N406: Unconventional Resource Assessment and Valuation
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Summary
This course provides the strategies, tactics, and tools needed to effectively assess and value oil and gas resource plays. Probabilistic techniques and a staged approach are applied to make good decisions about which projects to invest in and how to wisely spend limited capital. This is critically important, given the risks and uncertainties inherent in these plays, as well their technical complexities and limited datasets.

Learning Outcomes
Participants will learn to:

1. Use probability as a language for communicating uncertainty, including the use of log-probability plots to effectively display distributions.
2. Quantify the mean and variance of parameters such as in-place volumes, initial well rates, and ultimate recoveries.
3. Understand the key risks and uncertainties inherent in appraising and developing unconventional reservoirs.
4. Estimate the chances of geologic and economic success.
5. Understand the impact of aggregation, the use of confidence curves, and the utility of sequential aggregation plots to assess project performance.
6. Grasp the elements of probabilistic production forecasting, including the aggregation of production volumes to the project level.
7. Understand the unique practices and pitfalls of estimating resources and Reserves in unconventional reservoirs.
8. Use decision trees and value-of-information exercises to make better decisions about what data to acquire.
9. Use limited datasets and imperfect information to better quantify the range of possible outcomes.
10. Apply a stage-gate process to maximize value by assuring focus on the right risks and uncertainties at each stage.

Duration and Training Method
A five-day classroom course with classroom lectures, discussions, exercises, and a capstone project incorporating the course concepts.

Who Should Attend
This course is intended for geoscientists, engineers, commercial team members, business analysts, and managers charged with creating value from their unconventional resources.

Prerequisites and Linking Courses
N313 (Evaluating Resource Plays: The Geology and Engineering of Low Permeability Oil and Gas Reservoirs) is a prerequisite unless the individual has a thorough understanding of the technical fundamentals of resource plays gained through several years of work experience.

Additional insight into resource plays at a Basic Application level is presented in N184 (Unconventional Resources: The Main Oil Systems) and N259 (From Outcrop to Subsurface: Understanding and Evaluating Shale Resource Plays).
More advanced coverage may be found in a number of courses, including:


Engineering focus: N944 (Shale Gas and Shale Oil Completions Using Multi-Staged Fracturing and Horizontal Wells) and N973 (Reservoir Engineering for Unconventional Gas and Tight Oil Reservoirs).

Please refer to the Unconventional Resources Competency Map on our website for a complete listing of related courses.

Course Content

Day 1 focuses on the key risks and uncertainties faced in assessing unconventional reservoirs and then turns to the fundamentals of probability as a means of communicating uncertainty. Day 2 begins by improving our ability to estimate under uncertainty and then applies these techniques to estimate in-place volumes and the chance of geologic success. Day 3 focuses on the principles of aggregation and applies these to production forecasting and resources & reserves estimation. Day 4 shows how decision trees and value-of-information approaches can help us, followed by discussions of how we can make better decisions with limited data and how projects should be assessed using a decision stage approach. The course concludes on Day 5 with a Capstone exercise that encompasses the concepts covered in the course.

Day 1

- Introduction
  - Determinism vs. probabilism
  - Failure to attain production and value in unconventional reservoirs
  - The need for a decision-stage approach
- Work Processes and Deliverables in Unconventional Reservoirs
  - Key risks and uncertainties to consider
  - Data to gather and analyze
  - Work to undertake, associated deliverables, examples
- Probability, Distributions, and Dependencies
  - Definitions and distribution types, measures of central tendency and dispersion
  - Use of log-probability plots
  - Correlations and dependencies

Day 2

- Estimating Under Uncertainty
  - Use of probabilistic ranges
  - Impacts and mitigation of bias
  - Making multiple independent estimates
- Estimating In-Place Volumes
  - Dealing with input uncertainty
  - Determining gas-in-place in a high graded area (exercise)
Day 3

- Aggregation Principles
  - How aggregation works and its impact
  - Developing and using aggregation (trumpet) plots, confidence curves, and sequential aggregation plots
  - Modelling uncertainty around the mean initial rate (UaMIP)

- Quantifying Production Forecast Uncertainty
  - Comparison of empirical and model-based methods
  - Steps for building production type-curves
  - Quantifying forecast uncertainty

- Estimating Resources and Reserves in Unconventional Reservoirs
  - Resources other than reserves (prospective, contingent)
  - Reserves (PRMS, COGEH, SPEE Monograph 4)
  - Probabilistic methods for undeveloped reserves (SPEE Monograph 3)

Day 4

- Decision Trees and the Value of Information
  - Coin flip value of information (game)
  - Using perfect vs. imperfect information
  - Use of Bayes theorem and examples

- Making Better Decisions with Limited Data
  - Building EUR envelopes using log-probability plots
  - Montney Shale and Permian Wolfberry reservoir exercises

- Decision Stage Assessment
  - Project stages and relevance
  - Objectives and tactics associated with each stage
  - Economic modeling and portfolio ranking

Day 5

- Utopia Shale Capstone Exercise
  - Sweetspot mapping, petrophysics, and STOIP estimation
  - Selection of completion techniques and production type curves
  - Using confidence curves to optimize the number of pilot wells to drill
  - Calculation of expected value and bidding for leases
  - Drilling of winning team’s wells and exercise debrief