# Characterization of Unconventional Reservoirs
# (5-day course)

With the conventional hydrocarbon resources growing thinner, unconventional plays comprising heavy oil/bitumen and shale gas are being exploited and looked at as the next resource that could be used for the hydrocarbon needs in the near future. As both heavy oil/bitumen and shale gas are a global resource, they are fast becoming an asset base for many energy companies. Economical development of heavy oil/shale gas reservoir requires accurate characterization of the rocks as well as the fluids contained therein.

As heavy oil properties are different from conventional oil, its exploration and production requires special seismic strategies and rock physics models. Geophysical characterization of heavy oil reservoirs is therefore at the heart of production of this resource. The high viscosity of heavy oils hinders their displacement in the reservoirs and also present challenges in production. The different methods of production that overcome these challenges and their applicability play an important role in the overall production scenario. The transportation of heavy oil and the impact of heavy oil production will also be discussed.

Shale gas is being considered a transition fuel that could reduce greenhouse gas emissions. However, shales can have remarkably different properties (very low permeability and porosity) and so impact the production from them. Some shale plays are self-contained petroleum systems where the source rock is the reservoir and seal. In others hydrocarbons may be produced from sandstones or carbonates that are inter-bedded with shale. Besides, different factors such as mineralogy, stress states, burial history, elastic properties, and pore network development make each shale gas play unique and hence the need for accurate reservoir characterization.

This course has been designed to provide a practical knowledge and understanding of the techniques and concepts that are used in heavy oil/shale gas reservoir characterization.

## Learning Outcomes

After attending this course the participants will be able to:

- Understand the differences between the different kinds of oils based on their API.
- Learn about the geological origin of heavy crude oils.
- Learn about the structural composition of the different kinds of heavy oils.
- Learn about the different ways to characterize heavy oil formations.
- Carry out rock physics analysis that has a bearing on the choice of the method for reservoir characterization.
- Know the details of the different methods used for heavy oil production.
- Lean about the impact of heavy oil exploration and production on the environment.

- Use seismic attributes for mapping the features of interest.
- Learn how in certain cases oil and gas production are correlated with low curvature attribute regions.
- Understand how rose-diagrams generated from seismic attributes could be used to study the orientation of structural orientations.
- Understand the application of brittleness (derived from AVO attributes) for scaling curvature attributes to obtain more meaningful results.
- Identify azimuthal velocity and AVO anomalies and learn how they are used to predict open fractures.
- Learn the use of azimuthal acoustic impedance volumes for mapping fractures and stress field.
- Understand the estimation of seismic stress fields.
- Learn about the challenges that are still ahead in terms of heavy oil/shale gas formation characterization.

## Who should attend?

- Seismic interpreters who wish to extract meaningful information from their data
- Seismic processors who want to find out different ways to characterize heavy oil/shale gas formations
- Stratigraphers and structure geologists who use 3D seismic volumes to prepare detailed reservoir models
- Reservoir engineers who want to understand about the seismic input to add detail to 3D reservoir models