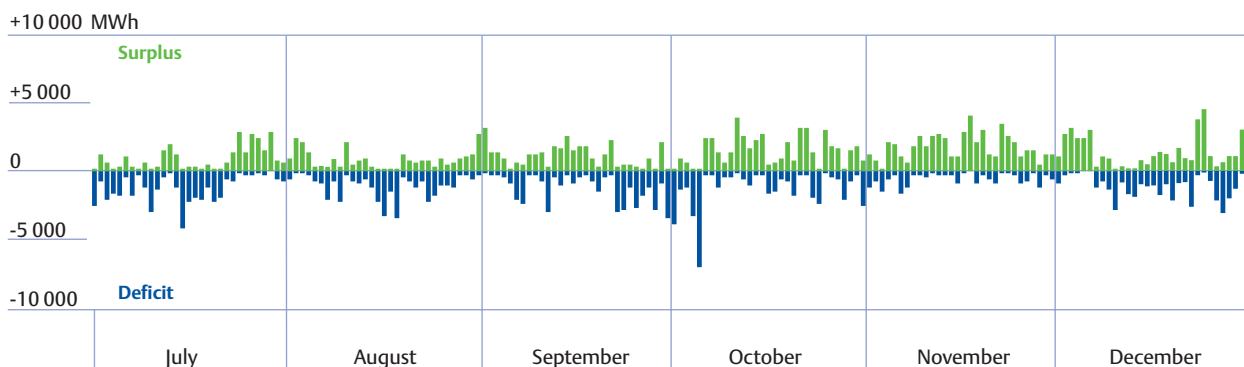
It is up to tennet to provide a secure, reliable and efficient power supply system, which – put succinctly – boils down to tennet having to safeguard and maintain the demand-supply balance. Although a slight imbalance – which it is up to tennet to control – prevails on the electricity grid at any one time owing to the large number of market players preventing a perfect balance being struck between the demand for power on the one hand and the supply of same on the other, the power demand and supply values are forecast with the greatest possible accuracy. A system of Programme Responsibility (PR) has been developed for this purpose in the context of which tennet receives daily Energy Programmes (EPs) from the Programme Responsible Parties (PRPs, these being parties that operate one or more connections to the grid) in which they advise us of the amount of electricity they expect to transmit or take in the next day. tennet continually monitors the level of imbalance and, where necessary, takes controlling action.

## Imbalance of PRPs on a daily basis

The graph below shows the aggregate daily imbalance of all PRPs for the period from 1 January to 31 December 2004, with the bars representing the daily positive imbalance (surplus) and negative imbalance (deficit) volumes.



