Nord Stream
The new gas supply route for Europe

Section 2

Background information

2 Background information

2.1 Project history to date

The following chapter describes the history of the Nord Stream project to date. Its purpose is to provide an overview of the evolution of the project from its inception until the present day. A more detailed description of the project history can be found in the Nord Stream Espoo Report.

2.1.1 1980 to 1990: Russian-Nordic initiatives to launch new supply projects

The idea of a natural gas pipeline supplying Western Europe with gas from Northern Europe goes back to the early 1980s. For example, there were Norwegian plans to supply gas to and transit gas via Sweden. The most ambitious plan was the Trans-Scandinavian project, with Statoil as promoter, to bring gas from the Barents Sea via Sweden and possibly Denmark to Germany.

2.1.1.1 Russian gas to Finland and Sweden via the Baltic Sea

In the late 1980s the Swedish gas company Swedegas, in cooperation with the Finnish company Neste Oy, worked on a business plan to transport Russian gas to Sweden and western Finland. Offshore routes north and south of the Åland Islands were studied and marine surveys conducted in 1989 and 1990. The breakdown of the Soviet Union and the following economic crises in Sweden and Finland were the main reasons for abandoning the proposal.

2.1.2 1990 to 1995: the construction of the Yamal pipeline

Established after the disintegration of the Soviet Union, Yamal was the first major pipeline undertaken by the newly founded Gazprom company. The Yamal pipeline runs from the western Siberian gas fields through Belarus and Poland to the German border in Brandenburg State. Yamal 1 was initiated as a result of expected increases in demand for natural gas in both Poland and Western Europe. It was also meant to diversify the existing transportation routes for Russian gas, and others have been built since then, supplying Europe with gas.

2.1.3 1995 to 2000: North Transgas Oy (NTG) studies

2.1.3.1 NTG project: definition and shareholders

The scope of the company North Transgas Oy (NTG), founded in 1997, was to conduct a thorough analysis of (1) gas supply to the Nordic countries and (2) the use of Nordic countries and Baltic Sea as a transit region to Western and Central Europe. From a European perspective, Brussels was eager that Finland and Sweden, which joined the EU in 1995, be integrated into the EU gas system.

NTG was regarded as a benchmark analysis at that time, as it included a very ambitious and detailed feasibility study with a higher budget – more than 20 million USD – than those of similar projects in Europe. The shareholders behind NTG were Gazprom and Neste Oy. Neste Oy was later called Fortum Oil and Gas Oy as a result of a merger between Neste Oy and Imatran Voima Oy in 1998. NTG had headquarters in Finland, from where most of the work on the feasibility study was carried out.

2.1.3.2 Feasibility study

The NTG study was conducted in 1998. Approximately 3,900 km in the Baltic Sea, Gulf of Finland and Gulf of Bothnia were screened to identify one or several pipeline routes. More than 100 geological seabed samples were taken for laboratory testing. Three different route options were investigated, together with 16 landfall sites. Pipeline routes both east and west of Gotland and Bornholm were surveyed.

The three main route options including alternative locations for the landfall areas were as follows:

- Option 1: overland Finland and Sweden, including offshore crossing north of the Åland islands;
- Option 2: overland Finland and continue through Baltic Sea; spur line to deliver gas to Sweden either north of the Åland islands (Alt. 2a) or north of Gotland (Alt. 2b)
- Option 3: totally offshore through Baltic Sea with delivery to Finland and Sweden through spur lines to Hanko and Nyköping, respectively.

The route options are depicted in Figure 2.1 below.

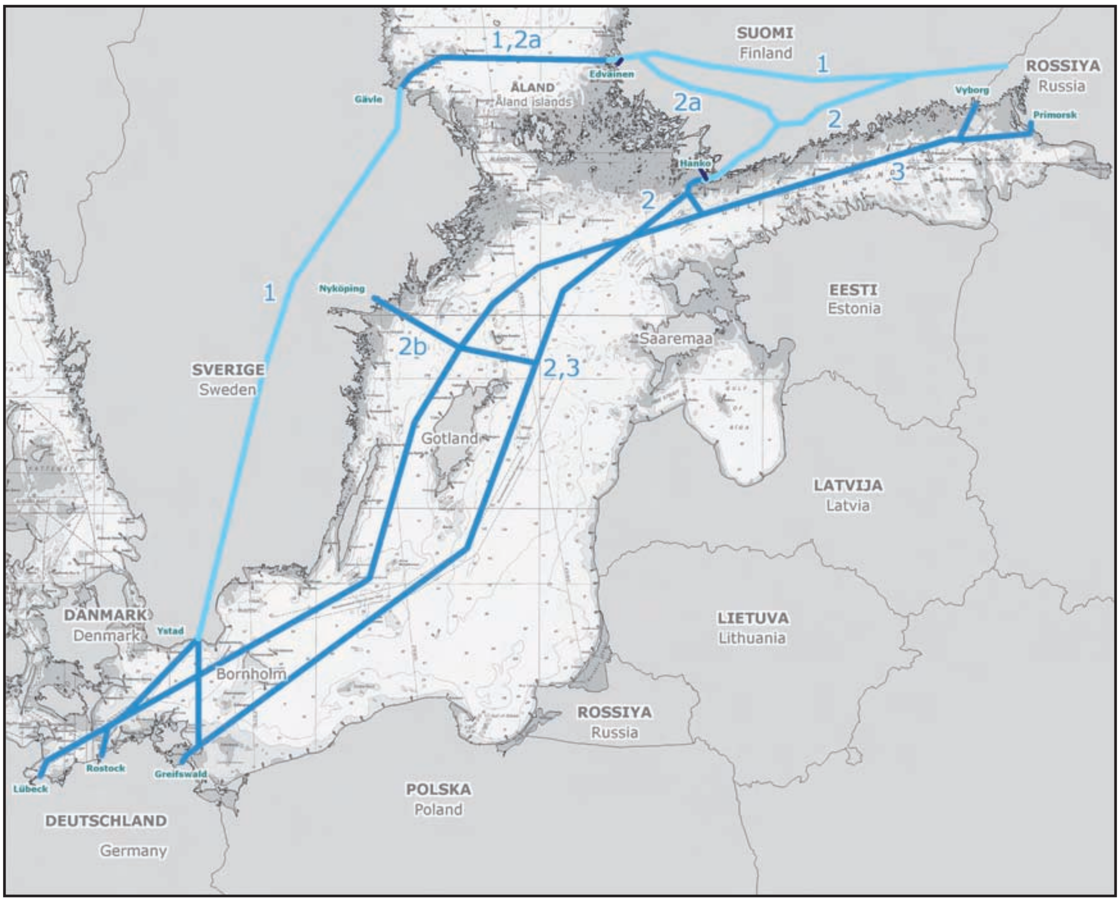

Figure 2.1. Route options investigated in the NTG feasibility study 1998.

All route options included landfall of the pipeline at Greifswald as the base case, although route alternatives to Lübeck and Rostock were also surveyed and evaluated. Furthermore, an alternative landfall at the island of Usedom (east of Greifswalder Bodden) was briefly considered, but it was abandoned before the survey campaign was launched because significant amounts of munitions were likely to be encountered along the proposed route – and also because of the area's tourism values.

Although routes via the Baltic States and Poland were not within the scope of NTG, all identified alternatives would have connected Russia with Finland, Sweden and Germany. Gas volume would have varied between 21.6 bcm/year and 35.5 bcm/year. The study included the possibility of reverse gas flows from Germany to the Nordic countries in the event of supply bottlenecks from Russia, using diversified German supply structures originating from the Mediterranean, Middle East and North Sea regions.

