



SCHOOL OF INTERNATIONAL STUDIES

JAWAHARLAL NEHRU UNIVERSITY

Programme:	M.A. Economics (with Specialization in the World Economy)
Course No:	IE 534
Course Title:	Energy Economics and Policy
Course Type:	Optional
Semester:	Winter
Course Teacher & Contact Details:	<i>Name: Prof. Atul Kumar Room No.: 302, SIS - II Email: atulkumar@jnu.ac.in</i>
Credits:	4
Contact Hours:	4 hours/week

Course Statement

Energy is at the heart of global economic growth, trade, technological progress, and environmental sustainability. The dynamics of energy production, consumption, and pricing shape international competitiveness, sustainable development, and climate outcomes. Given context globally, India's energy choices encompassing access, affordability, and decarbonisation serve as a pivotal case study for emerging economies navigating the energy transition. Therefore, a comprehensive understanding of energy systems is essential for analysing and interpreting both domestic policy discussion and global energy dynamics.

Course Objectives

The course is designed to provide students with a strong understanding of the core concepts and data tools used in energy economics integrating global perspectives and India's context. It aims to develop practical skills for analysing energy demand, pricing mechanisms, and investment decisions within the energy domain. The course also examines the interlinkages between energy systems, climate change, and sustainable development within both local and global perspectives.

Learning Outcomes

On successful completion of the course, students will be able to:

- Explain the economic principles and indicators underlying global and national energy systems.
- Evaluate energy investment decisions using quantitative and financial appraisal techniques.

- Assess the role of pricing reforms and policy instruments on energy markets and the energy transition.
- Evaluate the interlinkages between energy use, climate change, and international and national climate policy frameworks.
- Interpret and critique the application of Energy–Economy–Environment (E3) models and Integrated Assessment Models (IAMs) for policy and scenario analysis.

Evaluation Methods

Presentations, class participation, assignments, mid-term examination, end-term examination.

Course Outline

Module 1: Global Energy Systems, Energy Balances, and Indicators

Introduction, energy as a driver of economic growth and development, energy balances, indicators, global and Indian energy trends.

Module 2: Energy Demand Analysis

Demand determinants, elasticities, modelling approaches, and energy demand management.

Module 3: Investment Appraisal in Energy Projects

Time value of money, investment criteria (payback period, net NPV, IRR, B/C ratio), levelised cost of energy, sensitivity analysis, specific issues in renewable-energy project appraisal.

Module 4: Energy Pricing & Policy Instruments

Energy pricing, energy subsidies & taxation, energy reforms, electricity tariff, renewable-energy-specific instruments (feed-in tariffs, renewable energy purchase obligations, renewable-energy certificates, competitive auctions)

Module 5: Energy Access, Security & Transition Considerations — Global and Indian Contexts

Energy mix & historic shifts, energy access and equity issues, energy security dimensions, transition challenges and pathways.

Module 6: Global Energy–Climate Change Linkages and National Responses

Energy as a driver of emissions, mitigation options, transition policies, global and national perspectives.

Module 7: Energy–Economy–Environment (E3) Modelling for Global and National Policy Analysis

Modelling frameworks, bottom-up and top-down approaches, Energy–Economy–Environment (E3) models, Integrated Assessment Models (AIMs), scenario analysis, critical

reflections on modelling and policy applications

Readings

The basic readings for each module are outlined below. Additional readings may be provided in class.

Module 1:

Bhattacharyya, S. C. (2019). *Energy economics: Concepts, issues, markets and governance*. Ch 2, Springer.

United Nations (2018), *International Recommendations for Energy Statistics (IRES)*, Chs 4, 8, Department of Economic and Social Affairs, Statistics Division, UN

IAEA (2005), *Energy Indicators for Sustainable Development: Guidelines and Methodologies*, Ch 3, International Atomic Energy Agency, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1222_web.pdf

Module 2:

Bhattacharyya, S. C. (2019). *Energy economics: Concepts, issues, markets and governance*. Chs 3 - 5, Springer.

