Amsterdam, October 10, 2003

Note to : Ministry of Economic Affairs

From : Adrian Wals
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Subject : Trends in foreign power generation reserves and consequences for the supply security of the Dutch power market

1. INTRODUCTION

In the Netherlands, in 2001, total net imports amounted to around 16% of the total consumed electricity. As a result of the market liberalisation, the upgrading of interconnectors and lower wholesale prices in surrounding countries - primarily Germany and France - imports replaced more expensive generators from the Dutch market. It is expected that in the shorter-term these power plants are mothballed and become available again when prices rise due to an increase in demand and/or decrease in supply[1]. However, if they remain outside the market in the medium and longer term, they will most probably be decommissioned. Combined with only a limited number of new power plants, this will reduce the total national generation capacity and increase the country's dependency on imports. The expected further increase in the interconnector capacity might even exacerbate this trend, making the Netherlands even more dependent on foreign imports.

This note investigates two questions put forward by the ministry of Economic Affairs, in relation to the project Electricity for Ever (E4E). More specifically, (1) it investigates the situation in surrounding countries regarding expected development of production capacity and reserve margins of electricity. Furthermore, (2) it investigates on the consequences of the developments of neighbouring production capacity on the imports to the Netherlands. For answers to these questions three aspects are of importance: (1) the availability of interconnections that allows for electricity imports, (2) foreign generation capacity excess during peak demand that might be available for exports to the Netherlands and (3) the impact of market structures in surrounding countries on the (de)commissioning of power plants and, subsequently, on the reserve margins of national electricity systems.

In this note, first, the current and potential development of interconnection capacity between the Dutch and surrounding power systems is discussed, including the explanation why only countries that are geographically close to the Netherlands are investigated. Second, the generation adequacy[2] is analysed for Belgium, France, Germany and England & Wales, by monitoring reserve margin trends and analysing the market structure of each country. For reasons of comparison also reserve margin trends for the Netherlands will be presented. Finally, some general conclusions are considered.

[1] Mothballed plants in the Netherlands are: Lage Weide (265 MW) since 2000, after a turbine broke down and Flevo (513 MW), since 2001. Also the Harculo power plant (350 MW) has been mothballed in 2001 but has been taken into operations again in 2002.

[2] The term adequacy means a measure of the ability of the power system to supply the aggregate electric power and energy requirements of the customers within component ratings and voltage limits, taking into account planned and unplanned outages of system components. Adequacy measures the capability of the power system to supply the load in all the steady states in which the power system may exist (UCTE, 2002).

2. INTERCONNECTION WITH NEIGHBOURING COUNTRIES

The Dutch network is currently connected to the networks of Belgium and Germany by ten tie line circuits with the capacity of around 12,445 MVA (Figure 1). Despite the large amount of tie line capacity, due to the actual flows in Germany, Belgium and the Netherlands, the reserve for ensuring security on the net (N-1)[3] and the transmission reliability margin (TRM)[4], available capacity is much lower, around 3350 MW. Even though the total available interconnector capacity should have been increased to 4700 MW by mid 2003, the available capacity will remain at the current levels (TenneT, 2003) for at least until 2004. The interconnection capacity has been affected by fluctuations in electricity supply from wind turbines in Germany, fluctuations in the dispatch of conventional power stations in neighbouring countries and changes in the exchange flows between France and the UK. Only because of investments in transformer capacities by TenneT the capacity has not been decreased. Nonetheless, it is still expected that the available capacity will increase to the formally planned levels. Furthermore, the probable installation of a link with the U.K, will further increase interconnector capacity[5].

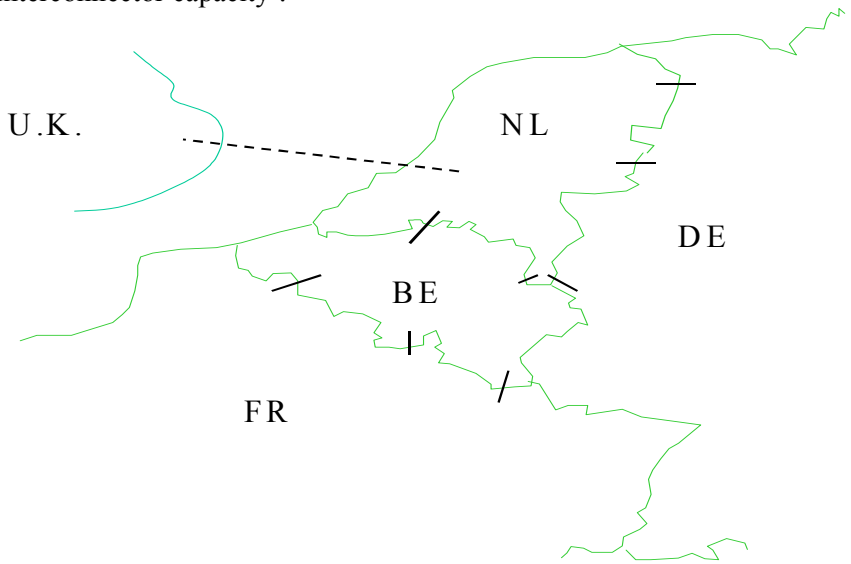

Figure 1 *Interconnectors of the high voltage network between the Netherlands and neighbouring countries*

A principal objective of interconnections between national electricity systems is to share reserve capacity for emergency situations. This is coordinated by the UCTE. About 300 MW interconnection capacity is reserved by TenneT for this purpose (the transmission reliability margin). However, during the period preceding liberalisation, long-term import contracts were signed by the SEP with German and French power generators, which used the interconnectors also for structural imports. Currently the available capacity of interconnectors with the Netherlands is allocated through the long-term contracts from the pre-liberalised era[6] and through auctions; the latter managed by the TSOs having stakes in the interconnected systems[7]. Auctions take place in yearly, monthly and

[3] This principle is used in a contingency analysis and implies that the system integrity is not affected if one element fails.

[4] The transmission reliability margin (TRM) is the capacity, which TSOs have to reserve for emergency situations on basis of the UCTE agreements.

[5] According to press releases (Ensoc Weekly, August 2003), the development of the interconnector between the Dutch and English electricity systems is in progress. The planned Direct Current link of between 1000-1300 MW and with an estimate cost of 400 million Euro will go live in 2005. The profit of the link will come not from the average price differential, but from the difference in prices in the different periods of time. England has different consuming patterns than the Netherlands.