After evaluating and establishing the technical feasibility of all routes, NTG concluded in 1999 that route Option 2b (as shown in Figure 2.1) through the Baltic Sea was the most advantageous. This route consisted of an onshore section in Finland and an offshore section through the Baltic Sea to Germany.

The results of these investigations were never implemented because Fortum Oil and Gas Oy shifted its focus towards the power sector, establishing nuclear power plants in Finland and buying Swedish utilities. Therefore, a natural gas pipeline connecting the Nordic countries to Western and Central Europe was no longer included in Fortum's corporate strategy.

Consequently, Gazprom and the Russian government turned their attention to their southern border. To enhance a strategic partnership between Russia and Turkey, both countries signed an intergovernmental agreement on the construction of the subsea pipeline Blue Stream from the Russian shore of the Black Sea to the Turkish town of Samsun in 1999. Gazprom and the Italian multinational oil and gas company Eni S.p.A. became the shareholders of this joint venture, which would pump 16 bcm/year of natural gas to Turkey and onwards to southern and south-eastern Europe.

2.1.4 2000 to 2001: Via the Baltic Sea – The preferred option for a new European energy supply route

2.1.4.1 Financing aspects

In the late 1990s, Russia was still one of the International Monetary Fund's receiving countries and thus was unable to finance a project of such magnitude. Alternative routes via the former Soviet sphere of influence were not an option due to a lack of funds, amongst other reasons. Therefore, initial discussions focused on then more economically feasible routes between Russia and Western Europe with onshore sections via Finland or Sweden. Russia's economic recovery finally allowed for a direct link from Russia to Western and Central Europe via the Baltic Sea.

2.1.4.2 Economic principles

From a supply point of view, the Russian Baltic Sea coast, with its geographical proximity to various Russian gas fields, is clearly favoured as the starting point of the pipeline. Key supply basis in the short and medium term include the Yamal peninsula and the Yuzhno-Russkoye gas fields. In the longer term, the Shtokman offshore gas field in the Barents Sea will become a supply option. From an investor's perspective, the target market of Western Europe offers great potential as the EU's gas reserves become depleted and the demand for natural gas increases. Its well-developed pipeline network makes Germany a suitable entry point for the planned gas supplies.

2.1.4.3 Cost analysis desk study

To investigate the economic aspects of onshore and offshore solutions, cost analyses have been carried out. The scope of these analyses compares the onshore design of the proposed Amber[1] and Yamal-Europe pipelines with Nord Stream's offshore approach. Although the construction cost of an offshore pipeline are significantly higher than an onshore pipeline, the operational cost are significantly less, resulting in an offshore pipeline being cost effective in the longer term.

2.1.4.4 Environmental focus

From an environmental perspective, the Kyoto Protocol, signed at the end of 1997, has had an important influence on energy-related questions in the countries that are parties to the treaty. The replacement of coal in Germany, the UK and other European countries by natural gas will contribute to the reduction of carbon dioxide emissions. In addition, an offshore pipeline through the Baltic Sea will generate significantly less carbon dioxide than onshore routes via Eastern and Central Europe. This is based on increased efficiencies due to higher design pressure and fewer compressor stations along the route. This is further elaborated in Section 2.3.

2.1.4.5 Axis acquires TEN-E status

In 2000 the EU recognized a northern European gas pipeline through the Baltic Sea as an integral part of the Trans-European Energy Networks (TEN-E).

2.1.5 2001 to 2006: NTG becomes the North European Gas Pipeline

2.1.5.1 Cooperation between new partners

From 2001 to 2005, development activities moved from Finnish Fortum Oy to Russian Gazprom. The Russian counterpart enhanced its cooperation with the German gas company Ruhrgas (which was taken over by E.ON AG and ultimately renamed E.ON Ruhrgas AG in 2004) and German gas producer and BASF subsidiary Wintershall. As Fortum Oil and Gas Oy had changed its business strategy, Gazprom bought Fortum's 50 percent ownership in NTG in 2005.

2.1.5.2 Aiming at new markets and improving technology

In 2005, the project changed its name to the North European Gas Pipeline (NEGP). Denmark and the Netherlands became additional potential markets. Due to a decline in gas production in the UK, attention was focused on the British gas market, and supply route solutions from

1 The so-called Amber pipeline is a proposed natural gas pipeline project from Russia to Germany via Estonia, Latvia, Lithuania and Poland.

Russia via Denmark to the United Kingdom were assessed. UK gas companies were also considering different supply routes, in addition to those from Russia, including Norwegian and LNG supplies.

From a technical point of view, technological improvements for large-diameter, high-pressure and long-distance pipelines were further developed, through projects mainly from Norway to the European mainland and the UK, but also in the Middle East. These included:

- The construction of the Blue Stream pipeline at water depths up to 2,150 m was a milestone that paved the way for a new generation of technologically advanced offshore projects.
- To diversify British supplies, the Langeled pipeline from the Norwegian offshore Ormen Lange field to the UK and other offshore connections from Norway to the United Kingdom were constructed.
- The construction of a new pipeline from the Netherlands to the United Kingdom, the Balgzand Bacton Line (BBL) pipeline was decided.

Moreover, plans to develop the Shtokman gas field as an LNG field for non-European markets were discussed. Hence, no direct pipeline from Russia to the UK was required, as the BBL pipeline could be used to serve this market via Germany and the Netherlands. Moreover, the possible use of intermediate storage facilities in Germany turned out to be an additional advantage.

2.1.5.3 Conceptual engineering and planning

In 2003 the Russian engineering and environmental company PeterGaz was contracted to launch a renewed assessment of the offshore section in the Baltic Sea. The objective of this assessment was to perform a detailed review of the NTG, public domain and commercially available data. Second, a preferred survey corridor was elaborated. This corridor formed the basis for the detailed geophysical survey in the Baltic Sea performed in 2005, which in turn led to a route alignment for further evaluation and design activities.

The selected alignment was considered appropriate for the purpose of conceptual engineering tasks and was identified as the base case for further development activities.

Simultaneously, more opportunities for optimisation were identified during the conceptual phase route evaluation to further reduce potential impacts and risks to the environment. Subsequently, the route was revised and new route alignments were established for detailed geophysical, geotechnical and visual inspection surveys conducted by remotely operated vehicles in 2006.

The route corridor surveyed in 2006 extends from Portovaya Bay near the Russian town of Vyborg in the Leningrad region to Lubmin near Greifswald in the German state of Mecklenburg-Western Pomerania, covering a route length of approximately 1,200 km.

2.1.5.4 European perspective

The agreements between the shareholders concerned two pipelines in order to ensure a greater annual capacity of 55 bcm and increased flexibility for inspection and maintenance. Pressure from EU countries to lower carbon dioxide emissions by replacing coal with natural gas was one reason for increasing the capacity proposed by NTG. With regard to demand, the project still became more attractive as the transportation companies of the two German shareholders E.ON and BASF would be responsible for two large diameter onshore pipelines from the new joint development of the Yuzhno-Russkoye gas field to respectively Achim and Olbernhau in Germany. Hereby, natural gas can be transported into the integrated EU gas distribution network. Consequently, the pipeline can supply Denmark, the Netherlands, the UK, Belgium, France, Poland, the Czech Republic and other countries.

