Paper

International trade in gas in the Netherlands

March 2019

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1. Introduction

Information on exports and especially on imports of gas by country of origin is only on a limited base available. This leak of information is caused by a liberalised EU energy market and an increased reliance on the spot markets, where the buyer is often not the end-user.

The current statistics on the import and export of gas by country of origin in the Netherlands is based on an *allocation key* that distribute the trade figures per border crossing point to various countries. This allocation key was estimated by statistics Netherlands in 2008[1], based on expertise by GasTerra[2] and a questionnaire under shippers[3]. Most likely this rather outdated allocation key does not longer represents the current situation and needs to be revised. It is however not possible to update this allocation key based on the previous method, because of the changed (international) market regarding the trade in gas.

Statistics Netherlands is asked by the Ministry of Economic affairs and Climate policy, as part of its contributions to the *National Energy Outlook (2017)*, to investigate new possibilities to detect the country of origin of imported gas. This paper is written in English, as there is also international interest (mainly from Eurostat) in this topic. The estimates on energy dependence helps the European Commission to take appropriate measures to avoid the reliance on a limited number of foreign sources of energy and to provide first alerts regarding the security of energy supply and help to protect against disruptions of gas supplies. Hence, EU-member states are obliged, under *regulation (EC) No 1099/2008*, to publish yearly trade figures on gas by country of origin.

For this project, Statistics Netherlands has acquired information on the international trade in natural gas from various actors and stakeholders: Ministry of Economic Affairs and Climate Policy, GasTerra (main gas trading company), Gasunie Transport Services (GTS, the Dutch Transmission System Operator for gas), National Environmental Planning Agency (PBL), Regulatory body for the gas market (ACM) and colleagues from the statistical offices in Germany and Belgium.

[1] Gas and Electricity Trade Statistics (GETS). Grant Agreement 45502.2007.001-2007.428.

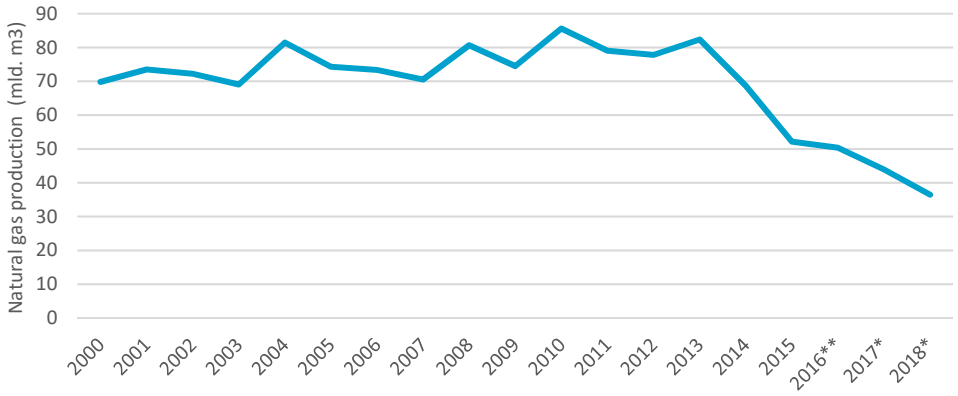
[2] Dutch wholesaler in natural and green gas.

[3] A gas shipper is a party that contracts with gas pipeline owners to transport gas through the gas network from a producer to a supply point (GTS).

2. Background

The Netherlands is an important player in the European gas market. However, the Dutch production[4] of natural gas has significantly declined since 2013, from 82,4 mld. m3 in 2013 to 36,5 mld. m3 2018 (see figure 2.1). As the amount of gas that is allowed to be extracted in Groningen declines[5] from, 24 mld. m3 in 2016-2017 to 19,4 mld. m3 in 2018-2019, with aim to end extraction completely in 2030, the Netherlands will become more dependent on gas imports to ensure a regular and reliable supply to the Netherlands.

