Monitor Wholesale Markets for Gas and Electricity

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Management Summary

The wholesale gas market
Access to the infrastructure (capacity) and free tradability of gas (commodity) are essential for a properly functioning wholesale gas market. In this respect several positive developments took place in 2008. Quality conversion is now available in larger volumes, unused transmission capacity can be made available again, and the trading volumes on the TTF gas hub are increasing.

- Since mid-2008 the capacity restrictions in quality conversion pose less problems. In recent years demand for quality conversion exceeded the capacity of the conversion stations. In July 2008 GTS and Gasterra agreed to meet the market demand for quality conversion using gas swaps – swapping high calorific gas for low calorific gas.
- In 2008 two initiatives were launched to make unused border capacity available to the market again. Although transmission capacity is fully booked on a first come, first served basis, the actual use of the capacity is often lower. In February 2008 the TSOs, GTS and BEB launched a platform for day-ahead interruptible capacity. In May 2008 the APX and Trac-X gas exchanges started secondary trading in firm day-ahead capacity.
- In 2008 the traded and delivered volumes on the TTF grew strongly after years of modest growth. The traded volume increased from 290 to 636 TWh and the delivered volume from 78 to 196 TWh. The TTF’s share of the total gas flows in the Netherlands has increased from 8% to 18%.

In short, 2008 saw more capacity being made available to the market and more commodity being supplied on the trading hub. This is of course in itself good for competition. But for the overall picture, little progress has been made. The wholesale gas market still has some major shortcomings. Shippers perceive the limited access to flexibility as a hindrance, and the product offer on the TTF is not sufficient to meet their needs.

- Access to flexibility is crucial if energy suppliers are to source their gas independently. Seasonal flexibility is needed to meet the high gas demand in winter, while short term flexibility is needed to accommodate variations in consumption between and within days. This flexibility can be delivered by the underground storage facilities which were properly utilised for the first time in 2008. However, limited access for third parties means that energy suppliers cannot meet their need for flexibility, so they remain dependent on Gasterra.
- Gasterra predominantly delivers this gas at the physical exit points. Shippers cannot redesignate this gas, re-trade it or combine it with gas from other sources. This prevents energy suppliers from optimising their gas sourcing with portfolio management. The TTF virtual marketplace is not an alternative because flexibility is in short supply. Volumes of low-calorific gas needed for seasonal flexibility are still limited, and although there is evidence of more liquid day-ahead trading, there is almost no trading in within-day products.

Competition on the wholesale gas market is still in its early stages. Measures have already been put in place to eliminate some shortcomings, these are the new market model and the market-based balancing system. Both of these are the result of the Gas Letter from the Minister and the underlying TTF advice from the NMa. These measures facilitate a development towards more competition. But for a better functioning market the commitment of all market participants is required. Gasterra, the exclusive marketer of Groningen gas, has a key responsibility here. Energy suppliers should be able to obtain gas on the TTF in the required periods and quantities. Otherwise the development of the wholesale gas market will just be stalled further.
The wholesale electricity market

Competition in the wholesale electricity market has progressed further than in the gas market. Tennet’s balancing system has served as inspiration for the upcoming balancing regime on the gas market, and both day-ahead capacity on the border and day-ahead commodity on the exchange have been available for many years. Positive developments in 2008 were the introduction of netting and intraday capacity on the borders and an increase in liquidity on the APX.

- In September 2008 the TSOs TenneT, RWE, Eon and Elia introduced the principle of netting on the borders with Germany and Belgium. As a result, the available day-ahead capacity for imports and exports is increasing with the size of the nominations of annual and monthly capacity in the opposite direction.
- On the cross-border connections with Germany, market parties can reserve year-ahead, month-ahead and day-ahead capacity. It was previously not possible to respond to changing market conditions on the day of execution itself. But since December 2008 any capacity remaining after the (explicit) daily auction has been made available to the market on an intraday basis. On the border with Belgium, where implicit daily auctions are being held, this has been possible since May 2009.
- The volume of day-ahead trading on the APX electricity exchange has increased by more than 4 TWh to 25 TWh. The diminishing price sensitivity to additional demand indicates a further improvement in liquidity. 50 MW additional demand would result in a price increase of 0.5% (previously 0.9%), and 500 MW additional demand would result in a price increase of 6.1% (previously 14.3%).

The introduction of netting and intraday trading on the borders means that border capacity is being utilised better. Market coupling in particular (the joint auctioning of day-ahead capacity and commodity on the exchange) with Germany and, at a later stage, Norway will help bring about further optimisation. The limited availability of interconnection capacity for the market remains a problem, however, as does the concentrated market structure of the wholesale electricity market.

- All measures aimed at improving the utilisation of the available border capacity (market coupling, netting, intra-day) are of course useful in themselves. But in the light of the physical capacity present on the borders, more capacity needs to be made available to the market. There is evidently such serious congestion on foreign networks in particular that TenneT is reducing the available capacity on the Dutch borders from 7000 MW to 4600 MW.
- Market structure indicators point to an increase in pivotality of one or more market players and also the extent to which players are pivotal has increased. Moreover, judged by the coverage ratio for new investments, the profitability of electricity production has also increased. The profits on inframarginal capacity evidently compensate sufficiently for the negative markup of the marginal power plant. It is a good sign that these profits are translating into large-scale plans for construction of new power plants.

Investment in transmission capacity is the solution to both of these obstacles. Congestion problems must be addressed on a European level, so that investments in domestic networks will also make more border capacity available. A regional investment plan is already on the European agenda. In addition, the market structure will be significantly less concentrated once the new power plants are operational. The necessary network upgrades have a longer lead time than the construction of a power plant, however. In January 2009 the NMa published a vision document containing a guideline for making network capacity less scarce. At the same time congestion management by TenneT should fulfil as many requests for connection as possible.
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1 Introduction

The Netherlands Competition Authority (NMa) has the statutory duty of keeping a watchful eye on the wholesale markets for electricity and gas. The aim of this monitoring is to determine whether competition in these markets is impeded and which measures the NMa and the Minister of Economic Affairs can take to remove these impediments. Because of the relationship between the electricity and gas markets, the similarities in the manner of analysing them, and the desire to achieve efficiency advantages in the monitoring, like last year the analysis of the gas market and that of the electricity market have been combined in a single report.

Method of approach

The monitoring of competition on the wholesale markets consists, roughly, of comparing observed developments with benchmarks. Three main aspects here are:

- Access to and availability of infrastructure;
- Degree of competition among players;
- Degree of liquidity of marketplaces.

Access to essential infrastructure, such as the high voltage network and the high pressure network, form the basis for the creation of competitive energy markets and the development of liquid marketplaces. The infrastructure must, in principle, be accessible to all market parties on terms which not only take sufficient account of the need to earn back the investment costs but also ensure that the decisions on using the infrastructure are made as efficiently as possible. Competitive markets are also characterised by a structure in which market parties are not able to exercise market power and prices are determined by the marginal costs of supply. Liquidity in marketplaces minimises transaction costs and inspires confidence in the market.

In order to determine to what degree the actual market situation has achieved the ideal situation, we use various criteria, depending on the availability of data and/or the possibility of calculating these benchmarks. The criteria we apply are:

- Development over time, both within the year itself and in comparison with the previous year;
- Situations in other countries, in particular countries with which the Netherlands has cross border connections, such as Germany, Belgium and the United Kingdom;
- Deviation from critical values of specific key indicators, such as the RSI, markup and the coverage ratio of investments.

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1 The Electricity Act 1998 (section 5, subsection 3) states (translated): 'The board of the competition authority in exercising the tasks and powers assigned to it on the grounds of this act and the Gas Act takes into account the interest of promoting an electricity market and a gas market that are non-discriminatory and transparent and characterised by actual competition and effective market operation. It keeps a close eye on the degree to which the electricity market and the gas market satisfy the [...] aforementioned interests [...].'

2 If the RSI (Residual Supply Index) is smaller than 1, a player has the possibility of influencing the market outcomes. If the markup is positive, that is a sign of (temporary) allocative inefficiency. If the degree of coverage of investments is greater than 1, it is a sign of (temporary) surplus profits.
Gathering data and information

Based on the general starting points listed above, the monitoring of the wholesale markets consists of gathering and analysing data and information about infrastructure, competition and marketplaces. The aforementioned statutory basis gives the NMa the power to request the necessary data from the market parties. These data requests are partly compulsory; for the rest market parties participate in information gathering on a voluntary basis. In addition to requests to market parties, information is gathered from external sources as well, such as from Platts and TSO Auction (see table).

