

# FINA 7372/4372 , PETR 6310

## Upstream Economics

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Using a combination of lectures, case studies and participation in a realistic economic simulation of exploration and production activities, used for training by oil and gas companies, students will gain an understanding of the economics of the upstream oil and gas industry, decision making under uncertainty and economic modeling.

### Instructor

The instructor is D. H. Bellman. Prior to working with the Global Energy Management Institute, Professor Bellman spent thirty-five years at Exxon. He gained experience in a wide variety of functions, including manufacturing operations, marketing, business analysis and strategic planning. As a Business Development Manager he was involved in creating new joint ventures, acquisitions, and investments in petrochemical complexes in East Asia, West Europe, Australia, Latin America, and the Arabian Gulf, as well as in the US. He earned a bachelor's degree in mechanical engineering at Duke University, and a master's degree in business administration at Stanford University.

### Required Texts

1. "Journey To Sakhalin (A), (B), (C)," case study (Harvard Business School, 2007)  
Obtain a copy online from Harvard Business Publishing Web Site using this link:  
<https://cb.hbsp.harvard.edu/cbmp/access/26840294>
2. "Ambitious Oil Company (A) case study (J. Tomlinson, 2008) available via Blackboard.

### Recommended Texts

1. *Oil & Gas Production in Nontechnical Language*, Martin Raymond and William Leffler (PennWell Publishing, 2006)

### Reference Books

1. *Project Economics and Decision Analysis, Volumes 1 and 2, 2<sup>nd</sup> ed.*, M. A. Mian, (PennWell Publishing, 2011)
2. *International Exploration Economics, Risk, and Contract Analysis*, Daniel Johnston (PennWell Publishing, 2003).
3. *Deepwater Exploration and Production – a Nontechnical Guide, 2nd ed.*, W L Leffler, et al, (PennWell Publishing, 2011).

## Course Outline

### Objectives

- Understanding of the physical systems affecting the exploitation of hydrocarbon accumulations
- Understanding the economic structure and issues associated with key upstream processes.
- Ability to construct and use financial models and performance measures for the upstream business
- Appreciation of the key management decisions and the considerations that go into them in the highly uncertain exploration and production businesses

### Requirements

1. Participation on a student team in a competitive simulated oil and gas exploration and production venture, concluding with an assessment of the team's results and lessons learned
2. Two brief recommendation memos relating to case studies discussed in class
3. Two financial analysis homework problems
4. A final examination

### Class Schedule and Topics

#### Session 1 8/24/15

- Course introduction and administration
- Overview of the exploration and production value chain

Read: Wallace-Wells, in the New York Times, January 14, 2011, "The Will To Drill"

- Aguilera and Radetski, in the Oil & Gas Journal, December 2, 2013, "Shale gas and oil: fundamentally changing global energy markets"
- Chapter 1 in "Oil and Gas Production" (optional)

#### Session 2 9/7/15

- Financial modeling of the upstream business
- Introduction to OilSim

Read: Pages 109 to 127 in "Guidelines for Application of the PRMS"

- IRS, "U.S. Depletion Rules"
- Pages 35 to 54 in Mian, "Project Economics and Decision Analysis," Volume 1 (optional)

Review: "Example Spreadsheet Model"

Session 3 9/14/15

- Identifying possible petroleum basins to explore
- OilSim challenge 1: Nominate blocks to be included in the licensing round, using geographic maps, and magnetic and gravimetric survey data.
- OilSim challenge 2: Identify the most promising of the blocks offered for lease and prepare bids, using common risk segment maps and 2D seismic surveys

Preparation: Financial homework #1

Read: Pages 23 to 33 in "Guidelines for Application of the PRMS"  
- Chapter 4 in "Oil and Gas Production" (Optional)

Session 4 9/21/15

- Discovery and appraisal of petroleum reserves
- OilSim challenge 2 continued: Submit bids and learn results
- OilSim challenge 3: Negotiate farm-ins and farm-outs with other teams, after obtaining and assessing 3D seismic surveys, then plan wildcat and appraisal drilling, including choice of rigs and service providers to contract.