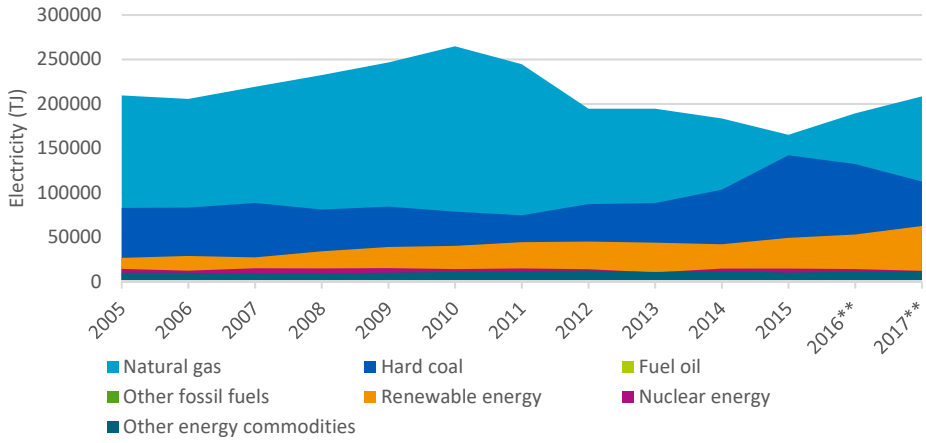
Figure 2.1. Dutch production of natural gas, in mld. m^3



Source: CBS, Energy balance

The energy transition towards renewable energy takes currently a central stage in energy policies. As the coal fired power plants have to be closed in the future, it is however likely that the demand for natural gas used for electricity will remain high even though the share of renewable energy supply increases. This because the increase of the latter, cannot outweigh the decline of the production of electricity by hard coal, see figure 2.2.

Figure 2.2. Dutch production of electricity by energy commodity, in TJ



[4] Excl. production from other sources than extraction from the soil and North Sea.

[5] https://www.government.nl/latest/news/2018/03/29/dutch-cabinet-termination-of-natural-gas-extraction-in-groningen

Source: CBS, Energy balance

To get an idea from which countries we source our gas when it concerns our gas consumption, it is relevant to know the country of origin of our imported gas and not only where it crosses the border. The country of origin is also an obligatory part of Eurostat energy statistics (*regulation (EC) No 1099/2008)*. Even though the apparent importance and obligation of publishing this kind of information, it should be realised that the country of origin may change drastically in case of a crises depending on contracts, international markets and physical limitations.

3. Gas network in the Netherlands

The transmission network of gas in the Netherlands is operated by GTS. The high pressure transmission lines (HTL) grid transports the gas across the country. It is split into a network transporting Low Calorific gas (L-gas), also known as Groningen gas (G-gas) and a network transporting High Calorific gas (H-gas)[6]. The two networks are connected via blending stations. Not only is gas produced from the Dutch gas fields injected into the HTL grids, but imported and exported gas also enters and leaves the country through these pipelines. Figure 3.1. shows the HTL-network, including the blending stations and cross-border points.

The Dutch production of natural gas consists of both L-gas from Groningen and H-gas from the other gas fields (on-shore and off-shore) in the Netherlands. The production of L-gas had always been much more than the production from the smaller fields (National Energy Outlook, 2017*)*. However, the government had set production constraints for Groningen from 2014 onwards as a result of the increased frequency and power of the earthquakes in that area. Hence, the production of L-gas has decreased significantly.

As the production of L-gas in the Netherlands is distinctive from the more common production of H-gas in Europe, their (flow) characteristics are considered separately.

3.1 Low Calorific gas

The primary production of L-gas in the Netherlands takes place in Groningen. It contains a relative high share of nitrogen (see NAM[7]), which makes it low calorific and different from most gas produced in other countries and from other gas fields in the Netherlands. The network for L-gas is connected with Belgium and Germany, from which L-gas is only exported to France, Switzerland and Italy as well. The Netherlands do not import L-gas, except from underground storages in Germany (which contains Dutch L-gas). These storages as well as the Dutch L-gas storages, are used to cope with fluctuation in gas demand. Flows of gas from a foreign underground storages are by statistical definitions also considered as an import-flow.

