Risk Assessment 2014

By
N.M. van der Sar

Department
Prognosis and Market Modelling

Report
Risk Assessment 2014

Due by
10 June 2014

Date, version
10 June 2014

Our reference

Status
Final Draft

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1 Executive Summary

The Dutch society is heavily dependent on gas. At the moment, the Netherlands is not reliant (or hardly reliant) on other countries for its gas supplies due to its substantial national production. This situation will not change in the foreseeable future, also taking into account the recent decision on production from the Groningen field. In this respect the Dutch situation regarding security of gas supply is fundamentally different to that of other EU countries. This situation is confirmed by this Risk Assessment which reviews the standards set out in the European Security of Gas Supply Regulation 994/2010.

Due to the large indigenous production the Dutch security of supply is only little influenced when flows in (North West) Europe are interrupted. Moreover, the Netherlands does not depend on one single production facility. The Groningen field alone is divided into over 20 facilities, and additional national production is delivered through more than 235 so-called "small fields." Notwithstanding the down scaling of the annual Groningen production, the measures that are taken assure that under peak and/or emergency situations maximum production capacity will still be available.

Security of supply in the Netherlands is delivered through an effective gas market. Commercial incentives on shippers/suppliers are vital to provide sufficient gas to customers. The Dutch virtual gas hub TTF is for example the most liquid gas hub on the European continent and almost on par with NBP. This highly effective gas market is supported by an additional legal framework which safeguards security of supply. It should nevertheless not be forgotten that although infrastructure is available, it is in the end up to shippers and traders to supply gas to where and when it is needed in the right amount.

The Dutch infrastructure standard and supply standard both satisfy the EU standard. For the N-1 infrastructure standard the result again is more than 160%. This result easily satisfies the minimum requirement of 100% as laid down by the Regulation, without hampering the operations of the internal gas market.

This 2014 Risk Assessment does not result in a finding which would support the introduction of bi-directional capacity on cross-border points which are not yet bi-directional. This assessment is supported by national assessments of the network and reflected by the absence of expressed market interest, as was confirmed by the results of the recent Open Season.

In the long term, Dutch domestic production of natural gas will decline. Well-timed investments in pipelines, storage facilities, LNG installations in the Netherlands and beyond will provide the market with sufficient transport capacity to compensate for this decline in domestic supply with additional imports and opportunities for supplying flexibility. An increase in the supply of green gas and the possible production of non-conventional gas may also contribute towards the availability of this commodity.

2 Introduction

In order to reinforce security of natural gas supply in the European Union and its member states, Regulation (EU) no. 994/2010 of the European Parliament and of the Council of 20 October 2010 entered into force (hereinafter referred to as the Regulation), replacing Council Directive 2004/67/EC of 26 April 2004 concerning measures to safeguard security of gas supply. The Regulation aims to prevent so-called protected customers (see Chapter 4 for a detailed description) being affected by the adverse consequences of a disruption in the gas supply. To this end, the Regulation introduces measures to ensure that all member states and players on the gas market take action in advance in order to prevent potential disruptions to the gas supply and, if a disruption should occur, to overcome the consequences of this as efficiently as possible.

In the Netherlands The Ministry of Economic Affairs (MEA) has been appointed as the national competent authority (for the implementation of) the regulation. The Gas Act provides that the Minister can ask the national gas transmission system operator Gasunie Transport Services (GTS) to perform specific tasks mentioned in the Regulation partly or completely, but the ultimate responsibility remains with the Minister. In concrete terms, this relates to the Risk Assessment, the Preventive Action Plan and the Emergency Plan.

This Risk Assessment is an update and further expansion of the first Dutch Risk Assessment, published in 2011. The 2011 Risk Assessment did not result in a requirement for investments needed to cope with the infrastructure standard defined in Article 6 of the Regulation. Neither were country-specific difficulties encountered in the implementation. As there was no need for investments to cope with this, the 2014 Risk Assessment does not include a reference to the progress made in this regard. This Risk Assessment does also not result in a requirement for investments needed to cope with the infrastructure standard.

The 2014 Risk Assessment of the Netherlands is a detailed description of the role of gas in the Netherlands and how the security of supply of this source of energy is upheld. The report gives an overview of all important data related to the role of gas in the Netherlands, the gas transport network and specifies the regulatory requirements of the infrastructure and supply standards. Furthermore it contains an evaluation of the risks for the security of gas supply for which purpose several scenarios were developed. For reasons of consistency and readability the 2014 Risk Assessment includes segments of the Dutch 2012 Preventive Action Plan. A concept of the Dutch Risk Assessment 2014 was shared with neighbouring countries within the Pentalateral Gas Platform, as is required by Article 9(1d) of the Regulation.

3 Gas in the Netherlands

This chapter discusses the relevant national and regional circumstances, as prescribed in article 9(1)(b) of the Regulation. The paragraphs include information about the role of gas in the energy mix, the role of gas in electricity production and for heating purposes and details national production, storage facilities, market size and actual flows. Furthermore the network configuration, the safety of the network and the potential for physical gas flows in both directions is detailed.

3.1 Gas plays a crucial role in the Dutch energy mix

Gas is crucial in the Dutch energy supply. Dutch gas supply is one of the world's most reliable. Gas shortage has hardly ever been experienced. Due to the large Dutch national production interruption of gas flow has only been the result of infrastructure failure and not of a volume deficit.

As is clearly illustrated by the blue colour in figure 1, natural gas has been the most important energy source in the Netherlands since the discovery of the Groningen gas field in the 1960s.

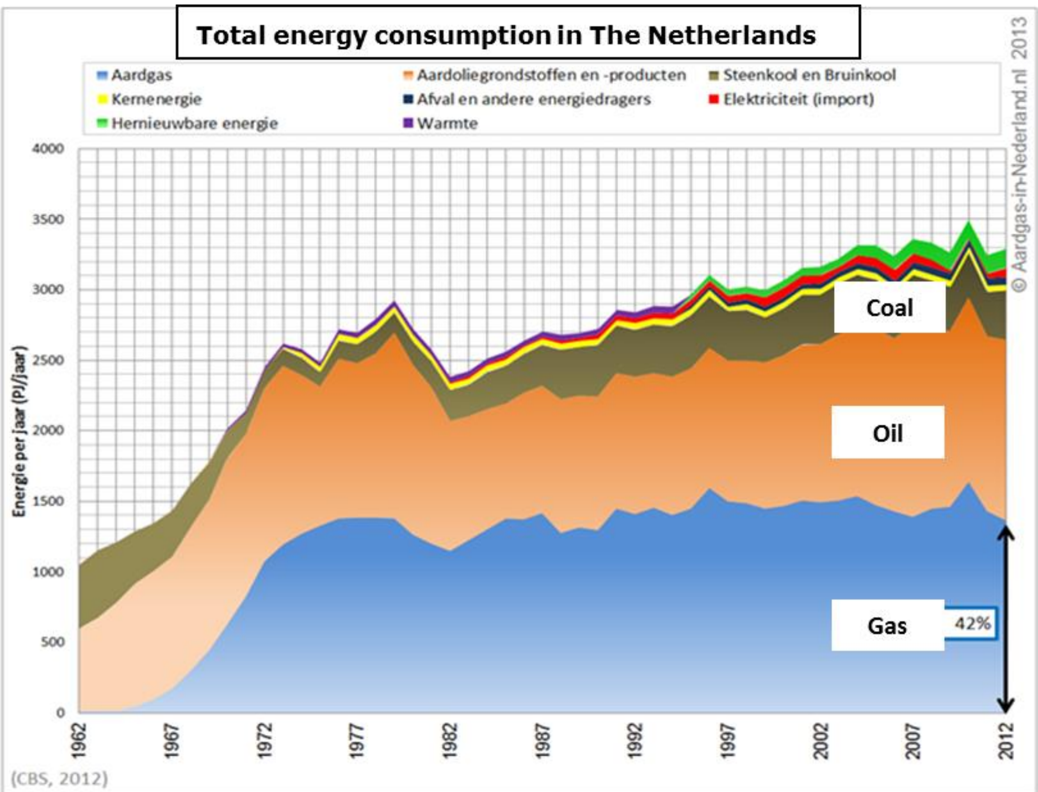

Figure 1 Total Consumption in the Netherlands 1960s-2012, source: http://www.aardgas-in-nederland.nl/nederland-aardgasland/aardgas-in-de-nederlandse-energievoorziening/

The share of gas in gross energy consumption in the Netherlands is around 42%. This is a large share compared other North West European countries, as is illustrated in figure 2 below.

2010 AND 2011 GAS SHARE IN GROSS ENERGY CONSUMPTION SOURCE TYNDP 2013-2022		
COUNTRY	**2010**	**2011**
Belgium	27,5%	25,7%
Denmark	20,0%	16,6%
France	16,1%	14,4%
Germany	21,9%	20,1%
Ireland	31,5%	29,3%
Luxembourg	26,3%	22,7%
The Netherlands	42,3%	42,2%
Sweden	2,9%	2,3%
United Kingdom	39,4%	34,4%

Figure 2 2010 and 2011 Gas share in gross energy consumption North West Europe, source: http://www.entsog.eu/publications/gas-regional-investment-plan-grips

As will be detailed in some of the following paragraphs gas is widely used in Dutch households, the electricity sector and industry. This is illustrated by the graph below (figure 3).

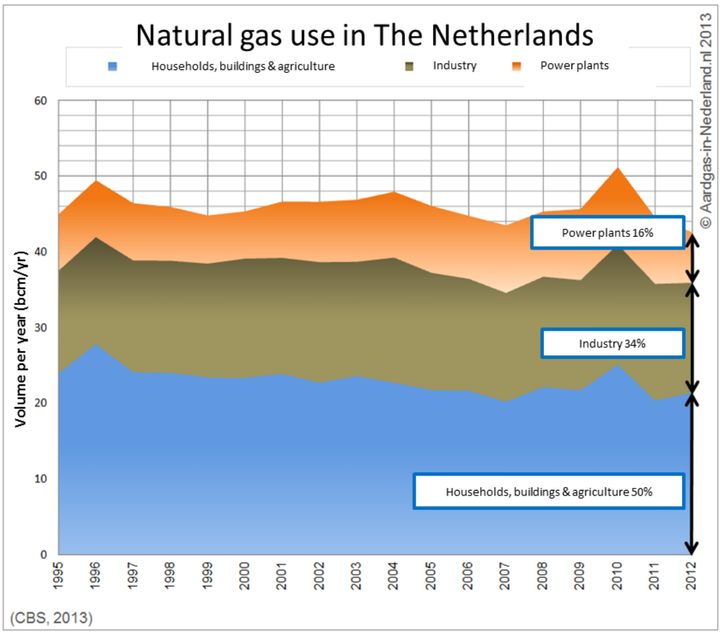

Figure 3 Natural gas use in the Netherlands 1995-2012, source: http://www.aardgas-in-nederland.nl/nederland-aardgasland/aardgas-in-de-nederlandse-energievoorziening/

3.1.1 Dutch Gas demand to slowly decrease

As shown in the figure below (figure 4), Dutch gas demand is likely to slowly decrease over the coming years. Due to many different variables (economic trends, penetration rate of renewable energy source, CO2 prices etc) this graph should only be seen as an indication of Dutch gas demand on the longer term. Moreover Dutch gas demand (volumes) forecasted below assumes a normal winter. Severe weather conditions have a strong impact on the actual annual gas demand in the Netherlands, as gas is widely used for heating.

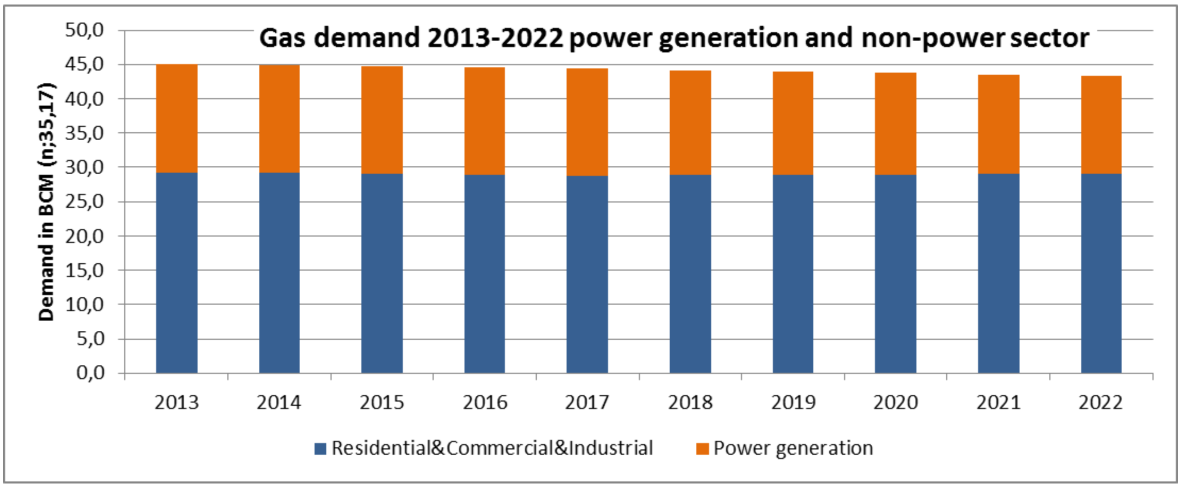

Figure 4 Projection Dutch annual gas demand 2012-2022 power generation and others, source: http://www.entsog.eu/publications/tyndp

3.1.2 Gas plays an important role in Dutch electricity production

In the Netherlands electricity is mainly generated through gas-fired power plants, as shown in figure 5. The proportion of electricity generation through gas-fired power plants in the Netherlands is high compared to other European countries.

The Netherlands is a leading country in the use of combined heat and power production (CHP) in energy supply. Almost a quarter of electric productive capacity set up in the Netherlands consists of gas-fired CHP installations.

Because gas-fired power plants can easily and quickly adjust their production, they are also extremely suitable for providing reserve capacity for wind and solar energy.

