Security of Supply Monitoring Report 2007-2023

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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 fourth 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. EU Directive 2005/89/EC prescribes an extension of the surveyed period to 15 years. In section 3.7 of this report, therefore, we look ahead to the possible situation in 2023.

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 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 early 2012 onward. Consequently, we also analysed whether the international transmission capacity is sufficient to export this potential capacity.

In the past few years, TenneT has had to deal with a considerable increase in the number of requests to connect production capacity to the grid. Plans have been developed for the construction of large power stations, as well as numerous smaller CHP plants and wind turbines. This development first became apparent in last year's Monitoring Report. 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. However, this may take several years, 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 will be granted where possible. In some cases, certain conditions may apply. In addition, TenneT is developing a congestion management system to deal with capacity shortages on the grid.

A further point of attention raised in this Monitoring Report concerns a possible shortage of export capacity. If most of the reported construction plans are realised, the analysis shows that the available export capacity as of the 2012 reference year will not be sufficient under all circumstances to transmit the full export potential.

Although there is a massive increase in the planned realisation of new large-scale production capacity, at the same time we cannot be certain that all these plans will actually be realised, thus making it difficult to produce long-term forecasts. As in previous Monitoring Reports, a separate ‘sensitivity calculation’ has therefore been carried out to determine the consequences for the security of supply if some of these plans are cancelled. For this calculation, a pessimistic scenario has been adopted in which approximately 30% of the registered projects will actually be realised.

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 working together with the German, French, Belgian and Luxembourg Transmission System Operators (TSOs) under the terms of the Pentalateral Energy Forum. The purpose of this collaboration is to develop a better assessment framework by such means as exchanging information, using shared models and conducting joint 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 2015) to meet domestic demand in the Netherlands. In addition, the Netherlands's structural dependence on imported electricity for its security of supply seems to be coming to an end in the short term.

The security of supply will continue to improve in the 2008-2015 period. This monitoring exercise shows a projected turnaround from structural dependence on imports to export potential from the 2009 reference year onwards, in all the scenarios that have been examined. This export potential will grow considerably in the reference years 2012 and 2015, a trend caused by a massive increase in the planned realisation of large-scale production capacity.

Looking back at developments in the past year, it becomes apparent that the Dutch electricity system was less dependent on imports for its security of supply in 2007 than was assumed in the previous Monitoring Report. Reasons for this include less growth in electricity consumption than was originally forecast, as well as a stronger increase in decentralised capacity (especially in the glasshouse horticulture sector). Dependence on imports for the security of supply will continue to decrease in 2008 compared to the levels forecast in the previous Monitoring Report.

As of 2009, we will see major growth in the supply of mainly large-scale production capacity. In 2009, for instance, 1.1 GW of new, large-scale production capacity is expected to be taken into operation. It is expected that this growth will only accelerate after 2009. For instance, more than 14 GW of new large-scale thermal production capacity has been reported for the period up to and including 2015. More than 10 GW of this capacity will be realised by the end of 2012. Partly due to excellent supply routes for fuels such as coal, a high-quality gas and electricity grid, relatively large quantities of cooling water, substantial gas reserves and a large interconnection capacity, the Netherlands offers a relatively favourable climate for the establishment of enterprises. In the evolving northwest European market, energy companies, too, are opting to establish their facilities in the Netherlands. This will have a positive effect on the security of supply within the Dutch electricity system.

We cannot be certain that all projects will in fact be realised. As in the previous Monitoring Report, a separate 'sensitivity calculation' has therefore been carried out to determine the consequences for the security of supply if some of these plans are cancelled. This analysis shows that even if just 30% of the plans for the realisation of new production capacity is achieved, the security of supply of the Dutch production system in 2015 will not fall below the level of the past few years.

As mentioned earlier, the results of this monitoring exercise indicate that we need not expect any structural problems. Nevertheless, extreme situations may occur which our assessment method does not cover. These include cooling water restrictions in the summer (Phase 2) and gas supply problems in 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 built at coastal locations and near open water, where there are few cooling water restrictions. In addition, some of the reported new production plants will no longer be gas-fired. This fuel diversification has a favourable effect on the security of supply.

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 2023 is therefore discussed briefly in this Monitoring Report. The analysis shows that electricity supplies in 2023 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 plants and decommission old ones. In addition, there is a high degree of uncertainty concerning the height of the demand for electricity at the end of a surveyed period of this length. It is not possible to predict all these developments accurately, although they may have a major impact on the height of the demand for electricity. Such development may include large-scale market penetration of electric cars or heat pumps. Consequently, the results of the security-of-supply analysis for the 2023 reference year are indicative to a large extent.

The monitoring of the security of supply can be improved if more insight is obtained into the value of available reserves in the surrounding electricity systems and into the available international transmission capacities. This requires thorough analyses of the entire interconnected electricity system in western Europe, which is why TenneT is currently performing cross-border analyses in collaboration with the TSOs of Germany, France, Belgium and Luxembourg. Initial results are expected towards the end of 2008. The simultaneity of events throughout the region will be a key consideration 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 the 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 (the so-called 'Loss of Load Expectation', abbreviated to LOLE). A maximum LOLE value is used as a criterion for the adequacy of a particular electricity system and refers to the acceptable risk of not meeting the demand. 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 (financial) damage to society in the event of a power disruption. 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 (the LOLE value exceeds the applicable standard) or surplus (the LOLE value falls below the 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) to meet the reliability criterion. In case 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 as regards 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 in this monitoring exercise. Section 3.3 indicates the sensitivity of the outcomes to alternative assumptions about the unavailability of means of production. As in the monitoring exercise conducted in 2007, this Monitoring Report again points to a massive increase in the planned realisation of new large-scale production capacity: more than 14 GW in total. We cannot be certain, however, that all these plans will actually be realised. A separate 'sensitivity calculation' has therefore been performed 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 3.3. In section 3.4, the results of the investigated variants are compared with the available transmission capacity for imports and exports. Section 3.5 contains an overview of the reserve factors that can be derived from the data we used. Section 3.6, finally, concludes with a discussion of the possible situation in 2023 based on conservative assumptions and information provided by producers.

