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# “Managing Risks and Strategic Decisions in Petroleum Exploration & Production”

## Detailed Course Synopsis for Days 1-3

### Day One

#### Strategic Decisions in Petroleum Firms

Managers face important decisions regarding capital and resource allocation which are influenced by any number of critical factors. Understanding the components of the decision problems faced by managers is an important element of the decision process. Seminar participants examine closely the characteristics of the strategy and capital allocation issues which confront the petroleum E&P firm.



#### Modeling and Structuring Decisions

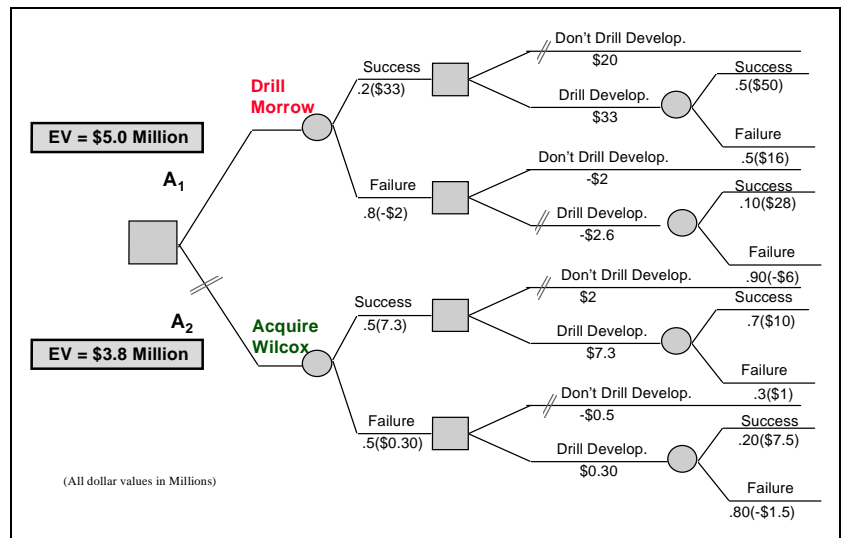
The ultimate purpose of formal decision science techniques is to *help decision makers make better decisions*. Participants are introduced to decision analysis and its application to decision problems faced by petroleum E&P managers. Participants have the opportunity to review actual problems and case studies of the decision analysis approach at oil companies worldwide. Discussion focuses on how participants can improve the quality of their E&P decisions and create value for the firm.

Topics include:

- The decision analysis process
- Measuring decision quality
- Introduction to influence diagrams
- Decision tree modeling
- Applications of decision analysis in the petroleum sector

#### Probability Concepts and Assessment

- Probability Primer
- Making Subjective Probability Assessments
- Estimating Probabilities in Exploration and Production
- Introduction to Bayesian Analysis – Incorporating New Information
- Using Statistics to Make Better E&P Decisions



## **Value of Information**

Information gathering is a normal activity associated with the E&P decision making process. To managers, the effect of this new information is to reduce the amount of uncertainty and risk. *Information only has value in a decision problem, however, if it results in a change in some action to be taken by a decision maker.* Participants will learn to apply value of information models to decisions regarding seismic acquisition, dry hole contributions, as well as other data sources utilized in E&P decision making. Participants will be presented spreadsheet applications of value of information decision models that can be utilized to improve information gathering decisions and save money.

- Information Value and Decision Making
- Value of Perfect and Imperfect Information
- Value versus Cost of Information in Petroleum Exploration
- Applications of Information Value Models in the E&P Sector
- Building Spreadsheet-Based Decision Support through the Use of Value of Information Models

## **Competitive Bidding**

Many petroleum firms compete regularly in the competitive bidding environment. E&P decision makers recognize that bid outcomes can be highly uncertain. Utilization of more systematic bid processes in the firm can improve the likelihood of winning blocks, reduce the chance of over-bidding and “winner’s curse”, and create value for the firm. It is important for decision makers to have a clear understanding of the competitive environment, estimate the likelihood of winning at alternative bid amounts, and search for the optimal bid that maximizes the firm’s value.