The Decision No 1364/2006 EC of the European Parliament and of the Council has confirmed the Nord Stream project status of both a priority project and a project of European interest (articles 6, 7 and 8, Annex I Trans-European Energy Networks, Gas Networks NG.1.). This Decision contains guidelines for trans-European energy networks, in which priorities are set to create a more open and competitive internal energy market and to secure and diversify the EU's energy supplies. Pursuant to Article 5 of the Decision, Member States shall take any measures they consider necessary to facilitate and speed up the completion of projects of European interest /6/. The Nord Stream pipeline is designated as a priority project because it is considered very important for the security of energy supply. In addition, a declaration of European interest is established for those projects receiving the highest priority. In September 2006, the EU confirmed the project's TEN-E status and referred to it as one of the highest priority energy projects and of interest to Europe as a whole /7/.

2.1.6 Establishment of Nord Stream AG

A basic agreement to construct the pipeline was finally reached between the shareholders in September 2005. Two months later, the North European Gas Pipeline Company was founded and registered in Zug, Switzerland, its shares originally being distributed between Gazprom (51%), E.ON Ruhrgas AG (24.5%) and BASF/Wintershall Holding AG (24.5%).[1] In October 2006, the company was renamed Nord Stream AG. The final shareholder agreement on the construction of the Nord Stream pipelines from Russia to Germany via the Baltic Sea was signed in July 2007. In June 2008 Gasunie Infrastruktur AG took over 4.5% from each of the two German shareholders, which led to a share of 9% for Gasunie. The incorporation of the Dutch company guaranteed the opening of the BBL pipeline as an onward connection of gas transported by Nord Stream to the UK.

1 Current distribution of shares see Chapter 2.2.1

2.2 Information about the company

2.2.1 The operator

In September 2005, OAO Gazprom (hereinafter ’Gazprom’), BASF AG (today BASF SE, hereinafter ’BASF’) and E.ON AG (hereinafter ‘E.ON’) reached an agreement to jointly assume responsibility for the development, construction and operation of this natural gas pipeline. The North European Gas Pipeline Company was founded in November 2005 on the basis of the cooperative intent of these three companies. In October 2006, the company was renamed Nord Stream AG.

Gazprom has a 51% share in the joint project. Each of the European companies BASF (indirectly via its 100%-owned subsidiary Wintershall Holding AG, hereinafter ’Wintershall’) and E.ON (indirectly via its 100%-owned subsidiary E.ON Ruhrgas AG, hereinafter ‘E.ON Ruhrgas’), has a 20% share. The gas infrastructure company Gasunie Infrastruktur AG, a 100% affiliate of the Dutch N.V. Nederlandse Gasunie (hereinafter ’Gasunie’) has a 9% share. The multinational nature of the shareholders, with direct involvement extending beyond companies in the countries of origin and destination of Nord Stream, underlines the European character of the project. The headquarters of Nord Stream AG is in Zug, Switzerland.

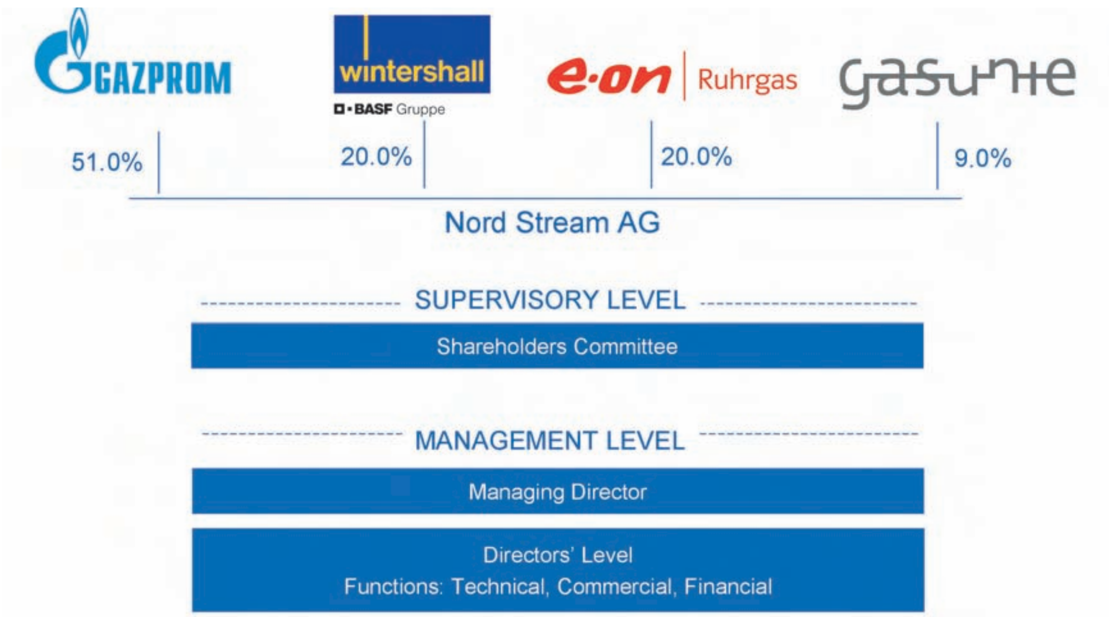

Figure 2.2. The Nord Stream AG organisation.

2.2.2 The Nord Stream organisation

Please refer to Appendix I for a brief description of the Nord Stream organisation, including its individual shareowners and most important suppliers.

2.3 Economic and socio-political rationale for the Nord Stream project: securing Europe's energy supplies

This section is a synopsis. Please refer to the Nord Stream Espoo Report for more detail.

2.3.1 New natural gas import capacities are needed to meet rising demand for natural gas within the EU

2.3.1.1 The rising demand for natural gas in the EU

Natural gas currently comprises 25% of the primary energy consumption, which is a significant proportion of energy consumption within the EU. Moreover, EU natural gas demand is expected to grow at an average annual rate of 0.74% from 543 bcm in 2005 to 629 bcm in 2025 /1/. Over this 20-year period, the share of natural gas in the primary energy mix is expected to rise from 25% to 26%, while the share provided by oil, coal and nuclear power declines /1/. The proportion supplied by renewable energy is forecast to increase from 7% to 11% /1/.

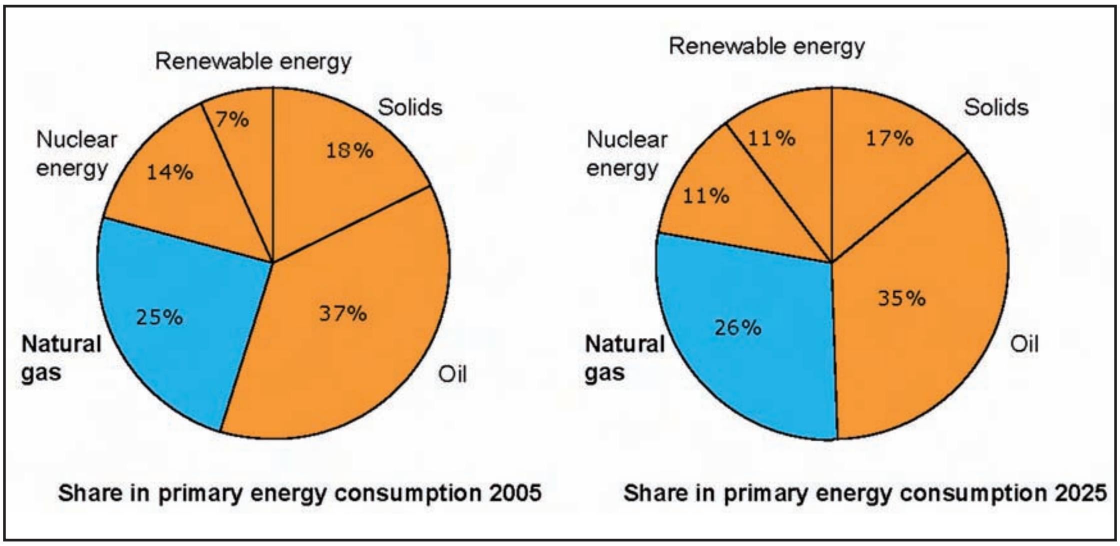

Figure 2.3. Projected development of the EU's primary energy mix, 2005 to 2025 /1/.

