Nord Stream
Secure gas supply for Europe

Energy to connect partners

Nord Stream AG

Nord Stream AG is an international joint venture established for the planning, construction and operation of the twin offshore gas pipelines through the Baltic Sea. Russian PSJC Gazprom holds a 51 percent stake in the joint venture. German companies Wintershall Oil AG (a wholly-owned subsidiary of Wintershall) and PEG Infrastruktur AG (a wholly-owned subsidiary of E.ON Beteiligungen), hold 15.5 percent each, and Dutch gas infrastructure company Gasunie Infrastruktur AG (a wholly-owned subsidiary of Gasunie), along with the leading French energy provider Engie Energy Management Holding Switzerland AG (a wholly-owned subsidiary of Engie), each hold a 9 percent stake. Nord Stream's head office and operations centre are located in Zug, Switzerland.

Nord Stream's natural gas pipelines through the Baltic Sea have the capacity to transport 55 billion cubic metres (bcm) of Russian gas annually to the EU, for at least 50 years. Both lines run in parallel for 1,224 kilometres from Portovaya Bay, near Vyborg on the Russian Baltic Sea coast, to Lubmin, Germany. Each pipeline comprises some 100,000 24-tonne concrete weight coated steel pipes laid on the seabed along the precise route approved by the authorities of the five countries through whose waters the pipelines pass. Construction of the first Nord Stream Pipeline began in April 2010, and both lines were completed and on-stream in October 2012, on schedule and on budget.

In 2006, Nord Stream was designated a "project of European interest" by the European Commission, the European Parliament and the Council of the European Union. This inclusion in the Trans-European Energy Network Guidelines (TEN-E) of the European Union recognised Nord Stream as a key project in meeting Europe's energy infrastructure needs.

Since its commissioning, Nord Stream has reliably and safely fulfilled all transport nominations. By November 2017, the pipeline has transported 200 bcm of natural gas to consumers in Europe.

Foreword by Managing Director of Nord Stream AG

Since 2012, Nord Stream AG has been a key player on the European energy market. Natural gas delivered via the Baltic Sea through the pipeline from Russia to Germany can supply 26 million European households per year.

Realised by experts with decades of industry experience, this is a project to be proud of. Nord Stream's team worked tirelessly to set a new benchmark in Europe in terms of technology, design, construction, safety and environmental compliance. And thanks to their dedication, commitment and vision, as well as the support of our shareholders, Nord Stream has delivered what we set out to achieve.

Since it began operation, the Nord Stream pipeline system has dependably delivered natural gas to European consumers, fulfilling all transport nominations without interruption. In 2017, we reached a capacity utilisation of 93 percent – an impressive figure for any energy infrastructure installation.

Nord Stream AG bolsters Europe's energy security by providing reliable and efficient infrastructure to deliver natural gas from Russia's vast reserves to the European market. Natural gas will continue to play an important role in the energy mix because it can affordably balance demand spikes from fluctuating renewable power generation. The Nord Stream Pipeline plays a key role in transporting this essential resource securely and sustainably, and under sensible economic conditions.

Our operation of the Nord Stream Pipeline follows the same ideals we established in the project's early phases. Prepared for any eventuality, our focus is on corporate integrity and a comprehensive maintenance strategy to continue contributing to energy security throughout the coming half century of the Nord Stream Pipeline's lifespan.

Alexey Zaytsev
Managing Director of Nord Stream AG

Bolstering Europe's Energy Security

Reliable Supply

Gas demand in the European Union is projected to remain mostly stable in the coming decades. Even with optimistic energy projections and the consideration of efficiency gains, natural gas will remain the backbone of Europe's energy supply. While natural gas will take an increasingly important role within the EU's energy supply portfolio, production levels within Europe are expected to halve in the next two decades. This drop is especially drastic in the Netherlands, UK and Germany – which currently make up about 75 percent of the EU's domestic production. As a result, Europe needs to import more gas – the International Energy Agency projects an import increase of 149 billion cubic metres by 2040.

