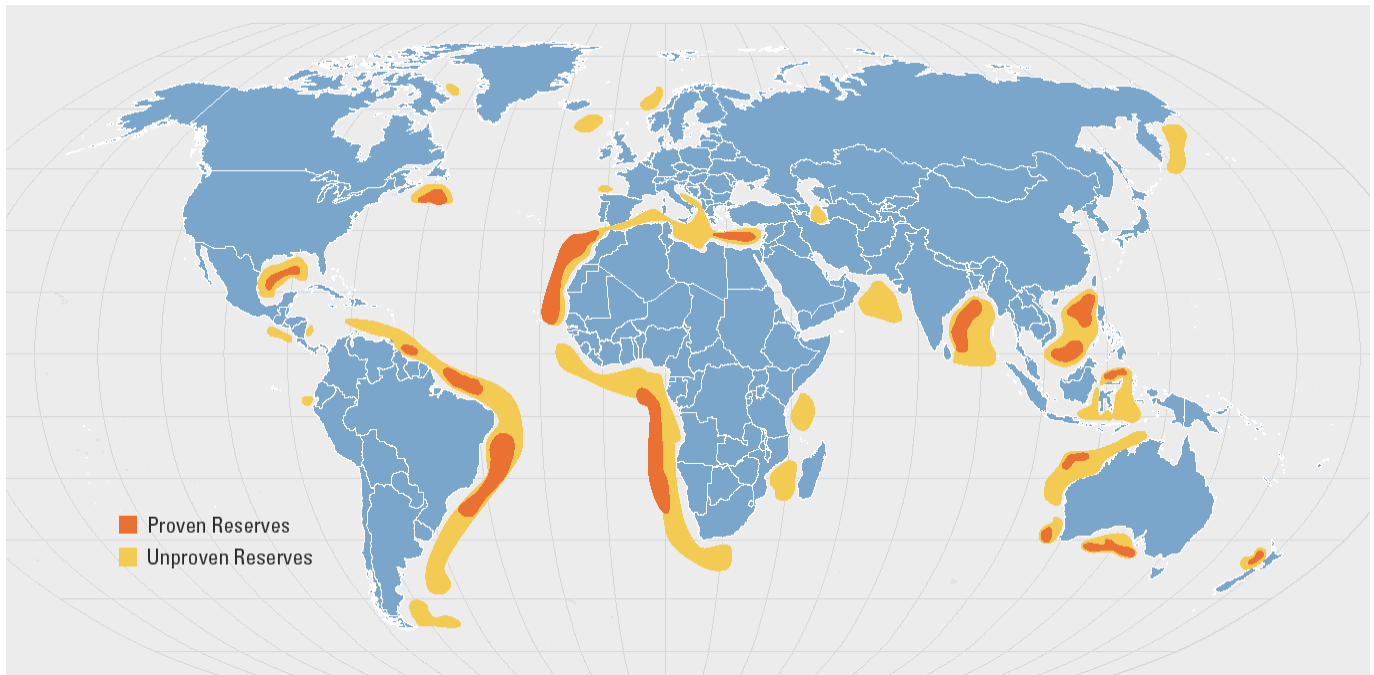




Deepwater Exploration and Production

Minimizing Risk, Increasing Recovery





This paper addresses three challenges that have the greatest effect on deepwater projects: reduction of risk by pre-planning; salt drilling; and maximizing production once an operator's payzone is on line.

Deepwater exploration, development and production present unique challenges to operators, and minimizing risk and maximizing recovery are among their top priorities. With average worldwide rig day rates remaining higher than \$300,000 (drillships and semisubmersible rigs), there is no room for unexpected costs resulting from nonproductive time.