The additional demand for natural gas, in terms of total volume, will come mostly from the UK, Italy, Germany, Poland and Spain /1/, reflecting amongst other factors a progressive replacement of oil and coal with natural gas for electricity generation /1/.

Household consumption of natural gas is also rising steadily. In Germany, France, Belgium, the UK, the Netherlands and Italy, households constitute the largest or second-largest source of natural gas demand /1/.

Environmental compatibility is another factor contributing to the rising demand for natural gas in the EU. Gas has a distinct advantage over other fossil fuels as a primary energy source: due to its higher hydrogen-to-carbon ratio and a cleaner combustion process, natural gas causes 30% to 50% less pollution and greenhouse gases than coal or oil, contributing significantly to an environmentally sustainable energy supply /8/. As a result of the March 2007 decision of the European Council to reduce greenhouse gas emissions by 20% by the year 2020 /9/, a further increase in demand for natural gas is expected.

The use of renewable sources to meet the EU's primary energy demand is projected to increase, but not enough to cover the anticipated shortfall in EU gas supplies. While the importance of renewables will grow, the share of renewables in the EU primary energy mix is forecast to rise to only 10% by 2020 and to 12% by 2030 /1/. As a consequence, alternative primary energy sources such as renewables cannot replace natural gas in the short term.

2.3.1.2 Drop in the EU's own natural gas reserves

While the demand for natural gas is rising in the EU, the available resources are diminishing. The known total natural gas reserves in the EU (about 2,800 bcm) /10/ are relatively low compared with the projected demand of 629 bcm per annum in 2025. At 1,250 bcm, the Netherlands has the largest proven reserves within the EU. Great Britain, which currently contributes approximately 16% of annual natural gas production in the EU, has reserves of only approximately 410 bcm. /10/ There are no noteworthy new natural gas finds anticipated in the EU /1/.

As a result, the EU's self-sufficiency will further decline. At present, natural gas production in the EU covers roughly 42% of demand /3/, and production from existing natural gas reserves in the EU will decline from around 229 bcm per annum in 2005 to only 120 bcm per annum in 2025 /1/.

With production declining and demand rising over the coming decades, the EU Council has recognised the importance of mobilising "significant additional volumes of gas" /11/. New natural gas import capacities will be needed to offset the emerging shortfall in EU natural gas supply. Europe currently obtains natural gas primarily from three sources: Russia provides the most important share, followed by Norway and Algeria /12/.

2.3.1.3 Imports will supply a greater share of total EU consumption

The demand for natural gas within the European Union (EU)[1] is expected to continue to increase, while at the same time the EU's own production capacity and reserves of natural gas are expected to decline. As a consequence, a greater share of the total EU consumption shall have to be covered by imports. Natural gas import requirements are expected to rise from 314 bcm per annum, corresponding to 58% of total demand, in 2005 to 509 bcm, corresponding to 81% of total demand, in 2025 /1/ [2]. The bar charts in Figure 2.4 are based on the assumption that current supply contracts will be renewed and that no new import infrastructure is developed. New import capacities are needed to prevent a natural gas import gap.

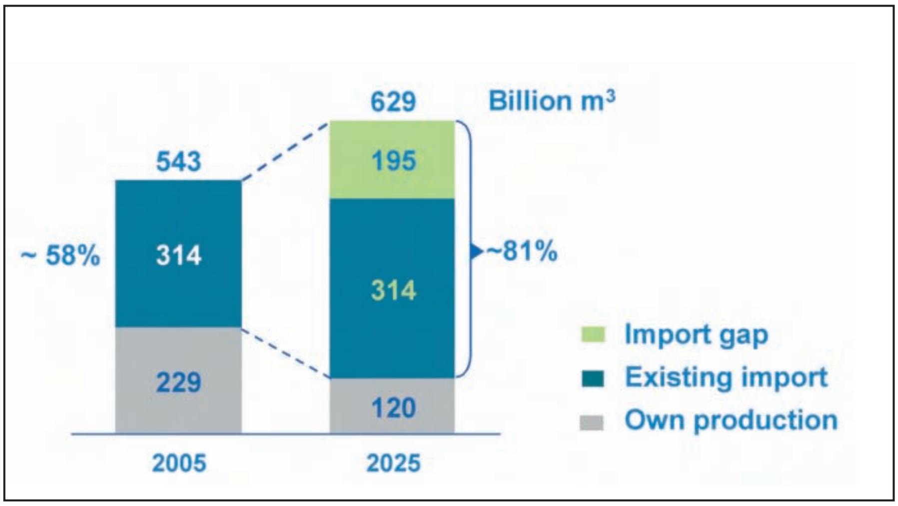

Figure 2.4. Projected natural gas supply and demand in the EU.

2.3.2 Strategic importance to EU of Russia as a natural gas supplier

Three factors confirm Russia's potential to make a significant contribution to the EU's future supply security:

- Russia has had a reliable supply relationship with natural gas consumers in the EU for more than 35 years;
- Russia has the largest confirmed natural gas reserves in the world; and
- Russia is geographically close to the EU.
-

1 "EU" refers to the 27 member states of the European Union

2 Based on data from the European Commission: European Energy and Transport – Trends to 2030 – update 2007, p. 96 /3/. The figures are based on 10.3 kwh/m³ at 20 °C. The source is based on the assumption of conservative oil price scenarios. These and subsequent figures were rounded.

2.3.2.1 Russia's long-term, reliable supply relationship with natural gas consumers in the EU

There has been a supply relationship based on mutual interest between the EU and Russia for more than 35 years. EU companies buy some 80% of Russian natural gas exports /10/. Russian reserves are also of great significance for the EU's future supply security. The oil and gas industries constitute a major sector of the Russian economy, accounting for two-thirds of its export revenue in 2007. Gas export earnings are crucial to Russia's national budget. The European Commission has emphasised the mutual dependency of the EU and Russia with respect to energy partnership /13/.

2.3.2.2 Russia has the world's largest confirmed natural gas reserves

The current composition of import volumes from natural gas-producing countries will shift in favour of regions with long-term resources. Therefore, the size of reserves will be an important factor in the choice of future import sources. Known world gas reserves are located in three main regions:

- Europe and Eurasia: approximately 33.5% (Russia: 25.2%; Norway: 1.7%)
- Middle East: 41.3% (Iran: 15.7%, Qatar: 14.4%)
- Africa: 8.2% (Nigeria: 3.0%, Algeria: 2.5%) /10/

The remaining 17% of total world reserves are distributed in small volumes across various regions.

