

<b>Course title:</b> Energy Economics				
<b>Course code:</b> MPE-183		<b>No. of credits:</b> 3	<b>L-T-P:</b> 34-8-0	<b>Learning hours:</b> 42
<b>Pre-requisite course code and title (if any):</b> None				
<b>Department:</b> Department of Policy Studies				
<b>Course coordinator:</b> Dr. Eshita Gupta			<b>Course instructor:</b> Dr. Eshita Gupta	
<b>Contact details:</b> eshita.gupta@teriuniversity.ac.in				
<b>Course type:</b> Elective			<b>Course offered in:</b> Semester 3	
<b>Course description:</b> This Energy Economics course would provide an understanding of economic concepts and theories related to the supply and utilization of energy resources, and technologies at various levels- economy, firm and individual. In this course we will learn how to apply economic tools and frameworks and use empirical data for economic analysis in the energy systems domain to support and influence decision making in the context of resource planning, energy efficiency, climate change and sustainable development.				
<b>Course objectives:</b> 1) To provide students with a thorough grounding in the key concepts of energy economics. 2) To illustrate how these concepts and standard economic tools can be used to analyse energy-related policy issues. 3) To be able to apply this knowledge to the analysis of specific energy issues in India.				
<b>Course contents</b>				
S.No	Topic	L	T	P
1	<b>Module 1: Introduction</b> • History of energy use • Current state of energy world • Resource substitution as the key process • Role of energy in development and growth • Classification of resources. • Some basic concepts: units/measurements, stocks/ flows	3	1	
2	<b>Module 2: Energy Demand</b> • Theoretical background: Derived energy demand - Consumer demand - Producer demand • Types of econometric demand models. • Issues treated by demand models - Capital-energy substitutability - Technical change - Scale effects - Short-run versus long-run analysis - Expectations - Disequilibrium and rationing - Time of day, seasonal, and block pricing	5	1	
3	<b>Module 3: Economics of Energy Supply</b> • The depletable concept • Economic theory of depletable resources - How much of a resource would be extracted? - What would be the timing of extraction? - What would be market price pattern over time? - What timing of extraction should be best for society? - How do market determined and socially optimal rates compare? - How market changes- higher interest rates, changed expectations, varying market structures, taxes-change patterns of extraction? - What is the nature of the supply function for depletable	5	1	

