# Security of Supply Monitoring Report 2008-2024

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TenneT

# Contents

# 1. Introduction

Every year, TenneT monitors the long-term security of supply at the request of the Dutch Minister of Economic Affairs. This year the monitoring exercise and the associated data gathering took place for the fifth time on a statutory basis under Section 16, subsection 2 (f) of the Electricity Act, which assigns the monitoring of the security of delivery and supply to TenneT (under Section 4a, subsection 1 of the Electricity Act 1998). In previous years, two monitoring exercises were conducted using data obtained through a voluntary exchange of information with members of the Production section of the trade organisation EnergieNed.

The purpose of the monitoring exercise is to provide insight into the expected development of the domestic supply of electricity in relation to the domestic demand for electricity over a 7-year period going forward. EU Directive 2005/89/EC prescribes an extension of the surveyed period to 15 years. In section 3.8 of this report, therefore, we look ahead to the possible situation in 2024.

This report examines the extent to which domestic capacity is sufficient to cover domestic demand. Security of supply is not confined to the national borders, however. Therefore, as in previous years, we have examined the extent to which foreign supplies and the required international transmission capacity are available for electricity supplies to the Netherlands. This latter point is particularly important because the available export capacity from Germany to the Netherlands continues to be under pressure, especially due to large transit flows resulting from sizeable production surpluses in northern Germany. This Monitoring Report shows that the Dutch electricity system will have a considerable export potential from 2010 onward. Consequently, we also analysed whether the international transmission capacity will be sufficient to export this potential capacity.

In the past year, TenneT has once again had to deal with further increases in the number of requests to connect production capacity to the electricity grid. Plans are under development for the construction of large power stations as well as numerous smaller CHP units and wind turbines. This development first became apparent in 2007. For the time being, most of this new production capacity will have to be transmitted across the existing grid. In some locations, however, the grid does not have sufficient capacity to transmit this (new) supply of electricity at all times. We are therefore working to expand the grid's capacity. This may take several years, however, as the development of new grid infrastructure generally takes longer than the construction of new power stations. In the meantime, we continue to abide by the principle that all connection requests are to be granted where possible. In addition, TenneT is developing a national congestion management system to deal with transmission capacity shortages on the grid. Systems for managing congestion at the local level are already in operation.

A new element in this year's Monitoring Report concerns the effects of the international economic crisis which began last year. We are currently observing a decline in the demand for electricity.

This Report addresses the possible effects of the crisis on the demand for electricity and on the security of supply.
Although there is a further increase in the planned realisation of new large-scale production capacity, at the same time we cannot be certain if and when all these plans will actually be realised. Furthermore, the exact impact of the economic crisis on the development of the electricity demand is as yet uncertain. The crisis may also affect the amount of new production capacity that is to be realised. Consequently, it is difficult to produce long-term forecasts with a high degree of certainty. We have therefore performed several additional 'sensitivity calculations' in order to determine the effects that anomalous supply and demand developments may have on the security of supply.

As was the case last year, a possible shortage of export capacity is raised as an additional point of attention in this Monitoring Report. If most of the reported plans for new construction are realised, the analyses show that the available export capacity will not be sufficient under all circumstances to transmit the full export potential from the 2013 reference year onward.

In this monitoring exercise, we have applied the so-called LOLE (Loss Of Load Expectation) method as a standard for assessing the adequacy of the electricity production system. A key reason for using LOLE-based assessments is that this methodology is in line with the models and analysis methods used in other countries, thus making it easier to compare results. TenneT is currently collaborating with the Transmission System Operators (TSOs) of Germany, France, Belgium and Luxembourg in the Pentalateral Energy Forum. The first result of the collaboration was the production of a joint assessment framework, which was completed towards the end of 2008. The parties involved will use this framework to conduct joint analyses in the coming years. The simultaneity of events throughout the region will be one of the main topics covered in these analyses.

Chapter 2 of this Monitoring Report presents conclusions and recommendations based on the results of the monitoring exercise. The results of the security-of-supply analysis are described in detail in Chapter 3. Chapter 4 provides notes on the data used, while Chapter 5 outlines the effects that dependence on imports may have on the security of supply.

# 2. Conclusions and recommendations

## 2.1 Conclusions

The results of this monitoring exercise indicate that in principle there will be a sufficient supply of electricity during the surveyed period (i.e. up to and including 2016) to meet domestic demand in the Netherlands.

The general picture presented in this report is largely in line with the results of last year's monitoring exercise: the security of supply will continue to improve in the 2009-2016 period. In addition, the Netherlands' structural dependence on imported electricity for its security of supply appears to be coming to an end from 2009 onward. This conclusion is reconfirmed in this year's monitoring exercise, as all the examined variants show an export potential beginning in 2009, which will then increase significantly during the remainder of the surveyed period. This trend is largely caused by the continued increase in the amount of planned large-scale production capacity. The trend is also reinforced in the short term because demand for electricity is currently lower than was previously forecast by market parties, due to the global economic downturn. The effects of the crisis on plans to develop new capacity are as yet uncertain.

The effects of the economic crisis are expected to become apparent in the development of domestic demand for electricity over the course of 2009 and 2010. Demand is currently decreasing. In this Monitoring Report, the development of demand in the next few years is based on an assumed direct link between the increase in electricity consumption and the economic growth forecasts published by the Netherlands Bureau for Economic Policy Analysis (CPB). This assumption results in a drop in demand of 4.75% in 2009 and 0.50% in 2010. Recovery is assumed to take place over the next few years, with a year-on-year economic growth rate of 2% and a corresponding rise in electricity consumption. The developments outlined above will result in the electricity demand decreasing by 11 TWh in 2010 compared to the demand forecast for that year in the previous monitoring exercise.

In the period after 2009 we can see a further increase in the planned realisation of new large-scale production capacity. Approx. 2.3 GW of capacity is to be realised in 2010, followed by 8.3 GW in the 2011-2013 period and 7.7 GW in the 2014-2016 period. This brings the total amount of planned new capacity to approx. 18.5 GW over the surveyed period, i.e. from 2009 to 2016. This exceeds the amount of planned new large-scale capacity announced in the previous Monitoring Report, which projected an increase of approx. 14.1 GW in the 2009-2015 period.

The Netherlands offers a relatively favourable climate for the establishment of enterprises, partly due to excellent supply routes for coal and other fuels, a high-quality gas and electricity grid, relatively large quantities of cooling water, substantial gas reserves and a relatively large amount of interconnection capacity. In the evolving North-western European market, energy companies are therefore opting to establish their facilities in the Netherlands. This is a favourable development for the security of supply in the Dutch electricity system.

There are uncertainties on both the supply and demand side when it comes to developments in the period through to 2016. On the supply side, there is no certainty that all the reported projects will in fact be realised. On the demand side, there is some uncertainty about the extent to which the economic crisis will affect the demand for electricity. We have performed several separate 'sensitivity calculations' in order to determine the effects that anomalous supply and demand developments may have on the security of supply. Even in the most 'extreme' sensitivity variant, which assumes no reduction in demand due to the economic crisis and completion of no more than 50% of reported new construction projects (amounting to approx. 10 GW), these analyses show that a very high degree of security of supply will be achieved in 2016, with an export potential for the Netherlands of approx. 4.6 GW.

As stated above, the results of this monitoring exercise indicate that we need not expect any structural problems with regard to the security of supply. Nevertheless, extreme situations may occur which our assessment method does not cover. These include 'Phase 2' cooling water restrictions in the summer and gas supply problems during extremely cold winters. This Monitoring Report indicates that the electricity system will be less vulnerable to such situations in the future because most of the reported large-scale new production capacity will be developed at coastal locations and near open water, where there are few cooling water restrictions. In addition, some of the reported new production units will no longer be gas-fired. This fuel diversification has a favourable effect on the security of supply.
In this context, it should be noted that this Monitoring Report does not factor in the availability of sufficient primary fuels (coal and natural gas).

EU Directive 2005/89/EC stipulates that the period surveyed in national monitoring reports must be extended to 15 years. The projected supply-and-demand situation in 2024 is therefore discussed briefly in this Monitoring Report. The analysis shows that electricity supplies in 2024 should in principle be sufficient to meet the domestic demand for electricity, although it should be noted that this reference year is associated with a great deal of uncertainty regarding producers' plans to construct new production units and take capacity out of operation.
In addition, there is a high degree of uncertainty associated with any projections of the demand for electricity at the end of a surveyed period of this length. It is not possible to predict all the relevant developments accurately, although they may have a major impact on the demand for electricity. Such development may include a major increase in the use of electric cars or heat pumps. Consequently, the results of the security-of-supply analysis for the 2024 reference year are largely indicative.