- Understanding the Competitive Bidding Environment
- Over-bidding and “Winner’s Curse” – Some Evidence
- Utilizing Econometric Analysis to Predict the Level of Competition
- Predicting the Winning Bid
- Utilizing Decision Analysis to Find the Optimal Bid Amount

## **Sensitivity Analysis and Simulation**

Participants will look closely at “hands-on” techniques for conducting sensitivity analysis and Monte Carlo simulation. Participants will become proficient in analyzing multiple sources of uncertainty and examining the effects of these uncertainties on firm profits. Participants will learn to simultaneously consider uncertain variables such as reserve recovery factors, productive area, drilling costs, product prices, operating expense, etc. in their economic analysis.

- Simulation Techniques
- Independent and Dependent Events in Simulation
- Introduction to Spreadsheet Based Simulation Packages
- Applying Simulation to a Exploration Prospect
- Modeling Uncertainty and Its Impact on Decision Making

## **Direct Choice Methodologies – Shortcuts to Effective Decision Making**

- Combining E&P Simulation Outputs and Direct Choice Methodologies
- Dominance Rules in Evaluating Project Uncertainty
- Examining Simple but Powerful Ranking Techniques in Project Analysis

## Day Two

### **Financial Principles and Project Valuation**

Participants are presented the fundamental concepts associated with modern financial theory and shown how to effectively link these concepts to exploration and production strategies. This module will help demystify the field of financial evaluation and provide participants a “hands-on” approach to E&P project valuation based on capital market concepts. Most important, participants will learn how to use valuation to make decisions about courses of action for their companies.

- Financial Management and Maximizing Market Value
- Efficient Financial Markets
- Cash Flows and Their Incremental Effects
- Fundamentals of Present Value Analysis
- Project Risk and Return
- Estimating Your Cost of Capital

### **An Introduction to Real Options Analysis**

Real option analysis is the newest advance in financial theory and project valuation and is particularly applicable to the petroleum exploration and production firm. Participants will learn that E&P managerial flexibility associated with capital allocation decisions is what gives options their added value. Participants will apply option pricing methods to value E&P strategies based on the flexibility they give.

- E&P Asset Options
- Abandonment Options
- Options to Defer Development
- Option to Expand
- Application of OPT to Oil Extraction

### **Diversification in Exploration and Production**

Participants will learn how diversification is an integral part of business and capital markets. They will learn how diversification works to reduce E&P risk because returns of different investments do not move exactly together. Participants will apply modern portfolio techniques to E&P decision problems and see how these techniques can be applied to their own specific decision contexts. Participants will be provided clear evidence that portfolio optimization techniques represent a valuable tool for capital budgeting.

- Diversification works to reduce E&P risk
- Systematic and unsystematic risk faced by the E&P firm.
- E&P portfolio analysis and some examples of the portfolio effect
- Constructing the “efficient” set of project portfolios
- Using linear and non-linear programming approaches for portfolio analysis

### **Limitations of Expected Value Analysis in E&P Decision Making**

In this module, participants will learn some of the common pitfalls associated with exploration risk analysis. Participants will learn, for example, that the *expected value* concept, which weights the financial consequences by their probabilities, often does not adequately take risk into account. To most decision makers, risk is more than just a function of the probability distribution of reserve outcomes or financial payoffs, but also the magnitude of capital being exposed to the chance of loss.

## Day Three

### **Modeling Risk Propensity**

Participants will be introduced to the concepts and application of preference analysis in the E&P setting. This decision analysis approach, utilized by petroleum companies, enables managers to measure their firm's financial risk tolerance, incorporate their propensity for financial risk into the decision process, and provide recommendations about the appropriate level of diversification. Participants will see actual applications at major and independent oil companies and learn how to apply the concepts to their own business setting.

- Risk Aversion - What Is It and How Do We Measure It?
- Valuing Risky E&P Projects - An Alternative Approach
- Certainty Equivalents - Bringing a "Cash Value" to an Uncertain Project
- Using Decision Analysis to Assess Risk Attitudes
- Using Preference Analysis in E&P Decision Making - Some Applications

### **Risk-Sharing and Joint Venture Analysis**

Participants are shown that the preference analysis approach provides guidance to the E&P firm in terms of the value of diversification and risk-sharing. Unlike expected value analysis, which is an "all or nothing" decision rule, the certainty equivalent approach will aid the participants in selecting the appropriate level of project participation consistent with the firm's risk propensity. Participants will be shown by examples from the E&P sector that this valuation approach provides them a formal means to quantify the advantages of selling down or "spreading the risk".