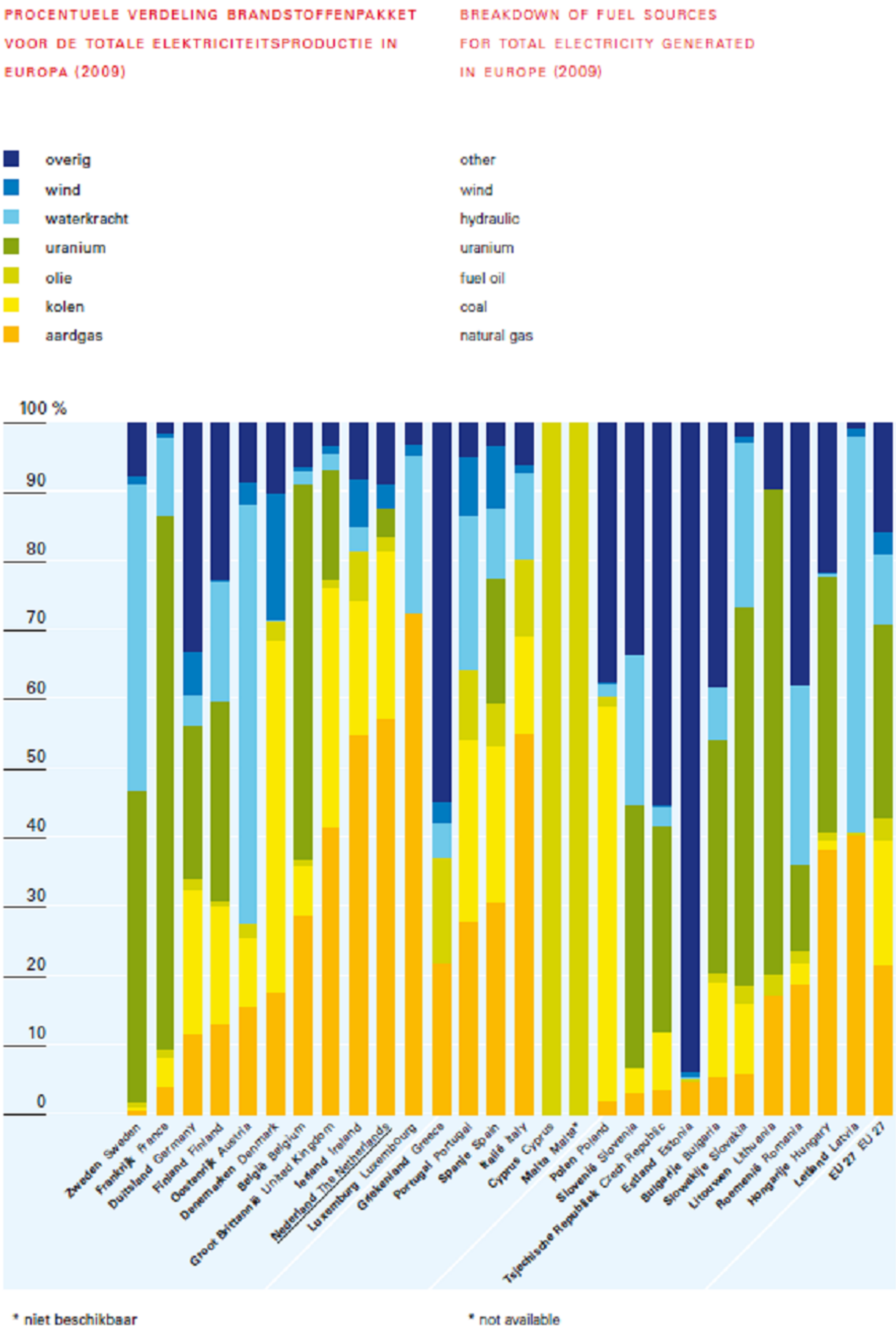

Figure 5 Breakdown of fuel sources for total electricity generated in Europe
source: http://www.windunie.nl/Documents/Energie-in-Nederland-2011rapport.pdf

However, like in the whole of North West Europe the role of gas in the electricity generation merit order is changing in the Netherlands. This is due to the combination of relatively low coal and carbon prices together with more renewable energy sources coming on line. Nevertheless, as figure 6 illustrates, with these external factors in play, gas still played a significant role in the regions and Dutch electricity generation mix.

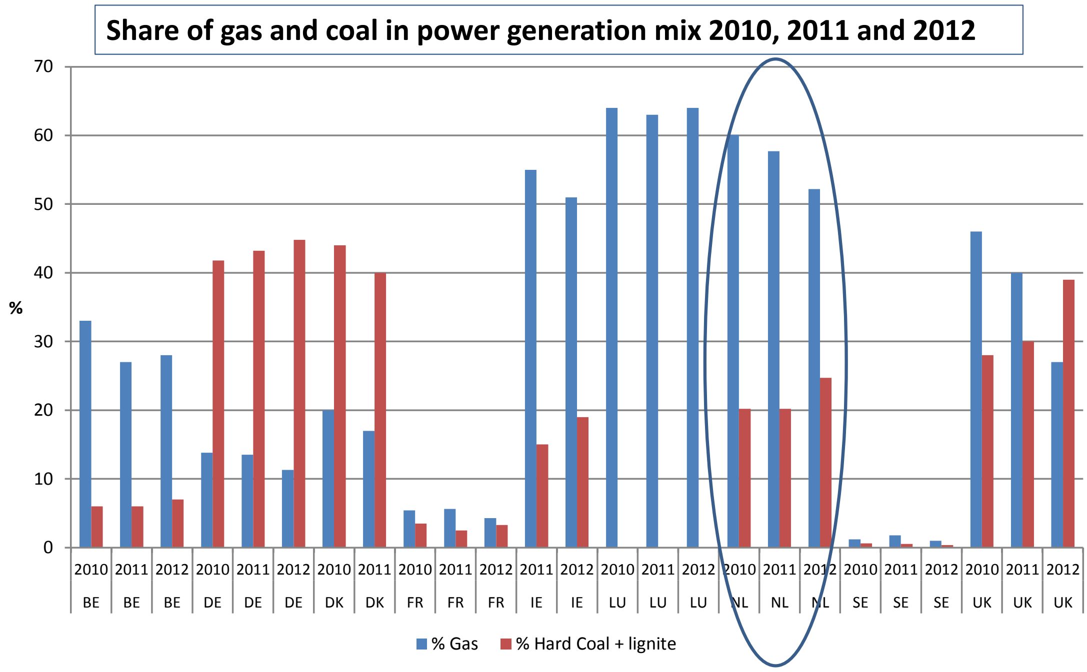

Figure 6 Share of gas and coal in power generation mix 2010, 2011 and 2012 in NEW, source: http://www.entsog.eu/publications/gas-regional-investment-plan-grips

3.1.3 96% of Dutch households use gas

In the Netherlands, 96% of the 7 million households are connected to the gas network. Market share of natural gas for heating is extremely high in the Netherlands. In most houses gas is used for heating, cooking and hot water supply. In comparison, this percentage is 82% in the United Kingdom, 42% in Germany and 55% in Belgium. Just over 500.000 Dutch houses use district heating. Gas is the main energy source for district heating.

Figure 7 shows that the Netherlands has a very high gas consumption per head of the population (light blue line) compared to other EU countries.

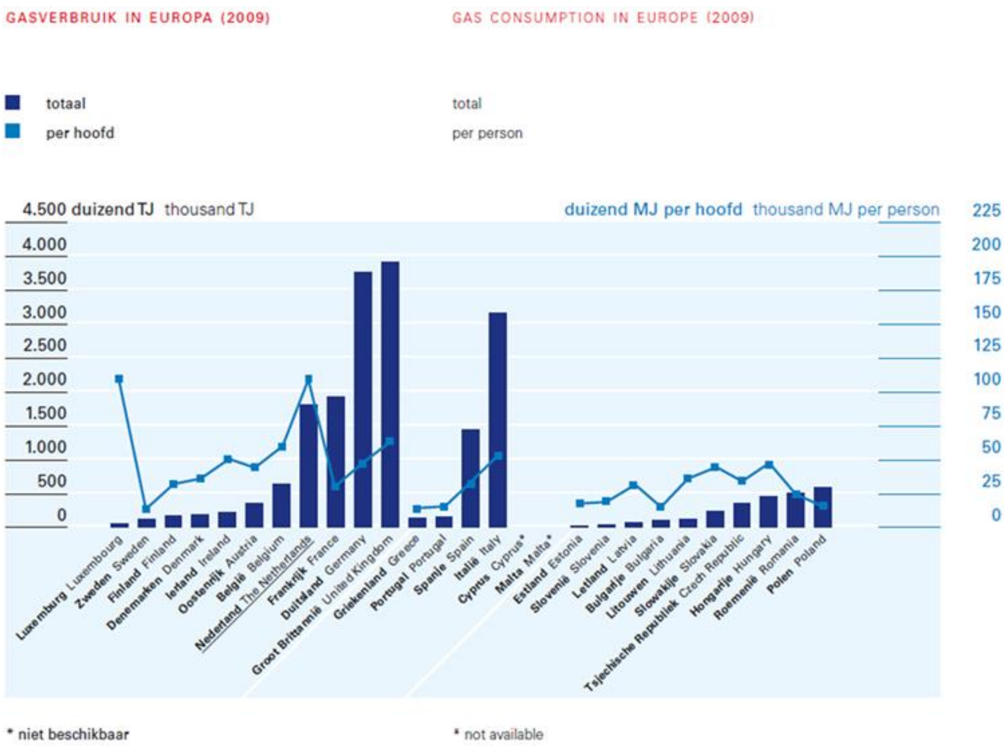

Figure 7 Gas consumption in Europe 2009, source: http://www.windunie.nl/Documents/Energie-in-Nederland-2011rapport.pdf

Over the years gas consumption per house showed a moderate decrease, see the dark blue line in figure 8 below. The reasons behind this are the growing level of insulation and the wide use of the condensing boiler. 86% of all houses installed with a boiler use a condensing boiler. Electricity consumption slightly increased, as is illustrated by the light blue line.

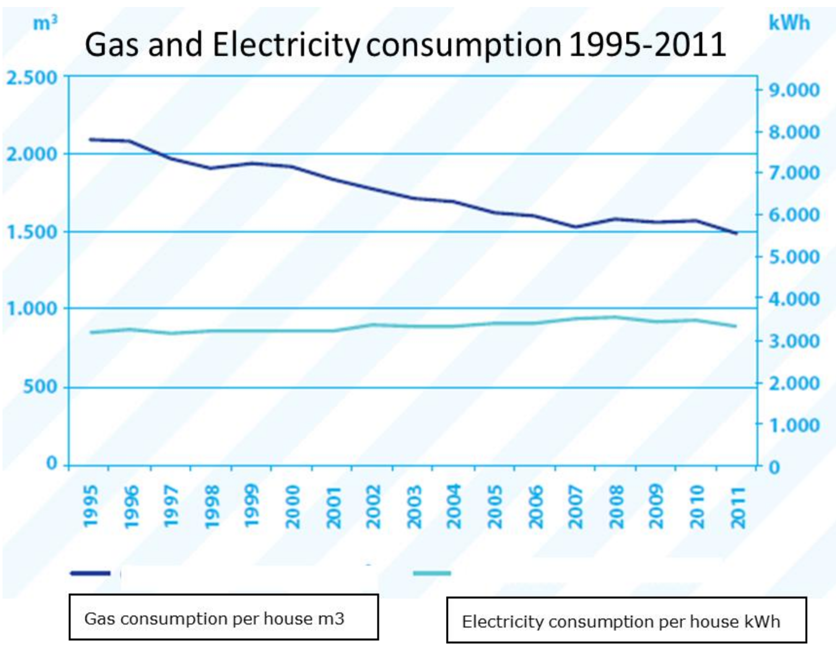

Figure 8 Gas and electricity consumption per Dutch house 1995-2011, source: http://www.energie-nederland.nl/energietrends/

3.1.4 Demand Dutch industry is around 34% of total Dutch gas demand

Natural gas is in general the main source of energy of the Dutch industry. In 2012 34% of Dutch annual gas demand was consumed by industry, as was illustrated by figure 3. Heat production is delivered mainly through gas in the Netherlands' industry. Gas is also a very important feedstock for the Dutch petro chemical industry. A large share is used for the production of ammonia, which in turn is used to produce fertilizer. CHP is widely used in Dutch industry (and in the agricultural sector).

3.2 Market size

A good illustration of the size of the Dutch gas demand is the fact that peak demand for gas is 10 times the size of peak demand for electricity. The Dutch network of gas pipelines, storage facilities and an LNG terminal can supply 10 times as much energy to the domestic market than the existing Dutch electricity grid.

In 2013 GTS transported a record of 116 bcm (n;35,17). This means that Dutch annual gas consumption of about 45 bcm (n;35,17) is less than 40% of the total volume of gas that annually flows through the country. This is due to export of indigenous gas and the role of the Netherlands as a transit country.

While national demand slightly decreases, domestic production is on the longer term in strong decline. As a result more volumes have to be imported. Infrastructure has been and will be adjusted to facilitate this. Around the year 2025 the Netherlands will become a net importer of gas. That is why the Government wants the Netherlands to become the gas hub of North Western Europe. Not only gas production, but also transit, storage, trade and knowledge development are important factors for the Netherlands as a gas hub.

How much more imported volume is required on the longer term also depends on the transit flows through the Netherlands. Detailed market information about these (contracted) future imports and exports of volumes of natural gas is included in the annual Reports on 'Security of Gas Supply'[1]. This report fulfils the EU obligation as laid down in article 5 of Directive 2009/73/EC and in Article 52a of the Dutch Gas Act. This report has shown over the past few years that the market needs to contract additional volumes in order to be able to continue to meet Dutch gas demand in the long term.

3.3 Sources

The sources of the gas that flows through the Netherlands are indigenous production, LNG, Norwegian gas and Russian gas. Contrary to what is sometimes believed, currently only little Russian gas physically flows through the Netherlands. According to ENTSOG calculations, only by 2022 physical Russian flows through the

[1] http://www.gasunietransportservices.nl/en/about-gts/publications

Netherlands will reach the 5% threshold. ENTSOG choose to use a threshold of a minimum of 5% to indicate a source of relevance for diversification. This is illustrated by the change from light green to dark green colour in the Final Investment Decision (FID) 2022 situation on the ENTSOG map, figure 9, below.