NORD STREAM'S TWIN PIPELINES PROVIDE THE DESIGN TRANSPORT CAPACITY TO MEET 12 PERCENT OF THE EU'S TOTAL CURRENT DEMAND OF NATURAL GAS.

With an annual design transport capacity of 55 bcm, Nord Stream's twin pipelines provide the transport capacity to meet 12 percent of the EU's total current demand for natural gas. That's enough energy for up to 26 million European households.

In other areas of the world, such as Asia, experts expect an even more pronounced increase in demand for natural gas. This makes access to reliable supplies all the more important. The Nord Stream Pipelines connect the European energy grid directly and reliably to the vast natural gas reserves in Russia, offering European consumers consistent supplies at competitive prices. Over its 50-year operation timespan, Nord Stream's state-of-the art twin pipeline will help cover the European market's projected import gap, and make the European Union's gas supply more robust, economically beneficial and sustainable.

An Environmentally Friendly Fuel

Although renewables will undoubtedly be used more prominently in the coming decades, Europe will not be able to do without fossil fuels altogether. As of 2016, the share of renewables in the EU energy mix was approximately 13 percent. According to the EU's climate protection goals, this share is to rise to 20 percent by 2020. For years to come, fossil fuels will remain an important source of energy.

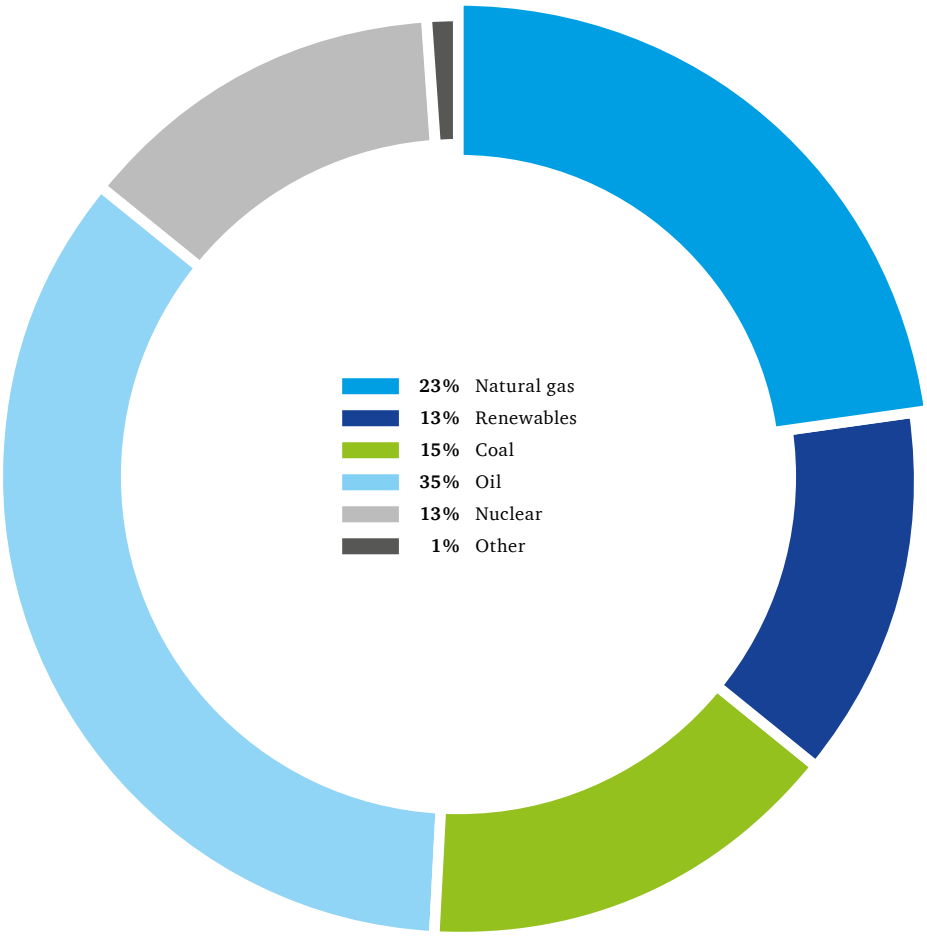
In its „Energy Roadmap 2050," which is the basis for developing a long-term European energy framework, the European Union stresses that "gas will be critical for the transformation of the energy system." Using gas to produce electricity creates about 50 percent fewer emissions per kilowatt-hour than using coal. Replacing only 10 percent of the EU's coal-generated power production with gas-generated power production would cut carbon dioxide emissions by some 120 million tonnes each year.

