Innovative Integrated Asset Model including ESP Gas Handling and Power Supply Managements, Al Khalij Field case

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Abstract

Since the start of production, the Al Khalij field, Qatar, has experienced a relatively rapid increase in water cut evolution and decrease in reservoir pressure. The associated consequences bring new challenges to the ESP development concept, increasing ESP exposure to free gas and power requirements. Therefore, operating and maximizing production of Al Khalij field requires not only integrated thermo-hydraulic fluid modeling from reservoir to surface, but also ESP gas handling and power supply managements. Integrated modeling is a cross-functioning simulation, monitoring and decision tool capturing the interactions from reservoir to surface facilities and from today to the end of field life. This paper describes the associated benefits of an innovative Al Khalij field Integrated Asset Model embedded into live data environment and performing production optimization accounting for ESP gas handling (gas volume factor and minimum bottom-hole pressure) and power supply management constraints (ESP motor, variable speed drive and wells and platforms transformers). As for any Integrated Asset Model, the reservoir, the wells, and the network thermo-hydraulic behaviors have been calibrated on the production data. The reliability of the well models to reproduce the measured production data has been demonstrated and is described in this paper. It has even proven capability to detect abnormal hydraulic and electrical behavior of the ESP motor and/or the pump. In the Integrated Asset Model, the intensity and voltage values are calculated at the ESP motor, the variable speed drive and the wells and platforms transformers levels. The electrical load based on these equipments design is used through an innovative workflow to constraint the field production optimization together with the free gas management constraints. The Integrated Asset Model has then been embedded into a live data environment of the field (DOF) for monitoring and automated models management and is used to further optimize the production including ESP free gas and power supply managements, and to anticipate on future debottlenecks.

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