



# International gas trade in Belgium

Determining the origin and destination of imports and exports, and eliminating transit from annual data





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## Table of contents

Introduction .....	4
1. The gas network in Belgium .....	4
1.1. Low-calorific gas.....	4
1.2. High-calorific gas.....	5
2. International gas trade in Belgium.....	6
2.1. Previous method .....	7
2.2. New adjusted method.....	7
2.3. Results .....	9
3. Conclusion.....	12
4. References.....	12

## List of figures

Figure 1. Belgian gas transmission network and linked interconnection points.....	5
Figure 2. Belux border interconnection points.....	6
Figure 3. Main transmission routes for H-gas in Belgium .....	8

## List of graphs

Graph 1. Total entries into the main Belgian gas network for 2019 .....	11
Graph 2. Imports of gas into Belgium for 2019 .....	11
Graph 3. Origin of natural gas consumed in Belgium for 2019 .....	11

## List of tables

Table 1. Physical flows of gas into and out of Belgium for 2019.....	7
Table 2. Calculated net imports – previous vs. new methodology.....	10
Table 3. Calculated net exports – previous vs. new methodology.....	10

## Introduction

Under regulation (EC) No 1099/2008, EU member states must report monthly and annual data on gas trade within their borders. Some definitions differ between monthly and annual data, among which the definitions of imports and exports. This article focuses on the reporting of annual data, and more specifically the determination of the origin and destination of imports and exports, and the elimination of transit.

Regulation (EC) No 1099/2008 specifies that *“imports’ refer to ultimate origin (the country in which the energy product was produced) for use in the country and ‘exports’ to the ultimate country of consumption of the produced energy product.”*

This would indicate that the Eurostat definition centres around the origin and destination of the actual molecule of gas, and not the origin or destination stated in a contract, although this is perhaps not clearly stated in the guidelines.

Belgium is at an international crossroads for gas, with border interconnection points with the Netherlands, Norway, the UK, Germany, France and Luxembourg, as well as the port of Zeebrugge through which liquefied natural gas (LNG) is imported.

However, while information on the true origin and/or destination of the gas transported on the Belgian network is available for certain countries (Norway for H-gas, the Netherlands and France for L-gas) as well as for LNG, this is not the case for all of the gas. This is due to increased reliance on short-term contracts and the spot market, as well as the fact that gas trading companies do not track the actual molecules of gas they trade, but rather the countries they have contracts with.

Reporting instructions for the joint Eurostat/IEA natural gas annual questionnaire state that *“Gas transiting your country should not be included.”* However, they also specify that *“Imported LNG which is regasified in your country and subsequently exported to another country should be considered as an import of LNG into your country and as an export of gas to the country of destination.”*

Until recently, the FPS Economy, SMEs, Middle Classes, and Energy used a method that calculated net imports to eliminate transit, then adopted a proportional approach to estimate the quantities of gas imported from and exported to (in the case of regasified LNG) each neighbouring country.

In order to improve their methodology, the FPS Economy, SMEs, Middle Classes, and Energy decided to use flow data provided by Fluxys Belgium, the Belgian Transmission System Operator, showing the quantities of gas entering and exiting each interconnection point on an hourly basis. This allowed the development of a model that is based as much as possible on the true physical flows of gas in Belgium and better highlights transit, as well as pinpointing the immediate origin of imports and destination of exports.

Please note that while the procedure described in this paper only applies to the Fluxys Belgium main gas network, the final figures quoted in the “Results” section also include direct connections and LNG that is used in Belgium without first being regasified and injected into the network. These are added after the steps described in this paper, to obtain final natural gas figures for Belgium.

## 1. The gas network in Belgium

Fluxys Belgium is Belgium’s independent operator of the high-pressure natural gas transmission network, the natural gas storage infrastructure and the LNG terminal in Zeebrugge.

The gas system in Belgium is split into two separate networks: a network for high-calorific gas or H-gas, and a network for low-calorific gas or L-gas<sup>1</sup>.