"NORD STREAM HAS STRIKINGLY SHOWN THAT THE STATE AND THE PRIVATE SECTOR CAN FORM A CONSTRUCTIVE AND PRODUCTIVE UNIT ACROSS SEVERAL NATIONAL BORDERS. WE CAN BE PROUD OF THIS TRULY EUROPEAN COLLABORATION."

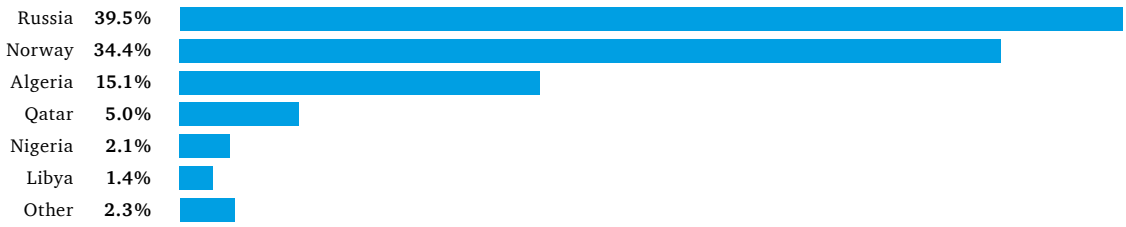
Angela Merkel,
Chancellor of Germany,
in 2011 on the occasion
of the opening of Line 1

› Sources: European Commission (most recent data available as of April 2018)

EU ENERGY MIX 2016



EU GAS IMPORT 2016
NATURAL GAS IN %



“OVER THE COURSE OF THIS PROJECT, WE REALISED THAT GAZPROM AND NORD STREAM AG WERE WILLING TO LEARN AND ENGAGE WITH THE CONCERNS OF ENVIRONMENTALISTS.”

Tobias Münchmeyer, Greenpeace, 2011

Preserving the Baltic Sea Environment

Nord Stream knows that the Baltic Sea is a sensitive ecosystem and approached the construction and operation of the natural gas pipelines from Russia to Germany with the aim of minimising environmental impact.

Comprehensive Surveys and Impact Assessment

We have carried out numerous studies to determine the safest route with the lowest environmental impact. More than 40,000 line kilometres were sailed by research vessels to conduct surveys and underwater investigations. Based both on these extensive surveys and on existing knowledge of the Baltic Sea, Nord Stream prepared thorough environmental impact assessments (EIAs) to submit to Russia, Sweden, Finland, Denmark and Germany – the Baltic Sea countries which had to grant permits for the pipeline. The EIAs concluded that the impact of the construction and operation of the Nord Stream Pipelines would only be temporary, local, and minor.

A green logistics concept for construction helped to reduce emissions from construction activities by as much as 200,000 tonnes. Pipe transport to marshalling yards by train or ship was more environmentally friendly than road transport. And a maximum distance of 100 nautical miles between the marshalling yards and the pipeline route meant that pipe carrier vessels were able to complete a round trip to supply the lay barges within just 24 hours.

Mitigation Measures

Comprehensive environmental monitoring programmes for the five permitting countries were developed to meet the requirements of each and to verify the predictions of the EIAs. The reinstatement of the seabed in the German sector, for example, confirmed the EIA's expectations. The pipelines had to be entrenched in the shallow waters of the Bay of Greifswald and the Pomeranian Bight. Here, the route passes through nature conservation areas. Disturbing the seabed and a temporary increase in turbidity could have been one of the largest construction-related impacts along the entire route. But the monitoring in 2011 and 2012 confirmed that there was no significant release of sediment pollutants. Furthermore, the backfilled sediment had not been contaminated, and the area of impact was within the projected size. The post-construction result of Nord Stream AG's significant logistical effort meant that the sand quality on the seabed surface was largely in line with its original condition after the submarine relief was reinstated to within 30 centimetres of its initial level.