In order to enhance the monitoring of the security of supply, TenneT is currently conducting joint cross-border analyses together with the TSOs of Germany, France, Belgium and Luxembourg. The first result of the collaboration was the production of a joint assessment framework, which was completed toward the end of 2008. The parties involved will use this framework to conduct additional joint analyses in the coming years. The simultaneity of events throughout the region will be one of the main topics covered in these analyses.

## 2.2 Recommendations

The results of this monitoring exercise do not give us cause to advise the government to take any new measures in order to guarantee the future security of supply in the Netherlands.

# 3. Results of security-of-supply analysis

## 3.1 Introduction

This chapter presents the results of the security-of-supply analyses performed using the LOLE methodology. The results of the assessment method used indicate the extent to which domestic supply can meet domestic demand.
The LOLE method is used widely in other countries to determine the adequacy of electricity systems. The method produces an expected value for the annual number of hours during which the available production capacity will not be able to meet the demand ('Loss Of Load Expectation' or LOLE). A maximum LOLE value is used as a criterion for the adequacy of a particular electricity system and refers to the acceptable risk that the demand cannot be met. This value can be easily translated into the minimum production capacity required.

In the Netherlands, too, the criteria used to assess the reliability of limited-capacity electricity production systems are usually based on macro-economic considerations involving the impact on society in the event of an interruption in the supply of electricity. By comparing these costs with the costs of investments in additional production capacity, the desired level of reliability can be determined. In calculations relating to the Dutch electricity system, an acceptable LOLE value of four hours is used.

This chapter presents the model results of several calculation variants on an annual basis and in several formats. In each variant, the calculated LOLE value is presented first. The presence of a shortage (LOLE value exceeds applicable standard) or surplus (LOLE value falls below applicable standard) can be deduced from this value. In addition, capacity values indicating the extent of the shortage or surplus are presented for each variant. If there is a shortage, these values will tell us exactly how much capacity must be added to the system (or purchased from surrounding systems) in order to meet the reliability criterion. In the event of a surplus, the values will tell us exactly how much capacity can be removed from the system (or sold to surrounding systems) before the criterion is no longer met.

As in the previous monitoring exercise, we examined two variants with regard to the assumed unavailability of means of production (basic variant and sensitivity variant A). The basic variant is presented in section 3.2. The unavailability figures assumed in section 3.2 are those indicated by the producers who supplied information for this monitoring exercise. Section 3.3 indicates the extent to which the outcomes are influenced by (i.e. sensitive to) alternative assumptions about the unavailability of means of production. As in the monitoring exercise conducted in 2007 and 2008, this Monitoring Report again points to a further increase in the planned construction of new large-scale production capacity, to a total of nearly 19 GW. We cannot be certain, however, that all these plans will actually be realised. A separate sensitivity calculation has therefore been

performed in order to determine the consequences for the security of supply if some of these plans for the realisation of new capacity are cancelled (sensitivity variant B). The results of this analysis are presented in section 3.4.

From late 2008 onward, the global economic crisis has started to affect the demand for electricity. Demand is currently decreasing. Figure 1 shows the relative difference in monthly electricity consumption as observed by TenneT compared to the corresponding month in the previous year. The figure shows that growth began to decline in November 2008. A turnaround occurred in February 2009 with growth figures dropping to approx. -1% and decreasing further to approx. -4.5% in May 2009. The same trend can be observed in the growth figures published by Statistics Netherlands (CBS).

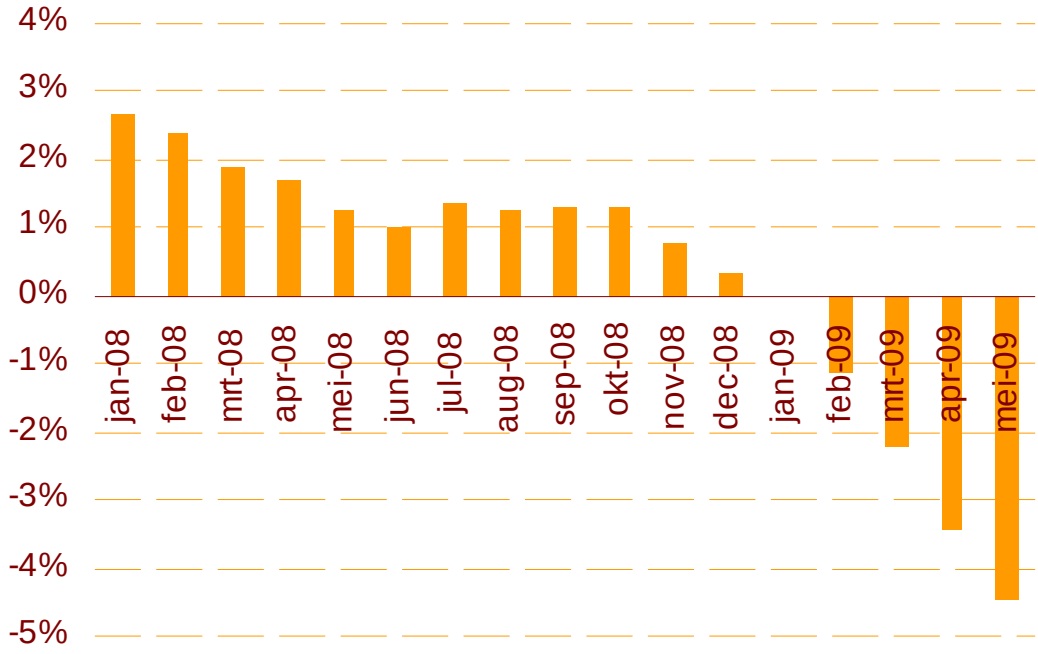


**Figure 1: Relative differences in observed consumption (including grid losses) per month compared to the corresponding month of the previous year**

In this Monitoring Report, we assume a direct link in the basic variant for 2009 and 2010 between the increase in electricity consumption and the economic growth forecasts published by the Netherlands Bureau for Economic Policy Analysis (CPB). This assumption results in a decrease in demand of 4.75% in 2009 and 0.50% in 2010. Recovery is assumed to take place over the next few years, with a year-on-year rise in electricity consumption of 2%. The assumptions outlined above will result in the electricity demand decreasing by 11 TWh in 2010 compared to the demand forecast for that year in the previous monitoring exercise.

The exact development of demand in the coming years is uncertain. In addition to the basic variant, we have therefore added an additional sensitivity variant (variant C) based on more

conservative assumptions regarding the development of demand. In this variant, zero growth instead of a decrease is assumed in 2009 and 2010. This development in demand is linked to the moderate increase in the amount of planned new production capacity assumed in sensitivity variant B. The results of this sensitivity analysis are presented in section 3.5.

Section 3.6 compares the results of the investigated variants with the available transmission capacity for imports and exports. Section 3.7 presents an overview of the reserve factors that can be derived from the data we used. Section 3.8, finally, concludes with a discussion of the possible situation in 2024 based on conservative assumptions and information provided by producers.

## 3.2 Main results of the 2008-2016 monitoring exercise (basic variant)

Figure 2 summarises the results of the basic variant employed in the 2008-2016 monitoring exercise. The line shown in this figure represents the calculated LOLE values. The black portion of the line represents the calculated actual values for the 2005-2008 period.

