Version date: August 15, 2001
University of California, Berkeley **Fall 2001**
Energy and Resources Group (ERG)

ER 100
Energy and Society

Lecture:
Tuesday & Thursday, 2:00 – 3:30 PM, 180 Tan Hall
Sections:
ER 100 Section 1: W 9:00 – 10:00 AM, 209 Dwinelle Hall
ER 100 Section 2: Th 8:00 – 9:00 AM, 229 Dwinelle Hally
ER 100 Section 3: W 3:00 – 4:00 PM, 109 Dwinelle Hall

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http://socrates.berkeley.edu/~dkammen/teaching/ER100-200.html

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How Can We Understand and Manage our Energy Resources and Needs?

- ***How did the U. S., and the global, energy industry and economy evolve to it current state?***
- ***In what ways does fossil-fuel use define the 20th Century?***
- ***What are the real economic, social, and environmental impacts of energy generation and use?***
- ***What caused, and what is going on with the California energy crisis?***
- ***What role is there for renewable energy and energy efficiency today and in the future?***
- ***What is the role of nuclear fission and fusion in our present and future energy situation?***
- ***Could fuel cells be the next revolution in the automotive industry?***
- ***What is the federal role in setting energy policy? Does it work?***
- ***What can we do about global warming?***
- ***What is distributed generation?***

Interested in these questions? Then ER100 is for you.

Each of these questions about the use and the impacts of energy systems requires an interdisciplinary understanding that explores the scientific, technical, economic, social, political and environmental opportunities and impacts of our energy system.

In this course, you will develop an understanding – and a real working knowledge – of our energy options. This will include analysis of the different opportunities and impacts of energy systems that exist within and between groups defined by national, regional, household, ethnic, gender distinctions. Analysis of the range of current and future energy choices will be stressed, as well as the role of energy in determining local environmental conditions, and the global climate.

ER100 is for both undergraduate and graduate students, and will be a highly interdisciplinary experience, combining analytic tools, social, economic, historical and policy analysis.

Course Goals

This course is designed to provide you with the methods, tools and perspectives to understand, critique, and ultimately influence the management of technical, economic, and policy choices regarding the options for energy generation and use. We will focus equally on the technical, socio-economic, political, and environmental impacts of energy.

Topically, we will examine the full 'life cycle' of energy, from the stage of raw materials, or inputs, to generation, conversion, distribution, consumption, recycling, waste, and impacts. This work is inherently interdisciplinary, and will involve a fascinating but extensive effort to understand, critique and integrate tools and perspectives from anthropology, cultural and ethnic studies, economics, engineering, physics, politics, sociology, and who knows what else.

The challenge of this integration is not simply one of learning and applying methods from very diverse disciplines, but more importantly is one of understanding how and when different types of analysis, disciplinary and political perspectives, and "voices" are heard, unheard, ignored, or discredited. Energy is both a fundamental resource for society, the control of which reflects and shapes interactions within society, and between humans and the natural environment.

Coverage

Over the semester we will take a roughly chronological tour of the major fuel types used in human civilization. From there we will begin a broad-ranging analysis of the energy resource, combustion or conversion processes, application, waste, economic, social, political, cultural and environmental impacts and options associated with these fuels and with the changing mix of fuels used within and across societies around the globe.

Assignments

There will be seven problem sets (30%), a mid-term examination (25%), and a final exam (35%). Participation in section will count for 10%.

Texts

Hirsh, Richard (2000) *Power Loss: The Origins of Deregulation and Restructuring in the American Electric Utility System* (MIT Press: Cambridge, MA).

The course reader is available at Central Copy (Bancroft Way).

Field Trips

There will be three half-day to full-day field trips during the semester, one to the Pittsburgh Energy 'Park', a 2200 MW fossil-fuel power plant (gas and oil), one to Diablo Canyon Nuclear Plant, and a combined trip that will include both a wind-farm and a hydroelectric power plant.