- Risk Sharing and Expected Value Analysis - Where's the Guidance?
- Risk, Risk-Sharing and Your Firm's Financial Risk Tolerance
- Finding Your Optimal Share in E&P Projects With Preference Analysis
- Constructing the Appropriate Portfolio in Light of Your Firm's Risk Policy
- Case Study: South Texas Energy Corporation

### **Managerial Perspectives on Risk and Risk Taking**

Participants will consider how managers view risk and what the impact of those perspectives are on risk-taking, project evaluation, and project selection. Participants will also become familiar with the risk adjustment practices used by petroleum companies. The seminar leader will provide additional information from the E&P industry regarding how managers perceive risk, how they adjust for risk, and how they behave in terms of making risky choices. Participants will explore the impact of such issues as:

- Do managers think of risk in a similar manner?
- Are managers generally risk takers or risk averters?
- Are managers more willing to take risks in their business decisions than in their personal decisions?
- Are older managers more risk-averse than younger managers?
- Are engineers more risk averse than geologists?
- Are CEO's more willing to take risks than junior managers?
- Do individual decision makers or firms agree on the "riskiness" of situations?

## **Measuring Corporate Risk Tolerance**

Participants will explore a number of practical methods for measuring corporate risk tolerance. They will learn how to encode the firm's risk preferences so that risky investments can be systematically evaluated in the context of the firm's risk propensity. Among the methods presented will be industry-specific questionnaires designed to elicit risk attitudes from senior management, analysis of prior project decisions, and a comprehensive empirical analysis of risk taking by some of the largest international petroleum firms.

## **Risk Taking and the Performance Implications from the Petroleum Industry**

Participants will review E&P industry evidence that firms vary significantly in their propensity for financial risk. We will examine differences in risk-taking among major and independent oil companies. Participants will be able to answer the question: "Who is taking significant financial risk and who is not?" among oil companies worldwide. Representatives from different companies will be able to explore their peer group of companies and observe how their risk-taking compares to other companies. Even more importantly, participants will analyze performance differences based on firms' willingness to take financial risk. This will enable participants to identify their firm's appropriate risk policy and make recommendations about implementing that policy in their firm setting.

- Corporate Risk Tolerance and the Major Oil Companies
- Making Comparisons Among Your Peer Group
- Some Implications About Risk Tolerance and Firm Size
- The Risk Tolerance Ratio (RTR) - A Relative Risk Propensity Measure
- Risk Tolerance and the Performance Implications
- Communicating a Risk Policy in Your Organization

## **Integrating E&P Business Strategy and the Capital Allocation Process**

Participants will learn methods to integrate two functions that are often very separated in the petroleum exploration firm - business strategy and capital allocation. The approach presented is designed to enable participants answer the very fundamental question: "*What mix of new and ongoing decision opportunities is most appropriate to achieve your firm's set of stated goals and objectives?*" It does so by explicitly relating the capital allocation process to the firm's stated strategy with regard to issues such as *geographical concentration, acquisition (development) of new core areas, exploration, and exploitation of mature assets* (including divestiture), etc. In other words, participants will learn an approach that enables them to act on their business strategy. Participants will discuss an actual case study and application that:

- Provides a means to identify and evaluate a larger set of potential opportunities
- Links those opportunities and decisions with the company's objectives and goals
- Formalizes the risk analysis process such that managers understand the risk implications of their choices concerning partnerships and diversification
- Provides a technique to evaluate the E&P firm's position relative to its strategic plan
- Improve the overall quality of investment decisions and ultimately create value for the firm.

