

FINA 7397 – 03 32970
FINA 4373 – 01 35164

Petrochemical and Refining Economics

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D. H. Bellman

e-mail: dbellman@comcast.net

The course applies economic concepts and analysis to understanding the structure and behavior of the global refining and petrochemical industries. The class will use various analytical tools to explore current issues facing the industry such as profitability and investment economics, 21st century global and local supply constraints, optimizing operating economics, impact of changes in relative hydrocarbon values, regulatory impacts, refining unconventional crudes, and alternative transportation fuels.

The course will provide persons interested in operations or planning in the refining and/or petrochemical industries with a sound economic foundation and a head start in those career areas. For those aiming at general management and leadership positions in these industries, the course provides an understanding of industry structure and trends and where value is created and lost. And, those who expect to see refining and/or petrochemical businesses as customers, suppliers, clients, partners, or as investment or trading opportunities will gain understanding of the issues, opportunities and constraints confronting their counterparts in these important industries. Students with a more general interest in applied economics will find the lessons learned from refining and petrochemicals to be broadly applicable to other basic industries as well.

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, from acquiring raw materials, to plant operations, to sales. In the early 1990s he was Business Analysis and Strategic Planning Manager for Exxon Chemical's worldwide polymers businesses. Subsequently, he was Business Development Manager for the company's Global Polyethylene Business and involved in creating new joint-ventures, acquisitions, and investments in olefin and polymer 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.

Course Materials

Textbook: Textbooks: W. L. Leffler, "Petroleum Refining In Nontechnical Language", Third Edition

D. L. Burdick and W. L. Leffler, "Petrochemicals In NonTechnical Language", Third Edition

Selected articles and presentations (to be available online)

Discussion cases and problems (to be available online)

Lecture notes (to be available online)

Course Requirements

Homework problems and cases to be discussed in class.

Three in-class tests

A concise (~5 pages) paper proposing how a national oil company in an oil producing nation, described in a case study, should exploit its resources, in terms of refining and petrochemical investment. The paper will be submitted in two stages. A paper identifying the issues to be considered will be due at about the midpoint of the course. The final paper will be due at the end of the course.

Class Schedule and Topics

August 25 Topics

- Molecules, fuels and crude oil characteristics

Preparation:

Read: "Petroleum Refining ..." chapters 1, 2 and 5 (28 pages)

September 8 Topics

- Homework discussion
- Financial performance measures
- Spreads and other tools for measuring performance
- Petrol Istheria case discussion
- Test #1 review

Preparation: Crude cutting homework

Read: Petrol Istheria case

September 15 Topics

- Test #1 (Basics)
- Review and discussion of test results
- Refining overview

Preparation: Study for test

September 22 Topics

- Value added calculations
- Crude valuation
- Complexity and investment costs

Preparation: Familiarization with refinery gate, netback, and margin calculations
Check out Topper simple LP model

Read: Johnston, "Refining Report Complexity Index Indicates Refinery Capability, Value".

September 29 Topics

- Homework discussion
- Simple refinery model and crude values
- Product blending

Preparation: Investment estimate homework problem

Read: Simple refinery description
"Petroleum Refining ..." chapters 3, 9, 12 and 13 (55 pages)

October 6 Topics

- Homework discussion
- Complex refineries
- Conversion economics

Preparation: Crude switching homework problem

Read: "Petroleum Refining ..." chapters 4, 6, 7, 8, 10 and 11 (56 pages)

October 13 Topics

- Homework discussion
- Refinery configurations
- Structure of the global refining industry
- Refining industry profitability and trends
- Test #2 Review

Preparation: Blending homework problem

Read: "Petroleum Refining ..." chapters 15 and 20 (25 pages)
Terreson, "The Long Cycle", 1-17, 24-40. (To be handed out in class)
The Economist, "Oil's Dark Secret"
Lajous, "Energy Supply and Energy Security"
Financial Times, "The New Seven Sisters"

October 20 Topics

- Test #2 (Processes and configurations)
- Trade in refined products
- Operations and optimization

Preparation: Study for test

October 27 Topics

- Test #2 results discussion
- Petrochemicals and feedstocks (overview)
- Refining unconventional crude oils
- Liquid fuels from natural gas
- Strategy and optimization

Preparation: Petrol Isthria paper, part 1 is due

Read: "Petroleum Refining ..." chapters 18, 19 and 21 (18 pages)
The Economist, "Grease Is Good"

November 3 Topics

- Homework discussion
- Olefin production
- Making biofuels

Preparation: Investments and markets homework

Read: "Petrochemicals ..." chapters 1, 5 and 6

Salameh, "Can Biofuels Pose A Serious Challenge To Crude Oil?"

Shaverien, "Biorefining"

The Economist, "Ethanol Schmethanol"

Shaheen, "Integrating Biofuels Into The Energy Industry"

November 10 Topics

- Dealing with uncertainty
- Homework discussion
- Refining industry technology and trends
- Global olefin industry
- Aromatics production and refinery integration
- Petrochemical derivatives overview

Preparation: Mysterious propylene value homework

Uncertain future case

Read: "Petrochemicals ..." pages 101 - 103, chapters 2 and 3

Banerji, "Refining Challenges and Opportunities"

November 17 Topics

- Homework discussion
- Samara Refining case, 1 and uncertain outlooks
- Petrochemical derivatives

Preparation: Propylene price homework

Samara Refining case, 1

Read: "Petrochemicals ..." pages 315 - 316, chapters 9, 10 and 22

November 24 Topics

- Homework discussion
- Samara Refining case, 2 and real options in refining
- Economic challenges and trends for US refining
- Test #3 review

Preparation: Product profitability homework

Samara Refining case, 1

Read: Arbogast, "The Future of Gulf Coast Refining"

Edwards, "The Future of Gulf Coast Refining"

December 1 Topics

- Test #3 (Petrochemicals, optimization, alternative fuels, future outlooks)
- Test results discussion
- Petrol Isthria term paper discussion

Preparation: Study for test

Read: Arbogast, "The Future of the Gulf Coast Petrochemical Industry"

Final Petrol Isthria paper due on December 5