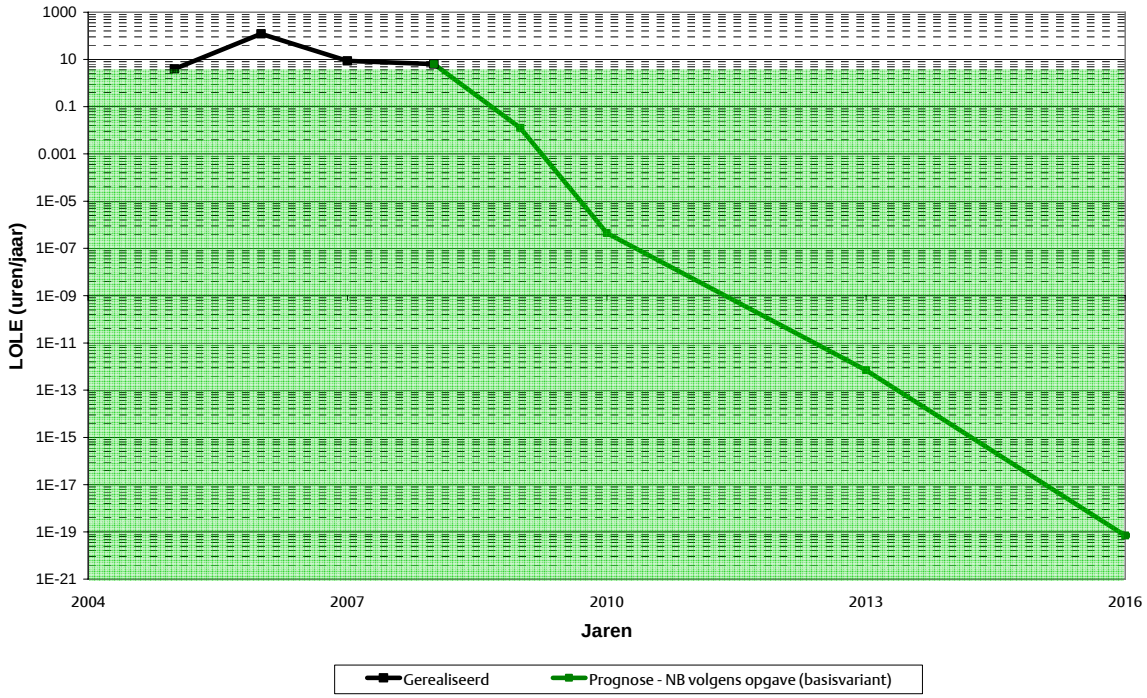


**Figure 2: Main results of the 2008-2016 monitoring exercise (basic variant)**

*[Tekst in grafiek:]*
*LOLE (hours/year)*
*Years*
*Realised*
*Forecast unavailability according to reported figures (basic variant)]*

Figure 1 shows that the Netherlands was (to a limited extent) dependent on electricity imports in the period up to and including 2008. The four-hour LOLE standard is indicated by the colour green in the graph. What is striking is that the security of supply has increased steadily over the years compared to the actual levels realised in 2005-2008 (i.e. the LOLE values are decreasing). After 2008, the line moves into the green area and a surplus (i.e. an export potential) exists.

**Table 1: Main results of 2008-2016 monitoring exercise, actual figures for 2005-2008 and forecasts for 2009-2016, taking account of the unavailability of means of production (according to information provided by producers) (basic variant)**

| | vraag | niet operationeel vermogen | operationeel vermogen | | | | LOLE NB | vermogenstekort | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | firm | equivalente productie-capaciteit |
| jaar | totaal | | totaal | stromings-bronnen | thermisch (m.u.v. waste) | overige (o.a. waste) | obv opgaven | | |
| | TWh | GW | GW | GW | GW | GW | h | GW | GW |
| 2005 | 114.8 | 0.4 | 21.0 | 1.1 | 19.4 | 0.5 | **4** | **1.8** | **2.2** |
| 2006 | 116.3 | 0.4 | 21.1 | 1.3 | 19.3 | 0.6 | **121** | **1.3** | **1.6** |
| 2007 | 118.7 | 0.0 | 23.5 | 1.6 | 21.2 | 0.7 | **8.7** | **0.3** | **0.4** |
| 2008 | 119.5 | 0.1 | 23.9 | 1.8 | 21.3 | 0.8 | **6.4** | **0.2** | **0.2** |
| 2009 | 113.8 | 0.0 | 24.1 | 2.3 | 21.0 | 0.8 | **0.0** | **-1.7** | **-2.0** |
| 2010 | 113.2 | 0.1 | 26.8 | 2.6 | 23.4 | 0.8 | **0.0** | **-4.0** | **-4.8** |
| 2013 | 120.1 | 0.7 | 35.3 | 3.8 | 30.6 | 1.0 | **0.0** | **-9.8** | **-11.7** |
| 2016 | 127.5 | 0.2 | 45.1 | 5.6 | 38.5 | 1.0 | **0.0** | **-15.9** | **-19.1** |

*[Tekst in tabel:]*
*Year*
*Demand*
*Total*
*Non-operational capacity*
*Operational capacity*
*Generation sources*
*Thermal (excluding waste)*
*Other (including waste)*
*LOLE unavailability according to reported figures*
*Capacity shortage*
*Firm capacity*
*Equivalent production capacity*

By way of amplification of the calculation results presented in the graph, Table 1 provides further information on the development of domestic demand and supply. The domestic supply has been subdivided into operational and non-operational capacity. Non-operational capacity refers to conserved or 'mothballed' capacity. The operational capacity has been subdivided into thermal capacity, capacity from generation sources (almost entirely wind power) and other capacity (including waste and biomass). Chapter 4 provides further information on the development of supply and demand.

In addition to the results in terms of LOLE, the table presents two different capacity values which indicate the extent of the shortage or surplus: a so-called ‘firm’ capacity value and an equivalent production capacity value. The firm value represents a surplus or shortage in terms of capacity with 100% availability. In practice more capacity will always be required, as capacity with 100% availability does not exist. This ‘equivalent production capacity’ depends to a large extent on factors such as the likelihood of a disruption or failure, the overhaul duration, and the unit size of the means of production concerned. In the results, the equivalent production capacity has been determined on the basis of a representative mix of large-scale production capacity.

The table clearly shows the effects of a drop in demand as a result of the economic crisis in 2009, the first year surveyed. Despite a decrease in thermal production capacity of approx. 0.3 GW compared to 2008, the security of supply in 2009 has increased compared to 2008. The firm capacity shortage of 0.2 GW in 2008 will become a surplus of 1.7 GW in 2009 due to the reduction in consumption. The table also reveals a capacity surplus (in terms of firm production capacity) during the entire surveyed period (2009-2016), rising from approx. 1.7 GW in 2009 to 15.9 GW in 2016. These surpluses can be used for export purposes without jeopardising the security of supply (see also section 3.6). Particularly in the 2013 and 2016 reference years, there will be a significant export potential due to a major increase in production capacity.

## 3.3 Sensitivity to the unavailability of production units (sensitivity variant A)

The assumptions made in respect of the likely unavailability of means of production supply important input for the calculations. These assumptions greatly influence the findings. As was the case in the previous monitoring exercises, we again noted a difference between the unavailability levels that actually occurred in the past and those forecast by producers. The producers’ forecasts were significantly lower than the unavailability levels actually realised. This can be seen in Figure 3, which depicts the actual unavailability levels from 2004 up to and including 2008, and the forecasts given by producers. The black line shows the historical average unavailability level (14.6%) in the past few decades. Compared with the previous monitoring exercise, it is striking that the difference between the forecast values and the historical average has decreased somewhat, by approx. 0.5 percentage points. Also striking is that a very favourable average unavailability of 11.4% was achieved in 2008.
These differences between reported and actually realised unavailability levels have prompted us to perform several analyses for this Monitoring Report whereby we based the unavailability figures for all surveyed years on the historical average. This is in addition to the basic variant, with unavailability figures according to the information provided by producers.