Graduate Student Instructors

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Schedule of Lectures

Week	Date	Lecturer	Topic
1	8-28	Kammen & Koshland	Course Organization, Overview & Goals
	8-30	Kammen	Energy and Society: How energy use shapes society & the environment
2	9-4	Kammen	Energy Toolkit I: Units, forecasts, and the back-of-the-envelope
	9-6	Koshland	Energy Tookit II: Basics of combustion
3	9-11	Kammen	Biomass I: Fuel for One billion
	9-13	Kammen	Biomass II: Energy, gender, and development
4	9-18	Koshland	Energy Toolkit III: Energy thermodynamics
	9-20	Koshland	Energy Toolkit IV: Hydrocarbon Fuel Combustion and Emissions
5	9-25	Kammen	Hydrocarbon Man: Hydrocarbon Man: Coal, Oil, Industry & Society
	9-27	Kammen	Energy Toolkit V: Thermodynamics and Economics of Modern Power Plants
6	10-2	Koshland	Energy Toolkit VI: Combustion; emissions, pollution, and the next generation of power plants
	10-4	Kammen	Energy Toolkit VI: Life Cycle Analysis
7	10-9	Kammen	The evolution of the modern energy economy: regulation & growth
	10-11	Kammen	The evolution of deregulation and the California energy crisis
8	10-16	Von Meier	The Grid
	10-18	Kammen	Energy Efficiency & Demand Side Management
9	10-23		Mid-term Examination
	10-25	Kammen	Energy and Environmental Justice
10	10-30	Koshland	Energy and Transportation
	11-1	Peterson	Nuclear Energy I: Physics and Engineering – Fission Systems
11	11-6	Kastenberg	Nuclear Energy II: Waste, Economics
	11-8	Kammen	The future of nuclear power
12	11-13	Kammen	Renewable energy I: solar, wind, and hydro
	11-15	Kammen	Renewable energy II: Fuel Systems
13	11-20 11-22	Kammen	Methods VI: Energy Futures – Forecasting Thanksgiving
14	11-27	Kammen	Distributed generation and green power
	11-29	Kammen	*Climate Change* I: Energy and climate
15	12-4	Kammen	*Climate Change* II: Energy policy
	12-6	Kammen & Koshland	Wrap-up and Integration: Energy Futures

Week 1 – Introduction to Energy Systems and Society

Lecture 1 (8/28) Course Organization, Overview & Goals
Lecture 2 (8/30) Energy and Society: How energy use shapes society and the environment

Note: Section meetings begin **Week 1**.
Note: Reading assignments should be completed before the lecture for which they are assigned.

Required Readings

Lecture 1:
McNeill, J. R. (2000) "Energy History since 10,000 B. C." in *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (W. W. Norton & Company: New York), 10 – 17.

Get into the habit of looking for energy articles in the newspapers, and begin to get a feeling for how ubiquitous and far-reaching energy issues are in society. In addition, check the Editorial and Opinion pages of your favorite newspapers.

Lecture 2:
Smil, V. (2000) "Energy in the Twentieth Century: Resources, conversions, costs, uses and consequences", Annual Review of Energy and the Environment, **25**, 21 – 51.
Yergin, D. (1991) The Prize: The Epic Quest for Oil, Money, and Power (Simon & Schuster: New York). Pages 11 – 16.

Problem Set #1 distributed 8/30

Topics: analysis of utility bills; unit analysis problems.

Week 1 Supplemental & Reference Material

Familiarize yourself with the wealth of energy data and resources available on the www. A class mailing of URLs will be sent out that includes: energy units conversion 'calculators'; data on national and regional energy use; updates on U. S. energy policy as well as energy and climate change, health, and development.

Week 2 – Methods in Energy Analysis

Lecture 3 (9/4) Energy Toolkit I: Units, forecasts, and the back-of-the-envelope
Lecture 4 (9/6) Energy Toolkit II: Basics of Combustion

Required Readings

Lecture 3:
Lovins, Amory (1976) "Energy Strategy: The Road Not Taken", *Foreign Affairs*, 65 – 96.

Holdren, John (1991) "Population and the energy problem", *Population and the Environment*, **12 (3)**, 231 – 255.

Hollander, J., Simmons, M. and Wood, D. (eds) (1997) Conversion Tables.

Norgaard, R. and von Meier, S. (1996) About Calculations and Unit Conversions (3 pages).