### 1.1. Low-calorific gas

Since the 1960s, Belgium has been importing L-gas from the Groningen field in the Netherlands. A proportion of this L-gas is consumed in Belgium and the remainder is transited through to

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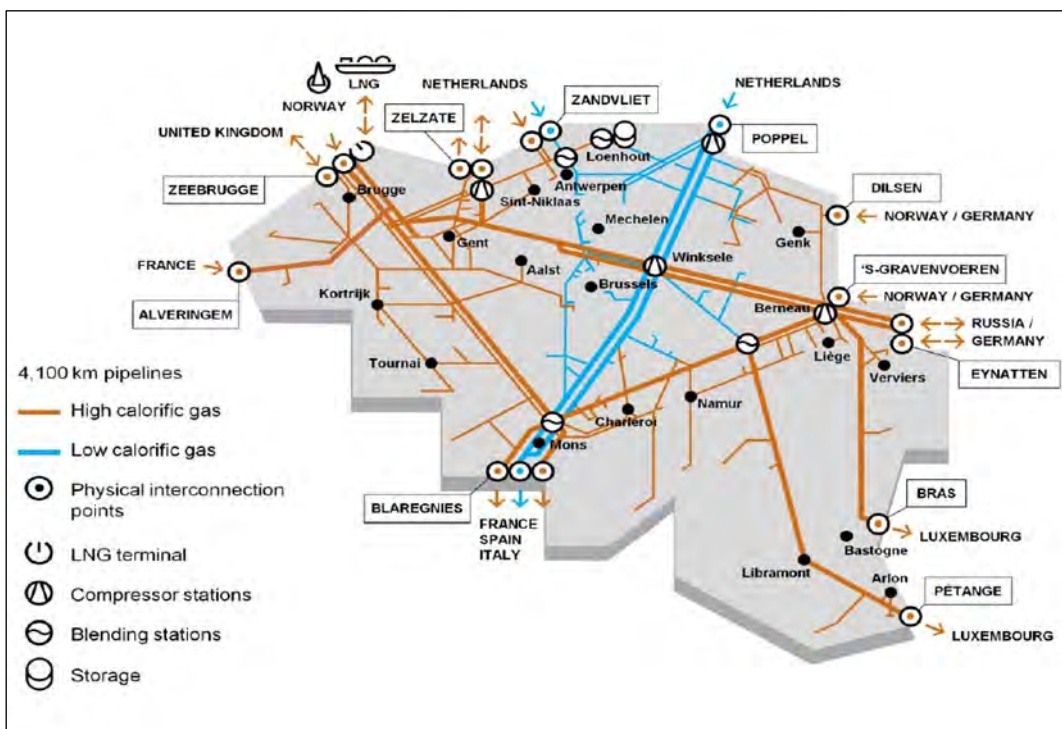
<sup>1</sup> L-gas has an average gross calorific value of 9.769 kWh/Nm<sup>3</sup> or 33.341 TJ/Mm<sup>3</sup>(s), while H-gas has an average gross calorific value of 11.63 kWh/Nm<sup>3</sup> or 39.693 TJ/ Mm<sup>3</sup>(s).

France. L-gas represented 23% of the Belgian market in 2019, but it is due to be progressively phased out by 2029.

The L-gas network (drawn in blue in figure 1) is centred around a double pipeline connected to the Netherlands via the Hilvarenbeek-Poppel and Zandvliet L interconnection points, and to France via the Blaregnies L interconnection point.

This backbone supplies several distribution networks covering the province of Limburg, the Campine, the south of Flemish Brabant and the north of Walloon Brabant, some parts of the province of Liège and Hainaut, as well as the large cities of Brussels and Antwerp.

Figure 1. Belgian gas transmission network and linked interconnection points



Source: Fluxys Belgium.

## 1.2. High-calorific gas

In 1977, Norway became the first importer of H-gas to Belgium. The H-gas network has since gradually been connected to France, the Netherlands, Luxembourg, Germany and the UK, as well as the Zeebrugge LNG terminal.

In addition to the standard service of regasification, the Zeebrugge LNG terminal allows loading and unloading of large vessels, direct transshipments between vessels and temporary storage. In addition, it serves the small-scale LNG market, providing an alternative fuel for smaller vessels and trucks, or for industrial customers not connected to the gas pipeline system.

The first LNG imports came from Algeria in the 1980s. Since 2007, Qatar has been the main importer of LNG to Belgium, but from 2018 there has also been an increase in Russian LNG imports.

Regasified LNG injected into the Belgian network is either used in Belgium or exported. As there is no indigenous production in Belgium, this regasified LNG is considered the only gas export for the country by Eurostat definitions.

In addition, regasified LNG can be imported from neighbouring countries, among others France (through the terminal of Dunkirk).