Gathered data

<table>
<thead>
<tr>
<th>Component</th>
<th>Target group</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas market</td>
<td>GTS</td>
<td>Available, booked and used capacity per hour per type of infrastructure</td>
</tr>
<tr>
<td>Gas storage operators</td>
<td></td>
<td>Characteristics and use of gas storage facilities</td>
</tr>
<tr>
<td>Shippers</td>
<td>Survey on liquidity of marketplaces and transparency in the market</td>
<td></td>
</tr>
<tr>
<td>APX/ENDEX</td>
<td>Prices, volumes and market analyses</td>
<td></td>
</tr>
<tr>
<td>Marketplaces (external)</td>
<td></td>
<td>Prices and volumes</td>
</tr>
<tr>
<td>Electricity market</td>
<td>Tennet</td>
<td>Available, obtained and nominated interconnection (cross border) capacity per hour</td>
</tr>
<tr>
<td>Producers</td>
<td>Production per power plant per hour</td>
<td></td>
</tr>
<tr>
<td>Traders</td>
<td>Survey on liquidity of marketplaces and transparency in the market</td>
<td></td>
</tr>
<tr>
<td>APX/ENDEX</td>
<td>Prices, volumes and market analyses</td>
<td></td>
</tr>
<tr>
<td>Marketplaces (external)</td>
<td></td>
<td>Prices and volumes</td>
</tr>
</tbody>
</table>

In addition to analysing the gathered data, two sounding board sessions were held with the sector to discuss the analyses and the findings.

Structure of the Monitor

The developments in the gas and electricity markets are reported in chapters 2 and 3 respectively. The structure of these chapters is identical. First we examine the efficiency in the use of infrastructure, then the degree of competition on the wholesale market and finally the liquidity of marketplaces.
2 Gas

2.1 Introduction

A properly operating gas wholesale market is essential if suppliers in the retail market are to be able to compete with one another for the customer’s favour.

In purchasing gas energy suppliers have to differentiate themselves from their competitors. If there is little choice in the wholesale market and all energy suppliers conclude contracts with the gas provider(s) on the same terms, competition in the retail market will not flourish. Keen pricing in the retail market can only be expected if suppliers can develop their own purchasing strategy. This calls for a competitive wholesale market with several active providers with a wide range of gas products and related services. Only then will the Dutch energy consumer also be able to benefit from competition in the energy markets.

What does a well-functioning wholesale gas market look like? Because demand for gas is to a large extent dependent on temperature and exhibits peaks in daily consumption, suppliers to end-users must be able to vary their gas supply. An important requirement, therefore, is for suppliers to be able to combine gas from different sources according to these consumption profiles. Gas can be obtained on the national trading hub, by importing from abroad and by using underground storage facilities. On the trading hub, suppliers purchase blocks of gas with different durations (year, month, day etc.) to give shape to their profile. By reserving transmission capacity on the borders for long or short periods, gas can also be obtained from abroad. In addition, underground gas storage facilities are used to accommodate seasonal demand or other variations in consumption. Energy suppliers transport this gas according to the consumption profile from the high-pressure network to the end-user connections.

However, the reality of the wholesale market tells a different story. The Groningen production field meets a significant proportion of the demand for seasonal and short term flexibility (see box on Gas Balancing). The gas trading company Gasterra has the exclusive right to market this Groningen gas. Gasterra delivers most of its gas directly from the source to the end-user connection. These gas supplies match the consumption profile, for which Gasterra generally takes over balancing responsibility from the energy supplier. The unique swing capacity of the Groningen production field makes this flexible supply possible. However, because it is delivered directly at the end-user connections, the gas from Groningen cannot be traded again and also cannot be combined with gas from underground storage facilities, for example. This hinders energy suppliers in their attempts to develop their own purchasing strategy on the gas wholesale market.

Only when market players have sufficient flexibility available themselves and gas is available in all forms and volumes on the TTF marketplace can the gas market be said to be functioning properly. Access to infrastructure, healthy competition and a liquid trading hub are therefore vitally important for achieving a well-functioning gas wholesale market. The market monitor measures the extent of progress in these aspects and identifies any obstacles that stand in the way of further development.
Figure 1: Gas balance: demand for gas (daily totals), 2008

Figure 2: Gas balance: supply of gas (daily totals), 2008
The above box illustrates the variation in the demand for and supply of gas during the course of the year. Producers, trading companies, industrial users and suppliers to end-users are all active in the wholesale gas market. The demand for gas differs from one market party to the next. Industrial users with a 24 hour production process use a constant flow of gas, while suppliers to households are faced with peaks and troughs in gas consumption (figure 1). There are also differences in the gas supply between producers. Gas from the small fields is produced virtually continuously at maximum output, while gas production from the Groningen field varies markedly over time (figure 2). Both figures illustrate the role of underground gas storage facilities. In the winter these facilities supply flexibility to the market, and in the summer they are replenished.

2.2 Infrastructure

2.2.1 Introduction

Access to infrastructure is essential to enable market participants to play an active role in the wholesale gas market. Shippers need transmission capacity, quality conversion capacity and storage capacity. Efficient cross-border trading implies that price signals determine the direction of the gas flows and also that the capacity is fully utilised if there are price differences between countries. This requires an optimal allocation of the available transmission capacity to shippers. In addition to transmission capacity, shippers also need quality conversion and flexibility. Imported high calorific gas has to be converted to low calorific gas for supplying to the retail market. Because of the fluctuating consumption pattern of households in particular, flexibility also needs to be added to the flat import profile. Optimum use of conversion stations and gas storage facilities therefore plays a key role in achieving a properly functioning gas market.

In this chapter on infrastructure we analyse the utilisation of transmission capacity, quality conversion capacity and storage capacity.

2.2.2 Transmission capacity

The Netherlands imports high calorific gas at border points with Germany and Belgium, for which GTS makes firm transmission capacity of more than 38 GW available to the market. The Netherlands exports high calorific gas at border points with Germany, Belgium and the United Kingdom. For this purpose, GTS makes firm capacity of more than 66 GW available to the market. For exports of low calorific gas at border points with Germany and Belgium, more than 87 GW is available.

We illustrate the use of these connections in figures showing the available, booked and used capacity. The utilisation rate indicator tells us how intensively border capacity is being used. If the usage is equal to the available capacity in any given hour, we call this full utilisation. The extent to which there is optimal utilisation of the border capacity is illustrated in figures showing the maximum utilisation on a day (peak usage rate) compared to the price difference on the gas hubs.
The prices on the gas hubs in the Netherlands and neighbouring countries seem to have moved closer in 2008. Compared with previous years big price differences were of shorter duration and prices on one hub were not structurally above or below those of another country.

Figure 3: TTF price compared with gas prices on foreign hubs (expressed as hub/TTF ratio)

In this section we look at the utilisation of the import capacity (high calorific gas) and of the export capacity (high and low calorific gas).³

Utilisation of import capacity

Figure 4: Available, booked and used import capacity of H-gas

³The figures show an aggregation over the countries, and the tables show the border points per country.
The increase in available import capacity was achieved on the border with Germany. Partly as a result of this, the utilisation rate was considerably lower in 2008, but the volume of gas flowing into the Netherlands from abroad was lower in a physical sense as well. Whereas import flows in 2007 regularly reached the capacity limits (physical congestion), this no longer happened in 2008. Full utilisation was not achieved during any hour.

Table 1: Utilisation rate and full utilisation (% of hours) of H-gas import capacity

<table>
<thead>
<tr>
<th>Import capacity of H-gas</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>78%</td>
<td>84%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>Belgium</td>
<td>62%</td>
<td>41%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

As in the previous year, the border capacity with Germany for 2008 was fully booked. GTS allocates the capacity on a first come, first served basis. Bookings are made on a firm basis as long as the capacity permits. Thereafter, bookings are registered on an interruptible basis. Some interruptible capacity was still available in 2008. The following figure shows that the more expensive the gas on the TTF (day-ahead) is in comparison to the German gas hub BEB, the better the import capacity is utilised. And yet the available import capacity is never fully utilised, even when there are significant price differences. Shippers see themselves confronted with a trade-off here: definite gains from arbitrage (since transmission costs are paid when capacity is booked) against more balancing risks because fewer flexibility options remain.

Figure 5: Utilisation rate of import capacity of H-gas NL-DE in relation to price difference TTF-BEB, 2008
Another reason why these opportunities remain unutilised is the inability of market participants that are interested in arbitrage gains to obtain the necessary day-ahead capacity (contractual congestion). In 2008 two initiatives were launched to make short-term capacity available to the market. In February the TSOs GTS and BEB started a platform (EUCABO) on which shippers can book day-ahead interruptible capacity. In May the APX and Trac-X gas exchanges started secondary trading in firm day-ahead capacity. The EUCABO platform is being used to a limited extent; in the secondary market there is evidence of some activity on the German side in particular.

Utilisation of export capacity

Figure 6: Available, booked and used export capacity of H-gas

Exports of high calorific gas only face a certain degree of physical congestion on the border with Belgium; these border points were fully utilised 4% of the time.

Table 2: Utilisation rate and full utilisation (% of hours) of H-gas export capacity

<table>
<thead>
<tr>
<th>Export capacity of H-gas</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilisation rate</td>
<td>41%</td>
<td>44%</td>
<td>48%</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Belgium</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Utilisation rate</td>
<td>42%</td>
<td>59%</td>
<td>58%</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>0%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilisation rate</td>
<td>85%</td>
<td>51%</td>
<td>68%</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Note on the graph: Because of the lack of data on BBL bookings in 2006 and 2007, it has been assumed to be the same as the available capacity (as in 2008). In addition, the increase in available capacity after the commissioning of the BBL (December 2006) coincides with a drop in available capacity on the German and Belgian borders.*
The capacity of the BBL (Balgzand Bacton Line) export connection with the United Kingdom is fully booked for the entire year. At certain times utilisation came in close proximity to capacity limits, but there was usually enough room left to transport more gas. Although the BBL connection is used more intensively on days when TTF prices are lower than those on NBP, many opportunities for arbitrage between the markets remain unused. This indicates contractual congestion on the connection with the United Kingdom.

