OneSubsea® is a global leader in subsea multiphase boosting, compression and metering. Operating in the subsea processing arena longer than any other company in the world, OneSubsea offers unique, field-proven, turn-key solutions to enhance recovery systems for subsea oil and gas developments around the globe. One such unique innovation is the OneSubsea Multiphase Compressor; the world’s first true subsea wet gas compressor, with no requirements for an upstream separation facility or an anti-surge system.

The WCG4000™ is a contra-rotating machine specifically designed for pressure boosting of unprocessed well stream. This unique configuration, developed in collaboration with Statoil, is a compact and robust design that is easy to install by use of light intervention vessels, and is based on the well-proven design developed for subsea booster pumps.

First Commercial Deployment
Together, OneSubsea and Statoil carried out the first commercial deployment for subsea wet gas compression. The main driver in the development of the subsea multiphase compressor was to increase recovery rates and provide a cost-effective solution for increasing tieback distances in subsea gas fields. For its Gullfaks South field, Statoil has implemented subsea wet gas compression with the goal of providing a means for extending the life of the producing assets.

“The Gullfaks Subsea Compression Project represents a key milestone for OneSubsea, Statoil, and the industry as such, as it is the world’s first application of subsea wet gas compression,” says Mads Hjelmeland, Director of Emerging Technologies at OneSubsea. “We’re proud to have been a part of this project, and are appreciative of Statoil’s supportive contributions throughout the technology development and project execution.”

The Gullfaks field is located in the Norwegian North Sea, and has been in production since December 1986. Like many aging fields, production in the Gullfaks South has been declining due to pressure depletion in the reservoir. Statoil expects that the Gullfaks South recovery rate will increase by 22 million barrels of oil equivalent, and extend production by approximately two years by using the subsea multiphase wet gas compression system combined with low-pressure production.

The Gullfaks project is a three-production platform development with several satellite fields, including the Gullfaks South. The platforms, referred to as Gullfaks A, B and C, are used for processing, storing and exporting oil and gas. The subsea multiphase wet gas compression project is expected to increase recovery rates by 22 million barrels of oil equivalent, and extend production by approximately two years.

Technology Specifications
- Capacity: 2 x 6000 Acm³/h
- Power: 2 x 5 MW
- Total system weight: 1100 t (1213 tn), including protective structure
- Total intervention module weight: 60 t (65 tn)
- Dimensions: 34 x 19 x 12 m (112 x 62 x 39 ft), including protective structure
- Gas-liquid ratio: G:100
- Pressure boost: 30 bar; 60 bar (parallel/serial)
- Flow rate: 10 MM std m³/d at 65 barg
- Water depth: 135 m (443 ft)
- Tieback distance: 16 km (10 mi)
Gullfaks multiphase wet gas compression station

The state-of-the-art high-pressure hydrocarbon test loop was designed and built in the OneSubsea facility outside of Bergen

compression station was installed in water depths of 135 metres (443 feet), approximately 16 kilometres (10 miles) from the Gullfaks C platform, and is tied in to existing templates and pipelines.

When start-up commences in the fall, the Gullfaks South will have a subsea multiphase wet gas compression station in a 420-tonne protective structure. The compression station comprises two 5-MW multiphase compressors with module weights of approximately 60 tonnes each, as well as all the necessary topside equipment for power supply and control. Together, the subsea multiphase wet gas compressors can handle flow rates of 10 MMstd m³/d.

Designing and Developing Innovation

Work on the WGC4000 began in 2009 to meet the requirements of an extensive Technology Qualification Program (TQP) after a 2008 study phase was conducted by Statoil. As part of the TQP, a state-of-the-art high-pressure hydrocarbon test loop was designed and built in the OneSubsea facility outside of Bergen. The subsea multiphase wet gas compressor was tested with simulated Gullfaks hydrocarbon fluids to fully map and understand the contra-rotating compressor’s mechanical, electrical and hydraulic performance in live conditions.

More than 4600 running hours and 900 performance test points were logged and subsequently verified by Statoil and the Norwegian University of Science and Technology. The WGC4000 was successfully qualified through the TQP and rated as technology readiness level (TRL) 4 by Statoil. In 2012, the contract for delivery of a complete subsea wet gas compression system based on the qualified subsea multiphase compressor was awarded.

The subsea multiphase wet gas compressor is capable of handling high liquid contents without mechanical issues, and at gas volume fractions (GVF) typically in the range of 95% to 100%. The application of a wet gas compressor in the subsea environment significantly simplifies a subsea compression system because it has less hardware and no need for pre-processing. This will enable deployment of simplified subsea systems at lower CAPEX and field development costs.

Documented Benefits

Because the OneSubsea multiphase wet gas compressor technology enables boosting of unprocessed wet gas production fluids, the same benefits are afforded to field developments and production scenarios as have been well documented by more conventional subsea pumping applications, e.g., accelerated production, increased plateau production, increased recovery factor from a given reservoir, and greater flow assurance.

Additional benefits of the technology may include reduced CAPEX via elimination of offshore facilities/hosts due to the multiphase compressor’s capability to extend the tieback reach of a given field.