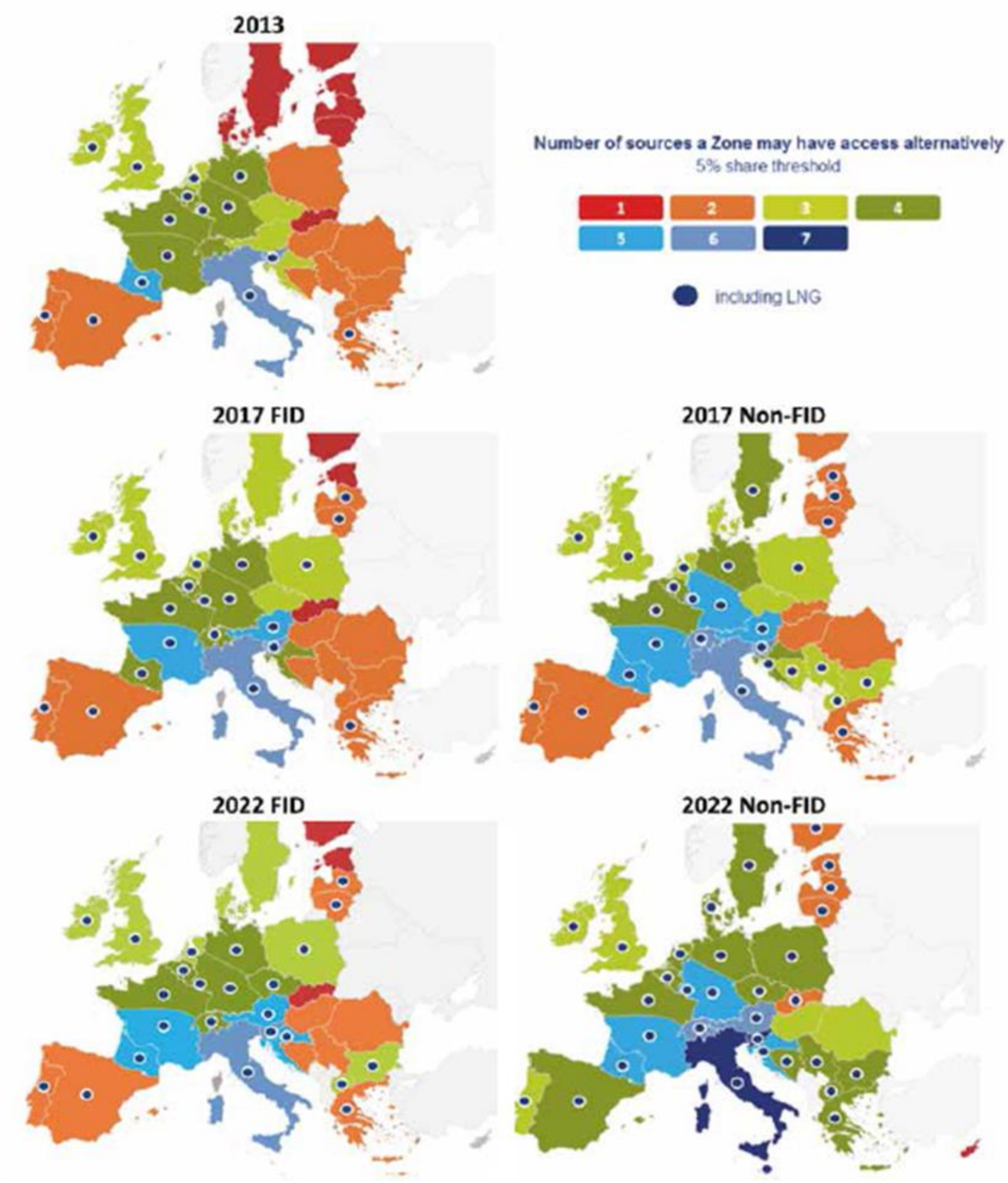

Figure 9 number of sources per balancing zone, situation 2013-2022 based on FID and non-FID projects, source: http://www.entsog.eu/publications/tyndp

3.4 Actual flows

Actual cross-border flows in BCM (n; 35,17) in 2013		
Belgium		
	To Belgium	20,4
	From Belgium	0,3
Germany		
	To Germany	33,4
	From Germany	4,9
Norway		
	To Norway	0,0
	From Norway	14,6
United Kingdom		
	To the UK	8,0
	From the UK	0,0

Source: GTS[2]

3.5 The TTF is the most liquid continental hub

The TTF (Title Transfer Facility) is the virtual gas trading platform in the Netherlands where gas can be traded. Trade on the TTF continues to grow steadily, further strengthening its leading position on the European continent. In 2013 113 traders were active on the platform, compared to 104 in 2012. The volume of gas traded on the TTF in 2013 was 8287 billion kWh, compared to 7569 billion kWh in 2012.[3] This is more than two-and-a-half times the volume of all other continental exchanges put together.

Figure 10 shows the strong growth in the number of parties on the TTF, the increase in traded volumes and the net volume between January 2009 and January 2014.

[2] the actual flows do not included flows related to cross-border connections to German storages.

[3] Gasunie Annual Report 2013

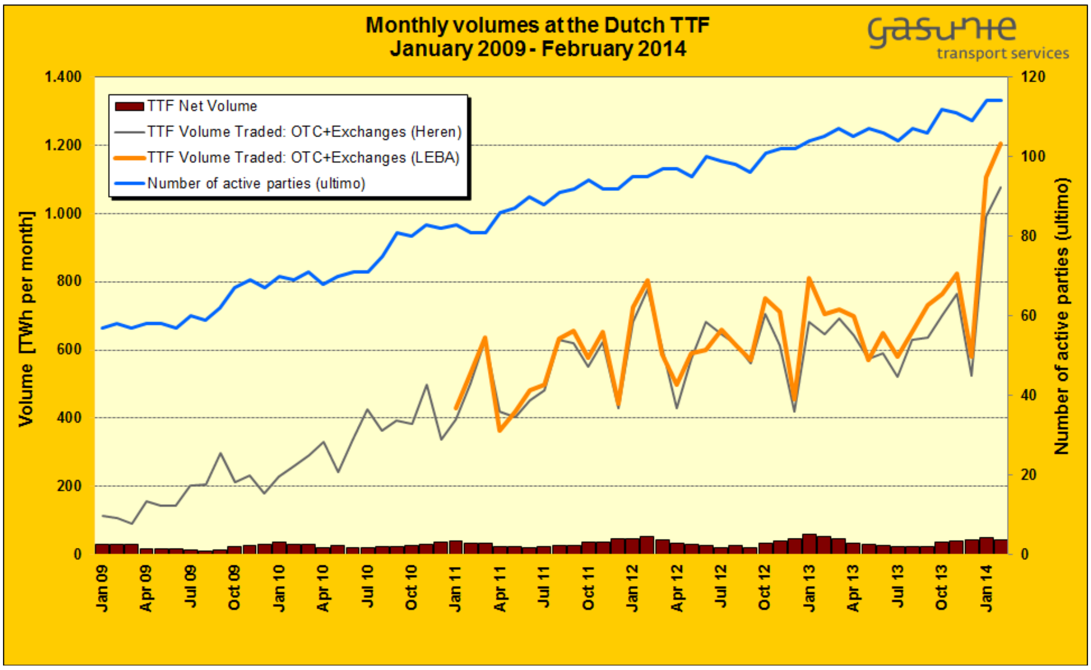

Figure 10 Monthly volumes and number of active participants at the Dutch TTF between January 2009 and January 2014, source: http://www.gasunietransportservices.nl/en/transportinformation/ttf-volume-development

3.6 The availability of production in the Netherlands

The Groningen gas field is a giant natural gas field located near Slochteren in Groningen province in the north eastern part of the Netherlands. Discovered in 1959, it is the largest natural gas field in Europe and one of the largest in the world.[4] The Groningen gas field is operated by the Nederlandse Aardolie Maatschappij BV (NAM), a joint venture between Royal Dutch Shell and ExxonMobil with each company owning a 50% share. The field accounted in 2013 for 67% of the natural gas production in the Netherlands, the other 33% being supplied by around 300 smaller gas fields, most of them located offshore in the North Sea.

As illustrated by figure 11, the production of the Groningen is in decline. Besides the natural decline of the Groningen field production, the growing number of earthquakes in the region where this gas is extracted resulted in a decision by the Minister of Economic Affairs to scale down the gas extraction from the Groningen field for the period 2014-2016.

3.6.1 Scaling down of the Groningen production due to earthquakes

The consequences of years of gas extraction in Groningen have become increasingly clear over the past few years through a growing number of

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4 http://www.nogepa.nl/en-us/oil-and-gas/history/

earthquakes of increasing magnitude.[5] These earthquakes and the concerns raised by the local population have over the past year been reason to re-think the quantity and method of gas extraction in Groningen. Research has enhanced the insights into the effects of gas extraction on the chance, magnitude and potential risks of earthquakes, into the value development of people's properties and the possibilities of reinforcing the houses and other buildings.

On January 17, 2014 The Minister of Economic Affairs (MEA) made public his envisaged decision[6] to approve the extraction plan submitted by NAM under the following conditions:

- Total production from the Groningen gas field will be reduced to 42.5, 42.5 and 40 bcm respectively over the years 2014, 2015 and 2016.
- Gas extraction from the Loppersum clusters, which are in the centre of the area most affected by earthquakes, will be scaled down for 2014, 2015 and 2016 to a maximum production level of 3 bcm a year. Compared to the average production levels of 15 bcm over recent years this means that production in the risk area will be lowered by 80%.
- to give approval for a period of three years, during which measurements and studies will be carried out to be incorporated in a new, modified extraction plan which will be decided on by the end of these three years. NAM has to submit this modified extraction plan for the Groningen gas field before 1 July 2016, after which a decision will be made on the production in 2017 and beyond.

It was calculated that halting total production at the Loppersum clusters would by 25% reduce the Groningen field's capacity to produce gas and feed it into the national network. Such a capacity reduction could be large enough to cause problems for security of supply in wintertime. In times of peak demand the remaining clusters and gas reserves would be unable to produce sufficient low calorific gas to meet the total demand. Therefore it was considered necessary to allow limited production of 3 bcm a year in order to respond quickly to peak demand. This means that under peak demand and/or emergency situations maximum capacity can be used, and security of supply is safeguarded.

It should be noted that the plan as described above, is an envisaged decision by the Dutch government. After publication of the envisaged decision, there was a six week public consultation period. After this consultation, the decision was/will be finalised. It will be possible to appeal the decision to the Council of State within six weeks after the decision is made. At the day of publication of this report the decision making process was not yet finalised.

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[5] This text is based on the information provided by the Minister of Economic Affairs to the Dutch Parliament, in its letter of 17th January 2014 with the subject "Gas extraction in Groningen"

[6] http://www.rijksoverheid.nl/onderwerpen/aardbevingen-in-groningen/besluit-rijksoverheid-over-aardgaswinning-groningen. For the background studies that underlie the decision, see http://www.rijksoverheid.nl/onderwerpen/aardbevingen-in-groningen/onderzoeken-aardbevingen-groningen (in Dutch only)

3.6.2 Historical and forecasted indigenous production

Due to the decision taken by the Dutch government, Dutch indigenous production from the Groningen fields can only be forecasted up to 2016. No graphs showing the new extraction plans were available at the time of writing of this document. For the purpose of this document a graph (figure 11) which includes the production forecast as detailed in the above was created. This graph is based on the data set underlying the initial production projection forecast,[7] combined with the Groningen field production plan for 2014, 2015 and 2016 as approved by the Dutch MEA. The projected production data for the period after 2016 of the Groningen field as foreseen in 2013 is included in this graph. But this number may change. This uncertainty is expressed through the use of a transparent layer over the Groningen production for period after 2016 and the inclusion of question marks.

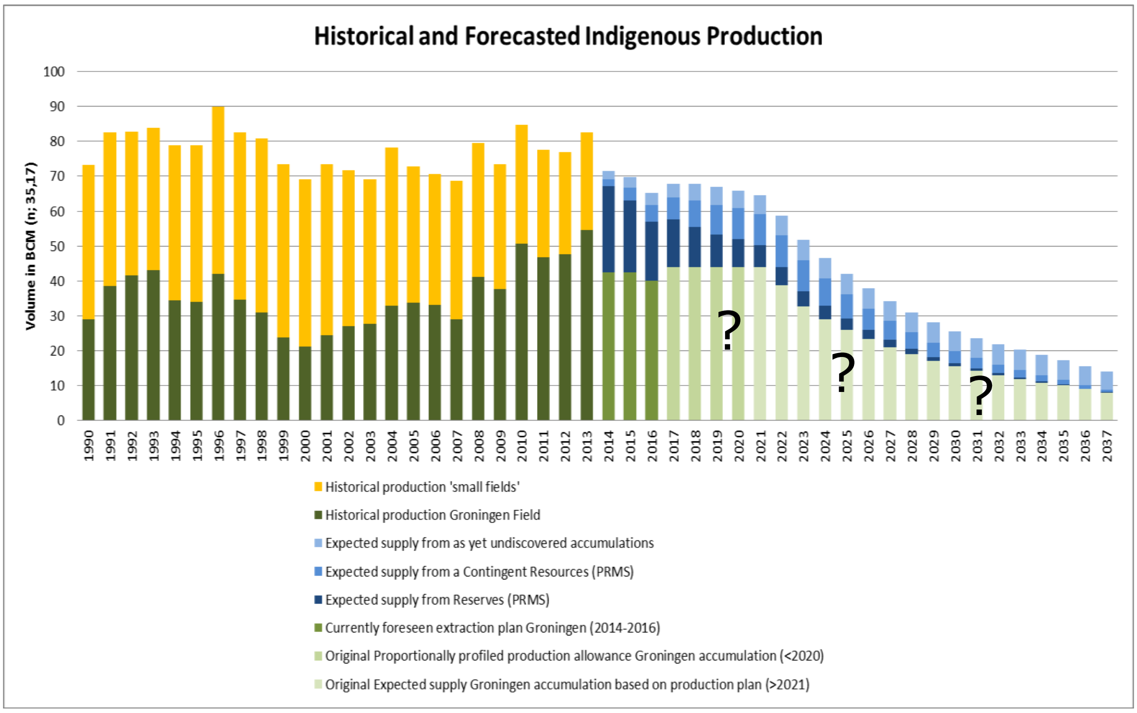

Figure 11 Historical and Forecasted Indigenous gas production in the Netherlands based on information available on http://www.nlog.nl/en/oilGas/oilGas.html and the Ministry of Economic Affairs letter to Parliament "Gas extraction in Groningen" 17-01/2014

3.7 The availability of storage in the Netherlands

Indigenous gas production plays an important role in compensating for fluctuations in northwest European market demand. The decline in gas production in northwest Europe is causing a decrease in the availability of this natural flexibility. Storage facilities are playing an increasingly greater part in order to compensate for this declining production flexibility. What's more, an important distinction must be made between storage facilities that can provide supplies for summer-winter variations

[7] http://www.nlog.nl/nl/oilGas/oilGas.html

and those that can absorb relatively short peaks in the gas demand. Depleted gas fields (DGF) are extremely suitable for absorbing seasonal fluctuations or to satisfy peak demand. Salt caverns are often used for shorter peaks, but can, when having a large storage volume, also be used to balance out seasonal supply and demand.

