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AQP Avoids Deferred Production with Petrel Platform's Advanced Production Forecasting

Model-based estimation of reservoir parameters using the PIPESIM simulator enables optimized production through more accurate forecasts

CHALLENGE

Obtain sufficient high-quality downhole data to model the reservoir without shutting in wells and production.

SOLUTION

Use the PIPESIM* steady-state multiphase flow simulator and rate transient analysis (RTA) in the Petrel* E&P software platform to QC existing data and estimate missing parameters for accurate forecasting.

RESULTS

- Forecast production based on a model, rather than conservative empirical formulas.
- Acquired reservoir parameter measurements without having to shut in wells.
- Equipped with a new workflow that can be applied to other AQP fields.

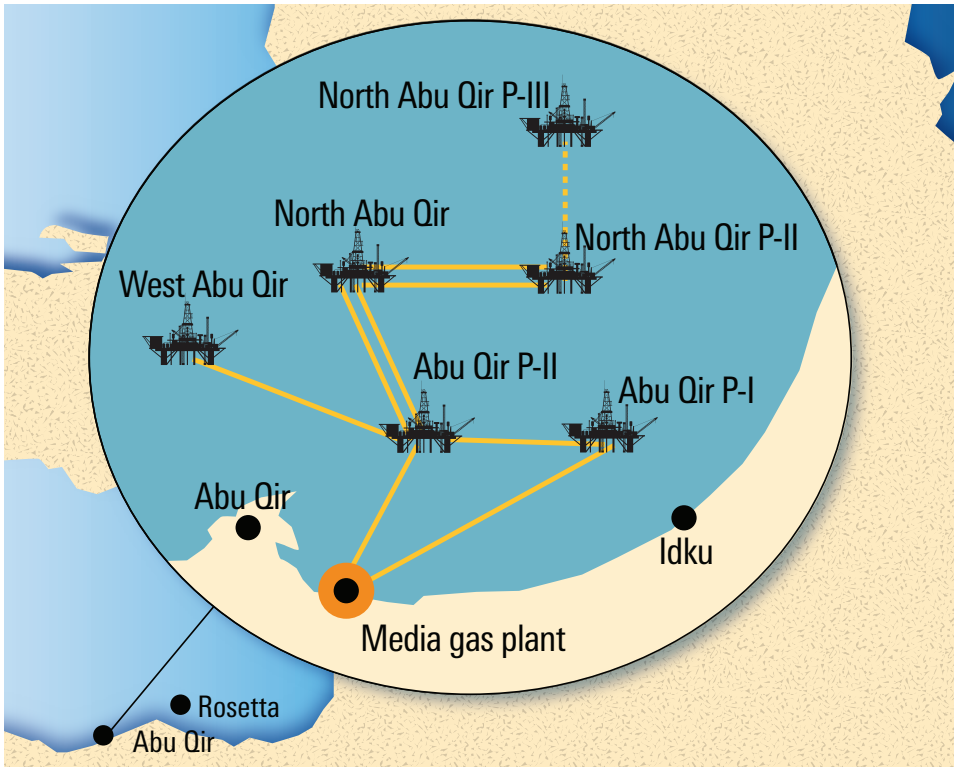
Insufficient information creates barriers in developing a model-based approach

Abu Qir Petroleum Company (AQP), a major gas operator in Egypt, holds 100% of the exploration, development, and production rights of the Abu Qir concession in the Nile Delta offshore. This development consists of three concessions that produce gas condensate from the Abu Madi and Kafr El Sheikh formations. The offshore facilities include 6 platforms, 34 wells, and a network of subsea pipelines.

With the goal of optimizing the development strategy, AQP sought to develop a model for estimating production rates, instead of relying on the empirical formulas that had been used throughout the concession's history for production forecasting. However, there were several barriers to developing a model-based approach:

- No reservoir pressure measurements had been taken in the past three years.
- Most wells had no valid productivity estimate.
- Shutting in wells for testing was not an option because downtime would incur production losses.

As a result, AQP could not determine whether wells were producing to their maximum potential.



The Abu Qir concession fields, offshore Nile Delta, Egypt, produce from the Abu Madi and Kafr El Sheikh formations.

OFM software, Petrel platform, and PIPESIM simulator yield more reliable field forecast and reserve estimation

Working with AQP, Schlumberger developed a workflow by which the missing reservoir parameters—reservoir pressure and the productivity indices of the wells—could be estimated using the RTA technique in the Petrel platform. These data could then be used to history match the reservoir simulation model and provide a more reliable field forecast and reserve estimation.

As a first step, all existing measured data were gathered and input into OFM* well and reservoir analysis software to remove any inconsistencies and bad data. The cleaned and prepared data were then imported directly into the Petrel platform.

