Holz, Franziska; Brauers, Hanna; Roobeek, Thorsten

Article

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Earthquakes in the Netherlands cannot shake the European natural gas market

By Franziska Holz, Hanna Brauers and Thorsten Roobeek

The rising number of earthquakes in the northeastern part of the Netherlands has been attributed to the extraction of natural gas from the Groningen field. This has led to strong opposition to natural gas production from the Dutch population, a matter that is increasingly preoccupying not only policy-makers on the local and provincial levels, but also the central government. In response, the Dutch government has decided a drastic reduction of production from the Groningen gas field, the largest natural gas field in the country. This has an impact on several Western European countries that import natural gas from the Netherlands. Model calculations by DIW Berlin based on a substantially reduced production of natural gas in the Netherlands show that due to diversified imports effects on the European natural gas market would only be small. Even if the lower Dutch production comes in addition to the disruption of the Russian supplies to Europe, it would not result in serious supply shortages or price increases in Western Europe since gas from other regions are possible. However, these supplies of natural gas would come partly from providers whose reliability might be called into question due to an unstable political situation, as for instance in North Africa.

Production of natural gas in the Netherlands amounted to 86 billion cubic meters in 2013; this corresponds to 20 percent of total natural gas consumption in the EU.[1] The large Groningen field in the northeastern part of the Netherlands is of prime importance as it accounts for around 60 percent of total natural gas production in the Netherlands and also compensates for seasonal fluctuations over the course of the year.[2]

Approximately one-third of the natural gas produced in the Netherlands is consumed directly in the country — particularly for power and heat generation, for instance, for greenhouses — and two-thirds are exported to neighboring countries in northwestern Europe, namely, to Germany, Belgium, Luxembourg, and France (see Figure 1).

Natural gas production plays a pivotal role for the Dutch economy and the national budget. In 2013 alone, the gas sector employed 70,000 people and accounted for 13 billion euros — or 4.5 percent — of government revenue.[3] This revenue flows exlusively into the central government budget.

The significance of the Netherlands as Europe's natural gas supplier will decrease considerably in the future. Intensive natural gas extraction in the northeast of the Netherlands has triggered an increasing number of earthquakes in the last years.[4] Under public pressure

1 IEA (International Energy Agency), Natural Gas Information Statistics 2015 (Paris: OECD/IEA, 2015), accessed June 5, 2015.

2 Seasonal compensation through the Groningen field is made possible by the exceptional flexibility of the (daily) production rates. In the summer – when demand normally is low – the Groningen field produces very little. Conversely, almost the entire annual production of the field (more than 40 billion cubic meters in 2014) takes place in the winter months. Consequently, the Groningen field acts similar to a storage facility.

3 IEA, Energy Policies of IEA Countries – The Netherlands – 2014 Review (Paris: OECD/IEA, 2014); Eurostat, Government revenue, expenditure and main aggregates (2015), accessed October 23, 2015, http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do.

4 The Groningen field is located onshore below the Groningen province. Most of the other natural gas fields in the Netherlands are offshore.

Box 1

Organization of natural gas production in the Netherlands

The Netherlands started producing natural gas in the 1960s. The centralist organization of its production chain has not changed since and, more recently, has been one of the major points for public criticism of the country's natural gas production.[1] The three main players in Dutch natural gas production are the Dutch government and the private companies Royal Dutch Shell and ExxonMobil.[2]

In order to produce natural gas in the Netherlands, a license is required from the Dutch Ministry of Economic Affairs. In addition, the public company EBN (*Energie Beheer Nederland)*, which holds a 40 percent stake in all oil and gas projects in the country, ensures the respect public interests. In the private sector, Royal Dutch Shell and ExxonMobil founded the Dutch petroleum partnership NAM (*Nederlandse Aardolie Maatschappij)* in 1947.