[6] These amount to around 1000 MW today, by 2006 around 750 MW and run until 2009.

[7] The TSOs involved are TenneT, RWE net, Eon and Elia. Information about the auction can be found in www.tso-auction.org.

hourly day-ahead contracts. Since the start of the auction system, in average, 328 MW was allocated through yearly contracts, 313 MW in monthly contracts, and between 200 MW and 1100 MW in day-ahead hourly contracts. It is expected that as the long-term contracts of the pre-liberalised era expire, the total available capacity will be allocated through auctions.

The adequacy of neighbouring countries that have an interconnection with the Netherlands, i.e. Belgium, France and Germany, are studied in this note. Although no link exists between the Netherlands and the UK, certain plans for the future implementation of an interconnector to the U.K. adds this country to the list[8]. No other countries are studied because:

- Most of contracted imports come from the aforementioned countries (CBS, 2002).
- Power flows from other countries will have to pass France and Germany. Although France is Europe's largest power exporter in absolute terms, its technical openness[9] is relatively low. The latter also applies to Germany. Consequently, these countries are not so dependent on foreign flows (OXERA & ECN, 2001). This means that if Scandinavia, for example, has shortages and therefore high price spikes, Germany will export to the country in the amount the interconnectors allow. If that is marginal or not sizeable, then the impact will not be significant in its own market.

Important for the analysis is to stress that according to Article 24 of the new EU Electricity Directive (European Commission, 2003) Member States are allowed to take temporarily measures in case the system integrity is threatened. In order to secure the uninterrupted power supply in cases of shortages, TSOs could take a temporarily measure to reduce export flows to other countries and to shut down interconnector lines, despite the existence of contracts.

In summary, since liberalisation of electricity markets, an increasing part of the interconnection capacity is being used for short-term electricity trade between countries. Due to the meshed transmission system in the north-west of Europe, and the complexity in determining available transfers' capacities, in the short-term the allocable import capacities are expected to remain relatively constant. However, in the medium and long-term the available import capacities are set to increase, although precise values are not foreseeable. Furthermore, due to the allocation mechanisms of interconnector capacities, it is not possible to secure import capacity for periods longer than a year. This makes it difficult to secure long-term contracts with suppliers from neighbouring countries, which as a result, impacts on the Netherlands' capability to hedge from shortages in other countries. Also the fact that TSOs could decide to shut down interconnector lines in case of shortages affects secure electricity imports. On the other hand, this risk is reduced by interconnections with an increasing number of countries, e.g. through the possible interconnection between the Netherlands and the UK.

[8] Plans still exist for an interconnection between the Netherlands and Norway. This connection is not considered in this note.

[9] Share (%) of interconnector capacity in total national installed capacity. France has approximately 8% of technical openness and Germany 10%.

3. ANALYSING GENERATION ADEQUACY

With the liberalisation of the electricity sector, the adequacy of the sector increased in uncertainty by shifting from being centrally determined to being determined by market forces. In order to analyse the future adequacy of supply in the considered countries, this note covers the following two areas:

- Review of the reserve margin's forecasts, which monitors the state of generation adequacy in the sector;
- Study of some aspects of the market structure, which analyses possible impacts on investment in generation plants by market driven stakeholders.

Reserve margin indicators

The Union for the Co-ordination of Transmission of Electricity (UCTE) is the association of transmission system operators in continental Europe. As one of its principles is to be responsible for the adequacy of its system, UCTE studies and publishes information on adequacy of supply in the member countries until 2005 (UCTE, 2002). For analysis of reserve margins for the Netherlands, Belgium, France and Germany UCTE data can be used. As the U.K. is not a member of UCTE, information of adequacy of supply of England & Wales is provided by National Grid Company (NGC), the national Transmission System Operator (TSO) for England & Wales (NGC, 2003).

The information on adequacy of supply presented by the two organisations differs in two respects:

1. The reserve margin (see also Figure 2):
    - For UCTE countries the reserve margin is calculated first by subtracting the *non-usable capacity, overhauls, outages and system services reserves* to the *national generating capacity*. By subtracting the *peak-load* to the result of the previous, i.e. the *guaranteed capacity*, the *remaining capacity* is determined (for more information on the calculation see Appendix A). Finally, the indicator used to analyse generation adequacy is the *percentage of remaining capacity in the total national generating capacity*[10].
    - For England and Wales the figures provided are the *plant margin*, which is defined as the *installed generation capacity*, which exceeds *peak demand.*
2. The time horizon and use of scenarios:
    - The time horizon for the UCTE is 2005. UCTE does not use a scenario approach.
    - The time horizon for the NGC is 2009. NGC uses six different scenarios. However, on the short term (until 2005) the forecasts for supply adequacy hardly differ between the scenarios.

Information reliability

In competitive electricity markets, individual companies make decisions on generation capacity (operation, maintenance, investment plans, etc.). The value of the information of the UCTE for the Netherlands, Belgium, France and Germany and NGC for England & Wales is based on information of TSOs and therefore restricted to which extend TSOs in these countries have knowledge of the intentions of generating companies.

[10] Because UCTE has to evaluate the adequacy for the whole European electricity network, two moments of peak demand in a year are considered for all UCTE countries: on the 3rd Wednesday in January and on the 3rd Wednesday in July on 11 a.m. However, for individual countries the moment of maximum peak demand is likely to be on another day. To cover for differences in peak demand the remaining capacity is calculated after adding a margin against monthly peak load to the peak load of the 3rd Wednesday.