The Belgian H-gas network (drawn in orange in figure 1) covers West Flanders, East Flanders, the province of Namur and Liège, the greater part of Hainaut and a large section of Limburg, and is centred around three backbones :

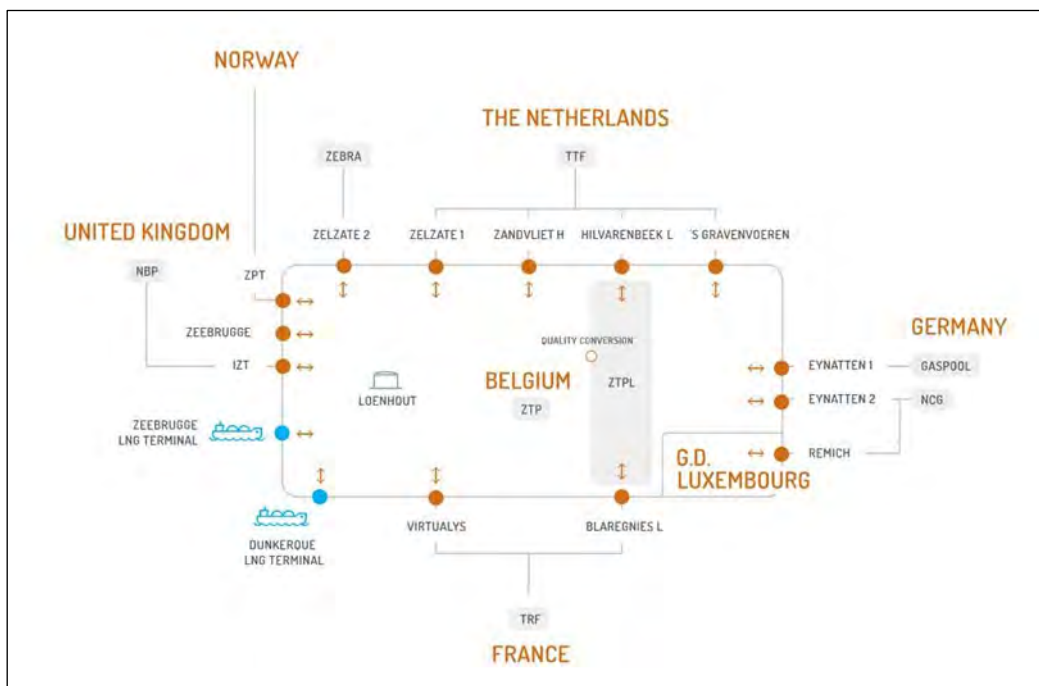
- a pipeline connected to the Netherlands, France and Luxembourg;
- a double pipeline connected to the Zeebrugge hub (which brings together flows from the Norwegian and UK pipelines, and the LNG terminal) and France;
- a bidirectional pipeline connected to the Zeebrugge hub at one end and Germany at the other.

## 2. International gas trade in Belgium

Belgium is at an international crossroads for gas, with 20 border interconnection points which allow the transmission of gas from:

- the Netherlands to France and Luxembourg;
- Norway to France;
- Norway and the UK to Germany, the Netherlands, Luxembourg and France;
- Germany to the UK, the Netherlands, Luxembourg and France.
- LNG-producing countries (such as Qatar, Russia or USA) to the UK, Germany, the Netherlands, France and Luxembourg (in the form of regasified LNG).

Figure 2. Belux border interconnection points



Note: the Luxembourg Bras-Petange interconnection points are not shown as they are considered as internal points in the Belux Network.

Source: Fluxys Belgium.

The physical flows of natural gas in Belgium are measured by Fluxys Belgium. They monitor the gas entering and exiting each interconnection point on an hourly basis, showing how much gas flows from neighbouring countries into Belgium and vice versa.

Table 1. Physical flows of gas into and out of Belgium for 2019

*In TJ.*

	L-gas		H-gas	
	Entry	Exit	Entry	Exit
France	0	157,941	14,700	403,167
Luxembourg	0	0	0	27,476
Germany	0	0	63,016	33,371
Netherlands	322,112	0	161,980	233,991
UK	0	0	172,867	14,947
Norway	0	0	578,963	0
LNG	0	0	261,571	9
<b>Total</b>	<b>322,112</b>	<b>157,941</b>	<b>1,253,096</b>	<b>712,961</b>

Source: Fluxys Belgium.