Together, NAM and EBN constitute the Groningen partnership (*Maatschap Groningen*) which manages the production of natural gas at the Groningen field. NAM has a 60-percent and EBN a 40-percent stake in the Groningen partnership, but voting rights are distributed evenly between the two organizations. As the operator, NAM produces the natural gas of the Groningen field on behalf of the Maatschap. The semi-public natural gas trader GasTerra is responsible for the sale of Groningen gas and all other natural gas produced in the Netherlands.[3]

Long-term strategic decisions on the production and sale of Dutch gas are made in a joint committee of the main shareholders of the Maatschap and GasTerra.[4] However, the Dutch Ministry of Economic Affairs has the final say on production at the Groningen field and is also entitled to intervene if there are safety concerns.[5] The State Supervision of Mines (SSM) plays an important advisory role here: It reports to the Ministry of Economic Affairs and analyzes the impact of natural gas production on the environment.

Until very recently, the Ministry adopted flexible production plans for the Groningen field. Between 2006 and 2015, the production cap was set at 425 billion cubic meters. However, in the last two years, the Ministry of Economic Affairs has repeatedly intervened with short-term adjustments to the cap. In June 2015, the Ministry of Economic Affairs restricted the production cap to 30 billion cubic meters for 2015, following a recommendation of SSM.[6]

Since the central government plays such a crucial role in natural gas production, it has become a key political issue and will remain so throughout parliamentary election campaigns in early 2017. All current opposition parties are very critical of natural gas production. An even faster reduction of Dutch natural gas production would therefore be possible if the current coalition of Social Democrats and Liberals were not reelected.

There is also additional pressure on the Dutch natural gas industry from climate policy. The EU's binding emission reduction targets up to 2020 and 2030 mean also for the Netherlands that CO_2 emissions must be reduced significantly. The Dutch government has so far failed to develop a national roadmap to meet these targets and has not introduced any policy instruments to implement these EU requirements.[7] Nevertheless, its dependence on fossil fuels will need to be reduced considerably and this applies particularly to natural gas which currently accounts for 54 percent of power generation and 42 percent of primary energy consumption.[8]

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1 The Dutch provinces and municipalities have not yet had a formal opportunity to participate in decision-making. Under public pressure, the Ministry of Economic Affairs has now made it at least possible for local authorities to participate in public consultations. Cf. Dutch Ministry of Economic Affairs (2015): Kamerbrief over aanstelling Nationaal Coordinator Groningen. Letter to the Parliament, May 1, 2015.

2 A. F. Correljé and P. R. Odell (2000): Four decades of Groningen production and pricing policies and a view to the future, Energy Policy 28 (1), 19–27.

3 GasTerra is the sole dealer of Groningen gas. Producers from other Dutch natural gas fields can, but are not obliged to, sell to GasTerra which then markets the natural gas. GasTerra is owned by Shell, ExxonMobil, EBN, and the Dutch Ministry of Economic Affairs.

4 The committee, known as the College van Gedelegeerd Commissarissen, consists of the Director-General for Energy, Telecommunications and Competition of the Ministry of Economic Affairs, two representatives from EBN, the President of ExxonMobil Benelux, and the President of Shell Netherlands.

5 The Ministry of Economic Affairs does not control production at any of the other natural gas fields.

6 Dutch Ministry of Economic Affairs, Kamerbrief Besluit Gaswinning Groningen in 2015 (letter to Parliament, June 23, 2015).

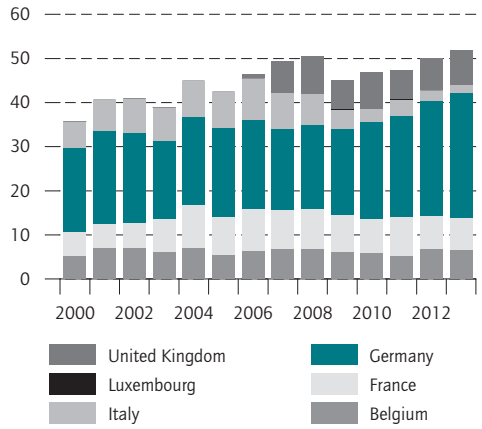
7 A court decision from June 2015 mandates the Dutch government to reduce emissions by at least 25 percent until 2020. Den Haag District Court, "Decision C/09/456689/HA ZA 13-01296," accessed July 1, 2015, http://uitspraken.rechtspraak.nl/inziendocument?id=ECLI:NL:RBDHA:2015:7196.

