Ramanan Krishnamoorti

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302K CBB
Hours: TuW: 12-1, by apt.

THE FUTURE Of NATURAL GAS

GENB 9397/ ENRG 4397, Spring 2015, 6-9 p.m. Mondays, 126 Melcher Hall

OVERVIEW:

This course is designed to give graduate students and outstanding undergraduates a multidisciplinary overview of the current natural gas industry and the key issues that will shape its future. It will include a variety of expert guest speakers drawn from the UH faculty, the natural gas industry, regulator agencies, and environmental groups. The course will be team taught by Ramanan Krishnamoorti (former chair of the Chemical Engineering department and currently chief energy officer at UH) and Joe Pratt (NEH-Cullen Chair of History and Business and currently director of the Energy & Sustainability Minor at UH). We plan to have fun in this course, and we hope you will join us. Students should leave the course with a broad understanding of the evolution of the natural gas industry, its current place in the national and global energy mix, and the prospects for its continued growth as a key energy source.

REQUIREMENTS:

The primary requirements of the course are as follows:

(1) Attend class regularly.
(2) Do the readings before the class for which they are assigned and come to class prepared to take part in discussions.
(3) Complete a total of five short (1-2 pages) "reaction papers" that discuss an important issue raised in the readings for that week. On weeks you do not turn in a reaction paper, you will bring to class two questions or issues from the readings that you would like to discuss.
(4) Complete a class project as an individual or in a group of two on a topic raised in the course that is of special interest to you. The end product will be a research paper of about 15 pages (about 10 pages for undergraduates) and a short presentation to the class about your key findings. In consultation with the professors and guest speakers, you will choose a topic and prepare a proposal for out approval by **Monday, March 9,** the class before spring break. Presentations will be during the last two classes. Papers will be due or before **Friday, May 8**.

GRADING:

Attendance class participation, and short papers: 50 %
Completed research paper and presentation: 50 %

COURSE OUTLINE (speakers are tentative)

PART 1: Introduction: Long-Term Trends in Natural Gas

Jan. 26: Overview of the Course and of the Traditional Natural Gas Industry

--Review Course Outline
--Discuss the Evolution of the Traditional Natural Gas Industry
--Snapshots of Today: Overview of RFF reading and BP Statistical Review

February 2: Determinants of Growth of Natural Gas: Past and Future

--Technology of Production and Use
--Transportation: The Link Between Supply and Demand
--Price and Interfuel Competition
--Constraints on Future Growth (RFF)

READ:
Resources for the Future, "The Natural Gas Revolution: Critical Questions for a Sustainable Energy Future"; and
BP, Natural Gas Sections in "Statistical Review of World Energy"
Short Paper Due: In your opinion, what is the key constraint on the the growth of natural gas discussed in RFF report? Explain your answer.

PART 2: Future Supplies: LNG, Shale, and Breakthrough Technologies

February 9: Technical and Financial Determinants of LNG Pricing

--Technology: Are economies available in liquefaction or in transportation?
--Finance: At what costs can LNG remain a growing fuel?
--Geopolitics: LNG versus Traditional Gas (Russia, U.S., Qatar, Iran)

READ: Articles on Blackboard Learn (BBL).

February 16: Future Prospects for a Global Market for LNG

--Will U.S. exports shape a new set of regional markets for LNG?
--Can Japan, S. Korea, and Asia as a whole assert market power?
--How would a global market for LNG shape its future growth?

READ: Material on BBL.
Short Paper Due: Answer one of the three questions above.

February 23: The Shale Gas Revolution

--Technology: Modern versus Traditional Fracking
--Environmental Constraints: Water, Chemicals, Flaring, and Methane Emissions
--The Economic and Geopolitical Impacts of U.S. Shale Gas

READ: Gregory Zuckerman, "Frackers: The Inside Story of the Energy Revolution"(parts); article on George Mitchell (BBL).

March 2: The Future of Fracking

--Prospects for Shale Gas Development Around the World
--Long-term Infrastructure Requirements for Shale Gas
--Possible Impacts of Shale Gas on Climate Change

READ: Continue Zuckerman; Articles on BBL.
Short Paper Due: What do you see as the major strength or weakness of Zuckerman in thinking through the future of shale gas?

March 9: Breakthrough Technologies? : GTL, Hydrates, Biogas, Arctic Gas

--The Process of Technical Breakthrough and Commercialization
--Gas to Liquid: How Far Into the Future?
--Hydrates: Pipedream or Bonanza?
--Biogas: Live Stock to the Rescue?
--Arctic Gas: The Limits of Transportation?

READ: Articles on BBL**.**

March 16-21: SPRING BREAK

PART 3: Markets for Natural Gas in North America and the World

March 23: Natural Gas and Interfuel Competition in Electricity

--Gas versus Coal versus Nuclear vs. Renewables
--The Impact of Climate Change Regulation
--The Impact of Government Subsidies

READ: Materials on BBL.
Short Paper Due: Dealer's Choice: Discuss an issue raised in the readings that is important and interests you.

March 30: Natural Gas as a Major Transportation Fuel?

--Evolution of Compressed Natural Gas for Vehicles
--Indirect Markets: Electric Cars
--Beyond Automobiles: Natural Gas in Mass Transit?
--Limits to the Growth of Natural Gas in Transportation

READ: Material on BBL.

April 6: The Future of Natural Gas in Global Energy Supply and Demand

--Can Natural Gas Become a Major Fuel in China?
--Will Climate Change Encourage or Discourage Global Gas Use?
--Flashpoints in the Geopolitics of Global Natural Gas
--National Governments and Global Gas
-- Is the Great Divide Inevitable: Will Coal Continue to Surge in Developed Nations?

READ: Material on BBL.
Short Paper Due: Discuss one of the three questions on the list above.

April 13: Constraints on the Future Growth of Natural Gas

--Technology
--Environmental Issues--Both Traditional and Climate Change
--Transportation
--Finance of Large-Scale Projects
--Interfuel Competition
--Price

READ: Material on BBL.

April 20: Analysis of Projections of the Future Role of Natural Gas: Bridge Fuel Or Foundational Fuel?

--The Strengths and Limitations of Projections
--Projections by Exxon, Shell, CERA, and the EIA
--Projections by IEA and Environmental Groups
--What "discontinuities" could alter the basic assumptions of those who attempt to project the future from current conditions?

READ: Material on BBL—at least two of the projections.
Short paper due: ANALYZE the basic strength OR weakness of one of these projections.

PART 4: Student Presentations and Discussions

April 27 / May 4