Figure 7: Utilisation rate of export capacity of H-gas NL-UK in relation to price difference TTF-NBP, 2008

Exports of low calorific gas have a much stronger seasonal pattern than exports of high calorific gas. In that sense, the Netherlands is an exporter of flexibility (figure 8). The capacity on the border with Belgium is fully booked; there is some capacity available on the border with Germany. Physical congestion does not occur in exports of low calorific gas. The utilisation rate also remains stable on both borders.
2.2.3 Quality conversion capacity

Quality conversion enables shippers to convert the gas quality. Quality conversion is essential because end-users take a specific gas quality, namely low calorific gas. Conversion takes place by mixing H-gas with L-gas or adding nitrogen to H-gas. GTS has mixing stations and nitrogen injection stations at a number of locations on the high pressure network. In 2008 the quality conversion capacity averaged more than 34 million KCEs (quality conversion units), 90% of which from nitrogen fixation and 10% from mixing different qualities.
The intake of nitrogen for converting gas from high calorific to low calorific quality fell significantly in 2008. Demand for quality conversion, however, is not decreasing. The reduction in nitrogen fixation is the result of the increasing use of gas swaps. In mid-2008 GTS and Gasterra agreed to make more quality conversion available to the market by swapping high calorific gas for low calorific gas. For many years quality conversion was seen by shippers as a bottleneck in the gas market. The available capacity was fully booked long in advance on a first come, first served basis, while the actual utilisation often showed considerably lower figures. Increased availability of quality conversion made it possible to eliminate booking completely in July 2009.
2.2.4 Storage capacity

Gas storage enables shippers to obtain flexibility. Flexibility in the gas supply is essential because the demand for gas is not constant. Gas consumption varies between seasons, but also from day to day with peaks during the day. In the Netherlands there are two operational gas storage facilities for seasonal flexibility with a working volume of around 45 TWh and a send-out capacity of around 45 GW. The storage capacity of Grijpskerk (H-gas) has 11% third party access; the rest of the capacity at Grijpskerk and all Norg storage capacity (L-gas) is reserved by the operator NAM. This reserved capacity is exclusively allocated to Gasterra. In terms of short term flexibility, more than 11 TWh of working volume and almost 29 GW of send-out capacity is connected to the Dutch high pressure network (excluding the LNG Maasvlakte peak shaver). The operators Essent, Nuon and RWE use these storages for their own purposes without third party access, while the operator TAQA makes 7% of the storage in Alkmaar available for third party access.

Figure 11: Withdrawal and injection of gas storage (load duration curve)

The above figure shows, by way of a load duration curve, how the capacity of gas storage facilities connected to the GTS high pressure network is utilised. Apparent is the higher utilisation of the withdrawal capacity in 2008 compared with previous years. Looking at the annual pattern in the figure below, the seasonal cycle is also much more visible.
The table below shows the average utilisation rate of the withdrawal capacity and the working volume for the period 2006-2008. This calculation takes account of the decrease in capacity resulting from the drop in pressure as more gas is withdrawn. When calculating the utilisation of working volume, the difference between the largest and the smallest quantity of gas present was simply divided by the (theoretical) working volume of the gas storage facilities.

Table 4: Utilisation rate of gas storage facilities (average)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdrawal capacity</td>
<td>5%</td>
<td>12%</td>
<td>20%</td>
</tr>
<tr>
<td>Working volume</td>
<td>27%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The utilisation of gas storage facilities in 2008 was much higher than in previous years. A cycle of emptying and refilling now seems to have occurred for the first time in the seasonal storage facilities. However, this does not mean that the gas storage facilities are now being utilised optimally; from a technical point of view, more than one cycle per annum is achievable in most storage facilities. Also, it is not clear why gas storage facilities have not been used in the same way in previous years. Despite better utilisation, the fact that storage capacity for seasonal flexibility is largely allocated to one party remains a problem.
2.2.5 Conclusion

Physical gas flows between countries are only driven by price signals to a limited extent. Although the border capacity is better utilised when there are bigger price differences, even then some of the capacity remains unused. Market players book capacity generously to ensure flexibility, as a result of which allocation on a first come, first served basis does not result in efficient cross-border trading. Positive developments in 2008 were the availability of day-ahead capacity on an interruptible basis and the creation of a secondary market for day-ahead firm capacity. Particularly important progress was made in the area of quality conversion. On account of the use of gas swaps the capacity of conversion stations now no longer imposes a ceiling on quantities of gas to be converted. This has made it possible to do away with booking quality conversion in advance altogether in July 2009. Furthermore, storage capacity was much better utilised in 2008 than in previous years. The pattern of injection and withdrawal is much closer to the seasonal cycle one would normally expect. Because of the limited third party access to underground storage facilities, this does not alter the dependence faced by energy suppliers in terms of seasonal flexibility in particular.

2.3 Competition

2.3.1 Introduction

On a level playing field the players have access to all the relevant infrastructure on the same terms. With an unequal distribution of capacity, it is not inconceivable that during periods of high market demand one or more players will become pivotal. After all, the gas market is marked by highly fluctuating demand. Households have a clear daily pattern in gas take-up, with peaks in the morning and evening. But much more important is the seasonal component in the demand for gas. On winter days demand is many times higher than it is in the summer. If this pivotality affects a substantial part of the capacity, this can have adverse consequences on market outcomes.

In this chapter on competition we look at the market structure, followed by the market outcomes. We establish whether players are pivotal in the market and what impact this has on market outcomes. A lack of transparency and possible barriers to entry may keep the market concentrated. The Monitor therefore also surveys the opinions of shippers on these aspects of the market structure.
2.3.2 Market structure

Concentration in supply

To gain insight into market structure, the pivotal supplier analysis is often used in economic studies of energy markets. This analysis shows how often a dominant player is pivotal in the market. This gives more information on potential market power than traditional indicators such as market share or the HHI (Hirschman-Herfindahl Index). A high market share (or high HHI) does not necessarily indicate market power if the other players have sufficient capacity to meet the entire demand. In that case the player with the high market share will probably not be able to drive up the price. If at any time the joint capacity of the other players is insufficient to meet the entire market demand, then this market party is pivotal in that hour.

The pivotal supplier index is expressed in the percentage of hours in which one or more players are pivotal. To calculate this index, we need to know the total capacity available to players other than Gasterra and the load per hour for the specific year. Capacity includes production fields, gas storage facilities, imports, interruptible demand and linepack. Capacity and demand (load duration curve) are shown in the following figure. To the left of the point where the demand and the capacity line intersect, these other players are not able to meet the entire demand. In 2008 this was the case in 5,411 hours, or 62% of the time.

Figure 13: Capacity of other players compared with market demand (pivotal supplier analysis)

---

This graph also shows that the extent to which Gasterra is pivotal varies strongly. At peak hours the demand for gas is more than double the capacity available to other players. The extent to which a player is pivotal can be measured with the Residual Supply Index (RSI). The RSI can be defined as: the joint capacity of other players/total load. This indicator is closely related to the Pivotal Supplier Analysis; an RSI value below 1 means that a supplier is pivotal. The more pivotal a player is (a lower RSI), the more freedom it has in terms of pricing. The average Residual Supply Index in 2008 was 0.88.

The following RSI frequency diagram shows that the seasons have a clear impact on the market structure. During the winter the RSI value is close to 0.5, while in the summer it is well above 1. This underlines that pivotality is an issue in winter in particular.

Figure 14: Residual Supply Index (frequency diagram)

![RSI Frequency Diagram]

Table 5: Market structure indicators for PSI (% of hours) and RSI

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivotal Supplier Index</td>
<td>60%</td>
<td>69%</td>
<td>62%</td>
</tr>
<tr>
<td>Residual Supply Index</td>
<td>0.87</td>
<td>0.86</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Transparency and obstacles to entry
The market structure indicators have changed little in recent years (table 5). There have also been no significant shifts in capacity between players. The survey of shippers also reveals that they regard the scarcity in transmission capacity and storage capacity as a significant barrier to entry. Available quality conversion is now seen as much less of a barrier (table 6).
In addition to the scarcity in capacity, a market with poor transparency can deter shippers from participating more in the market. The survey of shippers reveals that information on available storage capacity and on the price of flexibility is insufficiently transparent. The quality and timeliness of balancing information is generally rated as poor (table 7). In view of the upcoming introduction of a new balancing regime, this is cause for concern. Several shippers cite the quality and timeliness of balancing information as the most urgent area for improvement in the gas market.