8 IEA, Energy Policies of IEA Countries – The Netherlands – 2014 Review (Paris: OECD/IEA, 2014).

Figure 1

Natural gas imports from the Netherlands by EU Member States

Billion cubic meters



Source: IEA (2015): Natural Gas Information Statistics.

The Netherlands are an important natural gas supplier to Northwest Europe.

and growing safety concerns, the cap on natural gas production at the Groningen field has been repeatedly lowered over the past two years. Capped at 30 billion cubic meters, the production rate in 2015 is already 45 percent below the 2013 level (just under 54 billion cubic meters).[5]

This development raises questions about supply security in Europe as a whole, particularly given that confidence in natural gas supplies from Russia has plummeted since the crises with Ukraine in 2006, 2009, and since 2014. This article provides an overview of the expected impact of the decline in production on the Netherlands and its neighboring countries.

Shale gas to replace declining conventional natural gas production?

Using shale gas to compensate for the fall in natural gas production is a highly controversial topic in the Netherlands. One camp sees shale gas as an opportunity to sustain domestic natural gas production despite a decline in conventional extraction. The other camp, however, sees major risks for people as well as the environment in the densely populated country.

The Mining Act of the Netherlands stipulates that the central government alone cannot decide on shale gas exploration but that the municipalities must also be involved in the process.[6] Planned test drillings were suspended until further notice when a large number of municipalities opposed shale gas exploration. A total of 226 out of 393 municipalities in the Netherlands recently declared themselves to be "shale gas free."[7] In July 2015, the Minister of Economic Affairs bowed to public pressure and announced that there would be no commercial shale gas production in the Netherlands in the next five years.[8]

It is currently discussed, to give municipalities and regional governments in the provinces more influence over decisions regarding the production of natural gas. Plans are also being developed to involve the Ministry of Infrastructure and the Environment in the decision-making processes. Such a fundamental change to the decision-making structures might lead to greater acceptance of natural gas production. However, due to strong opposition large parts of society and the municipal authorities, shale gas is unlikely even after 2020.

L-gas and H-gas: different conversion issues in the Netherlands and in Germany

The natural gas produced at the Groningen field is known as L-gas (low-calorific gas). Most other natural gas fields in the world provide H-gas (high-calorific gas). The key difference between the two types of gas is the energy content per cubic meter.[9] All appliances burning natural gas must be set to the specific gas quality, meaning that it is not feasible to simply switch between L-gas and H-gas.

The entire natural gas infrastructure in the Netherlands is adjusted to L-gas. Although H-gas can also be used, it has to be converted to L-gas first, basically by adding nitrogen. For instance, the Dutch national gas network operator Gasunie converts liquefied natural gas (LNG) im-

5 Dutch Ministry of Economic Affairs, Kamerbrief Besluit Gaswinning Groningen in 2015 (letter to Parliament, June 23, 2015). In the event of supply bottlenecks, up to 33 billion cubic meters could be produced from the Groningen field in 2015.

6 EBN, Focus on Dutch Oil & Gas 2015 (2015), 20.

7 Schaliegasvrij, Overweldigende meerderheid voor motie tegen schaliegas op VNG jaarcongres (2015), accessed July 1, 2015, https://www.schaliegasvrij.nl/2015/06/03/overweldigende-meerderheid-voor-motie-tegen-schaliegas-op-vng-jaarcongres/.

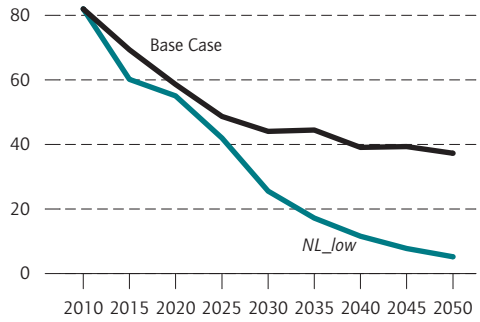
8 Y. Schavemaker, Shale Gas in the Netherlands (TNO, 2015), accessed October 23, 2015, http://www.shale-gas-information-platform.org/areas/the-debate/shale-gas-in-the-netherlands.html.