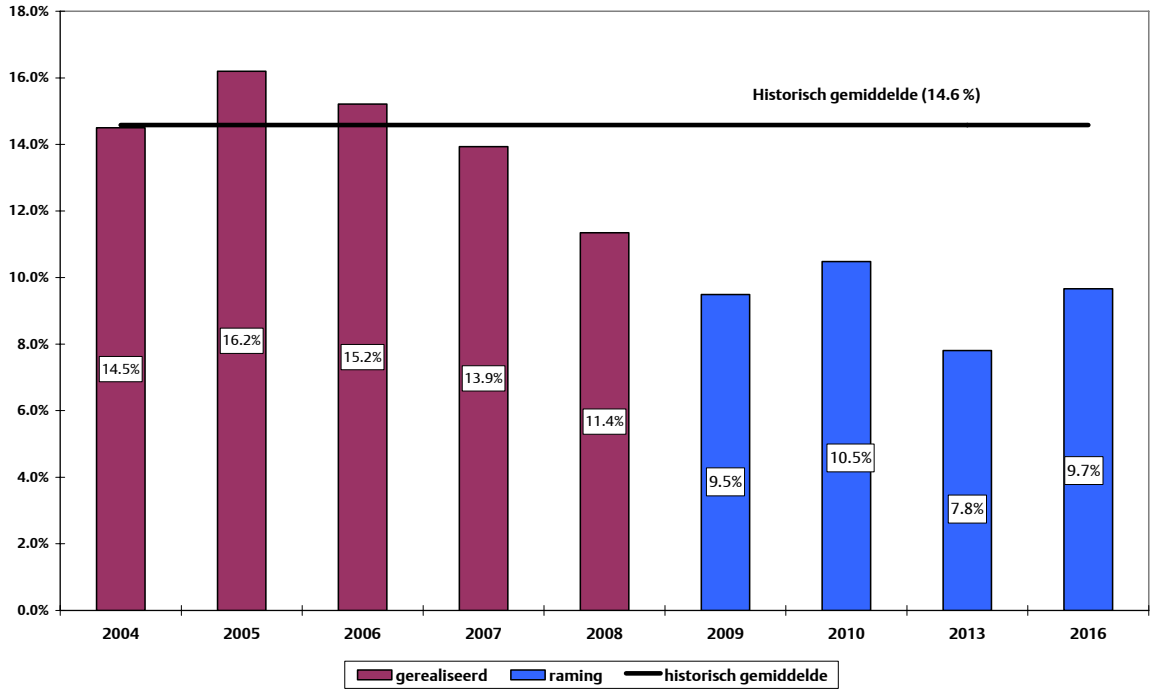


**Figure 3: Unavailability of production units as a percentage, actual and estimated values**

*[Tekst in grafiek:]*
*Realised*
*Estimate*
*Historical average*

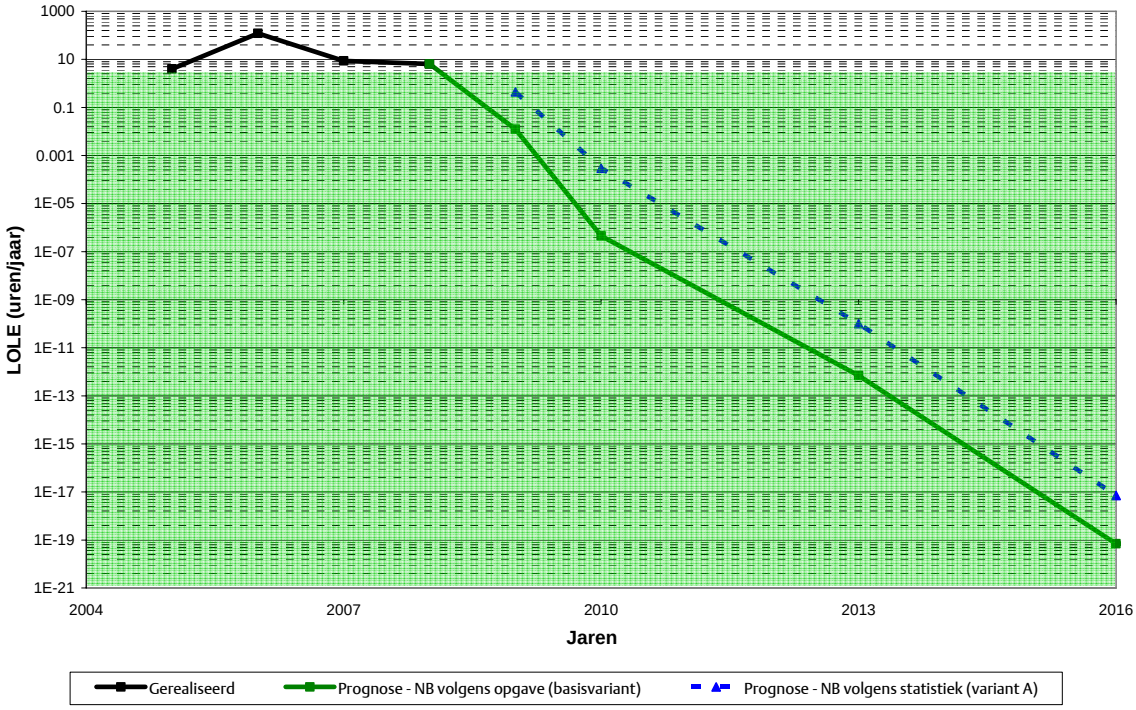


**Figure 4: Monitoring results for 2008-2016 (basic variant and sensitivity variant A)**

*[Tekst in grafiek:]*
*LOLE (hours/year)*
*Years*
*Realised*
*Forecast unavailability according to reported figures (basic variant)*
*Forecast unavailability according to statistical figures (variant A)*

To supplement the main results presented earlier, the dotted line in Figure 4 shows the results of the variant using the availability data based on actual historical values. Table 2 presents the results of this sensitivity variant in figures.

**Table 2: Monitoring results for 2008-2016, forecasts for 2009-2016 with standardised unavailability of means of production based on historical statistical data (sensitivity variant A)**

| jaar | vraag | niet operationeel vermogen | operationeel vermogen | | | | LOLE NB obv hist. statistiek | vermogenstekort | |
|---|---|---|---|---|---|---|---|---|---|
| | totaal | | totaal | stromings-bronnen | thermisch | overige (oa. waste) | | firm | equivalente productie-capaciteit |
| | TWh | GW | GW | GW | GW | GW | h | GW | GW |
| 2005 | 114.8 | 0.4 | 21.0 | 1.1 | 19.4 | 0.5 | **4** | **1.8** | **2.2** |
| 2006 | 116.3 | 0.4 | 21.1 | 1.3 | 19.3 | 0.6 | **121** | **1.3** | **1.6** |
| 2007 | 118.7 | 0.0 | 23.5 | 1.6 | 21.2 | 0.7 | **8.7** | **0.3** | **0.4** |
| 2008 | 119.5 | 0.1 | 23.9 | 1.8 | 21.3 | 0.8 | **6.4** | **0.2** | **0.2** |
| 2009 | 113.8 | 0.0 | 24.1 | 2.3 | 21.0 | 0.8 | **0.4** | **-0.8** | **-1.0** |
| 2010 | 113.2 | 0.1 | 26.8 | 2.6 | 23.4 | 0.8 | **0.0** | **-3.0** | **-3.8** |
| 2013 | 120.1 | 0.7 | 35.3 | 3.8 | 30.6 | 1.0 | **0.0** | **-8.1** | **-10.5** |
| 2016 | 127.5 | 0.2 | 45.1 | 5.6 | 38.5 | 1.0 | **0.0** | **-13.7** | **-17.8** |

*[Tekst in tabel:]*
*Year*
*Demand*
*Total*
*Non-operational capacity*
*Operational capacity*
*Generation sources*
*Thermal*
*Other (including waste)*
*LOLE unavailability according to historical statistics*
*Capacity shortage*
*Firm capacity*
*Equivalent production capacity*

As was to be expected, smaller surpluses are found in this sensitivity variant compared to the basic variant, due to the higher assumed unavailability of means of production. For instance, the firm capacity surplus amounts to 0.8 GW in the first surveyed year (2009), while the basic variant produced a surplus of 1.7 GW. At 3.0 GW, 8.1 GW and 13.7 GW, respectively, the firm capacity surpluses in 2010, 2013 and 2016 are 1.0 GW, 1.7 GW and 2.2 GW lower than in the basic variant, respectively.

## 3.4 Sensitivity to reduced realisation of new production capacity (sensitivity variant B)

For this monitoring exercise we have assumed a total of approx. 20 GW of planned new thermal production capacity over the 2009-2016 period. Of this total, approx. 18.5 GW concerns large-scale capacity. In the previous monitoring exercise, the planned large-scale capacity in the 2009-2015 period amounted to approx. 14 GW. This means that the total large-scale project capacity has increased by approx. 4.5 GW. The amount of capacity in new, small-scale thermal projects is approximately the same as forecast in the previous monitoring exercise. Because we cannot be certain that all these plans will actually be realised, a sensitivity calculation has been

performed to determine the consequences for the security of supply if most of these plans are not realised. In this sensitivity variant, we assume that about half of these projects (approx. 10 GW scheduled to be put into operation in the second half of the surveyed period) will not be realised. The calculations are based on standardised unavailability levels of means of production derived from historical statistics.
Figure 5 shows the results of this sensitivity calculation in combination with the results presented previously. Table 3 shows the results in figures.

