Reservoir Monitoring Using Permanent In-well Seismic

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We look at the benefits of placing permanent seismic sensors in a wellbore and recording data over time, either passively or with dedicated surface sources. Implementation involves placing an array of sensors permanently in a well along with the completion string. Challenges include recording data over fluid-flow noise in the well (production or injection) and reliability of the sensors and associated hardware. Applications include 4D imaging and monitoring of reservoir properties, both stand-alone and in conjunction with surface seismic, and mapping of faults and other features using micro-seismic events. Recently, a fibre-optic based system has been created for permanent emplacement in wellbores. This system has been tested with two field trials and 2006 plans are in place for production well installations. In addition flow noise tests in a test well examines the system for de-coupling the sensors from the tubing and borehole noise and demonstrates how the system can record data during production of a well.

Improving Recovery Factors in Central Sumatra Basin Indonesia Shaly Sand Reservoirs by Horizontal Drilling

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Petani Field is located in the Central Sumatra Basin of Indonesia and has produced 346 MMBO since its discovery in 1968. Most of that oil has come from high-quality Lower Miocene sands of the Sihapas Group. However, significant bypassed oil remains in lower-quality reservoirs whose recovery is typically in the 14% range. To facilitate and develop strategies to economically exploit these reserves, a 3D geocelluar model of reservoir architecture and properties distribution was made and used as a guide to further development. This model indicates distinct trends of estuarine, sand ridge, and margin facies throughout the field that reflect paleogeography. Reservoir properties and saturations were geostatistically populated within the model. The primary objective was to delineate the volumes and areas of remaining oil for use in developing a recovery strategy. Horizontal wells were chosen as the preferred alternative to provide connectivity among reservoir layers and improve production and ultimate recovery by three or more times over conventional vertical wells or frac jobs. Further reservoir characterization and validation of the geologic model was performed after which a 16-horizontal well project was developed and executed. The program was very successful with only two wells disappointing by excessive water production. A post-drill analysis suggests these two wells suffered uncertainty related to faults along the well bore acting as water conduits and/or improper ECP installation. Production from the project is approximately 3-4 more than vertical wells could achieve and predicted ultimate recovery has improved from 14% to 28%.

The "Cossack Pioneer" Oil Fields: New Subsurface Insights after Eleven Years on Production

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At end-2001, the “Cossack Pioneer” oil fields, situated on Australia's North-West Shelf, had produced more than half the then-booked reserves, while continuing to produce with little or no water-cut and minimal decline. An upward revision of reserves was clearly indicated, but seismic mapping consistently gave field sizes too small, and performance data were too immature to predict reserves.

The Wanaea, Cossack, Lambert and Hermes oil fields are produced via the “Cossack Pioneer” FPSO. Production commenced in 1995, and totals 321 MMbbl at end-2005. Light oils are reservoired in turbidite sands of the Tithonian Angel Formation, whose high permeabilities allow for individual well productivities of up to 40,000 bbl/d.

An intensive subsurface study was undertaken to better understand the size and recovery efficiency of each field, in order to update field development plans towards a realistic end-of-field-life. Work began with seismic data quality, which has been notoriously problematic at reservoir level. The Demeter high-density 3D survey was acquired in 2003, providing much-improved bandwidth and multiple suppression. This allowed more confident mapping of the fields, leading to: significant STOIIP gains; field structures less compartmentalised than previously mapped; and decreased incentive for appraisal drilling to reduce uncertainty. Furthermore, a number of development drilling opportunities emerged. Subsequent data gathering (5 new wells, interventions, developing water-cuts), combined with updated static and dynamic modelling/history matching, confirmed highly efficient sweep of the reservoirs. Recovery factors of 50-80% were indicated – far higher than previous estimates.

Technical Competency Assessment - A Strategy to Optimize the Value of Human Resource Assets

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Competent people are a company's most important asset; an essential pre-requisite to enhance reserves and increase production with innovative technology. The challenge is to establish a talented staff base. In addition to the problem of the industry-wide “maturing” workforce, further issues exist in organizations reengineering themselves from regulatory bodies into highly competitive international operators.

A sustainable future depends upon the ability to hire and develop national staff in significant numbers to successfully manage assets. This is made difficult by university systems which offer sound fundamental science programs, but where masters programs with applications training are locally inaccessible. Bringing new staff up to speed is further complicated by the switch from traditional departmental structures, to asset teams where cross-disciplinary skills are essential.

Development programs for both entry-level and mid-career staff must be carefully planned with emphasis on fast learning of essential skills.
Optimizing training investment requires an appreciation of required tasks plus understanding individuals' competency. This allows companies to accelerate delivery of focused training in essential technology and understanding the breadth and depth of their technical expertise.
Technical competency assessment is an objective, systematic process for measuring knowledge and experience. The goal is to identify technical strengths and gaps as they align with business/technical needs. The results steer training programs, build job descriptions, benchmark capabilities against competitive standards, and create career ladders.
This paper will focus on utilizing competency assessment techniques, using case studies to highlight advantages and pitfalls in the assessment process, and in developing staff and organizational technical capability.

A Global Toolkit for Maximizing Production from Shallow Litharenite Gas Reservoirs: A Case History from the Vidora Field, Southwest Saskatchewan, Canada

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Shallow biogenic gas production from muddy sandstones (litharenites) within the Upper Cretaceous Medicine Hat and Milk River Formations in southeastern Alberta and southwestern Saskatchewan has been continuous since the early 1900's. This immense multi-TCF biogenic gas play has continually expanded with time due in part to new technologies, increasing commodity pricing and new exploration concepts. The Vidora field is a southeasterly extension of this area, with emerging production from the Milk River Formation. The presence of numerous erosional surfaces within these strongly bioturbated sandstones offer considerable challenges to properly stimulating and producing economic gas rates from this type of formation. In an effort to better understand this complex reservoir and to maximize future well production a recent drilling program was undertaken to recover approximately 190 meters of wireline retrieved core from two wells. Specialized geophysical logging tools were then run in these and a number of offsetting wellbores to further calibrate the geophysical logging responses and provide additional geomechanical and lithological information. Data collection included standard porosity and permeability measurements, XRD determinations for whole rock analysis and clay mineralogy, SEM examination of clay and other minerals affecting pore throat geometries, as well as thin section work to visualize porosity and the influence of bioturbation. Samples were also collected to calibrate the dipole sonic log for frac modeling purposes. Information acquired included Young's Modulus and Poisson's Ratio (both dynamic and static), fracture toughness, and the pore elastic constant. The results of this work and ensuing economic benefits will be presented.