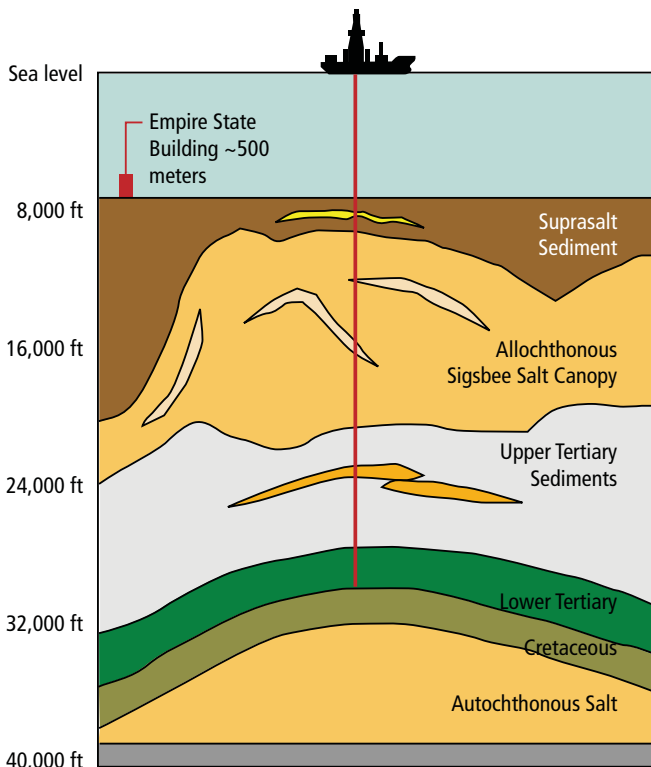
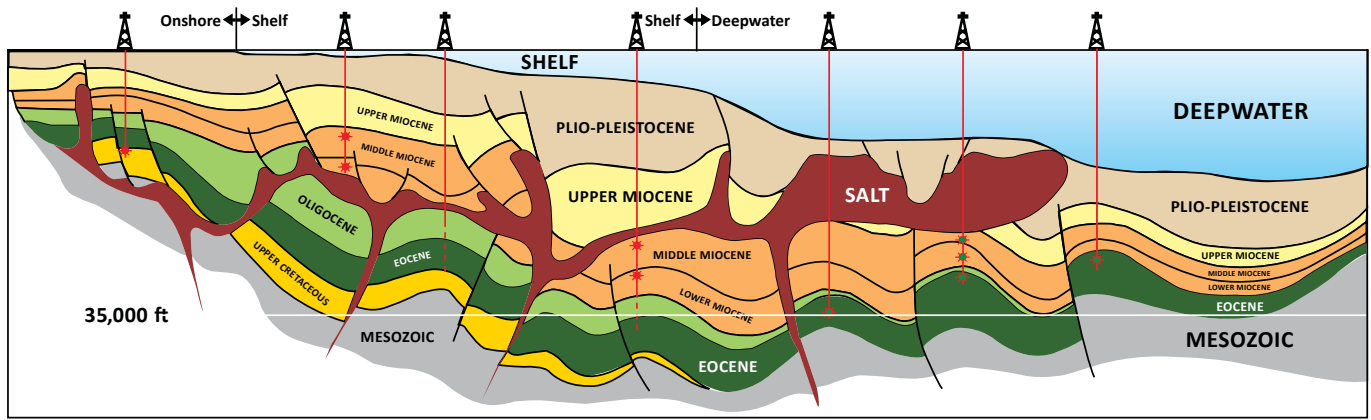
Developing a deepwater reservoir requires planning and proven, dependable expertise to achieve the most efficient and flawless execution possible in some of the most difficult formations and complex wells. When savings of millions of dollars can be gained, operators look for solutions that work and the people that can provide them.

At Baker Hughes, we've been supporting the development of oil fields for more than a century—starting with the introduction of the first offset bit. Since then, we've grown into a leading provider of oilfield solutions with a global footprint with dominant market share in the largest deepwater areas, including Brazil, the Gulf of Mexico and West Africa.

Baker Hughes' deepwater experience is comprehensive, built upon provision of drilling and evaluation services, bits, drilling fluids, completion services, artificial lift and chemicals.