The most important exit points are:

- With Germany: Oude Statenzijl, Zevenaar and Winterswijk
- With Belgium: Hilvarenbeek

L-gas, also called pseudo G-gas, can also be made from H-gas by blending it with nitrogen. It is however not known whether the H-gas used for this conversion is foreign or domestic.

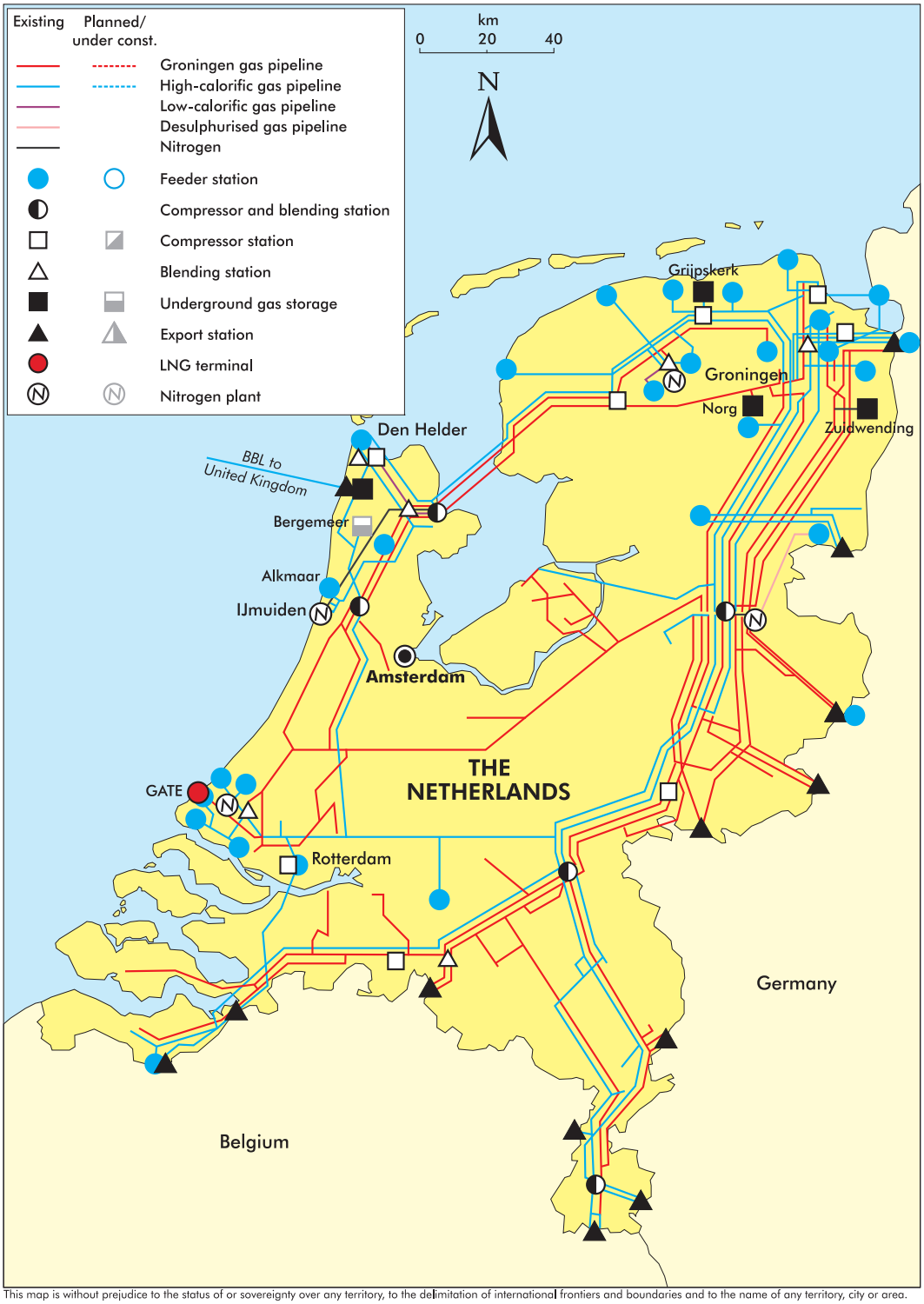
The distribution network of L-gas mainly serves small users of gas, like households and small and medium-sized businesses. Not only in the Netherlands, but also in Belgium,