Table 6: Views of shippers on barriers to enter the gas market

<table>
<thead>
<tr>
<th>Access to gas storage</th>
<th>Low barrier</th>
<th>Average barrier</th>
<th>High barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative procedures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General terms and conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scarcity in storage capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scarcity in transport capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scarcity in Quality conversion capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scarcity of flexibility</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Views of shippers on degree of transparency in the gas market

<table>
<thead>
<tr>
<th>Very bad</th>
<th>Bad</th>
<th>Neutral</th>
<th>Good</th>
<th>Very good</th>
</tr>
</thead>
<tbody>
<tr>
<td>APX-gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endex gas market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTC market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilateral market</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Virtual storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term available Transport capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term available Transport capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term available Quality conversion capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term available Quality conversion capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term available Storage capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term available Storage capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality Steering information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeliness Steering information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality conversion capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.3.3 Market outcomes

In the absence of a marketplace where demand and supply determine the price of gas, the oil price has been used as a reference price for gas. Prices in bilateral gas contracts are indexed to oil prices to a significant extent. These days gas hubs are taking an increasing share of the trading volume. An indicator of market development therefore is whether the prices on the gas hubs are increasingly reflecting demand and supply factors or whether they are still following the oil price.

The past three years provide a changing picture of the level of TTF prices. The average TTF price for day-ahead gas of EUR 25/MWh in 2008 is more than EUR 10 higher than in the previous year.

The following graph shows the gas price, the price of crude oil and the load on the Dutch high pressure network over the period 2006-2008. At first glance the gas price seems to follow the oil price quite closely. But the peaks in the oil price in 2008 are only reflected in the gas price to a limited extent. These high oil prices occurred in the summer, a period in which demand for gas is at its lowest.
Demand and supply factors may be gaining importance on the gas market. Market structure is one of the relevant variables here. We've already noted that the largest player on the market is pivotal during quite many hours (see the residual supply analysis). The question now arises whether this pivotality affects the market outcomes. The correlation between the Residual Supply Index (lowest RSI on daily basis) and TTF prices is shown in the following figure.
In 2008 we see TTF prices moving within a limited bandwidth compared with previous years, but they are at a higher level (see also the frequency diagram). The figure for 2006 and 2007 shows that high TTF prices occur with a low RSI, although it is difficult to identify a general trend in 2008. It is likely that the extremes in the TTF prices were caused among other things by a shortage in the market. To find out more about the relationship between market structure and market outcomes, we carried out an econometric analysis over the period 2006-2008 with more explanatory variables (see box below). This analysis examines the causality and its direction.

### Influence of market structure on market outcomes

In the regression analysis, the TTF day-ahead price (variable to be explained) is related to the RSI, a scarcity index, the temperature, the gas oil price and the coal price (explanatory variables).\(^6\)

#### Table 8: Results of regression analysis of TTF day-ahead, 2006-2008

| TTF      | Coef. | Std. err. | t     | P>|t|   | [95 % Conf. interval] |
|----------|-------|-----------|-------|------|----------------------|
| RSI      | -2.634| 0.300     | -8.770| 0    | -3.222 -2.045        |
| Scarcity | 2.295 | 0.196     | 11.730| 0    | 1.911 2.678          |
| Temperature | -0.188| 0.011     | -17.740| 0   | -0.209 -0.167        |
| Gas oil price | 0.035| 0.001     | 60.690| 0    | 0.034 0.036          |
| Coal price | 0.073| 0.017     | 4.260 | 0    | 0.039 0.106          |
| cons     | 1.500 | 0.497     | 3.020 | 0.003| 0.527 2.473          |

The outcomes show that the signs (coefficient column) for all variables are as expected. Thus, a higher oil price means a higher gas price and a higher temperature means a lower gas price. Furthermore, all statistical relations found are significant (absolute t-value greater than two). Particular attention is drawn to the influence of the market structure on the gas price. The outcome is a negative coefficient for the RSI and the statistical relation found is significant. The effect of pivotality on the gas price is more or less of the same magnitude as the effect of scarcity.

According to this analysis the degree of pivotality affects the level of the gas price. In view of the high correlation between TTF prices and prices on neighbouring gas hubs (BEB, EGT, Zeebrugge and NBP), this result is all the more striking.

### 2.3.4 Conclusion

The gas market is a highly concentrated market. The pivotality of the largest market player appears to be a fact. In 2008 this was the case more than 60% of the time. Barriers to entry keep the market structure concentrated. Shippers see the limited access to storage capacity and flexibility as a significant shortcoming in the gas market. There is too little storage capacity and flexibility available to the market and the information on available capacity and prices is inadequate. This makes it difficult for market participants to play a more active role in the market. Also problems with quality and timeliness of the balancing information

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\(^6\) The RSI is defined as \((\text{total capacity} - \text{capacity of biggest player}) / \text{total load}\). The scarcity index is defined as the inverse of \((\text{total capacity} - \text{total load}) / \text{total capacity}\).
pose obstacles for participation. At the same time, demand and supply factors and therefore market structure seem to play a more defining role in market outcomes. The gas price no longer automatically follows the peaks and troughs in the oil price. High prices as a result of a shortage in the market are then a manifestation of a properly functioning market. But we also note that (the extent of) pivotality in itself is a relevant factor with an impact on market outcomes.

2.4 Marketplaces

2.4.1 Introduction

A liquid gas hub enables shippers to steer their own course. This requires a wide range of products and services with different durations to be available on the gas hub. Blocks of gas of different durations (year, month, etc.) are needed to build up a rough profile. Then if take-up forecasts change, gas can still be purchased or sold. In order to more accurately match the supply to the actual gas take-up, a supply of short-term day-ahead and within-day products on the TTF is crucial.

In this chapter on marketplaces we take a look at the development of liquidity on the TTF. First we discuss traded and delivered volumes on the TTF. Then we look at the liquidity indicators: volatility, spread, resilience and depth. We also make a comparison with neighbouring hubs such as NBP and Zeebrugge.

2.4.2 TTF volumes

In this section we show the development of total traded and delivered volumes on the TTF. We then examine the division of these volumes over gas quality (H-gas or L-gas), time dimension (long-term or short-term products) and marketplace (exchanges, OTC or bilateral).

Figure 18: Traded and delivered volumes on the TTF (monthly totals)
Table 9: Traded and delivered volumes on the TTF (annual totals)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traded volumes (TWh)</td>
<td>201</td>
<td>290</td>
<td>636</td>
</tr>
<tr>
<td>Delivered volumes (TWh)</td>
<td>61</td>
<td>78</td>
<td>196</td>
</tr>
</tbody>
</table>

The traded volume and the delivered volume both more than doubled in 2008. Whereas growth in TTF volumes had to a certain extent stagnated in previous years, trading on the TTF recovered in 2008. Volumes in the first half of 2009 show clearly that the growth of 2008 is not continuing for the time being. This could be related to the drop in demand for gas as a result of the economic downturn. The increasing significance of TTF in the gas market can be seen from the proportion of the total gas flows made up by TTF gas. This increased from 8% in 2007 to 18% in 2008.\(^7\) The churn rate on the TTF, a measure expressing how often delivered gas has been traded, was slightly lower in 2008. This is to be expected given the high growth in the delivered volume. On the other hand, it could also be an indication of possible restrictive conditions imposed on TTF delivery.

Figure 19: Churn on TTF (ratio of traded/delivered) and share of TTF in gas flows

Table 10: Churn on TTF (ratio of traded/delivered) and share of TTF in gas flows

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Churn on TTF</td>
<td>3.3</td>
<td>3.7</td>
<td>3.2</td>
</tr>
<tr>
<td>TTF share</td>
<td>6%</td>
<td>8%</td>
<td>18%</td>
</tr>
</tbody>
</table>

\(^7\) This 18% is the delivered volume on the TTF divided by the total take-up (domestic and border points). When the TTF volume is expressed in domestic take-up, the share works out at 41%. This picture is slightly skewed since gas delivered on the TTF is also exported. A breakdown by small customer would therefore provide more insight. TTF's share of the small customer market (low calorific) is 9%.
Volumes alone do not tell the whole story. It is undoubtedly a positive development that there is considerably more gas available on the TTF. How this gas appears in the product offerings on the TTF is at least as important. Gas quality and the time dimension are relevant issues here. Shippers need low calorific gas to supply the retail segment, particularly households. In addition, the gas must be available in different durations in order to obtain the necessary flexibility.

Figure 20: TTF volumes (delivered) broken down into H-gas and L-gas

Figure 21: TTF volumes (traded) broken down into within-day, prompt and curve
The quantity of delivered L-gas on the TTF increased significantly in 2008. In view of the absence of L-gas on the TTF in 2006 and the limited volume in 2007, this was a necessary development. But these quantities can only provide a small part of the gas needed to supply the retail segment. The fact that the capacity restriction on quality conversion is posing less problems does not mean that all the H-gas can now easily be converted. It is even doubtful whether any TTF gas can be supplied to the households at all because the share of short-term products remains low. This makes it difficult if not impossible for shippers to put together the consumption profile with TTF gas.

Although there is still much scope for improvement in the supply of low calorific gas and short-term products on the TTF, it is a positive sign that shippers are performing comparatively more transactions via the gas exchange and fewer on the bilateral route. In view of the as yet limited extent of these transactions, however, this is no more than a good start.