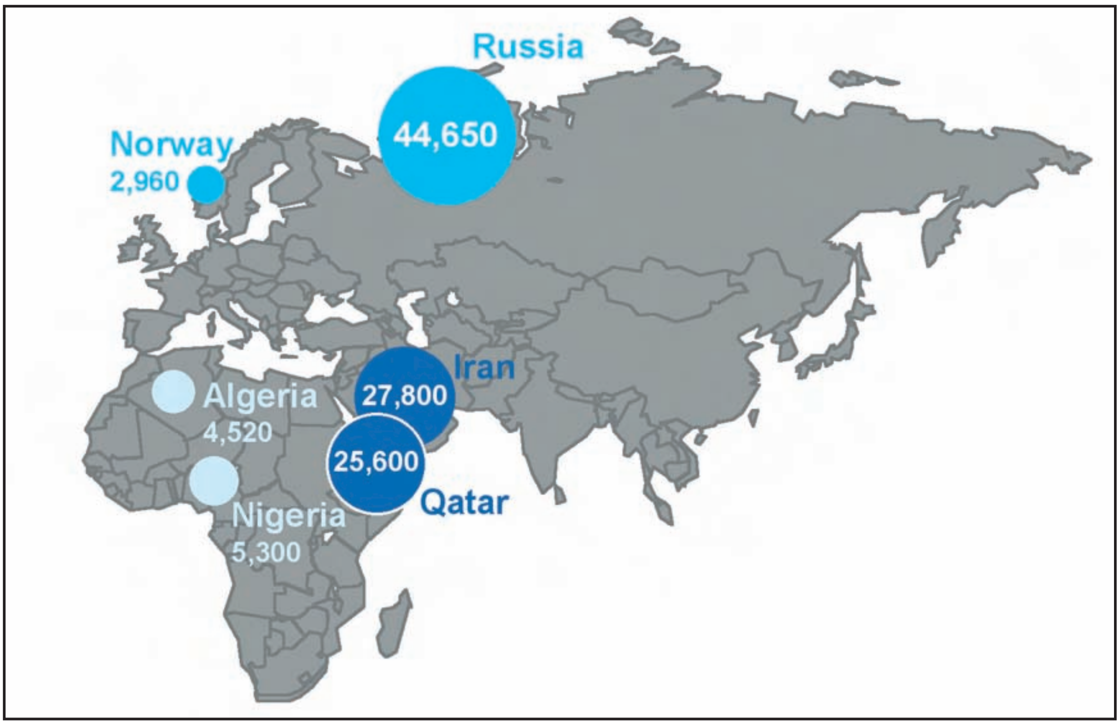

Figure 2.5. Overview of confirmed natural gas reserves: Russia, Norway, Iran, Qatar, Nigeria, Algeria /14/.

In each of the three regions mentioned above, the EU has a major supply relationship with those countries which have either the largest or the second-largest remaining gas reserves: Algeria, Qatar, Norway and Russia /10/. The EU has no supply relationship with Iran.

With 44,650 bcm, Russia has 25.2% of the world's current known natural gas reserves /10/. The geographic concentration of Russia's natural gas reserves also facilitates development, with 90% of Russian production current taking place in West Siberia. In future, extraction will be extended to include the Shtokman offshore field in the Barents Sea and some further offshore fields in the Kara Sea. The Shtokman field has 3,700 bcm of confirmed natural gas reserves concentrated in a single field and offers the significant advantage of being close to the EU.

The potential increase in gas exports from Norway, Algeria and Qatar are insufficient to cover medium- and long-term growth in EU import requirements. The potential shortfall adds to the importance of constructing additional large-volume transport capacities from Russia to the EU.

2.3.2.3 Russia's proximity to the EU

The sources of imported natural gas vary widely across the EU, with geographical proximity the key determinant. Countries like Germany, France, Belgium and the UK obtain natural gas mainly from Russia and Norway; most Italian and Spanish natural gas imports come from Algeria. Geographical proximity will be an important factor in the choice of future import sources. In addition to its unique resource base, Russia has the advantage of its geographical proximity to EU markets. The Shtokman field will make an outstanding contribution to the supply security of the EU in the future.

2.3.3 Competition between EU and Asia for Russian natural gas

China's geographical proximity to Russian gas fields in the north Tyumen region is comparable to the EU's geographical proximity. Given the increasing competition for access to natural gas supplies, the strategic safeguarding of sources in Russia is becoming increasingly important for the EU. This is primarily associated with the rising demand for natural gas in Asian countries /15/. Demand for natural gas between 2004 and 2030 is estimated to grow at 5.1% per annum in China and 4.2% per annum in India, compared with 3.4% and 3.0% per annum for oil and 2.8% and 3.3% per annum for coal /16/. The Asia-Pacific region currently consumes 439 bcm per annum, about 81% of EU levels.

China is one of the largest and fastest growing markets for natural gas in the region. Given the expected increase in demand, China is likely to show a heightened interest in Russian natural gas exports. China's geographic proximity to Russian gas fields will encourage the transport of gas from Russia to China.

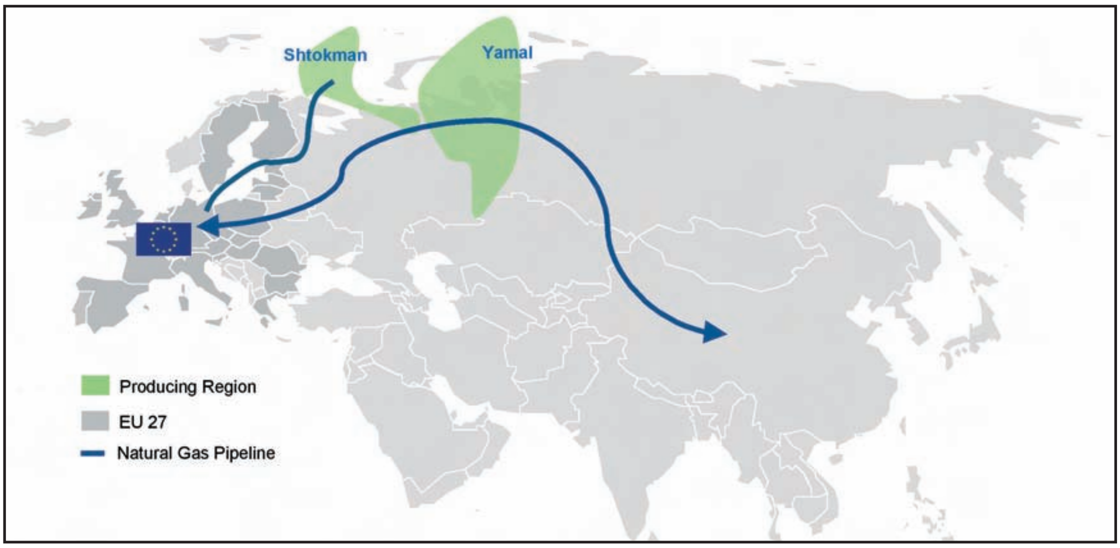

Figure 2.6. Existing gas reserves in Russia and the supply route to China.

As energy trading relations grow between Russia and Asia, there is a danger of the EU taking second place as a customer for Russian gas from the Tyumen region. An early strategic expansion of the connection from Russia to the European market is therefore important to secure the supply of natural gas to the EU over the long term. Gazprom's major investment commitment in the Nord Stream pipeline underlines the interest of the world's leading natural gas producer in a long-term supply relationship with the EU. This is a considerable benefit to the EU in the context of increasing competition for natural gas as an energy resource.