3.2 Main Results of the 2007-2015 Monitoring Exercise (Basic Variant)

Figure 1 summarises the results of the Basic Variant employed in the 2007-2015 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 2004-2007 period.

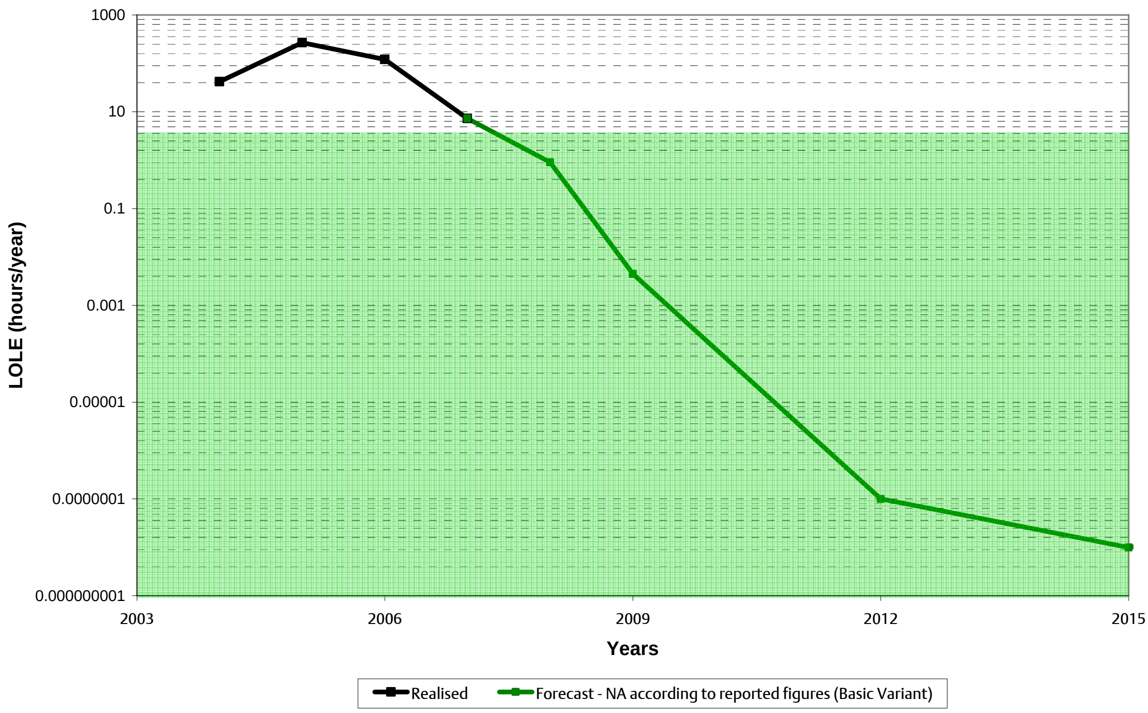

Figure 1: Main results of the 2007-2015 monitoring exercise (Basic Variant)

Figure 1 shows that the Netherlands was dependent on electricity imports up to and including 2007. The four-hour LOLE standard is indicated by the colour green. What is striking is that the security of supply has increased steadily through the years compared to the actual levels realised in 2005-2007 (i.e. the LOLE values are decreasing). As of 2008, the line moves into the green area and there will be a surplus (i.e. an export potential).

Table 1: Main results of 2007-2015 monitoring exercise, actual figures for 2004-2007 and forecasts for 2008-2015, including the unavailability of means of production (according to information provided by producers) (Basic Variant)

year	demand total	non operational capacity	operational capacity total	renewables	thermal	other (incl. waste)	LOLE NA acc.to reports	shortage of capacity firm	equivalent production capacity
	TWh	GW	GW	GW	GW	GW	h	GW	GW
2004	112.9	0.4	21.0	1.1	19.4	0.5	**42**	**0.9**	**1.1**
2005	114.8	0.4	21.1	1.3	19.3	0.5	**270**	**1.8**	**2.2**
2006	116.2	0.0	21.8	1.5	19.8	0.5	**121**	**1.3**	**1.6**
2007	117.0	0.0	23.2	1.6	20.8	0.7	**7.3**	**0.2**	**0.2**
2008	119.6	0.0	23.5	1.8	21.0	0.7	**0.9**	**-0.5**	**-0.6**
2009	121.7	0.1	25.2	2.3	22.2	0.8	**0.0**	**-2.0**	**-2.4**
2012	129.1	0.0	36.0	3.4	31.8	0.8	**0.0**	**-8.9**	**-10.7**
2015	137.0	1.0	40.4	5.0	34.6	0.8	**0.0**	**-10.7**	**-12.8**

Note: NA = Unavailability of means of production

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 solely wind) 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, because capacity with 100% availability does not exist. This 'equivalent production capacity' depends to a large extent on such factors 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 shows a capacity surplus (in terms of equivalent production capacity) during the entire surveyed period (2008-2015), increasing from approx. 0.6 GW in 2008 to 12.8 GW in 2015. These surpluses can be used for export purposes without jeopardising the security of supply (see also section 3.5). Particularly in the 2012 and 2015 reference years, there will be a significant export potential due to a major increase in production capacity.

