Subsea Power-grid

Seabed Processing Systems; Key to Unlock Hidden Deposits

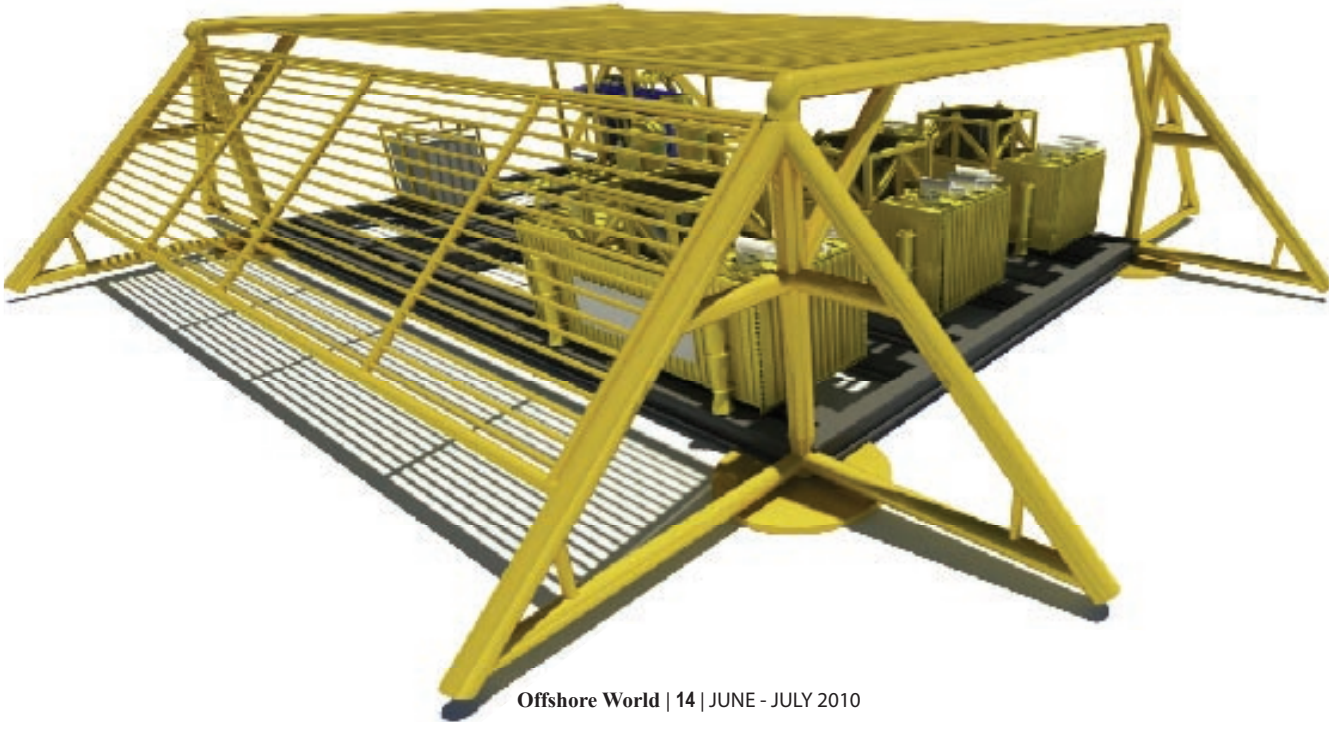
Bjoern Einar Brath

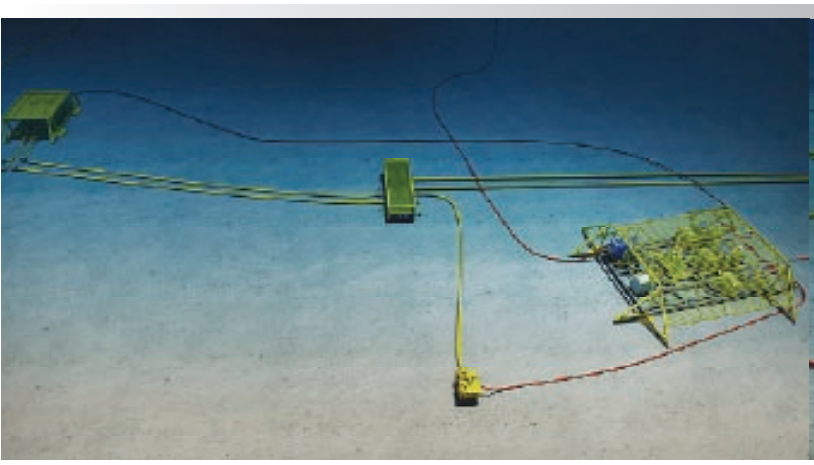
Subsea field discoveries have rapidly increased over the past years. However, very high field development costs restrict the operators from exploiting the available resources. Siemens has developed power grids to address the challenges for the offshore industry to produce oil from marginally economic fields and unlock the potential of isolated fields.