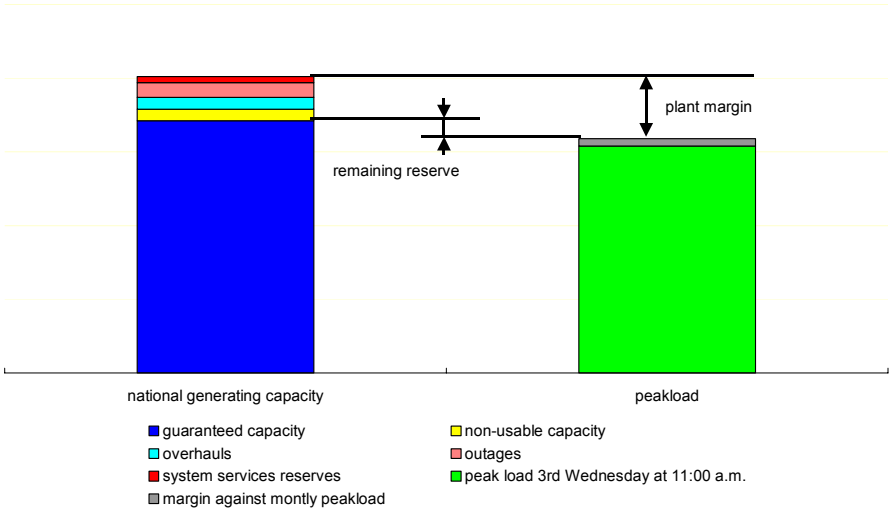

Figure 2 *Illustration of adequacy of supply indicators*

In principle, TSOs will have a better knowledge of changes in power generation capacity in the short term (2 to 3 years) than in the long term (> 3 years). Expected changes in the generation capacity in the short term are mainly based on the connection requests to the grid for planned power plants, nonetheless can also be based on maintenance programmes, lifetime extensions and decommissioning of power plants. On the longer term, this kind of information is consistently more uncertain than in the former, as in liberalised markets individual market parties make decisions on power generation capacity. To investigate possible developments of the electricity supply and demand a scenario approach can be used. Scenarios are used to analyse possible outcomes by varying a number of assumptions (e.g. developments in power generation capacity, interconnector capacity, demand growth, etc.). In principle such a scenario approach could also be applied for analysis of the impact of foreign power generation reserves on the security of the Dutch electricity supply. In this note, trends in generation capacity and reserve margins are being studied on basis of existing information. Unfortunately, scenarios from national agencies that provide information on the electricity sector are not comparable with each other because of the different parameters being used[11].

Other sources

On a country-by-country basis the IEA publishes annually generation capacity projections up to 2020, including information on capacity under construction, planned capacity, decommissioned capacity, etc. (IEA, 2002). Projections for electricity demand are, however, not published by the IEA. The Nuclear Energy Agency publishes country specific information on developments in nuclear generation (NEA, 2002). Furthermore, the European Commission recently published an energy outlook for Europe up to 2030 (EC, 2003). This outlook presents also country specific information, including power generating capacity and electricity demand growth. Appendix B gives an overview of country specific information on power generation capacity developments in the countries studied. Assessment of these data leads to the conclusion that information from these international publications cannot be used for determination of reserve margins in electricity supply, mainly because of the fact that these sources do not provide information on peak demand development. Furthermore, information on generation capacity seems sometimes inconsistent, not up to date or based on certain arguable assumptions.

Benchmark criteria

It is important to stress that the indicators used by the UCTE and NGC should not be classified in the same way as 'over-capacity', as in practice, there is a need to have reserve capacity available in addition to the capacity for system services reserves. This capacity is required to guarantee the

[11] For example: Voorstel van indicatief programma van de produktiemiddelen voor elektriciteit 2002-2011, CREG, december 2002; Capaciteitsplan 2003-2009 TenneT, 2002; Referentieraming energie en CO_2 2001-2010, ECN/RIVM, 2002

reliability of supply, and compensate, for instance, power plant failures. According to the UCTE report, several countries consider that power plant operators should maintain an additional reserve of approximately 5% of the national generating capacity (UCTE, 2002). The English TSO, on the other hand, argues that a notional 20% planning margin is appropriate to have between installed generating capacity and peak demand[12] (NGC, 2003). It is important to notice that this more conventional criterion also covers planning uncertainties, i.e. the uncertainty that arises from demand growth and timing of availability of new generation capacity. The UCTE criterion does not count for these uncertainties. As a result, results for the Netherlands, Belgium, France and Germany are benchmarked against the UCTE-criterion, while the results for the UK are benchmarked against the NGC criterion.

The aforementioned indicators do not consider physical exchanges between countries. A surplus, after the deduction of this additional reserve capacity for power plant operators, represents a potential capacity for exports. Long-term export contracts must be deducted from the surplus of available capacity in order to determine the capacity, which is really available to power plant operators and electricity traders. Conversely, in case of long-term import contracts, power plant operators and traders dispose of a larger surplus of available capacity.

Figure 3 shows the percentage of remaining capacity in the total national generating capacity for the Netherlands, Belgium, France and Germany. It shows that the remaining capacity for the Netherlands does not meet the UCTE criterion. The reliability of the Dutch power system depends partly on imports. If imports are included[13], i.e. subtracted to the peak load, the remaining capacity improves significantly. On basis of 2002 figures (see Appendix D) this results in a remaining reserve of 17.1% and 17.7% of the national generating capacity for the winter and summer peak respectively.

In the remaining part of this section, the development of power generation reserve will be discussed per country. For England & Wales the plant margin will be used as an indicator, whereas for the other countries the indicator will be the remaining reserve capacity. Appendix C shows the reserve margins of the Netherlands, Belgium, France and Germany calculated from UCTE data and using the NGC indicator definition. From comparison of Figure 3 and the figure in Appendix C it can be concluded that the results are relatively similar, except for Germany[14]. This is caused by the size of unusable capacity, which is not taken into account in calculating the plant margin, but included in the national generating capacity that is used in the representation of the remaining capacity in Figure 3. Results are also quite similar regarding the supply security criterion, i.e. the Netherlands does not meet both benchmark criteria, France does and Belgium and Germany only partly do so.

[12] In this case reserve margin is considered as the peak demand minus the guaranteed capacity. It should be noted that the surplus capacity is calculated with the guaranteed capacity, which is less than the total installed capacity

[13] All imports, i.e. short-term and long-term contracts

[14] It should be noted that reserve factors presented by TenneT in their 'Rapport monitoring Leveringszekerheid 2002-2010' are somewhat higher, i.e. for 2003 and 2004 TenneT reports a reserve factor of 1.18, whereas the calculated plant margins are 1.16 and 1.15 respectively.