[6] The quality of gas depends on its calorific value (heating value). It says how much energy (in mega joule) one cubic metre of natural gas contains.

[7] https://www.nam.nl/gas-en-oliewinning/het-winnen-van-aardgas/gas-kwaliteit.html

Germany and the North of France. The latter receives Dutch L-gas via Belgium. As GTS measures the border flows, they do not know how much L-gas from the Netherlands eventually ends up in France.

Figure 3.1. Gas transmission network in the Netherlands.



Source: GTS

3.2 High Calorific gas

H-gas is also produced in the Netherlands, and comes from the smaller gas fields (on-shore and off-shore). The biggest amount of H-gas is imported. The network over land for H-gas is connected with Belgium, Germany and the United Kingdom. The Netherlands is however also a transit country, so via the same networks H-gas is also exported.

The most important transit points are:

- With Germany: Oude Statenzijl (import and export), Emden (only import) and Bocholtz (only export)
- With Belgium: Zelzate (import and export), ‘s Gravenvoeren (only export)
- With the United Kingdom: Bacton – Balgzand (very limited import and export)

The Netherlands imports also H-gas produced in the Danish and UK-parts of the North sea, using the same pipelines as used for H-gas produced in the Dutch part of the North sea.

Moreover, H-gas in liquid form (LNG) is imported and re-exported via the GATE-terminal in Rotterdam. LNG mainly comes from areas where large volumes of natural gas have been discovered, such as North Africa, Middle East, the West Indies and in the near future North America.

There is also a pipeline across the Dutch part of the North sea that is only used for transit flows and is not connected to the Dutch transmission network. This pipeline is therefore not considered. In the EU statistics regulation 2017-2010 paragraph 4.2.3 it is stated that: exports should be reported as all gas flowing in and out of the country borders, transit or not. There is also transit of H-gas via pipelines that are also used for domestic supply (and storage). The gas that is transited is physically mixed with the gas that is used domestically. Hence, it is not possible here to separately determine countries of origin and destination for domestic and foreign gas.

H-gas is especially used by the energy-intensive industry and power stations, but it is also converted into L-gas. Currently there is an annual capacitiy of around 7 bln m3 for converting H-gas into L-gas.

To cope with fluctuation in gas demand there are also underground storages for H-gas.

4. International trade in gas in the Netherlands

The physical flows of natural gas are measured by GTS. They know how much gas flows from our neighbour countries to the Netherlands. However, where this gas exactly comes from is much more difficult to track. This because gas that enters the country is mixed in the country itself with gas from all the entry points. The same happens in the country from where the gas flows into the country. For example, gas that flows from Germany into the Netherlands is already a mix from gasses that flows into Germany from other countries, like Norway, Russia and Denmark. These countries can be either transit countries or countries where gas is actually extracted.

Table 4.1 shows how much gas flows from our neighbor countries into the Netherlands and how much we export through these points. It is the actual flow of gas that passes the border. Hence, it does not mean that the gas is really extracted in these countries.