As mentioned in the introduction, while information on the true origin and/or destination of the gas transported on the Belgian network is available for certain countries (Norway for H-gas, the Netherlands and France for L-gas), as well as for LNG, this is not (or only partly) the case for all of the gas.

In addition, the gas that enters a country through one border entry point may be blended with gas from other border entry points within that country, as well as gas the country itself might produce. The countries connected to these border entry points can in turn be countries where gas is actually extracted, but they can also be transit countries.

## 2.1. Previous method

Until recently, the FPS Economy, SMEs, Middle Classes, and Energy used a methodology that calculated net imports to eliminate transit, then adopted a proportional approach to estimate the quantities of gas imported from and exported to each neighbouring country.

L-gas is transported from the Netherlands via the Hilvarenbeek-Poppel and Zandvliet L interconnection points to France via the Blaregnies L interconnection point. Therefore, L-gas imports are simply calculated by subtracting the Exit flow for France from the Entry flow for the Netherlands.

For H-gas, a proportional approach was taken:

1. Net H-gas imports were obtained by subtracting the sum of H-gas Exit flows from the sum of H-gas Entry flows;
2. H-gas exports (i.e. regasified LNG exports) were calculated by a rule of 3:  

$$\text{Total regasified LNG} * \text{Sum of H-gas Exit flows} / \text{Sum of H-gas Entry flows}$$
3. H-gas exports were added to net H-gas imports to obtain final H-gas imports.

For each country, H-gas imports and exports were then calculated by a rule of 3:

- Country's H-gas Entry flows \* Final H-gas imports / Sum of H-gas Entry flows
- Country's H-gas Exit flows \* H-gas exports / Sum of H-gas Exit flows

## 2.2. New adjusted method

In an effort to improve its methodology, the FPS Economy, SMEs, Middle Classes, and Energy used flow data provided by Fluxys Belgium for H-gas, which shows the quantities of gas entering and exiting each interconnection point on an hourly basis. Further discussions with Fluxys Belgium provided a clearer picture of the different gas flows within the Belgian network.

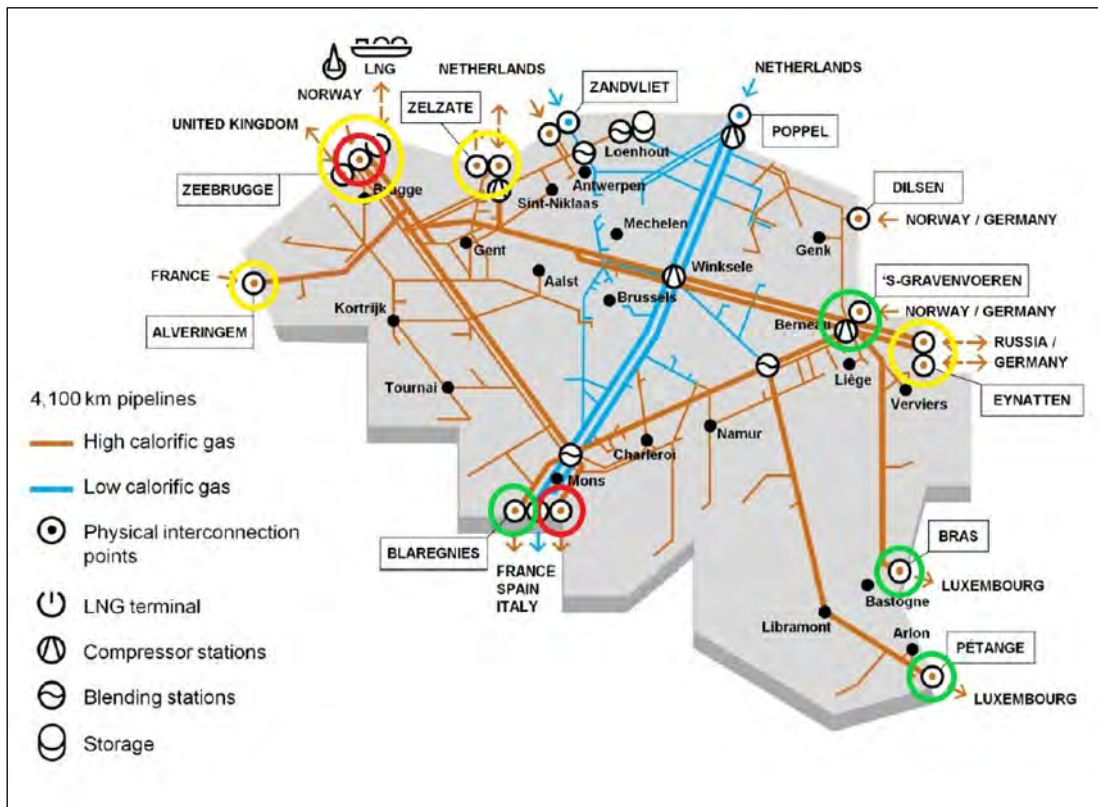
The Open Data made available online by Fluxys Belgium is aggregated and combines several interconnection points into virtual points. However, Fluxys Belgium agreed to provide flow data which shows the quantity of gas entering and exiting every interconnection point on an hourly basis.

