PUAF 698O: ENERGY AND ENVIRONMENTAL POLICY

(Spring 2003)

Time/Place: Thursdays 5:30-8:00, January 30 to May 15, Room 6208, Ariel Rios Building, 1200 Pennsylvania Ave NW, Washington, DC.

Coverage: Energy use greatly affects local and global environmental conditions, such as climate change, acid rain, urban air pollution, land use, and radiation hazards. In turn, past and future energy technology trajectories are intertwined with pathways of economic development, business investment decisions, social needs, and political priorities. This first half of the course will provide a basic understanding of energy in all of these dimensions—technical, economic, environmental, social, and political. Technologies covered include oil, gas, coal, renewable energy, energy efficiency, nuclear power, and hydrogen/fuel cells. Patterns of energy use in residential, industrial, and transport sectors will be discussed. The second half of the course will explore how a wide variety of policy mechanisms—technology policy, utility regulation and restructuring, emissions policies, multilateral interventions and agreements, and corporate strategies—can shape energy use and the environmental impacts of energy systems. Energy policy examples will draw from both developed and developing countries. Emphasis will be placed on renewable energy and promising technological trajectories for the future.

Instructor: Eric Martinot, Adjunct Professor, University of Maryland School of Public Affairs, and Climate Change Program Manager, Global Environment Facility. Phone 202-473-0169, email emartinot@worldbank.org. Office hours are Thursdays after class or by special arrangement.

Prerequisites: none.

Assignments: Four assignments and one final paper, no exams. The assignments (~5 pages) include two problem sets on energy patterns and quantitative analysis, a future energy and policy scenario, and a corporate case study of student's choice. Assignments handed out 2 weeks in advance. The topic of the final paper (~15 pages) should relate to linkages between energy and public policy (i.e., environmental policy, technology policy, utility restructuring) and should be discussed with instructor in advance.

Grading: Grade based upon four short assignments (45%), final paper (35%), and participation in class discussions (20%).

Readings: Regular assigned readings will be available in a photocopy reader and on-line. Additional weekly in-class handouts will supplement the reader. One book to purchase: *Energy Revolution: Policies for a Sustainable Future* by Howard Geller (Island Press, 2003).

Topical Outline and Assignments

Jan. 30 Introduction. How energy is connected to environmental sustainability, economic activity, and public health. Energy and international relations and trade. Energy, population, and development. Private investment and energy pathways.

Feb. 6 Energy supply technologies. Patterns of energy supply and demand. Developed vs. developing countries. Energy and power units. Energy supply technology characteristics and economic costs.

Feb. 13 Energy end-use technologies. Energy consuming (end-use) technologies. Indicators of energy intensity and efficiency. Energy consumption and efficiency by sector.

Feb. 20 Environmental impacts. Major pollutants and insults. Comparative assessment of environmental impacts of energy technologies.
First assignment due.

Feb. 27 Quantitative analysis tools. Unit conversions. Capacity vs. energy. Financial and life-cycle cost analysis. Energy conversion efficiencies of supply and end-use technologies. Pollutant emissions factors, dose-response relations and health impacts.

Mar. 6 Quantitative analysis. Problems for in-class solution and discussion.

Mar. 13 Policy and strategy overview. Policies and strategies affecting energy use: technology policies, utility regulation and restructuring, emissions policies, multilateral interventions and agreements, and corporate strategic decision-making and investment. Future energy use and policy scenarios.
Second assignment due.

Mar. 20 Technology policies. How policies that shape technological development affect patterns of energy use and environmental impacts. Investment incentives and disincentives. Research and development. Efficiency standards and building codes.

Mar. 27 Spring break.

Apr. 3 Utility regulation and restructuring. Restructuring occurring in developed and developing countries. How regulation and restructuring can affect technology and fuel choices and the environmental dimensions of electric power.

Apr. 10 Emissions policies. How emissions reduction policies for the energy sector affect fuel and technology choices and energy use. Clean air act, emissions limits and pollution control requirements, emissions allocation and trading systems.
Third assignment due

Apr. 17 Multilateral interventions and agreements. The UN, World Bank, Global Environment Facility, and other multilateral institutions. Climate change policies and agreements.