9 The two types of gas are formally distinguished by their Wobbe Index, which measures the calorific value and the density of natural gas. L-gas has a Wobbe index value below 46.5 MJ/m3 while natural gas with a Wobbe Index of over 46.5 MJ/m3 is called H-gas. The lion's share of natural gas produced in the Netherlands, including at the Groningen field, is L-gas. There are currently still two parallel pipeline networks in Germany, one for L-gas and one for H-gas. The natural gas network is to be gradually converted to H-gas by 2030.

Figure 2

GGM model assumptions of Dutch natural gas production between 2010 and 2040 in the Base Case and the Scenario *NL_low*

Billion cubic meters



Source: Calculations by DIW Berlin.

Dutch natural gas production is assumed to strongly decrease in the next decades, compared to previous projections that are reflected in the Base Case.

ported to Rotterdam. The lower level of production at the Groningen field in the future will lead to a higher need for conversion capacities in order to meet the domestic natural gas demand. Conversion capacities are limited, however, and subject to long investment cycles.[10] Consequently, the sharp decline in domestic production not only incurs additional costs for further conversion equipment but also restricts the extent to which the Netherlands could replace domestic natural gas with imports.

Importers of Dutch natural gas have precisely the opposite conversion issue. Germany, France, and Belgium have both L-gas and H-gas networks. These countries have begun to convert their local L-gas networks into H-gas networks, and they have resolved to only use H-gas from 2030 at the latest.[11] While Germany already has a very specific schedule for the transition by 2030, the other countries have not yet made as much progress in their planning. However, the accelerated decline of the Groningen production combined with mandatory network planning might push the process forward in all the countries concerned.

10 Gasunie has stated that the expansion of the current conversion capacity of 19 to 23 billion cubic meters will only be possible from 2019, when capacity will increase to 20 to 29 billion cubic meters. Gasunie, Mogelijkheden kwaliteitsconversie en gevolgen voor de leveringszekerheid – Resultaten onderzoek 7 (2013), 4.

11 Under EU network planning legislation, the conversion of the networks is announced in the gas network planning documentation: in Germany, FNB Gas, Netzentwicklungsplan Gas 2014 (2015); in France, GRTgaz, 2014/2023 Ten Year Development Plan for the GRTgaz Transmission Network; in Belgium, Fluxys, Fluxys Indicative Investment Programme 2010-2019 for the Development of Natural Gas Infrastructure in Belgium.

Box 2

The Global Gas Model

The Global Gas Model (GGM) is a partial equilibrium model of the global gas market. The model numerically simulates production, consumption, and trade flows of natural gas between 2010 and 2040. The GGM depicts the entire value chain for 120 countries and/or regions throughout the world from production, transport, and storage, to final consumption in the power, industrial, and household sectors. The model also takes into account seasonal fluctuations in demand, the market power of individual producers or traders, as well as endogenous investment in transportation and storage capacities. The GGM was developed in cooperation with the Norwegian University of Science and Technology (NTNU) in Trondheim and is based on the European Gas Model[1] and the World Gas Model.[2]

For the model's baseline scenario, reference production and consumption are adapted to the New Policies Scenario (NPS) of the World Energy Outlook 2013 of the International Energy Agency (IEA). In this scenario, it is assumed that by 2035 the EU will reduce its CO_2 emissions by 40 percent relative to the 1990 level, while global emissions will rise by 20 percent compared to 2011. Accordingly, reference demand for gas in 2015 is

1 R. Egging, S. A. Gabriel, F. Wood, and J. Zhuang, "A Complementarity Model for the European Natural Gas Market," Energy Policy 36, no. 7 (2008): 2385–2414.

2 R. Egging, F. Holz, and S. A. Gabriel, "The World Gas Model – A Multi-Period Mixed Complementarity Model for the Global Natural Gas Market," Energy 35, no. 10 (2010): 4016–4029.

Supply security in the EU: model results

The significance of reduced natural gas production in the Netherlands for the European natural gas market was analyzed by DIW Berlin using the Global Gas Model (see Box 2).[12] Two different scenarios for the period 2015 to 2040 were considered. In the first scenario, the impact of reduced natural gas production in the Netherlands on the European natural gas market was analyzed. In the second scenario, this lower production rate was combined with a scenario of Russia disrupting its supply of natural gas to Europe.[13] In the baseline scenario,

12 F. Holz, H. Brauers, P. M. Richter, and T. Roobeek, "Shaking Dutch Grounds Won't Shatter the European Gas Market," DIW Discussion Papers 1516 (2015).

