

## Enhanced oil recovery powered by nature – a WIN - WIN

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DNV GL has just kicked off a Joint Industry Project (JIP) called ‘WIN – WIN – WIND powered Water Injection’ to assess the technical and economic feasibility of using floating offshore wind turbines for powering subsea water injection systems for increased oil recovery (IOR)

### Smarter and greener

The oil business is currently challenged by a low oil price, increasing cost and a demand for more sustainable operations. If the industry is to become more efficient and if renewables are to be proved in a commercial setting, it is a need for collaboration.

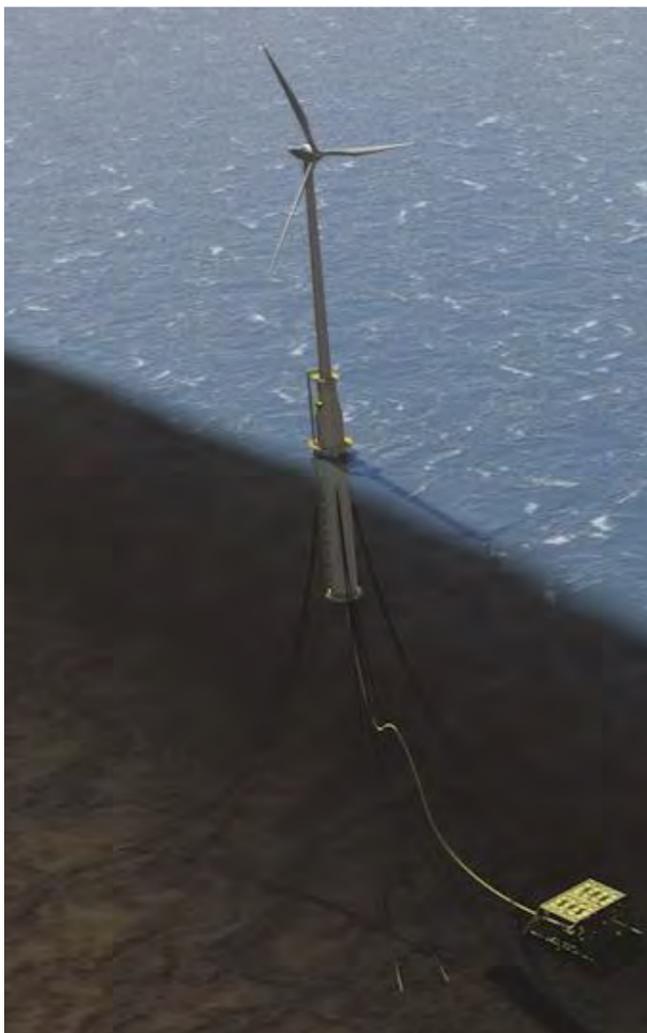
While wind intermittency may be a challenge for many oil and gas applications, the water injection process can handle some degree of intermittency as long as a specific volume of water is injected over a given time period. This power supply can be combined with relevant water injection technologies to provide water of required quality to the reservoir.

The upstream industry has for many decades injected water into oil reservoirs to increase recovery. Traditional solutions using processed injection water are impacted by the necessity for long power cables and water injection flowlines, which are significant cost drivers. The systems are energy-intensive and space consuming.

Floating wind turbines have in recent years emerged as a promising technology for large scale renewable power production. Several full-scale offshore pilot turbines have delivered promising results which builds on the knowledge from both the offshore oil and gas industry and the wind power industry.

Initial DNV GL studies suggest there are opportunities for a new generation of wind-powered water injection systems used to increase reservoir pressure. There are several advantages, such as extending the life of marginal and mature fields, and reduction of both costs and emissions from offshore oil and gas installations. The system could be installed without costly retro-fittings on the platform, it could provide access to systems normally located sub-sea and increase the flexibility of the injection location and reduce the installation time. It could also

be possible to move the system and use it at new locations after marginal fields where associated



the closure of a well or field.

### The Concept

The WIN WIN concept is based on a floating wind turbine system that is separated and at a distance from the production platform. The power for the water treatment systems, injection pumps, and the auxiliary systems will be supplied by the wind turbine generator itself

The economic rationale is dependent on the characteristics of the field. The best business cases

are typically applications with marginal fields where associated

gas for fuel is limited and tie-back to other production hosts or import of fuel are the main alternatives.

### Technical considerations

High level studies indicate that the stand-alone wind powered system is technically feasible and potentially cost-competitive to alternative solutions. To deepen the knowledge and develop a more detailed understanding of the system with its opportunities and challenges, the JIP will take a

detailed approach through analysis of a number of technical and economic case studies reflecting the operators needs and real-life experience.

Building on the results obtained from an earlier study by DNV GL, some of the critical issues to be addressed by the JIP are:

- \* Reservoir characteristics and well system
- \* Floating wind turbine system design and selection of wind

turbine

- \* Operational challenges and pump intermittency
- \* System stability and availability
- \* Power outages and black start capability
- \* Economic and regulatory aspects

### Conclusion

The aim of the JIP is provide enough information to give the

industry confidence to develop the WIN WIN concept into an actual project. Participants in the project now include a handful of operators from several countries. A successful integration of offshore wind power with offshore oil and gas operations could provide the oil and gas industry with a new and cost-efficient means to develop marginal reservoirs and increase production in mature fields with long step-out distanc-

es. It could reduce costs for certain activities while also offering a new niche market for offshore wind technology, creating momentum for both industries. It's a WIN WIN!