2.3.4 The Nord Stream pipeline as an essential element of the Trans-European Energy Networks

The need to establish a direct link between Russian gas reserves and the EU market is becoming more urgent. Therefore, the European Commission supports projects aiming at the timely expansion of gas infrastructure to the EU from third countries via the guidelines for Trans-European Energy Network (TEN-E). The Nord Stream pipeline can provide a significant proportion of the required additional transport capacities into the EU and is therefore very important for the security of the EU gas supply. On 6 September 2006 the European Parliament and Council recognized the Nord Stream pipeline as "a project of European interest", and a priority project. /6/

2.3.4.1 In the context of the axes for priority projects of the Trans-European Energy Networks

Implementing the Trans-European Energy Networks decision involves improving the integration and development of the energy transport infrastructure by furthering the connection, inter-operability and development of natural gas transport capacities. This European Commission program prioritizes certain axes for the expansion or re-establishment of natural gas supplies to the EU from third countries, as well as raising the efficiency of energy markets within the EU /17/. The EU supports projects that correspond to these "Axes for Priority Projects". With reference to Figure 2.7, Nord Stream project is part of the NG1 axis of EU natural gas priority projects. On 6 September 2006, the EU defined six axes for priority projects (NG1 to NG6) /6/.

- The **NG1 axis** covers a corridor from Russia to Great Britain via northern continental Europe (including Germany, the Netherlands and Denmark) for the establishment of a new import route for Russian natural gas. This axis aims to connect Russian gas reserves in Western Siberia in general – and more particularly in the Shtokman field – with the EU. The Nord Stream pipeline, as the backbone of this corridor, will serve to realise this goal. The efficiency of the internal EU gas market is also to be enhanced by increasing transport capacity between continental Europe and Great Britain.
- A pipeline network connecting Algeria with Europe is to be created on the **NG2 axis**. This includes several routes to Spain and Italy. From there, other connections to France are envisaged.
- On the **NG3 axis**, the connection of gas reserves from the Middle East and the Caspian Region to the EU is planned via the Nabucco, pipeline which is to run across Turkey, Bulgaria, Romania and Hungary as far as Austria.
- The aim of the projects designated as **NG4** is the construction of additional re-gasification terminals for liquefied natural gas (LNG) in Belgium, France, Spain, Portugal and Italy. By creating flexible transportation routes by ship, these projects are designed to stimulate competition between natural gas exporting countries, to establish additional import capacities and to diversify the sources from which natural gas is imported. However, the LNG world market today is already characterized by strong competition between importing countries in Europe, the US and the Far East.
- The aim of the projects designated as **NG5** is to increase gas storage capacity primarily by constructing underground storage facilities (e.g., depleted natural gas deposits, salt caverns).
- The **NG6 axis** focuses on expanding pipeline capacity from Libya, Egypt, Jordan, Syria and Turkey to EU member states in the Mediterranean region, i.e. establishment of the East Mediterranean gas ring.

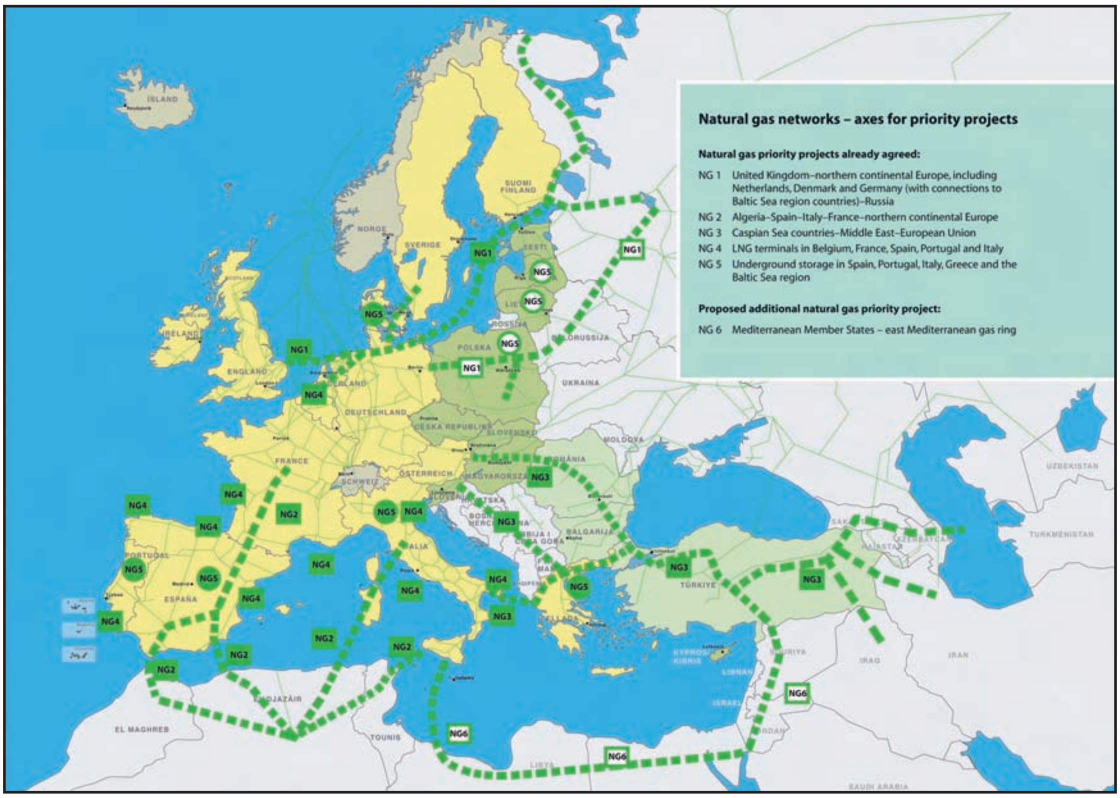

Figure 2.7. Trans-European Energy Networks: natural gas priority projects. (Illustration by the European Commission.)

In environmental impact assessments, an overview of a so-called “0-alternative” (non-implementation of the Nord Stream project) is presented in addition to the alternative(s) that are assessed and documented in the EIA report itself. In this case, the 0-alternative may mean an increase in the use of other energy sources, such as coal, nuclear or renewable energy by the EU. Due to the fact that there are several uncertainties connected to the 0-alternative, this environmental impact assessment focuses on assessing the impacts of the implementation alternative i.e. the offshore natural gas pipeline through the Baltic Sea.

An EIA Program /18/ was submitted to the Uusimaa Environment Centre, the national EIA coordinating authority for this project in Finland. This is detailed further in section 4.2 of this report and set out the scope of the proposed EIA for the Nord Stream pipeline. In the context of the Nord Stream project’s EIA process in Finland, and as documented in the EIA Program /18/ the 0-alternative includes:

- Onshore pipelines from Russia to Europe (NG1). Two options are Yamal-Europe and Amber;
- Combinations of off-shore and onshore natural gas pipelines to Europe from Algeria (NG2); Caspian and Middle East (NG3) and from Libya (NG6);
- LNG shipments (NG4); and
- Renewable energy.

The Yamal-Europe pipeline underwent planning during the late 1990's. The route goes from Russia parallel with the existing pipeline via Belarus and Poland to Western Europe. To date it has not been implemented.

The Amber pipeline was proposed to go from Russia via Latvia, Lithuania and Poland to Western Europe. Feasibility studies were conducted; however no decision has been taken to proceed with this project.

