Reliable Energy for the Future

TurkStream

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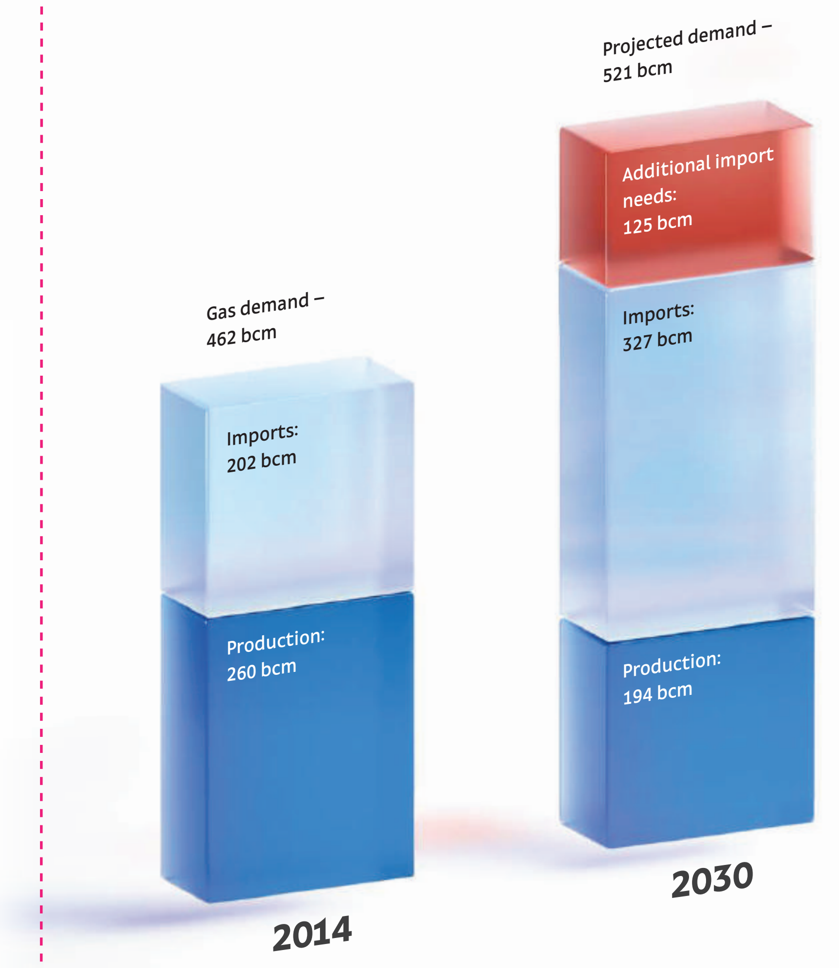
Designed by Dmitry Koltyrev, 2017

Energy for a growing market

Russia has a long-standing partnership with Turkey. Gazprom delivered the first gas via the Trans-Balkan pipeline as far back as 1987. Since then, Turkish energy needs have grown significantly, in tandem with the county's rapid economic development.

As of 2003, the Blue Stream Pipeline has supplied additional volumes of natural gas directly from Russia to eastern Turkey. The TurkStream Pipeline System will further increase the country's energy security by providing a direct and reliable supply for the west of Turkey. When fully operational, the pipeline will be able to transport up to 31.5 billion cubic metres of gas each year. This will not only satisfy the growing energy needs of the Turkish economy, but also that of neighboring countries. Turkey will continue to increase its strategic position in the regional energy market, acting as an energy gateway for the whole of south-east Europe.



Gas demand OECD Europe in billion cubic metres (bcm) Source: IEA, World Energy Outlook 2016 (The New Policies Scenario)

Reliable Gas Supplies

The TurkStream pipeline will directly connect the Russian gas reserves to the Turkish network and provide reliable energy supplies for Turkey, as well as South and Southeast Europe. Its offshore section will be developed by South Stream Transport B.V. and consist of two parallel pipelines running through the Black Sea. Both strings will start near the Russian city of Anapa and end near Kıyıköy, 100 kilometres from Istanbul. The first of the onshore pipelines will connect to the Turkish network at Lüleburgaz. The second line will be directed to the Turkish-European border.