	resources? <ul style="list-style-type: none"> <li>• Discussion on Peak oil</li> <li>• Strategies for modelling exhaustible resource</li> <li>- Estimation of cost functions</li> <li>- Computational equilibrium models</li> <li>- Econometric models of exhaustible resource supply</li> <li>• Economic theory of renewable energy supply</li> <li>- Economics of solar, wind, Hydro and bio-fuels</li> <li>• Economic of oil refining</li> <li>• Economics of power generation</li> </ul>			
4	<b>Module 4: Energy markets and pricing</b> <ul style="list-style-type: none"> <li>• Structure of energy markets</li> <li>• Natural resource Cartels: An example of OPEC</li> <li>• Concepts of energy pricing</li> <li>- Average and Marginal cost pricing</li> <li>- Peak and off-peak pricing</li> <li>- Cross-Subsidization</li> </ul>	3	1	
5	<b>Module 5: Issues Facing the Energy Sector</b> <ul style="list-style-type: none"> <li>• Energy Access and poverty</li> <li>• Geopolitics and Energy Security</li> <li>- Key Indicators of energy security</li> <li>- Possible energy security externalities</li> <li>- Energy security policies</li> <li>• Energy efficiency</li> </ul>	5	1	
6	<b>Module 6: Energy-Economy-Environment Interactions</b> <ul style="list-style-type: none"> <li>• Externalities and their valuation</li> <li>• Energy and climate change</li> <li>• Intertemporal resource-environmental interactions</li> <li>- Dynamic models of resource-environmental interactions</li> <li>- Intertemporal efficiency and intergenerational equity</li> </ul>	5	1	
7	<b>Module 7: Energy policy and regulatory issues</b> <ul style="list-style-type: none"> <li>• Energy policy instruments</li> <li>• Distributional incidence of energy taxes and subsidies.</li> <li>• Technology assessment and risk analysis</li> </ul>	5	1	
8	<b>Module 8: Energy for Sustainable Development</b> <ul style="list-style-type: none"> <li>• Defining Sustainability</li> <li>• What is sustainable energy consumption?</li> <li>• Concept of green accounting</li> <li>• Low carbon options</li> </ul>	3	1	
	<b>Total</b>	<b>34</b>	<b>8</b>	
<b>Evaluation criteria:</b>				
Test 1- Minor Exam (Module 1- Module 4)- 40%				
Test 2 - Presentation (Module 5-8) - 20%				
Test 3- Major Exam(Module 5-8) - 40%				
<b>Learning outcomes:</b>				
1. Appreciate and understand economics of energy production and supply, energy consumption and demand, energy regulation, and energy market and trading (Test 1)				
2. Comprehend both theoretical and empirical aspects of energy economics (Test 1 and Test 3)				
3. Learn advanced tools and techniques for conducting empirical assessment energy sector (Test 2)				
4. Understand complex nuances of energy, environment and climate interactions and interdependencies (Test 2 and Test 3)				
<b>Materials:</b>				
<b>Suggested readings</b>				
Required text				
1. J.M. Griffin, and H.B. Steele, Energy Economics and Policy, Academic Press,1985				
2. Hunt, Lester C., and Joanne Evans, eds. International handbook on the economics of energy. Edward Elgar Publishing, 2011. (EEP)				

3. Bhattacharyya, Subhes C., Concepts, Issues, Markets and Governance, Springer, London, 2011. (BS)
4. Shogren, Jason. Encyclopedia of Energy, Natural Resource, and Environmental Economics. Newnes, 2013. (SJ)
5. Allen V. Kneese & James L. Sweeney (eds.), Handbook of Natural Resource and Energy Economics, Vol. III, Elsevier Science Publishers, Amsterdam, 1993. (KS)

**Other text**

6. Carol A. Dahl, International Energy Markets: Understanding Pricing, Policies, and Profits, Tulsa: Pennwell, 2004.
7. Ferdinand E. Banks, Energy Economics: A Modern Introduction , Kluwer Academic, 2000
8. J.M. Conrad and C.W. Clark, Natural Resource Economics, Cambridge University Press (1987).
9. R. Perman, Y. Ma, J. McGilvray and M. Common, Natural Resource and Environmental Economics, 3rd edition, Pearson Education, Harlow (2003).
10. J.M. Hartwick and N.D. Olewiler, The Economics of Natural Resource Use, 2nd edition, Addison Wesley (1998).
11. Tietenberg, Thomas H., and Lynne Lewis. Environmental and natural resource economics. Reading, MA: Addison-Wesley, 2000.

Suggested Readings:

Section 1

Energy and economic growth

1. \*Smil, Vaclav. "World history and energy." Encyclopaedia of Energy 6 (2004): 549.
2. \*Solow, Robert, "Resources and Economic Growth," The American Economist, Vol. 22, No. 2 (Fall, 1978), pp. 5-11.
3. \*Stern, David I. "The role of energy in economic growth." Annals of the New York Academy of Sciences 1219.1 (2011): 26-51.
4. Neumayer, Eric, "Scarce or Abundant: The Economics of Natural Resource Availability," Journal of Economic Surveys, vol. 14, 3, 2000: 307-335.
5. Kraft J. and A. Kraft (1978) , On the relationship between energy and GNP, Journal of Energy and Development 3, 401-403
6. \*Nordhaus, William D. "Resources as a Constraint on Growth." The American Economic Review (1974): 22-26.
7. Stokey N. L. (1998) Are there limits to growth? International Economic Review 39(1):1-31.
8. Fouquet, Roger. "The slow search for solutions: Lessons from historical energy transitions by sector and service." Energy Policy 38.11 (2010): 6586-6596.
9. \*Sengupta, Ramprasad. Ecological Limits and Economic Development: Creating Space. Oxford University Press, 2013, Chapter 12.