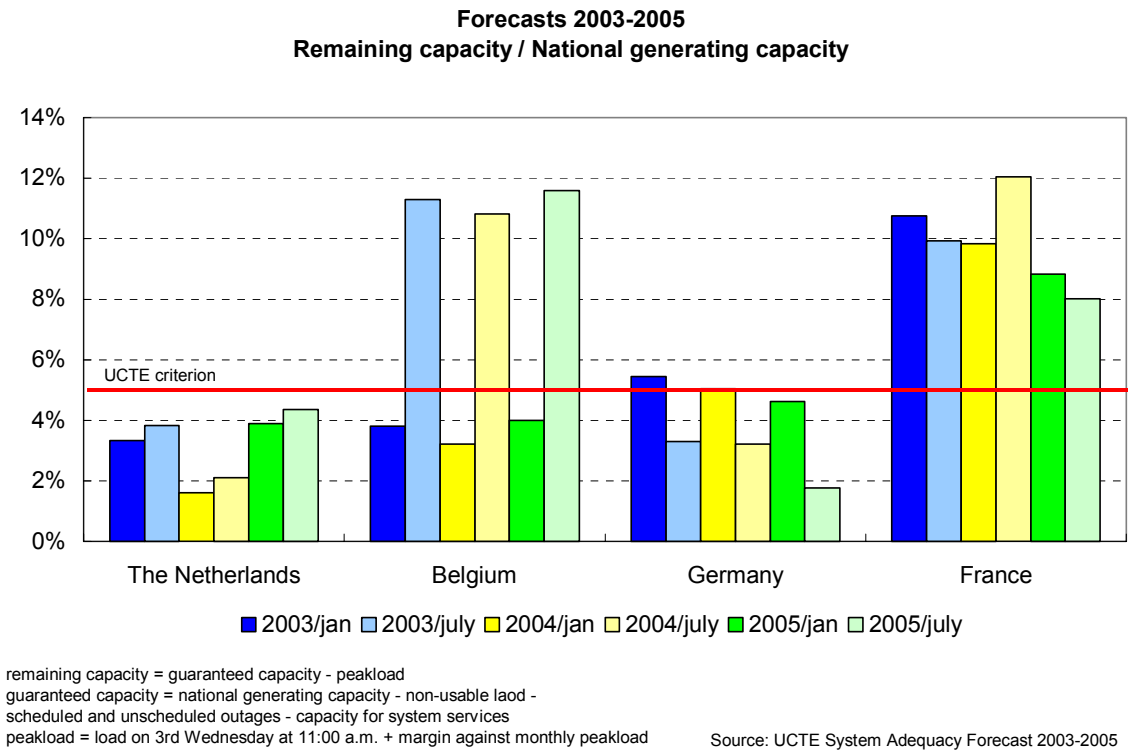

Figure 3 *Remaining capacity as a percentage of total generating capacity in Belgium*

Belgium

While a significant reserve margin exists in Belgium during summer (see Figure 3), in winter the number is lower than the 5% margin that guarantees system adequacy. Some remarks are:

- The difference in reserve margins is in part caused by a 20% difference in peak demand between summer (July) and winter (January).
- The figure also shows that the remaining capacity is likely to increase after 2004. This is caused by an expected increase in national generating capacity between 2003 and 2005, higher than the expected increase in demand.
- The import capacity of the Belgium electricity system amounts to 25 to 30% of the national generating capacity, whereas the export capacity is approximately 30%. Some indications of the impact of exchanges with surrounding countries on remaining reserves can be derived from 2002 figures (see also Appendix D). In 2002 Belgium was an importing country during both peak moments: 526 MW net imports in January and 555 MW net imports in July. Although the remaining capacity without the imports was lower in 2002 than in 2003 (generating capacity did hardly change), the ratio between remaining capacity and national generating capacity is above the 5% criterion if imports are included (7.2% for January and 9.5% for July).

In Belgium Electrabel, a vertically integrated monopolist, controls the wholesale electricity sector. Economic literature argues that the level of competition is inversely correlated with the level of market concentration. Furthermore, it argues that monopolistic or highly concentrated oligopolistic markets will, by exercising market power, generate enough returns to finance for enough investments while at the same time it will avoid new market entrants by not rising prices significantly higher than the long-run marginal costs of production. As a result the typical boom-and-bust cycle that characterises capital-intensive industries, and questionably the electricity sector, is avoided and consequently sufficient capacity should exist. This is probably the case in Belgium.

During the heat wave of August 2003, even though power systems suffered an extreme tight market in France, the Netherlands and Germany, no power shortages were reported in Belgium. It was argued that the reasons for this were on the one side higher capacity margins and less dependency of

imported electricity than, for example, the Netherlands. On the other side, less increases in demand due to lower consumption of air-conditioners, and generation technologies that do not rely on cooling water, had also influence on this (Energie Management, 2003).

Germany

Remaining capacity margins in Germany have decreased through the years and, while remain around the 5% margin in winter, are lower in the summer, reaching around 2% in 2005 (see Figure 3). Some remarks are:

- New commissioned capacity mainly comes from renewable energy sources, which profit from support schemes. During the period from 2003 to 2005, the installed generating capacity will increase by around 8 GW in wind power stations and by around 1 GW in hydro power stations; the latter due to the commissioning of a pumped storage plant. It will also be reduced by around 0.6 GW (shut-down) in nuclear power stations (UCTE, 2002).
- National generation values only take into account plants of more than around 1MW of capacity. As a result, the major part of generation from renewable units is not included in the analysis.
- Germany has interconnections with nine countries: France, Luxembourg, Netherlands, Austria Switzerland, Czech Republic, Poland, Denmark and Sweden. The import/export capacity of these interconnections amounts to approximately 10% of the German generating capacity. Some indication of the impact of these exchanges on remaining reserves can be derived from 2002 figures (see also Appendix D). During both peak moments exchanges took place with all nine countries, amounting to 936 MW net imports in January and 5085 MW net imports in July. After including these exchanges, the ratio between remaining capacity and national generating capacity is below the 5% criterion in January (4.5%) and above the criterion in July (9.2%). In 2002 the remaining capacities in January (without imports) were somewhat lower than in 2003 and in July somewhat higher. The national generating capacity in 2002 was approximately 2500 MW lower than in 2003.

The German wholesale sector is in hands of a higher number of firms than in both the French and Belgium sector. Higher competition levels lower the possibility of dominant behaviour and therefore results in a system that inherently works with lower reserve margins. Although Germany is a relatively competitive market, it is not likely that the market will be characterised by crash and boom periods. Incumbents are relatively large firms and vertically integrated with strong incentives to secure supply to their customers and restrict market entrance for new generation companies.

