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Optimal Management of Topside Diluent Injection for a Heavy Oil Field

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Abstract:

Heavy oil fields can be developed using diluent injection at the well level as a flow improver. However, diluent can also be injected at surface. Benefits of topside diluent injection include (1) improved oil/water separation in the surface processing facility and (2) better final oil product quality. Additional OPEX due to the high price of light oil (diluent) can be very significant. This paper describes an integrated modeling solution designed to minimize the topside diluent requirement while honoring technical and market crude specifications. The field studied is an offshore heavy oil field. It consists of two reservoirs with API gravities of 14 and 12, and oil viscosities at reservoir conditions of 70 cp and 500 cp.

The wells are producing into a two-stage surface processing facility followed by a coalescer aimed to separate the water from the final sales oil. Diluent is injected in the surface processing facility prior to the second stage separator. Operating variables include (1) the topside diluent injection rate and (2) the temperature of the second stage separator. The difficulty of the production optimization problem lies in the non-linearity of the process and viscosity models, and the consistency of the fluid's PVT description throughout the production system.

The field being still in the development phase, the proposed solution is coupled with a reservoir simulator to determine optimal topside diluent requirements over time and foresee eventual bottlenecks in the surface infrastructure design. The proposed solution can easily be used as a real-time management tool during the production phase to find the optimal operating point based on real-time data. The optimal operating point ensures the lowest diluent consumption while meeting all system constraints. Such an approach can lead to significant savings in OPEX.

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