This EIA report does not assess the environmental impacts of the above-mentioned 0-alternative. However, some of the environmental issues related to various energy solutions for the EU are discussed briefly in section 2.4 of this report.

2.3.4.2 In the context of the projects realised for the Trans-European Energy Networks

In accordance with the axes prioritized by the European Commission (see Figure 2.7), various new natural gas import infrastructure projects are to be implemented. The Nord Stream pipeline is defined as one of the TEN-E infrastructure projects and is the largest single project for new import capacity into the EU.

All the pipeline projects currently planned and under construction in the framework of TEN-E – including Nord Stream – would add a total of 140 bcm to EU import capacity. This corresponds to more than 70% of the EU's additional gas import needs in 2025. The Nord Stream pipeline, with a planned capacity of 55 bcm per annum, is meant to provide more than 25% of the EU's additional gas import needs and therefore will make a significant contribution to guaranteeing the security of EU gas supplies.

As emphasized by EU Energy Commissioner Andris Piebalgs, Nord Stream should be seen as supplementary to other projects that must also be completed, not as an alternative /2/. In addition to being important in terms of volume, Nord Stream will contribute significantly to the "diversification of natural gas sources and supply routes" /3, 6/. A 10 June 2004 report from the European Commission on the TEN-E priority projects confirms this /17/. Diversification was defined as a priority in the future development of the TEN-E by EU Decision No 1364/2006/EC of 6 September 2006. This decision recognized the Nord Stream project as being "in the general interest" of the EU /4/.

2.4 The environmental rationale for the Nord Stream Project

This section briefly summarizes some of the environmental issues of the various options – including the 0-alternative - that are available to the EU.

2.4.1 Choice of fuel type

2.4.1.1 Renewable Energy

The European Union expects the Europe-wide share of renewable energy to be 12% of the primary energy mix by 2030 /1/. An increased use of renewable energy sources through economic and political stimulation is likely to take place in the future, especially if hydrocarbon prices continue rising. However, it is assumed that the speed will not match the predicted energy demands in future. EU Leaders set a target of 20% of energy consumption to come from renewables by 2020 /19/, and a package of proposals was agreed in January 2008.

2.4.1.2 Nuclear Power

If the long term supply of natural gas through existing infrastructure proves less than demand, an increased use of nuclear energy may be an alternative. Nuclear power generation has a positive effect on CO_2 emissions. However, uncertainty still exists about the long term environmental effects of nuclear power generation.

2.4.1.3 Fossil Fuels

From an environmental perspective, the Kyoto Protocol, signed at the end of 1997, has had an important influence on choice of energy sources. As natural gas has a higher hydrogen-carbon ratio and a clean combustion process it emits 30 – 50% less pollution and greenhouse gases than other fossil fuels such as coal and oil. Gas therefore has less impact on the environment than other fossil fuels. In the context of the decision by the European Council in March 2007 to reduce the greenhouse gas emissions by 20% by the year 2020, compared to 1990 /19/, a further increase in the demand for natural gas is expected.

2.4.2 Source of natural gas and mode of transport

2.4.2.1 Onshore pipelines

With reference to figure 2.8, the Nord Stream pipeline is shorter in length than the Amber or Yamal/Europe onshore pipelines would be. More significantly, a higher operating pressure can be used safely in the offshore pipeline. For both of these reasons, the Nord Stream pipeline requires only one compressor station while an onshore pipeline need intermediate compressor stations - approximately one every 100 to 200 km[1]. Consequently onshore pipelines require more fuel gas resulting in higher greenhouse gas emissions.

Constructing an onshore pipeline requires a corridor of approximately 40 m to be cleared of vegetation and other obstructions in order to permit the field joint welding, trenching and lowering of the pipelines. Construction and operation of an onshore pipeline is further affected by property issues, the crossing of populated areas, nature conservation areas, roads, railways, rivers, forests, lakes and the like.

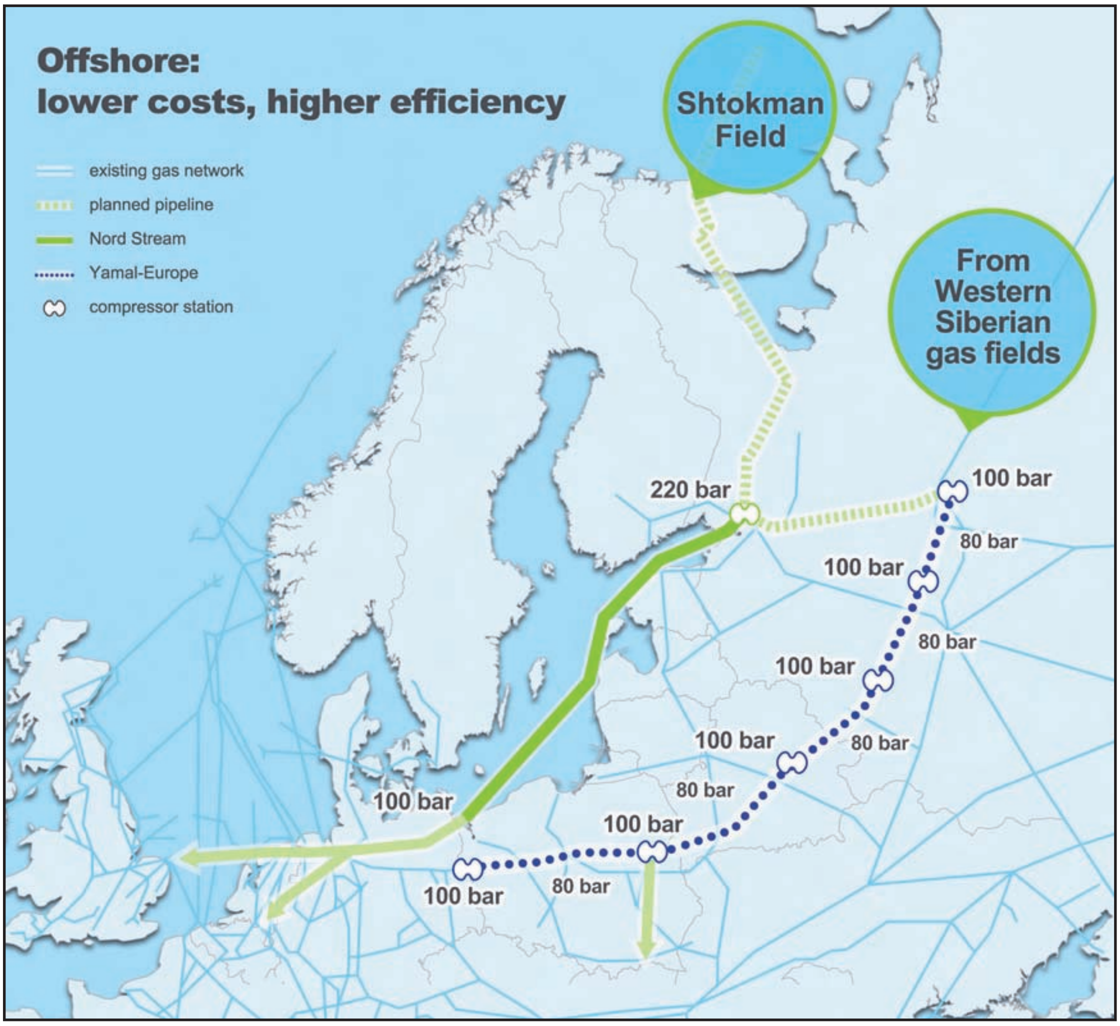

Figure 2.8. Compressor stations of offshore versus onshore pipeline alternatives in the context of the Nord Stream project.