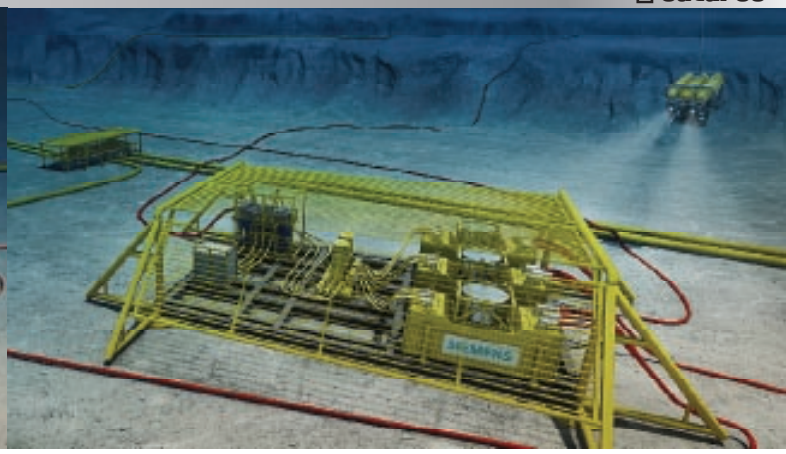
Last May, Siemens announced that it was developing a subsea power grid. This could have significant repercussions on the industry by providing the burgeoning subsea processing sector with the regulated power that it needs at water depths of up to 3000 meters at ultra long step-outs from the coast.

Many fields are discovered by operators annually but are disregarded because the development costs outweigh the value of the oil that might be produced.

This is especially true if such fields are located away from existing platforms or pipelines. With a rise in the oil price, it might be possible to tie in nearby deposits to existing developments at a relatively modest investment, but deposits located long distances from facilities have to remain







unexploited.

In recent years, the offshore industry has developed a number of technologies that might be used to unlock these isolated deposits. One such is using seabed processing systems, pumping the well stream long distances to existing platforms or even to shore. So promising are these technologies, which many are looking at such long step-out technologies as being the most economic solution even if the field is not marginally economic. These include subsea separation systems and water injection pumps.

Deep and Subsea Challenges

A similar problem occurs in deep water. As the industry looks for oil in increasing water depths, it is common for fluids reaching the seabed, to need further boosting or artificially lifting from electrically driven pumps in order to get them the 3 km or so through the water column, to the surface.

Another consideration is heavy oil because of high specific gravity. The higher the specific gravity, the more difficult it is to pump oil to the surface. One of the most practical and cost effective methods of pumping is to locate the pumps on the seabed.

These challenges have resulted in the development of a range of competitive technologies enabling the separation and pumping of gas and liquids operations that may, in other locations, have taken place on offshore platforms. Most platforms, however, would include electrical generation systems to power the machinery. For seabed systems, the electricity must be supplied from an industrial onshore or topside combined cycle power plant remote to the subsea facility.

We see our proposed 72kV power grid as a solution to this problem. It will mean seamlessly integrating a number of technologies, but doing it in extreme conditions.

The higher the specific gravity, the more difficult it is to pump oil to the surface. One of the most practical and cost effective methods of pumping is to locate the pumps on the seabed.

It is difficult to send electricity long distances. It may mean converting it from AC to DC and then back to AC again, stepping it up or down to suit applications, and distributing power locally within the field. Some equipment such as compressors, pumps and water injection systems have variable speed drives, which have variable energy demand. Regulating the speed of the motor is complex but the main difficulty is marinizing the equipment.

The Solution

The complete power grid solution provided by Siemens is mounted on a single base frame directly on the seabed. The energy demand for normal downhole pumping is around 1MW, however a simple multiphase pumping system requirement rises to 2-5MW. Gas compression technology is still at its infancy, but the energy demand for such equipment is around 10-15MW.

To ensure and maintain the availability of subsea power, it is necessary to have a dedicated power management; performance/condition based monitoring system.

The remote monitoring will enable fault diagnosis and network control, preventing black-outs, load shedding etc)

Siemens has accumulated extensive experience in subsea applications. For the Snorre project for the customer Statoil Siemens supplied a complete control system operating at a depth of 350 meters back in 2000. Since 1998, Siemens transformers have also been in operation at a depth of 1000 meters in Carapeba oil field owned by Petrobras off the Brazilian coast. The Siemens subsea power grid solution will be available for deployment by late 2012. ■

About the Author:
Bjoern Einar Brath,
Senior Vice President,
Offshore -Subsea,
Siemens AS
Email - bjoern.brath@siemens.com