Figure 22: TTF volumes (traded) broken down into exchanges, OTC market and bilateral contracts

2.4.3 Liquidity on the TTF

The development of liquidity on the TTF can not only be judged from the volume. Relevant indicators of liquidity are volatility of the prices and the bid/offer spread. Volatility is a measure of expressing price fluctuations. Generally speaking, the greater the volatility, the greater the uncertainty surrounding the price. The bid/offer spread provides an indication of the level of transaction costs. The lower the bid/offer spread, the easier it is to arrive at a transaction. In addition, the survey of shippers asked about the number of standard lots that can be traded without affecting the price and how far ahead (days, months, years) shippers trade in products. These liquidity indicators are known as resilience and depth of the market respectively.

* Prompt means day-ahead, weekend, balance of the week, working week + 1 and balance of the month. Curve products include months, quarters, summer/winter, year(s) ahead.
Volatility and spread

Figure 23: Volatility of prices on TTF (monthly contracts)

<table>
<thead>
<tr>
<th>TTF month ahead volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

Note:
- average 2006 = 1.0
- average 2007 = 3.1
- average 2008 = 1.8

Table 11: Volatility of prices on TTF for daily, monthly, annual contracts (annual averages %)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day ahead</td>
<td>5.1</td>
<td>4.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Month ahead</td>
<td>1.8</td>
<td>3.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Year ahead</td>
<td>0.8</td>
<td>1.2</td>
<td>1.3</td>
</tr>
</tbody>
</table>

For day-ahead contracts, the volatility has been developing positively now for three consecutive years. Monthly contracts are back at 2006 levels despite an improvement on last year. It can be seen that the volatility of annual contracts is increasing slightly over the years.
The bid/offer spread for daily, monthly and annual contracts in 2008 was lower than in previous years. As with volatility, the development of the bid/offer spread is most positive in day-ahead contracts. The drop in monthly and annual contracts that occurred in 2007 was reversed.
Resilience and depth of the market

Figure 25: Resilience on the TTF

Resilience has increased for almost all contracts on the TTF. Shippers were asked about the number of standard 30 MW lots they can trade without influencing the price. The large increase in resilience in day-ahead contracts is yet another indication of a more liquid day-ahead market on the TTF.

Figure 26: Depth of the market on the TTF

The depth of the market on the TTF has decreased significantly for monthly and quarterly contracts. Shippers evidently prefer to enter into contracts closer to the delivery date. Uncertainty about price developments is a possible explanation for this.
A comparison with the gas hubs in neighbouring countries reveals that with the exception of the spread in Germany, the volatility and bid/offer spread on the TTF in 2008 was more or less comparable.

Figure 27: International comparison of price volatility (monthly contracts)

Figure 28: International comparison of bid/offer spread (monthly contracts)
2.4.4 Conclusion

Traded and delivered volumes on the TTF increased substantially in 2008. This is a major boost for the gas market. Gas is also being increasingly traded on APX and ENDEX, an indication of more confidence in pricing on the gas exchanges. However, the share of low calorific gas remains limited and there has been virtually no improvement in the supply of within-day products. This implies that the TTF offers the industrial segment (H-gas) genuine opportunities for sourcing, although it is not yet a viable alternative for the retail segment serving households. Nonetheless, it is clear that the TTF is developing into a more liquid gas hub. Particularly in the case of day-ahead contracts, the liquidity indicators (volatility, bid/offer spread and resilience) point to a positive development.

2.5 Final remarks

Competition in the wholesale gas market is to a large extent being frustrated by the limited access to flexibility. A small number of underground storage facilities for seasonal flexibility has been opened to third parties, and short-term flexibility, particularly within-day, is hardly available on the TTF. This makes it difficult if not impossible for providers to put together the required take-off profile of their customers. These energy suppliers will therefore not manage to differentiate themselves from competitors in the retail market on the basis of their purchasing strategy. The introduction of the new market model will probably only have a slight impact on this. Providers who have their own gas storage facilities have more opportunities for portfolio optimisation, but with the new balancing regime there are also calls to offer this flexibility on the bid ladder. One complicating factor is the relatively limited capacity of Dutch gas storage facilities. Because of the swing production in the Groningen field, there were virtually no incentives to invest in underground storage facilities. Therefore, competition in the Dutch gas market would benefit from more flexibility being offered on the TTF. As the exclusive marketer of Groningen gas, Gasterra plays a key role in the transition to a more competitive market.
3 Electricity

3.1 Introduction

As with gas, a properly operating electricity wholesale market is essential if suppliers in the retail market are to compete with one another for the customer’s favour.

A fundamental characteristic of the electricity market is that consumption and production must be balanced at all times. Unlike gas, however, there is no buffer capacity in the electricity network, and there is as yet no way to store electricity on a large scale. On the other hand, temperature only plays a minor role in the demand for electricity, so days and seasons only differ slightly. Like gas, however, electricity is subject to a daily take-up pattern. The demand for electricity differs from hour to hour, which implies the production at power plants also varies throughout the day.

What does a well-functioning wholesale electricity market look like? Because production needs to equal consumption, it is important that energy suppliers are able to meet the demand for electricity from hour to hour. Suppliers can build up this consumption profile with electricity blocks of various durations (for instance month, day, hour). Suppliers buy these blocks of electricity through several different channels. They can obtain it straight from the producer, through a broker or on the electricity exchange. Market participants can also reserve transmission capacity on the borders for long or short periods in order to import from abroad. Access to transmission capacity and liquid marketplaces are therefore essential elements in the wholesale electricity market. Smart purchasing on (inter)national marketplaces should enable energy suppliers to provide end-users with a competitive offering.

In practice, suppliers have good opportunities to obtain the necessary blocks of electricity. Besides bilateral agreements or OTC (over the counter), suppliers can obtain forward contracts on the ENDEX futures market. Capacity is also auctioned on an annual and monthly basis at cross-border connections. Since the demand for electricity changes hour by hour, the short term is also very relevant. Suppliers can obtain short-term blocks on the APX day-ahead market, where electricity for every hour of the next day is traded. Moreover day-ahead border capacity is also auctioned on an hourly basis. Compared to the gas market, where the commodity is traded mainly in forward contracts and where border capacity is allocated on a first come, first served basis, the wholesale electricity market is much further developed. But the electricity market is dominated by a few major producers, many of whom are vertically integrated with large suppliers to the retail market. It is therefore very important for energy suppliers with little or no production capacity to be able to trust pricing on the wholesale market, otherwise they will not succeed in differentiating themselves from their competitors in the retail market.

Access to infrastructure, healthy competition and liquid marketplaces are therefore vitally important for achieving a well-functioning wholesale electricity market. The market monitor measures the extent of progress in these aspects and identifies any obstacles that stand in the way of further development.
3.2 Infrastructure

3.2.1 Introduction

Cross-border trading in electricity has a positive impact on competition in the Dutch wholesale electricity market. During peak hours shortages on the Dutch market can exert upward pressure on prices. Imports of cheap electricity from abroad then have a disciplining effect. Cross-border trading can furthermore lead to more efficient electricity generation when generation costs vary from country to country (at a particular time).

In this section we look at the utilisation of interconnection capacity (imports and exports) with Belgium, Germany and Norway respectively.

3.2.2 Interconnection capacity

The Netherlands has cross-border connections with Belgium, Germany and Norway. TenneT makes 1400 MW of capacity available to the market on the border with Belgium, 2500 MW on the border with Germany and 700 MW on the border with Norway. For these borders, EnTSO-E reports an NTC (net transfer capacity) of 2300 MW with Belgium, 4000 MW with Germany and 700 MW with Norway. It is not clear why considerably less capacity is available on the Dutch borders in practice.

We illustrate usage of these interconnections with figures showing the available, obtained and nominated capacity. The utilisation rate indicator shows how intensively an interconnector is being used. If the nominations are equal to the available capacity in any given hour, we call this full utilisation.

Cross-border trade is regarded as efficient if relative prices determine the flow direction of electricity and the available capacity is fully utilised when there are price differences between countries. So if electricity is being traded at a lower price on a foreign electricity exchange, it would make sense to use the full capacity to import cheap electricity. The extent to which there is optimal utilisation of interconnection capacity is illustrated in figures that compare (on hourly basis) the utilisation rate with the price difference on the exchanges.

Electricity prices in the Netherlands, Belgium and Germany follow one another reasonably closely, but they can also differ quite considerably. The general picture for 2008 is that exchange prices in the Netherlands are lower than in Belgium but higher than in Germany. The price of electricity in Norway is clearly lower than in the Netherlands.
In the rest of this section we look at the utilisation of the import and export capacities of Belgium, Germany and Norway respectively.

Belgium

Figure 30: Utilisation of import capacity from Belgium (daily average MWh)
Table 13: Utilisation rate and full utilisation (% hours) of import capacity from Belgium

<table>
<thead>
<tr>
<th>Imports from Belgium</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation rate</td>
<td>55</td>
<td>25</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>22</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 31: Utilisation of export capacity to Belgium (daily average MWh)

Table 14: Utilisation rate and full utilisation (% hours) of export capacity to Belgium

<table>
<thead>
<tr>
<th>Exports to Belgium</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation rate</td>
<td>22</td>
<td>38</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

The interconnection capacity with Belgium was used less intensively for imports and more intensively for exports in 2008. In that year electricity was often traded at a lower price on the APX than on Belpex, the Belgian exchange. As a result, physical congestion on import capacity is now less of a problem (down from 22% to 6% of hours). In fact, export capacity was fully utilised more often than import capacity in 2008.