Lecture 4:
Masters, G. Chapter on combustion and energy

Class Handout on Combustion (to be distributed electronically)

Problem Set #1 due 9/6

Week 2 Supplemental & Reference Material

Notes about Energy Data (3 pages)

Notes about Energy: Reference Numbers (4 pages)

Contents	URL
Conversion factors for energy equivalents	http://physics.nist.gov/cuu/Constants/energy.html
The energy advocate: Energy conversions	http http://www.energyadvocate.com/index.htm

Week 3 – Biomass Energy

Lecture 5 (9/11) Biomass I: Fuel for One Billion
Lecture 6 (9/13) Biomass II: Energy, gender, and development

Required Readings

Lecture 5:

Reddy, Amula K. N., Williams, Robert H., and Johansson, Thomas B. (1997) *Energy After Rio*, Chapter 2, *Energy and Major Global Issues* (United Nations Development Program: New York), pages 30 – 42.
URL http://www.undp.org/seed/eap/rio/chapter2.html

Smith, Kirk, R. (1993) "Fuel combustion, air pollution, exposure, and health: the situation in developing countries", *Annual Review of Energy and the Environment*, **18**, 529 – 566.

Problem Set #2 distributed 9/11
Covering: energy use at household and national scales; basic thermodynamics; combustion

Lecture 6:

Crewe, Emma (1997) "The silent traditions of developing cooks", in Grillo, R. D. and R. L. Stirrat, editors, *Discourses of Development: Anthropological Perspectives* (Oxford, UK: Berg). Pages 59 - 81.

Kammen, D. M. (1995) "Cookstoves for the developing world," *Scientific American*, **273**, 72 - 75.
URL http://socrates.berkeley.edu/~dkammen/cookstoves.html

Reddy, Amula K. N., Williams, Robert H., and Johansson, Thomas B. (1997) *Energy After Rio*, Chapter 2, *Energy and Major Global Issues* (United Nations Development Program: New York), pages 7 – 41. [You can skip, or skim if interested, the latter parts of this chapter, after page 42]
URL http://www.undp.org/seed/eap/rio/chapter2.html

Week 3 Supplemental & Reference Material

Ezzati, M. and Kammen, D. M. (2001) "Quantifying the effects of exposure to indoor air pollution from biomass combustion on Acute Respiratory Infections in developing countries", *Environmental Health Perspectives*, **109 (5)**, 481 – 489.
URL http://socrates.berkeley.edu/~rael/ezzati-kammenEHP_2001.pdf

Week 4 – Hydrocarbon Energy

Lecture 7 (9/18) Energy Toolkit III: Energy Thermodynamics
Lecture 8 (9/20) Energy Tookit IV: Hydrocarbon Fuel Combustion and Emissions

Required Readings

Lecture 7:
Class Handout

Ledwell, Tom A. (1995) *Physics of the Environment* (Ledwell: Gloucester, Ontario), Chapters 9 - 11, pages, 81 - 133. **[Not ideal; Students found all the phase diagrams confusing.]**

Lecture 8:
Nef, John U. (1977) "An early energy crisis and its consequences", *Scientific American*, November, pages 140 – 150.

Masters, Gilbert M. (1991) "Air pollution", *Introduction to Environmental Engineering and Science* (Prentice Hall: New York). Pages 327 – 368.

Other readings Cathy wants to use here?

Week 4 Supplemental & Reference Material

Reynolds, William C. and Perkins, Henry C. (1977) *Engineering Thermodynamics* (McGraw Hill: New York), chapters 1 – 2 (review), chapters 3 – 5 (basic), chapters 6 – 8 (advanced).

Week 5 – Hydrocarbon Man

Lecture 9 (9/25) Hydrocarbon Man: Coal, Oil, Industry & Society
Lecture 10 (9/27) Energy Toolkit V: Thermodynamics and Economics of Modern Power Plants

Required Readings

Lecture 9:

Yergin, Daniel (1991) "Hydrocarbon man", in *The Prize: The Epic Quest for Oil, Money, and Power* (Simon & Schuster: New York). Pages 541 - 560.

Colin J., Campbell and Jean H. Laherrere (1998) "The End of Cheap Oil", *Scientific American*, March. Pages 78 - 83.