The following table was taken from the database underlying the Gas Storage Europe (GSE) map 2013. It lists the storages in the Netherlands. The storage operators provided this data to GSE.

Storage facilities in the Netherlands 2013, copy GSE database								
Facility/Location	Company	Type	Working Gas		Withdrawal Capacit		Injection Capacity	
			TPA	Project	TPA	Project	TPA	Project
The Netherlands			**5278**		215,60		59,05	
Grijpskerk	NAM	Gas Field (not depleted)	**1500**		55,00		12,00	
Norg (Langelo)	NAM	Gas Field (not depleted)	**3000**		55,00		24,00	
Maasvlakte	Gasunie	LNG Peak Shaving	**78**		31,20		0,25	
Alkmaar	TAQA Energy BV	Depleted Field	**500**		36,00		3,60	
Bergermeer late 2014	TAQA Energy BV	Depleted Field		4100		57,00		42,00
Zuidwending I	Gasunie Zuidwending	Salt Cavity	**200**	100	38,40	4,80	19,20	4,80
mcm/d TQ								

Figure 12 Storage facilities in the Netherlands 2013, source: http://www.gie.eu/index.php/maps-data/gse-storage-map

In addition to the figure above, it is worth noting that the Underground Gas Storage (UGS) in Norg will be significantly expanded in the next few years. The withdrawal capacity will increase to 76 mcm/d and the working gas volume to about 7 bcm.[8]

Besides access to storages located on Dutch territory, the Dutch gas network has access to German storage facilities.

3.8 Network configuration

In the Netherlands there is a total of 135.000 km of gas pipelines.[9] Of this number 11.000 km is high pressure pipelines, operated by the national Transmission System Operator Gasunie Transport Services (GTS). The high pressure gas network is shown on the map below, figure 13. The Dutch high pressure network is directly connected to Belgium, Germany, Norway and the United Kingdom. Through over 1000 gas custody transfer stations gas is distributed to the Dutch domestic market to for example large industries, power plants and to local distribution companies.

[8] http://www.nam.nl/nl/our-activities/norg/planned-work.html

[9] Netbeheer Nederland, http://www.netbeheernederland.nl/branchegegevens/infrastructuur/

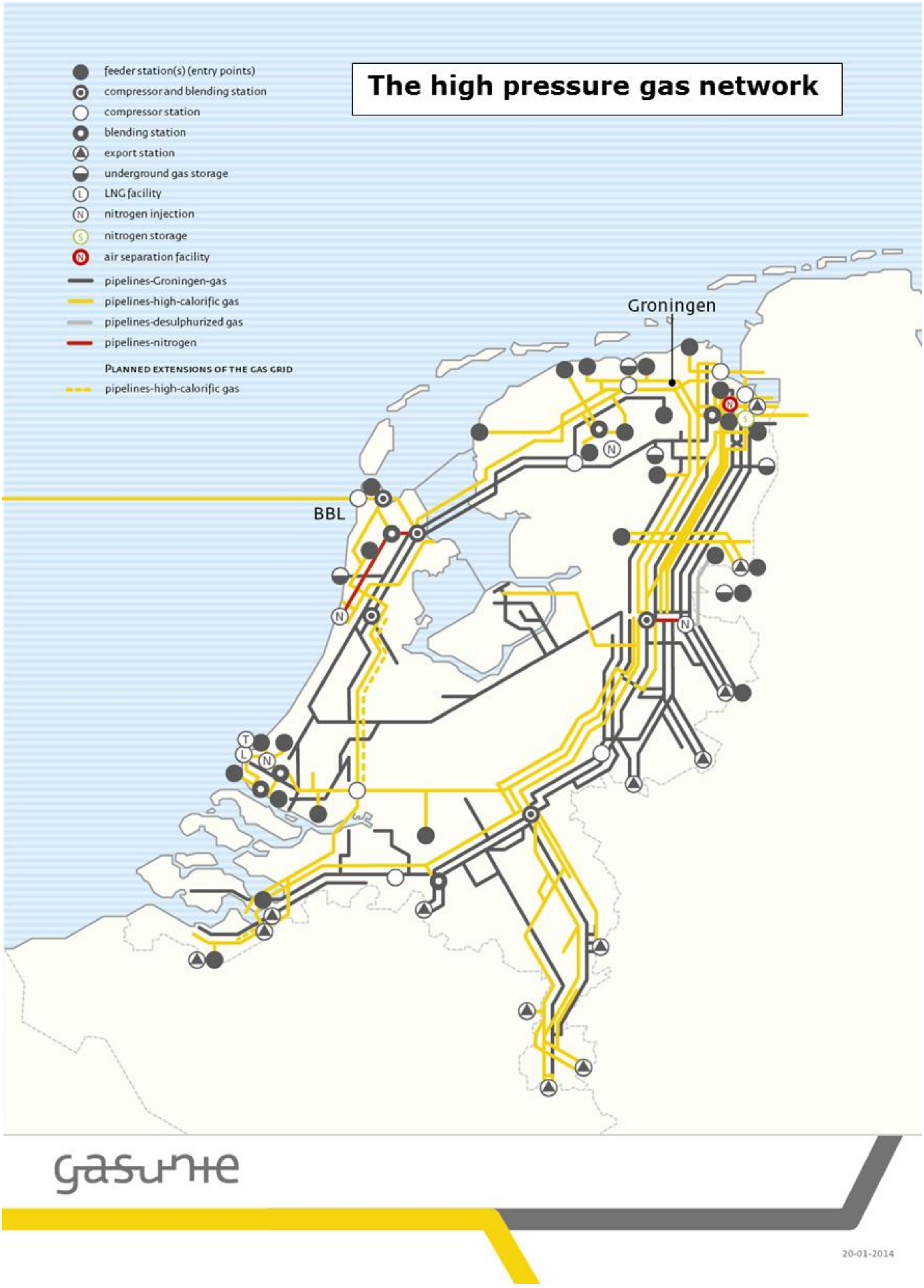

Figure 13, The high pressure gas network in the Netherlands 2013, source GTS

At the time of writing there were 9 Local Distribution Companies for gas in the Netherlands.[10] On the map below, figure 14, the service areas of the different distribution companies for gas is indicated

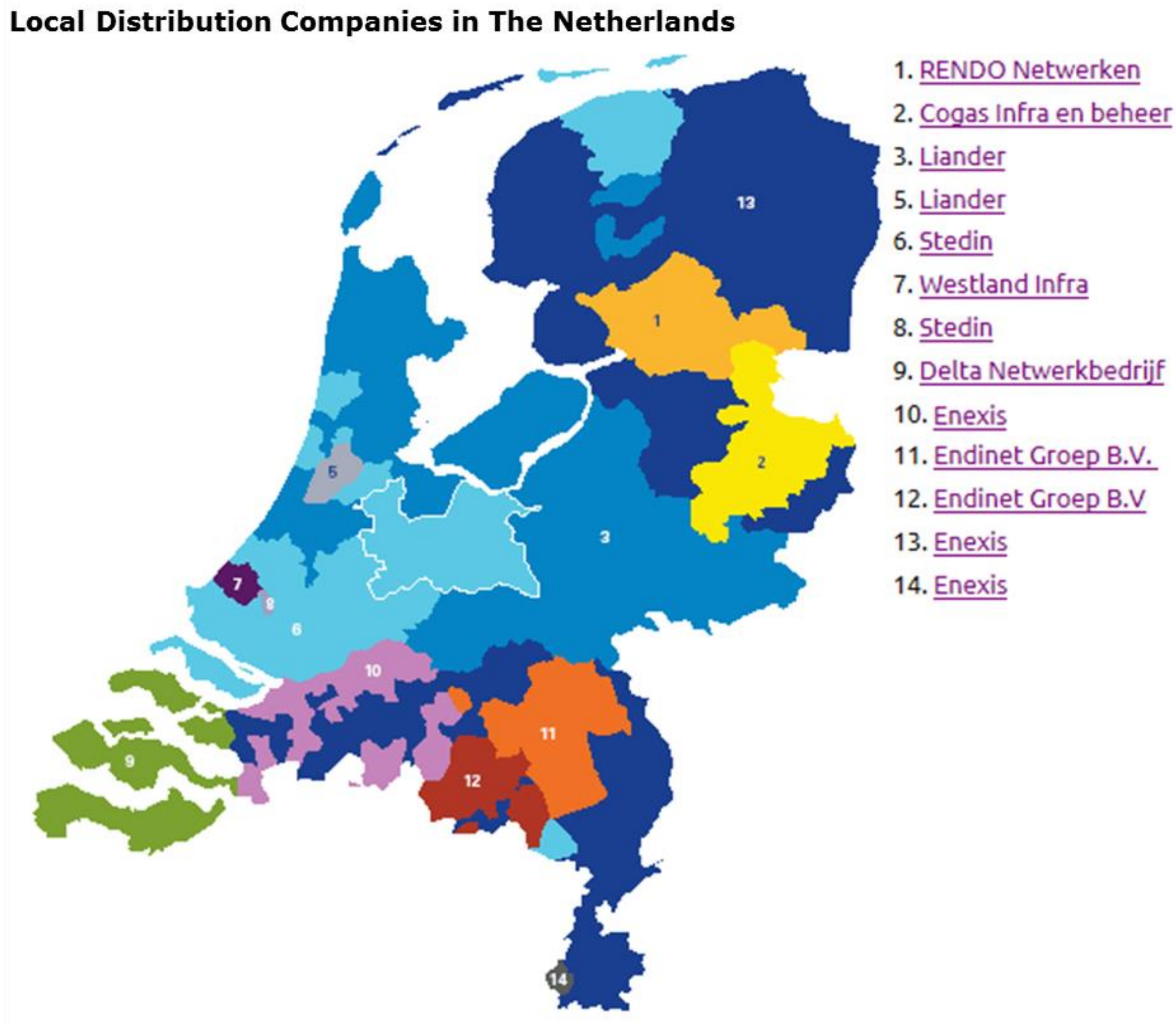

Figure 14 Service areas of the Dutch Local Distribution Companies for Gas in 2014, source: http://www.energieleveranciers.nl/netbeheerders/gas

3.8.1 The network: ready for the future, adaptations remain necessary

The gas transport network (capacity) is continually adapted in order to ensure that the network is organised in such a way that transport requirements can be met. Reports about the condition of the Dutch transport network and the requirement for transport capacity are made every two years in the Dutch network operators' Quality and Capacity Documents, which have to be submitted to the Dutch regulator. This statutory obligation ensures that the risks and capacities of the Dutch transport network are monitored and that necessary investments are reported. All these reports are publicly available on the website of the Dutch regulator and of system operators.

[10] Website Dutch regulator, https://www.acm.nl/nl/onderwerpen/energie/elektriciteit/regulering-regionale-netbeheerders/overzicht-netbeheerders/

Transport requirements change over the course of time. Of course, this is dependent on the position of gas on the northwest European market. However, one important reason for adapting the Dutch transport network is the fact that domestic gas production is decreasing (see paragraph 3.6) and that replacement (additional) volumes must be imported and, consequently, border points must be extended. That means that new entry capacity and the underlying infrastructure must be realised. This also gives rise to the need for supplementary storage capacity.

By 2020, renewable energy sources (volumes) will play a fair part in Dutch energy supply. As yet, this volume-substitution has had a very limited effect on the demand for gas transport capacity. After all, the very nature of wind and solar energy involves the need for a back-up capacity (especially gas).

3.9 Interruption of the gas flow

All Dutch transmission system operators have to report annually to the Dutch regulator about the quality of their gas system. These reports include all foreseen and not foreseen interruptions, financial compensations and indicators about the level of service (dealing with complaints, timely information about foreseen interruption).[11] This information is also included in the Dutch Security of Supply report which fulfils the EU obligation as laid down in Directive 2009/73/EC and Article 52a of the Dutch Gas Act.

As can be read from the 2013 Security of Supply report, in 2011, on average a Dutch household had no gas for 43 seconds. Due to some incidents this average was rather high compared to previous years. Most interruptions are related to incidents due to excavation works. How to minimize this risk in the Netherlands is elaborated in the Preventive Action Plan.

3.10 No change to the situation with regard to physical reverse flow

Article 7 of the Regulation obliged all transmission system operators to submit a proposal to enable permanent bi-directional capacity on cross-border interconnections between member states or a request for an exemption, by the 3rd March 2012. Virtual reverse flow is possible on all Dutch cross-border points. Physical reverse flow (H-gas) was at that time already possible between the Netherlands and Germany and the Netherlands and Belgium. All L-gas border points are connection points to production facilities in the Netherlands. The regions connected to these exit points in the neighbouring countries have no supply (or almost no local supply).