Apr. 24 Corporate strategies and investments. What types of private initiatives and trends are emerging? Voluntary emissions reductions. R&D strategies. Marketing and production strategies. Short and long term investment strategies and planning.
Fourth assignment due April 21. Brief student presentations in class

May 1 Country comparisons. Comparative energy situations and policies of selected developed and developing countries.
Finish student presentations of fourth assignment in class

May 8 Future energy pathways. Technology and policy towards a renewable energy economy in 2050. The role of natural gas as a bridging fuel. Competing visions for the use of fuel cells and hydrogen. Energy security and decentralized energy.

May 15 Course integration and group discussion.
Final paper due

Readings

Jan. 30

"Energy in Transition," John P. Holdren, *Scientific American* 263(3): 157-163 (1990).

"An Introduction to Energy," Hans-Holger Rogner and Anca Popescu, eds., in *World Energy Assessment: Energy and the Challenge of Sustainability,* UN Development Programme, UN Department of Economic and Social Affairs, and World Energy Council (2000), pp. 29-38. Available at www.undp.org/seed/eap/activities/wea/drafts-frame.html.

Feb. 6

"Energy from Fossil Fuels," William Fulkerson, Roddie R. Judkins, and Manoj K. Sanghvi, *Scientific American* 263(3): 128-135 (1990).

"Getting Over Oil," Charles C. Mann, *Technology Review,* Jan./Feb. 2002, pp. 32-38; also "Fuel Cells vs. the Grid," David H. Freedman, pp. 40-47, and "Hitting the Natural Gas Jackpot," David Voss, pp. 68-72.

Natural Selection: Evolving Choices for Renewable Energy Technology and Policy, United Nations Environment Programme (Paris, 2000). 36 pp. [Read pp. 5-19.] Available at http://www.uneptie.org/energy/publ/pdfs/naturalselection.pdf.

"The Power Plant in Your Basement," Alan. C. Lloyd, *Scientific American* 281(1): 64-69 (1999).

"Renewable Energy Markets in Developing Countries," Eric Martinot, Akanksha Chaurey, Jose Moreira, Debra Lew, Njeri Wamukonya, *Annual Review of Energy and the Environment* 27: 309-348 (2002). [Read pp. 315-325.]

Feb. 13

"Efficient Use of Electricity," Arnold Fickett, Clark Gellings, and Amory Lovins, *Scientific American* 263(3): 65-74 (1990).

Indicators of Energy Use and Efficiency: Understanding the Link Between Energy and Human Activity, International Energy Agency/Lee Schipper (Paris, 1997), pp. 11-44 (Exec. Summary).

Supplementary reading: "Energy End-Use Efficiency," Eberhard Jochem, ed., in *World Energy Assessment: Energy and the Challenge of Sustainability,* UN Development Programme, UN Department of Economic and Social Affairs, and World Energy Council (2000), pp. 173-218. Available at www.undp.org/seed/eap/activities/wea/drafts-frame.html.

Feb. 20

"Energy, the Environment, and Health," John P. Holdren and Kirk R. Smith, in *World Energy Assessment: Energy and the Challenge of Sustainability,* UN Development Programme, UN Department of Economic and Social Affairs, and World Energy Council (2000), pp. 61-110. Available at www.undp.org/seed/eap/activities/wea/drafts-frame.html.

"The Environmental Imperative for Renewable Energy: Executive Summary," Adam Serchuk, Renewable Energy Policy Project Special Report (Washington, DC, 2000), 10 pp. Available at http://www.repp.org.

"Confronting Nuclear Waste," Nicholas Lenssen, in *State of the World 1992*, Lester Brown et al (New York: W.W. Norton, 1992), pp. 46-65.

"Whose Nuclear Waste?," Gary Taubes, *Technology Review,* Jan./Feb. 2002, pp.60-67.

Feb. 27

"Energy Hazards: What to Measure, What to Compare," John P. Holdren, *Technology Review* 85(3): 32-38; 74-75 (1982).

"Sorry, Wrong Number: The Use and Misuse of Numerical Facts in Analysis and Media Reporting of Energy Issues," Jonathan G. Koomey, Chris Calwell, Skip Laitner, Jane Thornton, Richard E. Brown, et al., *Annual Review of Energy and the Environment* 27: 119-158 (2002).

"Exploiting Wind vs. Coal," Mark Z. Jacobson and Gilbert M. Masters, *Science* 293: 1438-1439 (2001).

Mar. 13

"Barriers" in *Energy Revolution: Policies for a Sustainable Future*, Howard Geller (Washington, DC: Island Press, 2003), pp. 33-45.

"Policy Options" in *Energy Revolution: Policies for a Sustainable Future*, Howard Geller (Washington, DC: Island Press, 2003), pp. 47-92.

