

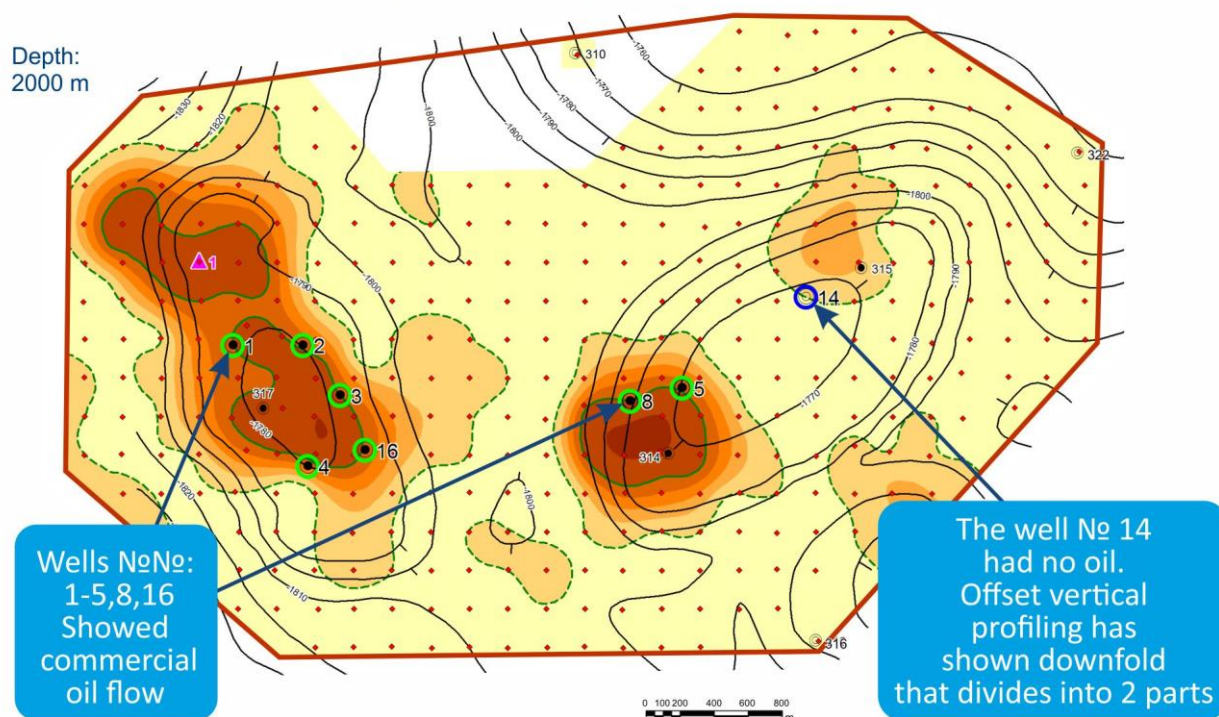
Low-Frequency Seismic (LFS)

Discovering and exploration of hydrocarbon saturated reservoirs

It is a DHI (Direct Hydrocarbon Indicator) methodology that is easily applicable, cost effective and environmentally friendly and a robust alternative to find untapped oil-gas deposits from matured or brown fields. LFS method can be applied for geophysical prospecting for oil & gas, detailed surveys on the oil & gas fields, delineation of oil & gas fields, optimization of exploration and production drilling. In addition, it can be implemented in situations, where conventional practices would not be an option, either due to block size, active seismic waves energy penetration issues, budget limitations, accessibility and/or environmental restrictions. The technology process includes acquisition, data processing and interpretation.

LFS has already been applied extensively to different geological and geographical situations, wherein the success ratio in solving tasks of hydrocarbon prospecting and exploration is about 85%. 126 wells out of 148 drilled based on the LFS results confirmed the forecast.