The results described above are in accordance with the general picture presented by last year's analysis. A striking difference compared to the previous monitoring exercise is that the security of supply at the beginning of the surveyed period is slightly higher in this analysis. Last year's Monitoring Report projected a structural dependence on imports in 2008 in the basic variant. This more favourable situation can be explained by the fact that the demand for electricity grew less in 2007 than originally forecast. In addition, the decentralised capacity (particularly in the glasshouse horticulture sector) showed stronger growth in 2007 than was assumed in 2006.

3.3 Sensitivity to the Unavailability of Production Units (Sensitivity Var. A)

The assumptions made in respect of the likely unavailability of means of production are important input for the calculations. These assumptions greatly influence the findings. As was the case last year, we again noticed a major 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 2, which depicts the actual unavailability levels from 2004 up to and including 2007 and the forecasts given by producers. The black line shows the historical average unavailability level (14.6%) in the past few decades. As in the previous monitoring exercise it is striking that the further we look ahead, the larger the difference between the actual historical values and the values reported by producers: the values forecast are 4.0 to 8.7 percentage points below the historical average, while the actual values remain around the line of the historical average. For this reason, we again performed several analyses for this Monitoring Report – in addition to the Basic Variant, with unavailability figures according to the information provided by the producers – in which we based the unavailability figures for all surveyed years on the historical average.

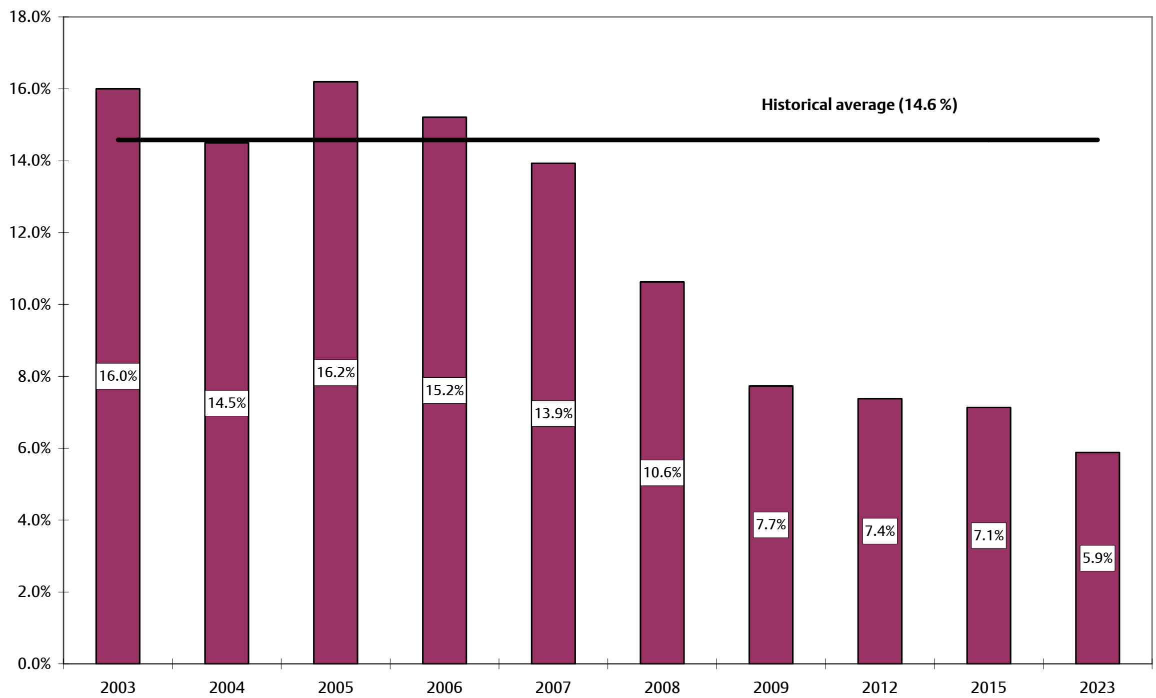

Figure 2: Unavailability of production units as a percentage, actual and estimated values