Problem Set #2 due 9/25

Problem Set #3 distributed 9/25

Covering: more on thermodynamics of energy systems, combustion of various fuels; comparisons of conversion efficiencies, emissions, financial analysis (discounting).s

Lecture 10:

Reynolds, William C. and Perkins, Henry C. (1977) *Engineering Thermodynamics,* Hill: New York), chapter 9

Week 5 Supplemental & Reference Material

Melosi, Martin (1985) "Through boom and bust – Waning Coal, Rising Oil", *in Coping with Abundance* (Temple University Press: Philadelphia, PA). Pages 138 – 159.

Meyers, N. with Kent, Jennifer (1998) *Perverse Subisdies: Tax $s Undercutting our Economies and Environments Alike* (International Institute for Sustainable Development: Paris, France). Pages 55 – 78.

Week 6 – New Frontiers for Fossil Fuels and New Frontiers in Energy Analysis

Lecture 11 (10/2) Energy Toolkit VI: Combustion; Emissions and the next generation of power plants
Lecture 12 (10/4) Life-Cycle Analysis

Required Readings:

Lecture 11:
Beer, J. M. (2000) "Combustion technology developments in power generation in response to environmental challenges", *Progress in Energy Combustion Science*, **26**, 301 – 327.

Lecture 12:
Short, W., et al. (1995) *A Manual for the Economic Evaluation of Energy Efficiency and Renewable Energy Technologies* (Golden, National Renewable Energy Laboratory: Golden, CO). NREL/TP-462-5173. (and accompanying tutorial CD).

Class handout on financial analysis and discounting.

Week 6 Supplemental & Reference Material

Week 7 – Electricity Supply and Demand Management

Lecture 13 (10/9) The evolution of the modern energy economy; regulation and growth
Lecture 14 (10/11) The evolution of deregulation and the California energy crisis

Required Readings

Lecture 13:
Hirsch, Richard (1999) *Power Loss* (MIT University Press: Cambridge, MA) Section I, Pages 1 - 79.

Problem Set #3 due 10/9

Problem Set #4 distributed 10/9
Covering: life-cycle analysis; evolution of the modern energy system; politics of regulation and de-regulation; thermodynamics/combustion review problem.

Lecture 14:
Taylor, J. and VanDoren, P. (2001) "California's Energy Crisis: What's Going On, Who's to Blame, and What to Do" *Cato Institute News Release.*

Norgaard and Bachrach – Handout on the evolution of the crisis

Kammen, D. M. (2001) "Renewable energy and energy policies and the California Energy Crisis", in *Controller's Quarterly: Energy in California* (Office of Cathleen Connell, California State Controller), Summer, 19 – 21.
URL http://sco.ca.gov.

President Loretta Lynch and Electricity Oversight Board Chairman, Michael Kahn's, Summer 2000 Report to Governor Davis regarding California's Electric System.
URL http://www.cpuc.ca.gov/published/report/Table%20of%20Contents.htm

Week 7 Supplemental & Reference Material

Taylor, J. and VanDoren, P. (2001) "California's Energy Crisis: What's Going On, Who's to Blame, and What to Do" *Cato Institute Policy Analysis Report Number 406.*
URL: http://www.cato.org/pubs/pas/pa406.pdf

Week 8 – Electricity Supply and Demand Management

Lecture 15 (10/16) Electricity Grids: Managing the Network
Lecture 16 (10/18) Energy Efficiency and Demand-Side Management

Lecture 15:
Overbye, T. J. (2000) "Reengineering the Electric Grid", *American Scientist*

Lecture 16:
Fickett, Arnold P., Gellings, Clark W. and Lovins, Amory B. (1990) "Efficient Use of Electricity", *Scientific American*, September. Pages 65 – 74.

Gadgil, A. (1994) "Development, environment, and energy efficiency", in *Industrial Ecology and Global Change*, Socolow, Robert; Andrews, Clinton; Berkhout, Franz, and Thomas, Valerie (Cambridge University Press: New York). Pages 451 – 466.

Weizacker, Ernest von, Lovins, Amory B. and Lovins, L. Hunter (1997) *Factor Four: Doubling Wealth, Halving Resource Use* (Earthscan: London, UK). Pages 1 – 67.

