Project Economics and Investment Risk Analysis: Monte Carlo, Decision Trees and Real Options

4 – 15 January 2027
Amsterdam - Zuidas business district hotel



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Introduction:

Capital-intensive organisations commit large sums years before first revenue, yet many investment decisions still rest on a single-point NPV built on one price, one cost estimate and one schedule. Project Economics under uncertainty closes that gap. This Core Concept programme trains evaluation staff to model project cash flows under general fiscal terms, test value against price and cost drivers, and quantify risk with Monte Carlo simulation, decision trees and real options. Week one builds deterministic and probabilistic evaluation skills; week two adds decision analysis, stage-gate governance and portfolio allocation, ending with a Probabilistic Economic Model and Investment Case.

Course Objectives:

- Build a project cash flow model for a capital project that applies fiscal terms, escalation and discounting conventions consistently
- Calculate and interpret NPV, IRR, discounted payback, maximum cash exposure and capital efficiency metrics in line with the maturity of the cost and schedule estimates
- Test investment value against price, market and cost drivers using scenarios, tornado charts and breakeven analysis
- Run Monte Carlo simulations with defensible input distributions and correlations, and report P10, P50, P90 and expected value
- Value flexibility and further information using decision trees, value of information and real options analysis
- Rank projects in a capital-constrained portfolio and present a probabilistic investment case at a stage-gate decision

Target Audience:

- Economists and evaluation staff who build cash flow models for capital investment proposals
- Planning and investment analysts who prepare stage-gate submissions and portfolio reviews
- Asset and project managers accountable for the economic performance of developments in oil and gas, energy, mining and infrastructure
- Cost engineers and estimators who supply capex, opex and schedule inputs to economic evaluations
- Finance business partners who review and challenge investment cases before approval
- Portfolio and capital allocation staff who rank competing projects under budget constraints

Course Outline:

Day 1: Capital Project Economics Foundations and the Cash Flow Model

- Project Economics Scope: Capital, Operating and Abandonment Cash Flow Phases
- Real Versus Nominal Cash Flows and Escalation Index Selection
- Discounting Conventions: Mid-Year, End-Year and Reference Date
- Incremental Cash Flow Logic: Base Business Versus Project Case
- Project Cash Flow Template Layout: Inputs, Timeline and Output Sheets

Day 2: Fiscal Terms, Economic Indicators and Estimate Maturity

- Fiscal Regime Types: Royalty and Tax, Production Sharing and Service Contracts in General Terms
- Contractor Take, Government Take and Tax Depreciation Schedules
- NPV, IRR, Discounted Payback and Maximum Cash Exposure Indicators
- Capital Efficiency Metrics: Profitability Index, NPV per Unit Capex and Unit Technical Cost
- AACE 18R-97 Cost Estimate Classes and Schedule Estimate Maturity

Day 3: Price Scenarios and Deterministic Sensitivity Analysis

- Commodity Price Deck Construction: Forward Curves, Consensus and Low-Base-High Cases
- Market and Demand Scenario Narratives for Energy, Metals and Infrastructure Tariffs
- One-Way Sensitivity Runs and Tornado Chart Construction
- Spider Plots, Breakeven Price and Threshold Capex Calculation
- Correlated Scenario Design and Common Sensitivity Pitfalls

Day 4: Probabilistic Analysis Tools and Input Data

- Probability Distributions for Reserves, Capex, Opex and Schedule Inputs
- Expert Elicitation Protocols and Bias Controls for Range Estimates
- Monte Carlo Simulation Setup in Spreadsheet Add-Ins: Iterations, Seeds and Convergence
- Correlation Matrices and Dependency Modelling Between Inputs
- P10, P50, P90 and Expected Value Outputs with Cumulative Probability Curves

Day 5: Week-One Case: Deterministic and Probabilistic Evaluation

- Gas Processing Plant Case: Cash Flow and Fiscal Model Assembly
- Open-Pit Mine Expansion Case: Price Deck and Tornado Analysis
- Solar Farm Case: Monte Carlo Run and S-Curve Interpretation
- Expected Monetary Value Comparison of Development Concepts
- Evaluation Memo Drafting and Peer Challenge

Day 6: Decision Trees, Value of Information and Real Options

- Decision Tree Construction with Chance and Decision Nodes
- Rollback Analysis and Risk-Adjusted Expected Value
- Value of Information and Value of Control for Appraisal Wells, Pilots and Surveys
- Real Option Types: Defer, Expand, Phase, Switch and Abandon
- Binomial Lattice Valuation of an Expansion Option

Day 7: Stage-Gate Governance and Investment Assurance

- Stage-Gate Decision Framework: Identify, Select, Define, Execute and Operate Phases
- Gate Deliverables and Decision Quality Checklist
- Cognitive Bias Audit: Anchoring, Overconfidence and Optimism in Estimates
- Independent Project Review and Economic Model Audit Protocol
- Contingency and Management Reserve Setting from Probabilistic Outputs

Day 8: Communicating Probabilistic Results to Decision Makers

- Investment Committee Paper Structure for Probabilistic Economics
- Visualising Uncertainty: S-Curves, Fan Charts and Probability Bands
- Partner and Co-Venturer Alignment on Economic Assumptions
- Downside Exposure and Risk Appetite Briefing for Non-Specialist Boards
- Challenge Session Rehearsal: Defending P50 Versus Expected Value

Day 9: Portfolio Ranking, Capital Allocation and Post-Investment Review

- Portfolio Ranking by Capital Efficiency and Risk-Adjusted Value
- Efficient Frontier Portfolio Optimisation Under Capital Constraints
- Capital Allocation Scorecard and Budget Cycle Integration
- Post-Investment Review: Forecast Versus Actual Capex, Schedule and NPV
- Estimate Accuracy Benchmarking and Forecast Performance Tracking

Day 10: Capstone: Probabilistic Economic Model and Investment Case

- Capstone Data Pack Review for an Own-Organisation or Sector Project
- Full Probabilistic Economic Model Build with a Monte Carlo Engine
- Decision Tree and Real Option Overlay on the Base Model
- Investment Case Drafting with a Gate Recommendation
- Investment Case Presentation to a Mock Investment Committee

Skills You Will Gain:

- Project Cash Flow Modelling
- Fiscal Terms Analysis
- Capital Efficiency Assessment
- Price Scenario Design
- Monte Carlo Simulation
- Decision Tree Analysis
- Real Options Valuation
- Portfolio Capital Allocation

Why Attend This Course:

- Return with a Probabilistic Economic Model and Investment Case built on a capital project from your own organisation or sector
- Replace single-point forecasts with P10, P50 and P90 ranges that investment committees can compare across projects
- Put a value on appraisal, pilot and phasing choices before capital is committed
- Compare evaluation practice with economists and analysts from oil and gas, power, mining and infrastructure

Conclusion:

Sound capital decisions depend on economics that show the range of outcomes, not a single figure. Week one moves from cash flow conventions, fiscal terms and economic indicators through price scenarios and tornado analysis to Monte Carlo simulation and a guided multi-sector case. Week two adds decision trees, value of information and real options, stage-gate assurance, the communication of probabilistic results, and portfolio ranking with post-investment review. The capstone combines these methods in a Probabilistic Economic Model and Investment Case ready for the next gate decision.