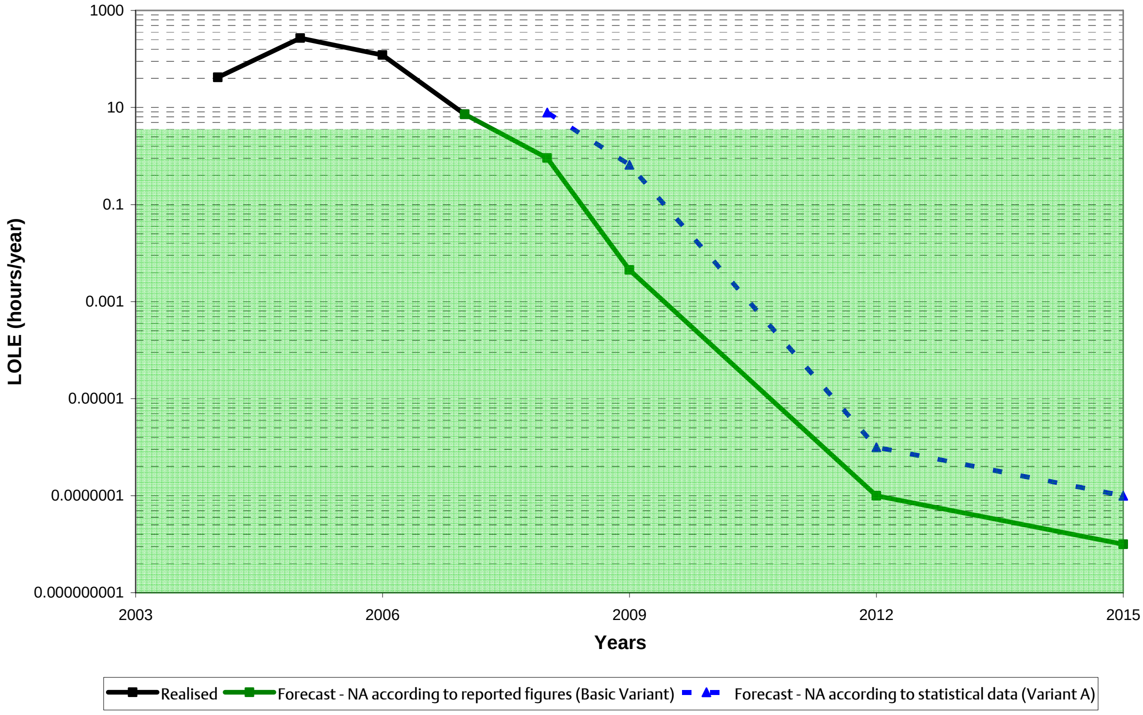

Figure 3: Monitoring results for 2007-2014 (Basic Variant and Sensitivity Variant A)

To supplement the main results presented earlier, the dotted line in Figure 3 shows the results of the variant with the availability data based on actual historical values. Table 2 presents the results of this sensitivity variant in figures.

Table 2: Monitoring results for 2007-2015, forecasts for 2008-2015 with standardised unavailability of means of production based on historical statistical data (Sensitivity Variant A)

	demand	non operational capacity	operational capacity				LOLE	shortage of capacity	
year	total		total	renewables	thermal	other (incl. waste)	NA acc.to reports	firm	equivalent production capacity
	TWh	GW	GW	GW	GW	GW	h	GW	GW
2004	112.9	0.4	21.0	1.1	19.4	0.5	**42**	**0.9**	**1.1**
2005	114.8	0.4	21.1	1.3	19.3	0.5	**270**	**1.8**	**2.2**
2006	116.2	0.0	21.8	1.5	19.8	0.5	**121**	**1.3**	**1.6**
2007	117.0	0.0	23.2	1.6	20.8	0.7	**4.6**	**0.2**	**0.3**
2008	119.6	0.0	23.5	1.8	21.0	0.7	**7.9**	**0.3**	**0.4**
2009	121.7	0.1	25.2	2.3	22.2	0.8	**0.7**	**-0.7**	**-0.8**
2012	129.1	0.0	36.0	3.4	31.8	0.8	**0.0**	**-7.6**	**-9.9**
2015	137.0	1.0	40.4	5.0	34.6	0.8	**0.0**	**-9.1**	**-11.8**

As was to be expected, greater shortages occur in this Sensitivity Variant than in the Basic Variant due to the higher assumed unavailability of means of production. The shortage of equivalent production capacity in 2008 amounts to 0.4 GW in this Sensitivity Variant, while the Basic Variant shows a surplus of 0.6 GW. The capacity shortage in 2008 can be easily compensated by imports (see section 3.5). A turnaround will occur in 2009, whereby the capacity shortage will become a surplus amounting to 0.8

GW of equivalent production capacity (compared to a surplus of 2.4 GW in the Basic Variant). The export potential in 2012 (9.9 GW) and 2015 (11.8 GW) will be 0.8 GW and 1.0 GW below the Basic Variant, respectively. Here, too, the conclusion as described under the Basic Variant applies to the reference years 2012 and 2015.

3.4 Sensitivity to Reduced Realisation of New Large-Scale Production Capacity (Sensitivity Var. B)

For this monitoring exercise we have taken into account a total of more than 14 GW of planned new production capacity. 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 the Basic Variant, the plans for new large-scale thermal production capacity in the period from 2009 through 2014 account for a total of 14.1 GW. In this Sensitivity Variant we assume that only 5.0 GW will be realised during the latter part of this period, instead of 14.1 GW (construction projects planned at the start of the surveyed period). This is approximately 30% of the large-scale production capacity of all registered projects in the 2009-2015 period. The calculations are based on standardised unavailability levels of means of production derived from historical statistics.
Figure 4 shows the results of this sensitivity calculation in combination with the results presented previously. Table 3 shows the results in figures.

