OFFSHORE CHARGING BUOY TO REDUCE EMISSIONS

Maersk Supply Service and Ørsted, have formed a partnership to test an innovative charging buoy that can bring green electricity to offshore wind farm service vessels and potentially to a wide range of maritime vessels.

The buoy can be used to charge the smaller battery- or hybrid-electrical vessels and to supply power to larger vessels, enabling them to turn off their engines when laying idle. By substituting fossil-based fuels with green electricity, virtually all emissions are eliminated while the buoy is in use.

The prototype buoy has been developed by Maersk Supply Service while Ørsted is responsible for the buoy's integration with the electrical grid at the offshore wind farm.

The charging buoy will be tested in the second half of 2021, where it will supply overnight power to one of Ørsted's service vessels.

Upon technical validation and commercial ramp up, the electrical charging buoy has significant potential, short to medium term, to contribute positively to reduce emissions for the maritime industry.

This will happen through displacing tens of thousands of tons of fuel consumed every year in the wider maritime sector by enabling inactive vessels to turn engines off and replace energy consumption and charge batteries with renewable electricity.

Within five years of global operation, Maersk Supply Service has the ambition to remove 5.5 million tons of CO_2, additionally avoiding particulate matter, NOx, and Sox. The charging buoy is applicable as a mooring point outside ports, in offshore wind farms, and near vicinity to other offshore installations.

Additionally, it will further help limit the increasing vessel congestions and remove air pollution in port areas.

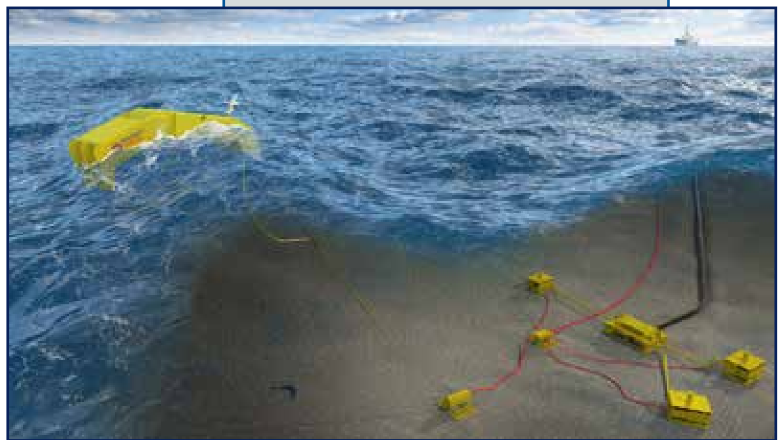
MOCEAN WINS FUNDING

Mocean Energy has raised £612 000 equity seed funding plus £250 000 from Innovate UK to advance the design of their Blue Star wave machine and drive its adoption in subsea oil and gas.

"Blue Star has been created from first principles to operate autonomously in remote locations and deliver green energy for a range of applications – including scientific ocean monitoring, aquaculture, oil and gas, and delivering energy to remote communities.

The first prototype will commence testing at the European Marine Energy Centre in Orkney next year enabling Mocean to advance our engineering design, including a new power take off, moorings and umbilical, and will deliver additional grant support to our project partners Newcastle University's Electrical Power Research Group and Rosyth-based electronics-specialists Supply Design.

The Oil and Gas Technology Centre will look to use Mocean Energy's Blue Star wave energy converter and EC-OG's HALO subsea energy storage system to power subsea tiebacks or residential AUVs.



Blue Star wave machine

SUBSESA POWER: THE NEXT STEP

Following ABB's successful validation of the world's first subsea technology power technology system last November, the company in association with OneSubsea, has conducted a new test demonstrating that 8-megawatt (MW) shaft power is available with one single Variable Speed Drive (VSD) connected to a compressor.

Using OneSubsea's multiphase wet gas compressor (WGC6000) operating in a hydrocarbon loop, the test was conducted in a shallow water pit at OneSubsea's facilities on Horsøy, off the coast of Bergen.

Per Erik Holsten, Managing Director of ABB in Norway said: "The integrated test proves that we have a robust and reliable high power subsea VSD for submerged pumps and compressors like OneSubsea's WGC6000 and those from other manufacturers."

Funded by industry partners Chevron, Total and Equinor, the test took place during the summer. With lockdown travel and social restrictions prevailing the teams at ABB and OneSubsea carried out much of the work remotely, culminating in a virtual event with over 100 attendees from around the world, witnessing the test.

By successfully completing this milestone, both ABB's VSD and OneSubsea's multiphase compressor Have achieved Technology Readiness Level 5 (TRL5) and are ready to be deployed to the market. Together they offer a disruptive optimisation of subsea processing and tie-backs.