1 The design pressure for the Nord Stream offshore pipeline is 220 bar and the allowable onshore pipeline pressure is normally around 110 bar.

2.4.2.2 LNG Shipment

If a comparable quantity of natural gas was to be transported by LNG tankers across the Baltic Sea it would equate to between 600 and 700 shiploads. This would result in 1,200 to 1,400 extra voyages per year in the Baltic Sea.

Shipping is graded under HELCOM as one of the four most significant ecological contamination sources of the Baltic Sea. When considering LNG shipping as a transport alternative, CO_2 emissions from ship traffic have to be considered in addition to noise, safety at sea, and marine contamination.

Calculations show that the emissions associated with LNG imports into Germany are much higher than the emissions associated with the Nord Stream project. /20/. The LNG chain has been scaled up to match the Nord Stream phase 1 volumes (27.5 bcm/year). It shows that own use and losses along the LNG chain are three to four times the level of emissions from piped gas exports. LNG uses 14% of the throughput gas in the liquefaction process, a further 2% in re-gasification and 0.15% per day during shipment.

2.4.3 Comparative emissions of potential natural gas solutions for the EU

Apart from the option of using more renewable energy, none of the other options comprising the 0-alternative is environmentally preferential to the Nord Stream Project. However, the option of using more renewable energy does not generate enough energy to meet projected demand. The Nord Stream project has lower carbon dioxide emissions than LNG transport and on-shore pipelines. LNG is the most carbon-intensive way to transport natural gas.

Table 2.1. A comparison of the energy required for transportation of gas by various means.

Potential natural gas solution	Approximate energy required for transportation in percentage of transported volume
Nord Stream	+ 2%
Yamal/Europe onshore pipeline	+3%
Amber onshore pipeline	+ 4%
LNG transport from Russia (e.g. Vyborg)	+14%
LNG transport from Algeria or Qatar	+ 17% or +19%

2.4.4 Opportunities for environmental benefits

Figure 2.9 depicts the key engineering and environmental milestones in the Nord Stream project. The green curve is a conceptual representation of the opportunity for realising environmental benefits during the project.

Significant environmental benefits were realized in 1997 at the initial selection of the project objectives i.e. to export Russian natural gas by pipeline to Europe. As discussed earlier in this chapter, the selected type of fuel (natural gas), transport mode (pipeline) and route (offshore) are environmentally-preferable to most currently feasible energy solutions that are available to the EU.

During detailed design environmental impacts are minimized through the process of route optimization and selection of installation methods. However, the opportunities for realising environmental benefits during the project are lowest during construction phase.

Looking beyond construction phase - the green curve indicates that there are a range of possible scenarios regarding the project's environmental footprint. There is the potential to realize varying degrees of environmental benefits by working with Nord Stream shareholders, party of origin governments and NGOs to implement voluntary sustainability initiatives[1] - possibly addressing such inter-related challenges as climate change, poverty and biodiversity loss.

2.4.5 Summary

In summary, an offshore pipeline is a relatively efficient way to transport large amounts of fuel. The emissions resulting from the use of natural gas are less than for other fossil fuels. In view of the projected increasing gap between energy demand and supply in the EU, and the failure of renewable energy alone to bridge the gap, the Nord Stream project is an environmentally acceptable option at this time for the reasons set out in this chapter.

1 Nord Stream shall implement selected voluntary sustainability initiatives during forthcoming project phases.

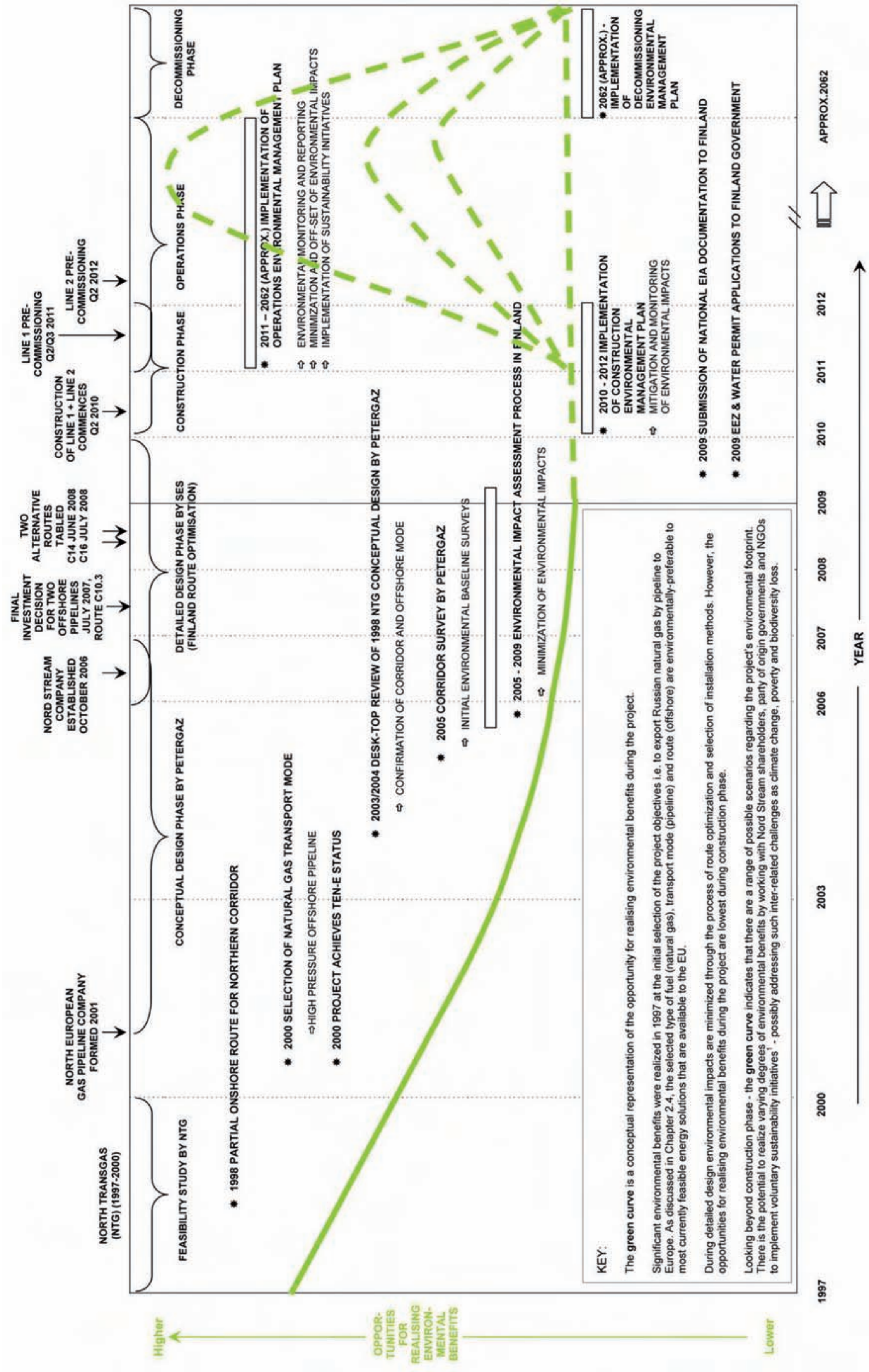

Figure 2.9. Nord Stream Project – Historical and projected milestones (❋).