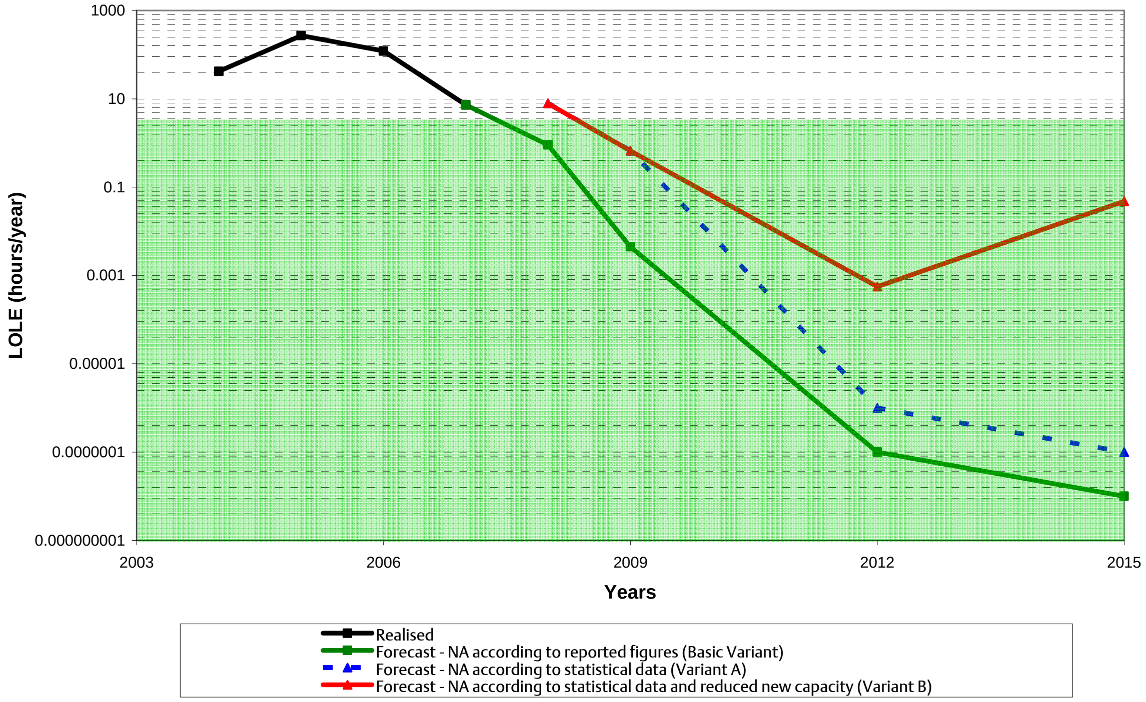

Figure 4: Monitoring results for 2007-2015 (Basic Variant and Sensitivity Variants A and B)

Table 3: Monitoring results for 2007-2015, forecasts for 2008-2015 with standardised unavailability of means of production based on historical statistical data and reduced realisation of new production capacity (Sensitivity Variant B)

year	demand	non operational capacity	operational capacity				LOLE	shortage of capacity	
	total		total	renewables	thermal	other (incl. waste)	NA acc.to reports	firm	equivalent production capacity
	TWh	GW	GW	GW	GW	GW	h	GW	GW
2004	112.9	0.4	21.0	1.1	19.4	0.5	**42**	**0.9**	**1.1**
2005	114.8	0.4	21.1	1.3	19.3	0.5	**270**	**1.8**	**2.2**
2006	116.2	0.0	21.8	1.5	19.8	0.5	**121**	**1.3**	**1.6**
2007	117.0	0.0	23.2	1.6	20.8	0.7	**4.6**	**0.2**	**0.3**
2008	119.6	0.0	23.5	1.8	21.0	0.7	**7.9**	**0.3**	**0.4**
2009	121.7	0.1	25.2	2.3	22.2	0.8	**0.7**	**-0.7**	**-0.8**
2012	129.1	0.0	31.0	3.4	26.8	0.8	**0.0**	**-3.8**	**-4.9**
2015	137.0	1.0	31.3	5.0	25.5	0.8	**0.0**	**-2.1**	**-2.7**

These results show that even if just 30% of plans for new large-scale production capacity are realised in the period up to and including 2015, there is sufficient production capacity to meet Dutch domestic electricity demand up to the end of the surveyed period.

3.5 Comparison of Shortages and Surpluses with the 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. With regard to the available transmission capacity for imports and exports, two scenarios have been investigated. In the cautious transmission scenario, the import/export capacity at the German/Belgian borders totals 3.85 GW during the period up to and including 2008. From 2009 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. In the optimistic transmission scenario, the Doetinchem-Wesel interconnection, with a capacity of 1.5 GW, will be operational in 2015, which will result in a total import/export capacity at the German/Belgian borders of 5.65 GW in the 2015 reference year.
Taking into account the NorNed cable (taken into operation in 2008) and the BritNed cable (1.0 GW as of the 2012 reference year), the cross-border transmission capacity for imports and exports in 2015 will total 5.85 GW in the cautious scenario and 7.35 GW in the optimistic scenario.

The table below gives an overview of the assumptions used with regard to the available capacity in the two transmission scenarios. In addition to 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 4: Available import/export capacity and maximum utilisation in the three calculation variants

year	Belgium/Germany		NorNed	BritNed	tot. nominal [1]		tot. after reductions [2]		maximum utilisation of import/export capacity (%)					
	cautious	optimistic			cautious	optimistic	cautious	optimistic	cautious transm. scenario			optimistic transm. scenario		
									basic var.	var. A	var. B	basic var.	var. A	var. B
	GW	GW	GW	GW	GW	GW	GW	GW						
2007	3.9	3.9	0.0	0.0	3.9	3.9	3.6	3.6	6%	6%	6%	6%	6%	6%
2008	3.9	3.9	0.7	0.0	4.6	4.6	4.2	4.2	-12%	7%	7%	-12%	7%	7%
2009	4.2	4.2	0.7	0.0	4.9	4.9	4.5	4.5	-44%	-14%	-14%	-44%	-14%	-14%
2012	4.2	4.2	0.7	1.0	5.9	5.9	5.5	5.5	-162%	-138%	-55%	-162%	-138%	-55%
2015	4.2	5.7	0.7	1.0	5.9	7.4	5.5	6.9	-194%	-166%	-30%	-155%	-132%	-24%

1) Excluding reductions

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

In both Table 4 and Figure 5, the available import and export capacity after reductions in the two transmission scenarios is compared to the firm production shortages and firm production surpluses occurring in the three calculated variants (Basic Variant, Variant A and Variant B).

