COURSE SYLLABUS

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SEMESTER COURSE OFFERED: Fall 2015

DEPARTMENT: Engineering

COURSE NUMBER: GENB 7397 (26852)

NAME OF COURSE: Case Studies in Energy and Sustainability

NAME OF INSTRUCTOR: John Hofmeister

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The information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.

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Learning Objectives

This course is organized around the Four Mores of energy and environmental policy in the U.S.: energy supply, technology for energy efficiency, environmental sustainability and energy infrastructure. The course incorporates the wider context of energy and the environment in the larger society in which we live, taking into account our historic past and future potential life experience with energy availability and use. Through critical examination and analysis of these Mores, students apply knowledge to the creation of a comprehensive energy and environmental policy plan that addresses past conditions, present states and future possibilities.

Upon completion of this course, students will be able to:

- Anchor analysis and understanding of energy and environment in facts, not ideology or political conviction.
- Position and examine multiple complex questions about energy and the environment to achieve satisfactory answers, such as:
    - Can hydrocarbon energy be cleanly produced and consumed?
    - Can technology solve known challenges to energy supply, efficiency, environment and infrastructure?
    - Must energy be subsidized by government?
    - Can federalism (local, state and federal government working interactively) deliver the policy and enablers that equip industry suppliers and all classes of consumers with energy and sustainability in the future as we have experienced in the past?
    - What must people know and when should they know it to be responsible consumers of energy and enablers of a sustainable environment?
    - Can sustainability transform an otherwise dirty energy system?
    - Can nuclear energy play a role? Is it safe?
    - Can/should we protect and preserve the American lifestyle's predilection for energy consumption?
    - Is an impending energy abyss speculative or realistic within the decade?

    - Do we adequately understand and appreciate the negative and positive implications of the entire range of the ten sources of energy: coal, oil, natural gas, nuclear, biomass, wind, solar, hydrogen, hydropower and geothermal?
- Understand the crucial role of land use management in any environmental and energy system plan or strategy.
- Articulate and reconcile the time dimensions relative to politics and energy.
- Differentiate between the roles of the citizen, families, communities, corporations, institutions, associations (NGO's) and the local, state and federal system of government as they pertain to energy and environmental policy.
- Understand the technology and science demanded by the Four Mores.
- Explain the political, social, economic, cultural, historic, and environmental implications of the Four Mores.
- Appreciate the free market, regulated, and legislated necessities of the energy and environmental systems.
- Critique energy writers' views of the future (e.g. John Hofmeister, Matt Simmons, Al Gore, Chris Horner and others).
- Understand the requirements of short, medium and long term plans in the context of imagining and building a 21st Century energy and environmental system to replace the 20th Century system with a clear view of the ongoing requirements of the 22nd Century system.
- Create a plan that articulates that understanding.

Major Assignments/Exams

Mid term exam: 20%
Final exam: 20%
Final paper: 30%
Final presentation: 15%
Class participation throughout: 15%

Required Reading

- National Petroleum Council: Facing Hard Truths about Energy – Executive Summary
- National Academy of Sciences: What You Need to Know About Energy
- The Third Industrial Revolution: How Lateral Power Is Transforming Energy, The Economy and the World. By Jeremy Rifkin
- National Academy of Science Liquid Transportation Fuels from Coal and Biomass
- S. Borenstein: Cost Conflict and Climate: US Challenges in the World Oil Market
- Sierra Club and Worldwatch Institute: Smart Choices for Biofuels
- The Atlantic: Dirty Coal, Clean Future
- EIA: Energy in Brief: What is the Role of Coal in the U.S.?
- MIT: The Future of Natural Gas
- WSJ: US Gas Fields from Bust to Boom
- What History Can Teach Us About the Future Costs of U.S. Nuclear Power (Hultman et al)
- Scientific American: The Rise of Renewable Energy
- Vaclav Smil, The OECD Observer: 21st Century Energy
- New Yorker: David Owen – Green Manhattan

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- American Energy Innovation Council: A Business Plan for America's Energy Future
- McKinsey: Unlocking Energy Efficiency in the U.S. Economy
- National Petroleum Council: Prudent Development: Realizing the Potential of North America's Abundant Natural Gas and Oil Resources
- Congressional Budget Office: Policy Options for Reducing CO2 Emissions
- Paul Krugman: Building a Green Economy
- Scientific American: A Plan to Keep Carbon in Check
- David McKay: Visualizing Sustainable Energy for the USA
- National Academy of Sciences: Hidden Costs of Energy – Unpriced Consequences of Energy Production and Use
- US DOE: The Smart Grid – An Introduction
- National Research Council: The Hydrogen Economy – Opportunities, Costs, Barriers and R&D Needs
- Center for American Progress: Wired for Progress – Building a National Clean Energy Smart Grid
- EIA – Energy in Brief: What is the electric Power Grid
- Additional readings as assigned.

