

Electrification Environmentally friendly hydropower at sea

ABB has been awarded the main contract for every power-from-shore project on the Norwegian continental shelf. In 2011, ABB secured its second contract for power from the onshore grid to the world's largest offshore gas installation, the Troll A-platform. ABB technology provides a reliable power supply and is contributing to the avoidance of more than 1 million tons of CO₂-emissions a year.

ABB has pioneered the development of reliable, energy efficient power links, both onshore and offshore, and is involved in each of the four major electrification projects on the Norwegian continental shelf: Troll A, Gjøa, Valhall and Goliat. Electrification of offshore operations provides an efficient way to help combat climate change and is supported by all the major environmental organizations in Norway. The concept means that power generated by onboard gas turbines, is either completely or partly replaced by power from the shore, which is mainly from renewables in Norway. The most important drivers for electrification of offshore installations are:

- Reduced climate emissions
- Better safety
- Lower operations and modifications costs
- Increased energy efficiency
- Higher uptime
- More gas for sale

The petroleum industry in Norway accounts for approximately 25 per cent of the total emissions of CO₂ in Norway, about 13 million tons. Replacing electricity generated by gas turbines on board with power from shore is one of the most efficient ways of reducing point sources of CO₂ emissions.

Troll A, pre-compression phase 1

In October 2005, Troll A became the first installation on the Norwegian continental shelf powered from the shore. Statoil chose ABB's energy efficient high-voltage direct current



ABB was awarded a power-from-shore contract at Troll A for a second time in 2011. (Photo: Øyvind Hagen, Statoil).

(HVDC) system, to ensure enough power to operate two high-voltage motors from ABB, that run the offshore compressors. ABB's electric drive system comprises onshore and offshore converter stations, a pair of subsea cables and two high-voltage motors. The motors, which are located on the platform, run the compressors that are used to maintain reservoir pressure and increase production. Power from the mainland grid is converted to direct current (DC) in a converter station on the Kollsnes onshore plant, transmitted through a subsea cable and converted back to alternating current (AC) in the HVDC module onboard Troll A.

Installation	Troll A (compressor 1/2)
Operator	Statoil
Comissioned	Oktober 2005
Transmission system	HVDC Light
Power requirement	2x41 MW/60 kV
Distance to shore	70 km
CO ₂ reduction	230 000 ton/year
NO _x reduction	230 ton/year

Troll A, pre-compression, phase 2

In September 2011 it was announced that the compressors number 3 and 4 on Troll A will also receive power from the mainland grid. ABB was once again awarded the contract for the electrical drive system and the HVDC Light link. The compressors are necessary to increase the gas pressure in

the pipeline to ensure passage of the gas to the onshore plant at Kollsnes. As was the case for phase 1, the two new compressors will maintain the production capacity and extend the lifespan of the world's largest gas platform.

Installation	Troll A (compressor 3/4)
Operator	Statoil
Comissioned	Q3 2014
Transmission system	HVDC Light
Power requirement	2x50 MW/60 kV
Distance to shore	70 km
CO ₂ reduction	250 000 ton/year
NO _x reduction	200 ton/year

Gjøa

Gjøa benefits from power supplied through the world's longest alternating current (AC) offshore transmission system, which was delivered by ABB. The semisubmersible platform receives power through a cable 98 kilometer long from the Statoil plant at Mongstad on the Norwegian west coast. It provides reliable power and at the same time helps avoid approximately a quarter of a million tons of CO₂ emissions each year. The static part of the cable runs from the shore to a connection point on the seabed. The dynamic part of the cable runs from the seabed to the platform. It is designed this way so that the power link will withstand the strains imposed upon it by the seas.

Installation	Gjøa
Operator	GDF SUEZ E&P Norge
Comissioned	Juli 2010
Transmission system	AC
Power requirement	40 MW/90 kV
Distance to shore	98 km
CO ₂ reduction	250 000 ton/year
NO _x reduction	n/a ton/year

Valhall

Valhall is the first field in the North Sea and on the Norwegian Continental Shelf to be entirely powered from the shore, enabled by an energy efficient HVDC Light transmission system from ABB. The cable from the onshore station at Lista on the south coast of Norway to the platforms on the Valhall field is 292 kilometers long, providing a stable power supply, which slashes CO₂ emissions by 400,000 tons a year. The project is a part of Valhall redevelopment, extending the lifecycle of the field by 40 years. BP has removed all onboard power generation equipment, relying completely on the power provided by ABB's shore side solution.

Installation	Valhall
Operator	BP Norge
Comissioned	Q3 2011
Transmission system	HVDC Light
Power requirement	78 MW/150 kV
Distance to shore	292 km
CO ₂ reduction	400 000 ton/year
NO _x reduction	250 ton/year

Goliat

The floating production unit on the Goliat field will be partly

powered from the shore. For the time being, the mainland grid is not capable of completely covering the power requirements of the platform. The remaining power supply will be provided by onboard gas turbines. The cross-linked polyethylene cable will consist of one static and one dynamic part and will be the world's longest and most powerful AC cable ever delivered to an offshore installation.

Installation	Goliat
Operator	Eni Norge
Comissioned	Q4 2013
Transmission system	AC
Power requirement	75 MW/123 kV
Distance to shore	100 km
CO ₂ reduction	90 000 ton/year
NO _x reduction	88 tonn/år

Electrification counts

The electrification of offshore installations are the single most efficient way to help reach ambitious emission reduction targets for the oil and gas industry. ABB is the leading supplier of power transmission and electrical drive systems from shore to offshore installations. ABB has years of experience in developing effective power transmission systems, which is now benefitting the oil and gas industry.

One of ABB's great successes has been the development of technology to model and simulate different scenarios to ensure the platform will receive the reliable, high-quality power that it needs. To be able to predict the stresses the electrical system will endure is especially useful when designing subsea power links. Under the surface of the sea the strain on the system is significant and careful design and installation can prevent the need for complicated repairs.

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Valhall receives power-from-shore with ABB technology (Photo: BP).