The trilateral market coupling with Belgium and France ensures optimal day-ahead trading on the borders. Because the APX, Belpex and Powernext trading systems are connected to each other, the electricity always flows in the right direction. As long as there is free border capacity, the exchange prices will be identical. APX, Belpex and Powernext prices will start to diverge as soon as the border capacity forms a restriction to the exchange of electricity (in other words full utilisation). The figure below, in which the utilisation rate is compared with the price difference, shows that in those hours nominations are in fact still being made for annual and monthly capacity in the opposite direction. With the introduction of netting in September 2008, this capacity is made available for day-ahead trading. From that moment the full border capacity is utilised in the right direction in the event of price differences between APX and Belpex.
Figure 32: Utilisation rate of NL-BE interconnection in relation to price difference APX-Belpex, 2008

Figure 33: Utilisation of import capacity from Germany (daily average MWh)

Table 15: Utilisation rate and full utilisation (% hours) of import capacity from Germany

<table>
<thead>
<tr>
<th>Imports from Germany</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation rate</td>
<td>80</td>
<td>81</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>
Utilisation of the border capacity with Germany is on a similar level to last year. The utilisation rate of both import and export capacity has remained more or less the same. At 12% of hours, the physical congestion in import capacity increased slightly in 2008. The introduction of netting on the border with Germany in September 2008 is reflected in the additional booking of export capacity. Since December 2008 it has also been possible to obtain intra-day capacity on the border with Germany. This has enabled players to respond to changing market conditions on the day of execution.

Day-ahead capacity is still being auctioned explicitly on the border with Germany. Market coupling is now scheduled to start in the spring of 2010. Until then, players will have to purchase the commodity and the capacity separately. Coordination is complicated by the fact that the auction for day-ahead capacity closes before the prices on the electricity exchanges are known. As can be seen in the figure below, therefore, the interconnection capacity with Germany is not being optimally utilised. When APX prices are higher the import capacity is often not fully utilised, and when APX prices are lower the Netherlands sometimes continues to import electricity.

---

**Table 16: Utilisation rate and full utilisation (% hours) of export capacity to Germany**

<table>
<thead>
<tr>
<th>Exports to Germany</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation rate</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Full utilisation</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

---
Figure 35: Utilisation rate of NL-DE interconnection in relation to price difference APX-EEX, 2008

Norway

Figure 36: Utilisation of import capacity from Norway (daily average MWh)

Table 17: Utilisation rate and full utilisation (% hours) of import capacity from Norway

<table>
<thead>
<tr>
<th>Imports from Norway</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation rate</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Full utilisation</td>
<td></td>
<td>94</td>
</tr>
</tbody>
</table>
The NorNed cable between the Netherlands and Norway started operation in May 2008. Day-ahead capacity is auctioned explicitly on this connection. The figures show that the cable is mainly used to import electricity from Norway. It is clear from the utilisation rate that this connection was necessary. The utilisation rate of the available import capacity is 97%, and for export capacity 75%. These figures are calculated on the actual available capacity. Ramping constraints imposed by the Norwegian TSO for reasons of system integrity mean that the 700 MW of the NorNed cable is not always available. Ramping takes place in two stages (from 0 to 300 MW and from 300 to 700 MW and back), so it is also not possible to reverse the direction of the flow at once.

Right from the start the intention was to create market coupling between the Netherlands and Norway on the NorNed cable. On account of certain obstacles, including different gate closure times on the APX and NordPool, this has not yet happened. Although the available capacity on the NorNed cable is being well used, the figure below shows that it is by no means being used optimally. In view of the electricity prices at both ends of the cable, the electricity regularly flows in the opposite direction. This is partly the result of the ramping constraints mentioned above. With market coupling, however, the capacity should at least no longer be utilised entirely in the opposite direction.

Table 18: Utilisation rate and full utilisation (% hours) of export capacity to Norway

<table>
<thead>
<tr>
<th>Export to Norway</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation rate</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Full utilisation</td>
<td></td>
<td>46</td>
</tr>
</tbody>
</table>
We measure the efficiency of cross-border trading by plotting the use of the capacity against price differences between countries. The greater the price difference, the more desirable it is to make optimal use of capacity. This concerns both the direction of the flow of electricity and the utilisation rate of the capacity. The efficiency of cross-border trading is measured with the cross border efficiency indicator\(^9\). On the connections between Belgium and the Netherlands this is close to 1. Market coupling is responsible for this high score. Because market coupling has not yet been achieved between Germany and the Netherlands, the cross border efficiency of these border connections is quite a bit lower. The capacity that is made available on the connection between Norway and the Netherlands is almost always fully utilised, so cross-border trading is highly efficient.

<table>
<thead>
<tr>
<th>Country Pair</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium – Netherlands</td>
<td>0.97</td>
<td>0.96</td>
</tr>
<tr>
<td>Germany – Netherlands</td>
<td>0.53</td>
<td>0.54</td>
</tr>
<tr>
<td>Norway – Netherlands</td>
<td></td>
<td>0.94</td>
</tr>
</tbody>
</table>

\(^9\) This indicator has a maximum of 1. The efficient part of cross-border trade (price difference multiplied by utilised capacity) is divided by the total (including the unused capacity when there’s a favourable price difference and capacity used in the wrong flow direction).
Market integration

Border capacity ensures that the Dutch electricity market is connected to neighbouring countries. Therefore, it would be logical to ask the question: to what extent are markets integrated by now?

In figure 29 we saw that prices in the Netherlands, Belgium and Germany follow one another reasonably closely, but also that they differ quite considerably in some periods. The price level in Norway is usually lower than those in the other countries. By using a Principal Component Analysis (PCA) we can ascertain which part of the movements in prices is driven by a common price pattern. We have performed this analysis for the region comprising the Netherlands, France and Germany. We find that this common price pattern explains 82% of the price movements. If we also include Norway in this analysis, this principal component amounts to 70%.

Table 20: Common price pattern (PCA) for the Netherlands and neighbouring countries

<table>
<thead>
<tr>
<th></th>
<th>NL, FR, DE region</th>
<th>NL, NO, DE, FR region</th>
</tr>
</thead>
<tbody>
<tr>
<td>All hours</td>
<td>0.82</td>
<td>0.70</td>
</tr>
<tr>
<td>Peak hours</td>
<td>0.79</td>
<td>0.68</td>
</tr>
<tr>
<td>Non-peak hours</td>
<td>0.88</td>
<td>0.78</td>
</tr>
</tbody>
</table>

This analysis can also be performed for several successive periods. This makes it possible to examine the impact of measures designed to promote market integration, such as the introduction of trilateral market coupling (21 November 2006) or the start of the NorNed cable (6 May 2008). The following tables show the results of this analysis.

Table 21: Impact of introduction of trilateral market coupling (NL, FR, DE region) according to PCA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All hours</td>
<td>0.72</td>
<td>0.83</td>
</tr>
<tr>
<td>Peak hours</td>
<td>0.78</td>
<td>0.79</td>
</tr>
<tr>
<td>Non-peak hours</td>
<td>0.86</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Table 22: Impact of start of NorNed cable (NL, NO, DE, FR region) according to PCA

<table>
<thead>
<tr>
<th>Commissioning of NorNed</th>
<th>01/01/2006 to 06/05/2008</th>
<th>06/05/2008 to 11/06/2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>All hours</td>
<td>0.62</td>
<td>0.77</td>
</tr>
<tr>
<td>Peak hours</td>
<td>0.59</td>
<td>0.76</td>
</tr>
<tr>
<td>Non-peak hours</td>
<td>0.68</td>
<td>0.77</td>
</tr>
</tbody>
</table>

The principal component analysis shows that trilateral market coupling and the NorNed cable have both promoted further market integration. Also the PCA shows that both have done so to a considerable extent. TLC has added another 11% to the common price pattern and through NorNed an additional 15% of prices are now driven by a common pattern. The analysis therefore also suggests that NorNed’s contribution to market integration is even greater than that of trilateral market coupling for the specific regions defined.
3.2.3 Conclusion

Transmission capacity on the borders is allocated in various ways. On the border with Germany and Norway, day-ahead capacity is auctioned explicitly, and on the border with Belgium (and France) day-ahead capacity is auctioned implicitly on the electricity exchange. Depending on the auctioning method, cross-border trading is efficient to a more or lesser extent. Market coupling ensures optimal utilisation of day-ahead capacity. As a result of the introduction of netting in 2008, more capacity is now available for day-ahead, which enables the connections with Belgium to be even better utilised. Optimal utilisation has clearly not yet been achieved on the border connections with Germany and Norway. When prices differ significantly, the capacity is not fully utilised and electricity regularly flows in the wrong direction. Market coupling with Germany and Norway will represent a major step forward. Furthermore, it is still surprising that TenneT makes about 4600 MW of capacity available in total, while Entso-E puts the figure at 7000 MW for the Dutch border connections.