13 For a detailed analysis of the possible effects of various scenarios involving disruptions to supplies of Russian natural gas, see P. M. Richter and F. Holz, "All Quiet on the Eastern Front? Disruption Scenarios of Russian Natural Gas Supply to Europe," Energy Policy 80 (2015): 177–189.

498 billion cubic meters for the EU-28, 43 billion cubic meters for the Netherlands, and 82 billion cubic meters for Germany. The demand for natural gas in the EU will rise to 560 billion cubic meters by 2035 and to 96 billion cubic meters in Germany, while consumption in the Netherlands changes only slightly and is forecasted to remain relatively constant at 43 billion cubic meters in 2035. Overall, according to the New Policies Scenario, the supply of primary energy in the EU is shifting ever further toward energy sources with lower CO_2 emissions than the current energy mix. According to the IEA, the share of natural gas in EU primary energy consumption is set to increase to 30 percent by 2035, while hydropower, biomass, and other renewable energy sources together are expected to account for a share of 23 percent. In 2011, the share of natural gas was 24 percent while renewable energies accounted only for 12 percent.

As published in previous *DIW Economic Bulletins*, the GGM can be used to analyze a variety of global natural gas trade scenarios: In 2014, it was used to calculate the impact of various scenarios depicting a disruption in supply of natural gas from Russia to Europe and, in 2013, to determine the effect of different climate change scenarios and the corresponding need for investment in natural gas infrastructure.[3]

3 H. Engerer, F. Holz, P. M. Richter, C. von Hirschhausen, and C. Kemfert, "European Natural Gas Supply Secure Despite Political Crises," DIW Economic Bulletin, no. 8 (2014): 3-15; F. Holz, P. M. Richter, and C. von Hirschhausen, "Structural Shift in Global Natural Gas Markets: Demand Boom in Asia, Supply Shock in the US," DIW Economic Bulletin, nos. 11/12 (2013): 13-20.

we assume a total demand for natural gas in the EU of 498 billion cubic meters for 2015.

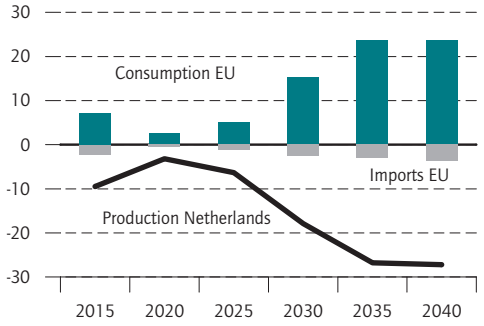
In accordance with the decisions made by the Dutch Ministry of Economic Affairs in July 2015, the *NL_low* scenario envisages a reduction of production at the Groningen field from the 39 billion cubic meters originally planned to 33 billion cubic meters in 2015 and further cuts in line with current Dutch forecasts for subsequent years up to the end of the modeling period in 2040.[14] As a result, total Dutch production — at the Groningen field and the multiple smaller fields — would reach a maximum of 60 billion cubic meters in 2015 and only 12 billion cubic meters in 2040. In comparison to the baseline scenario with the originally planned production caps, this equates to a reduction of 13 percent for 2015 and 70 percent for 2040 (see Figure 2).

14 Dutch Ministry of Economic Affairs, Kamerbrief Besluit Gaswinning Groningen.

Figure 3

GGM results: change in natural gas consumption, imports and Dutch production in the scenario *NL_low* compared to the Base Case

Billion cubic meters



Source: Calculations by DIW Berlin.

The strong reduction of Dutch natural gas production can be compensated by imports from other countries.