## **Industry Overview**

Petroleum exploration and production firms enter the 21<sup>st</sup> Century in an increasingly competitive and risky business environment. Under those circumstances, managers have a growing need to adopt better and more systematic decision processes that explicitly embody the firm's objectives, desired goals, and resource constraints. Managers, for

example, are regularly confronted with the issue of allocating scarce capital among a set of available exploration, development and acquisition opportunities.- opportunities generally characterized by high degree of financial risk and uncertainty. Because these decisions are among the most conceptually difficult to make, managers are compelled to utilize the most advanced techniques to guide their project and portfolio evaluations. Moreover, in modern capital and business markets the link between strategic and financial decision making has become more and more important. Consequently, firm managers must focus as never before on the value their corporate and business level strategies are creating. Efforts to build linkages in the petroleum firm between strategy and finance issues must involve the entire organization -- the impact on mitigating risk and improving performance can be significant.

### **Course Background**

This training course is a practical, hands-on approach to modern techniques in risk management and strategic decision making for all aspects of petroleum exploration and production -- including prospect evaluation, resource allocation, diversification and risk-sharing, corporate planning, and strategy development. Participants are presented an advanced set of decision science and strategy techniques and shown how to implement these techniques in their own E&P business setting to enhance the value of the firm. The seminar is a concentrated four-day course of study based on the premise that individuals learn most effectively through an active analysis of realistic business situations. Through a carefully designed sequence of lectures, case study, and discussion, attendees actively participate in the study of business situations faced by managers in oil companies. Participants are guided through hands-on exercises to familiarize them with the analytical and problem-solving techniques. Particular emphasis is given to computer-based technologies for decision support. Under the experienced guidance of the seminar leader, participants learn how to integrate the theories and practical procedures presented into their own specific “real-world” problem contexts.

### **Course Objectives**

- Understand the characteristics of strategy and capital allocation issues which confront the E&P firm.
- Learn how to most effectively apply an advanced set of decision science and strategy techniques to their specific business situation.
- Understand the importance of risk-sharing and diversification in project selection.
- Measure, manage, and control financial risk.
- Understand the performance implications of your firm’s risk taking actions.
- Learn to act on your E&P business strategy through the capital allocation process

## **Immediate Benefits of Attending**

In this four day seminar you will improve your own skills in risk management and strategic decision making. We will show you how to apply practical and proven methods that will enable you to:

1. *Apply risk assessment and analysis techniques to your specific business situation;*
2. *Incorporate multiple E&P objectives into your risk analysis and decision process;*
3. *Employ state-of-the-art asset and project evaluation techniques;*
4. *Utilize a portfolio analysis approach to allocating scarce capital and resources.*
5. *Provide managers clear guidelines on making choices among risky projects;*
6. *Measure the value of seeking additional information before you pay for it;*
7. *Organize objectives into a systematic framework to evaluate investment alternatives;*
8. *Measure, interpret, and implement your firm's unique risk tolerance level;*
9. *Show clearly how improving E&P decision making can create value for your firm;*
10. *Identify and create new decision opportunities for improving exploration activities;*
11. *Develop concepts and techniques you can apply to your job....immediately.*

## **Is This Course For You?**

If you are a manager in the petroleum exploration and production industry, these issues are of concern to you:

- How do you quantify the notion of “risk” in your E&P analysis?
- What are the pitfalls and deficiencies associated with expected value analysis and other risk-adjustment methods?
- What are the appropriate techniques for measuring and managing the financial risks associated with E&P?
- How can you integrate multiple E&P objectives into your risk analysis and capital allocation process?
- What is the relationship between a project's risk and your firm's cost of capital?
- How do you define an E&P business strategy that is consistent with your company's goals and benchmarks?
- How can you effectively communicate and implement a consistent E&P risk policy?
- How can you account for political and environmental risk?
- How do you improve the quality of your firm's E&P decisions?

## **Who Should Attend**

- Petroleum exploration managers
- Geological and geophysical managers
- Economics and planning personnel
- Financial analysts
- Project evaluation personnel

- Vice presidents of exploration and production
- Finance directors
- Corporate executives specifically responsible for corporate risk activities
- Bankers responsible for petroleum financing activities
- Representatives from oil ministries responsible for resource development

### **Expanded Vita**

Dr. Walls holds a B.S. degree in geology from Western Kentucky University, an M.B.A. in Finance and a Ph.D. in Management from the University of Texas at Austin. Dr. Walls is a professor of Mineral Economics at the Colorado School of Mines in Golden, Colorado and founder and Managing Director of Strategic Systems Group, a Denver-based decision consulting firm.