France

Remaining capacity margins in France, though decreasing through the years, remain well above the 5% criterion. Some remarks are:

- Around 22% of the national generation capacity is composed by hydro power stations. This can generate significant variances in guaranteed capacity. For example, this occurred in 2002, when the water availability observed in the first months was very low, especially when compared to the availability observed at the end of 2001.
- Six countries are interconnected with France: Belgium, Germany, Spain, Italy, Switzerland and the UK. The export capacity of these connections amounts to approximately 8% of the French generating capacity (UCTE does not report on import capacity). Some indication of the impact of these exchanges on remaining reserves can be derived from 2002 figures (see also Appendix D). During both peak moments France was exporting to all six countries, amounting to 7141 MW net exports in January and 7137 MW net exports in July. After including these exchanges, the ratio between remaining capacity and national generating capacity is around the 5%-criterion: January 4.8% and July 6.4%. In 2002 the remaining capacities without exports were somewhat higher than in 2003 whereas the national generating capacity was slightly lower.

In France, Electricité de France (EdF), a vertically integrated firm, controls the wholesale electricity market. The same analysis could apply as in Belgium. In other words, the fact that EdF is a monopolist in the wholesale sector, as an incumbent it would maximise profits by keeping potential

market entrants outside France. To achieve that, it should avoid significantly higher prices than the LRMC of new power production. Furthermore, the fact that EdF is state owned can provide the firm with stronger incentives to secure generation adequacy.

Interesting is to stress that the French TSO (RTE) considers it necessary that around 8.5% of the guaranteed capacity must remain as reserve because of the strong variability of demand with the climatic conditions and of the composition of the national generation capacity (i.e. hydro power). The remaining capacity, as figure 3 shows, represents 8-12% of the national generation capacity.

England & Wales

The England and Wales power system is not a member of the UCTE. Consequently, most recent data on adequacy forecasts in the system are provided by National Grid (the TSO), in the *Seven Year Statement 2003* report. The time horizon of the analysis reaches the year 2009 and includes, due to the uncertainty associated with future generation capacity, three different generation scenarios. Results are presented with and without import capacity.

The definition of plant margin used is the installed generation capacity that exceeds the peak demand, as a percentage of peak demand. According to National Grid, and based on international experience, a notional planning margin of 20% may be appropriate for discussion purposes. On the other hand, the old vertically integrated company that managed all generation and transmission lines, Central Electricity Generating Board (CEGB) sought to achieve a plant margin of 24% several years ahead. In this note, the 20% criterion is considered as the correct 'plant margin' necessary to secure electricity supplies.

Different assumptions result in different 'plant margin' forecast levels. For the sake of the analysis, in this report the higher, middle and lower scenarios are outlined, which give a broad picture of the possible development of the plant margin in the England & Wales power system. It should be stressed that the purpose of the scenarios is not to present NGC's view of the future plant/demand balance but rather to provide scenarios with information of possible outcomes. As figure 4 shows, the further in the future, the more uncertain the scenarios.

Figure 4 shows the higher, middle and lower 'plant margin' forecast levels with and without import capacity. While the lower scenario is inferior to the 20% criterion, the middle is around the same and the higher superior. Some remarks are:

- Total generation capacity includes the total importable capacities. In other words, importable capacities are considered as potential generation capacity. For the higher and middle scenarios, apart from the interconnector between England and France and England and Scotland, the projects considered are 1320 MW of new import capacity from Norway in 2006/07 and 1320 MW of new import capacity from the Netherlands in 2007/08. For the lower scenario, only the interconnectors between England and France and England and Scotland are considered.
- Future peak demand does not include future demand from other countries. More specifically, it does not consider potential exports of electricity from the UK to the Netherlands.
- Plant margin presents projected plant margins against a number of demand and generation backgrounds, that is: the future demand growth based on customer information; without as yet un-notified generation closures; and with an assumed future generation closure stream.
- The plant margin forecast is lower than previous forecasts and is, in part, due to the withdrawal of a coal/oil plant.

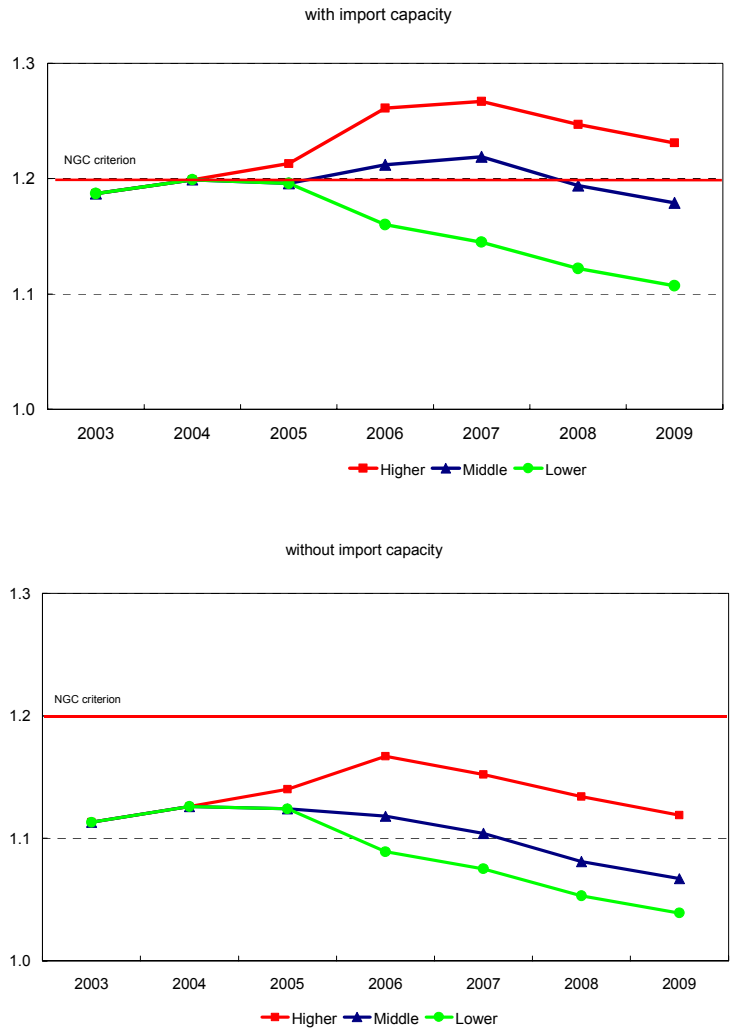

Figure 4 *Plant margin (installed generation capacity relative to peak demand) in England & Wales, including import capacity (top) and excluding import capacity (bottom)*

Figure 4 excluding imports indicates the adequacy of the system based only on national generation capacity. In other words, it assumes an extreme situation where surrounding countries are in no position to export power to England and Wales. It can clearly be seen how plant margins decrease significantly, with all scenarios below the benchmark number of 20%.