Environmentally Friendly Transport

Nord Stream approaches operation of its pipeline with the same concern for the ecosystem. All work is carried out safely and in an environmentally responsible manner. Because offshore pipelines can sustain higher pressure, the Nord Stream Pipelines operate without interim compression, compared to a pipeline on land which requires compression stations every 100 to 200 kilometres. This technical advantage has the environmental benefit of reducing greenhouse gas emissions by some 40 percent.

140 MILLION EUROS INVESTED

100 million for studies of the Baltic Sea prior to construction, and around 40 million for environmental monitoring along the route until 2016.

16 PARAMETERS ANALYSED

Nord Stream has assessed the impact of construction and operation on water and air quality, birds, fish and fisheries, seabed flora, and cultural heritage, among others.

1,000 SAMPLING LOCATIONS

Along the route, extensive environmental monitoring input was collected and analysed by independent experts and researchers.

‹ As a compensation measure, Nord Stream AG developed coastal sandy and neglected grasslands at the German landfall.

A Vision Becomes Reality

Nord Stream was a hugely ambitious project, and its completion signalled a historic moment in the further development of Europe's energy mix. It was finished on time, on budget, and without any permanent impact on the environment. Now the Nord Stream pipeline system is fully operational and is capable of securely transporting up to 55 billion cubic metres of natural gas every year to the European energy grid.

The pipeline system will be a crucial element in Europe's energy supply for at least the next 50 years. They represent an important milestone in the evolution of a long-term, mutually beneficial relationship between Europe and Russia in the vital field of energy supply and production. Nord Stream AG is proud of its role in this historic development. From a European Union (EU) perspective, the new source of gas provided by Nord Stream contributes to the region's economic and environmental policy objectives. Policymakers increasingly view natural gas as an essential supplement to renewable sources of energy. And just as Europe needs a reliable source of gas from Russia to meet its goals, Russia also relies on gas customers in Europe for income. This project shows how an undertaking of this scale can be successfully orchestrated when a unique set of conditions is met.

The establishment of Nord Stream AG in 2005 emerged from a much longer history. Already in the late 1990s, Russia and its European partners had begun exploring the possibilities of transporting gas to the European market. The project got a boost from the EU in 2000, when the European Commission recognised the pipeline through the Baltic Sea as an element in its Trans-European Network for Energy (TEN-E) guidelines. The TEN-E status was reconfirmed in 2006 when the Commission named Nord Stream one of the highest priority energy projects in the EU, and one that was of interest to the whole of Europe.

THE TEN-E STATUS WAS RECONFIRMED IN 2006 WHEN THE COMMISSION NAMED NORD STREAM ONE OF THE HIGHEST PRIORITY ENERGY PROJECTS IN THE EU.

Nord Stream was established as an independent company in 2006 in Zug, Switzerland, and backed by strong Russian and European companies as shareholders. Surveys of the seabed topography along the proposed route began in the same year. The complex permitting process was initiated in 2006 as well with the submission of a Project Information Document to the responsible environmental authorities in Russia, Finland, Sweden, Denmark, and Germany, in accordance with the United Nations Espoo Convention. The final Espoo meeting took place in June 2009. The complex multinational consultation and permitting process ended in December 2009 when the last construction permits were granted.

Construction of the offshore pipeline system had already been in preparation for several years, with the tendering process for major investments such as steel supply, concrete coating and logistics, and pipe laying completed between 2007 and 2009. Offshore construction started in March 2010, and was fully completed just 30 months later.

On 8 November 2011, Line 1 of the Nord Stream Pipeline was inaugurated and hailed by political and business leaders as a significant contribution to Europe's long-term energy security. Line 2 began operating one year later on 8 October 2012.