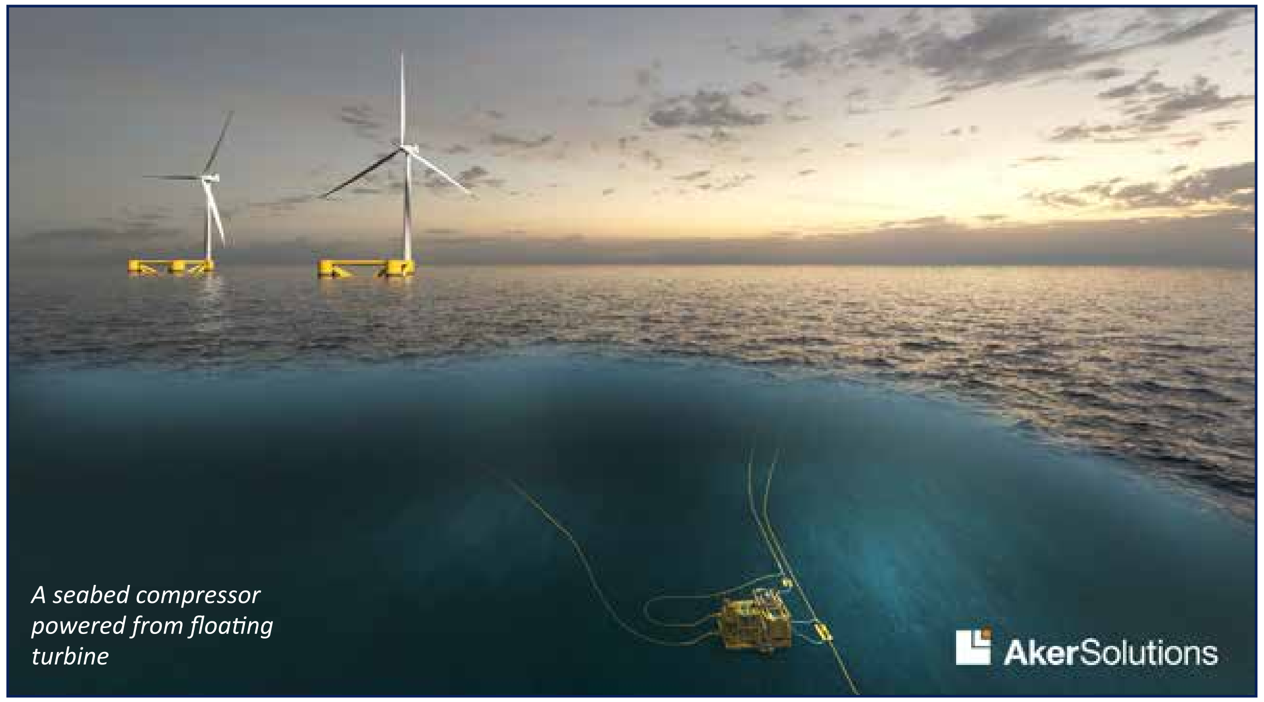
ABB's VSD

VARIABLE SPEED DRIVE

The Variable Speed Drive forms a major component of ABB's state-of-the-art subsea and power distribution and conversion system, that was proved commercially viable in world first at the end of 2019.

The system enables companies to access a reliable supply of up to 100 megawatts of power, over distances up to 600km--and down to 3,000 meters water depth via a single cable. It is expected to help transform offshore oil and gas operations, enabling increasingly remotely operated, autonomous and subsea powered facilities in the ocean space. ABB brings groundbreaking potential to the offshore hydrocarbon industry and new frontiers in the ocean space.

Renewables-powered SUBSEA COMPRESSION



A seabed compressor powered from floating turbine

The argument for adding compression is unambiguous.

If compression is added at the start of the field development, the higher production rate gives increased early revenue. Adding compression as the field plateaus means that it can continue plateau production for longer while boosting at any time can provide increased total overall recovery.

Historically, compression has been added either from a topsides or onshore station. This requires the gas to be pulled from the wellhead and up through an upstream pipeline before it reaches the compressor. A more efficient alternative is to carry out the compression subsea.

In both cases, the resistance from the pipe must be overcome but keeping the gas at high pressures results in smaller losses than if the pipe were at a lower pressure. Consequently, when compared with an equivalent topside or onshore compression system, a subsea compression station requires substantially less energy.

In 2015, production started on the Asgard subsea compression station and has recently celebrated 5 years of operation.

“Since production commenced on Asgard, the facility has provided better-than-expected performance," said Andrew Grant, senior process engineer at Aker Solutions. "At present, we are working on developing the Jansz Io subsea compression facility and facing the next stage of challenging design parameters.

"The new compressors will operate in deeper water, further from the host facility at higher flow rates and operating pressures.

"Both projects consist of a dry gas compression design where the fluids are separated prior to boosting.

"This means that both the pump and compressor require separate high voltage strings, and getting sufficient power in the correct form is one of the main challenges with subsea systems.

"At one time, the only solution would be to provide the power from land or a nearby platform. The recent developments in renewable energy systems, with increasingly higher power ratings, could result in these new energy sources being a candidate for supplying power to a subsea compression station.”