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 figure shows the maximum capacity for imports and exports in the cautious transmission scenario (orange line) and in the optimistic transmission scenario (red line). In addition, the figure shows the production-capacity surpluses and shortages occurring in the three calculation variants in terms of firm capacity.

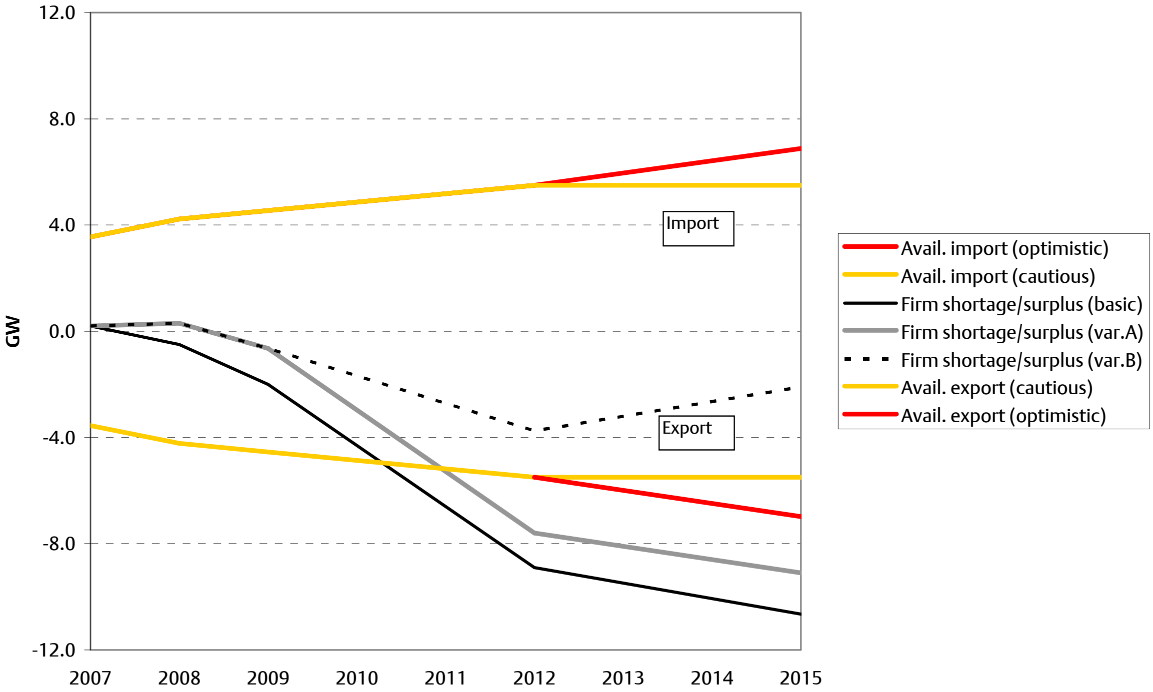

Figure 5: Comparison of surpluses and shortages with the available import and export capacity in the Basic Variant and in Sensitivity Variants A and B

In the 2008 variants where there is still 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.

From 2012 onwards, in the basic scenario as well as in sensitivity variant A, the available export capacity will be insufficient to make full use, under all circumstances, of the entire export potential that arises when all the plans for realisation of new capacity are achieved. For instance, the basic scenario indicates a firm export potential of 8.9 GW in 2012, while the available export capacity amounts to approx. 5.5 GW. This means that around 3.4 GW of the export potential cannot be utilised under all circumstances. In 2015, the unutilised export potential will increase to 5.2 GW in the cautious transmission scenario and 4.8 GW in the optimistic transmission scenario.
In the (more realistic) sensitivity variant with standard availability levels (Variant A), the unutilised export potential is considerably lower: 2.1 GW in 2012, and 3.6 GW in the cautious transmission scenario and 3.2 GW in the optimistic transmission scenario in 2015. As was to be expected, the available export capacity is more than sufficient in the variant involving reduced realisation of new large-scale production capacity (Sensitivity Variant B).

3.6 Reserve Factors

As in our previous reports, we have once again estimated the reserve factors. The reserve factor is the ratio of the installed production capacity and the maximum demand. Table 5 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. an almost identical level in the years 2007 to 2009 inclusive, followed by a substantial increase in the reserves in the years 2012 and 2015.

Table 5: Reserve factors 2007-2015

year	non-operational capacity	total operational capacity	capacity from renewables	available import cap. (cautious)	peak demand	reserve factor		
	GW	GW	GW	GW	GW	1)	2)	3)
2007	0.0	23.2	1.6	3.6	18.5	1.25	1.18	1.37
2008	0.0	23.5	1.8	4.2	18.9	1.24	1.17	1.39
2009	0.1	25.2	2.3	4.5	19.2	1.31	1.22	1.45
2012	0.0	36.0	3.4	5.5	20.4	1.77	1.63	1.90
2015	1.0	40.4	5.0	5.5	21.6	1.87	1.68	1.94

1) excluding import, renewables included for 100%, non operational for 0%

2) excluding import, renewables included for 100%, non operational for 0%

3) import capacity included for 100%, renewables for 20% and non operational for 0%

3.7 Prospects for 2023

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 2023 is discussed briefly below.