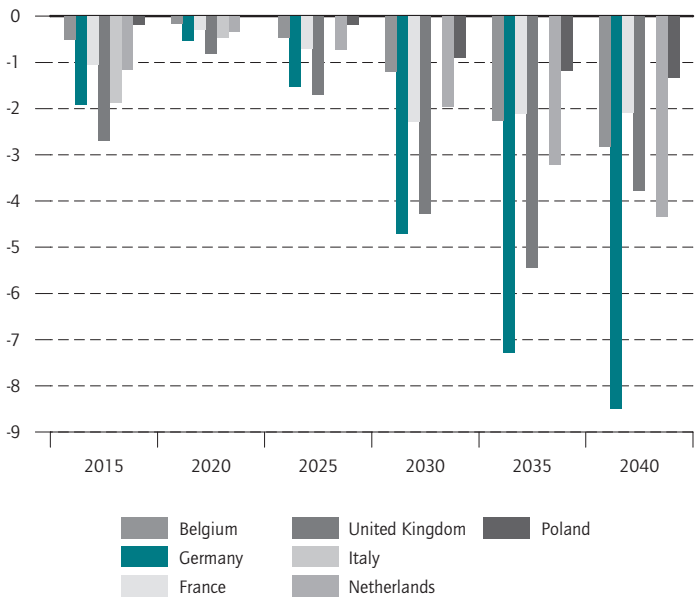
Changes in gas consumption, import structures, and prices in Europe compared to the baseline scenario were analyzed. The biggest impact can be observed at the end of the modeling period — because of the sharp decrease in natural gas production by this stage.

Although production in the Netherlands is 27 billion cubic meters lower than in the baseline scenario, total consumption of natural gas in the EU in 2040 only falls by three billion cubic meters. As in previous years, the difference can be compensated by imports from other countries (see Figure 3). The largest volume of imports after 2020 come from Africa, Russia, and Norway. The largest amount of *additional* imports as a result of the decline in natural gas production in the Netherlands is mainly in the form of LNG from North America (+25 percent), South America (+17 percent), and the Middle East (+10 percent). The reason for the relatively low impact on the European natural gas market is, *inter alia*, the oligopolistic market structure, since the market is attractive for a large number of suppliers due to high prices. There will be an increase in both natural gas pipeline and LNG imports in the EU.

In the *NL_low* scenario, import prices of natural gas in the EU only rise by around 0.7 percent, with this effect relatively evenly distributed across the member states due to a highly interconnected European natural gas market. As traditional importers of Dutch natural gas, the western EU countries are slightly harder hit than

Figure 4

GGM results: change in supplies of natural gas from the Netherlands in the scenario *RUS_NL_low* by consuming country
Billion cubic meters



Note: Countries with changes smaller than 1 bcm are not reported.

Source: Calculations by DIW Berlin.

All Northwest European EU countries have to find other sources of natural gas, with Germany being the most affected.

the eastern member states, but no country experiences a price hike of more than 1.3 percent.

Reduced natural gas production in the EU is particularly important in light of political tensions with Russia, especially since the crisis in Ukraine. European natural gas imports are largely dominated by Russian natural gas and various model-based studies have analyzed what impacts a potential supply stop from Russia might have on the EU market.[15] Negative effects would be seen primarily in Eastern Europe, while the West would be able to compensate the missing supply from Russia due to its diversified supply sources and transport routes.

In a second scenario, *RUS_NL_Low*, we therefore combine the reduced output in the *NL_Low* scenario with a complete cessation of Russian natural gas supplies to Europe.[16] We would expect supply problems to spread from Eastern European to Western European countries that are more heavily dependent on the Netherlands. However, the effects of lowering Dutch production are — as in the first scenario — relatively minor.

The biggest impacts of the reduced Dutch production of natural gas with a simultaneous stopn of Russian natural gas supplies can be felt in the Netherlands itself and in the neighboring importing countries (see Figure 4). However, these effects represent only a fraction of what is experienced by countries in Eastern Europe in terms of decline in demand and price increases as a result of the disruption of supply from Russia. Although Germany can import almost nine billion cubic meters less from the Netherlands in 2040, this will be compensated by imports from other countries. Consequently, no substantial price increases are to be anticipated either.

The inevitable consequence of the worst case scenario of a reduced natural gas supply from the Netherlands in addition to a supply disruption from Russia would be a switch from the pipeline-dominated European natural gas market to more LNG imports. Then imports of LNG from Africa as well as North and South America would gain considerable importance and further investment in the LNG infrastructure would be entailed. However, demand for LNG in the EU would continue to be so low compared to international levels that it would not drive up global market prices substantially.