A characteristic problem with most renewable power sources is that the energy fluctuates, and this must be accommodated for in the system design. It only becomes a problem, however, when keeping the compression turbine running at top speed, continuously. It disappears by simply electing to carry out the compression only when power is available. It does, however, require a compression system able to speed up or down on demand.

“We have examined a number of case studies where power from renewables could be harnessed,” said Grant.

ONSHORE HOST

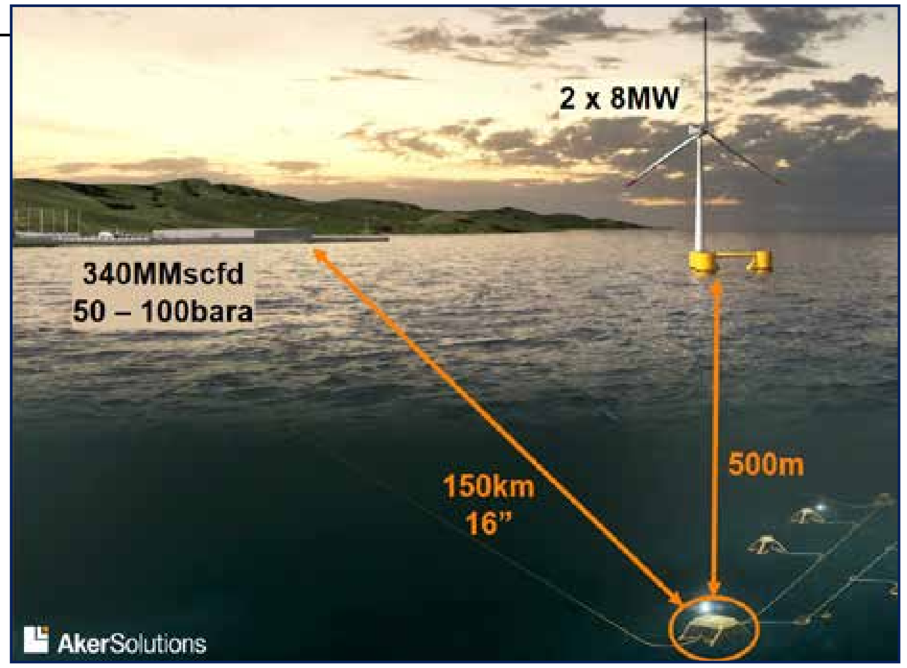
One such example is an onshore host facility capable of processing 340 MMscfd and accommodate arrival pressures from 50 to 100 bar. In this example, the subsea compression facility is located 150km from the host facility and the pipeline connecting the two has a nominal diameter of 16in.

"The compression facility sits 500m below the two wind turbines, each with a maximum power output of 8 MW," said Grant. "The subsea facility has the same power rating as the existing Asgard compressor. A constant suction pressure of 100bar is assumed which is not too far of what we would see in reality.

"With little to no wind, a small amount of production can be maintained by bypassing the subsea compression station. Once wind speed picks up enough to provide the compressor with a MegaWatt of power, the compressor can operate at minimum speed. As the speed picks up, compression increases to its maximum.”

SUBSEA PRODUCTION/HIGH WIND

In this example, the host facility production rate is 340 MMsfcfd but the subsea compression facility is capable of achieving production rates in excess of this. As a result, energy storage in the form of line packing can be introduced.



Case studies

"Line packing is the name given to the procedure of allowing pressurisation of the pipeline during sustained periods of high wind. This enables production to continue for a certain time even after windspeeds drop.

"In an illustrative 30hr period, we start at steady state operating conditions with 10 MW of power available from the wind turbines. This allows for a constant production rate at the subsea and host facilities, and a host arrival pressure of 50 bar.

"The example assumes the wind speed increases and decreases linearly, with a peak speed at 9 hours. After a couple of hours, compression power reaches its maximum and the pipeline pressure begins to climb.

“Once the wind speed and thus, the compression power begins to fall to a point at which it is no longer possible to maintain the host production rate, the pipeline starts to 'unpack'. Full host production can be maintained for at least 1.5 hrs upon loss of power.”

There are transitions from very high wind speed to very low wind speed or low to very high windspeed and in the want of better the lack of statistical analysis an that this happened 80 times in the year. This means that in total, at least five days of full production that can be maintained as a result of line packing. It gives at least 1% more full production up time.

For this example, an average host production rate of 288scf/d for the entire year of operation can be attained.

"It is reasonable to assume that onshore facilities have a gas gathering network rather than a single production pipeline,” said Grant. “Additional pipelines in the network can be also used for line packing.”

It is also possibile to employ energy storage in the form of batteries, making use of the additional capacity of the wind turbines during periods of high wind where the compressor cannot use all available power. Voltaic solar panels can also be used conjunction with wind turbines to keep the compressor spinning during periods of low wind.