Problem Set #4 due 10/18

Week 8 Supplemental & Reference Material

Contents	URL
LBL Energy Efficiency Standards	http://eappc76.lbl.gov/tmacal/ees.cfm
US DoE Energy Efficiency & Renewable Energy Network	http://www.eren.doe.gov/
Energy Use Forecasting	http://eappc76.lbl.gov/tmacal/ees.cfm
Scenarios for a Clean Energy Future	http://www.ornl.gov/ORNL/Energy_Eff/CEF.htm

Week 9 – Energy and Equity

Lecture 17 (10/23) Mid-term examination
Lecture 18 (10/25) Energy and Environmental Justice

Lecture 18:

Shell Oil In Nigeria

Onishi, N. (2000) "In the oil-rich Nigeria Delta, Deep Poverty and Grim Fires, *The New York Times*, A1, A8.

Anthony, C. (1991) "Energy policy and inner city abatement", *Race, Poverty & the Environment*, **2 (2)**, 3, 12-15.

Week 9 Supplemental & Reference Material

Tahkofper, Carl L. (1982) "Political pressures affecting natural resource development on Indian reservations", *Ethnicity and Public Policy* (University of Wisconsin Press: Milwaukee, MI). Pages 105 – 120.

Week 10 – Transportation, Nuclear Energy

Lecture 19 (10/30) Energy and Transportation
Lecture 20 (11/1) Nuclear Energy I: Physics and Engineering – Fission Systems

Lecture 19:

Inter-laboratory Working Group on Energy Efficient and Clean Energy Technologies (2000) "Transportation Sector", in Scenarios for a Clean Energy Future (U. S. Department of Energy).
Chapter 5: http://www.ornl.gov/ORNL/Energy_Eff/CEFCh6.pdf

Jensen, Marc W. and Ross, Marc (2000) "The ultimate challenge: Developing an Infrastructure for Fuel-Cell Vehicles", *Environment*, **42 (7)**, 10 – 22.

Problem Set #5 distributed
Covering: environmental justice; transportation; basics of nuclear energy

Lecture 20:
Handout, and chapter from ___ (nuclear fundamentals)

Week 10 Supplemental & Reference Material

Friedman, D. J., Mark, J. Monahan, P., Nash, C. and Ditlow, C. (2001) *Drilling in Detroit: Tapping Automaker Ingenuity to Build Safe and Efficient Automobiles*, Union of Concerned Scientists, Cambridge, MA.

The Five Lab Study (1999) *Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy-Efficient and Low-Carbon Technologies by 2010 and Beyond* (US National Laboratory Integrated Analysis Team). Chapter 5, "The Transportation Sector".
URL: http://eappc76.lbl.gov/tmacal/ees.cfm

US DoE reference site for transportation issues: http://www.eren.doe.gov/EE/transportation.html

Take a virtual 3-D tour of a nuclear power plant:
http://www.entergy-nuclear.com/education/virtual/tour_page_intro.asp

Week 11 – Nuclear Energy

Lecture 21 (11/7) *Nuclear Energy* II: Waste, Economics & Politics
Lecture 22 (11/9) *Nuclear Energy* III: The Future of Nuclear Power

Lecture 21:

Flynn, James, Kasperson, Roger E., Kunruether, Howard, and Slovic, Paul (1997) "Overcoming tunnel vision: redirecting the U. S. High-Level Nuclear waste program", *Environment,* **39 (3)**, 6 – 11,

Kastenberg, William E. and Gratton, Luca, J. (1997) "Hazards of managing and disposing of nuclear waste", *Physics Today*, June. Pages 41 – 46.

Kuletz, Valerie L. (1998) *Tainted Desert: Environmental Ruin in the American West* (Routledge Press: New York). Pages 1 – 37.

Von Meier, Alexandra; Miller, Jennifer Lynn, and Keller, Ann C. (1998) "The disposition of excess weapons plutonium: A comparison of three narrative contexts", *The Nonproliferation Review*, Winter. Pages 20 – 31.

Lecture 22:
Fission – technical introduction document

Peterson, P. (1999) "The future of nuclear energy", *Paper delivered at the National Academy of Engineering Symposium on Frontiers of Engineering.*
URL: http://www.nuc.berkeley.edu/thyd/papers/Future_Nuclear_Energy.pdf

Sailor, W. C., Bodansky, D., Braun, C. Fetter, S. and van der Zwaan, R. (2000) "A nuclear solution to climate change", *Science*, **288**, 1177 – 1178.

Problem Set #5 due 11/9

Problem Set #6 distributed 11/9
Covering: nuclear energy, waste, renewable energy systems, costs, and comparisons.

