

Passive Seismic Monitoring Technologies: A Promising Innovation Tool for Detection of Hydrocarbon Accumulations and Reservoir Monitoring
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There still exists a time gap between the availability of the new energy substitutes and the remaining potential hydrocarbon (HC) reserves. This implies technological innovations and massive investment in petroleum exploration and extraction also.

In this framework, infrasonic passive differential spectroscopy (IPDS) is a technology for direct detection of hydrocarbon reservoir independently of the trap type: structural or non. Non-structural traps (NST): stratigraphic, lithologic, morphologic, diagenetic and traps of differential compaction are difficult to be recognized on seismic profiles, while they are becoming identifiable when they are accumulated in a porous reservoir medium by the IPDS. Less than half of the known petroleum in the world occurs in exclusively structural traps, the remaining part is occurring in NST, pure or combined, especially stratigraphic traps.

The IPDS is based on the principles that the HC reservoir as a multi-fluids system in porous medium has an unconventional non-linear transfer characteristic for acoustic waves. Hydrocarbons in porous system can be detected as a characteristic deformation of the natural earth noise spectra within the acoustic low frequency range 0.1-10 Hz. HCs are excited/activated by external field of elastic vibration, where HC pass in generation of its proper infra-acoustic waves.

Described features distinguish the IPDS as outstanding technology for detecting and monitoring HC accumulation in the sub-salt horizons also. Here, reflection seismic has serious limitations for revealing structures and traps as prospects for exploration.

The IPDS technology provides detailed spatial hydrocarbon distribution, reservoir delineation and monitoring (being HC or CO₂ reservoirs) and reliable estimation of hydrocarbon potential. Assessment hydrocarbon remaining potential in old or under exploitation fields is highly valued for any EOR/IOR project, as well as for better orientation of horizontal drills for field development. Passive seismic/IPDS reservoir monitoring results correlated to field production data in the Pre-Caspian basins, among many other case studies is enough convincing of the promising future of this technology.

Economically, the IPDS technology is extremely advantageous as compared to seismic surveys, though this innovative tool is to be considered as complementary tool to seismic investigations contributing to considerably reduce the exploration risk.