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[11] Report Monitoringsrapportage Leverings- en Voorzieningszekerheid Elektriciteit en Gas 2013 (Security of Supply 2013), Dutch Ministry of Economic Affairs, http://www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2013/07/18/monitoringsrapportage-leverings-en-voorzieningszekerheid-elektriciteit-en-gas-2013.html

Exemptions from the obligation to enable bi-directional capacity on relevant cross-border points which were not yet bi-directional were provided by the relevant authorities to the Dutch Transmission System Operator GTS and to BBL Company (BBLC), the operator of the Balgzand-Bacton pipeline connecting the Netherlands and the UK. These exemptions were granted after a thorough assessment of possible benefits for the security of supply, projections for demand and supply and a technical feasibility study. An estimation of the costs of enabling physical reverse flow capacity and an assessment of market demand were also included and supported the request for the exemptions.

This Risk Assessment 2014 does not result in any finding (see chapter 4 and 5) which would support a change in the situation with regard to reverse flow on Dutch cross-border points. In line with these findings, the bi-annual capacity assessment in the Dutch Quality and Capacity document (published December 2013) and the ENTSOG Ten Year Network Development Plan 2013-2022 did also not lead to a finding which would alter this situation. Moreover, over the past two years market parties have not expressed any interest in an alteration of the current situation.

4 Supply Standard

4.1 General description of the Dutch system

The Dutch internal gas market is due to the large indigenous production only little influenced when flows in (North West) Europe are interrupted. Moreover, the Netherlands does not depend on a single production facility. The Groningen field alone is divided into over 20 facilities, and additional production is delivered through more than 235 so-called "small fields." In this Assessment no distinction is made between Groningen gas (G-gas) and high-calorific gas (H-gas) because this distinction is of no relevance for the supply and infrastructure standard due to the provisions in the Netherlands for quality conversion.

Physically the Dutch G/L-gas and H-gas networks are separated. Each entry-exit point has its own specifics. Shippers can nevertheless book capacity on any entry/exit point without indicating quality. To deliver gas with the correct quality is a legal responsibility of GTS, according to the Dutch Gas Act, Article 10(1/e/c). The two networks are connected through blending stations. These can blend the different gasses and/or use nitrogen to produce the required Wobbe-index.

Security of supply in the Netherlands is delivered through an effective gas market. Commercial incentives on shippers/suppliers are vital to provide sufficient gas to customers. The Dutch virtual gas hub TTF is for example the most liquid gas hub on the European continent. This highly effective gas market is supported by an additional legal framework which safeguards security of supply. It should nevertheless not be forgotten that although infrastructure might be available, it is in the end up to shippers and traders to supply gas to where and when it is needed in the right amount.

As described in the Dutch Preventive Action Plan in detail, the security of gas supply in the Netherlands is stipulated in Public Service Obligations. Most relevant with regard to the protected customers are the Dutch Gas Act and the 'Decision in Relation to Security of Supply Pursuant to the Gas Act'.

4.2 Supply to protected customers based on three pillars

Protected customers in the Netherlands are defined in the Dutch Gas Act as: customers who have a connection to a network with a total maximum capacity not exceeding $40m^3$ (n;35,17) per hour. The protected customers comprise the households and small enterprises.

In effect ensuring the Dutch gas supply to protected customers (security of supply) is based on three pillars.

4.2.1 A licensing system for suppliers of protected customers

There is a licensing system for suppliers of protected customers. Suppliers of small consumers are set standard requirements, amongst others through the "Decision license for delivering gas supply to small consumers." A supplier can get his license only when he can prove his ability to provide his customers in the circumstances stipulated in the license. Suppliers of protected customers are required to meet standard requirements concerning the supply of gas as well as on its organization, finances and technical abilities. The Authority for Consumers & Markets (ACM), the Dutch regulator, is the organisation responsible for the licensing in the Netherlands.

4.2.2 GTS to take action in case of bankruptcy of a supplier

The Dutch transmission system operator GTS is statutorily responsible for the uninterrupted supply of gas to protected customers in case of a bankruptcy of a supplier, by guaranteeing the payment to producers and by the co-ordination of the re-distribution of protected customers of the bankrupt supplier among the remaining suppliers. In such a case GTS has a coordinating task to make sure that the customers of the non-compliant supplier continue to receive gas. Non-compliance of a supplier does not imply shortage of gas, and will therefore be solved by the market. In this way these customers can choose a new supplier within a reasonable time without an interruption in their gas supply. Bankruptcy of a supplier does therefore not imply shortage of gas towards the protected customers.

4.2.3 Peak supply a responsibility of GTS

Under severe conditions the obligation for security of supply (peak supply) is allocated to the Dutch transmission system operator GTS. This obligation is detailed in the paragraph 4.5.

4.3 Security of Supply is a combination of factors

Supplying the Dutch gas market even under severe conditions does not require additional market measures. Only in case of a catastrophe customers might be interrupted. This is further detailed in the Dutch Emergency Plan. The Dutch balancing system plays an important role in maintaining general system integrity, and therefore also in relation to the electricity and district heating market. Its functioning is described in detail in the Preventive Action Plan.

The availability of infrastructural capacity does not guarantee that there will be sufficient gas volumes available; availability of gas depends on the contracted volumes by shippers/traders and, finally, on the physical volumes they deliver.

As required by Directive 2009/73/EU and Regulation 994/2010/EU all EU members report to the Commission about the Security of Supply situation. The Dutch Security of Gas Supply report gives an outline of the short-term and medium-term security of gas supply in the Netherlands. This report looks 20-years ahead. The report deals with a number of themes which, as a whole, give an outline of the security of gas supply in the Netherlands. Peak and emergency supply are also examined. The report is based on information sent by market parties to the Dutch transmission system operator. Shippers are asked to state the volumes they are currently expecting to ship during the next twenty years and whether that volume has already been contracted or if that is not yet the case. Together with an estimate of the trend in Dutch gas demand, this information can be used to give insight into the degree to which Dutch demand can be met by contracted supply volumes already known at present. This investigation does not result in a forecast of the balance between demand and supply but will give an insight into the extent to which the Dutch gas demand can be fulfilled with contracted supply volumes known at present.

4.4 The Netherlands applies a 1-50 standard

Article 8 of the Regulation sets minimum requirements in respect of the supply standard. In the Netherlands, standards for the infrastructure and security of supply have been laid down via the 'Gas Act' and since 2004 in the 'Decision Security of Supply Gas Act'.[12] The Dutch standard is stricter than the minimum standard laid down in Regulation 994/2010/EU.[13] Other member states also apply stricter standards.

The existing Dutch standard for infrastructure and security of supply under peak circumstances is related to a situation occurring when there is an average daily effective temperature of -17°C in the town of De Bilt, corresponding to a probability of once every 50 years. The European standard of 1:20 years could be translated for the Netherlands into a temperature of -15.5°C.

The data sheet "overview lowest temperatures in De Bilt since 1961 taken from the Royal Netherlands Meteorological Institute shows that on the 14th January 1987 is was effectively -17°C in De Bilt.

De Bilt (sinds 1 januari 1961)

Year	Month	Day	Tbuiten	Wind	Temp1	Temp2
1987	1	14	-13,2	6,7	-17,67	-15,02
1978	12	31	-11,6	6,2	-15,73	-12,77
1987	1	15	-9,3	8,2	-14,77	-16,22
1985	1	7	-11,8	4,1	-14,53	-12,6
1997	1	1	-11,4	4	-14,07	-13,88
1997	1	2	-12,6	2,2	-14,07	-14,07
1979	1	5	-12,4	2,1	-13,8	-11,9
1963	1	19	-8,6	7,7	-13,73	-13,05
1987	1	11	-11,3	3,6	-13,7	-12,67
1996	12	31	-9,7	6	-13,7	-9,38
1996	1	26	-9,2	6,7	-13,67	-13,3
1979	1	2	-10,2	4,1	-12,93	-12,52
1996	1	25	-7,8	7,7	-12,93	-10,67
1991	2	6	-8,5	6,2	-12,63	-8,3
1963	1	17	-11,2	2,1	-12,6	-11,35
1985	1	15	-10,1	3,6	-12,5	-11,3
1987	1	12	-10,7	2,6	-12,43	-13,07
1963	1	10	-11	2,1	-12,4	-11,07
1968	1	13	-10	3,6	-12,4	-10,88
1963	1	18	-10,3	3,1	-12,37	-12,48

Figure 15 Overview lowest temperatures in De Bilt since 1961. Temp1=effectieve temperature, source: KNMI.

[12] the order in Council of 13 April 2004, laying down regulations regarding provisions in connection with security of supply (Decision Security of Supply the Gas Act)

[13] Regulation 994/2010/EU article 8(2)

4.4.1 The Dutch standard related to the regulatory obligations

The European standard of 1:20 years can be translated for the Netherlands into a temperature of -15.5°C (a national average effective daily temperature of -15.5°C prevails on the coldest day in a period of 7 or 30 days in the Netherlands). The existing Dutch standard for infrastructure and security of supply under peak circumstances is related to a situation occurring when there is an average daily temperature of -17°C, corresponding to a probability of once every 50 years.

Where extreme temperatures are concerned, the European supply standard is restricted to a 7-day peak period and to any period of 30 days of exceptionally high gas demand. In the Netherlands this is met by the Dutch standard which is based on a 1:50 winter and the associated daily temperature distribution. This determines the temperature and demand limits of the 7 and 30 days periods mentioned above.

In the event of a disruption of the single largest gas infrastructure under average winter conditions, the European minimum supply standard mentions a period of thirty days. There is no mention of 'peak circumstances.' In the Netherlands, this type of situation is met by the standard requirements expected of suppliers to small consumers. These requirements focus on the obligation to supply gas and on the organisational, financial and technical qualities of the suppliers.[14]

4.5 Dutch peak supply and free market functioning

On the basis of the 'Decision Security of Supply Gas Act', the Dutch national transport operator GTS is legally responsible to contract both the capacity and the volumes that are necessary in order to be able to supply the additional amount to the small consumers market in the Netherlands when temperatures are between -9°C and -17°C (so called peak supply).

These contracts may only be claimed by GTS under specific conditions on the day before a peak day is foreseen. When it is not claimed it can be used by the market.

The volume reserved by GTS for peak supply is about 95 mcm. This is only 0.1% of the annually by GTS transported amount of gas. Lowering the standard to a 1:20 would reduce this volume demand with 2% of 95 mcm. This is 1.9 mcm which is 0.0025% of the by GTS annually transported amount of gas (this amount is so low because it is the peak of the peak demand).

Also the reserved transport capacity that can be made available to the market if the standard should be lowered to a 1:20 situation is very limited since the capacity applied for this purpose was created specifically for this purpose. The reserved exit capacity is exit capacity on exit-points to regional distribution networks

[14] Article 43 and following of the Gas Act.

4.6 Quantification Dutch security of supply standard protected customers

As was explained in paragraph 4.4.1 the Dutch legal standard covers the requirements as set out by the regulation. In this paragraph protected customer demand under the various demand scenarios as listed in the Regulation is quantified and compared to national production, storage & LNG.

The requirements as set in Article 8 of the Regulation are:

a) extreme temperatures during a 7-day peak period occurring with a statistical probability of once in 20 years;

b) any period of at least 30 days of exceptionally high gas demand, occurring with a statistical probability of once in 20 years; and

c) for a period of at least 30 days in case of the disruption of the single largest gas infrastructure under average winter conditions.

The black columns in figure 16 show the mcm/d required by the protected customers (dd 1st January 2014) in these three scenarios and under the Dutch legal national standard for peak supply, compared to the available Dutch indigenous production and available storage & LNG in mcm/d in the yellow columns.

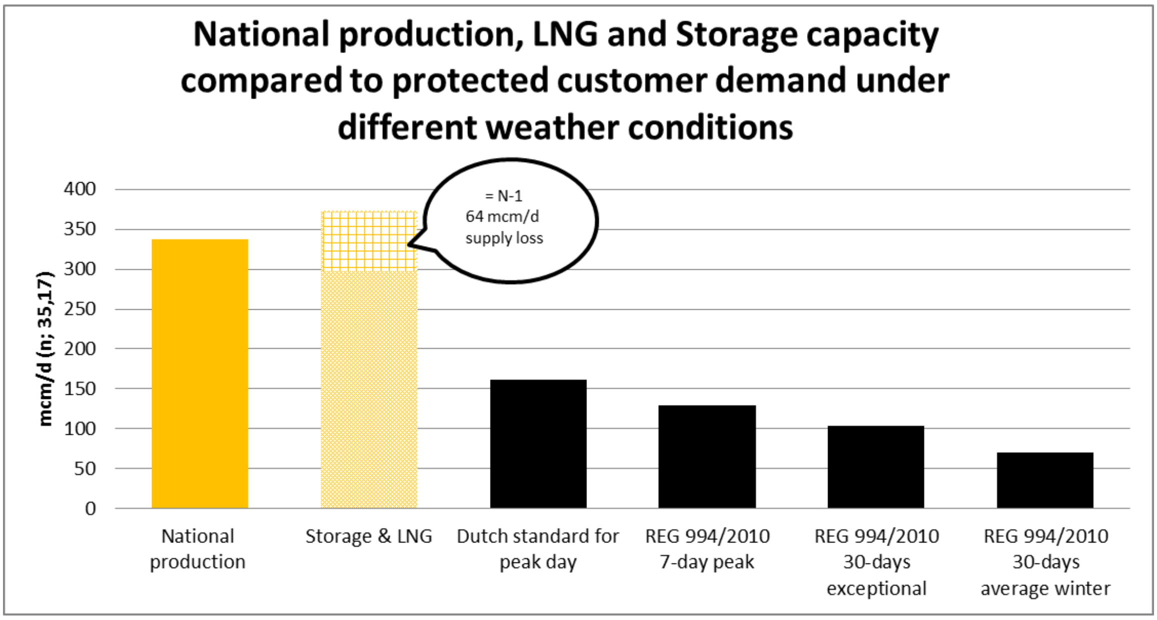

Figure 16 demand protected customers under 4 different scenarios compared to national production and storage/LNG in mcm/d, source: GTS

From the figure above it can be concluded that due to the large indigenous production, the Netherlands can easily supply its protected customers under all scenarios. It can also be concluded that the existing Dutch standard is stricter (leads to a higher demand) than the obligations of the Regulation. Even when the single largest gas infrastructure is disrupted (as indicated by the top shading of the storage & LNG column). A distinction was made between national production and storage & LNG. Notwithstanding what was written about the production cap on the Groningen field, it can be argued that national production is always available. The available storage capacity, however, depends on the time of the year (capacity is in general lower at the end of the Winter than at the beginning) and the capacity of the LNG terminal may not be fully available due to the unavailability of LNG on the market (can be related to price, general availability etc).