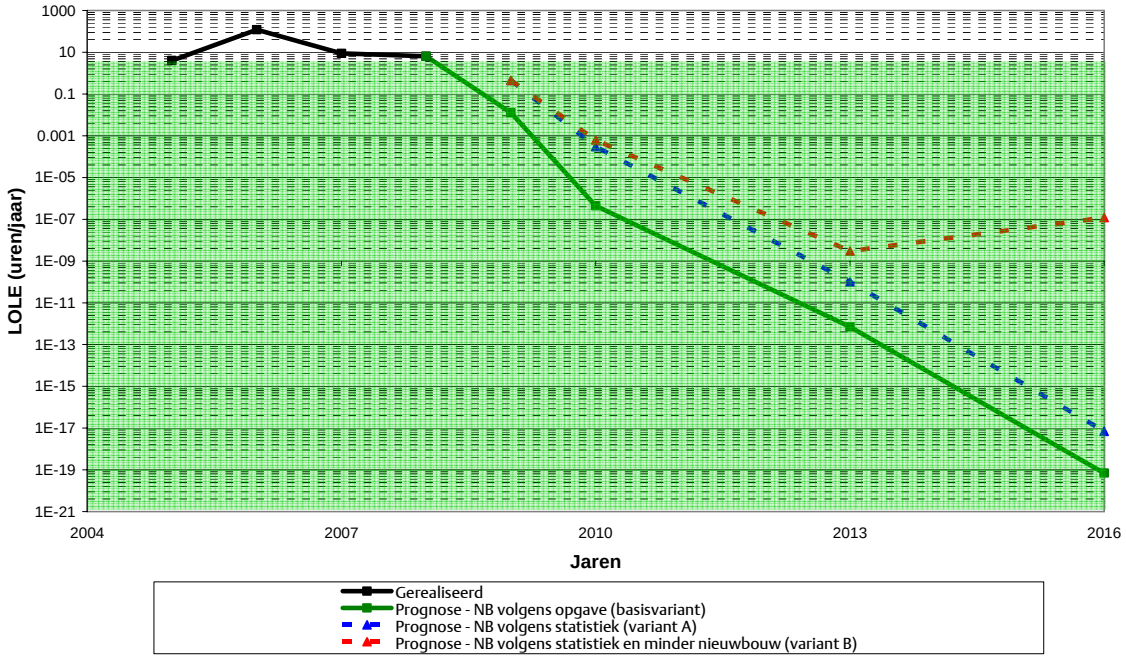


**Figure 5: Monitoring results for 2008-2016 period (basic variant and sensitivity variants A and B)**

*[Tekst in grafiek:]*
*LOLE (hours/year)*
*Years*
*Realised*
*Forecast unavailability according to reported figures (basic variant)*
*Forecast unavailability according to statistical data (variant A)*
*Forecast unavailability according to statistical data and assuming less new capacity (variant B)*

**Table 3: Monitoring results for 2008-2016, forecasts for 2009-2016 with standardised unavailability of means of production based on historical statistical data and reduced realisation of new production capacity (sensitivity variant B)**

| jaar | vraag | niet operationeel vermogen | operationeel vermogen | | | | LOLE NB obv hist. statistiek | vermogenstekort | |
|---|---|---|---|---|---|---|---|---|---|
| | totaal | | totaal | stromings-bronnen | thermisch | overige (oa. waste) | | firm | equivalente productie-capaciteit |
| | TWh | GW | GW | GW | GW | GW | h | GW | GW |
| 2005 | 114.8 | 0.4 | 21.0 | 1.1 | 19.4 | 0.5 | **4** | **1.8** | **2.2** |
| 2006 | 116.3 | 0.4 | 21.1 | 1.3 | 19.3 | 0.6 | **121** | **1.3** | **1.6** |
| 2007 | 118.7 | 0.0 | 23.5 | 1.6 | 21.2 | 0.7 | **8.7** | **0.3** | **0.4** |
| 2008 | 119.5 | 0.1 | 23.9 | 1.8 | 21.3 | 0.8 | **6.4** | **0.2** | **0.2** |
| 2009 | 113.8 | 0.0 | 24.1 | 2.3 | 21.0 | 0.8 | **0.4** | **-0.8** | **-1.0** |
| 2010 | 113.2 | 0.1 | 26.3 | 2.3 | 23.3 | 0.8 | **0.0** | **-2.8** | **-3.6** |
| 2013 | 120.1 | 0.7 | 32.8 | 2.3 | 29.8 | 0.8 | **0.0** | **-6.9** | **-9.0** |
| 2016 | 127.5 | 0.2 | 32.5 | 2.3 | 29.5 | 0.8 | **0.0** | **-5.6** | **-7.3** |

*[Tekst in tabel:]*
*Year*
*Demand*
*Total*
*Non-operational capacity*
*Operational capacity*
*Generation sources*
*Thermal*
*Other (including waste)*
*LOLE unavailability according to historical statistical data*
*Capacity shortage*
*Firm capacity*
*Equivalent production capacity*

These results show that even if just half of the plans for new production capacity are realised, there is more than enough production capacity to meet Dutch domestic electricity demand up to the end of the surveyed period.

## 3.5 Sensitivity to reduced realisation of new production capacity in conjunction with greater demand for electricity (sensitivity variant C)

There are uncertainties on both the supply and demand side when it comes to developments in the period through to 2016. On the supply side, there is no certainty that all the reported projects will in fact be realised. On the demand side, there is some uncertainty about the extent to which the economic crisis will affect the demand for electricity.
As part of this monitoring exercise, we performed an additional sensitivity analysis (sensitivity variant C) in order to determine the effects on the security of supply if the above-mentioned uncertainties on the demand and supply side occur as part of a single scenario. On the supply side, sensitivity variant C assumes a scenario with less new capacity, as described in the preceding section (sensitivity variant B). On the demand side, variant C assumes that no reduction

in demand due to the economic crisis will occur in 2009 and 2010, but that both years will show zero growth in electricity consumption.
The results of this sensitivity calculation are shown in Figure 6 and Table 4.

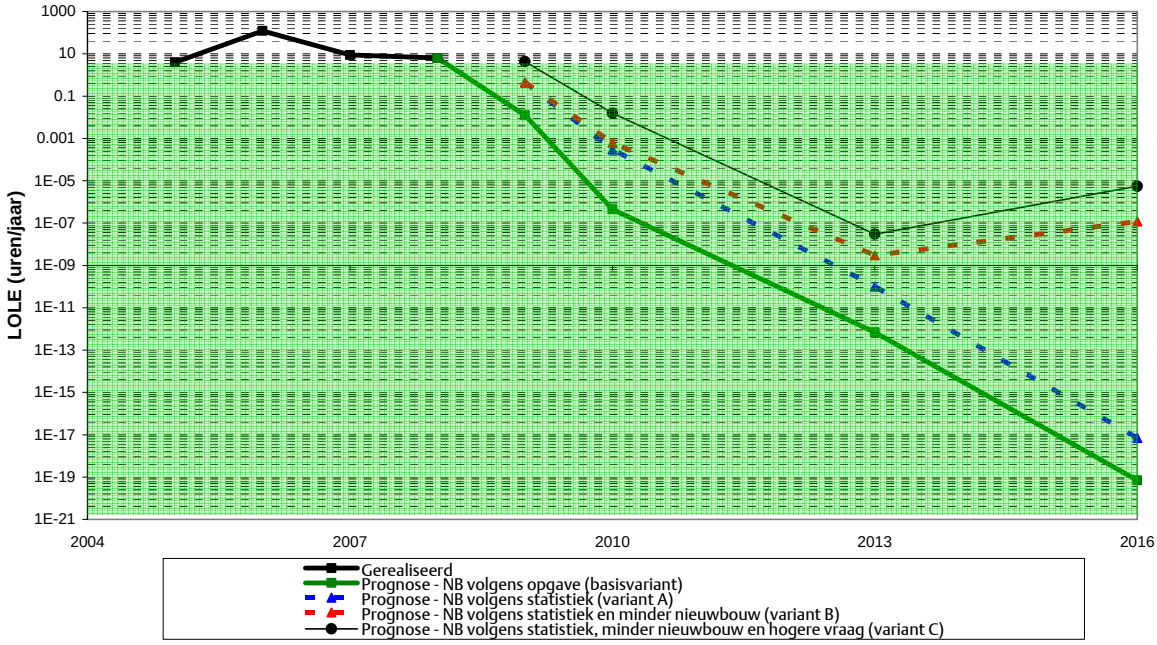


**Figure 6: Monitoring results for 2008-2016 (basic variant and sensitivity variants A, B and C)**

*[Tekst in grafiek:]*
*LOLE (hours/year)*
*Years*
*Realised*
*Forecast unavailability according to reported figures (basic variant)*
*Forecast unavailability according to statistical data (variant A)*
*Forecast unavailability according to statistical data and assuming less new capacity (variant B)*
*Forecast unavailability according to statistical data and assuming less new capacity and higher demand (variant C)*

The results of this sensitivity variant show that no dependence on imports will occur in the 2009-2016 period in this scenario. A situation of balance is achieved in 2009. Firm capacity surpluses (leading to export potential) exist in 2010, 2013 and 2016, amounting to 1.9 GW, 6.0 GW and 4.6 GW, respectively.