"THE OPERATIONAL COMMENCEMENT OF THE FIRST STAGE OF THE NORD STREAM PIPELINE, OPEN[S] A NEW CHAPTER IN THE PARTNERSHIP OF RUSSIA WITH THE EUROPEAN UNION."

Dmitry Medvedev, Former President of the Russian Federation, in 2011 on the occasion of the opening of Line 1

NORD STREAM MILESTONES

1997 – 1999 / 2005 – 2009

PLANNING
Feasibility study, pipeline design

2006

FOUNDATION
of Nord Stream AG

2006 – 2010

EIA
Environmental impact assessments

2009 – 2010

PERMITTING
Applications and consultations

2009 – 2010

FINANCING
Solid project financing

2010 – 2011 / 2011 – 2012

CONSTRUCTION
Laying Line 1 and Line 2

2011 / 2012

OPERATIONS
Start of operations on schedule

SINCE 2011

MAINTENANCE
Maintaining the integrity of the system

Reliable Supply with State-of-the-Art Infrastructure

From Russia's Vast Reserves to European Consumers

As a pipeline operator, Nord Stream AG provides transport capacities for 55 billion cubic metres of natural gas per year through its pipeline system. In a journey that takes about 12 days, natural gas flows from the entry point in Russia to the exit point in Germany, where it is received by the connecting pipelines OPAL (Baltic Sea Pipeline Link) and NEL (North European Gas Pipeline).

A SOPHISTICATED SERIES OF VALVES, FILTERS, PREHEATING, MEASURING AND CONTROL FACILITIES ENSURES THAT THE GAS IS OF TOP QUALITY.

Gas transport from Russia to Germany begins and ends in landfall facilities that connect the offshore pipeline and the onshore grids. Nord Stream's landfall facilities are located at the shore of Portovaya Bay near Vyborg and in Lubmin, Germany. They are the logistical links between the Unified Gas Transport System of Russia, the Nord Stream Pipelines, and the European gas distribution grid.

To transport gas over a distance of 1,224 kilometres, a powerful compressor station is needed to build sufficient pressure. At the Compressor Station Portovaya operated by Gazprom Transgaz St. Petersburg, the gas is treated and pressurised before entering the Nord Stream landfall complex. Following fiscal measurement to confirm the contractually agreed flow rate and quality, as well as system pressure and temperature, the gas is fed into the Nord Stream Pipeline and flows all the way to the receiving terminal in Germany operated by GASCADE. Here, more than 6.5 million cubic metres of natural gas can be processed every hour. A sophisticated series of valves, filters, preheating, measuring and control facilities ensures that the gas is of top quality and flowing through the connecting pipelines at the right pressure.

OPAL is capable of transporting more than 35 bcm of gas annually and runs south from Lubmin to Brandov, in the Czech Republic. NEL can carry 20 bcm per year and runs westward across northern Germany to Rehden, in Lower Saxony. Via the connecting pipelines, the Russian gas transported by Nord Stream can reach European consumers in many different markets.
The landfalls are also home to the equipment needed for the operation of the pipelines, including isolation and emergency shut-down valves to separate the offshore from the onshore pipelines. Fire and gas detection equipment is installed at the landfalls to detect any irregularities before they become hazardous. For integrity management purposes, intelligent Pipeline Inspection Gauges (PIGs) are sent through the pipelines every few years, propelled by the gas flow.

"IT IS HARD TO OVERSTATE THE IMPORTANCE OF THE NORD STREAM PROJECT. […] AS WE SEEK LARGE-SCALE RENEWABLE ENERGY SOLUTIONS, NATURAL GAS REMAINS THE TRANSITION FUEL OF CHOICE."

Mark Rutte, Prime Minister of the Netherlands, in 2011 on the occasion of the opening of Line 1

‹ All equipment needed for the operation of the pipelines is located at the landfalls.

Monitoring the Flow from the Heart of Europe

The natural gas transported through the Baltic Sea via the Nord Stream pipeline system is constantly monitored by the pipeline operators in Nord Stream AG's Control Centre in Zug, Switzerland. The Nord Stream Pipelines are operated according to DNV standards, as well as to local and national regulations at the Russian and German landfalls.