5 Infrastructure standard

Article 6 of the Regulation sets minimum requirements in respect of the infrastructure. The infrastructure of every member state must be capable of coping with the disruption of its single largest gas infrastructure (the so-called N-1 indicator), even during a day of exceptionally high gas demand.

5.1 Result of the calculation of the N-1 formula: 162%

The calculation set out below shows that the N-1 score of the Netherlands, at 162%, lies far above 100%. This result corresponds to the outcome of the Dutch 2011 Risk Assessment which was also 162%. A higher demand compared to 2011 was compensated by an increase in entry cross border, entry storage and production capacity. The downscaling of the Groningen production, due to earthquakes, does not influence the outcome of the N-1 formula. As measures have been taken to ensure that under a situation of peak demand and/or an emergency situation maximum capacity from the Groningen field is still available. Details about the values of the parameters used are given in paragraph 5.2.

$$N-1[\%] = \frac{EP_m + P_m + S_m + LNG_m - I_m}{D_{max}} \times 100, \; N-1 \geq 100\,\%$$

$$162\% = \frac{178+337+331+42-64}{509} \times 100\%$$

5.2 Parameters and sources of the N-1 formula

The Regulation describes how the parameters of the formula should be calculated (see grey text in boxes). This paragraph describes for the Netherlands which value goes with which parameter, together with a short description of how the value is determined. In this document the values are recorded in millions (or billions) m3 (n; 35.17) per day (Groningen equivalent)

2014 has been chosen as the reference year. The values of the parameters are equal (hourly data x 24) to the data published (or underlying) in the Dutch Quality and Capacity Document of December 2013 (basic estimates).[15] In this public

[15] http://www.gasunietransportservices.nl/over-gts/publicaties

document the calculation of the values is specified. In addition to this the value for the technical capacity of the single largest gas infrastructure was calculated by GTS. The parameters make no distinction between Groningen gas (G-gas) and high-calorific gas (H-gas) because this distinction is of no relevance due to the provisions in the Netherlands for quality conversion.

5.2.1 Demand-side definition

D max — the total daily gas demand (in millions m 3 per day) of the calculated area during a day of exceptionally high gas demand occurring with a statistical probability of once in 20 years.

GTS recalculates annually the total expected daily gas demand in the Netherlands for the coming years. Demand of protected customers is automatically included when taking account of the demand under peak circumstances (as described in chapter 4). Demand-side measures are not applied in the Netherlands and are therefore not included in the D-max calculation.

D-max = 509 mcm (n; 35.17)/d

5.2.2 Supply-side definitions

EP m — the technical capacity of entry points (in million m 3 per day) other than production, LNG and storage facilities covered by P m, S m and LNG m: the sum of the technical capacity of all border entry points capable of supplying gas to the calculated area.

The Dutch transport network is directly connected to four countries, Belgium, Germany, Norway and the United Kingdom.

The table below gives an overview of the maximum border capacity. The table provides supplementary details to fulfil the requirement of article 9(1)(e) of the Regulation.

Netherlands' maximum technical border capacity 2014			
Belgium			
	Entry	17	mcm (n; 35,17)/d
	Exit	122	mcm (n; 35,17)/d
Germany			
	Entry	56	mcm (n; 35,17)/d
	Exit	200	mcm (n; 35,17)/d
Norway			
	Entry	94	mcm (n; 35,17)/d
	Exit	0	mcm (n; 35,17)/d
United Kingdom			
	Entry	0	mcm (n; 35,17)/d
	Exit	50	mcm (n; 35,17)/d
source: data underlying GTS Quality and Capacity Report 2014			

Figure 17 Netherlands' maximum technical border capacity 2014, source: GTS

The value for EPm is slightly higher than the entry border capacity as shown in the table above, due to the inclusion of directly connected production sites in the number used for EPm.

EPm = 178 mcm (n; 35.17)/d

P m — maximal technical production capability (in mcm/d) means the sum of the maximal technical daily production capability of all gas production facilities which can be delivered to the entry points in the calculated area.

As detailed in paragraph 3.6 under peak demand and/or emergency situations the maximum production capacity can be used. Therefore the production capacity for 2014 as projected in the Dutch Quality and Capacity Document 2013 is the input for this variable.

Pm = 337 mcm (n; 35.17)/d

S m — maximal technical storage deliverability (in million m 3 per day): the sum of the maximal technical daily withdrawal capacity of all storage facilities which can be delivered to the entry points of the calculated area, taking into account their respective physical characteristics.

The number for storage capacity used as input for the N-1 formula is higher than the number listed in the overview of Dutch storage, because the Netherlands has also direct access to storages in Germany.

Sm = 331 mcm (n; 35.17)/d

LNG m — maximal technical LNG facility capacity (in million m 3 per day): the sum of the maximal possible technical daily send-out capacities at all LNG facilities in the calculated area, taking into account critical elements like offloading, ancillary services, temporary storage and re-gasification of LNG as well as technical send-out capacity to the system.

From September 2011, the Netherlands has the potential to supply gas to the market via an LNG terminal, the GATE terminal on the Maasvlakte in Rotterdam.

LNGm = 42 mcm (n; 35.17)/d

I m — technical capacity of the single largest gas infrastructure (in million m 3 per day) with the highest capacity to supply the calculated area. When several gas infrastructures are connected to a common upstream or downstream gas infrastructure and cannot be separately operated, they shall be considered as one single gas infrastructure.

Based on information available to GTS it is established that the Grijpskerk storage facility is the Netherlands' single largest gas infrastructure with the largest capacity. The number given here is different from the number listed in the storage in The Netherlands data set (paragraph 3.), because this number was converted into (n; 35,17) in order to match this number with other input data for the N-1 formula.

Im = 64 mcm (n; 35.17)/d

6 Scenarios

6.1 General

Article 9(1)(c) of the Regulation states that, in the assessment of the risks affecting the security of gas supply, various scenarios shall be examined and the probable consequences assessed. In running through the scenarios, parameters such as exceptionally high gas demand or supply disruption, such as disruption of the main transmission infrastructure, storage facilities or LNG terminals and disruption of supplies from third country suppliers may be applied. Exceptionally high gas demand is the standard starting point for the scenarios set out below.

The Dutch high-pressure network is very robust. All the main subsystems in this network are equipped with a reserve system (redundancy, also known as N+1 subsystems). If very high availability is required (for critical functions) then a whole system performs redundantly (in duplicate) and independently or there is another system elsewhere in the gas transport network that can take over the function (a back-up system). If a disaster should occur at the dispatching centre in Groningen, then ‘control’ of the network is also possible from another (classified) location in the Netherlands.

As described in paragraph 3.6 “The availability of production in the Netherlands” earthquakes in Groningen, where the majority of Dutch gas is produced, have led to a lowered projected annual production. However under peak demand and/or in times of security of supply problems production from the Loppersum clusters will be possible up to a maximum of 3 bcm a year. This implies that the consequences for security of supply have been mitigated, and there is no volume/capacity loss under these circumstances. The consequences of earthquakes are therefore not further detailed in the scenarios.

The scenarios detailed below are clustered into three different groups.

1. Scenarios related to the N-1 formula
2. Other Dutch scenarios
3. ENTSOG scenarios

Figure 18 shows all scenarios, divided into these three groups. Scenarios coloured red are assessed as very realistic scenarios. Scenarios coloured orange are realistic, but less likely to happen. The green colour refers to a scenario in which the Bergermeer storage facility is included, this storage facility will become operational later in 2014 (and is therefore not in included in the data set underlying the N-1 formula, as this is based on the 1st January 2014 situation).

	disruption largest infrastructure	exceptional demand	new storage facility	disruption outside country	N-1result
Scenarios related to the N-1 formula					
N-1 formula	X	X			162%
1 Disruption full Norwegian entry (no Norwegian supply)	X	X		X	143%
2 Disruption full German entry ("no Russian supply")	X	X		X	151%
3 Non-availability of LNG	X	X		X	145%
4 Groningen field disruption	X	X			153%
5 Gas exports fully honoured	X	X			94%
6 Bergermeer storage becomse operational	X	X	X		173%
7 Gas exports fully honoured &Bergermeer storage	X	X	X		100%
Other Dutch Scenarios					
A Bankruptcy of a supplier					
B Gas infrastructure problems due to earthquakes					
C Decrease in domestic production on the longer term					
D Nord Stream disruption					
ENTSOG Scenarios					
I Resilience Assessment: potential investment gaps in the European gas system					
under normal Situations (Reference Case): potential investment gaps in the European gas system					
Under Supply Stress: through the calculation of Remaining Flexibility of each Zone of the system					
II Supply Dependency Assessment: the dependence of some Zones on a single supply source					
III Network Adaptability Assessment: the ability of the system to adapt to various supply patterns					

Figure 18 overview of scenarios and scaling

6.1.1 Scenarios related to the N-1 formula

Scenario 1
Also a complete disruption of Norwegian supply:
total disruption = 64 (Grijpskerk) + 94 (Norway) = 158 mcm/d

When complete Norwegian supply (the technical capacity as indicated in figure 17) via Emden (in reality 2 separate pipelines) is no longer available, 94 mcm/d less is available. Under these conditions the outcome of the N-1 formula is 143%.

Scenario 2
Also a complete disruption of German entry (“no Russian supply”):
total disruption = 64 (Grijpskerk) + 56 (entry Germany) = 120 mcm/d

To illustrate the possible impact on the N-1 formula of the non-availability of Russian gas, full entry from Germany was interrupted (see figure 17 entry Germany). However, gas flowing to the Netherlands at this border point is not just Russian gas, it also includes gas from German storages and Norwegian gas imported to Germany. The exact combination of these sources will differ on an hourly base (based on shipper contracts and actual flows). Therefore the impact of “no Russia supply” is illustrated by a complete interruption of German entry.

When complete German entry is interrupted, 56 mcm/d is less available. Under these conditions the outcome of the N-1 formula is 151%.

Scenario 3
Also non-availability of LNG:
total disruption = 64 (Grijpskerk) + 42 mcm/d (LNG) = 108 mcm/d

Suppose the only LNG terminal in the Netherlands fails or LNG is not available at the market (LNG m = 42 mcm/d) at the same time as the largest infrastructure storage Grijpskerk, then the result of the N-1 formula comes out at 153%.

Scenario 4
Also Groningen field disruption:
total disruption = 64 (Grijpskerk) + 45 mcm/d (largest group Groningen) = 109 mcm/d

The Groningen field does not comprise one physical entry point, but consists of various different clusters connected on a ring system. These clusters are divided into 11 independent groups to make the electricity supply to the clusters less vulnerable. If supply to one group fails, the others are able to continue.

Disruption of the group of clusters with the greatest capacity means the loss of a volume of production capacity of 45 mcm/d maximum. The result of the N-1 formula in the event of disruption of one of the Groningen production points results in 153%.

Scenario 5
Gas exports honoured in full despite disruption of largest infrastructure: total demand = 881 mcm/d

The N-1 formula only takes account of domestic demand (Dmax). The exit capacities at border points are not included in the N-1 formula. However, in the event of the disruption of the largest infrastructure in the Netherlands (and under the conditions set in the N-1 formula), it is possible to provide for the maximal export capacity. If exports are included within Dmax (figures taken from overview of maximal border capacity in the Netherlands, paragraph 5.2.2), then N-1 comes out at 94% which is below the N-1 norm.

Scenario 6
Potential effect of Bergermeer storage facility:
storage = + 57 mcm/d

During the 1990s, storage facilities at Grijpskerk and Norg were developed near the Groningen field in order to keep capacity (swing) at the required level. Over the last few years, the storage facility capacity in the Netherlands has been greatly expanded and new projects are in the pipeline (f.e. expansion of the Norg storage). The Bergermeer storage facility is scheduled to become operational later in 2014 (see paragraph 3.7). If the Bergermeer withdrawal capacity is included in the N-1 formula, then the N-1 result will increase to 173%.

Scenario 7
Gas exports honoured in full despite disruption of largest infrastructure scenario but with Bergermeer storage operational:
total demand = 881 mcm/d & storage = + 57 mcm/d

The effect of the additional Bergermeer storage capacity is that the N-1 formula would result in exactly 100%, when gas exports are honoured in full.

6.1.2 Other Dutch scenarios

Not all realistic risks can be quantified. Whether there is actually sufficient gas volume available, depends besides sufficiently available infrastructure (capacity) on sufficient volume supply and most importantly whether these volumes are made available at the right time, at the right place in the right volume by shippers and traders. These aspects cannot be determined by the N-1 formula, and are therefore included in a separate group of realistic scenarios for the Netherlands.

Besides the above type of situations, several other realistic risks in the Netherlands were identified for the purpose of this Risk Assessment. It should however be noted that the risks and scenarios listed here are only a small illustration of the huge amount of risks assessed on a day-today base when dealing with pipeline security. The processes related to these detailed risk assessments are laid down in the Dutch Preventive Action Plan.