Section 2

10. \*Ramanathan, Ramu. "Short-and long-run elasticities of gasoline demand in India: An empirical analysis using cointegration techniques." Energy economics 21.4 (1999): 321-330.
11. Mallick, Hrushikesh. "Examining the linkage between energy consumption and economic growth in India." The Journal of Developing Areas 43.1 (2009): 249-280.
12. \*Gundimeda, Haripriya, and Gunnar Köhlin. "Fuel demand elasticities for energy and environmental policies: Indian sample survey evidence." Energy Economics 30.2 (2008): 517-546.
13. Baker, Paul, Richard Blundell, and John Micklewright. "Modelling household energy expenditures using micro-data." The Economic Journal (1989): 720-738.
14. Wolfram, Catherine, Ori Shelef, and Paul J. Gertler. How will energy demand develop in the developing world? No. w17747. National Bureau of Economic Research, 2012.
15. Dubin, Jeffrey A., and Daniel L. McFadden. "An econometric analysis of residential electric appliance holdings and consumption." Econometrica: Journal of the Econometric Society (1984): 345-362.
16. Hausman, Jerry A. "Individual discount rates and the purchase and utilization of energyusing durables." The Bell Journal of Economics (1979): 33-54.
17. William Nordhaus, (1979): The Efficient Use of Energy Resources, Yale University Press.
- 18. Costa, Dora L., and Matthew E. Kahn. "Electricity Consumption and Durable Housing: Understanding**

**Cohort Effects." American Economic Review 101.3 (2011): 88-92. (data online)**

19. \*H. Hotelling, "The Economics of Exhaustible Resources," J. Political Economy, April 1931, 39, 137-175.
20. \*Robert M. Solow. The Economics of Resources or the Resources of Economics, Journal of Natural Resources Policy Research Vol. 1, Iss. 1, 2008.

Section 4

21. \*Barsky, R., and L. Killian. "Oil and the Macroeconomy since the 1970s," Journal of Economic Perspectives 18, no. 4 (2004): 115-134.
22. The Economic Effects of Energy Price Shocks, Lutz Kilian, Journal of Economic Literature 2008, 46:4, 871-909.
- 23. Kilian, Lutz. "Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market." The American Economic Review (2009): 1053-1069. (dataset online)**
24. Schubert, Stefan F., and Stephen J. Turnovsky. "The impact of oil prices on an oilimporting developing economy." Journal of Development Economics 94.1 (2011): 18-29.
25. \*Hamilton, James, "Understanding Crude Oil Prices," Energy Journal, vol. 30, 2, 2009:179-206.
26. McNally, Robert, and Michael Levi, "A Crude Predicament: The Era of Volatile OilPrices," Foreign Affairs, July/ August 2011.
27. Bohi D. (1989) Energy Price Shocks and Macroeconomic Performance, Resources for the Future, Washington DC.
28. Wolfram, Catherine D. "Measuring duopoly power in the British electricity spot market." American Economic Review (1999): 805-826.
29. Ryan Nicholas. The competitive effects of transmission infrastructure in the Indian electricity market. Working Paper, MIT (September), 2013.
- 30. FABRIZIO, Kira R., Nancy L. ROSE, and Catherine D. WOLFRAM. "Do markets reduce costs? Assessing the impact of regulatory restructuring on US electric generation efficiency." The American economic review 97.4 (2007): 1250-1277.(online dataset)**
- 31. Ito, Koichiro. "Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing." THE AMERICAN ECONOMIC REVIEW 104.2 (2014): 537-563. (dataset online)**
32. Joskow, Paul L., and Catherine D. Wolfram. "Dynamic pricing of electricity." The American Economic Review 102.3 (2012): 381-385.