Recommended Reading

- Hofmeister, John: *Why We Hate the Oil Companies: Straight Talk from an Energy Insider* Palgrave Macmillan 2010
- Smil, Vaclav: *Energy at the Crossroads: Global Perspectives and Uncertainties* The MIT Press
- Friedman, Thomas L.: *Hot, Flat, Crowded 2.0: Why We Need a Green Revolution – And How it Can Renew America*. Picador
- MacKay, David: Sustainable Energy – *Without the Hot Air* UIT Cambridge Ltd.
- Owen, David: *Green Metropolis: Why Living Smaller, Living Closer, and Driving Less Are the Keys to Sustainability* Riverhead Trade
- Yergin, Daniel: *The Prize: The Epic Quest for Oil, Money & Power*. Free Press
- Goodell, Jeff: *Big Coal: The Dirty Secret Behind America's Energy Future*. Mariner Books.
- Burrough, Bryan: *The Big Rich: The Rise and Fall of the Greatest Texas Oil Fortunes*. Penguin.
- Muller, Richard: *Physics for Future Presidents: The Science Behind the Headlines*. W.W. Norton & Company.
- Tucker, William. *Terrestrial Energy: How Nuclear Energy Will Lead the Green Revolution and End America's Energy Odyssey*. Bartleby Pr.
- Madrigal, Alexis: *Powering the Dream: The History and Promise of Green Technology*. Da Capo Press.
- Sperling, Daniel and Gordon, Deborah: *Two Billion Cars: Driving Toward Sustainability*. Oxford University Press.
- Shively, Bob and Ferrare, John: *Understanding Today's Electricity Business*. Enerdynamics LLC
- Nye, David: *Consuming Power: A Social History of American Energies*. MIT University Press.

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- Richter, Burton: *Beyond Smoke and Mirrors: Climate Change and Energy*. Cambridge University Press.
- Pooley, Eric: *Climate War*. Hyperion Books.
- Gore, Al: *Our Choice: A Plan to Solve the Climate Crisis*. Rodale Books

List of discussion/lecture topics

Week One: Course Overview of Four Mores, review of class project and other requirements, review of energy systems today and changes made in past decades projected to future decades. Introduction of time-based energy plans: short, medium and long term, ranging from 0-10 years, 10 to 25 years, and 25 to 50 years.

Week Two: Introduction to Energy Supply at the macro level, including overview of ten sources of energy supply to support the nation's transportation and power generation systems.

Week Three: Deeper dives into the strengths and weaknesses, advantages and disadvantages of the ten sources of supply, including implications for affordability, sustainability and availability.

Week Four: Class presentations on research into selected sources of supply and the implications of the research regarding the outline and final plan for each team.

Week Five: Introduction to Technology for Energy Efficiency and the prospects and possibilities for greater efficiency at the macro level of the wider energy systems for transportation and power generation.

Week Six: Deeper dives into the strengths and weaknesses, advantages and disadvantages of the opportunities for greater energy efficiency, evaluation of the various technologies and their readiness for systems-wide application.

Week Seven: Class presentations on research into selected alternatives/initiatives for increased energy efficiency and the implications for the outline and final plan for each team.

Week Eight: Mid-Term Exam, up to 45 minutes. Introduction to Environmental Sustainability including the legal and regulatory history; enforcement and updating the legal and regulatory framework up to today.

Week Nine: Deeper dives into the pluses and minuses of environmental policy as administered and the projected changes required by current outlook on environmental policy changes anticipated over the next years, relative to energy supplies, utilization, efficiency through technology, implications on affordability and availability, as well as sustainability.

Week Ten: Class presentations on research into historic enforcement initiatives, such as Rocky Mountain Arsenal, Deepwater Horizon disaster in the Gulf of Mexico, Superfund Clean ups and evaluation of what works and what doesn't. Implications of the environment for the outline and final plan for each team.

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Week Eleven: Introduction to Energy Infrastructure, both hard infrastructure, e.g. physical presence, and soft infrastructure, e.g. legal and regulatory framework at local, state and national levels of government.

Week Twelve: Deeper dives into the challenges, especially from soft infrastructure and the way government works among federal levels, corporate, institutional, association, special interests, and citizens interests, to infrastructure development.

Week Thirteen: Class presentations on actual, historic examples of infrastructure initiatives and what did or did not work in delivering both physical and soft infrastructure initiatives, such as Keystone XL Pipeline, U.S. Cap and Trade policy, etc. Implications for the outline and final plan for each team.

Week Fourteen: Final exam, up to 45 minutes, and presentation practice for final plan presentation in the following week.

Week Fiften: Final plan presentations and critiques.