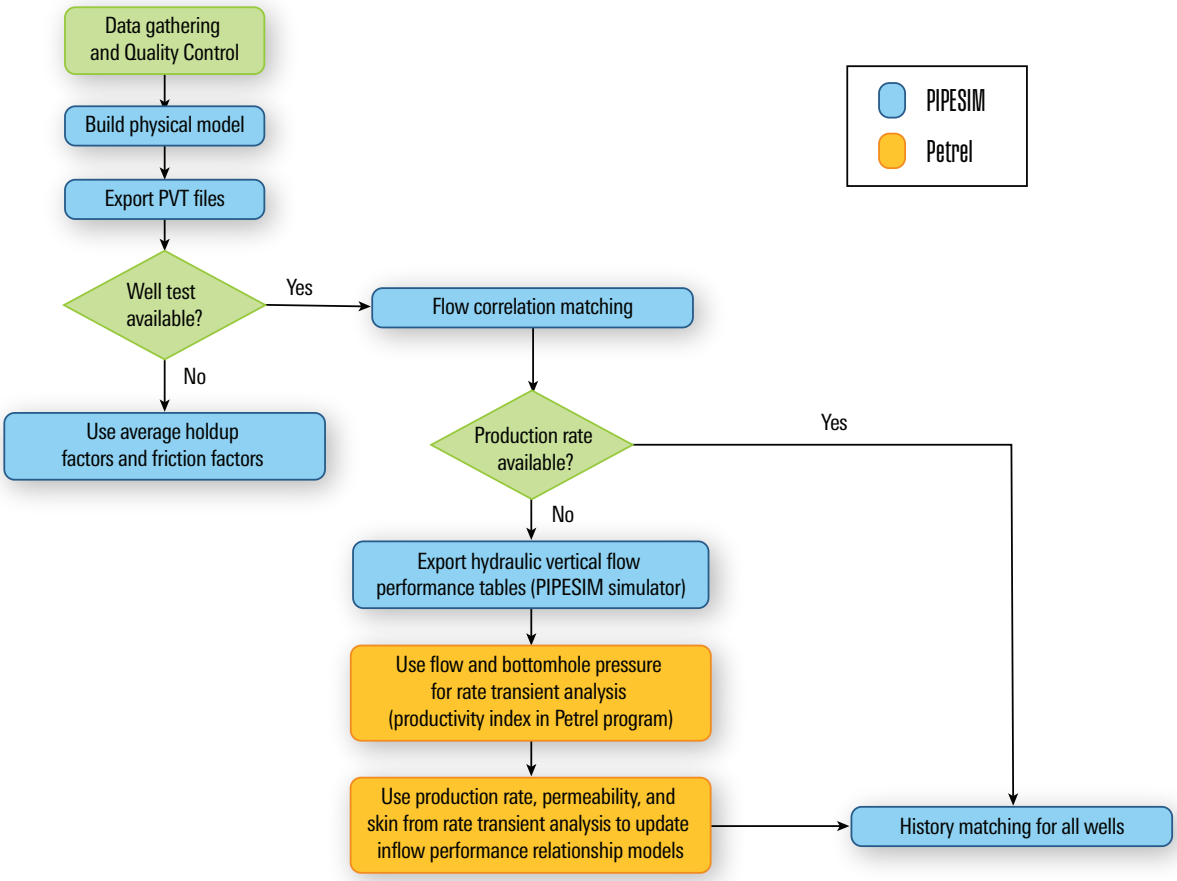
Well deliverability capabilities in the Petrel platform are powered by the PIPESIM simulator, which calculates well hydraulics. Inputs to the model include well geometry, PVT information, and wellhead pressure and rate information. For wells with recent well test data, which includes wellhead and bottomhole measurements, the model was tuned using flow correlation matching—this adjusts the friction factors (FF) and holdup factors (HF). For wells that did not have well test data, the average FF and HF were used in each of these models to calculate the bottomhole flowing pressure.

In some cases, there were accurate downhole gauge measurements or estimates of static reservoir pressure from well test analysis, so the PIPESIM simulator was used to calculate the well productivity index. This could then be used to history match each well.

In the majority of cases, there was no static reservoir pressure information. For these, hydraulic vertical flow performance (VFP) tables were created in the PIPESIM simulator and imported into the Petrel platform. By using measured wellhead flow rate and pressure data in combination with the VFP, the bottomhole flowing pressure could be estimated and used to analyze flow rate history and compute bottomhole pressures for rate transient analysis.

Use of the obtained parameters improves certainty in the production forecast

Conducting RTA in the Petrel platform provided estimates of the average static reservoir pressure, skin, permeability, and productivity parameters—data that were critical to the production optimization project. The obtained parameters were used in the well history-matching process to optimize production through simulation and obtain production forecasts based on physics (rate and reservoir pressure), rather than the empirical estimates of the past.



Working with AQP, Schlumberger developed a workflow for reservoir parameter estimation to history match the reservoir simulation model.

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