Week 11 Supplemental & Reference Material

League of Women Voters (1993) *The Nuclear Waste Primer*. League of Women Voters Education Fund, New York.

Nuclear Energy Institute - 2001 Market Forecast
Draft Generation IV study: The Next Generation of Nuclear Energy Technologies

Week 12 – Renewable Energy

Lecture 23 (11/13) Renewable Energy I: Solar, Wind and Hydro
Lecture 24 (11/15) Renewable Energy II: Fuel Cell Systems

Lecture 23:

Herzog, A.V., Lipman, T.E., and Kammen, D.M. (2001) ""Energy Resource Science and Technology Issues in Sustainable Development: Renewable Energy Sources," in, OUR FRAGILE WORLD: Challenges and Opportunities for Sustainable Development, forerunner to the Encyclopedia of Life Support Systems (EOLSS), (UNESCO-EOLSS Secretariat, EOLSS Publishers Co. Ltd.)
URL: http://socrates.berkeley.edu/~rael/eolss.pdf

Rader, Nancy A. and Short, William P. III (1998) "Competitive retail markets: Tenuous ground for renewable energy", in *The Electricity Journal"*, April. Pages 72 – 80.

Lecture 24:

Laramie, J. and Dicks, A. (2000) *Fuel Cell Systems Explained* (Wiley & Sons, Inc.: New York), 1 – 27, 37 – 53.

Week 12 Supplemental & Reference Material

Clemmer, S.L., Nogee, A., and Brower, M. (1999) "A Powerful Opportunity: Making Renewable Electricity the Standard," Union of Concerned Scientists, January.

Contents	URL
The Clean Power Estimator	http://www.consumerenergycenter.org/renewable/estimator/default.htm
National Renewable Energy Laboratory	http://www.nrel.gov
Union of Concerned Scientists Energy Information, Fact Sheets, and Reports	http://www.ucsusa.org/arms/ (then go to the Energy Page)

Week 13 – Energy Forecasting

Lecture 25 (11/20) Methods VI: Energy Futures and Forecasting

Lecture 25:

Inter-laboratory Working Group on Energy Efficient and Clean Energy Technologies (2000) "Executive Summary and Chapter 1", in Scenarios for a Clean Energy Future (U. S. Department of Energy).
Executive Summary: http://www.ornl.gov/ORNL/Energy_Eff/CEFES.pdf
Chapter 1: Integrated Analysis and Conclusions:
http://www.ornl.gov/ORNL/Energy_Eff/CEFCh1.pdf

Holdren, John (1991) "Population and the energy problem", *Population and the Environment*, **12 (3)**, 231 – 255. [Re-read.]

Problem Set #6 due 11/20

Week 13 Supplemental & Reference Material

Global Energy Perspectives (1998): Modeling and Forecasting Tools
http://www.iiasa.ac.at/Research/ECS/docs/scenarios-new.html?sb=13

Nakienovic, N., Grübler, A., and McDonald, A. (1998) *Global Energy Perspectives* Cambridge University Press: Cambridge, UK).

Week 14 – Energy Systems and the Global Environment

Lecture 26 (11/27) Distributed generation and green Power
Lecture 27 (11/29) *Climate Change* I: Energy and Climate

Lecture 26:
Dunn, S. (2000) *Micropower: The Next Electrical Era* (WorldWatch Institute, Paper 151).

Rader, N. (2000) "Getting it Right and Wrong in the States," *Windpower Monthly*, 42-47, April.

Problem Set #7 distributed 11/27
Covering: forecasting, energy-climate analysis; problem set contains a 5 page policy memo assignment (this piece could be announced earlier).

Lecture 27:
Epstein, Paul (2000) "Is global warming harmful to health", *Scientific American*, August, 50 – 57.

Houghton, John T. *et al.* (1996) *The Science of Climate Change;* Intergovernmental Panel on Climate Change, IPCC Working Group I (Cambridge University Press: Cambridge, UK). Pages 55 – 64.

DeCanio, Stephen (1997) *The Economics of Climate Change* (Redefining Progress: San Francisco, CA). Pages 1 – 45.