A greater role for LNG would shift the geopolitical risks of using alternative suppliers into focus. The political situation in North Africa continues to be volatile after the Arab Spring and it still remains to be seen to what extent the geological potential of the natural gas reserves in the Middle East (Iran and Iraq) can be exploited.

Conclusion

This issue of the *DIW Economic Bulletin* analyzes the possible impact of a stronger reduction of natural gas production in the Netherlands on the European natural gas market. The Dutch government recently decided to cut the country's natural gas production more rapidly than previously envisaged, since the increased incidence of earthquakes in the Groningen region has raised safety concerns. Subsequent upward adjustments of the current output cap are unlikely, and compensation by

15 Richter, P.M. and Holz, F. (2015), "All Quiet on the Eastern Front?", Energy Policy, Vol 80, pp. 177–189; H. Hecking, C. John, and F. Weiser, "An Embargo of Russian Gas and Security of Supply in Europe" (Institute of Energy Economics at the University of Cologne (EWI), 2014); ENTSO-G, Winter Supply Outlook 2014/15 (Brussels: November 3, 2014).

16 The reference scenario corresponds to the "Long Disruption" scenario in P. M. Richter and F. Holz (2015)

increasing production from other natural gas fields or unconventional natural gas (shale gas) is highly questionable for geological reasons and due to growing opposition among the Dutch population.

The modeling by DIW Berlin presented here is an initial attempt to map the future reduced production in the Netherlands and to depict the possible consequences for the European natural gas market. The model calculations until 2040 show that only minor effects are to be expected for countries in northwestern Europe supplied by the Netherlands, since they have a diversified structure of suppliers and transportation routes. A sharp fall in production in the Netherlands would lead to a decrease in natural gas consumption of only three billion cubic meters (less than one percent of total consumption in the EU) and average price increases below one percent.

Even in the worst case scenario, in which the cut in production in the Netherlands comes in addition to a Russian supply stop, only minimal additional effects on natural gas consumption and prices are to be expected for Western Europe, since these countrieshave access to sufficiently diversified imports.

Although the reduction in natural gas production in the Netherlands is unlikely to cause any supply problems, it is worth noting its current role as a swing supplier absorbing seasonal fluctuations in northwestern Europe. The Groningen field has the rare capacity to vary production rates flexibly. To date, it is used similar to a storage facility and its output is flexibly adjusted to demand.[17] The drastic restriction of the production capacity of the Groningen field means this seasonal compensation mechanism will cease to exist. Additional storage facilities must be created so as to continue to ensure security and flexibility over the course of the year. Several of these projects are already underway in the Netherlands and northwestern Europe.

Through the timely announcement and joint planning of supply cuts it is possible to facilitate a smooth transition while at the same time avoiding soaring costs, in particular of conversion of the L-gas network to H-gas in Germany, Belgium, and France. However, Belgium and France must begin to develope detailed plans for the conversion of the natural gas network, as Germany has already done. It would be advisable to coordinate planning between these countries and the Netherlands in order to ensure that the conversion is carried out efficiently.

It still remains to be seen what effect the outcome of the Climate Change Conference in Paris in December 2015 will have on the role of natural gas in the European energy mix. With ambitious climate targets, natural gas as a fossil fuel might almost completely disappear from the energy mix by 2050. However, the use of natural gas is associated with lower emissions in comparison to coal. Consequently, it is still being discussed as a necessary bridgetechnology for the next few decades towards an energy system completely based on renewables.

17 IEA, Energy Policies of IEA Countries – The Netherlands – 2014 Review (Paris: OECD/IEA, 2014).

Franziska Holz is Senior Researcher in the Department Energy, Transportation and Environment of DIW Berlin | fholz@diw.de

Hanna Brauers is student research assistant in the Department Energy, Transportation and Environment of DIW Berlin | hbrauers@diw.de

Thorsten Roobeek was interning in the Department Energy, Transportation and Environment of DIW Berlin | t.roobeek@mpp.hertie-school.org

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DIW BERLIN

DIW Berlin — Deutsches Institut
für Wirtschaftsforschung e. V.
Mohrenstraße 58, 10117 Berlin
T +49 30 897 89 -0
F +49 30 897 89 -200

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Press office
Renate Bogdanovic
Tel. +49-30-89789-249
presse@diw.de

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