I. Course Objective

This course focuses on the sources value creation (i.e., the process of generating superior economic performance for the firm over the long run) in the energy industries. It studies the special challenges associated with energy projects and the methods, conventional and advanced, for evaluating these opportunities. But while the focus is on the energy industry, the concepts are cutting-edge and should be in the tool-kit of all students interested in working for major corporations or as stock analysts.

Three types of problems will be examined in the course.

- Limitations inherent in the prevailing Net Present Value or WACC (weighted average cost of capital) methodology.

- Characteristics of energy industry projects, shared with some other industries, e.g. long-life assets, commodity business risks, capital intensity with long project development periods, that magnify and compound the conceptual limitations of NPV/WACC.

- Special, less widely appreciated characteristics of the energy industry. These include having to commit large funds in advance of obtaining reliable information to assess discovery/depletion risks; the impact of grassroots investments on commodity price structures, the organizational challenges of developing integrated projects across different business units and the tendency for successful projects to amplify political risk in emerging market countries.

The Advanced Methods to be evaluated will be:

- Competitive Advantage Theory;

- Real Options Theory.

The course will also provide some material on Decision Analysis, a technique used by consulting firms to help project sponsors organize and evaluate key issues before defining key planning bases for capital projects.

The course aims to demonstrate how each of these can address specific limitations of NPV/WACC. Ultimately the course aims to show how the Advanced Methods can refine and supplement NPV/WACC rather than entirely replace it.

In some respects, this course is also a research project. Students will join faculty in testing the application of advanced methods to case studies of recent energy industry projects. The case studies have been chosen for the way in which they illustrate the advanced problems that strain current evaluation practices.
II. Course Organization

The course will be divided into two modules.

- Module 1, encompassing eight weeks, introduces students to the Advanced Problems and especially the limitations of NPV/WACC. It then introduces and examines the basic concepts of the Advanced Methods.

- Module 2 is concerned with applications. Six new case studies of recent energy industry projects provide students with an opportunity to consider the limitations of NPV/IRR when evaluating upstream, refining and petrochemical investments. The students will then have an opportunity to consider if and how the Advanced Methods might produce a sounder, more complete evaluation.

III. Course Materials

The course material will consist of:

- Lecture notes (in the form of PowerPoint slides);
- Portions from textbooks;
- Case studies; most of the case studies have been authored by the course instructors and will be placed on WebCT Vista. A few must be purchased by students from an online course set up on the Harvard Business School Publishing website (further details will be provided in advance).

The slides will be e-mailed to students and placed on WebCT Vista.

IV. Class Content and Attendance

Class time will be divided between lectures on the analytic material and discussion of cases that highlight the practical management issues raised by the theoretical frameworks. The cases are carefully chosen, and do much more than simply illustrating the concepts covered in the lectures. The cases will often point to ambiguities in the concepts or invite attention to subtle issues in real-world management that do not usually come through in the study of text-books. Class attendance is very important and strongly encouraged (see the description of the class participation grade below).
V. Course Requirements

Students will be required to present both written work and oral presentations and analysis. The written work will involve:

- A homework problem set;
- An in-class mid-term exam;
- 2 case reports (one of which will serve the purposes of a final exam).

In additions, students will make at least one team presentation of cases and participation in class discussion of cases.

VI. Grading

The grading weights of the course-work are as under:

1. Homework 1 15 percent.
2. Midterm Exam 20 percent.
3. Case Report 1 20 percent.
5. Case Presentation 10 percent.
6. Class Participation 10 percent.

At the conclusion of the course, students should have a sharpened awareness of the weaknesses associated with conventional presentations of energy project economics. They should then be able to use the Advanced Methods to determine whether the investments in question are likely to turn out better or worse than portrayed via conventional NPV/IRR. As a result, students will be better equipped to contribute unique perspectives on the investment choices facing their own companies; in particular they should be able to identify whether projects up for approval are more or less likely to lead to follow-on opportunities and a gain in competitiveness versus other projects with which they are competing internally for scarce capital.