As a result, the new methodology focused on three main transmission routes for H-gas, shown in figure 3:

- A. Norway to Blaregnies Troll (red circles);
- B. 's Gravenvoeren D900 to Blaregnies Segeo, Bras and Petange (green circles);
- C. Zeebrugge hub to Alveringem, Zelzate and Eynatten in one direction, and from Eynatten to Zelzate, the UK and Alveringem in the other (yellow circles). The regasified LNG exported from Belgium to the UK, Germany, the Netherlands, France and Luxembourg is also included.

It should be noted that these routes are not “closed circuit” and that gas can be transferred from one route to another.

Figure 3. Main transmission routes for H-gas in Belgium



Source: Fluxys Belgium.

The work is based on the following strong assumptions:

1. Gas takes the shortest route available and is transited within the hour.
2. Gas imported through Zandvliet H, Dilsen and 's Gravenvoeren D400 is principally used in Belgium.
3. Gas transported on Route A is either used in Belgium, is transited directly to France, or is sent into Route B or route C. The remainder of the gas that is transited to France via Route A comes from Route B (or more rarely Route C).
4. Part of the gas transported on Route B is used in Belgium, the remainder is transited to Luxembourg and France.
5. It is estimated that at least 500.000 kWh/h of the gas entering via Dilsen and 's Gravenvoeren is for Belgian use.



6. Route C is used for transit only<sup>2</sup>. Any gas that is not transited directly is sent into Route B (or more rarely Route A).
7. Germany and, less frequently, the Netherlands use interconnection points along Route C to transfer gas within their own country. This is known as Shorthaul Wheeling and this gas transfer must be eliminated before further calculations can be done.
8. On average 1.000.000 kWh/h of regasified LNG is consumed in Belgium; any extra regasified LNG is sent into Route C.
9. All gas stored in the Loenhout facility is consumed in Belgium.
10. The "linepack" is not taken into account. This is a form of flexibility built into the system, a procedure that allows a buffer volume of gas to be temporarily stored in the network, which can cause the capacity to fluctuate from one hour to the next.

The new methodology developed uses the hourly data provided by Fluxys Belgium, basing calculations around the concept of "Real Entry", obtained by subtracting a route's hourly Exit flow(s) from its hourly Entry flow(s). A negative "Real Entry" indicates that only transit has taken place during that hour, while a positive "Real Entry" indicates that gas has remained in Belgium (to be either used or sent into another route). The gas flow balances from each of the different routes are resolved one by one, in order to achieve an equilibrium.

## 2.3. Results

Once the gas flow balances have been resolved, the data obtained is plotted in a summary table. This shows the quantities of gaseous H-gas transiting from one country to another, the quantities imported for Belgian use from each country, and the quantities of regasified LNG used in Belgium and exported to each country.

Checks are made to ensure that all Entry and Exit flows are accounted for. The physical Entry flows of H-gas are checked against the sum of H-gas used in or transited through Belgium, and the physical Exit flows of H-gas are checked against the sum of H-gas transited through and exported from Belgium (regasified LNG).

Imports of L-gas, imports from direct connections and imports of LNG used in Belgium without being regasified and injected into the network are then added to the total to obtain final imports figures for Belgium.

Compared to the results obtained with the previous methodology, those obtained with the new methodology not only show lower exports of regasified LNG, which in turn mean lower imports overall, but also a different distribution of the imports from and exports to each country.