Scenario A bankruptcy of a supplier

The Dutch transmission system operator GTS is statutorily responsible for the uninterrupted supply of gas to protected customers in case of a bankruptcy of a supplier, by guaranteeing the payment to producers and by the co-ordination of the re-distribution of protected customers of the bankrupt supplier among the remaining suppliers. In such a case GTS has a coordinating task to make sure that the customers of the non-compliant supplier continue to receive gas. Non-compliance of a supplier does not imply shortage of gas, and will therefore be solved by the market. In this way these customers can choose a new supplier within a reasonable time without an interruption in their gas supply. Bankruptcy of a supplier does therefore not imply shortage of gas towards the protected customers.

Scenario B Gas infrastructure problems due to earthquakes

Currently GTS studies all possible consequences of earthquakes for the GTS network and supporting facilities. This study covers pipelines as well as GTS offices and public infrastructure relevant for GTS facilities, like telephone connections. If required, these elements will be replaced by GTS with items that can withstand the expected level of earthquakes. This also applies to pipelines (-segments) and other relevant gas infrastructure in the region.

Scenario C Decrease in domestic production on the longer term

The decrease in the production of domestic natural gas over the long term is a fact. The Dutch and European infrastructure is already being adapted to cope with these changing circumstances. Entry at border points is being extended to allow these volume flows to increase and storage facility capacity is being extended in order to allow sufficient swing to be generated. Whether sufficient volumes will be transported depends on the choices then made by the shippers/traders.

This loss in volume can be partly compensated for by an increase in the domestic supply of green gas and possibly, in the long term, by the production of shale gas.

Scenario D Nord Stream disruption

If the Nord Stream pipeline fails, then there is sufficient infrastructure in northwest Europe to supply gas to customers via another route. This is the result of the substantially increased capacity on the northwest European market in order to be able to facilitate market operations. Whether sufficient volumes will be transported depends on the choices then made by the shippers/traders.

6.1.3 ENTSOG scenarios

ENTSOG scenarios Ukraine and Russia disruption scenarios

ENTSOG modelled the consequences of Ukraine disruption and Russian disruption ("no Russian supply") for the whole of the EU under 4 different demand patterns (see figures 19-22). Its specific findings for the Netherlands are listed and detailed here. It should be noted, as stated by ENTSOG as a disclaimer that the results provide an estimation of the impact of a possible disruption crisis and should not be understood as an actual forecast neither in term of demand disruption nor supply mix.

Disruption of flows through Ukraine, does not impact the Netherlands under any of the set conditions. This can be concluded from the fact that the Netherlands is coloured blue under all different scenarios in figures 19-22.

Disruption of all Russian flows does impact the Netherlands, but only on a January peak day (figure 20, maximum daily demand in all EU countries – design demand) and during a cold spell in March (figure 21, with low storage stock due to end of season timeframe). The pink colour indicates that a maximum of 20% of total demand needs to be interrupted in order to solve the problem. The 20% is the average demand share not covered under the maximum spread of the event. This means that the goal of the modelling was minimization of impact on each country.

The fact that the Netherlands, despite it relatively low yearly imported Russian volumes (see scenario 2, paragraph 6.1.1), is also impacted in some situations (according to the ENTSOG modelling) can be explained by the good connectivity between the Netherlands and adjacent zones which allows "sharing of misery", as was the aim of the ENTSOG modelling. Due to this good cross-border connectivity less regions are bright red and more regions are light pink.

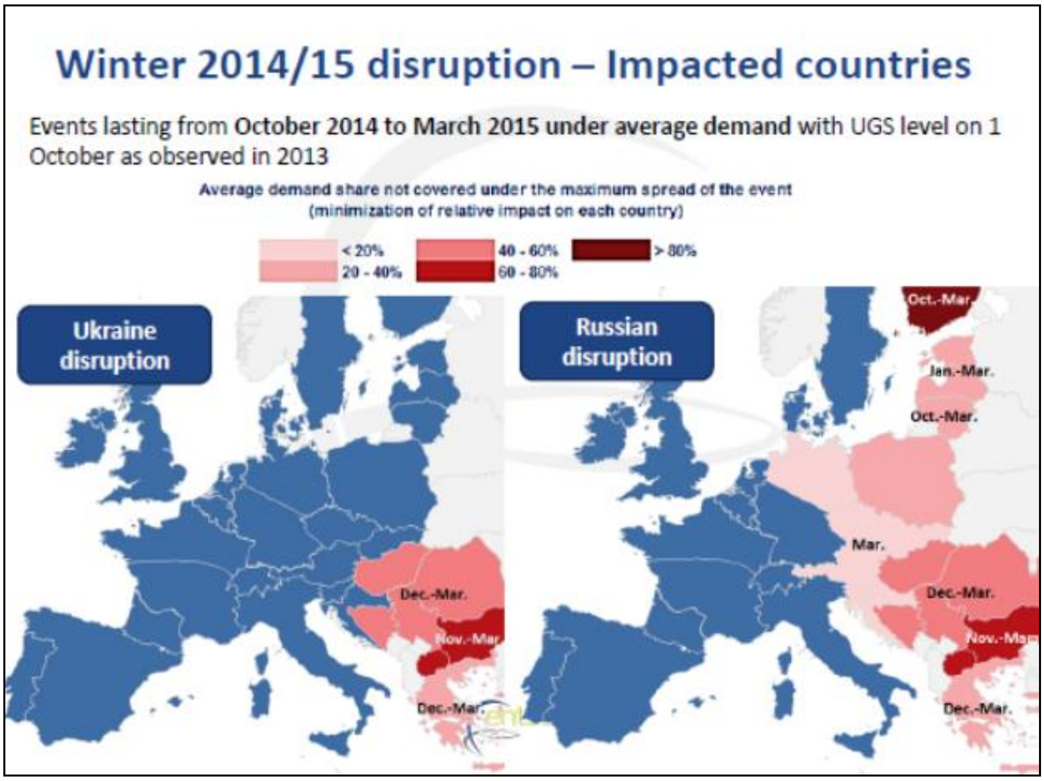

Figure 19 Winter 2014/2015 Ukraine and Russia disruption, impacted countries, source: ENTSOG, Risk assessment for winter 2014/2015, preliminary results, as presented at the Madrid Forum 6/7 May 2014

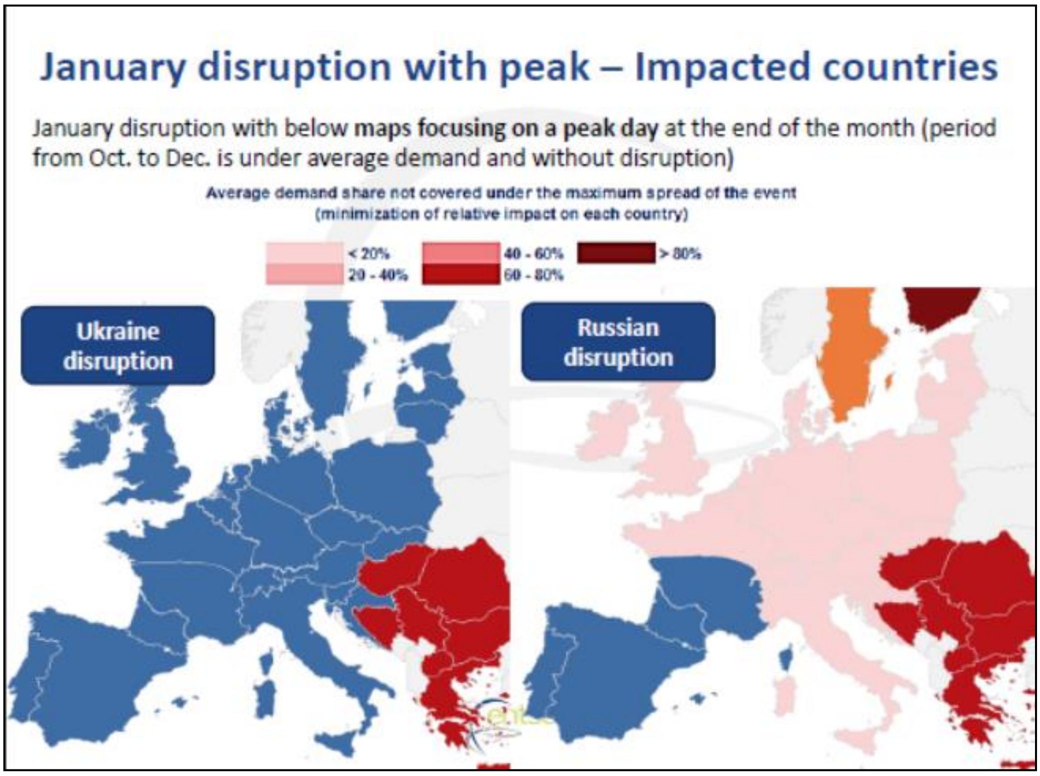

Figure 20 January with peak Ukraine and Russia disruption, impacted countries, source: ENTSOG, Risk assessment for winter 2014/2015, preliminary results, as presented at the Madrid Forum 6/7 May 2014

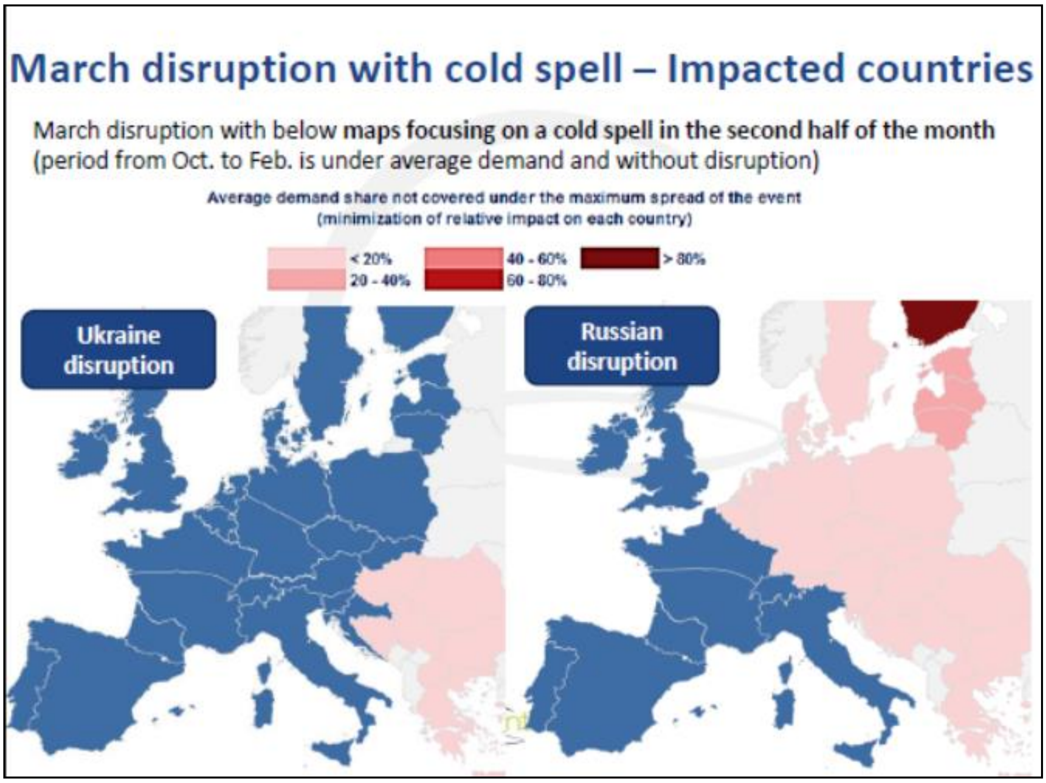

Figure 21 March disruption with cold spell Ukraine and Russia disruption, impacted countries, source: ENTSOG, Risk assessment for winter 2014/2015, preliminary results, as presented at the Madrid Forum 6/7 May 2014

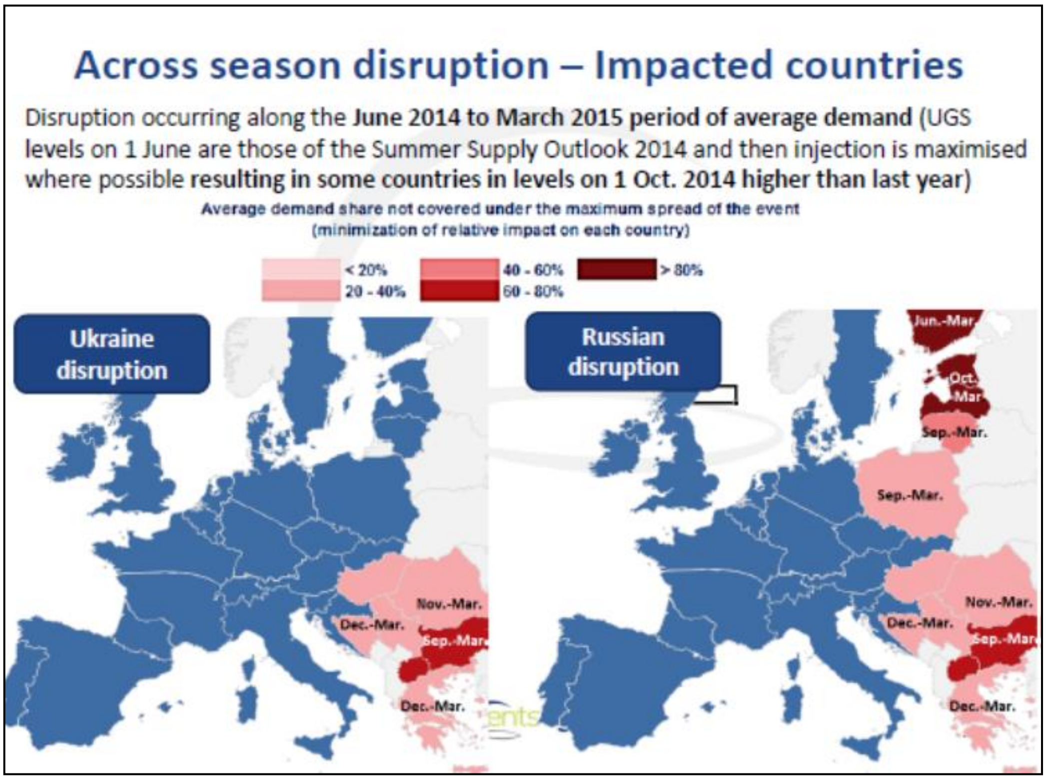

Figure 22 Across season disruption Ukraine and Russia disruption, impacted countries, source: ENTSOG, Risk assessment for winter 2014/2015, preliminary results, as presented at the Madrid Forum 6/7 May 2014

TYNDP scenarios

Every two years ENTSOG publishes its Ten Year Network Development Plan. Ten Year Network Development Plan analyses whether, when daily demand is very high, sufficient flexibility (physical congestion at entry points) is available at European border points to be able to counterbalance various disruptions of infrastructure under different demand scenarios. In the Gas Regional Investment Plan (GRIP) the findings of the TYNDP are elaborated for North West Europe. This document can be found on the websites of the TSO in North West Europe and the ENTSOG website.