Enjoy the Course and Good Luck!
Detailed Reading and Class Schedule

Class I

Topics

Why a course on Energy Project Evaluation?
Review of the WACC/NPV/IRR Methodology
Introducing the Advanced Methods
The course as a Research effort

Assignments

Class Notes introducing Problems with Traditional Methodology, Introduction of Advanced Methods
Class Notes on Value-Creation Drivers
Class Notes on WACC Calculation and embedded assumptions

Class II

Topics

Investigating Problems with NPV/WACC
- Problems with NPV/IRR & Cost of Capital
- Technical Problems
- Static vs. Dynamic Planning
- Special problems of Residual Value and Political Risk
- Organizational Problems
Why NPV/WACC has endured
Special distortions using NPV/WACC on Energy Projects

Assignments

Class Notes on NPV/IRR Embedded Assumptions
Class Notes on NPV vs. Real Options
Class III & IV

Topics

Basic Concepts of Competitive Advantage (CA)

- Industry Value Chain
- Company Value Chain
- Types of Competitive Strategy
- Porter’s 5 Factors
- Supply Curves
- Experience Curves
Using Competitive Advantage to identify Tactical and Strategic options

Construction and Use of Industry Competitive Scenarios (ICS)

Methodology
Using Competitive Advantage Theory and Industry Scenarios to refine commodity pricing, operating costs, & sales projections
Using Competitive Advantage/ICS to develop Strategic Content Analysis (SCA) and refine Residual value assumptions
Scenario Techniques to Address Political Risk
Restating the Project’s ‘Business Proposition’ beyond NPV

Assignments

Industry Analysis (HBS)
Building Strategy on the Experience Curve (HBS)
Class Notes on Industry Structure
Class Notes on Creating & Sustaining CA
Class Notes on ICS Methodology
Class

V, VI, & VII

Topics

Using Real Options Theory to upgrade NPV/WACC
Basics of Real Options Theory
Applying Real Options Theory to Long Term capital projects
- Identifying options that can Shape a projects long term Ability to compete

Assignments

Capital Projects as Real Options: An Introduction
Strategies and Real Options
Investment Strategy as Real Options: Getting Started with Numbers
Class Notes on Real Options
Case: Arundel Partners (HBS)

Class

VIII

Cases to Prepare

MW Petroleum (A)

Case Questions

1. What do you think motivated the sale of MW properties? Are the properties likely to be worth more to Apache than to Amoco?

2. Consider the cash flow projections. Who made the projections? Are they true expected cash flows? How does the nature of the cash flow forecasts affect the discount rate that you use?

3. Estimate the value of MW using the APV method.
4. Do you think the 13% discount rate is excessive? How would the value change if the discount rate was say 9%? How does the discount rate relate to what you might expect to estimate from the forward curve?

5. Which MW assets should be regarded as options? Provide a strategy for valuing these options and make some rough estimates.

Class IX

Midterm Exam

Class X - XIII

Topics

Using Real Options to value Embedded Investment opportunities
- Using Real Options to assess Long term competitiveness, margins And growth
Using Real Options to coordinate investment
Creating Real Options as a Pro-active strategy
Integrating Competitive Advantage, ICS and Real Options into An Advanced Methods Synthesis
M&A, Strategic Content Analysis and Residual Value Dynamic Scenarios and High Political Risk

Assignments: Case Studies

Case Study 2 Upstream
Investing with Exploration risk
Read: Bidding under Uncertainty for GOM Leases

Case Preparation questions to be assigned

Case Study 3: Refining
Grassroots Manufacturing Investments
Read: Valuing Flexibility for the Samara Refinery Expansion

Case Study 4: Petrochemicals
Investing/Divesting on the Experience Curve
Read: NCC Micro-porous Film
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<th>Read: Structuring Terrasia Aromatics</th>
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<th>Read: Negotiating a Tar Sand/Refinery JV</th>
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<th>Read: Comparing US tight gas vs. W. Africa under capital constraints</th>
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<tr>
<td>Investing Under Acute Political Risk</td>
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Using Scenarios to Decompose and Value Political Risk