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<sup>2</sup> There is a small amount of Belgian consumption along this route but this is not considered in the calculations. This hypothesis will no more be true in a few years when the L-gas backbone will be converted to carry H-gas.

Table 2. Calculated net imports – previous vs. new methodology

*In TJ.*

	2017		2018		2019	
	Previous	New	Previous	New	Previous	New
Norway	205,030	251,169	238,918	293,721	274,070	266,881
Netherlands	292,196	339,060	294,181	331,761	252,168	300,415
Germany	47,458	15,346	62,563	15,047	29,830	17,922
UK	106,009	28,230	70,525	16,101	81,780	39,764
France	386	277	737	263	6,959	3,086
LNG	44,482	44,482	98,739	98,739	266,238	266,238
<b>Total</b>	<b>695,561</b>	<b>678,562</b>	<b>765,663</b>	<b>755,632</b>	<b>911,045</b>	<b>894,306</b>

Note: these figures include the Fluxys Belgium main gas network, as well as direct connexions and the LNG used in Belgium without being regasified and injected into the network.

Source: FPS Economy.

Table 3. Calculated net exports – previous vs. new methodology

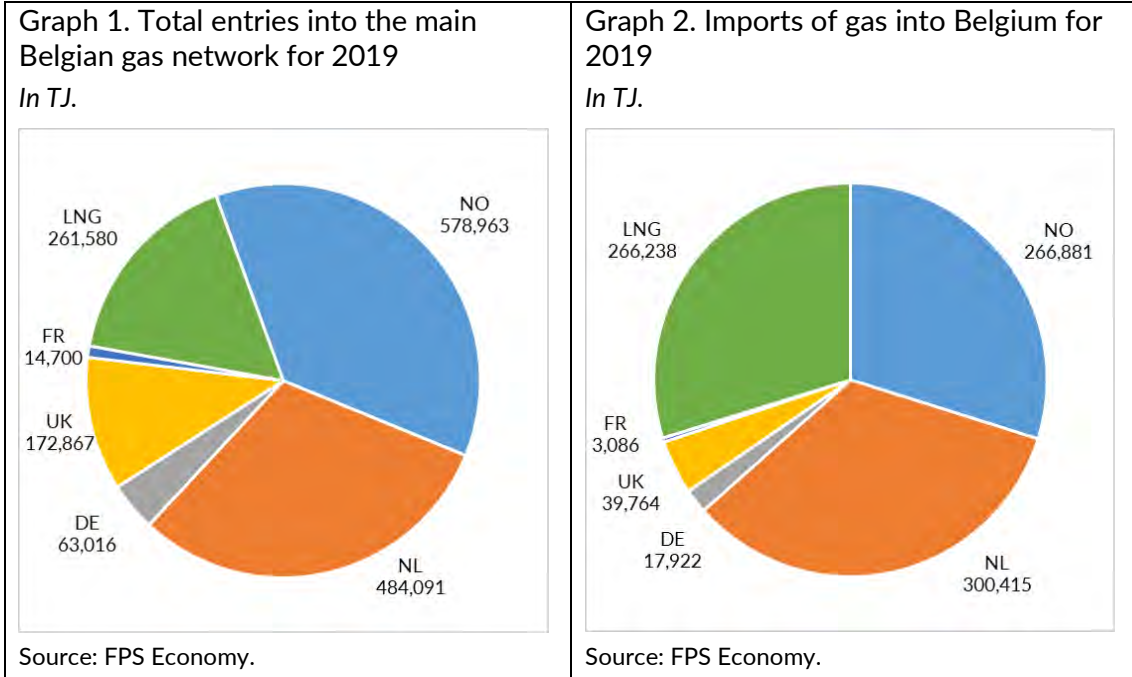
*In TJ.*

	2017		2018		2019	
	Previous	New	Previous	New	Previous	New
Netherlands	7,241	7,557	16,296	37,747	62,612	109,973
Germany	3,361	1,363	4,964	2,647	8,929	9,811
UK	3,349	751	10,573	1,213	3,970	6,439
France	14,581	2,270	29,425	9,084	107,880	37,587
Luxembourg	822	415	1,768	2,304	7,352	10,193
<b>Total</b>	<b>29,354</b>	<b>12,355</b>	<b>63,026</b>	<b>52,994</b>	<b>190,743</b>	<b>174,004</b>

Source: FPS Economy.

