Recovering Historical Decline Rates and Maximizing Production in a Mature Field

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Abstract

A restoration plan has been applied in Señal Picada field since 2012 to recover historical decline rate, which had deteriorated and doubled its value in the period 2007-2012. This situation led to P1 reserves loss in the same period.

The field was discovered in 1963 and had several drilling campaigns, mainly between 1960s and 1980s. In the 1970s Water injection for IOR was implemented. Currently it has 270 producers and 110 injector wells.

This restoration plan involves drilling replacement and infill wells, also it includes work over and maintenance activities for existing wells. An integrated subsurface model was proposed as the primary decision tool. A full field static model was finished in 2012. In the period 2012-2014 we use data from the static model to propose new wells, either replacement or infill. We used and compared a set of static and dynamic data as a method to maximize production:

- OOIP, RF, injected pore volume per layer and pattern, acreage
- Last production rate and date in original wells (criteria for replacement wells)
- DCA analysis per pattern.
- Well integrity analysis: used to select work overs (both injectors and producers)

This method has proved to be successful considering that the project was profitable and decline rate recovered near historical values at the end of 2013. Major surface modifications were also needed to achieve this goal. In 2014 the method showed marginal results and the need for a full field dynamic model was clear if we wanted to maximize production and profit. It was created using dynamic software to evaluate current recovery factor and to assess new wells to be drilled in the field (replacement or infill). We had to validate fluid production and injection for more than 400 wells (with 3 or more active layers) and near 50 years of field history.

Current investment proposal in the field is supported by this tool, adding to the previous criteria the following:

- Current and final oil saturation, RF, and injected pore volume per pattern and layer. Identifies poor drained zones
- Scenario analysis (e.g. do nothing vs drill) with production curves supported by a model (not only by DCA method)

Actually, we are drilling new wells and initial results are as forecasted by the model. We continue to gather new data from wells (e.g. logs not acquired before like NMR or RFT) to improve the static and dynamical models.