Daily imbalance

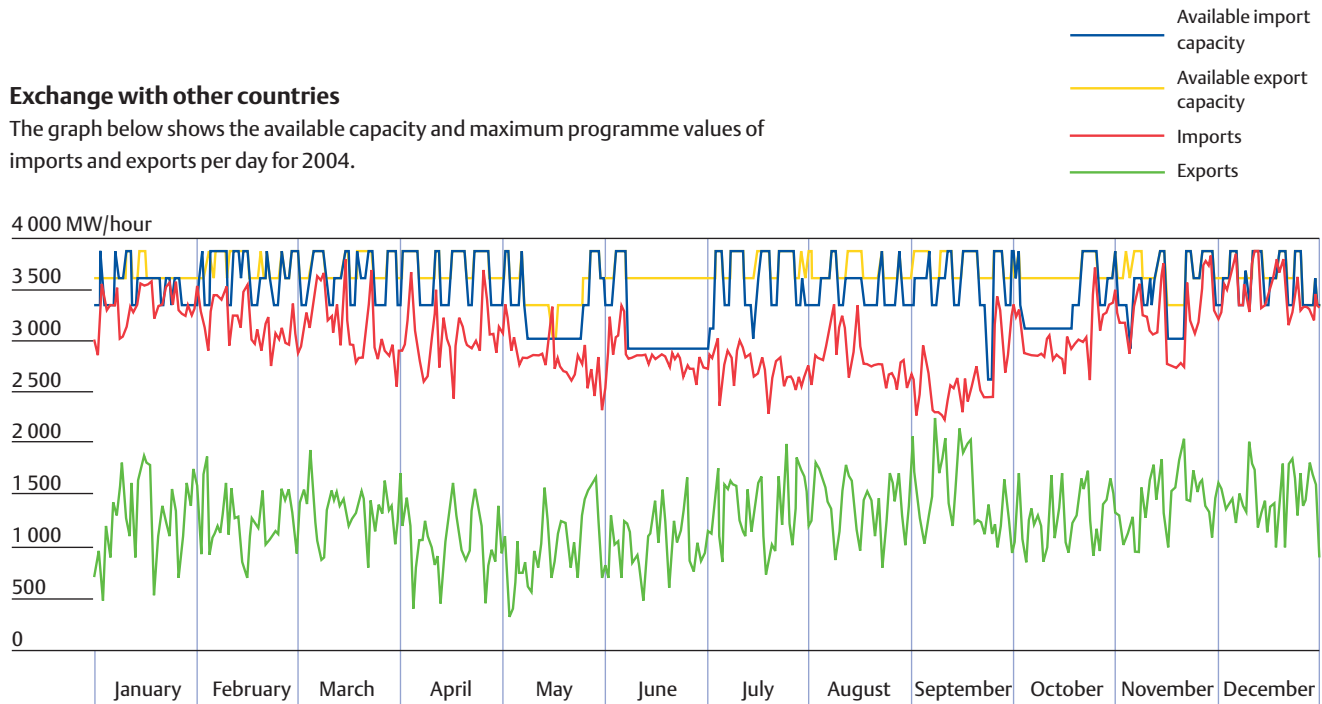


# Cross Border Interconnections

Interconnections are in place at the highest voltage level (380kV) between the Netherlands and the vast European grid. These three German-Dutch and two Belgian-Dutch interconnections ensure that the Netherlands have access to the European market and facilitate international power transactions between market players. In view of the great mutual influence of international grids that are connected to one another, the available capacity is closely reconciled with the grid operators in neighbouring countries on a daily basis. In recent years our country's power imports have exceeded its exports.

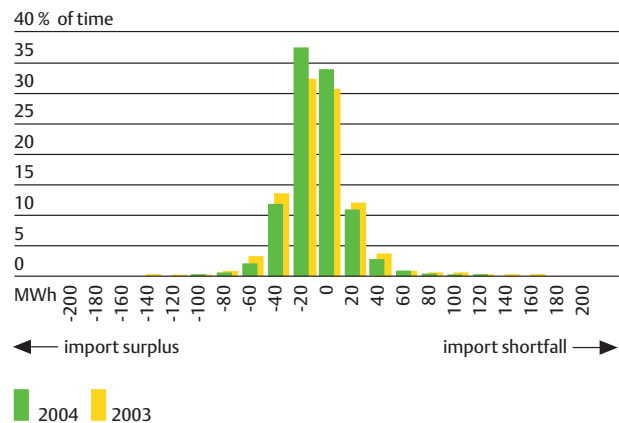
## Exchange with other countries

The graph below shows the available capacity and maximum programme values of imports and exports per day for 2004.



## Inadvertent interchange between the Netherlands and other countries

The diagram on the right shows (in terms of hourly values) the differences in physical energy flows relative to the interchange programme. The difference relative to the interchange programme turned out at less than 20MWh for 71.1% of the time whereas the national standard of 100MWh was not achieved for 0.2% of the time.

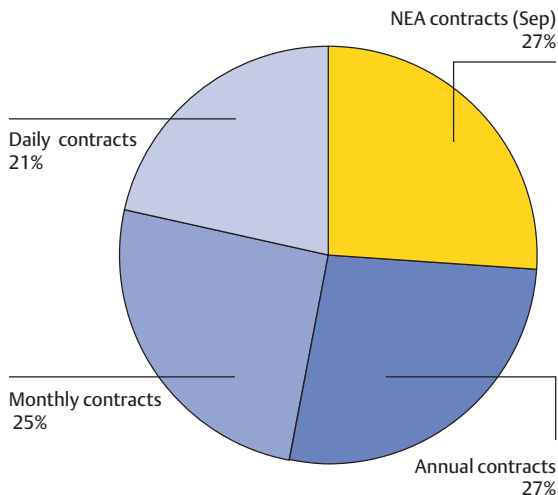


# Reliability of Supply

The Netherlands' exceptionally low average annual outage duration of only 30 minutes per connection leaves no doubt that in terms of reliability of supply, our country ranks among the world's best. Through our supervisory operations we ensure that power transmission across our grids is possible virtually regardless of circumstances.

## Distribution of net import capacity for 2004

Reference date: 31 December 2004



The aggregate net release of available import capacity on the cross-border interconnections amounted to 3,350MW for the whole year of 2004. Whenever operational conditions permitted, the import capacity was raised to 3,600MW and 3,850MW, respectively. A total of 900MW (27%) was earmarked for long-term import contracts in 2004. Where the capacity was extended to 3,600MW or 3,850MW, the residual capacity was made available through daily contracts. Contractual availabilities were as follows in 2004: annual contracts, 900MW (27%), monthly contracts, 849MW (25%) and daily contracts, 701MW (21%).  
The distribution has been based on 3,350MW in import capacity.

## Cross-border interconnection transmission in 2004

in GWh	Programmes		Measurements	Cross-border interconnections
	Programmes	UCTE programme setoff	Total programmes	
<b>2004 imports</b>	<b>22 075</b>	<b>39</b>	<b>22 114</b>	<b>21 405</b>
2003 imports	22 060	21	22 081	20 801
<b>2004 exports</b>	<b>5 882</b>	<b>15</b>	<b>5 897</b>	<b>5 188</b>
2003 exports	5 028	61	5 089	3 809



**tennet** 

Utrechtseweg 310  
NL-6812 AR Arnhem

Address for correspondence:  
P.O. Box 718  
NL-6800 AS Arnhem

Phone +31 26 373 11 11  
Fax +31 26 373 11 12  
E-mail [service@tennet.org](mailto:service@tennet.org)  
Website [www.tennet.org](http://www.tennet.org)