Week 14 Supplemental & Reference Material

Watson, Robert T. *et al.* (1996) *Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analysis;* Intergovernmental Panel on Climate Change, IPCC Working Group I (Cambridge University Press: Cambridge, UK). Pages 21 - 53.

Week 15 – Science, Society, and the Future

Lecture 28 (12/4) *Climate Change* II: Energy Policy
Lecture 29 (12/6) Wrap-up and Integration: Energy Futures

Lecture 28:

Baer, P., Harte, J., Herzog, A., Holdren, J., Hultman, N., Kammen, D. M., Kresch, B., Norgaard, R., and Raymond, L. (2001) "Atmospheric equity: Response to Westing", *Science* **291**, 827-828.
URL: http://socrates.berkeley.edu/~dkammen/Erg-Science-equity.pdf

Holdren, J. (2001) "Searching for a National Energy Policy" by John Holdren in the Spring 2001" *Issues in Science & Technology,* Spring.

Victor, New York Times editorial (Spring, 2001).

Shove, E., Lutzenhiser, L., Hackett, B., Guy, S. and Harold Wilhite (2000) "Re-Thinking The Human Dimension: Social Science, Energy And Global Environmental Change" (mimeo).

Lecture 29:

Clark, W. (2000) "Memorandum to the president: America's national interests in promoting a transition toward sustainability", in U. S. Policy and the Global Environment: Memos to the President, Edited by Kennedy, D. and Riggs, J. A. (The Aspen Institute: Washington, DC), 183 – 198.

Kammen, D. M. (1999) "Bringing power to the people: Promoting appropriate energy technologies in the developing world", *Environment*, **41 (5)**, 10 – 15, 34 - 41.

Week 15 Supplemental & Reference Material

Gelbspan, Ross (1997) *The Heat is On: The High Stakes Battle over the Earth's Threatened Climate* (Addison-Wesley Publishing: Reading MA). Pages 33 – 61.

ITEMS REMOVED, USED LAST YEAR: TO BE RE-INSERTED IF ANYONE REALLY WANTS A PARTICULAR PAPER INCLUDED

Gottlieb, Robert (1993) *Forcing the Spring: The Transformation of the American Environmental Movement* (Island Press: Washington DC). Excerpts from chapters 6, 7, & 8.

Norman, Colin (1981) *The God that Limps* (W. W. Norton & Company: New York). Chapter 2, "Technology in a New Era", Pages 27 – 60.

Taylor, Peter and García-Barrios, Raúl. (1999) "The dynamics of socio-environmental change and the limits of neo-malthusian environmentalism", in Dore, Mohammed H. I. and Mount, Timothy, D. (editors), *Global Environmental Economics: Equity and the Limits to Markets* (Blackwell Publishers: London, UK). Pages 139 – 166.

Cooper, Mark N., Sullivan, Theodore L., Punnett, Susan, and Berman, Ellen (1983) "Introduction: A Decade of Despair, *Energy and Equity: Rising Energy Prices, and the Living Standards of Lower Income Americans* (Westview Press: Bounder, CO). Pages 1 – 50 & 237 – 245 (footnotes).

Oppel. Richard A., Jr. (2000) "A gas giant bets heavily on a surge in demand", *The New York Times*, Page AX.

Landes, David (1969) *The Unbound Prometheus; Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge University Press: Cambridge, UK). Pages 94 – 108.

Corbett, Andrew (1988) "Nuclear-free Belau", in *Indigenous Voices: Visions and Realities* (CIP-Gegevens Koninklijke Bibiotheek: The Hague), Pages 135 – 139.

Coy, Peter and Gary Mc Williams with John Rossant (1997) "The New Economics of Oil", *Business Week November* 23. Pages 140 – 148.

Giampietro, M., Ulgiati, Sergio, and Pimentel, David (1997) "Feasibility of large-scale biofuel prodution", *BioScience*, **47 (9),** 587 – 600.

Rambo, A. Terry (1991) "Energy and the evolution of culture: A Reassessment of White's Law", in A. Terry Rambo and Kathlees Gillogy (eds), *Profiles in Cultural Evolultion* (Anthropological Papers, University of Michigan: Ann Arbor, MI). Pages 291 – 310.

Moore, Stephen (1995) "The coming age of abundance", in *The True State of the Planet,* Ronald Bailey (ed.) (The Free Press: New York). Pages 110 – 139.