It has been argued that lower concentration measures in the wholesale sector, together with the introduction of the New Electricity Trading arrangements (NETA) were the cause of the significant reduction of wholesale prices in the England and Wales electricity market in the last years. As a result of an increase in competition forces in the sector, more plant closures could occur than expected. Even though scenarios argue that, including imports, plant margins are expected to be healthy enough to secure adequacy of supply, the current market situation in England and Wales fulfil the conditions for a crash and boom effect in investment and prices.

4. CONCLUSIONS

This note analysed the trends in power generation reserves in Belgium, Germany, France and England & Wales, since it is expected that the Netherlands will continue to import electricity and that supply security of the Dutch power system will depend on the generation reserves of its neighbouring countries. The note looked into three aspects: the availability of interconnection capacity, reserve margins of generation capacity in neighbouring countries during peak demand and the impact of market structure on trends in reserve margins.

Availability of interconnection capacity
The analysis results in the following conclusions regarding availability of interconnection capacity:

- In the short-term the allocable interconnection capacities between the Dutch electricity market and neighbouring markets are expected to remain relatively constant. In the medium and long-term the available interconnection capacities are set to increase, although precise values are not foreseeable. The available interconnection capacity determines to which extend power generation capacity abroad can contribute to a secure power supply in the Netherlands.
- Due to the allocation mechanisms it is not possible to secure import capacity for periods longer than a year. In principle, in a liberalised European electricity market the duration of the contract is not a relevant factor for security of supply, but the availability of production and interconnection capacity is.
- The fact that TSOs could temporarily reduce export flows to secure system integrity in their region/country affects secure electricity imports. The impact of such a temporarily measure for the Netherlands is reduced when the Dutch market is connected to more regions/countries. Therefore, an interconnection with England & Wales will help to reduce the effects of an import interruption. Whether cancelled imports can (partly) be taken over by generators within the country or in other countries depends on the generating reserves and remaining available interconnection capacities.

Reserve margins
UCTE data have been used to assess the reserve margins in The Netherlands, Belgium, Germany and France and data from National Grid have been used for England & Wales. The data are provided by TSOs who, apart from generators themselves, have the best knowledge on power generation capacity developments. The UCTE provides information until 2005 and National Grid until 2009. National Grid, however, uses six scenarios and information for the longer term is less reliable.

Both UCTE and National Grid use a benchmark for reserve margins. Although these benchmarks provide some direction in the assessment of recommendable reserve margins, they do not determine whether supply security is at risk or not. This is because, among other things, indicators take not into account interconnector capacity (or this is arguable) and demand side response.

From the assessment of the reserve margins the following can be concluded:

- Without taking into account the import capabilities, the reserve margin in the Netherlands is the lowest, followed by Germany and Belgium (only during winter peak periods). The remaining reserves are below the UCTE criterion. France has the highest reserve margin.
- If actual exchange flows between countries are considered, i.e. the level of import flows in 2002, remaining reserve in the Netherlands is the highest, followed by Belgium. The remaining reserves for Germany and France are just below the UCTE criterion during winter peak periods.
- For England & Wales, National Grid uses three scenarios. Until 2006 the reserve margin meets the criterion (a plants margin of 20%) if total import capacities are included. In the period 2007 until 2010 the reserve margin could decrease and increase, depending on the different scenarios. If import capacities are excluded the reserve margin drops to levels below the 20% criterion.

Impact of market structure

Changes in power generating capacity depend to a large extend on the market structure in the different electricity markets. Although for the next years (2004 and 2005) these changes might be known by market monitoring, on the longer term this is uncertain. The market structure in neighbouring countries will determine to a large extend whether power generation investments will take place. It is argued that in markets with a monopolistic (France, Belgium) or oligopolistic structure (Germany) incumbent power generators will respond in time to decreasing reserve margins. More competitive markets, like England & Wales, could be characterised by a boom-and-bust market, with risks of under investment in power generation.

Security of supply of the Dutch power market

The Dutch power system is already dependent on imports. If power generation capacity in the Netherlands does not increase in the same rate as (peak)demand growth, the country will become even more dependent on imports. The Dutch electricity market has a sufficient interconnector capacity for these imports, also in the future, because of planned expansions.

For the time being the remaining capacity in Belgium and Germany argue against adequacy of supply in the Dutch power system. If the Dutch government considers certain policy measures, this should also be based on the developments in neighbouring countries. Therefore, it is recommended to monitor power generation investments in these countries. For the longer-term a scenario approach can be used to analyse possible impacts of market behaviour and other factors such as extension of interconnectors to other countries.

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APPENDIX A DATA FROM UCTE SYSTEM ADEQUACY FORECAST 2003-2005

Definitions:

National Generating Capacity: represents the maximum potential net generating capacity of electric utility companies and auto-producers in the countries concerned.

Non-usable capacity: Is the part of generating capacity that can not be scheduled for different reasons: a temporary shortage of primary energy sources (hydroelectric plants, wind farms), power plants with multiple functions, in which the generating capacity is reduced in favour of other functions (co-generation, irrigation, etc), reserve power plants that are only scheduled under exceptional circumstances, unavailability due to cooling-water restrictions, etc.

Reserve for System services: The reserve for system services is the estimated reserve capacity that is required for system operation. It is therefore the reserve capacity that is available to TSOs from power plant operators.

Guaranteed capacity: Is obtained by deducting non-usable capacity, overhauls, outages and system reserve from the national generating capacity. It represents the capacity that is available to power plant operators and electricity traders for meeting their clients' demands.

Load: It should be noticed that, in specific, the reference points selected (third Wednesday of the month at 11a.m.) do not correspond to the monthly peak load. There are significant discrepancies in relation to this monthly peak in some countries: in January for instance, the margin against peak-load represents approximately 5 GW in Germany and approx. 2-3 GW in France.

Remaining Capacity: This value is obtained by deducting the reference load from the guaranteed capacity, and corresponds to the surplus of capacity, available to power plant operators. This should not be classified as an over-capacity, as several countries consider that power plant operators should maintain an additional reserve of approximately 5% of the national generating capacity.

