

## Subsea solutions

Improving the capacity and life span of oil and gas fields

Power and productivity  
for a better world™



# Longer, deeper and colder

**As oil and gas fields in shallow coastal shelves become exhausted, the energy industry has begun to develop reserves in increasingly deep water. The record so far is held by Royal Dutch Shell, which announced last year that it was to drill in an area of the Gulf of Mexico that is 3.2 kilometers deep, however fields that are more than a kilometer below the surface have become increasingly common.**

The further you go down, the more difficult it is to extract oil and gas. Falling temperatures make it more difficult to maintain flow, and the greater water pressure means that all engineering operations are harder to perform. The solution the industry has produced is “subsea processing”, which means the installation of equipment on the seabed, rather than in the production platform above it. This machinery can perform a number of tasks. For example, it can “boost” a field by pumping water or air into it to force out oil and gas; it can also separate the oil and gas from the water and air, and it can make physical measurements of what is happening within the casing of the well and promote what the industry calls “flow assurance”.

ABB, a power automation and technology provider, has responded to this developing need among its customers by producing a range of robust equipment and power supply solutions that work in the extreme conditions encountered at these new sites. And as well as the kit itself, ABB offers the means to manage the production process with sophisticated monitoring and control systems.

## **Innovation from ABB**

ABB has been involved in the development of subsea equip-

ment and systems for three decades. Feasibility studies on these components began in 1984 and the first commercial transformer was delivered to a client in 1998. Since then, the company has delivered variable-speed drive systems and transformers to some of the largest and most advanced offshore developments in the world.

## **A highly qualified supply partner**

This long experience with the world of subsea engineering means that ABB can offer clients a range of advisory and consultation services in addition to the specially designed hardware and software. With each ABB delivery, our customers gain a knowledgeable partner that can offer service and support throughout the lifecycle of the field. Our vision is to ensure our customers' production activities are possible and profitable in locations that are ever further from shore, and in ever deeper and colder water.

## **Benefits of subsea installation**

Subsea engineering can perform a number of tasks more efficiently and cheaply than would otherwise be the case. As mentioned above, compressors can extend the life of a field when the reservoir becomes depleted by pumping liquid or gas into it, and heaters can prevent the formation of hydrates, which can block a pipeline.

They can also cut costs. In some cases, the underwater factory can be connected directly to an onshore plant, eliminating the need for expensive platforms. They can also be installed quickly to accelerate production and reduce the cost of equipment hire. And as the costs of production increase exponentially with depth, the deeper the water the greater the savings.

