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Technical Status and Development Needs for Subsea Gas Compression

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Abstract

Recent industrial drives have accelerated the development of subsea processing technologies, with implementation of subsea pumping and separation processes already demonstrated. Subsea gas compression is a natural following application. This is a relative complex technology to bring subsea. Extensive technology development is therefore needed.

The development of Subsea Gas Compression technology will make the operators able to increase overall recovery from depleting gas fields for a lower cost. The potential is significant, especially comparing with the development of comparable topside solutions. Also remote fields with long transport distances to production units can be enabled by the use of the technology.

The main parts of the subsea compression system are the process system, power distribution system and control system. The heart of the system is the compressor itself which is considered to be one of the less mature technologies, and requires the most attention. Further, the subsea control system with fast acting control loops is meeting new challenges. With increasing distance to the production facilities (i.e. platform or shore) there will be limited possibility to keep control logics topside and thus control loops will have to be closed subsea.

The electrical distribution for the compressor system requires a leap up in transmitted power for subsea systems. Again the distance to the production facilities will give a change in the applicable technology, where at a certain step-out; the electrical concept must be changed to have a larger portion of the power equipment subsea.

Introduction

Subsea processing technology is maturing and is making its way into the toolbox of the oil companies for development of oil and gas fields /1/. Subsea liquid/multiphase boosting, separation and water injection are technologies that have

become available as field development building blocks. Several installations are already in operation. Subsea gas compression is regarded as the next step in the development of subsea processing. Conceptual development and initial qualification has been ongoing for some time, with recent industrial initiatives accelerating the development of subsea gas compression.

Subsea gas compression can be installed towards the end of the field life to extend the plateau production or be implemented initially for boosting support for remote fields with long tie-backs. The former is, however, the most likely driver for the first implementation of subsea gas compression, driven by larger gas fields where long distance from wells to surface processing facility would require either subsea compression or a new topside facility at later stage of the field lifetime due to the decline in reservoir pressure.

The application of a compression system subsea with large power consumption, fast acting control and use of complex equipment is a technical challenge. Normally, when developing new subsea processing technology it is aimed to use known and proven technology from subsea or topside applications. New solutions are however necessary in some cases.

The technical solution for a subsea gas compression system is dependent on the field conditions and reservoir conditions. Parameters such as step-out from the host facility, water depth and reservoir pressures will influence this selection and thus also the needs for development of new technology compared to implementing field proven technology.

This paper gives an overview of a subsea gas compression system and discusses the technical status of the components within the system. From the evaluation of the technical status the general need for technology development is identified and presented. Seven cases with regards to step-out distance, water depth and internal design pressure were defined and significant changes in applicable technology and thus need for development is presented.

Compression system overview

Installing gas compression subsea will require that several or all functions needed to run a compression system must be operated under water. Such a system will be much more complex than any previously installed subsea system. This introduces considerable technical challenges for the development and installation of the technology. Still there are strong incentives to take such risk on-board, such as reduced total CAPEX and increased recovery /2/.