The Netherlands

	Power data (net values in GW)	2003		2004		2005	
		3rd Wednesday		3rd Wednesday		3rd Wednesday	
		January	July	January	July	January	July
	National generating capacity:						
1	hydro power stations	0.0	0.0	0.0	0.0	0.0	0.0
2	nuclear power stations	0.4	0.4	0.4	0.4	0.4	0.4
3	conventional thermal power stations	17.5	17.5	17.5	17.5	18.3	18.3
4	renewable energy sources	0.7	0.7	0.7	0.7	0.8	0.8
5	not clearly identifiable energy sources	1.4	1.4	1.5	1.5	1.6	1.6
6	**National generating capacity (6=1+2+3+4+5)**	**20.1**	**20.1**	**20.2**	**20.2**	**21.2**	**21.2**
7	non-usable capacity	0.8	1.4	0.8	1.4	0.8	1.4
8	overhauls (thermal power stations)	0.8	0.8	0.8	0.8	0.8	0.8
9	outages (thermal power stations)	1.0	1.0	1.0	1.0	1.0	1.0
10	system services reserve	0.4	0.4	0.4	0.4	0.4	0.4
11	**Guaranteed capacity (11=6-(7+8+9+10))**	**17.1**	**16.5**	**17.2**	**16.6**	**18.2**	**17.6**
12	**Load**	16.4	15.7	16.9	16.2	17.4	16.7
13	margin against the monthly peak load	0.2	0.5	0.2	0.5	0.2	0.5
14	**Remaining capacity (14=11-12)**	**0.7**	**0.8**	**0.3**	**0.4**	**0.8**	**0.9**
	Transportable capacities						
15	importable capacity	3.6	4.7	4.7	4.7	4.7	4.7
16	exportable capacity	3.6	4.7	4.7	4.7	4.7	4.7

Belgium

	Power data (net values in GW)	**2003** **3rd Wednesday**		**2004** **3rd Wednesday**		**2005** **3rd Wednesday**	
		January	**July**	**January**	**July**	**January**	**July**
	National generating capacity:						
1	hydro power stations	1.4	1.4	1.4	1.4	1.4	1.4
2	nuclear power stations	5.8	5.8	5.8	5.8	5.8	5.8
3	conventional thermal power stations	8.3	8.3	8.3	8.3	9.0	9.0
4	renewable energy sources	0.2	0.2	0.3	0.3	0.3	0.3
5	not clearly identifiable energy sources						
6	**National generating capacity (6=1+2+3+4+5)**	**15.6**	**15.7**	**15.8**	**15.8**	**16.5**	**16.5**
7	non-usable capacity	0.5	0.9	0.5	0.9	0.6	1.0
8	overhauls (thermal power stations)	0.2	1.4	0.2	1.4	0.3	1.5
9	outages (thermal power stations)	0.9	0.7	0.9	0.7	1.0	0.8
10	system services reserve	1.2	1.2	1.2	1.2	1.2	1.2
11	**Guaranteed capacity (11=6-(7+8+9+10))**	**12.9**	**11.5**	**13.0**	**11.6**	**13.4**	**12.0**
12	**Load**	12.3	9.7	12.5	9.9	12.8	10.1
13	margin against the monthly peak load	1.2	1.6	1.2	1.6	1.3	1.6
14	**Remaining capacity (14=11-12)**	**0.6**	**1.8**	**0.5**	**1.7**	**0.7**	**1.9**
	Transportable capacities						
15	importable capacity	3.9	3.2	3.9	3.2	3.9	3.2
16	exportable capacity	4.8	5.3	4.8	5.3	4.8	5.3

Germany

	Power data (net values in GW)	**2003** **3rd Wednesday**		**2004** **3rd Wednesday**		**2005** **3rd Wednesday**	
		January	**July**	**January**	**July**	**January**	**July**
	National generating capacity:						
1	hydro power stations	9.3	9.5	10.0	10.3	10.3	10.3
2	nuclear power stations	20.4	20.4	19.8	19.8	19.8	19.8
3	conventional thermal power stations	67.1	66.7	67.3	66.8	66.6	66.1
4	renewable energy sources	11.5	12.5	13.9	15.0	15.9	16.5
5	not clearly identifiable energy sources						
6	**National generating capacity (6=1+2+3+4+5)**	**108.3**	**109.1**	**111.0**	**111.9**	**112.6**	**112.7**
7	non-usable capacity	16.7	17.9	19.0	20.0	20.4	21.1
8	overhauls (thermal power stations)	1.9	11.5	1.9	11.8	1.9	12.2
9	outages (thermal power stations)	3.2	2.5	3.2	2.5	3.2	2.5
10	system services reserve	7.2	7.1	7.2	7.1	7.3	7.1
11	**Guaranteed capacity (11=6-(7+8+9+10))**	**79.3**	**70.1**	**79.7**	**70.5**	**79.8**	**69.8**
12	**Load**	73.4	66.5	74.1	66.9	74.6	67.8
13	margin against the monthly peak load	5.1	3.4	5.0	3.4	4.9	3.5
14	**Remaining capacity (14=11-12)**	**5.9**	**3.6**	**5.6**	**3.6**	**5.2**	**2.0**
	Transportable capacities						
15	importable capacity	12.2	12.7	12.2	12.7	12.2	12.7
16	exportable capacity	11.6	15.5	11.6	15.5	11.6	15.5

France

	Power data (net values in GW)	**2003** **3rd Wednesday**		**2004** **3rd Wednesday**		**2005** **3rd Wednesday**	
		January	**July**	**January**	**July**	**January**	**July**
	National generating capacity:						
1	hydro power stations	24.1	24.1	24.1	24.1	24.1	24.1
2	nuclear power stations	63.0	63.2	63.2	63.2	63.2	63.2
3	conventional thermal power stations	18.6	18.6	18.2	18.2	17.7	18.2
4	renewable energy sources	0.2	0.3	0.4	0.5	0.6	0.8
5	not clearly identifiable energy sources	5.4	5.4	5.7	5.7	5.8	5.8
6	**National generating capacity (6=1+2+3+4+5)**	**111.2**	**111.5**	**111.5**	**111.7**	**111.4**	**112.1**
7	non-usable capacity	14.9	20.4	15.2	20.8	15.3	21.4
8	overhauls (thermal power stations)	3.9	15.8	3.8	12.3	3.7	15.8
9	outages (thermal power stations)	4.1	3.9	4.4	4.0	4.7	4.1
10	system services reserve	5.2	4.2	5.2	4.2	5.2	4.2
11	**Guaranteed capacity (11=6-(7+8+9+10))**	**83.1**	**67.3**	**83.0**	**70.5**	**82.6**	**66.7**
12	**Load**	71.1	56.2	72.0	57.0	72.8	57.7
13	margin against the monthly peak load	2.9	0.6	3.0	0.7	3.1	0.9
14	**Remaining capacity (14=11-12)**	**12.0**	**11.1**	**11.0**	**13.5**	**9.8**	**9.0**
	Transportable capacities						
15	importable capacity	NRV	NRV	NRV	NRV	NRV	NRV
16	exportable capacity	9.0	9.0	9.0	9.0	9.0	9.0