Operators oversee and coordinate technical operation of the pipelines, and all relevant parameters of gas transport are transmitted in real-time to Zug. The facilities are operated 24 hours a day, year round. The operators and dispatchers are in constant contact with the gas supplier and receivers to assess the physical flow of the gas through the pipelines and ensure the reliable delivery of gas required by the European customers and partners. The Nord Stream Control Centre also coordinates with the compressor station in Portovaya to adapt the gas volumes at the entry of the Nord Stream system. If more gas is needed in the European grid downstream, flow rates and pressure are increased accordingly.

The dispatching team also continuously monitors ship traffic within the safety area of the two Nord Stream Pipelines. All traffic is assessed according to its distance from the pipelines, speed, gross tonnage, and ship behaviour. Depending on this analysis, a warning alarm might be triggered to ensure safe gas transport. In the case that any safety processes or parameters of the gas transport itself are violated, automatic safeguards are ready to close the inlet valves at the landfalls. When this is necessary, the operators can also remotely open or shut the pipeline valves with the push of a button.

50 YEARS

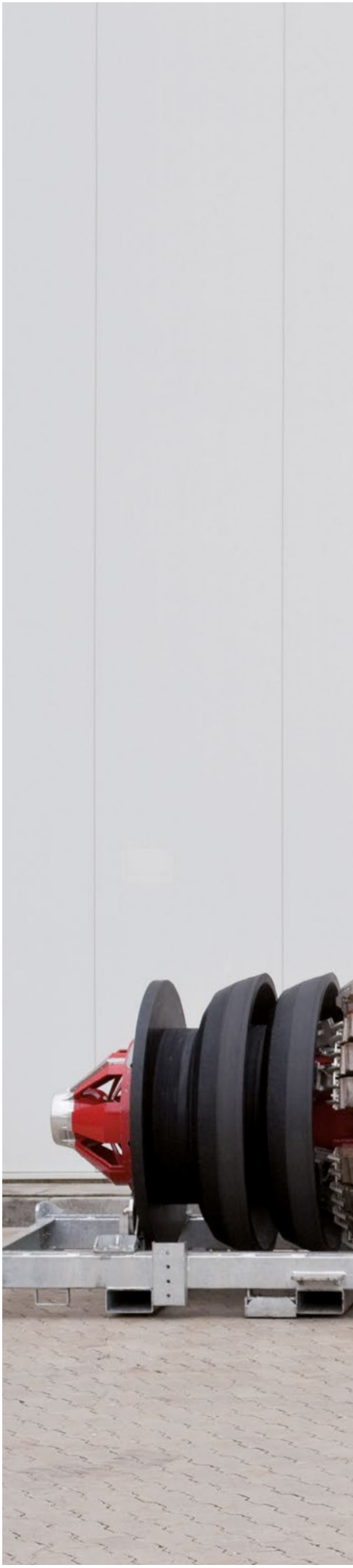
minimum planned operation of the pipelines

