N572: Petroleum Economics, Risk, Uncertainty and Resource Assessment

Instructor(s): Pete Smith

Format and Duration

Classroom - 5 Days
Virtual - 10 Sessions

Summary

The course focusses on the fundamentals of estimating risk and uncertainty to improve decision making and introduces both probabilistic and deterministic approaches. Included, is the examination of factors contributing to uncertainty throughout subsurface, drilling, facilities, production cost and economics. The underlying conjecture is that if a greater understanding of risks and uncertainty can be developed then unwanted surprises in delivering estimates of production, reserves and value can be lessened.

Business impact: Participants in this course will develop an understanding of **economic evaluation techniques** and their **related financial concepts** that are used in business to assist **decision making** in the face of **risk and uncertainty**. This will allow **volumes** to be converted to **value** and an **assessment** can be made of whether, for example, additional reservoir appraisal is worthwhile.

Learning Outcomes

Participants will learn to:

1. Illustrate what is critical to the business decision-making process.
2. Understand the basics principles of economic analysis such as the time value of money, discounting, and other project cash flow measures.
3. Calculate the economic indicators Net Present Value and Rate of Return along with the Cost of Capital (Weighted Average Cost of Capital).
4. Understand risk ranking and bow-tie models to manage risks through project life.
5. Assess the sources of the wide range of data which contribute to the understanding and development of hydrocarbon reservoirs, their use and associated uncertainty.
6. Develop decision trees to lay-out the logic and evaluate the robustness of the decision.
7. Recognize the various types of heuristics and biases and be able to distinguish between them.
8. Practice through exercises on range and probability estimation the need to keep ranges wide as possible.
9. Evaluate how to combine uncertainties for projects at different stages of the E&P lifecycle and select key variables in a probabilistic evaluation to manage uncertainty by acquiring additional data (appraisal) or design of interventions (contingency) within a Value of Information framework.
10. Understand Bayes theory and illustrate pertinence when evaluating risk mitigation cost.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussion, case studies, and practical exercises.

Who Should Attend

The course is designed for reservoir / petroleum / production / facility / drilling engineers, geoscientists, team leaders and managers.

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Course Content

This course will explain the concepts of petroleum economics, how to manage risk and uncertainty, the human biases involved, and how to make better business decisions

Part 1

- Heuristics Questionnaire
- Introduction
- Petroleum economics
- Principles of cash flow analysis and discounted cash flow
- The concept of Value
- Basic process of economic evaluation, inflation, time value of money, nominal & effective interest rates, discounted cash flow, net present value (NPV), internal rate of return (IRR), profitability index (PI), cumulative net cash-flow
- Estimating Capex and Opex
- Fiscal analysis – tax models (royalty-profit models and production sharing contracts)

Part 2

- Heuristics & biases theory
- Heuristics of probability estimation - ground rules for estimation
- Making decisions – use of decision trees/ link between studies and decisions
- Business decisions
- Risk management Bow-Tie Models
- Exploration risking
- Estimating probabilities - improving estimates by calibration
- Finding a deterministic value that represents a distribution

Part 3

- Analysis of the tools required to evaluate the worth of a business opportunity - building the financial model
- Economic indicators from the cashflow
- Gas price negotiation exercise
- Bayesian revision - Value of additional data
- Mitigation techniques - Bayes Theory
- The value of Information-Value of Study, cost of delay, opportunity cost
- The value of appraisal or intervention
- The value of planning and flexibility

Part 4

- Risk and uncertainty fundamentals and definitions
- Influence Diagrams and the Boston Squares to identify key risks
- Estimating ranges - improving estimates by calibration
- Decisions with uncertainty - probability distributions and basic statistics
- Combining uncertainties
- Statistics and distributions - key types and parameters
- Combining distributions - Parametric method
- Combining distributions – Monte-Carlo Method - impact of portfolio choices

Part 5

- Resource assessment - categorization and classification of petroleum resources
- Correlations and dependent variables – how best to incorporate them
- Sensitivity models for reserves and production – estimating uncertainties
- Importance - which variables to focus upon
- Production forecasting – uncertainties in quarterly/annual forecasts
- How to improve the estimation process by learning – train wrecks
- Risk management
- Cost uncertainty
- Timing uncertainty - schedule uncertainty and Critical Path Analysis
- Summary of course and close-out