**Table 4: Monitoring results for 2008-2016, forecasts for 2009-2016 with standardised unavailability of means of production based on historical statistical data, reduced realisation of new production capacity and higher electricity demand (sensitivity variant C)**

| | vraag | niet operationeel vermogen | operationeel vermogen | | | | LOLE NB obv hist. statistiek | vermogenstekort | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | firm | equivalente productie-capaciteit |
| jaar | totaal | | totaal | stromings-bronnen | thermisch | overige (oa. waste) | | | |
| | TWh | GW | GW | GW | GW | GW | h | GW | GW |
| 2005 | 114.8 | 0.4 | 21.0 | 1.1 | 19.4 | 0.5 | **4** | **1.8** | **2.2** |
| 2006 | 116.3 | 0.4 | 21.1 | 1.3 | 19.3 | 0.6 | **121** | **1.3** | **1.6** |
| 2007 | 118.7 | 0.0 | 23.5 | 1.6 | 21.2 | 0.7 | **8.7** | **0.3** | **0.4** |
| 2008 | 119.5 | 0.1 | 23.9 | 1.8 | 21.3 | 0.8 | **6.4** | **0.2** | **0.2** |
| 2009 | 119.5 | 0.0 | 24.1 | 2.3 | 21.0 | 0.8 | **4.2** | **0.0** | **0.0** |
| 2010 | 119.5 | 0.1 | 26.3 | 2.3 | 23.3 | 0.8 | **0.0** | **-1.9** | **-2.4** |
| 2013 | 126.8 | 0.7 | 32.8 | 2.3 | 29.8 | 0.8 | **0.0** | **-6.0** | **-7.7** |
| 2016 | 134.5 | 0.2 | 32.5 | 2.3 | 29.5 | 0.8 | **0.0** | **-4.6** | **-6.0** |

*[Tekst in tabel:]*
*Year*
*Demand*
*Total*
*Non-operational capacity*
*Operational capacity*
*Generation sources*
*Thermal*
*Other (including waste)*
*LOLE unavailability according to historical statistical data*
*Capacity shortage*
*Firm capacity*
*Equivalent production capacity*

## 3.6 Comparison of shortages and surpluses with available import and export capacity

The previous sections presented an overview of the shortages and surpluses that occur when the various supply and demand forecasts are compared. In this section, the shortages and surpluses will be compared with the available transmission capacity for imports and exports.

The import/export capacity at the border with Germany and Belgium totals 3.85 GW during the period up to and including 2009. From 2010 to the end of the surveyed period, an additional 0.3 GW is expected as a result of the realisation of phase shifters in the Belgian grid. The construction of the Doetinchem-Wesel interconnection, with a capacity of 1.5 GW, will result in a total import/export capacity of 5.65 GW in the 2016 reference year. Taking into account the NorNed cable (taken into operation in 2008) and the BritNed cable (1.0 GW from the 2013

reference year onward), the total cross-border transmission capacity for imports and exports in 2016 will amount to 7.35 GW.

The table below provides an overview of the assumptions with regard to the available capacity levels. Besides the sum of the nominally available transmission capacity for imports and exports, the table also provides an estimate of the average available capacity when taking account of reductions resulting from faults, overhauls and loop flows due to production surpluses from wind capacity.

**Table 5: Available import/export capacity and maximum utilisation in the four calculation variants**

| jaar | Bel/Duit | NorNed | BritNed | Totaal nominaal [1)] | Totaal na reducties [2)] | maximaal beslag op import/exportcapaciteit (%) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | basis var. | var. A | var. B | var. C |
| | GW | GW | GW | GW | GW | | | | |
| 2008 | 3.9 | 0.7 | 0.0 | 4.6 | 4.2 | 5% | 5% | 5% | 5% |
| 2009 | 3.9 | 0.7 | 0.0 | 4.6 | 4.2 | -40% | -18% | -18% | 1% |
| 2010 | 4.2 | 0.7 | 0.0 | 4.9 | 4.5 | -88% | -65% | -60% | -41% |
| 2013 | 4.2 | 0.7 | 1.0 | 5.9 | 5.5 | -177% | -146% | -126% | -108% |
| 2016 | 5.7 | 0.7 | 1.0 | 7.4 | 6.9 | -231% | -199% | -81% | -67% |

[1)] Excluding reductions

[2)] Including reductions resulting from faults, overhauls and loop flows due to production surpluses from wind capacity

*[Tekst in tabel:]*
*Year*
*Belgium/Germany*
*Total nominal capacity[1)]*
*Total capacity after reductions[2)]*
*Maximum utilisation of import/export capacity (%)*
*Basic variant*
*Variant A*
*Variant B*
*Variant C*

In both Table 5 and Figure 7, the available import and export capacity after reductions is compared to the firm production shortages and firm production surpluses occurring in the four calculated variants (basic variant and variants A, B and C).

In the table, this comparison is expressed in terms of the utilisation of import and export capacity (expressed as a percentage), whereby a positive value indicates utilisation of import capacity and a negative value indicates utilisation of export capacity.

The red lines in the graph below show the maximum import and export capacities. The graph also shows the production capacity surpluses and shortages occurring in the four calculation variants in terms of firm capacity.

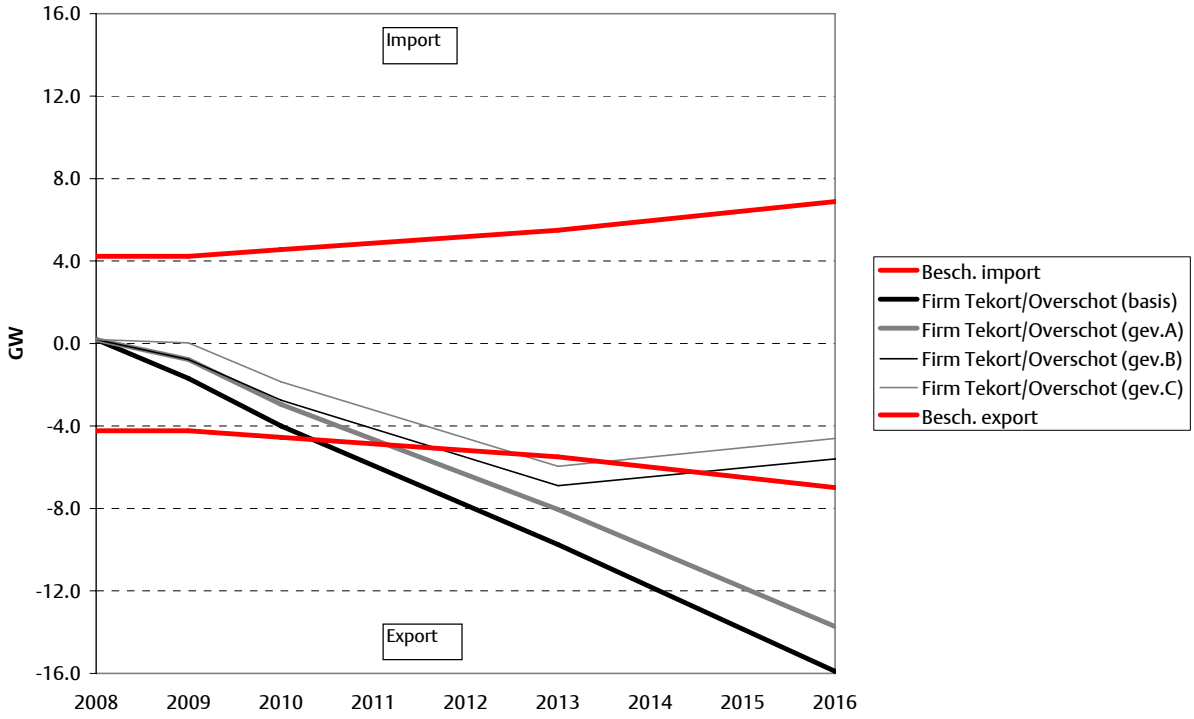


**Figure 7: Comparison of surpluses and shortages with the available import and export capacity in the basic variant and in sensitivity variants A and B**

*[Tekst in grafiek:]*
*Imports*
*Exports*
*Available imports*
*Firm shortage/surplus (basic variant)*
*Firm shortage/surplus (variant A)*
*Firm shortage/surplus (variant B)*
*Firm shortage/surplus (variant C)*
*Available exports*

In the 2008 variants where there is still limited structural dependence on imports, the available import capacity is more than sufficient to transmit these shortages. After 2008, there is no structural dependence on imports in any of the variants.