Table 4.1 Physical flows of gas into and from the Netherlands[8]

	Import (mld m^3)		**Export (mld m^3)**			
	2016	**2017**	**2016**		**2017**	
	Only H-gas		**L-gas**	**H-gas**	**L-gas**	**H-gas**
Germany	31.9	34.1	19.0	10.4	18.5	9.7
Belgium	2.1 and 1.5	4.6 and 2.0	10.0	8.3	9.4	8.9
United Kingdom				4.9		2.1
LNG	0.5	0.9				
Total	**34.5**	**39.6**	**29.0**	**23.6**	**27.9**	**20.7**

Source: GTS and Zebra pipeline

4.1 Long-term-contracts versus spot market

Gasunie has been a central player in the gas market for a long time and before 2000, all Dutch market players were obliged to buy their gas from Gasunie. In 2000 the gas market was liberalized following the EU legislation and the virtual gas trading place Title Transfer Facility (TTF) which is operated by GTS became the central place for gas trading in the Dutch market. TTF consists of two platforms:

- The spotmarket and futures market: like TT (title transfer) and EEX (gas trading platform), where the other party is anonymous
- over-the-counter (OTC) trade (bilateral trade), which is not anonymous.

Trade via TTF does not automatically involve the real physical flow of natural gas. Hence, gas is easily traded via TTF without an agreeing physical flow of gas. Currently, gas traded at TTF is much more than the physical flows via TTF. Moreover, the physical deliveries are bigger than the Dutch consumption (Gasunie, 2017). This means that foreign companies buy gas at TTF, which is meant for foreign consumption. According

[8] Excluding gas to and from underground storages abroad which are directly connected with the Dutch transmission network, and gas from UK and DK production fields in the North sea directly connected to Dutch transmission system.

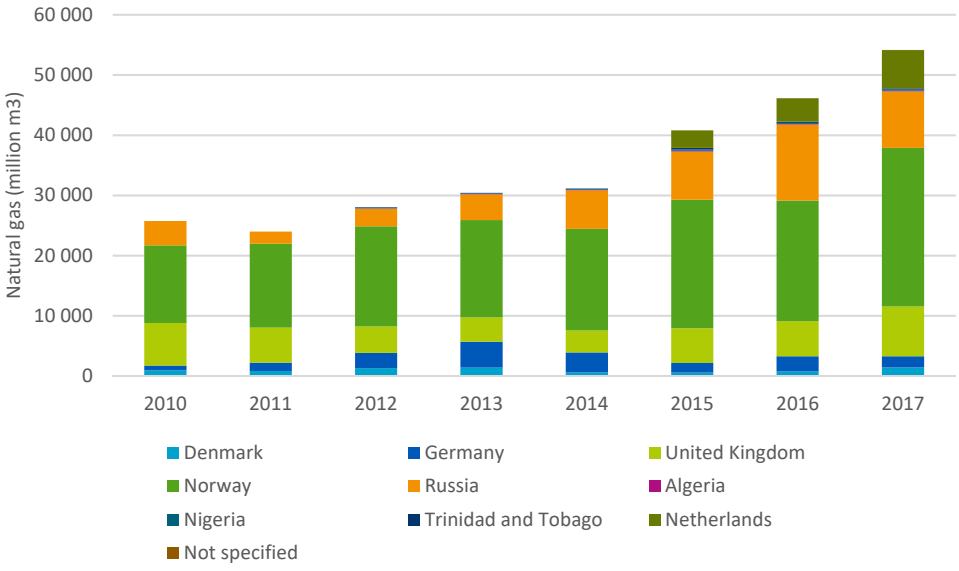
to a survey by ACER under trading companies[9], the majority of the respondents use location spread products in gas because of hedging. More than 80 percent says that they engage in hedging activities in markets other than the market(s) they sell gas in. On average, respondents are active in three markets for trading reasons only – these are markets where they do not sell gas to end-users. Hence, the liquidity of the market and the fact that there are many anonymous buyers, illustrates the difficulty to rely on contracts for an estimation of the country of origin of our gas imports.

In addition to the TTF, there have been long-term-contracts (LTCs) as well. However, the growing scale and liquidity of traded spot markets for gas in Europe, decreased the importance of long term contracts for security. According to IHS Markit, LTCs will cover a small percentage of the demand of gas in the Netherlands in 2023. In other Northwest European countries the reliance on LTCs is higher, where it has been the standard in secure gas supplies for more than 50 years now (HIS Markit, 2018).