In the Gulf of Mexico alone, the following demonstrate why Baker Hughes is recognized as a deepwater leader:

- Conducted more than 172 fracture and gravel pack treatments
- Installed more than 250 liners
- Drilled more than 127,000 feet of salt with its bits, motors and rotary steerable systems
- Drilled more than 270,000 feet of salt using Baker Hughes drilling fluids



Conceptual model – ultradeep onshore to shelf to deepwater

Reducing Risk, Increasing Confidence

Planning often predetermines the final outcome of a project. However, the quality of the planning process affects both the drilling and completion costs as well as ultimate recovery.

Baker Hughes' planning is based on its global experience in deepwater and ultra-deepwater projects, which enables more knowledgeable and targeted identification and mitigation of risks/hazards associated with varied projects. For example, the company has developed the OASIS process, which captures the professional experience of its certified engineers to plan the fine details of drilling an operator's well. From matching the best drill bit to an optimal bottomhole assembly, to modeling complete well paths and pore pressure trends using offset and target well descriptions, Baker Hughes can provide detailed recommendations based on best practices developed through hundreds of other deepwater projects it has worked on all around the world.

After a well has been drilled, the same planning expertise is applied to the evaluation and completion phases. The Baker Hughes deployment risk management process quantifies, communicates, and mitigates risks in deepwater wireline logging operations. Getting stuck or not being able to get a wireline tool string down in a deviated hole are the types of challenges for which Baker Hughes develops contingency plans ahead of time, minimizing nonproductive time at the wellsite.



Overcoming the Fear of the Unknown in Salt Drilling

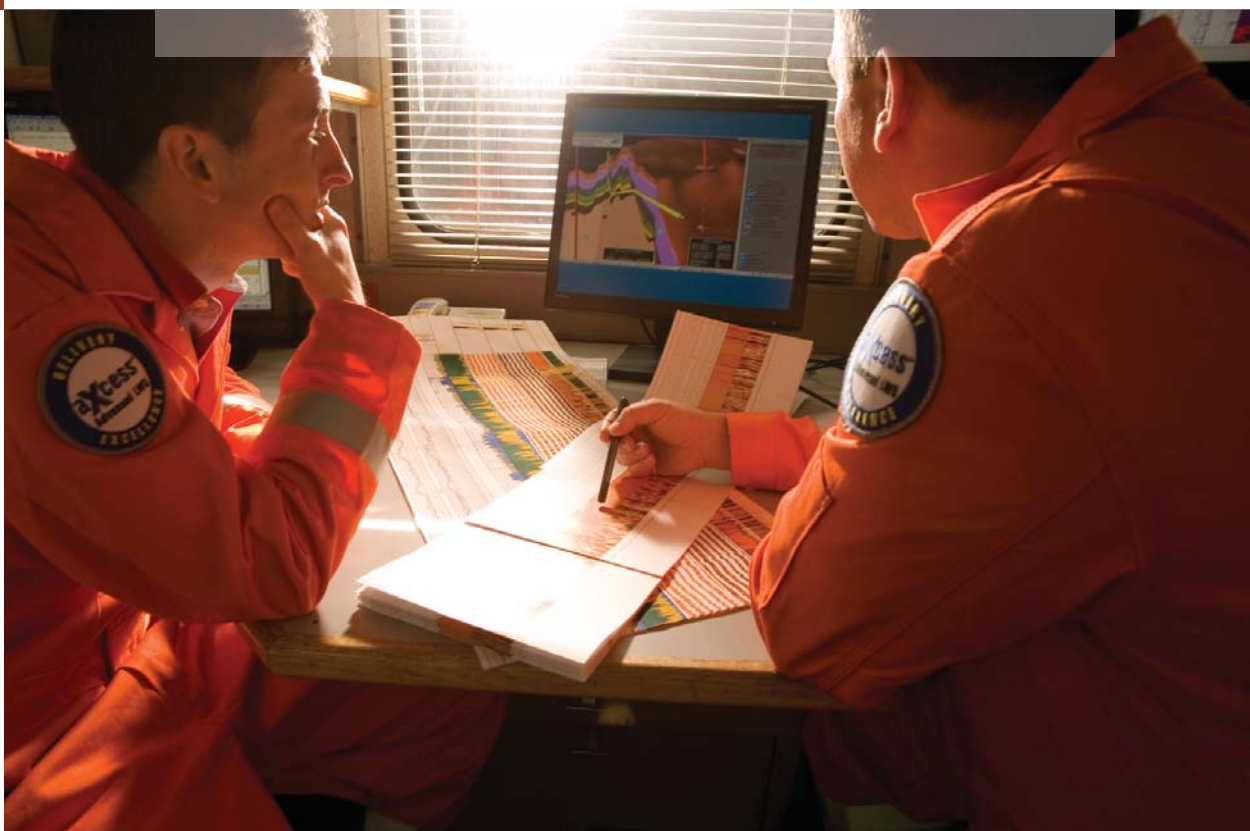
Since the earliest days of exploration, salt has been associated with hydrocarbon deposits in onshore and offshore basins. In the 1920s, initial seismic and gravity methods helped in delineating salt domes. Operators usually drilled around these structures because there was a lack of understanding and, considering the available technology and limited experience at the time, a well-founded fear of the unknown.

