Schlumberger

Ithaca Energy Exceeds Production Expectations with 3D Geomechanics, North Sea

Collaboration on injector well optimizes drilling and completions of "undrillable" Cook Field well

New 3D model from Petrel* Geomechanics and VISAGE* finite-element geomechanics simulator addressed and eliminated reservoir uncertainty and optimized injector well parameters before drilling.

Boost production from prolific reservoir

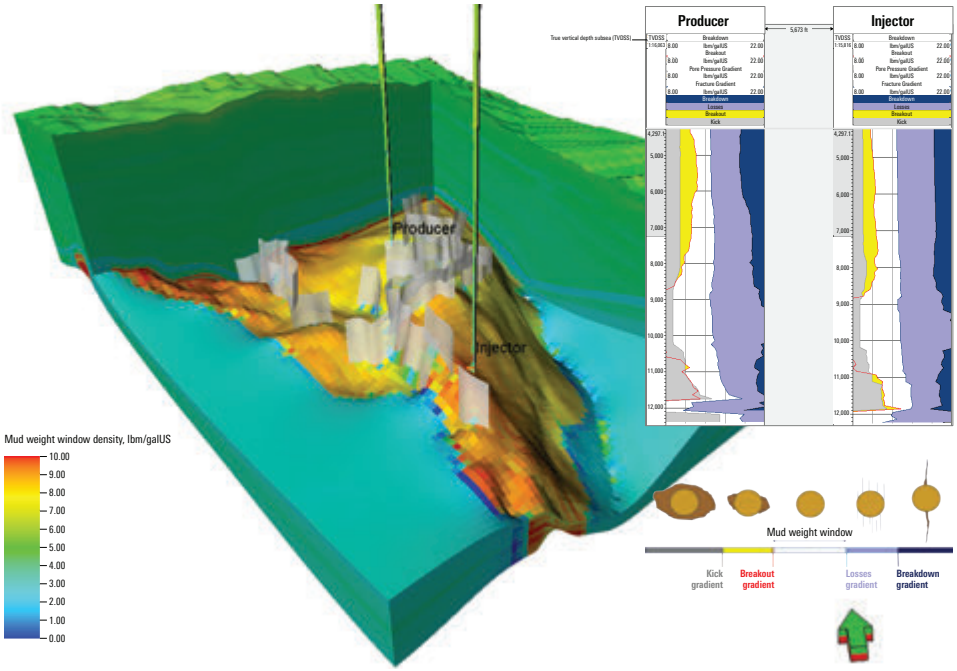
The Cook Field is one of the North Sea's most prolific oil fields, with historic production in significant excess of initial expectations with impressive uptime. The field is an oil trap in a simple domal structure that measures approximately 2.153e+7 ft². Fulmar, the field's main reservoir, is an Upper Jurassic marine transgressive that resulted in the deposition of the upper shoreface, 300- to 400-ft thick, with average porosity of 22% and permeability that can be greater than 1 D.

Ithaca Energy is producing the Cook Field, tying back a single production well at 312-ft water depth to an FPSO. To enhance production, Ithaca Energy planned to drill a water injection well in the southern accumulation of the field by sweeping the reservoir from the water injector toward the producing well.

Manage uncertainties and tight logistics

The level of depletion within the target formation is highly uncertain, showing potential for losses and formation breakdown. The pressure transition between the clay formation was also not known, nor whether the transition through the target formation was sharp or gentle. At the same time, a virgin-pressure formation could lead to gains.

For some formations to be at virgin reservoir pressure, the field would need to be compartmentalized and the fault sealing between the depleted sand and the area targeted. Addressing this aspect of the project was crucial for success of the injection well.



The 3D geomechanics model generated using Petrel Geomechanics and VISAGE simulator enabled Ithaca Energy to optimize its completion design, investigating possible occurrence of sanding and screening water-weakening effects during injection.

Ithaca Energy turned to Schlumberger because of its experience in integrated projects in the UK and around the world.

Combine capabilities and maximize insights with geomechanics

Ithaca Energy and Schlumberger collaborated to plan and execute the well injector. The model was based on an integration strategy in which Schlumberger would perform project management, carry out engineering work, and manage all services, including contracting Subsea 7 to lay pipeline, umbilicals, and risers for final hookup to the FPSO. Ithaca Energy provided wellsite supervision, the semisubmersible, transportation, and onshore waste management.

As part of the technical preparation during the planning phase, a detailed 3D geomechanics study was performed using Petrel Geomechanics and VISAGE simulator. This study was based on new core data, a recent reservoir simulation model, and seismic cubes provided by Ithaca Energy. The new geomechanics model helped illuminate rock properties and characterize subsurface stresses to enable designing the optimal drilling fluid for each section. The 3D geomechanics model also supported Ithaca Energy's completion design, investigating possible occurrence of solid production (sanding) and screening unwanted water-weakening effects during injection.

Schlumberger also used the model to estimate reservoir depletion levels and select an adequate injection target. Several lab tests and OPTI-STRESS* wellbore stability software simulations were performed to optimize the best mud formulation required for wellbore strengthening and loss circulation.

Surpass production estimates with minimized risk

Schlumberger carefully mitigated uncertainties related to reservoir depletion. In cooperation with Ithaca Energy, Schlumberger carried out due diligence and calibrated the risk for both companies to ensure successful project execution. The completion design unlocked the possibility to perform the injectivity test before handing over the well to operations.

A maximum planned injection rate was achieved and sustained during the required timeframe. Ithaca Energy hooked up the injector well and began injection in October 2019. Since then, successful injection has continued, and Ithaca Energy exceeded its expected production results.

The new Schlumberger 3D geomechanical model for the Cook Field was instrumental in allowing Ithaca Energy to design and plan for a well that was previously thought to be undrillable. It's a testament to the rigorous well planning and designing that Ithaca and Schlumberger both completed that the operational phase of the well significantly outperformed expectations for cost and time.

Jay Kelly
Wells Manager
Ithaca Energy

slb.com/ism

Schlumberger