In his consulting work, Dr. Walls has advised extensively in the areas of risk analysis and strategic planning to oil companies such as Texaco, Phillips Petroleum, Amoco, Petrobras Petroleos Brasileiro, PDVSA, Ecopetrol, Cabot, Westport Resources, JM Huber, Devon, Schlumberger, and Anadarko Petroleum. Among these engagements, Dr. Walls has advised a major integrated oil company on risk management policy and systems design for managing exploration risk in the capital allocation process. He has also developed a multi-criteria portfolio planning model for another company that evaluates E&P projects based on the firm's major business objectives. Dr. Walls has provided assistance to an international group of exploration directors from a major oil company in developing a capital allocation model for risky investments, and recently undertook a study of corporate risk taking at another company in order to provide the firm guidance on the appropriate risk policy for worldwide exploration decisions. Dr. Walls brings a combination of business expertise, industry knowledge and technical superiority which has proven outstandingly effective to clients in developing strategies, allocating resources and managing risk.

Professor Walls has a significant level of teaching experience in executive programs as well as in-house briefings for oil and gas professionals at numerous international petroleum firms. Dr. Walls has conducted his petroleum industry course in risk management since 1989 and is well known for introducing sophisticated decision making and risk management techniques in a manner that is understandable and applicable to a broad range of decision contexts. His "hands-on" knowledge and experience regarding the problems and decisions facing petroleum managers provides seminar participants a unique perspective for solving complex E&P problems.

Dr. Walls is recognized as an industry authority on the application of risk and investment theory to the petroleum industry. He has published extensively in the fields of decision and management science. Included among his many publications are:

- "Risk Propensity and Firm Performance: A Study of the Petroleum Exploration Industry" published in the prestigious international journal, *Management Science*;
- "Decision Analysis of Exploration Opportunities in the Onshore U.S. at Phillips Petroleum Company" published in the management applications journal, *Interfaces*;

- “Corporate Risk Tolerance and Capital Allocation: A Practical Approach to Implementing an Exploration Risk Policy” published in the *Journal of Petroleum Technology*;
- “Combining Decision Analysis and Portfolio Management to Improve Project Selection in the Petroleum Exploration and Production Firm”, *Journal of Petroleum Science and Engineering*, Vol. 44, pp. 55-66.
- “Developing an Exploration Decision Support System: A Strategy for Combining Information and Analytics” published in *Nonrenewable Resources*;
- “Petroleum Firms Must Determine Their Optimal Risk-Tolerance Level" published in the *Oil and Gas Investor*; and
- "Software Utilizes Firm's Risk Attitude in Prospect Evaluation" published in the *Oil and Gas Journal*.
- “Managing Technological and Financial Uncertainty: A Decision Science Approach for Strategic Drilling Decisions”, *Natural Resources Research*..

Prior to joining the faculty at the Colorado School of Mines, Dr. Walls worked for 14 years in the petroleum exploration and production industry. As Vice President of Exploration and Production for Petrosec Exploration, Dr. Walls was responsible for all exploration and production activities in North America from the period 1981 through 1986. His responsibilities include overseeing all prospect development, joint venture activities, evaluation of exploration and producing properties, and the development of financing for the company’s ongoing activities. Among Dr. Walls’ responsibilities was monitoring the activities and performance of Petrosec’s holdings in the 150 BCF gas Ynojosa Gas Field in southern Texas.

Prior to joining Petrosec Exploration, Dr. Walls was Division Manager for Felmont Oil Corporation where he was responsible for all exploration and production activities in the eastern United States. Dr. Walls was responsible for an \$11 million annual E&P budget and directed all activities associated with the petroleum property procurement, drilling activities, production and contract sales, as well as the performance monitoring of the largest natural gas storage field in the eastern U.S. Prior to joining Felmont, Dr. Walls worked with Conoco, Inc. in Houston, Texas in their in-house consulting group, Production Engineering Services. At Conoco, he was responsible for both land-based and offshore drilling and production operations located primarily in the Gulf of Mexico and the Rocky Mountain region of the western U.S.