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## **Rock Physics for Seismic Oil Detection and Recovery Monitoring**

The worldwide volume of already discovered but unrecovered oil is by now enormous - on the order of the oil that still remains to be discovered. On average, only 25% of discovered oil is being recovered in the world, whereas 65% to 75% is considered recoverable. Consequently, improved oil recovery especially in old giant fields is emerging as a major target for oil producers worldwide.

One of the main reasons for the widespread poor oil recovery is subsurface reservoir heterogeneities of the rock properties that control production and fluid flow: permeability, porosity, rock and fluid compressibility, fluid saturation, fluid viscosity, etc.

Because reservoir parameters generally vary from place to place in an oil field, or change with time during oil and gas production they often lead to observable changes in measured seismic attributes in the volume subject to production. Consequently, it should be possible - provided we develop the appropriate technology and techniques - to delineate or map the distribution of subsurface fluids and monitor their movement with time from surface seismic and repeated surface seismic measurements, and from sonic and repeated sonic logs.

Rockphysics can enable geophysicists to provide means to significantly help improve recovery, in both new and old fields. The reason for this optimism is that seismic wave velocities and attenuation in most sedimentary rocks are sensitive in various ways to the state of porous rocks, the fluids in their pores, and the state of these pore fluids.

Because the economics of recovery monitoring appear very encouraging, it is conceivable that in the future many large but relatively unproductive fields will require a continuous monitoring treatment to maximize recovery. This prospect provides both a challenge as well as a great opportunity to geophysics and reservoir engineering both in industry and in academia.