3.3 Competition

3.3.1 Introduction

The demand for electricity changes from hour to hour and is relatively price-inelastic. In terms of the supply of electricity, the ascending merit order (industry cost curve) is a key feature. This means that the marginal costs of electricity production, and, in a competitive market, the price, will be higher when demand is higher. The extent of the price increase is determined by the shape of the merit order, but the market structure could also be a relevant factor. Concentration on the supply side can make individual producers pivotal during peak hours. This results in additional upward pressure on prices, which has an adverse effect on market outcomes: the further the price rises above the marginal production cost, the less efficient the market outcomes are.

In this section we take a look at the market structure followed by the market outcomes. In our discussion of the market structure we examine concentration on the supply side (pivotal supplier), transparency of the market, and the cost structure of the sector. With regard to market outcomes we calculate the markup (the difference between the price and the marginal system costs) and analyse the relationship between markup and pivotality (market structure).

3.3.2 Market structure

Concentration in the supply

In our assessment of the market structure, the key issue is whether certain players are able to influence market outcomes. The opportunity to exercise market power is determined by the degree to which these players are pivotal in meeting market demand. Indicators that measure this pivotality are the Pivotal Supplier Index (PSI) and the Residual Supply Index (RSI).

The PSI shows for what percentage of the hours some or all of an electricity producer’s capacity is needed in order to meet the market demand given the joint capacity of the other producers. In 2008 there were one or more pivotal suppliers during 79% of peak hours. This percentage is once again higher than the previous
year. The increase in export demand is to a large extent responsible for this. As prices in the Netherlands are often lower, the Netherlands has been exporting more to Belgium and France. As a result the shortage in the market has increased, as has the pivotality of certain players. The number of pivotal players has remained more or less the same as in 2007.

Figure 39: Number of pivotal players, peak hours (daily average)

The RSI indicates the degree to which market parties are pivotal. If the RSI is less than 1, the market player concerned is pivotal. The further the RSI drops below 1, the more capacity of this player is needed to satisfy demand. This therefore increases the scope for this player to influence market outcomes. By taking the lowest of the RSI values for each player, we obtain the RSI for the sector. In 2008 the RSI averaged 0.9 during peak hours. This RSI is lower than in previous years. The extent to which one or more players are pivotal during peak hours has therefore increased.

Figure 40: RSI at sector level, peak hours (frequency)
Table 23: Market structure PSI (% hours) and RSI sector level, peak hours

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivotal Supplier Index</td>
<td>62%</td>
<td>72%</td>
<td>79%</td>
</tr>
<tr>
<td>Residual Supply Index</td>
<td>0.98</td>
<td>0.94</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Transparency in the market

A lack of transparency in the market can cause a concentrated market structure to persist. In the liquidity survey we asked traders for their views on the information provision on demand, generation, transmission and marketplaces.

The liquidity survey shows that traders were more satisfied with the provision of information on transmission (both domestic and cross-border) in 2008. According to the traders, transparency is improving on all aspects of transmission (see table 24). Traders are most dissatisfied with transparency in respect of generation. They find that there is too little information on the available production capacity (ex-ante) and on the actual production figures (ex-post). Traders have become more dissatisfied with transparency on the OTC marketplace. They report that there is a shortage of price information and that it is not clear how many parties are in the market. Transparency therefore needs to be increased in the areas of generation and OTC trading in particular.

Table 24: Views of traders on degree of transparency in electricity market
Cost structure of the industry
In a competitive market the price level of electricity is determined to a significant extent by the (marginal) cost of generation. The cost per MW produced depends on the efficiency of the power plant and on fuel prices. In 2008 the prices of gas, coal and CO$_2$ emission allowances (start of new period) were higher than in previous years.

Figure 41: Fuel prices of gas, coal, CO$_2$

![Graph showing fuel prices of gas, coal, CO$_2$ over 2006-2008](image)

This increase in production costs means that the cost curve for the sector as a whole is on a higher level. The merit order for the Netherlands also indicates this. In the merit order the Dutch generation park is ranked according to the level of marginal production costs. Due to the inelastic demand for electricity, the merit order gives an indication of the competitive price level. Also, individual producers become more pivotal the closer the demand gets to the capacity limits.

Figure 42: Merit order of sector (average per annum)

![Graph showing merit order of sector 2006-2008](image)

source: NMa (2008)
3.3.3 Market outcomes

Averaged over all hours, the market outcomes in 2008 are characterised by higher electricity prices and higher profits than in 2007, with prices for gas, coal and CO$_2$ emission allowance also at a higher level.

The average APX price during peak hours increased from EUR 58/MWh in 2007 to EUR 89/MWh in 2008. The following figure shows the development of APX day-ahead prices and prices for OTC month-ahead and quarter-ahead products.

![Figure 43: Electricity prices APX and OTC, peak hours](image)

One important indicator of competition is the markup. This measures the difference between the APX price and the marginal system costs, expressed as a percentage of the marginal system costs. In 2008 the average markup was -9% during peak hours. Compared with 2007, the average markup is lower. The following frequency diagram (figure 44) also shows that the variation in markups has decreased.

The interpretation of negative markups must be sought in dynamic restrictions which prevent the dispatch of power plants to be fully coordinated with the development of hourly APX prices. Also the market conditions on the day itself, which can be read from the imbalance prices, can explain a dispatch of power plants which, in relation to APX prices, seems less logical. A calculation of the markup with imbalance prices gives a positive markup of almost 2% on average during peak hours in 2008.
Conduct of electricity producers

An important indication of market outcomes is the markup. This gives the difference between the electricity price and the marginal costs of the most expensive power plant. If this power plant is also the marginal power plant under optimal dispatch, then the markup analysis is sufficient. Strategic behaviour to drive up prices can also present itself by an inefficient dispatch of power plants. With inefficient dispatch, the marginal power plant moves up one or more positions in the merit order, so the marginal system costs increase. This results in a higher electricity price which, in turn, increases the margins on the inframarginal power plants.

The dispatch inefficiency indicator indicates how much more expensive the production of a unit of electricity by the actual marginal power plant is compared with the marginal power plant in an optimal dispatch scenario.

Observed inefficiencies on the individual portfolio level may be ascribed to missing information on factors that determine the optimal dispatch of power plants. After all, we may assume that players will use their own portfolio as efficiently as possible. If a player wants to withhold capacity in order to influence market outcomes, then that will be capacity at the margin, that is to say, the most expensive capacity that, given the demand, could be operating. If, in reaction to this, another player offers a more expensive plant, then this will lead to higher system marginal costs at the sector level. Insofar as strategic behaviour is manifested in dispatch inefficiency, it is therefore at the sector level.

Table 25: Dispatch inefficiency at sector level and at portfolio level, peak hours in 2008

<table>
<thead>
<tr>
<th></th>
<th>Average dispatch inefficiency (%)</th>
<th>Standard error</th>
<th>95% confidence interval</th>
<th>T test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>34</td>
<td>0.6</td>
<td>33.2</td>
<td>35.5</td>
</tr>
<tr>
<td>Producer 1</td>
<td>10</td>
<td>0.2</td>
<td>9.9</td>
<td>10.7</td>
</tr>
<tr>
<td>Producer 2</td>
<td>11</td>
<td>0.4</td>
<td>10.4</td>
<td>11.9</td>
</tr>
<tr>
<td>Producer 3</td>
<td>13</td>
<td>0.4</td>
<td>12.6</td>
<td>14.3</td>
</tr>
<tr>
<td>Producer 4</td>
<td>2</td>
<td>0.4</td>
<td>1.3</td>
<td>3.1</td>
</tr>
</tbody>
</table>

The table above compares the dispatch inefficiency of the sector with the dispatch inefficiency within the individual portfolios. This comparison reveals that the dispatch inefficiency of the sector is significantly higher than that of the individual players. This may be a sign of strategic behaviour in the dispatch of power plants. Higher dispatch inefficiency at the sector level, however, can also be caused by market imperfections in the marketplaces. Contractual obligations in relation to purchasing fuel or selling electricity can result in a player dispatching relatively expensive power plants while other players are not using cheaper ones.
The level of the markup is closely related to the market structure. The following figure shows that high markups occur almost exclusively when the RSI is less than 1.

In an econometric analysis we related the markup to several explanatory variables. We use this analysis to test the causality and its direction. In addition to the RSI a scarcity index has also been included. This enables us to establish whether high markups are caused by shortages in the market or whether pivotality has an impact in itself. This econometric analysis (see box) confirms that pivotality is a relevant factor for the level of the markup.
Influence of market structure on market outcomes

In the regression analysis, the markup (variable to be explained) is related to the RSI at sector level, the scarcity index and the gas, coal and CO\textsubscript{2} prices (explanatory variables).

| Markup     | Coef. | Std. err. | t     | P>|t| | [95% conf. interval] |
|------------|-------|-----------|-------|------|-----------------------|
| RSI        | -0.386| 0.007     | -56.4 | 0    | -0.399 -0.372         |
| Scarcity   | 0.855 | 0.001     | 67.4  | 0    | 0.083 0.088           |
| Gas price  | -0.012| 0.001     | -24.17| 0    | -0.013 -0.011         |
| Coal price | 0.008 | 0.001     | 6.43  | 0    | 0.006 0.011           |
| CO\textsubscript{2} price | 0.008 | 0.000 | 19.37| 0    | 0.007 0.009          |
| cons       | -0.153| 0.016     | -9.67 | 0    | -0.184 -0.122         |

There is a statistically significant relation between the markup on the one hand and scarcity and the pivotality of players on the other. The greater the scarcity on the market, that is to say, the less unutilised capacity there is, the higher the markup. Despite the close correlation between scarcity and pivotality, the pivotality of players also evidently has its own impact the markup. The greater the pivotality, that is to say, the lower the RSI, the higher the markup. Further analysis shows us that the impact of RSI on the markup is roughly the same as that of scarcity.