Preparation: OilSim bids  
Farm-in, farm-out strategy and plans

Read: Pages 35, 36, 78 and 79 in "Guidelines for Application of the PRMS"  
- Chapters 5 and 6 in "Oil and Gas Production" (Optional)

Session 5 9/28/15

- Review results of the exploration phase
- Reservoir depletion
- OilSim challenge 4: Prepare a depletion plan for every reservoir to be developed and determine the initial expected detailed production profile for each.

Read: Shell, "Oil and Gas Offshore Production"  
- Pages 9 to 20 in Shell, "Deepwater Development"  
- Chapters 7 and 8 in "Oil and Gas Production" (Optional)

Scan: Example exploration plan

Session 6 10/5/15

- Complete challenge 4, if necessary
- Field processing and transportation
- OilSim challenge 5: Plan the facilities to produce the oil and gas that has been found in the block.
- OilSim challenge 6a: Plan the construction of needed facilities, including cost and time estimates

Read: Pages 4 – 16 in ABB, "Oil and Gas Production Handbook"  
- Chapter 9 in "Oil and Gas Production" (Optional)

Session 7 10/12/15

- OilSim challenge 6b: Construction Plan execution
- Financial models revisited

Preparation: Facility construction plan

Read: Santiago & Magallon, "Critical Path Method"  
- NetMBA.com, "PERT"

Session 8 10/19/15

- OilSim challenge 7: Adapt/react to events occurring during the production life of the venture.
- Review financial results through challenge 6.

Preparation: Financial analysis homework #2

Read: Campbell for Reuters, June 14, 2010, "Deepwater Spills and Short Attention Spans"  
- Chapter 10 in "Oil and Gas Production" (Optional)

Session 9 10/26/15

- Review and discuss results of OilSim venture and lessons learned
- Petroleum fiscal systems
- Introduction to Journey to Sakhalin Case (Issues involved in dealing with sovereign governments to gain access to petroleum resources, using Royal Dutch/Shell's experience with the Sakhalin 2 venture)

Preparation: Individual reappraisals of the OilSim ventures to be submitted before class.  
- Financial analysis homework #3

Session 10 11/2/15

- Petroleum reserves (Guest lecturer)
- "Ambitious Oil Company (D)" case
- Introduction to Ambitious Oil Company (A) Case (Issues relating to matching exploration and production investment strategy with organizational objectives and capabilities.)

Preparation: Ambitious Oil Company (D) homework

Read: Ambitious Oil Company (D)  
- Pages 7 to 22 in "Guidelines for Application of the PRMS"  
- Simmons, "Calculating Oil and Gas Reserves"  
- Chapters 2 and 3 in "Oil and Gas Production" (Optional)

Session 11 11/9/15

- Journey to Sakhalin case discussion
- Questions about AOC(A) case
- Risk and uncertainty
- Natural gas and natural gas liquids

Preparation: Sakhalin (A) one page recommendation memo (one per team)

Read: IEA, "Golden Rules for a Golden Age of Gas" (Executive Summary)  
- "Supermajordämmerung," in The Economist, August 3, 2013  
- Coopersmith, Burkholder and Schulze, "Improving Exploration, Appraisal & Pilot Planning "

Session 12 11/16/15

- The value of information (Guest lecturer)

Read: Value of information documents to be provided on Blackboard  
- Coopersmith and Cunningham, "A Practical Approach to Evaluating the Value of Information and Real Option Decisions"

Session 13 11/23/15

- Integrating project economics (Guest lecturer)

Read: Chazan in the Financial Times, July 8, 2013, "Kashagan – a struggle for oil"  
- Booz Allen Hamilton, "Capital Project Execution in the Oil and Gas Industry," 2006  
- Merrow, in Oil and Gas Facilities, April 2012, "Oil and Gas Megaprojects,"  
- Pages 111 to 173 and 190 to 195 in Mian, "Project Economics and Decision Analysis," Volume 1 (Optional)

Session 14 11/30/15

- Ambitious Oil Company (A) case discussion
- Exam review

Preparation: Ambitious Oil Company (A) recommendations paper

Final Exam 12/14?