As in the previous monitoring exercise, the available export capacity will be insufficient from 2013 onward to make full use, under all circumstances, of the entire export potential that arises when all the plans for construction of new capacity are actually realised. This insufficiency arises in the basic scenario as well as in sensitivity variant A. For instance, the basic scenario indicates a firm export potential of 9.8 GW in 2013, while the available export capacity will amount to approx. 5.5 GW. This means that around 4.3 GW of the export potential cannot be utilised under all circumstances. In 2016, the unutilised export potential is set to increase to 9.0 GW.
In the (more realistic) sensitivity variant with standard availability levels (variant A), the unutilised export potential is lower: 2.6 GW in 2013 and 6.8 GW in 2016.
In the sensitivity variants B and C the available export capacity is sufficient in 2016, but not entirely sufficient in 2013.

## 3.7 Reserve factors

As in our previous reports, we have again estimated the reserve factors. The reserve factor is the ratio of the installed production capacity and the maximum demand. Table 6 provides an overview of the reserve factors that can be derived from the data used.

The reserve factors show the same trend as the results based on the LOLE calculations, i.e. a relatively low level in 2008 and 2009, followed by a substantial increase in the reserves in 2013 and 2016.

**Table 6: Reserve factors 2008-2016**

| jaar | niet operationeel vermogen GW | totaal operationeel vermogen GW | vermogen uit stromings-bronnen GW | beschikbare importcapaciteit (prudent) GW | piekvraag GW | reservefactor [1] | [2] | [3] |
|---|---|---|---|---|---|---|---|---|
| 2008 | 0.1 | 23.9 | 1.8 | 4.2 | 18.9 | 1.26 | 1.19 | 1.41 |
| 2009 | 0.0 | 24.1 | 2.3 | 4.2 | 18.0 | 1.34 | 1.24 | 1.47 |
| 2010 | 0.1 | 26.8 | 2.6 | 4.5 | 17.9 | 1.50 | 1.38 | 1.64 |
| 2013 | 0.7 | 35.3 | 3.8 | 5.5 | 19.0 | 1.86 | 1.70 | 1.99 |
| 2016 | 0.2 | 45.1 | 5.6 | 5.5 | 20.1 | 2.24 | 2.02 | 2.29 |

[1] zonder import, stromingsbronnen tellen voor 100% mee, niet operationeel voor 0%
[2] zonder import, stromingsbronnen tellen voor 20% mee, niet operationeel voor 0%
[3] importcapaciteit telt voor 100% mee, stromingsbronnen tellen voor 20% mee, niet operationeel voor 0%

*[Tekst in tabel:]*
*Year*
*Non-operational capacity*
*Total operational capacity*
*Capacity from generation sources*
*Available import capacity (cautious scenario)*
*Peak demand*

*Reserve factor*
*Excluding imports, generation sources included for 100%, non-operational capacity for 0%*
*Excluding imports, generation sources included for 20%, non-operational capacity for 0%*
*Import capacity included for 100%, generation sources for 20% and non-operational capacity for 0%*

## 3.8 Prospects for 2024

EU Directive 2005/89/EC stipulates that the period surveyed in national monitoring reports must be extended to 15 years. Consequently, the projected supply and demand situation in 2024 is discussed briefly below.

As in the previous monitoring exercise, the information supplied by producers for 2024 does not produce a clear picture of the development of their portfolios. In most cases, therefore, no changes compared to 2016 have been indicated. This applies to the construction of new production units as well as the decommissioning of existing means of production. The information supplied by producers who have indicated changes shows that approximately 3.6 GW of capacity will be taken into operation in the 2016-2024 period, while approximately 1.7 GW will be decommissioned. Table 7 in Chapter 4 of this report summarises the development of the electricity supply according to data supplied by producers.

In order to determine how the electricity demand will develop in the eight years added to the surveyed period (i.e. the 2016-2024 period), the annual growth rate assumed for the 2011-2016 period (2%) has been extrapolated. This scenario would result in an annual electricity demand of approx. 149 TWh in 2024 in the basic variant and in sensitivity variants A and B, and approx. 158 TWh in sensitivity variant C (also see Table 8 in Chapter 4). In assessing these forecasts, it should be kept in mind that there is a high degree of uncertainty concerning the level of the electricity demand at the end of a surveyed period of this length. It is not possible to predict all the relevant developments accurately, although they may have a major impact on the level of electricity demand. Such developments may include large-scale market penetration of electric cars or heat pumps.

An indicative calculation has been carried out to determine the security of supply if supply and demand levels develop as outlined above. This calculation yields a substantial export potential in 2024 in the basic variant and in sensitivity variants A and B. Sensitivity variant C, which assumes a higher demand for electricity, produces a slight dependence on imports in 2023. In the introduction to this Monitoring Report, we already indicated that it was difficult to produce long-term forecasts of supply and demand in 2016. Obviously, an even higher level of uncertainty applies to any forecasts made for 2024. Combined with the uncertainty regarding the demand trend, the results of the security-of-supply analysis for the 2024 reference year must be regarded as largely indicative.

# 4. Notes on the data used

This monitoring exercise and the resulting report are based on the following data:

- Data obtained from producers known to TenneT TSO. Every year, producers with units of 5 MW and larger are asked to provide prospective data on the domestic means of production they currently manage or plan to manage in the future (the latter plans are generally provisional in nature).
- Data obtained from producers known to CertiQ. As was the case last year, for this monitoring exercise we requested data from CertiQ on the installed capacity (including biomass and CHP) of all electricity producers. Our aim in doing this was to increase the extent of coverage and make less use of our own estimates so as to enhance the quality and reliability of the analysis.
- Data on domestic means of production obtained for inclusion in the Quality and Capacity Plan 2010-2016 (currently being prepared), as well as data on the growth of the domestic market in the period after 2009, and the transmission capacity of cross-border connections.
- Data provided by Netherlands Statistics (CBS) on the actual domestic demand in the period up to and including 2008.
- Data provided by the Netherlands Bureau for Economic Policy Analysis (CPB) on economic growth in the period after 2008.

Table 7 summarises the development of the installed capacity. The information provided produces a similar picture to last year's monitoring exercise. A further increase in planned new production capacity (by approx. 4.5 GW) is set to occur at the end of the surveyed period. Consequently, the analysis provided below is in line with the conclusions set out in last year's Monitoring Report.

The information provided reveals that most of the reported new large-scale capacity will be built at coastal locations. This is favourable for the security of supply because coastal locations are generally not subject to cooling water restrictions. We also noted that some of the reported new capacity will not be gas-fired. This diversification of fuels is again favourable for the security of supply, because it reduces dependence on gas, thus limiting the system's vulnerability to gas supply restrictions in extremely cold periods.