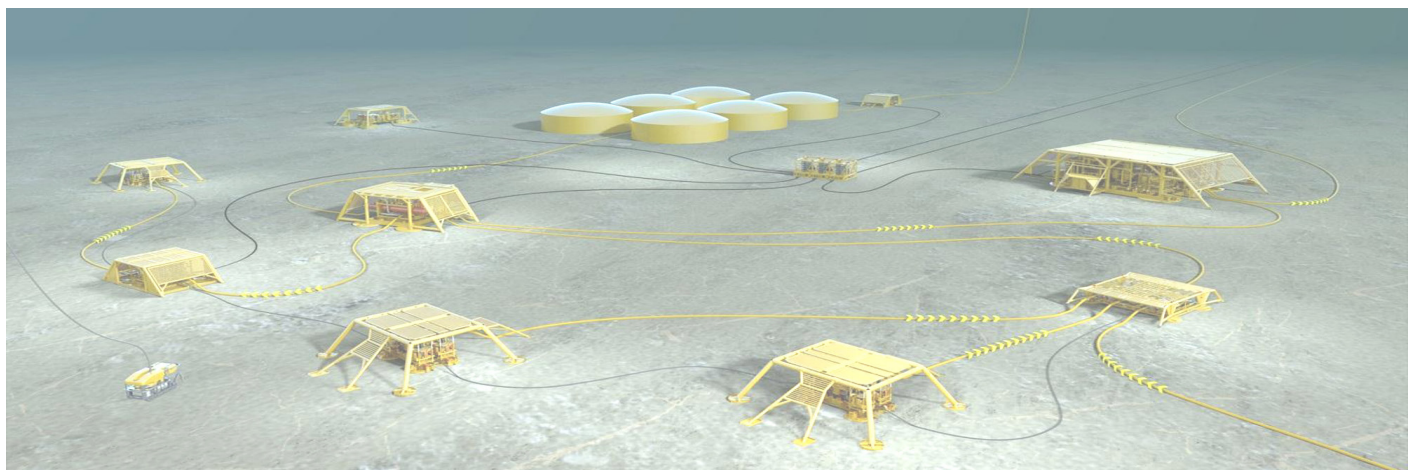


Photo courtesy of Statoil

# Enable future subsea processing

## Subsea power

Conventional oil and gas production is based on platforms tied to the seabed or “floaters” that are able to maintain a fixed position above it. This “topside” set-up is inherently dangerous for the people who staff it, and it requires a great deal of infrastructure, from the steel or concrete platforms itself to the pipelines and cables for power transmission and distribution. And at the end of its life, all this must be taken away for disposal on shore, at a cost of about \$11,000 a tonne.

Then there is the “step-out” to consider: that is, the distance between the power generator and the consumer of that power. Some subsea factories are located a long way from shore: the Pazflor field in the southern Atlantic, for example, is 150 kilometers from the coast of Angola. That kind of step-out distance makes it difficult to power the equipment.

ABB has provided an answer to this problem with its new subsea AC supply, which can transmit energy up to 200 kilometers from shore with just one cable and using a standard 50/60 Hz frequency. Lower frequency AC solutions will be able to provide up to 100 MW of electrical power over a distance of up to 400 kilometers. This kind of reliable long-term, long-distance supply takes power off the list of things that the field operator has to worry about.

## Subsea automation

One of the obvious problems posed by working in deep water is that the equipment is inaccessible. This puts a premium on the systems that tell an operator what is going on 3 kilometers below their feet, and allow them to detect and correct problems before they interrupt the production process. And ABB's automation software allows engineers to manage the whole operations from a quietly humming modern onshore control room that may be 600 kilometers away from the action.



Subsea transformer

## Subsea transformers

In 1998, ABB was the first company to supply subsea transformers to customers around the world. These units can operate in the most extreme depths at temperatures close to freezing. They work by equalising internal and external pressure, which is possible because they are entirely filled with liquid, and rely on convection rather than gas for cooling.

These maintenance-free units can be delivered with a single or double shell and have been qualified for depths of up to 2.5 kilometers. Subsea transformers are used with ABB's boosters, pumps compressors, pipeline heating systems, electrical distribution systems, frequency converters and wave hubs.

## Åsgard – a world first from Statoil, and a world record from ABB

The present state of the art in subsea power has been defined by the 310 meter-deep Åsgard field in Norwegian territorial waters. Here, the operator Statoil has just installed the world's first wet gas seabed compressor to increase pressure in the reservoir. It is estimated that it will extend the life of the Brent field by the equivalent of 280 million barrels of oil.

ABB was commissioned to provide power to the compression system, which it did by means of a cable that transmits 15 megavolt-amperes at 189 hertz over 43 kilometers. That sets a new world record for distance, voltage and frequency between a drive on a floating production facility and a seabed compressor, and points the way to what will be possible in the increasingly challenging future of subsea electrical engineering.

Project facts:

Field Operator: Statoil

Application: Subsea compression module

ABB Scope: Subsea transformers

Topside drives and transformers

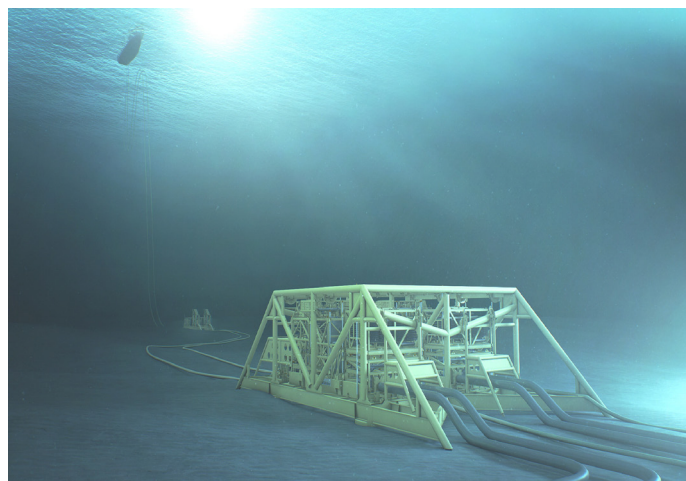


Photo courtesy of Aker Solutions

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