Today, Baker Hughes can deliver an integrated plan that matches the right bit with the right fluid with the right drilling systems. This ability often delivers results in fewer days than planned in the operator's Authority for Expenditure (AFE) program by decreasing nonproductive time or increasing the rate of penetration.

The benefits of Baker Hughes' experience are shown in the following key performance indicators from an exploratory well in the Gulf of Mexico Mississippi Canyon:

- 11,530 feet total vertical depth of salt drilled
- 79 feet per hour average rate of penetration
- 34-percent improvement over AFE
- 0.1 degree of inclination maintained to simplify casing and completion runs
- \$5.27 million savings, as estimated by the operator

Another deepwater challenge is tight pore and fracture pressure margins. A cornerstone of the Baker Hughes Reservoir Technology and Consulting Group, GeoMechanics International, models pressure and fracture gradients using highly advanced software tools and techniques. Our logging-while-drilling capabilities allow real-time updating of these models to anticipate and correct for dangerous changes. Operators avoid surprises while maximizing wellsite safety.





Maximizing Production and Return on Investment

The innovation and experience of Baker Hughes are also evident in its completion systems. Tapping into this expertise and technology allows operators to capture stranded assets that would often be left in place, or to gain incremental revenue by accelerating their existing production rates.

For example, the deepwater-proven, exclusive InForce™ hydraulic intelligent well system allows the management of multiple production zones with fewer control lines. The operator can extract more reserves from zones that pay, while isolating those that don't, at the push of a button without intervention.

Avoiding the shutdown of production for intervention saves operators, on average, \$10 million.

Another problem causing drop-offs or shutdowns in production rates are gas hydrates. Baker Hughes FATHOM™ Certified production chemicals treat the flowline and help the operator avoid costly surprises in the production phase. Pre-qualification for umbilical service and testing for material compatibility ensure that you get the right chemicals for the project.

As part of its comprehensive technologies, Baker Hughes also provides its in-house artificial lift capabilities for improved deepwater production.

Artificial lift is often necessary in green fields where the flowing wellhead pressure equals the system resistance. By boosting or assisting the wellhead pressure, Baker Hughes can help the operator realize additional and faster production in a new field.

In a mature field, Baker Hughes subsea electrical submersible pumping (ESP) system boosting can help you achieve incremental production.

Whether you are interested in mudline boosting applications, in-well dual ESP completions, or even increasing your flow from inside your production risers, Baker Hughes has a variety of proprietary tools and systems to help you increase your return on investment.

Baker Hughes gives you the confidence to conquer your fear of deep water.

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