**Table 7: Development of installed capacity**

| jaar | niet oper. vermoge | operationeel vermogen | | | evolutie operationeel vermogen | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | grootschalig thermisch | | | kleins.th. | stroming | totaal |
| | totaal | totaal | stromings bronnen | tot. excl. str. bron. | nieuw | mothball en uitbedrijf | saldo | saldo | saldo | saldo |
| | GW | GW | GW | GW | GW | GW | GW | GW | GW | GW |
| 2007 | 0.0 | 23.5 | 1.6 | 21.8 | | | | | | |
| 2008 | 0.1 | 23.9 | 1.8 | 22.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.4 |
| 2009 | 0.0 | 24.1 | 2.3 | 21.8 | 0.2 | 0.6 | -0.4 | 0.1 | 0.5 | 0.2 |
| 2010 | 0.1 | 26.8 | 2.6 | 24.2 | 2.3 | 0.1 | 2.3 | 0.2 | 0.3 | 2.7 |
| 2013 | 0.7 | 35.3 | 3.8 | 31.6 | 8.3 | 1.5 | 6.7 | 0.7 | 1.1 | 8.5 |
| 2016 | 0.2 | 45.1 | 5.6 | 39.5 | 7.7 | 0.1 | 7.6 | 0.3 | 1.9 | 9.8 |
| 2024 | 1.2 | 47.7 | 6.3 | 41.4 | 3.6 | 1.7 | 1.9 | 0.1 | 0.6 | 2.6 |

*[Tekst in tabel:]*
*Year*
*Non-operational capacity*
*Total*
*Operational capacity*
*Generation sources*
*Total excluding generation sources*
*Development of operational capacity*
*Large-scale thermal capacity*
*New*
*Mothballed and decommissioned*
*Balance*
*Small-scale thermal capacity*
*Generation sources*
*Total*
*Balance*

The data provided (see Table 7) gives rise the following points for attention:

- In 2013 and 2016, we observe a massive increase in the planned realisation of new large-scale production capacity. For example, more than 18.5 GW of new large-scale thermal production capacity has been reported for the period up to and including 2016. This represents an increase of approx. 4.5 GW compared to last year's monitoring exercise. Approximately 10.8 GW of this total of 18.5 GW is to be realised in the period up to and including 2013. However, we cannot be certain that all projects will in fact be realised. The figures do show that the Netherlands offers a relatively favourable climate for the establishment of enterprises, partly due to excellent supply routes for coal and other fuels,

a high-quality gas and electricity grid, relatively large quantities of cooling water, substantial gas reserves, and a relatively large amount of interconnection capacity. In the evolving North-western European market, energy companies are therefore opting to establish their facilities in the Netherlands. This is a favourable development for the security of supply in the Dutch electricity system.

- The expected growth of small-scale thermal production capacity from 2009 onward has been revised downward from the level indicated in the previous Monitoring Report. This is mainly due to the use of gas engines in the glasshouse horticulture sector.
- Approx. 4 GW of large-scale thermal production capacity will be decommissioned in the 2009-2024 period.

Table 8 summarises the main assumptions with regard to the size of the domestic market.

**Table 8: Assumptions concerning market size**

| | monitoring 2003-2011 | | monitoring 2004-2012 | | monitoring 2005-2013 | | monitoring 2006-2014 | | monitoring 2007-2015 | | monitoring 2008-2024 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | hoofdvariant en varianten A en B | | variant C | |
| Jaar | groei verbruik % | vraag TWh | groei verbruik % | vraag TWh | groei verbruik % | vraag TWh | groei verbruik % | vraag TWh | groei verbruik % | vraag TWh | groei verbruik % | vraag TWh | groei verbruik % | vraag TWh |
| 2003 | 1.09% | 109.6 | 1.32% | 109.8 | 1.32% | 109.8 | 1.32% | 109.8 | 1.32% | 109.817 | 1.32% | 109.8 | 1.32% | 109.8 |
| 2004 | 1.25% | 110.9 | 0.92% | 110.8 | 2.83% | 112.9 | 2.83% | 112.9 | 2.83% | 112.9 | 2.83% | 112.9 | 2.83% | 112.9 |
| 2005 | 1.50% | 112.6 | 1.00% | 111.9 | 1.53% | 114.7 | 1.64% | 114.8 | 1.64% | 114.8 | 1.64% | 114.8 | 1.64% | 114.8 |
| 2006 | 2.00% | 114.9 | 2.25% | 114.5 | 2.75% | 117.8 | 1.27% | 116.2 | 1.36% | 116.3 | 1.36% | 116.3 | 1.36% | 116.3 |
| 2007 | 2.00% | 117.1 | 2.00% | 116.7 | 3.00% | 121.3 | 2.75% | 119.4 | 0.53% | 117.0 | 1.99% | 118.7 | 1.99% | 118.7 |
| 2008 | 2.00% | 119.5 | 2.00% | 119.1 | 2.00% | 123.8 | 2.75% | 122.7 | 2.25% | 119.6 | 0.68% | 119.5 | 0.68% | 119.5 |
| 2009 | 2.00% | 121.9 | 2.00% | 121.5 | 2.00% | 126.2 | 2.00% | 125.2 | 1.75% | 121.7 | -4.75% | 113.8 | 0.00% | 119.5 |
| 2010 | 2.00% | 124.3 | 2.00% | 123.9 | 2.00% | 128.8 | 2.00% | 127.7 | 2.00% | 124.1 | -0.50% | 113.2 | 0.00% | 119.5 |
| 2011 | 2.00% | 126.8 | 2.00% | 126.4 | 2.00% | 131.3 | 2.00% | 130.2 | 2.00% | 126.6 | 2.00% | 115.5 | 2.00% | 121.8 |
| 2012 | *2.00%* | *129.3* | 2.00% | 128.9 | 2.00% | 134.0 | 2.00% | 132.8 | 2.00% | 129.1 | 2.00% | 117.8 | 2.00% | 124.3 |
| 2013 | *2.00%* | *131.9* | *2.00%* | *131.5* | 2.00% | 136.7 | 2.00% | 135.5 | 2.00% | 131.7 | 2.00% | 120.1 | 2.00% | 126.8 |
| 2014 | *2.00%* | *134.6* | *2.00%* | *134.1* | *2.00%* | *139.4* | 2.00% | 138.2 | 2.00% | 134.3 | 2.00% | 122.5 | 2.00% | 129.3 |
| 2015 | *2.00%* | *137.3* | *2.00%* | *136.8* | *2.00%* | *142.2* | *2.00%* | *141.0* | 2.00% | 137.0 | 2.00% | 125.0 | 2.00% | 131.9 |
| 2016 | *2.00%* | *140.0* | *2.00%* | *139.5* | *2.00%* | *145.0* | *2.00%* | *143.8* | *2.00%* | *139.8* | 2.00% | 127.5 | 2.00% | 134.5 |
| | | | | | | | | | | | | | | |
| 2023 | *2.00%* | *160.8* | *2.00%* | *160.3* | *2.00%* | *166.6* | *2.00%* | *165.2* | 2.00% | 160.6 | *2.00%* | *146.5* | *2.00%* | *154.5* |
| 2024 | *2.00%* | *164.0* | *2.00%* | *163.5* | *2.00%* | *169.9* | *2.00%* | *168.5* | *2.00%* | *163.8* | 2.00% | 149.4 | 2.00% | 157.6 |

**legenda**

| | |
|---|---|
| 140.0 | gerealiseerd (definitief CBS) |
| 140.0 | gerealiseerd (eerste schatting CBS) |
| 140.0 | prognose (op basis meest recente CPB-prognoses) |
| *140.0* | *prognose-extrapolatie vroegere monitoring* |

*[Tekst in tabel:]*
*Monitoring = Monitoring exercise*
*Hoofdvariant en varianten A en B = Basic variant and variants A and B*
*Variant C = Variant C*
*Jaar = Year*
*Groei = Growth*
*Verbruik = Consumption*
*Vraag = Demand*

*Legenda = Legend*
*Gerealiseerd (definitief CBS) = Realised (final CBS figures)*
*Gerealiseerd (eerste schatting CBS) = Realised (initial CBS estimate)*
*Prognose (op basis meest recente CPB prognose) = Forecast (based on most recent CPB prognosis)*
*Prognose-extrapolatie vroegere monitoring = Forecast extrapolation from previous monitoring exercise*

The following conclusions can be drawn from Table 8:

- The definitive figure for the domestic electricity demand in 2007 is approx. 1.7 TWh higher than the preliminary estimate used for the previous monitoring exercise. On the other hand, the initial CBS growth estimate for 2008 is 1.8 TWh lower than was assumed in the previous monitoring exercise. These two effects produce a demand in 2008 that is virtually the same in last year's and this year's monitoring report.
- The size of the national market in 2009 and 2010 has been based on the most recent CPB forecast of GDP growth in 2009 (-4.75%) and 2010 (-0.50%) (issued in June 2009). The growth rate in subsequent years has been based on the reference scenario set out in the Quality and Capacity Plan 2008-2014 and amounts to 2%.
- Together, the above factors result in a domestic market size of 127.5 TWh in 2016 (including grid losses). This is approximately 12.3 TWh lower than assumed in our previous monitoring report. Extrapolation of this expected growth rate would result in a domestic market size of more than 149 TWh in 2024.
- In the high-demand scenario (used in sensitivity variant C), the demand in 2016 amounts to 134.5 TWh. This is approximately 5 TWh lower than assumed in our previous monitoring report.