4.2 Trade by country of origin/final destination: current method

Statistics Netherlands produces yearly figures on trade in gas by country of origin (or final destination). This is also a statistical obligation by Eurostat (Regulation (EC) No 1099/2008). The country of origin means the country where the goods originate; the origin of goods wholly obtained or produced in a country is attributed to that country. Figure 4.2. shows the Dutch import figures by country of origin, based on the current method.

Figure 4.2. Import of gas by country of origin, in mln. m^3.[10]



Source: CBS

[9] https://www.acer.europa.eu/Events/Presentation-of-ACER-Gas-Target-Model-/Documents/A14-AGTM-13-03b_GTM_Annex%204%20-%20Stakeholder%20Requirements%20Market%20Inquiry%20Results_final.pdf

[10] Import from the Netherlands is gas from underground storages abroad, which are directly connected with the Dutch transmission network.

4.2.1 Imports of natural gas

The neighboring countries export gas to The Netherlands. For Belgium, Germany and Norway (via Emden Germany) these amounts can be measured at the entry points of the GTS network. Statistics Netherlands receives a monthly file containing all of the in- and outflows of the GTS network, in standard Groningen gas quality. For the import of gas from the UK and Denmark, Statistics Netherlands relies on data from their national gas data providers.

To obtain the specification of country of origin for the gas crossing the German border a standard allocation key is used. This key was estimated by statistics Netherlands in 2008[11] based on expertise from GasTerra and a questionnaire under shippers and traders. It has been assumed that 17 percent from gas entering from Germany has actually been extracted in Germany, and the other 83 percent comes from Russia.

When looking at the absolute amounts, then the import of gas has especially grown from 2015 onwards. Between 2014 and 2015 this was mainly an increase in Norwegian gas, which remained stable between 2015 and 2016. In the latter period the increase was mainly due to an increase of Russian gas. Gas originated from the other countries seem to remain rather stable over time.

4.2.2 Exports of natural gas

The Netherlands exports natural gas via the GTS network to the exit points at the neighboring countries. Besides that there is also export via the BBL pipeline to the UK.

A portion of the gas that is exported to Belgium and Germany, is assumed to be re-exported to other countries south of Belgium and Germany. To obtain the specification of countries ultimate destination for the gas crossing the German and Belgium borders, an allocation key is obtained from the study in 2008[11]. The fixed allocation key specifies the amount of gas to the following countries as final destination: Belgium, France, Germany, Italy and Switzerland.

4.3 Trade by country of origin/final destination: proposal for adjusted method

The allocation key for the import as well for the export is rather outdated and may no longer mirror the reality so we have to look at the possibilities to update the trade figures by country of origin/final destination. As trading has become more anonymous and trading transactions have become decoupled from the physical flows, it is not feasible to update the allocation key by identifying again the shippers like Statistics Netherlands had previously done. Moreover, shippers play a different role in the supply chain than back in 2008. Nowadays a shippers only contracts an entry and exit point for an amount of KWh gas at a certain point of time indifferent where this gas originates from. GTS then makes this transaction possible in the most efficient way

[11] Gas and Electricity Trade Statistics (GETS). Grant Agreement 45502.2007.001-2007.428.

while keeping the balance on its grid. Therefore, statistics Netherlands looked at a different way to estimate trade in gas by country of origin and destination.

In principle there are two fundamentally different ways to consider the country of origin/final destination of traded gas: either via contracts or via physical flows.

4.3.1 Trade via contracts

Trade via contracts is increasingly decoupled from physical flows, as already mentioned in chapter 4.1. Also, trade via contracts occurs more often on an anonymous market. This is especially the case in the Netherlands, were trade in gas is presently rarely based on LTC's. This makes it almost impossible to consider the origin or final destination of traded gas via contracts. Hence, we try to focus on the physical flows of gas.