24 HOURS, 7 DAYS A WEEK, 365 DAYS A YEAR

monitoring to ensure safe operation

TELESCOPIC DESIGN IN 3 PIPELINE SECTIONS

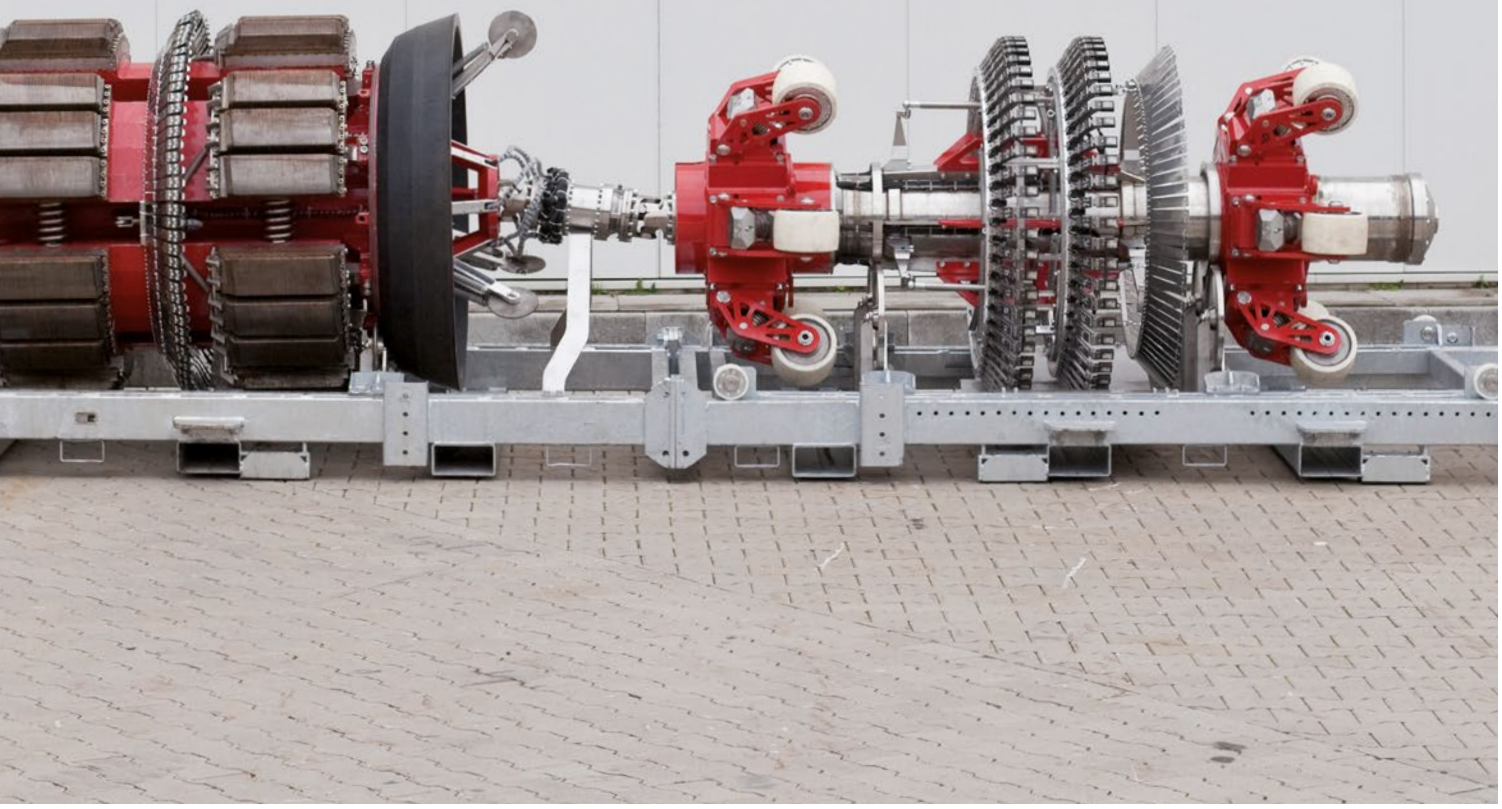
As the gas moves through the pipelines, the pressure gradually reduces from 220 bar to around 100 bar. Reducing wall thicknesses of the pipelines account for that.



› An intelligent Pipeline Inspection Gauge (PIG) collects information about the integrity of the pipelines.

“I BELIEVE IN NATURAL GAS. IT HAS AN IMPORTANT ROLE TO PLAY IN MEETING THE ENERGY AND ENVIRONMENTAL CHALLENGES THAT WE ALL FACE. ALL OF OUR COUNTRIES ARE FACING THIS DECISION TO SEEK OTHER ENERGY RESOURCES, AND THUS GAS, IN ORDER TO AVOID GLOBAL WARMING.”

Francois Hollande, Former President of France,
in 2011 on the occasion of the opening of Line 1




S-1
S-2

‹ Custom-designed tools such as this pipeline recovery tool can be used to repair the pipeline if needed.

