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Mitigating Flow Assurance Challenges Using Subsea Meters on Independence Hub

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Abstract

The Independence Hub development is a fifteen-well subsea tieback to the host capable of producing up to 1 bscf/d of gas production and associated fluids. The subsea architecture is designed to deliver the required amount of hydrate inhibitor (mono-ethylene glycol) to each well. This is done using a combination of subsea wet gas meters (SWGMs) installed in the well jumpers and subsea orifice valves installed with the subsea trees, in addition to topside MEG injection pumps and meters. The SWGMs measure the total gas, condensate and water production from the wells and these measurements are used to optimize the MEG injection requirements. In addition to the SWGMs and subsea orifice valves, subsea acoustic sand detectors are used to monitor sand production. A combination of these devices provides a robust methodology to mitigate any flow assurance challenges for this development.

The subsea architecture is such that a common MEG injection umbilical can deliver the required volume of MEG and chemicals to each well by using the information from the SWGMs and by controlling the subsea orifice valves. In addition to the CAPEX savings from avoiding a MEG injection line for each well, the use of SWGMs also provides accurate production measurements to conduct produced gas and liquid allocations. The wells producing to the host are of varied royalty regimes and ownership. The use of one SWGM per well provides the required measurements for allocation of production with minimal uncertainty.

The experiences from the Independence Hub operation are shared in this paper, especially related to the measurement of production from each well and optimization of chemicals using subsea orifice valves. Also, some of the operational challenges and lessons learned during startup and routine operations are addressed.

Introduction

The Independence Hub development started as a joint project between Independent producers to tap the reserves around the Mississippi Canyon 920 block. During the exploration and development phase, the hydrocarbons discovered were primarily dry biogenic gas with a condensate-gas ratio of less than 1 bbl/mmscf. Several independent E&P companies had discoveries in the vicinity (a summary is provided in Table 1 below). The E&P companies made a decision to jointly develop these fields to not only optimize CAPEX and OPEX, but to also use the best expertise in various areas of development to make the project feasible and successful. The Independence Hub semi-submersible platform receives production from these wells with a capacity to process up to 1 Bscf/d of hydrocarbon gas. It is located 123 miles southeast of Biloxi, Mississippi. The platform is operated by Anadarko and owned by Enterprise (80%) and Helix (20%). The Independence trail, owned 100% by Enterprise, is used to transport the gas and associated fluids from the platform to the shallow-water hub (West Delta 68). The wells and subsea systems are owned by the operating companies.

An overall field schematic of the Independence Hub project is presented in Figure 1. As seen in the figure, well locations and their distances from the Hub are extensive. The subsea tieback distances from wells to the Hub range from 11 miles (18 km) to 45 miles (72 km). The hub-and-spoke development has several challenges from a flow assurance and production perspective. These challenges include delivery of regulated chemical supply to each well, measuring the hydrocarbon