2 offshore pipelines

2200 meters maximum depth

930 kilometres per line

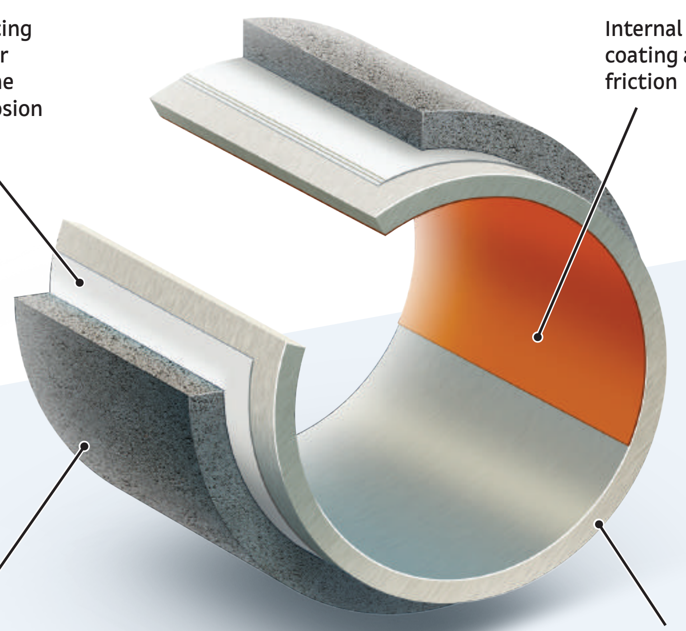
31.5 billion cubic metres of transport capacity per year

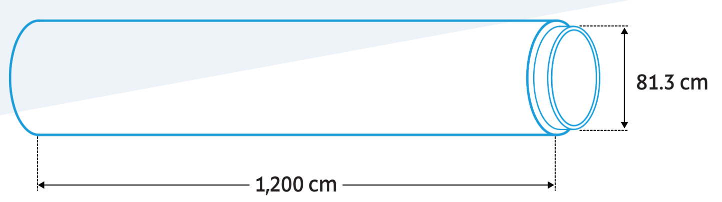
From Concept to Construction

The offshore pipeline is constructed in several steps. First, extensive surveys were conducted to find the best route for the pipeline along the seabed. In parallel, engineers worked on a so called Front-End Engineering Design (FEED) for the system. Once all designs were approved as safe and environmentally sound, the construction work started. During this phase, heavy pipes were welded together and laid on the seabed by specialized vessels. And, in the final stage, the system is tested and the first gas can be transported!

Designed for maximum safety

Each of the two offshore pipelines was made up of thousands of individual pipe joints of 12 metres in length. The pipes are designed and manufactured especially for safe use in the deep seas. The walls of the pipeline are made up of 39 millimeters of high-quality carbon manganese steel and each joint weighs around 9 tonnes.





During production, the steel is heat-treated to improve the mechanical characteristics of the pipe that are required to withstand the huge pressure. Pipes laid closer to the shore are coated in concrete for added stability and protection against marine activities.

Offshore Construction

Steel pipes were produced in special mills and checked thoroughly during production. They were inspected with x-ray and ultra-sound and tested from the inside with water at high pressure. Finally, an independent inspector verified the quality of each pipe before it left the factory floor. The individual pipes were then brought to storage yards on the Black Sea coast by rail and boat.

Onboard the vessel, the pipes were welded onto the main string with high-precision equipment. Afterwards, each weld was tested and then coated, before the pipe string was lowered into the water.

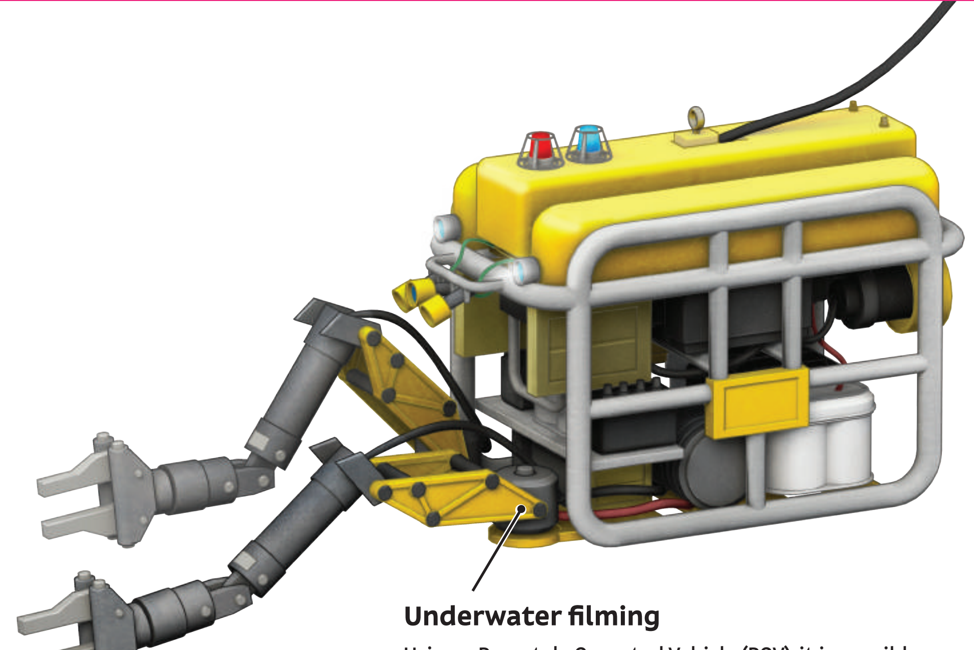
Slowly but surely, the pipe-laying vessel traversed the Black Sea, adding new sections to the pipe string as it moves. The pipeline was be laid directly on the seabed at depths of up to 2 kilometers. Operating around the clock, vessels typically lay as much as 3 kilometres of pipeline per day. Afterwards, a visual inspection was conducted to verify the line was laid exactly within the designated corridor.