As can be concluded from the graphical presentations below (figures 23 - 25), none of the scenarios included in the TYNDP 2012 and as such in the GRIP 2013 resulted in a finding of insufficient resilience for the Netherlands (which would be indicated by a red colour in figure 23 and 24 and by a red or blue colour in figure 25).

I Resilience Assessment: potential investment gaps in the European gas system under normal Situations (Reference Case): potential investment gaps in the European gas system.

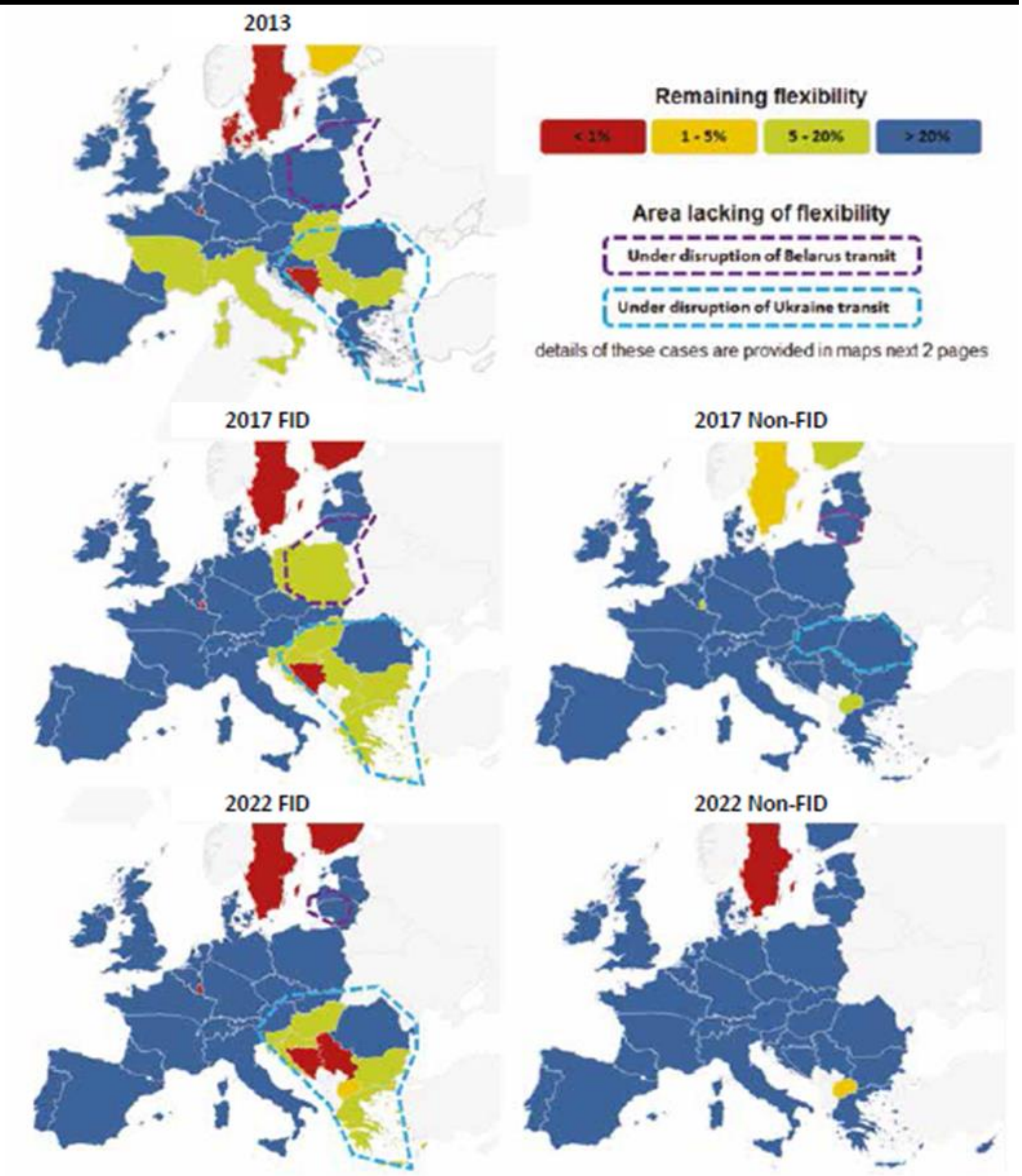

Figure 23 Infrastructure under Reference Cases, source: http://www.entsog.eu/public/uploads/files/publications/GRIPs/2013/GRIP-NW_131105_MainReport_FINAL-lowres.pdf

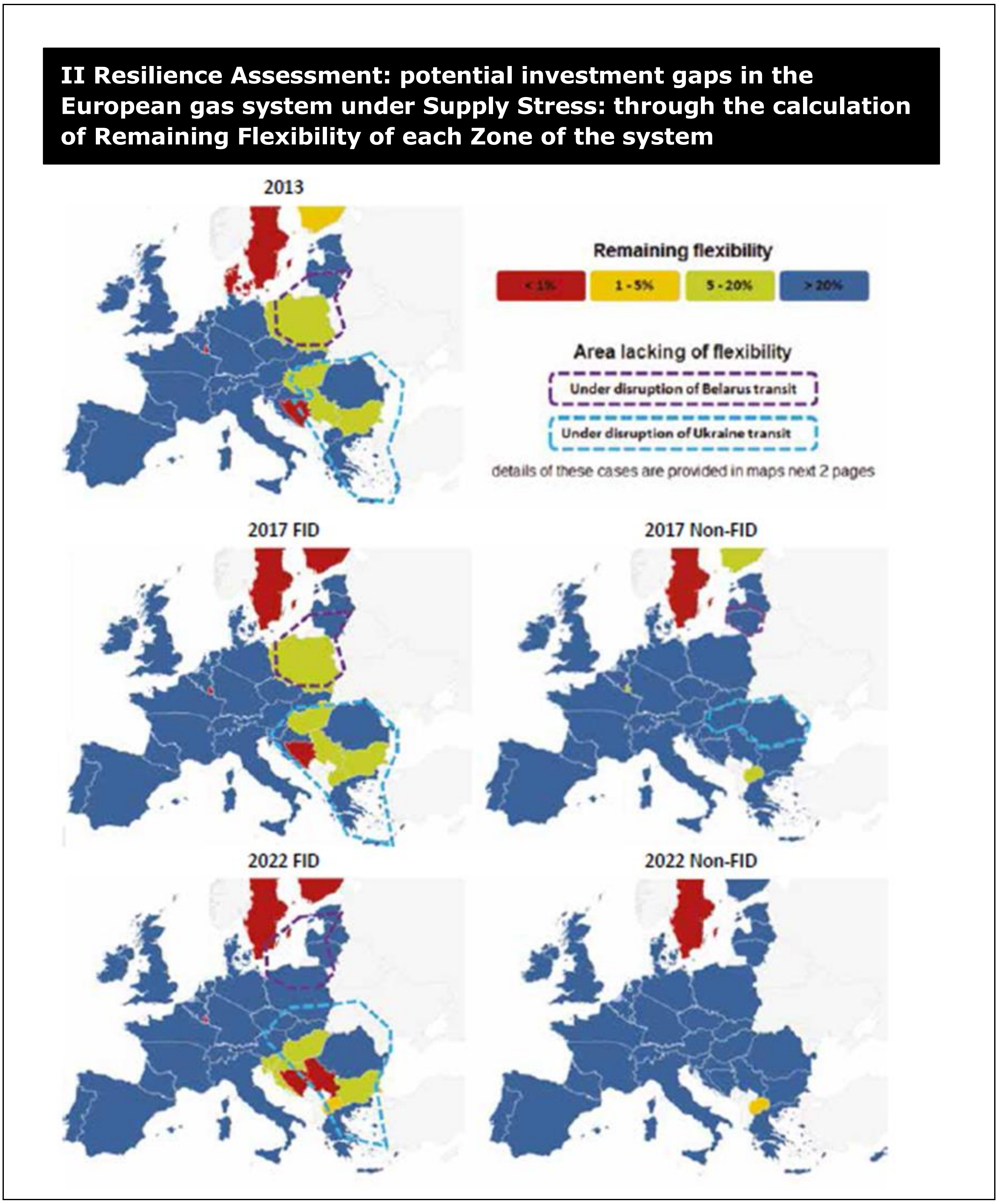

Figure 24 Infrastructure under Supply stress cases, source: http://www.entsog.eu/public/uploads/files/publications/GRIPs/2013/GRIP-NW_131105_MainReport_FINAL-lowres.pdf

III Supply Dependency Assessment: the dependence of some Zones on a single supply source

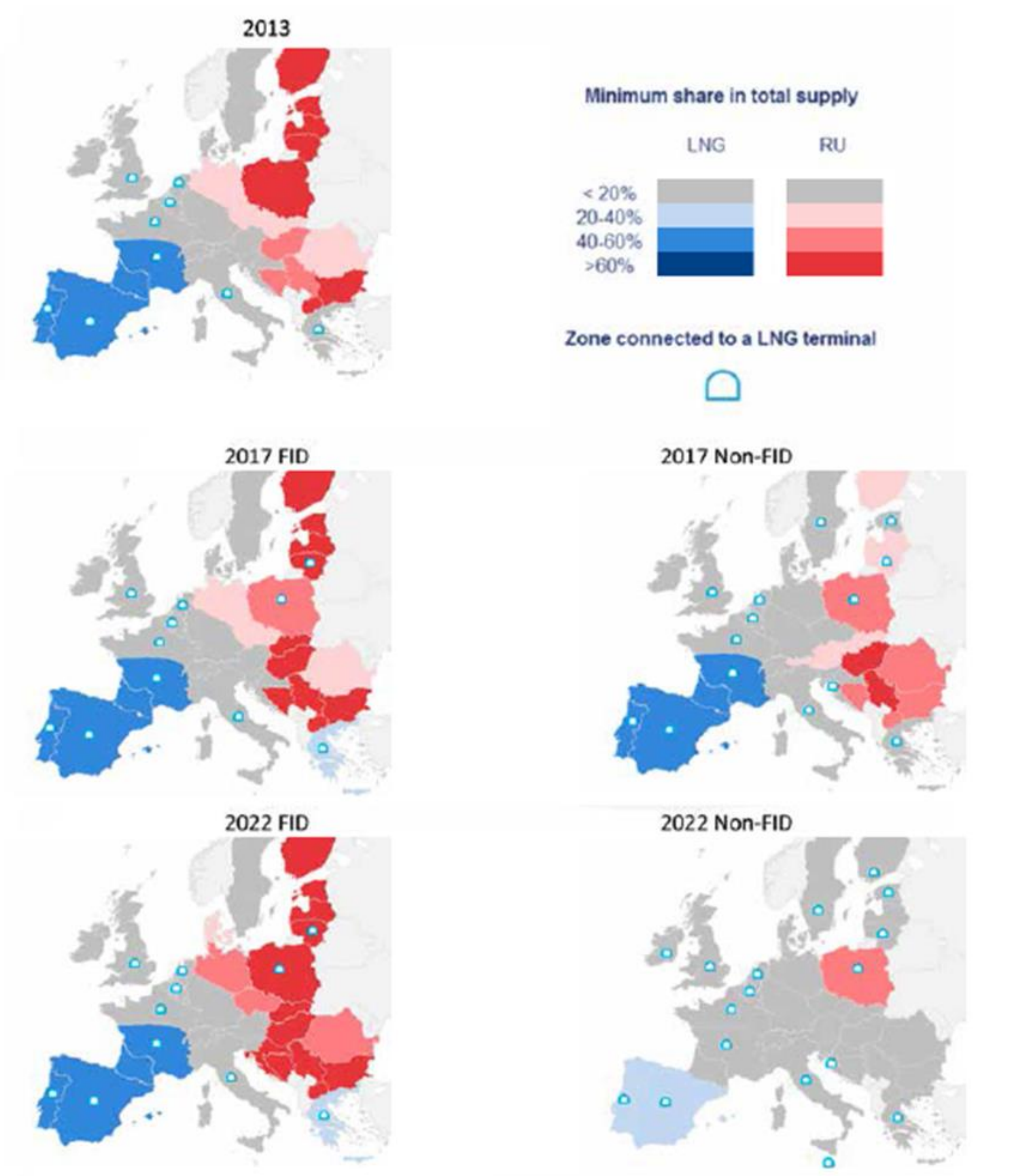

Figure 25 dependence of some Zones on a single supply source, source: http://www.entsog.eu/public/uploads/files/publications/GRIPs/2013/GRIP-NW_131105_MainReport_FINAL-lowres.pdf

7 Interaction and correlation with risks existing in other member states

In a meeting of the Pentalateral Forum on the 23rd of May 2014, an informal consultative body where Belgium, France, Germany, Luxemburg and The Netherlands meet regularly, the representatives from the aforementioned countries presented their Risk Assessments.

The members of the Pentalateral Forum held an exchange of views about the main results and conclusions of the Risk Assessment of the individual participating countries, including the results of the supply standard and the infrastructure standard, with the aim of identifying a possible correlation with risks existing in one of the other member countries of the Forum.

The Netherlands and the United Kingdom also exchanged their Risk Assessment Reports, and concluded that the 2014 Risk Assessments do not result in a finding which would support the introduction of bi-directional capacity on the cross-border point between the UK and The Netherlands which is not yet bi-directional, i.e. the BBL pipeline.