Deepwater Developments Focus of Mumbai Workshop

Deepwater discoveries and development plans are expanding from well-established regions like the US Gulf of Mexico (GOM) to frontier regions such as offshore India, but there is a lag in experience that must be filled. An SPE Applied Technology Workshop (ATW) in Mumbai titled "Deepwater Development" aimed to do that, by bringing together a multidisciplinary, multinational group of 117 oilfield professionals to exchange ideas in the area of deepwater project planning and execution.

Workshop Steering Committee Chairperson N.K. Mitra of Oil and Natural Gas Corporation (ONGC) welcomed all delegates and presented an overview titled "Deepwater: An Indian E&P Perspective." He highlighted India's deepwater potential, which includes 1.35 million sq km of sedimentary area containing 10 billion bbl of reserves. He described ONGC's successful deepwater drilling effort at Sagar Samridhi in August 2003 that resulted in the discovery of the G-1, GS-15, and Vashishtha fields, which are scheduled to begin production in 2010–2012. Challenges preventing further deepwater developments in the region include drilling and completion technical hurdles, flow assurance, and a resistance to changing mind sets.

In the keynote address that followed, A.K. Balyan with ONGC saw an urgent need to increase deepwater exploration and development off the coast of India to stem its dramatically increased petroleum import bill. This will require increased cooperation among all players in the areas of reservoir management and drilling, as well as further technology optimization.

ONGC's R.S. Sharma, the chief guest of the ATW's inaugural session, pointed to nonavailability of deep- and ultradeepwater drilling rigs as driving rig costs to stratospheric levels, and estimated that each second of lapsed drilling activity at a site costs USD 146. He felt that the speed of technology development has not been keeping pace with industry needs, and placed emphasis on the areas of deepwater equipment standardization, technology for high-pressure/high-temperature (HP/HT) wells, and smart completions.

Case Histories

The first technical session reviewed two deepwater case histories. The first outlined the planning and execution of the Shell NaKika project in the US GOM.

Integration of several new deepwater technologies from various disciplines and an integrated team of experienced people, from subsurface planning to operations, were the keys to the success of the NaKika project.

The second case study reviewed StatoilHydro's overall deepwater development and management philosophy which gives high priority to efficient inspection, maintenance, and repair. The Kristin field, with a three-stage overpressure protection design, is an example of StatoilHydro's experience with HP/HT wells.

Deepwater Appraisal

The next session highlighted ways to develop an accurate understanding of a deepwater asset prior to making major investments.

Ashok Dixit and Grant Paterson with Weatherford International discussed the challenges inherent in deepwater asset modeling, including a lack of efficacy in mathematical models at extreme temperatures and pressures, accurately calculating the possible formation of hydrates and other flow-assurance obstacles, and capturing accurate field data for history matching. To measure these data, they recommended optical monitoring systems, which are flexible systems that monitor pressure, temperature, and flow and phase fractions in a wide operating range with no downhole electronics.

Mrityunjay Kumar of Shell India next discussed the importance of pore-pressure prediction in providing better assessments of a play or prospect; safer drilling operations; and an improved business impact with regards to exploration, appraisal, and development.

Deepwater Wells

The third technical session reviewed well-construction, completion, and intervention technologies.

Gerald Heisig of Baker Hughes, UAE elaborated on deepwater construction issues. He stressed that activities should be focused on reducing nonproductive time and should start at the planning phases. Technologies to optimize drilling time include real-time borehole imaging, formation-pressure testing while drilling, and bit resistivity. A systematic approach to collecting and using the right data and an integrated knowledge-management process are also necessary.

While discussing deepwater well completions, Tomaso Ceccarelli of Schlumberger, Malaysia explained how the use of standalone expandable screens saves rig time during installation. The proper selection of valves and packers can also save time.

Kris Ravi of Halliburton stated that successful deepwater cementing can only occur with cementing fluids designed to help prevent shallow water flow and hydrate destabilization, as well as provide zonal isolation for the life of the well. Benefits include a reduction in nonproductive time; improved economics; and improved health, safety, and environmental standards.