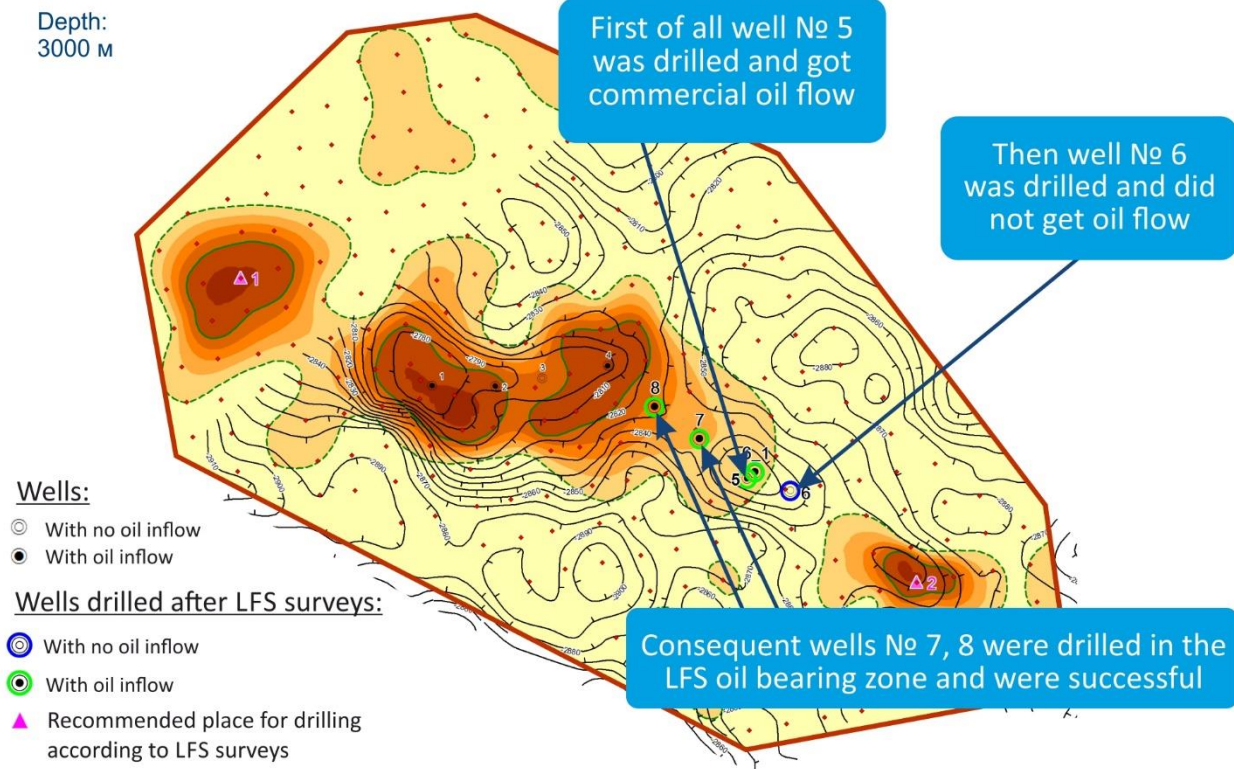
Hydrocarbon potential map



LFS uses natural low-frequency (0.5-10 Hz) vertically oriented P-waves. The accumulated pre-processed spectrum of registered on the surface signal is considered as the result of filtering the ambient background waves by the geological media, i.e. the amplitude-frequency characteristic (AFC) of the media.

Due to the mechanics of fluid-saturated, fractured and porous media, oil and gas reservoirs have high dispersion of velocity and high attenuation at low frequencies. A thin layer of oil/gas reservoir with high attenuation amply reflects the low-frequency P-waves that is why it transforms AFC of the media under observation point on the ground surface. This makes it possible to identify oil and gas deposits using observations from the surface by highly sensitive low-frequency equipment and using the original processing and interpretation software.

Hydrocarbon potential map



The advantages include: (a) high efficiency, (b) Identification of non-structural deposit types, (c) conducting surveys in regions difficult to access; (d) surveys in an area of 30 sq.km with 300-400 observation points can be processed in two months i.e. 1 month for data acquisition and 1 month for processing and interpretation; (e) ecological cleanliness (without explosives, chemicals and drilling).

Since 2005, more than 170 projects have been completed with a total area of more than 3,200 sq.km.

In 2016, an OFFSHORE project for the company ROSNEFT near Sakhalin Island was completed. The results were reported together with the client at an international conference EAGE "Geomodel-2017".

The partners of Gradient CJSC in Russia are the largest oil and gas companies ROSNEFT, LUKOIL, GAZPROM, TATNEFT and many small private oil&gas companies. Our regular partners outside of Russia are various divisions of the Indian state company ONGC.