The information supplied by producers for 2023 does not produce a clear picture of the development of their portfolios. In most cases, therefore, no changes compared to 2015 have been indicated. This applies to the construction of new production units as well as the decommissioning of existing units. The information provided by producers who have indicated changes, shows that approximately the same amount of production capacity will be taken into operation in the 2015-2023 period as will be decommissioned (3.0 GW and 2.7 GW, respectively). Table 6 in Chapter 4 summarises the development of the electricity supply according to information reported by producers.

In order to determine how the electricity demand will develop in the eight years added to the surveyed period (2015-2013), the annual growth rate forecast for the 2010-2015 period (2%) has been extrapolated. This scenario would result in an annual demand for electricity of approx. 160 TWh in 2023. This represents an increase of around 40 TWh compared to current annual demand levels (also see Table 7 in Chapter 4). In assessing these forecasts, it should be kept in mind that there is a high degree of uncertainty concerning the height 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 height of the demand for electricity. Such development 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. The calculation reveals a significant export potential in 2023 in the Basic Variant and the variant with standard availability levels (Sensitivity Variant A). In the introduction to this Monitoring Report, we already indicated that it was difficult to produce long-term forecasts of the production situation in 2015. Obviously, an even higher level of uncertainty applies to any forecasts made for 2023. Combined with the level of uncertainty regarding the demand trend, the results of the security-of-supply analysis for the 2023 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 information on the domestic means of production they currently manage or plan to manage in the future (generally speaking these data concern provisional plans).
- 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 degree of coverage and make less use of our own estimates so as to enhance the quality and reliability of the analysis.
- Data obtained from the reference scenario included in the new Quality and Capacity Plan 2008-2014 concerning other domestic means of production, growth of the domestic market, the period after 2008, and transmission capacity on cross-border connections.
- Data provided by CBS (Netherlands Statistics) on the actual domestic demand in the period up to and including 2007.
- Data provided by CPB (Netherlands Bureau for Economic Policy Analysis) on economic growth after 2007.

Table 6 summarises the development of the installed capacity. With regard to the plans to construct new large-scale thermal production capacity, it should be noted that we have tried to remain as consistent as possible with the Quality and Capacity Plan 2008-2014. Full consistency is, however, not possible because the collection of information for the Quality and Capacity Plan was completed by the end of 2007.

The information provided produces nearly the same picture as last year’s monitoring exercise. A further increase of new production capacity 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 for the 2023 reference year is a new element in Table 6.

The information provided reveals that most of the new, large-scale capacity will be built on the coast. This is favourable for the security of supply because coastal locations are generally not subject to cooling water restrictions. We also noticed 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 and, by consequence, the vulnerability of the system to gas supply restrictions in extremely cold periods.

Table 6: Development of the installed capacity

	non oper. capacity	operational capacity			evolution					
					large scale thermal			sm. scale therm.	renewable	total
year	total	total	renewables	tot. excl. renewables	new	out of operation	balance	balance	balance	balance
	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
2006	0.0	21.8	1.5	20.3						
2007	0.0	23.2	1.6	21.5	0.1	0.0	0.1	0.9	0.3	1.4
2008	0.0	23.5	1.8	21.7	0.0	0.0	0.0	0.2	0.2	0.4
2009	0.1	25.2	2.3	23.0	1.1	0.1	1.0	0.3	0.5	1.8
2012	0.0	36.0	3.4	32.6	8.9	0.0	8.9	0.7	1.2	10.8
2015	1.0	40.4	5.0	35.4	4.1	1.8	2.2	0.6	1.5	4.3
2023	1.2	45.2	10.1	35.1	2.7	3.0	-0.4	0.1	5.1	4.8

The data provided (see Table 6) gives rise the following points for attention:

- In the years 2012 and 2015 we can see an enormous increase in the planned realisation of new large-scale production capacity. For example, more than 14 GW of new large-scale thermal production capacity has been reported for the entire period surveyed in this monitoring exercise. This represents an increase of approx. 1 GW compared to last year's monitoring exercise. Approximately 10 GW of this total of 14 GW is to be realised in the period up to and including 2012. 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 considerable amount of interconnection capacity. It therefore appears that in the evolving northwest European market, energy companies, too, are opting for a Dutch location. This will have positive effects on the security of supply within the Dutch electricity system.
- The expected growth of small-scale thermal production capacity has been revised upwards from the level indicated in the previous Monitoring Report. This is mainly related to the use of gas engines in glasshouse horticulture.
- More than 5 GW of large-scale thermal production capacity will be decommissioned in the 2015-2023 period. Around 2.2 GW of this capacity will be conserved. Because approx. 2.7 GW of new production capacity has been reported in the same period, the overall production capacity will decrease.

Table 7 summarises the main points of departure with regard to the size of the domestic market.