Facilities

The fourth technical session discussed issues affecting the selection of field-development scenarios.

Stein Christensen and Vikas Thakur of SINTEF Rock and Soil Mechanics Division, Norway reviewed SINTEF's 30-year deepwater geotechnical experience. They explained the challenges in obtaining accurate soil samples from deepwater fields for better understanding of their behavior. They stated that geotechnical challenges can only be adequately addressed with proper development of soil models and computational tools, well-equipped laboratories and engineers, and experience transfer from other fields.

Shankar Bhat of DeepFlex provided an overview of deepwater platforms and water-depth limits, as well as the differences between dry-tree and wet-tree systems. Dry-tree systems are ideally suited for classic and new generation tension-leg platforms and spars in up to 1500 and 2500 m of water, respectively. Wet trees (production trees placed at the seafloor) are connected to floating production, storage, and offloading vessels in up to 2500 m water depth. The criteria for deciding on the system include water depth, well access requirements, the availability of pipeline infrastructure, gas-disposal requirements, metocean conditions, and anticipated field life.

Production and Operations

The fifth technical section outlined flow assurance, slug control, and hydrate mitigation in deepwater production.

Abhinav Goel of SPT Group explained hydrate and wax formation and their mitigation measures. Hydrates are solid compounds composed of water molecules in a cage-like structure encapsulating small-chain hydrocarbons (C1 to C5), and waxes are straight-chain paraffins that precipitate from the oil at the right conditions of pressure and temperature to form a gel. Both cause flow-assurance challenges, even blocking wells and pipelines. Mitigation measures for hydrates include dehydration with methanol or monoethylene glycol, and employing low-dosage hydrate inhibitors if the expected subcooling is not high. Wax-mitigation methods include insulation, pigging, and the use of wax inhibitors.

Stuart Mackay of Schlumberger, Australia discussed production management, focusing on sandface measurements. Mackay said that miniaturized sensors deployed onto the sandface of deepwater subsea multistage completions provide real-time reservoir temperature data that is converted by reservoir analysis software into a flow profile.

Deepwater 2020

A panel of speakers provided their thoughts on the future of deepwater development in the last session.

Ramashish Rai of India's Directorate General of Hydrocarbons gave an overview of India's potential to help meet the projected demand of 380 million metric tons of oil by 2025. There are a total of 26 sedimentary basins covering an area of 3.14 million sq km in India, with 15 explored or under exploration. Rai mentioned that in the latest bidding round of India's New Exploration Licensing Policy, there are 31 discoveries—26 gas and the rest oil—with the potential for 4.2 billion bbl of oil and oil equivalent in 12 commercially viable basins.

Rabi Bastia of RIL India provided a perspective on the global outlook and potential of deepwater projects. Bastia estimated that recent discoveries have helped establish a total of 77 billion bbl of oil and oil equivalent reserves. Of the total offshore reserves only 8% is classified as deepwater. He felt that this number could increase significantly as more companies begin exploring deeper waters. To achieve production from ultradeepwater fields in greater than 3000 m of water, technology developments such as better pore-pressure prediction techniques, safer drilling standards, and advanced completion and stimulation techniques must continue.

Klas Eriksson presented Aker Kvaerner's perspective on the benefits of subsea multiphase boosting for increasing the economic lifetime of deepwater fields. The benefits of boosting vary with water depth, stepout distance, and crude composition, but generally boosting increases well flow rate and production lifetime. Eriksson discussed Aker's successful installation of a twin screw multiphase pump at the BP King Field in the US GOM.

Shell's Tom McAlister provided a brief journey through the development and adaptation of deepwater technologies from the early 1970s to today. He touched on advances in logging, enhanced oil recovery, platform construction, development of 3D-seismic techniques, and extended-reach drilling as giving the industry greater confidence in moving into deeper waters. McAlister said that a major future challenge for the industry will be to develop more complex reservoirs with a workforce that is shifting to younger, less experienced engineers. **JPT**