

BLUE STREAM

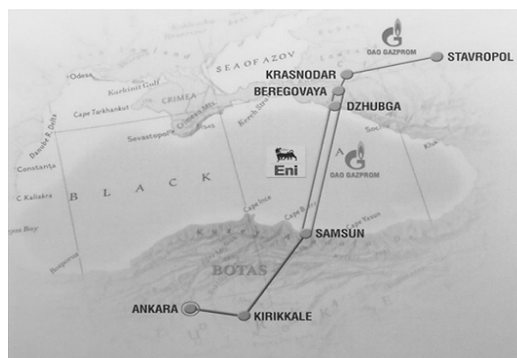
Blue Stream is a **transport system for the supply of gas from the network of southern Russia to Turkey through the Black Sea**, with capacity to transport 16 Gm³/year.

The system consists of a **compressor station at Beregovaya** on the Russian Black Sea coast and **two offshore pipelines** laid at a record depth of 2,150 m.

The Blue Stream is undoubtedly one of the most challenging project of its type ever attempted because of the **difficulties in terms of design, construction, organisation and logistics**. The significance of the operational performances on the Blue Stream derives from the unprecedented difficulties of the two sea-lines. Geotechnical, geomorphologic and bathymetric characteristics of the seabed, to be traversed by the pipelines, presented varied and challenging features. Ultra deep water, H₂S environment, steepness of the slopes and geo-hazards, are the key design considerations that Saipem faced during design, installation engineering and construction.

The project calls for the installation of a **gas compressor stations in the region of Dzhubga**, on the Russian coast of the Black Sea and **gas pipeline 385 km long between Russia and Turkey**. The gasline is designed to link the gas distribution network of the Krasnodar region, in southern Russia, to the central Turkish greed at the capital city of Ankara. The gas pipeline is 1,250 km long. The two 24-inch lines enter the sea on the Russian coast at Beregovaya and cross the sea bed at a maximum depth of 2,150 metres before emerging close to Samsun in Turkey.

Supplies of natural gas through the first line started in 2003 and they are expected to continue up to 2025, peaking at 16 billion cubic meters a year. Eni's equity capacity is 8 billion cubic meters of gas, which have been allocated to Botas. The compressor station was completed in 2003.



Blue Stream transport system – Map

Project Description

The work scope of the project is a **gas pipeline of about 1,250 km** involving:

- a 56" pipe, 373 km long across Russia, owned by Gazprom, from Stavropol to Dzhubga;

- two 24" pipelines across the Black Sea, from Dzhubga to the Durusu station (Samsun);
- 470 km of a 48" pipeline linking up with pipeline networks at Ankara, operated by Botas.

Blue Stream is owned by a **partnership** between Gazprom, the Russian National Hydrocarbon Company and Eni. Saipem has been awarded the Blue Stream project by BSPC, which is the joint venture between Gazprom and Eni, in November '99. The award was preceded by more than one year of intensive technical evaluation, the assessment of the Basic design and negotiations.

The award of the contract is based on a turn-key lump-sum and carried out by Saipem as a leader of a consortium of contractors consisting of Saipem, Bouygues Offshore, Katran-K and Japanese Consortium (Mitsui, Sumitomo, Itochu). The Saipem portion of the work has been relevant to the design, procurement, construction and pre-commissioning of 2 nos. 24" pipelines between Russia and Turkey in the Black Sea reaching the maximum water depth of 2,150 meters.

The Bouygues Offshore and Katran-K portion of the works is relevant to the design, procurement, construction and commissioning of the Compressor Station. The Compressor Station will pressurise the gas to 25 Mpa. The Japanese consortium scope of the work consists of production and supply of 24". The two 24" 31.8 mm wall thickness pipeline routes differs only on the Russian Shelf and Upper Russian Slope, where they join and run parallel up to the Turkish landfall.

Route E1 is approximately 380.4 km long while route W2, is about 387.6 km long. The different water depth, from 10 meters at shore approaches up to 2,150 meters in the abyssal plan has requested two different laying methods, the traditional S-laying performed by Castoro 8 and the innovative J-laying performed by Saipem 7000 in the abyssal plan up to 2,150 meters the deepest sea-line ever laid.

The laying of approximately 320 km of pipelines in water depths exceeding 1,000 meters and of more than 200 km in water depths beyond 2,000 meters tested the actual capacities of the J-lay system.

Hence very severe pipe materials and welding specifications, 100 % automated ultrasonic inspections, maximum strain level allowed less than 0.15 % have been adopted.

All the project phases have been certified through a severe programme by Det Norske Veritas. Saipem 7000 has laid the pipelines with an average production rate of 3,000 meters/day with peaks of 4,800 meters/day, achieving very good precision laying, without any abandonment and recoveries due to bad weather. No buckles occurred during all the operations, no sizeable damages were registered even under extreme environmental conditions.

The laying of the two lines has been completed by Saipem 7000 in 2002.



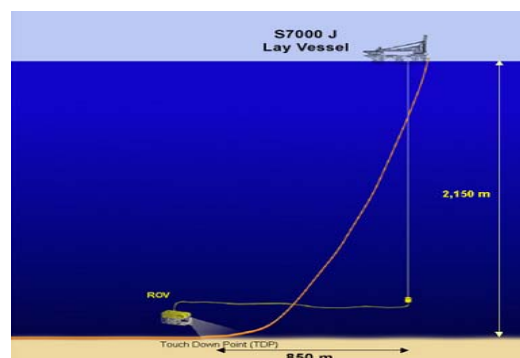
The pull ashore in **Dzhubga**, on the Russian coast of the Black Sea, and to Beregovaya has been successfully carried out by the Castoro 8 in 2002. Saipem is responsible for the laying of some 3 km of land pipeline and has completed a temporary compressor station to de-water the pipe during the laying, if necessary and for hydrotesting and drying operations.

The first line of the compression station of Dzhubga started in early November 2005. It features three gas-pumping plants and three turbo-generators, allowing pipes to increase gas capacity.

In **Istanbul** the crossing of the Bosphorus Strait by two major Saipem vessels was a challenging task. The busy shipping traffic and narrow clearance with the bridges made this a very delicate operation. The Castoro 8 crossed on the 21st of July and the Saipem 7000 on the 6th of August.

With its state-of-the-art J lay tower, its upgraded dynamic positioning capability and fast ballasting system, the **Saipem 7000** semi-submersible crane vessel has the capacity to handle the entire scope of work of offshore construction developments worldwide, including pipe-laying in water depth greater than 2,000 meters and heavy lift operations up to 14,000 tons. The vessel's Class 3 DP system of 12 thrusters ensures that the vessel maintains good station keeping even in the most difficult of weather conditions. Additionally, because the Saipem 7000 has accommodation facilities for close to 700 people, the vessel can assist hook-up and commissioning as well as initial platform life support activities. Taken overall, this high specification means that the Saipem 7000 can be counted on to provide the highest level of reliability for conventional, deep and ultradeep water development projects. In support of its underwater works, the Saipem 7000 operates two state-of-the-art Innovator type of working rovs, which are an essential part of the vessel's equipment to complement and integrate surface and subsea operations of the Saipem 7000.

Saipem has set up its quadruple joint prefabrication yard at **Samsun**. Two 1,400 tonnes lifts of quadruple joint racks are performed each day to load the pipe carriers for laying activities. The pull ashore was successfully completed by the Castoro 8 in September 2002. The joint to the onshore pipe in Turkey was successfully completed performing the golden weld of the second line in November 2002.



J-Lay by Saipem 7000, with *Touch Down* on the seabottom