TG09

Unconventional Gas and HP-HT reservoirs : overview of main challenges and use of 4D seismic and geomechanics as a monitoring and risk mitigation tool

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SUMMARY

The development of unconventional gas resources (tight gas reservoirs, gas shale, coal bed methane), including HP-HT prospects, poses many challenges to the petroleum industry in terms of sweet spots identification, drilling and stimulating wells, petrophysical characterization and reservoir monitoring. Geomechanics is recognized as a fundamental tool to address some of those challenges.

This presentation is structured in two parts. The first part will show Total's workflow in dealing with UGR and HP-HT reservoirs which is the fruit of extensive R&D efforts and field experience. The second part will show how time-lapse (4D) seismic can be used in both quantitative and qualitative manners to better understand and predict the behavior of HP-HT gas fields during depletion. The presentation will focus on two main topics :

- An integrated workflow that combines results from 4D seismic inversion, geomechanics modelling and reservoir simulations in a shared earth model
- Application to the Elgin and Franklin HP/HT fields located in the UK Central Graben of the North Sea :
 - o Interval time-shifts using an in-house warping method
 - o A coupled faulted reservoir and geomechanical models to determine both the stress redistribution within and around the reservoir including associated reactivated fault slips, and to derive synthetic 4D time-shifts with the help of a rock physics model
 - o Closing the loop by achieving reasonable match between the observed and the synthetic 4D time-shifts.

This integrated study proved to be a useful tool for progressing understanding of the reservoir and production behaviour of the Elgin and Franklin Fields, with the ultimate goal being identification of new drilling targets, mitigation of casing integrity risks, safe infill drilling.