Graph 1 shows the total entries of natural gas into the Belgian main gas network for 2019. This includes gaseous L-gas, gaseous H-gas and LNG.

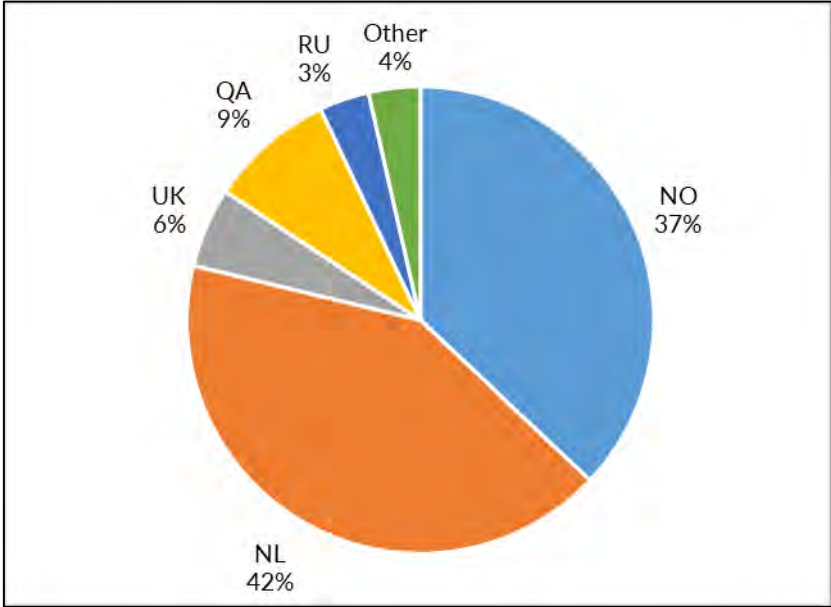
Graph 2 shows the imports of natural gas into Belgium for 2019. This includes the main gas network, direct connections and the LNG used in Belgium without being regasified and injected into the network, as well as the LNG that is regasified and exported.



It must be noted that imports of LNG via ships increased sharply in 2019, now accounting for 17% of entries on the main gas network and 30% of imports.

As explained earlier, Eurostat's reporting conventions mean that all regasified LNG is reported as imports, which leads to an oversized representation of this LNG in imports. We have therefore decided to also include a graphic showing the origin of the gas consumed in Belgium in 2019 (graph 3).

**Graph 3. Origin of natural gas consumed in Belgium for 2019**



Source: FPS Economy.

We can see that 42% of the gas consumed in Belgium in 2019 entered via a gas pipeline coming from the Netherlands, 37% from Norway and 6% from the United Kingdom. In addition 9% of the gas consumed was regasified LNG from Qatar and 3% regasified LNG from Russia.

In practice, only gas from Norway (and imported LNG) actually comes entirely from the country of extraction. Gas entering via pipeline from the Netherlands, the United Kingdom, Germany or

France contains, at least in part, gas originating from other countries. The “Other” category includes Egypt, France, Germany, Saudi Arabia and the USA.

### 3. Conclusion

This project aimed to revise and improve the current method to eliminate transit and determine the countries of origin for imports and of destination for exports.

The previous methodology used a proportional approach in order to estimate the quantities of gas imported from and exported to each neighbouring country.

The new methodology follows the physical flows of gas within Belgium instead, analysing the flows of gas entering and exiting each interconnection point on an hourly basis, and focusing on three main transmission routes for H-gas.

This allows for the identification of the quantities of gaseous H-gas transited from one country to another, the quantities imported for Belgian use from each country, and the quantities of regasified LNG used in Belgium and exported to each country.

The new methodology was first applied to data in the 2018 reporting cycle, and was also applied to the 2017 and 2019 data in the 2019 reporting cycle.

Unfortunately, information on the true origin and destination of the gas imported into, transited through and exported from Belgium is only available for certain countries (Norway for H-gas, the Netherlands and France for L-gas), as well as for LNG.

In order to further determine the origin and destination of gas transported on the Belgian network, more detailed information would be needed from the countries that Belgium shares border crossing points with. As it has not yet been possible to obtain this, the only data that can be provided at this moment is the immediate import and export countries.

The new methodology can also be used to determine the origin of gas that transits through Belgium. Should a European collaboration be put in place to resolve the issue of the true origin and destination of gas, this data could be made available.

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