During operations, each pipeline can safely operate at high pressure to transport up to 15.75 billion cubic metres (bcm) of natural gas per year - the total capacity of 31.5 bcm is enough to satisfy the energy demand of 15 million households.

Advanced subsea surveys

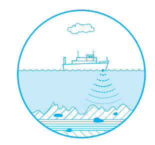
Over 16,500 kilometres of offshore surveys were performed to find the most suitable path to lay the pipeline across the Black Sea. Near the coast, the pipeline runs along the relatively shallow part of the sea called the continental shelf. However, at the so-called continental shelf break the seabed suddenly plunges from about 80 to over 1,500 metres deep and engineers paid extra attention to the routing and design of this section.

The route of the pipeline takes into account aspects such as possible shipwrecks or objects of historical value, as well as potential fault lines or geological structures. Little was known about the abyssal plain, therefore a range of survey techniques was applied to map out the best route for the pipeline.



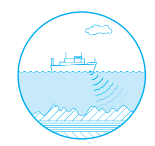
Underwater filming

Using a Remotely Operated Vehicle (ROV), it is possible to film in the deep seas to investigate objects in detail and perform a visual inspection of the route.



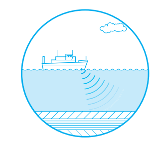
Sub-bottom profile survey

A transducer emits a sound pulse vertically towards the seafloor, then a receiver records the return of the pulse. This technique helps create an image of the layers of sediment or rock under the seabed.



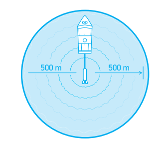
Echo sounding

A multi-beam echo sounder is used to emit a broad acoustic pulse, which bounces back onto the seabed in different ways to reveal the seabed profile.



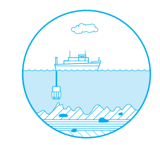
High-resolution seismic survey

Surveyors send a sonic blast to the seabed. They then analyse the return pulse to build up an acoustic image of the soil.



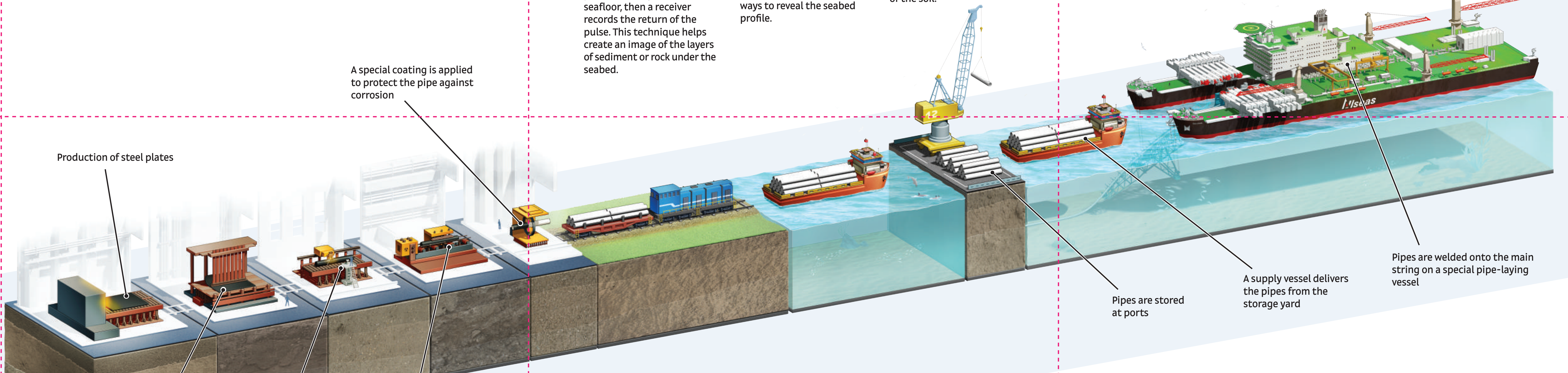
Side scan sonar survey

Used to create an image of large areas of the sea floor by scanning up to 500 metres left and right, to investigate any possible obstacles near the route.



Seabed samples

Samples are taken from the seabed at different depths. The soil is then analyzed in a laboratory to determine if the seabed is suitable for laying the pipeline.



Underground connections

The pipeline will connect to the Turkish gas grid at Luleburgaz. From there, underground lines will carry the gas to the Turkish-Greek border. The underground sections of TurkStream will be constructed in several stages.