Table 7: Assumptions concerning market size

year	monitoring 2003-2011		monitoring 2004-2012		monitoring 2005-2013		monitoring 2006-2014		monitoring 2007-2023	
	growth of cons.	demand	growth of cons.	demand	growth of cons.	demand	growth of cons.	demand	growth of cons.	demand
	%	TWh	%	TWh	%	TWh	%	TWh	%	TWh
2003	1.09%	109.6	1.32%	109.8	1.32%	109.8	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
2005	1.50%	112.6	1.00%	111.9	1.53%	114.7	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
2007	2.00%	117.1	2.00%	116.7	3.00%	121.3	2.75%	119.4	0.53%	117.0
2008	2.00%	119.5	2.00%	119.1	2.00%	123.8	2.75%	122.7	2.25%	119.6
2009	2.00%	121.9	2.00%	121.5	2.00%	126.2	2.00%	125.2	1.75%	121.7
2010	2.00%	124.3	2.00%	123.9	2.00%	128.8	2.00%	127.7	2.00%	124.1
2011	2.00%	126.8	2.00%	126.4	2.00%	131.3	2.00%	130.2	2.00%	126.6
2012	2.00%	129.3	2.00%	128.9	2.00%	134.0	2.00%	132.8	2.00%	129.1
2013	2.00%	131.9	2.00%	131.5	2.00%	136.7	2.00%	135.5	2.00%	131.7
2014	2.00%	134.6	2.00%	134.1	2.00%	139.4	2.00%	138.2	2.00%	134.3
2015	2.00%	137.3	2.00%	136.8	2.00%	142.2	2.00%	141.0	2.00%	137.0
2023									2.00% p/j	160.6

legend

- (dark grey) realised (final figures from CBS)
- (light grey) realised (initial estimation of CBS)
- (white) prognosis (based on most recent CPB prognosis)

The following conclusions can be drawn from Table 7:

- The definitive figure for the domestic electricity demand in 2006 is in line with the preliminary estimate used in last year's monitoring exercise.
- The actual growth in 2007 (based on the initial CBS estimate) is approximately 2 percentage points lower than was assumed for the purposes of last year's monitoring exercise.
- The size of the domestic market in 2008 and 2009 has been based on CPB's most recent expectations of GDP growth in 2008 (2.25%) and 2009 (1.75%) (published in April 2008). 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 137.0 TWh in 2015 (including grid losses). This is approximately 4 TWh lower than assumed in our previous monitoring exercise. Extrapolation of this expected growth rate results in a domestic market size of more than 160 TWh in 2023.

5. Vulnerability of the Security of Supply Due To Dependence on Imports

The analyses show that the Netherlands is dependent on supplies from other countries for its security of supply in the 2007 and 2008 reference years. Dependence on imports is acceptable in principle, provided that we can rely on sufficient reserve capacity being available under all circumstances in our neighbouring markets to meet domestic demand, combined with production capacity in the Netherlands. Additionally, the various transmission grids and their interconnections must provide sufficient capacity for the required transmission volume.

In order to estimate the extent to which the security of supply in the Netherlands is vulnerable due to dependence on imports, it is particularly important to know how much import capacity and reserve production capacity is reliably available in our neighbouring countries.

Production surpluses in the northern German grid mean that less and less of the nominally available capacity on the interconnectors with Germany and Belgium can be regarded as reliable import capacity. We took this into account when calculating the import capacity. For all the surveyed years, there is sufficient reliable import capacity to make up for the domestic shortage by means of imports. Consequently, the available reserves in our neighbouring countries form the decisive factor when it comes to determining the degree of vulnerability of the Netherlands due to dependence on imports. The UCTE System Adequacy Forecast is the best source of information that is currently available on the reserves present within the European electricity system.

The most recent UCTE System Adequacy Forecast (2008-2020) paints a positive picture of the available reserves in countries neighbouring the Netherlands over the coming years. The ‘cautious scenario A’, for instance, concludes that sufficient reserves are present in the entire UCTE system for the period up to and including 2015. In the period that follows, supplementary investments appear to be necessary. The main conclusions of the UCTE Report include the following:

- *The comparison of Remaining Capacity and Adequacy Reference Margin shows that generation adequacy of the UCTE system should not be at risk up to 2015 in any generation scenario and at any reference point.*
- *After 2015, additional investments in generating capacity are required to maintain the level of adequacy at an appropriate level.*

The report also states that reserves in the UCTE’s Northwest region (which includes the Netherlands) appear to be sufficient to meet the demand in the period up to and including 2015 in the aforementioned ‘cautious scenario’.

5.1 Cross-Border Analyses

The UCTE method provides a rough indicator of the security of supply. There is room for improvement in the UCTE method in the following and other respects:

- One-year modelling period. The UCTE method is based on two measurements per year. It would be better to have more measurements, preferably one every hour.
- Modelling of uncertainties. Taking proper account of uncertainties is important in order to form an impression of the security of supply in an electricity system. Important uncertainties include the load, the amount of wind, the unforeseen unavailability of power stations (due to failures), and the hydropower conditions.
- Modelling of the market. Better allowance could be made for the reactions to market prices on the demand and supply side.
- Limitations in the transmission grid. The integration of these limitations into the model could be improved.

A reliable and consistent data set is essential to improving the model. A group of countries consisting of the Netherlands, Belgium, Germany, Luxembourg and France has established the Pentalateral Energy Forum to facilitate the exchange of information. Several TSOs from the participating countries, including TenneT, are conducting analyses of the entire region based on the data obtained and using their own particular methods. These analyses will enable examination of the extent to which the security of supply can be improved through synergy effects, i.e. by regarding the various Western European systems as a single market. These synergy effects are likely to occur both on the demand and on the supply side. A certain synergy may be expected on the supply side because, for example, failures of means of production can be compensated by reserves present in the systems of other countries. On the demand side, there is likely to be a certain lack of synchronicity in the various systems as regards the occurrence of high demand.

The next step is to compare the results of the different analyses. This will allow alignment to our own results and to those of neighbouring countries that use the same method. An initial report of the findings is expected in late 2008.