Section 5

33. Pachauri, S., Mueller, A., Kemmler, A., & Spreng, D. (2004). On measuring energy poverty in Indian households. World Development, 32(12), 2083-2104.
34. Bhattacharyya, Subhes C. "Energy access problem of the poor in India: Is rural electrification a remedy?" Energy Policy 34.18 (2006): 3387-3397.
35. Auffhammer, Maximilian, and Catherine D. Wolfram. "Powering up China: Income Distributions and Residential Electricity Consumption." The American Economic Review 104.5 (2014): 575-580.
- 36. Dinkelmann, Taryn. "The effects of rural electrification on employment: New evidence from South Africa." The American Economic Review (2011): 3078-3108.(dataset online)**
37. Gupta, Eshita. "Oil vulnerability index of oil-importing countries." Energy policy 36.3 (2008): 1195-1211.
38. Michael Toman, "The Economics of Energy Security: Theory, Evidence, Policy" Handbook of Natural Resource and Energy Economics, Vol. III, ch 25
39. Binswanger M. (2001) Technological progress and sustainable development: what about the rebound effect? Ecological Economics 36: 119-132.
40. Brookes L. (1990) The greenhouse effect: the fallacies in the energy efficiency solution, Energy Policy 18: 199-201.
41. Allcott, Hunt, Allan Collard-Wexler, and Stephen D. O'Connell. How Do Electricity Shortages Affect Productivity? Evidence from India. No. w19977. National Bureau of Economic Research, 2014.
42. Herring, Horace (1999): "Does energy efficiency save energy? The debate and its consequences," Applied Energy, 63: 209-226.
43. Lucas W. Davis "Durable Goods and Residential Demand for Energy and Water: Evidence from a Field Trial", The RAND Journal of Economics, Vol. 39, No. 2 (Summer, 2008), pp. 530-546
44. Eichholtz, Piet, Nils Kok, and John M. Quigley. "Doing well by doing good? Green office buildings." The American Economic Review (2010): 2492-2509. (dataset online)

**45. Chan, Hei Sing Ron, Maureen L. Cropper, and Kabir Malik. "Why Are Power Plants in India Less Efficient Than Power Plants in the United States?." The American Economic Review 104.5 (2014): 586-590. (dataset online)**

Section 6

46. Beckerman, Wilfred. "Economic growth and the environment: Whose growth? Whose environment?" World development 20.4 (1992): 481-496.
47. Stern, David I., Michael S. Common, and Edward B. Barbier. "Economic growth and environmental degradation: the environmental Kuznets curve and sustainable development." World development 24.7 (1996): 1151-1160.
48. Suri, Vivek, and Duane Chapman. "Economic growth, trade and energy: implications for the environmental Kuznets curve." Ecological economics 25.2 (1998): 195-208.
49. Gupta, Eshita. "Global warming and electricity demand in the rapidly growing city of Delhi: A semi-parametric variable coefficient approach." Energy Economics 34.5 (2012):1407-1421.
50. Summary for Policy Makers and Chapters 5 and 7 of IPCC WGIII (2014)