4.3.2 Trade via physical flows

The Dutch gas trade with other countries can best be analyzed when looking at the physical flows of imports and exports separately.

When observing the map of the Netherlands and the Dutch part of the North Sea, see figure 4.3, we can see how the Netherlands is connected via pipelines with our neighboring and nearby countries.

Figure 4.3. Physical flow of gas, entry/exit points with neighboring countries.

Source: Gasunie

4.3.3 The import flows

Imported gas entering via Germany could be either from Germany's own production, Russia, Norway or the Netherlands (Bundesanstalt für Geowissenschaften und

Rohstoffe, BGR)[12]. Due to privacy regulation, the German Federal Office for Economic Affairs and Export Control has stopped publishing import volumes by country. This is problematic, as we will no longer be able to define the country of origin from the imported gas from Germany. Hence, we'll have to rely on some assumption in order to allocate the imported gas to country of origin:

- Gas produced in Germany is not exported to the Netherlands, but consumed within Germany;
- Dutch H-gas flowing to Germany is also considered to be consumed in Germany or otherwise further exported to Italy or Switzerland
- Hence, gas entering the Netherlands via Germany (except for entry-point Emden) comes from Russia. Emden supplies Norwegian and Russian gas via German networks.

As the German gas production has declined since 2007, from 15.000 mln m3 to around 6.000 mln m3 in 2017 and the use of natural gas in Germany has risen, Statistics Netherlands assumes that the existing allocation key (which also took into account German gas) is no longer valid. The newly proposed allocation key is that the gas imported from Germany exept Emden is 100% Russian gas.

The Netherlands is connected with Belgium via the Zebra pipeline for imports of gas. Some of this gas originates from the UK indigenous production. However there is also substantial LNG imports in the UK which also flows via the Zebra pipeline to the Netherlands. Regassified gas can be transported to the Netherlands with Zebra.

The Netherlands also imports gas produced in the Danish and UK-parts of the North sea, using the same pipelines as used for gas produced in the Dutch part of the North sea. To estimate the Danish and British part, we use the figures that these countries publish on export to the Netherlands. These figures are then corrected for the part we already count as import and the rest is considered as import from the North Sea.

There is no reason for changing the methodology for the imports of gas from Denmark and UK as these amounts are derived from direct pipelines. A specific allocation key for these streams are not needed as we can fairly assume that these flows of gas originates from the corresponding countries.

The calorific values (GCV) can be obtained from available exit entry points. It must be noted that these are means of fluctuating values. For instance via Emden gas is one day imported from Russia and another day from Norway, which both have their specific GCV. Currently we are discussing with the Gas Network Operator on how we can deduce the origin from the GCV data.

4.3.4 The export flows

In the statistical obligation (Regulation (EC) No 1099/2008) it is stated that imports and exports reflect all flows crossing the national boundaries. The definition of the Annual Gas Questionnaire of the exports, restricts the export only of gas molecules which were produced at the Dutch territory. As there is no reliable method known to identify

[12] There are also some small amounts from elsewhere, but as these amounts are rather small we exclude them here for simplicity reasons.

Dutch produced gas from imported gas this statistical definition is very hard to follow. Hence, re-exports are also included in the export figures.

Gas that crosses the border in the south of the Netherlands likely ends up in Belgium and Germany, but also in the North of France, Italy and Switzerland. According to an network expert at GTS the physical amounts do not reflect the LTC's anymore. Therefore the current allocation key can no longer be used. The country specification of the export of gas via the south of the Netherlands would therefore change in the GASAQ to 'unspecified'.

The Netherlands has a direct pipeline connection with the United Kingdom via entry-/exit-point Julianadorp, also known as BBL. It is mainly used to export Dutch H-gas, however some small amounts are also imported from the UK. We assume that the import also originally comes from the UK, as it is closely located to some off-shore production fields), and that exported Dutch H-gas is directly consumed in the UK.