Despite the average negative markup for the marginal power plant, the profitability of electricity generation is positive. Power plants lower in the merit order generate more than enough revenues to cover the fixed cost of new power plants. The annual profit per MW for all (major) players is double or more than double the annual costs of a new power plant. The investment plans in new production capacity confirm this picture. Planned new power plants cover more than half of the current installed capacity.\textsuperscript{10}

Figure 46: Coverage ratio (ratio of profit to investment costs)

\textsuperscript{10} According to the Tennet Security of Supply Monitoring Report for 2009, 18.5 GW of new large-scale thermal capacity by 2016, with 2.3 GW being preserved and shut down (16.2 GW net). The size of the current production system is 22 GW.
Table 27: Market outcome indicators markup (peak hours) and coverage ratio (annual average)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markup</td>
<td>0%</td>
<td>7%</td>
<td>-9%</td>
</tr>
<tr>
<td>Coverage ratio</td>
<td>2.8</td>
<td>2.0</td>
<td>2.2</td>
</tr>
</tbody>
</table>

3.3.4 Conclusion

The market structure indicators PSI and RSI indicate a deterioration in the structure of the wholesale electricity market. Individual producers are more frequently pivotal, and the degree of pivotality has increased. To a large extent, this development is the result of the increase in export demand. In addition, the costs of all fuels (gas, coal, CO₂ emissions) have risen so the industry cost curve (merit order) is at a higher level. With higher demand and higher costs, electricity prices in 2008 are above those of the previous year. In contrast, markups have dropped. This is partly the result of higher marginal system costs (or to put it differently: a steeper merit order) which also explains the positive coverage ratio. At the same time, the correlation between markup and pivotality has not disappeared. In 2008 as well, it is evident that the more pivotal a producer is, the higher the markup.

3.4 Marketplaces

3.4.1 Introduction

This section analyses the development of liquidity on the various marketplaces. In a liquid market standard transactions can generally be carried out quickly and a high volume can be traded per transaction without having an appreciable effect on the price. Liquidity minimises the transaction costs and inspires confidence among market parties. This in turn draws more parties to the market, improving the liquidity further.

Growing trading volumes and decreasing price sensitivity to additional demand are signs of improved liquidity on the APX electricity exchange. Less volatile prices and a lower bid/offr spread are indications of better liquidity on the OTC market. In this section we will discuss trading on the APX spot market followed by trading in OTC forward contracts.

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11 The average of the degree of coverage per player. The degree of coverage is the relationship between the annual profit per MW and the annual costs per MW of an investment in a new power plant. This is based on the following assumptions: investment amount of EUR 1 million, discount rate of 7% and investment term 25 years.
3.4.2 Trading on the APX spot market

APX is a marketplace for trading in day-ahead contracts for every hour of the following day. In addition to day-ahead trading, intraday contracts can also be traded on the APX. This is still done to a limited extent.

The total traded volume on the day-ahead market in 2008 increased by more than 4 TWh to 24.8 TWh on an annual basis.

Figure 47: Traded volume on APX (annual totals)

<table>
<thead>
<tr>
<th>Year</th>
<th>Traded Volume (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>19.2</td>
</tr>
<tr>
<td>2007</td>
<td>20.7</td>
</tr>
<tr>
<td>2008</td>
<td>24.8</td>
</tr>
</tbody>
</table>

On the day-ahead exchanges in Germany (EEX) and France (Powernext) the volumes also increased further in 2008. In view of the size of the national electricity market, APX volumes are relatively high compared with France, but volume development lags behind that of Germany.
The price sensitivity indicator illustrates the extent to which additional demand results in price increases. Specifically this concerns the supply that is in the market but has not been drawn on. Simulations of additional demand bids on the APX day-ahead market deliver the following outcomes. Price sensitivity to additional demand decreased further in 2008. 50 MW additional demand would on average result in a price increase of 0.5% (previously 0.9%), and 500 MW additional demand would result in a price increase of 6.1% (previously 14.3%). This indicates that liquidity on the APX improved further in 2008.
Intraday trading on the APX is still limited. If necessary, market participants will often adjust the balance position on the day themselves with their own power plants or bilateral contracts. Tennet settles the remaining imbalance against imbalance prices. This price is arrived at through a bid ladder whereby as much electricity is called off as necessary. Imbalance prices are generally lower on average than APX day-ahead prices but have more and larger extremes at times of shortage in the market. The following figure shows that in these instances imbalance prices in 2008 compared with previous years are clearly higher than APX prices.
3.4.3 Trading in OTC forward contracts

Standardised forward contracts are traded on the ENDEX futures market or on the OTC market via brokers.

ENDEX volumes

After a drop in 2007, the total traded volume on ENDEX increased again in 2008. Most of this increase was on the futures exchange where the volume increased by almost 50% compared with 2007.
Table 30: Traded and cleared volumes on ENDEX (annual totals)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traded volume (TWh)</td>
<td>32.1</td>
<td>28.0</td>
<td>41.2</td>
</tr>
<tr>
<td>Cleared volume (TWh)</td>
<td>99.2</td>
<td>73.0</td>
<td>77.5</td>
</tr>
</tbody>
</table>

Volatility and spread on OTC market

Relevant indicators of liquidity on the OTC market are volatility in prices and the spread between bid and offer prices. Volatility is a measure of expressing price fluctuations. Generally speaking, the greater the volatility, the greater the uncertainty surrounding the price. The bid/offer spread provides an indication of the level of the transaction costs. The lower the bid/offer spread, the easier it is to arrive at a transaction.

Figure 53: Price volatility on OTC monthly contracts, peak hours

Table 31: Price volatility on OTC monthly, quarterly, annual contracts, (annual average %)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month ahead (peak)</td>
<td>2.4</td>
<td>3.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Quarter ahead (peak)</td>
<td>3.1</td>
<td>1.9</td>
<td>1.6</td>
</tr>
<tr>
<td>Year ahead (base)</td>
<td>0.8</td>
<td>0.7</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Figure 54: Bid/offer spread on OTC monthly contracts, peak hours

Table 32: Bid-offer spread on OTC monthly, quarterly, annual contracts, (% annual average)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month ahead (peak)</td>
<td>3.5</td>
<td>2.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Quarter ahead (peak)</td>
<td>3.4</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Year ahead (base)</td>
<td>0.9</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

It is difficult to obtain a clear picture from the development of the volatility and the bid-offer spread over the period 2006-2008. With regard to volatility there is evidence of improvement year on year in quarterly contracts only, while in terms of the bid-offer spread only monthly contracts are improving. The volatility of the bid-offer spread is deteriorating once more for other contracts. However, these indicators do indicate a slight improvement in the liquidity of the Dutch OTC market across the board in 2008.
A comparison with the OTC markets in Germany and France reveals that volatility is comparable in these markets but that there is a significantly higher bid/offer spread in the Netherlands. Although this has been decreasing in recent years, transaction costs on the Dutch OTC market are clearly higher than in neighbouring countries.

Figure 55: International comparison of price volatility OTC monthly contracts, peak hours

Figure 56: International comparison of bid/offer spread OTC monthly contracts, peak hours
3.4.4 Conclusion

Liquidity on the APX electricity exchange increased in 2008. The volume of day-ahead trading increased by more than 4 TWh to 25 TWh. The diminishing price sensitivity to additional demand also indicates an improvement in liquidity. 500 MW additional demand should result in a price increase of 6.1% (previously 14.3%). On the forward market the improvement in liquidity is less evident. After last year’s downswing, ENDEX volumes have increased again, and the share of the futures exchange has also increased. Total volumes and the futures share have been higher in previous years. The picture on the broker market differs depending on the term of OTC contracts. On the whole, there seems to be a slight improvement. The bid/offer spread remains high compared with other countries, however.

3.5 Final remarks

Impediments to competition in the wholesale electricity market mainly occur in the utilisation of infrastructure and the concentrated market structure. Because the existing infrastructure is not being optimally utilised, the Dutch wholesale market remains partly shielded from competitive pressure from abroad. Partly on account of increased export demand from Belgium and France, electricity producers in the Netherlands were more often pivotal in 2008. The extent to which these producers were pivotal also increased further. This is an adverse development for energy suppliers who do not have their own production capacity and who are dependent on the wholesale market for purchasing electricity. Measures aimed at better utilisation of the transmission capacity on the borders intensify the competitive pressure on the Dutch wholesale market. Market coupling with Germany and Norway, scheduled for 2010, means that the available capacity will be utilised better. Coordinating the network investments at a regional level could also make more physical capacity available. The announced investments in new power plants should also reduce the pivotality of individual producers. But the Dutch high-voltage network is not designed for large-scale expansion of the production system. To coincide with the necessary network improvements and extensions, TenneT must connect new capacity as soon as possible using congestion management.