Engineering of Resource Plays for Technical Professionals (G003)

Tutor(s)

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Overview

This course presents the terminology, methodology and concepts of drilling, completion and reservoir engineering as applied to unconventional resource plays, including oil-rich shales, gas shales and coal-seam gas. It will cover the latest practices as well as discuss future directions in unconventional resource engineering. Case studies are used to illustrate particular challenges presented by these plays. The environmental impacts on air and water resources are considered. Participants will learn to become more effective members of multi-disciplinary resource evaluation teams by developing a solid understanding of appropriate engineering concepts and terminology.

Duration and Logistics

Classroom version: A 3-day course comprising a mix of lectures (70%), case studies (20%) and exercises (10%). The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Five 4-hour interactive online sessions presented over 5 days, including a mix of lectures (70%), case studies (20%) and exercises (10%). A digital manual and hard-copy exercise materials will be distributed to participants before the course.

Level and Audience

Intermediate. The course is designed for technical professionals and managers who want to understand the role of the engineer in resource play projects. In particular, geoscientists, petrophysicists and drilling, completion and stimulation engineers would benefit from the course.

Objectives

You will learn to:

1. Discuss aspects of reservoir, drilling, completion and stimulation engineering with engineering members of unconventional project teams.
2. Contrast engineering approaches to conventional and unconventional projects.
3. Assess resource estimates, production forecasts and economic evaluations for unconventional plays.
4. Review the sampling procedures adopted by reservoir engineers.
5. Predict the hydrocarbon phase change in reservoirs.
6. Assess the demand for and disposal of water associated with fracturing and producing unconventional reservoirs.
7. Assess the impact of unconventional projects on air quality.
8. Discuss recent advances in the optimization of resource plays.

Course Content

Introduction

- Overview of unconventional resources
- Geological and geochemical considerations for resource shales

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- Horizontal well drilling
- Multi-stage hydraulic fracturing
- Micro-seismic monitoring

Sampling and laboratory measurements for shale

- Sampling techniques and field measurements of fluid content
- Porosity and pore size measurements
- Permeability measurements
- Storage and flow characteristics of resource shales
- Pore size considerations for hydrocarbon storage and transport
- Multi-phase flow in tight formations

Reservoir engineering

- Hydrocarbon recovery from kerogen pores
- Volumetric calculations for natural gas reservoirs
- Material balance for natural gas reservoirs
- Pressure transient regimes in hydraulically fractured horizontal wells
- Rate-transient and pressure-transient models and their applications
- Production history-marching and forecasting
- Fracture Net Present Value (NPV) and Discounted Return on Investment (DROI) calculations
- Decline curve analysis using Arp’s equation
- Estimated ultimate recovery of production well

Future directions in unconventional resource engineering

- New trends in drilling and completion technologies
- Enhanced hydrocarbon recovery technologies for shale
- Environmental considerations, including water resources management, groundwater protection and waste-water disposal