



N014: Petroleum Economics and Risk Analysis

Tutor(s): Mark Cook/David Palmer

5 Days

Competence Level:
Basic Application



Classroom Course

Computer Usage

Summary

Business Impact: This course will provide attendees with methods to identify and incorporate **subsurface facilities and commercial uncertainties** into an **economic evaluation** of a project. Additionally, it will provide practice with tools with which to **manage the associated risks**, thereby **reducing the investor's exposure to financial downside** while **taking advantage of potential upside**.

This course details the main financial concepts and economic evaluation techniques and related financial concepts that are used in the oil and gas upstream business to assist decision making on either the investment of capital or the divestment of assets. The course will be focussed upon the conversion of hydrocarbon volumes to 'monetary value' and the requirement for consistent means of determining both the absolute and relative attractiveness of investment opportunities, from exploration, through appraisal and new field development to portfolio management decisions.

Learning Outcomes

Participants will learn how to:

1. Employ the principal elements and techniques of Petroleum Economics.
2. Analyse wider trends that determine worldwide hydrocarbon reserves, supply and demand pressures, and possible trends for the future.
3. Illustrate how Petroleum Economics is critical to the project decision-making process.
4. Analyse the nature of discounted cash flow, Net Present Value, Rate of Return indicators, and the Cost of Capital.
5. Demonstrate how Profitability and Efficiency are measured for a project, including the role of inflation.
6. Distinguish the various Petroleum Fiscal Systems in operation around the world (tax and royalty-based, PSC's).
7. Examine more fully, and from a wider perspective, how projects are screened and ranked economically.
8. Perform sensitivity analysis within the ranking and screening process, along with risk and its quantification.
9. Employ decision trees in analysing business opportunities at various stages of the upstream field life, from exploration through to late life development opportunities.
10. Use TRACS MCAApp or @RISK® and Precision Tree® software for Monte Carlo simulation and decision tree analysis.
11. Apply quantitative risk analysis tools, such as the Bow Tie model, to identify and manage project risk and to capture actions on a risk register.
12. Apply the principles of Portfolio Management when faced with multiple E&P investment options.

Duration and Training Method

This is a five-day classroom course comprising of a mixture of lectures and practical exercises some of which use bespoke software tools.



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Who Should Attend

Subsurface professionals of all disciplines (geoscientists, engineers and managers) involved in the E&P process who wish to obtain an understanding of petroleum economics, and those who are transferring from a technical discipline into the world of commercial evaluation.

Prerequisites and Linking Courses

A working use of Excel is required (including an understanding of formula use and basic Excel functions).

Upon completion of this course possible follow up courses could include N006 (An Introduction to Reservoir Engineering), N412 (A Critical Guide to Reservoir Appraisal and Development), N425 (Play Analysis for Targeted Prospect Identification) and N995 (Managing Uncertainty and Risk in Appraisal and Development).

Course Content

This course will explain the petroleum economics techniques that are applied in the oil and gas business to assist decision making on either the investment of capital or the divestment of assets. This course will focus on the conversion of hydrocarbon volumes to 'dollars' and the requirement for consistent means of determining the attractiveness of investment opportunities, from exploration, through appraisal and new field development to new field developments to portfolio management decisions. The course materials include many exercises to embed the principles of petroleum economics and some related financial concepts across the E&P asset life cycle. A feature of this course is the use of AGR TRACS MCAApp tool for Monte Carlo simulation.

Introduction

- The global oil and gas industry; distribution of reserves; world supply and demand; trends for the future
- The role of petroleum economics in decision making

Development Economics

- The input required for constructing a project cash flow (exercise)
- Principles of cash flow analysis
- Constructing the project cash flow (exercise)
- Indicators from the undiscounted project cash flow (exercise)
- Petroleum Fiscal Systems ; tax and royalty, Production Sharing Contracts
- The principles of discounting
- Discounted cash flow (exercise)
- Indicators from the discounted cash flow (NPV, IRR)
- Use and abuse of EXCEL to calculate NPV, IRR
- Calculating the cost of capital (weighted average cost of capital)



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- Profitability indicators and efficiency ratios (exercise)
- Project screening and ranking (exercise)
- Sources and measures of inflation
- Incorporating inflation into the project economics (exercise)
- Understanding real terms, money of the day, Internal Real Rate of Return
- Sensitivity analysis and spider diagrams (exercise)

Incremental Economics

- Defining an incremental project
- Analysis of incremental project economics; alternative methods
- Risking incremental projects; appropriate discount rates
- Operational decision making (2 exercises)

Risk and Uncertainty Analysis

Defining Uncertainty and Risk; Statistician's vs Practitioner's View

- Identifying relevant parameters which exhibit uncertainty
- Expressing uncertainty as probability distributions
- Basic statistics
- Distribution types (normal, triangular, log-normal, etc.)
- Dependent and independent variables (Bayes theorem)
- Combining uncertainties
- Monte-Carlo methods, parametric methods
- Getting to know AGR TRACS MCAApp (or @RISK) for Monte Carlo simulation (exercise)

Exploration Economics

- Understanding and incorporating exploration risk (cased study based exercise)
- Introduction to gambling theory exercise
- Introduction to decision tree analysis (exercise)
- Exploration ranking using expected monetary value EMV (exercise)
- Exploration risking (exercise)
- Detailed decision tree analysis
- Use of MCAApp to create P90, P50, P10 estimates
- Combining continuous distributions with decision tree analysis

Economics of Appraisal

- The objectives of appraisal; Value of Information (VOI) concepts
- VOI calculations in appraisal (exercise)
- Appraisal planning for maximum value (exercise)



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Heuristics - Human Bias in Uncertainty Estimation

- Identifying human bias
- The impact of human biases (examples)
- How to manage human bias

Risk and Uncertainty in Development Planning

- Causes and consequences - the Bow Tie Model (exercise)
- Managing risk - the risk register and action plan (exercise)

Portfolio Management

- Portfolio management theory
- Why and how companies diversify in the oil industry
- Managing a group of assets; use of Boston Consulting Group matrix (group exercise)
- Use of comparative indicators: NPV/bbl, net income per day
- Presentations for the groups on portfolio recommendations