Since 2011, the Netherlands has an import-/export-terminal for LNG (liquid natural gas). The existing allocation key, allocates this part to Norway, Algeria, Nigeria and Trinidad & Tobago. As there is no new information available, we keep applying the existing allocation key for the import of LNG. It is not known where the export exactly ends up. Hence, we keep that figure on destination unknown.

4.3.5 Underground storages in Germany of Dutch gas

The Netherlands also import some L-gas, but this is constricted to the import from underground storages in Germany which actually contains Dutch L-gas. These storages are used to cope with fluctuation in gas demand. Flows of gas from a foreign underground storage is by statistical rules also considered as an import-flow, with origin Germany. The storage of this gas in Germany is then considered to be an export flow with origin Netherlands.

5. Conclusion

This project aimed to revise and update the current method to estimate international trade of gas by country of origin and country of final destination. The current method is based on an allocation key that was estimated in 2008, which is rather outdated, and mainly based on a questionnaire under shippers. As the international trading market has changed the last few years, it is not feasible to repeat the same method as in 2008.

There are two distinctive ways when considering the country of origin or final destination of international trade in gas: following the physical flows or looking at trading contracts. As the Netherlands increasingly rely on the spot market, where the buyer is often not the end-user, it is not feasible or even desirable to look at LTCs. Hence, we have tried to trace back the physical flows of traded gas. For this we considered the entry-/exit-points for L-gas and H-gas and per neighboring country separately. Hence, the proposed adjusted estimation for the allocation to country of origin is less stiff then the existing one, which had a fixed allocation key per neighbor country. The difficulty however is the reliance on figures provided by neighboring countries and they are facing similar problems as we do. It is important to keep in mind that we only looked at the Dutch situation. It might easily be that in other countries that still mainly rely on LTC's, looking at trading contract will be more efficient and reliable to trace back the country of origin and final destination of traded gas.

It appeared that the consulted actors and stakeholders did not have more information or data available on the origins of our gas. Hence, we did not get any further then some best guesses. Because of the lack of data and no new insights, we decided to keep the allocation for the export on gas to final destination the same as before. Only the allocation of imported gas to country of origin can be slightly adjusted by looking more specifically to some entry-/exitpoints, rather than using the allocation key on the total inflows from neighboring countries. The proposed adjusted allocation estimation can however not simply be considered to be of a better quality compared to the existing allocation, because it relies on many assumptions. However, considering that the allocation key was outdated and it did not longer reflect the current trading situation, the adjusted allocation can be a good alternative and it is more sustainable on the long run. For the export country specification the allocation key used is no longer feasible because the long term contracts do not represent the physical flows. The only credible option is to put the export amount to non-specified in the yearly gas questionnaire.

This study also shed a light on the difficulty of tracing back the countries of origin and final destination of traded gas. All gas (except for the differences in L-gas and H-gas) end up in the same pipelines and you simply cannot see from a molecule where it has been produced. Looking at contracts is, at least in the case of the Netherlands, also not feasible as the trading market has become more anonymous and decoupled from physical flows. Hence, one could argue if such a statistic is realistic given the available sources and characteristics of natural gas and the functioning of the international market. Especially when knowing that the estimations are based on many assumptions and best guesses. Hence, the significance of such a figure becomes questionable.

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Explanation of symbols

Empty cell	Figure not applicable
.	Figure is unknown, insufficiently reliable or confidential
*	Provisional figure
**	Revised provisional figure
2018–2019	2018 to 2019 inclusive
2018/2019	Average for 2018 to 2019 inclusive
2018/'19	Crop year, financial year, school year, etc., beginning in 2018 and ending in 2019
2016/'17–2018/'19	Crop year, financial year, etc., 2016/'17 to 2018/'19 inclusive

Due to rounding, some totals may not correspond to the sum of the separate figures.

Colophon

Publisher
Statistics Netherlands
Henri Faasdreef 312, 2492 JP The Hague
www.cbs.nl

Prepress: Statistics Netherlands
Design: Edenspiekermann

Information
Telephone +31 88 570 70 70
Via contact form: www.cbs.nl/information