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The Value of PRM in Enabling High-Payback IOR

Innovative uses of seabed seismic technology will help operators glean billions from new and mature fields. High-potential returns with low risk and lower lifetime cost of ownership are increasingly attractive.

Contributed by TGS

Increasing the hydrocarbon recovery factor from a producing reservoir will make a significant economic contribution, according to TGS. In Norway it is estimated that a 1% increase in the recovery rate for operating fields will increase oil production by approximately 570 MMbo, according to a recent white paper. Assuming an oil price of US $94 per barrel, the gross sales income from such an oil volume is approximately 53 billion, the paper predicts.

The use of 4-D seismic on the Gullfaks field has been estimated by Statoil to have provided value creation of 990 million; the total value creation from 4-D seismic over the last 10 years is estimated at more than 3.6 billion, the paper notes.

The number of seabed multicomponent time-lapse (4-C/4-D) seismic permanent reservoir monitoring (PRM) systems will increase in the years ahead as successive surveys on the six existing and three planned PRM installations in the North Sea, Caspian, and Brazil fulfill their promise to deliver significant additional recovery. Asset managers who have studied the results know that the benefit of on-demand 4-D seismic over the life of the field far outweighs the cost. To help overcome the inertia that can block operators in other regions from accessing these benefits, TGS offers innovative feasibility, seabed risk mapping, and illumination studies that ensure effective project delivery and mitigate the potential geoscience and operational risks associated with a PRM installation.

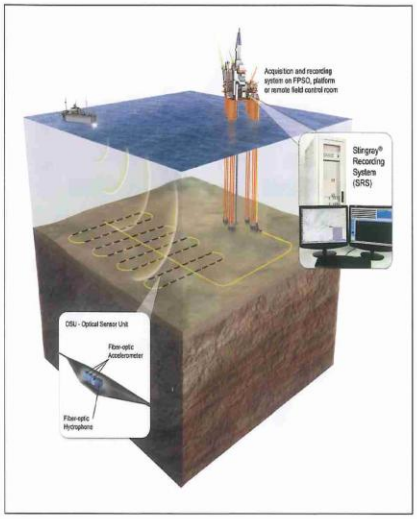
A PRM system requires about the same level of investment as one deepwater well. Yet PRM investments are often seen as major projects with high technical and commercial risk. In fact, early adopters now understand that a PRM system is considerably less risky than a deepwater well. They have learned that a well-designed PRM system will deliver a substantial reward. The PRM prize can reach a return on investment of five to 25 times the cost of the investment, with "super high-definition" field-wide reservoir attributes being delivered quickly and frequently such that they can impact all aspects of IOR programs.

PRM systems enable informed reservoir management decisions that impact five significant drivers of improved recovery:

- Better in-field exploration;
- Improved well placement;
- Optimized completions;
- Fracture monitoring from active and passive microseismic; and
- Flood front monitoring.

Geoscientists and engineers managing fields with PRM systems are experiencing these benefits because they are not limited to the data quality of a towed survey. By leveraging 4-C/4-D data, they can map minute pressure changes, monitor saturation and phase changes, and manage reservoir drainage. With these inputs, production can be optimized with better planning of infill drilling locations, improved sweep efficiency and, most importantly, accurate knowledge of what is going on between the wells. Drillers are even taking advantage of permanent seismic array data to understand geomechanical rock properties and monitor cuttings disposal beds to avoid overcharging them.

In common with experience in the telecommunications industry, the latest PRM systems use fiber-optic technology that has been qualified to deliver a 25+ year life in deep water. The proven optical sensors in TGS' Stingray arrays have a low noise floor and a 180-dB dynamic range. Cables are lightweight, with simple and reliable connectivity rigorously tested and qualified to military standards. With no subsea electrical power requirements, the seabed array is connected through a riser cable to a compact acquisition and recording unit situated on surface facilities or an FPSO or tied back to a remote host facility up to 500 km (311 miles) away.



This image shows a typical Stingray PRM system array layout. PRM systems are as expensive as a deepwater well but are considerably less risky. (Image courtesy of TGS)

Unlike all other alternative methods, permanent sensors installed on the seafloor minimize the impact on existing oilfield infrastructure and enable highly repeatable time-lapse seismic imaging in and around obstructed zones. PRM systems are much less costly over the life of the field and present a significantly lower health, safety, and environmental risk. Since many mature offshore fields have low recovery factors, the question asset managers ask is no longer, "Why 4-C/4-D PRM?" but instead, "Why not 4-C/4-D PRM?" ■