APPENDIX B INFORMATION ON POWER GENERATION CAPACITY IN INTERNATIONAL PUBLICATIONS

Table B.1 *Forecasts of total power generation capacity in [GW]*

	2001-2005 IEA	2005 UCTE/NGC	2005 EC	2006-2010 IEA	2010 EC
Belgium	13.65	16.5	14.08	14.17	15.07
France	114.96	111.4	117.82	121.25	125.51
Germany	126.72	112.6	125.14	126.41	132.07
Netherlands	23.53	21.22	26.55	26.03	28.15
United Kingdom	151.21	86.61	87.48	155.21	118.97

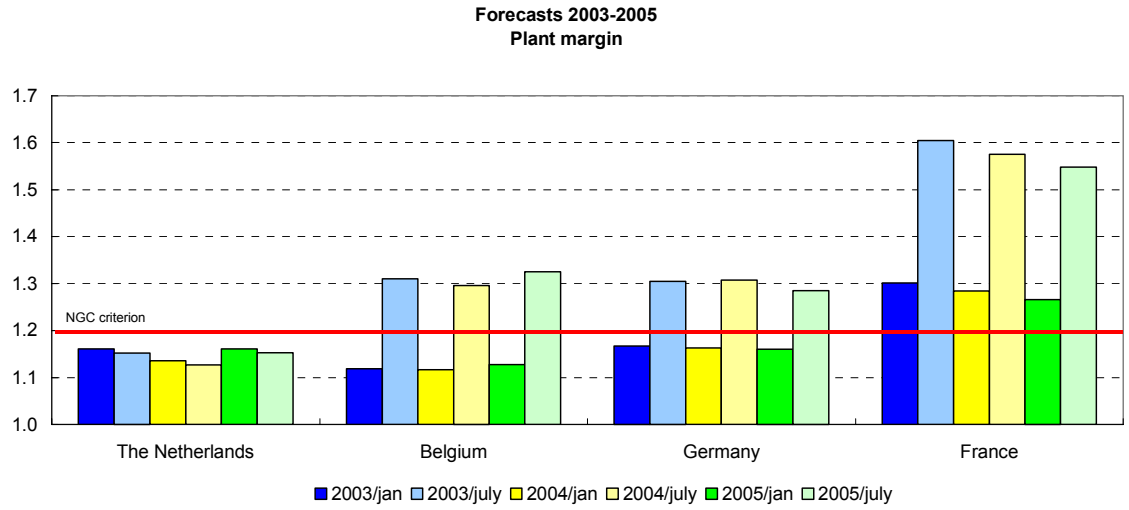
Table B.2 *Developments in power generation capacity in [GW] (IEA, 2002)*

	Belgium	France	Germany	Netherlands	United Kingdom
2000.Total Capacity	15.68	115.63	118.35	21.06	79.09
2001-2005.Capacity Under Construction	0.01	0.5	0	2.48	0
2001-2005.Authorized Capacity	0	0.27	0	0	0
2001-2005.Other Planned Capacity	0	0	12.42	0.44	74.84
2001-2005.Conversion to Other Fuel	0	0	0	0	0
2001-2005.Capacity to be Decommissioned	-2.04	-1.44	-4.04	-0.45	-2.72
2001-2005.Total Capacity	13.65	114.96	126.72	23.53	151.21
2006-2010.Capacity Under Construction	0	0	0	0	0
2006-2010.Authorized Capacity	0	0	0	0	0
2006-2010.Other Planned Capacity	0.96	12.37	2.81	2.52	14.82
2006-2010.Conversion to Other Fuel	0	0	0	0	0
2006-2010.Capacity to be Decommissioned	-0.44	-6.08	-3.12	-0.02	-10.82
2006-2010.Total Capacity	14.17	121.25	126.41	26.03	155.21
2011-2020.Capacity Under Construction	0	0	0	0	0
2011-2020.Authorized Capacity	0	0	0	0	0
2011-2020.Other Planned Capacity	2.57	14.59	13.1	3.2	17.77
2011-2020.Conversion to Other Fuel	0	0	0	0	0
2011-2020.Capacity to be Decommissioned	-0.2	-4.28	-14.14	-0.25	-14.77
2011-2020.Total Capacity	16.54	131.56	125.37	28.98	158.21

Table B.3 *Forecasts for nuclear power generation capacity in [GW] (NEA, 2002)*

	2000 (Actual)		2005		2010	
	Total	Nuclear	Total	Nuclear	Total	Nuclear
Belgium	15.7	5.7	15.6	5.8	15.7	5.8
France	111.2	63.2	111.0	63.2	110.8	63.2
Germany	114.0	21.3	104.0	22.3	105.0	22.0
Netherlands	18.6	0.5	21.8	0.5	23.2	0.5
United Kingdom	70.9	12.5	73.0	12.0	74.0	10.0

APPENDIX C PLANT MARGINS FOR THE NETHERLANDS, BELGIUM, GERMANY AND FRANCE



plant margin = (national generating capacity - unusable capacity - peakload)/peakload
peakload = load on 3rd Wednesday at 11:00 a.m. + margin against monthly peakload

Based on data from UCTE System Adequacy Forecast 2003-2005

APPENDIX D REMAINING CAPACITY IN 2002 AFTER CORRECTIONS FOR IMPORT/EXPORT

		Import*	Export*	Net import	Remaining capacity 2002**	Generating capacity	Remaining capacity incl. net imports
		MW	MW	MW	MW	MW	%
The Netherlands	Jan-02	2666	526	2140	1200	19500	17.1
The Netherlands	Jul-02	2697	555	2142	1300	19500	17.7
Belgium	Jan-02	1791	865	926	200	15600	7.2
Belgium	Jul-02	2294	1818	476	1000	15600	9.5
Germany	Jan-02	6152	5216	936	3800	106300	4.5
Germany	Jul-02	8096	3011	5085	4700	106800	9.2
France	Jan-02	753	7894	-7141	12500	111700	4.8
France	Jul-02	1391	8528	-7137	14300	111900	6.4

* load flows on the 3rd Wednesday at 11:00 a.m.
** forecast

Source: UCTE.