The Technology Behind the Pipeline

The Nord Stream Pipeline through the Baltic Sea set new benchmarks for the industry. With an annual design transport capacity of 55 bcm, Nord Stream is a major gas provider for the European market that is crucial for the security of supply.

Owing to the high quality of the construction materials and the conservative design of the pipelines, damage or deformation are highly unlikely and pipeline repairs are not expected to be necessary during Nord Stream's minimum operational lifespan of 50 years. In fact, Nord Stream's risk assessment specialists estimate that the probability of pipeline failure or leakage is as low as one damage event every 100,000 years. Nord Stream has an exemplary record for safety and environmental protection and it has received annual commendation from independent certification body DNV GL since operations began.

The external and internal inspection of the Nord Stream Pipeline is a large-scale project and one of the most complex in existence.

Detailed Inspections

The first external inspection for Line 1 was performed in 2012 following the completion of construction and the first period of operation to determine that the pipeline had settled under load. External visual and instrumental inspection of the pipeline was conducted via remotely operated vehicles (ROVs). The external inspection confirmed the stability and integrity of pipelines and their corresponding structures. It also confirmed that no foreign objects such as trawl nets or debris accumulated near the pipeline.

NORD STREAM HAS AN EXEMPLARY RECORD FOR SAFETY AND ENVIRONMENTAL PROTECTION AND IT HAS RECEIVED ANNUAL COMMENDATION FROM INDEPENDENT CERTIFICATION BODY DNV GL SINCE OPERATIONS BEGAN.

In the summer of 2013, Nord Stream concluded the first comprehensive inspection of the internal conditions of both pipelines, as part of its long-term safety and pipeline integrity management strategy. During the internal inspection, an intelligent Pipeline Inspection Gauge (PIG) carrying an array of electronic sensors was sent through the pipelines to confirm their integrity. The high-resolution measurement technology can detect smallest changes in the condition of the pipelines. The evaluation of the results confirms that the pipelines have moved only minimally while being operated under full pressure and that there has been no corrosion or deformation.

Thorough Maintenance

Nord Stream has a detailed asset management policy that includes an extensive set of maintenance activities. The gas transport system relies on the availability of all its key components. Regular maintenance, inspection, and testing serves to guarantee it. At each landfall in Russia and Germany, contractors and staff are responsible for the regular maintenance, inspection, and testing of equipment, which applies to the pipeline safety, telecommunications, power supply, fire and gas detection, and security systems, as well as the shutdown and isolation valves. Routine annual maintenance has been performed since the start of operations.

Best-in-class Approach

Nord Stream is ready for any eventuality when overseeing its certified system. To preserve the pipeline as a valuable asset to the European gas supply security for the coming decades, comprehensive management measures were designed for the automation systems, landfall installations as well as the 1,224-kilometre offshore section of the twin-pipeline itself.

Owing to the scale and technical specifications of the Nord Stream Pipeline, our technicians use specialised repair tools. These tools have been custom-built by our contractors and cannot be easily loaned from standard resource pools. Should they ever be needed, these tools are ready to ensure swift repair, minimising expensive downtime and ensuring reliable gas flow to consumers in Europe.

One example of these specially designed tools is our hydraulically activated repair clamp, which can restore structural and pressure integrity of the pipeline by locking around it, sealing it and restoring normal operating conditions along a length of 3 metres. Other examples include a pipeline recovery tool used to lift the pipeline onto the surface in case of above-water repair operations, and unique tools used for pipeline isolation and installation.

‹ The hydraulically activated repair clamp can restore integrity of the pipeline along a length of 3 metres.

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Images
Nord Stream AG

SWITZERLAND

Nord Stream AG
Industriestrasse 18
CH-6302 Zug

Tel.: +41 41 766 91 91
Fax: +41 41 766 91 92

info@nord-stream.com

RUSSIA

Nord Stream AG
Dimitrova St, 4B, office 42
188800 Vyborg

Tel.: +7 81378 670 00
Fax: +7 81378 670 00

www.nord-stream.com

Nord Stream AG
Malaya Pirogovskaya 3
119435 Moscow

Tel.: +7 495 777 06 76
Fax: +7 499 921 34 58