

# PROJECT SHEET

POWERGAS - PGN SUBMARINE PIPELINE PROJECT SINGAPORE / INDONESIA

# BOSKALIS OFFSHORE: SKILLS, RESOURCES, EXPERIENCE

Boskalis Offshore brings together the offshore skills, resources and experience of Royal Boskalis Westminster nv. The offshore capabilities of Boskalis include seabed rectification works for pipeline/cable and platform installation, construction of pipeline shore approaches and landfalls, offshore mineral mining, offshore supply and support services and decommissioning services. Boskalis provides clients with tailored, project-specific solutions for above dredge related offshore services, as illustrated by the following project summary.

# THE POWERGAS - PGN SUBMARINE PIPELINE

The pipeline between Pulau Pemping, Indonesia, and Pulau Sakra, Singapore, is the final link of the transportation system for natural gas from onshore fields on South Sumatra to Singapore. The successful completion of the Engineering, Procurement and Construction contracts for the 27-kilometres 28-inch gas pipeline with a 96-core fibre optic cable in one of the busiest ports and shipping traffic zones of the world marked a milestone for Boskalis. The scope of work comprised not only seabed preparations and protective rock berm installation - Boskalis Offshore core activities - but also pipeline manufacturing and installation.

## **EPC SCOPE OF WORK**

The following comprehensive scope of work has been completed on a lump sum basis in two countries, with two clients and under three different contracts:

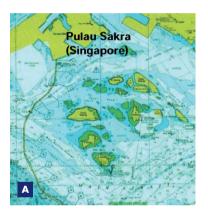
- Construction of two landfalls: a cofferdam and 200-metres pipe pull at Pulau Sakra and a trench in shallow reef with 700-metres pipe pull at Pulau Pemping.
- Seabed preparation for pipe lay: trench dredging and seabed levelling.
- Procurement and installation of 28-inch concrete coated line pipe, grade X-70, and 96-core double armoured fibre optic cable.

## **FEATURES SINGAPORE SECTION**

Client	PowerGas Ltd
Location	Singapore Port
Period	July 2001 - July 2003
Contractor	Jan De Nul - Boskalis JV

#### FEATURES INDONESIA SECTION

Client	PT Perusahaan Gas Negara (Persero), (PGN)
Location	Pulau Batam
Period	July 2002 - July 2003
Contractor	Boskalis - IDROS JO





- A Location map Singapore
- B Location map Indonesia
- C Landfall and shallow shore approach at Pulau Pemping, Indonesia
- Design verification of both a rock berm (drop and drag of 22-tonnes anchors in Singapore waters) and its filter layer (impact on cable of falling rock).
- Procurement of 2,150,000 tonnes of rock armour and filter material and installation over a length of 25 kilometres.
- Hydro-testing, drying and precommissioning \ of pipeline system.

# TRENCH DREDGING WORKS

In Singapore waters the Marine Port Authority required a pipeline top level below 28m-CD. A 8-kilometres long trench with depths up to 15 metres below original seabed was dredged by the Trailing Suction Hopper Dredger "Queen of the Netherlands" and the Cutter Suction Dredger "Marco Polo". This capital





**Dredging & Marine Experts** 

dredging involved some 700,000 cubic metres of material, including 125,000 cubic metres fresh rock. Later on maintenance dredging was executed by the Trailing Suction Hopper Dredgers "WD Fairway" and "Barent Zanen".

In Indonesia the pipeline had to be trenched in areas where water depths were less than 13 metres. These dredging works, in various cohesive soils and rock, were carried out by the Backhoe Dredgers "Jerommeke" and "Zinkoon V".

## **SEABED LEVELLING**

Elimination of irregularities along the route was required to avoid unacceptable pipeline spans and stresses. The optimum route and associated dredging and rock placement works were defined after detailed engineering.

Dredging works, involving removal of rock outcrops, sand waves and clay hills, were carried out in water depths up to 50 metres by the heavy duty Grab Dredge "Goomai", assisted by "Jerommeke" and "Zinkoon V" in the nearshore areas. 77 pre-lay rock supports were installed along the route, in water depths up to 70 metres and in strong currents. Boskalis mobilised the Side Stone Dumping Vessel "Cetus" to execute these pre-lay rock installation works. Pipeline engineers on board







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"Cetus" monitored the quality and progress of the work.

#### PIPE AND CABLE LAY

The pipe lay works were subcontracted to Global Industries, who utilised barge DLB 264. The pipeline had to be laid in the busy Singapore Port and had to cross three busy traffic lanes. A 3D-simulation study on safe passage of Very Large Crude Carriers by the Singapore Maritime Academy resulted in a crossing method statement that involved shorter anchor patterns for the pipe lay barge and Marine Advisors to be put on board every crude carrier passing during pipe lay.

The installation of the very fragile fibre optic cable was given special attention. Numerous installation methods and ways of protecting the cable were generated to come up with the safest and most efficient method: piggybacked with only manual handling.

#### **ROCK ARMOUR PROTECTION**

The rock armour designs for protection against drop and drag of a 22-tonnes anchor have been verified by model tests. Based thereon the designs were optimised and the approval criteria were set. A rock filter layer was designed for protection of the fibre optic cable against direct impact from larger armour rocks.

More than two million tonnes of rock were installed in a record time of 4.5 months. The rock installation spread consisted of the Fall Pipe Barges "Zinkoon VI" and "Zeepaard", and Side Stone Dumping Vessels "Cetus" and "Pompei". Special current measurement systems and linked in-house developed rock installation software enabled accurate rock placement in prevailing currents up to 3 knots and water depths up to 70 metres, and ensured successful completion in time.







- **D** Grab Dredger "Goomai" during seabed levelling in Indonesia
- SSDV "Cetus"
- Karimun rock stockpile
- **G** 28-inch pipeline with piggybacked 96-core fibre optic cable
- Pipe lay barge at Singapore landfall
- TSHD "Queen of the Netherlands"

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