Clean Energy Blueprint: A Smarter Energy Policy for Today and the Future, Steven Clemmer et al. (Washington, DC: Union of Concerned Scientists, 2001). 35 pp. [Read especially pp. 1-9.] Available at http://www.ucsusa.org/index.html.

Mar. 20

"Market Transformation" in *Energy Revolution: Policies for a Sustainable Future*, Howard Geller (Washington, DC: Island Press, 2003), pp. 93-130.

"States Emerge as Clean Energy Investors: A Review of State Support for Renewable Energy," Bolinger, M., Wiser, R., Milford, L., Stoddard, M., and Porter, K., *The Electricity Journal* (Nov. 2001), 82-95.

"Renewable Energy Policies and Barriers," Fred Beck and Eric Martinot, in *Encyclopedia of Energy* (Academic Press, forthcoming in 2003).

"Federal Energy Subsidies: Not All Technologies Are Created Equal," Marshall Goldberg, Renewable Energy Policy Project Research Report No. 11 (Washington, DC, 2000). 18 pp. [Read pp. 5-12.] Available at http://www.repp.org.

Apr. 3

"Power Switch: Will the Restructured Electric Utility System Help the Environment?" R.F. Hirsh and A.H. Serchuk, *Environment* 41: 4-9; 32-39 (1997).

"Power Sector Reform and Environment," Eric Martinot (Washington, DC: Global Environment Facility, 2000). 20 pp.

"Current Experience with Net Metering Programs," Y. Wan and H.J. Green, presented at Windpower '98, Bakersfield, CA (National Renewable Energy Laboratory, Golden, CO, 1998).

"Lessons from California's Power Crisis," John E. Besant-Jones and Bernard Tenenbaum, *Finance and Development*, Sept. 2001, pp. 24-28.

Apr. 10

"Grandfathering and Coal Plant Emissions: The Cost of Cleaning up the Clean Air Act," Frank Ackerman, Bruce Biewald, David White, Tim Woolf, and William Moomaw, *Energy Policy* 27(15): 929-931 (1999).

"A Guide to the Clean Air Act for the Renewable Energy Community," David R. Wooley, Renewable Energy Policy Project Issue Brief No. 15 (Washington, DC, 2000), 29 pp. Available at http://www.repp.org.

Apr. 17

"World Bank Energy Projects in China: Influences on Environmental Protection," Eric Martinot, *Energy Policy* 29: 581-594 (2001).

UN Framework Convention on Climate Change, United Nations (New York, 1993). 29 pp. Available at http://www.unfccc.de/resource/conv/index.html.

"Moving the Climate Change Agenda Forward," Seth Dunn and Christopher Flavin, in *State of the World 2002* (New York: W.W. Norton, 2002), pp. 24-50.

"Policy Forum: Global Warming Economics," William Nordhaus, *Science* 294: 1283-1284 (2001).

May 1

"The United States: Policies and Scenarios" in *Energy Revolution: Policies for a Sustainable Future*, Howard Geller (Washington, DC: Island Press, 2003), pp. 131-164.

"Brazil: Policies and Scenarios" in *Energy Revolution: Policies for a Sustainable Future*, Howard Geller (Washington, DC: Island Press, 2003), pp. 165-190.

"Powering Non-Nuclear Growth in China with Natural Gas and Renewable Energy Technologies," Jeffrey Logan and Jiqiang Zhang, *China Environment Series* 2 (Washington, DC: Woodrow Wilson Center, 1998), pp. 12-19.

May 8

"Exploring the Future: Energy Needs, Choices and Possibilities; Scenarios to 2050" (London: Shell, 2001), 30 pp. Available at http://www.shell.com/files/media-en/scenarios.pdf.

"Sizing up Micropower," Seth Dunn and Christopher Flavin, in *State of the World 2000,* Lester Brown et al (New York: W.W. Norton, 2000), pp. 142-161.

"Routes to a Hydrogen Economy," Seth Dunn, *Renewable Energy World*, Jul-Aug 2001, pp.19-29. Available at www.jxj.com/magsandj/rew/2001_04/routes_to_a_hydrogen_economy.html.

Tomorrow's Energy: Hydrogen, Fuel Cells, and the Prospects for a Cleaner Planet, Peter Hoffman (Cambridge, MA: MIT Press, 2001), 289 pp. [Read Ch. 12, "The Next 100 Years," pp. 247-264.]