Section 7

51. \*Datta, Ashokankur. "The incidence of fuel taxation in India." Energy Economics 32 (2010): S26-S33.
- 52. \*Davis, Lucas W. "The Economic Cost of Global Fuel Subsidies." American Economic Review 104.5 (2014): 581-85. (dataset online)**
53. Gangopadhyay, S., Ramaswami, B., & Wadhwa, W. (2005). Reducing subsidies on household fuels in India: how will it affect the poor? Energy Policy, 33(18), 2326-2336.
54. \*Stern, Ed., Fuel taxes and the poor" 2012, RFF Press.
55. Hochman, Gal, Deepak Rajagopal, and David Zilberman. "Are biofuels the culprit? OPEC, food, and fuel." The American Economic Review (2010): 183-187.
56. Jorgenson, Dale W., et al. "Carbon taxes and economic welfare." Brookings Papers on Economic Activity. Microeconomics (1992): 393-454.
57. Sterner, Thomas. "Fuel taxes: An important instrument for climate policy." Energy Policy 35.6 (2007): 3194-3202.
58. Metcalf, Gilbert E. "Using Tax Expenditures to Achieve Energy Policy Goals." The American Economic Review (2008): 90-94.
59. Davis, Lucas, Alan Fuchs, and Paul Gertler. "Cash for coolers: Evaluating a large-scale appliance replacement program in Mexico." Energy Institute at Haas, WP-230R (2013).
60. Malik, Kabir, et al. Estimating the impact of restructuring on electricity generation efficiency: The case of the Indian thermal power sector. National Bureau of Economic Research, 2011.
- 61. Jessoe, Katrina, and David Rapson. "Knowledge Is (Less) Power: Experimental Evidence from Residential Energy Use." American Economic Review 104.4 (2014): 1417-38. (dataset online)**
- 62. Kellogg, Ryan. "The Effect of Uncertainty on Investment: Evidence from Texas Oil Drilling." American Economic Review 104.6 (2014): 1698-1734. (dataset online)**
63. Murray, Brian C., et al. "How Effective Are US Renewable Energy Subsidies in Cutting Greenhouse Gases?" The American Economic Review 104.5 (2014): 569-574.
64. Hoel, Michael. "Carbon taxes and the green paradox." Climate Change and Common Sense: Essays in Honour of Tom Schelling, Oxford University Press, Oxford (2012):203-224.

Section 8

65. Gordon, Richard L. "Hicks, Hayek, Hotelling, Hubbert, and Hysteria or Energy, Exhaustion, Environmentalism, and Etatism in the 21st Century." Energy Journal 30.2 (2009).
66. \*Steckel, J., et al. "Development without energy? On the challenge of sustainable development in the context of climate change mitigation." Ecological Economics 90.1(2013): 53-67.
67. \*Srivastava, Leena, and I. H. Rehman. "Energy for sustainable development in India: Linkages and strategic direction." Energy Policy 34.5 (2006): 643-654.
68. \*The unsustainability of fossil fuel use in India, Ramprasad Sengupta, Ideas for India.
69. \*Green Economy: Indian Perspective K S Kavikumar, Ramprasad Sengupta, R Maria Saleth and K R Ashok and R Balasubramanian, Madras School of economics, Chennai, 2012.
70. \*Pachauri, Rajendra K. "The future of India's economic growth: the natural resources and energy

dimension." *Futures* 36.6 (2004): 703-713.

71. Sengupta, Ramprasad. "Inclusive Economic Growth and Sustainable Energy Development of India." *India's Economy and Growth: Essays in Honour of VKRV Rao* (2010): 155.

72. Muller, Nicholas Z., Robert Mendelsohn, and William Nordhaus. "Environmental accounting for pollution in the United States economy." *The American Economic Review* (2011): 1649-1675. (dataset online)

73. Parikh, Jyoti, and Kirit Parikh. "India's energy needs and low carbon options." *Energy* 36.6 (2011): 3650-3658.

74. Acemoglu, Daron, et al. "The Environment and Directed Technical Change." *The American Economic Review* 102.1 (2012): 131-166. (dataset online)

#### **Journals**

Energy Economics

Energy Policy

The Energy Journal

Economics of Energy and Environmental Policy

The Journal of Energy and Development

Resources and Energy Economics

Journal of Environmental Economics and Management

Ecological Economics

American Economic Review

Economic and Political Weekly

The Economist

#### **Websites Resources**

BP statistical Review

World Bank Indicators

Central Electricity Authority of India

Energy Statistics

#### **Additional information (if any):**

**Student responsibilities:** Attendance, feedback, discipline: as per university rules.

#### **Course reviewers:**

**Subhes C. Bhattacharya, E. Somanathan, Kanchan Chopra, Ritu Mathur and Meeta Mehra**