Filippini, M., & Srinivasan, S. (2024). *An introduction to energy economics and policy*. Ch 3, Cambridge University Press. <https://doi.org/10.1017/9781009471831>

Bhattacharyya, S. C., & Timilsina, G. R. (2010). Modelling energy demand of developing countries: Are the specific features adequately captured?. *Energy Policy*, 38(4), 1979-1990. <https://doi.org/10.1016/j.enpol.2009.11.079>

Bose, R. K., & Shukla, M. (1999). Elasticities of electricity demand in India. *Energy Policy*, 27(3), 137-146. [https://doi.org/10.1016/S0301-4215\(99\)00011-7](https://doi.org/10.1016/S0301-4215(99)00011-7)

Zarnikau, J. (2003). Functional forms in energy demand modeling. *Energy Economics*, 25(6), 603-613. [https://doi.org/10.1016/S0140-9883\(03\)00043-4](https://doi.org/10.1016/S0140-9883(03)00043-4)

Module 3:

Kandpal, T. C., & Garg, H. P. (2003). *Financial evaluation of renewable energy technologies*. Chs 4 - 6, 10, Macmillan India.

Gittinger, J. P. (1973). *Economic analysis of agricultural projects*. Chs 9 - 10, Johns Hopkins University Press.

Filippini, M., & Srinivasan, S. (2024). *An introduction to energy economics and policy*. Ch 4, Cambridge University Press. <https://doi.org/10.1017/9781009471831>

- Palit, D., Malhotra, R., & Kumar, A. (2011). Sustainable model for financial viability of decentralized biomass gasifier based power projects. *Energy Policy*, 39(9), 4893-4901. <https://doi.org/10.1016/j.enpol.2011.06.026>
- Purohit, P., & Chaturvedi, V. (2018). Biomass pellets for power generation in India: a techno-economic evaluation. *Environmental Science and Pollution Research*, 25(29), 29614-29632. <https://doi.org/10.1007/s11356-018-2960-8>
- Rana, G. S., & Jindal, R. (2025). Factors affecting solar levelized cost of electricity in India & policy recommendations. *Energy and Climate Change*, 6, 100207. <https://doi.org/10.1016/j.egycc.2025.100207>
- Steckel, J. C., & Jakob, M. (2018). The role of financing cost and de-risking strategies for clean energy investment. *International Economics*, 155, 19-28. <https://doi.org/10.1016/j.inteco.2018.02.003>

Module 4:

- Bhattacharyya, S. C. (2019). *Energy economics: Concepts, issues, markets and governance*. Chs 9, Springer.
- ERIA (2019), "History of Pricing and Energy Reforms in India", in Phoumin, H., S., Kimura, and R. G (eds.), *Energy Pricing in India: A Study on Taxes and Subsidies*. ERIA Research Project Report FY2018 no.15, Jakarta: ERIA, pp.3-19. https://www.eria.org/uploads/media/07_RPR_FY2018_15_Chapter_2.pdf
- Ghosh, P. P. (2022). Impact of India's diesel subsidy reforms and pricing policy on growth and inflation. *Energy Economics*, 113, 106195. <https://doi.org/10.1016/j.eneco.2022.106195>
- Malhotra, M., Aggarwal, D., & Agrawal, S. Implementing Dynamic Tariffs for Residential Consumers: A Literature Review. *PROCEEDINGS OF ENERGISE 2023*, 279.
- Qudrat-Ullah, H. (2024). A framework for developing and implementing FIT policies for renewable energy based on local economic conditions. *Sustainable Futures*, 7, 100170. <https://doi.org/10.1016/j.sftr.2024.100170>
- Shrimali, G., Konda, C., & Farooquee, A. A. (2016). Designing renewable energy auctions for India: Managing risks to maximize deployment and cost-effectiveness. *Renewable Energy*, 97, 656-670. <https://doi.org/10.1016/j.renene.2016.05.079>

Module 5:

- Bhattacharyya, S. C. (2019). *Energy economics: Concepts, issues, markets and governance*. Chs 14, 17, Springer.
- Cherp, A., & Jewell, J. (2014). The concept of energy security: Beyond the four As. *Energy Policy*, 75, 415-421. <https://doi.org/10.1016/j.enpol.2014.09.005>
- Sehgal R., Ramji A., Soni A., Kumar A. (2014). Going beyond incomes: Dimensions of cooking energy transitions in rural India. *Energy*. 68(1):470–477. <https://doi.org/10.1016/j.energy.2014.01.071>

Rao, N. D., & Pachauri, S. (2017). Energy access and living standards: some observations on recent trends. *Environmental Research Letters*, 12(2), 025011. <https://doi.org/10.1088/1748-9326/aa5b0d>

Smil, V. (2016). Examining energy transitions: A dozen insights based on performance. *Energy research & social science*, 22, 194-197. <https://doi.org/10.1016/j.erss.2016.08.017>

Pandey, J. G., & Kumar, A. (2025). Justice in transition: Contesting narratives and converging interpretations in India's energy shift. *Energy Research & Social Science*, 129, 104333. <https://doi.org/10.1016/j.erss.2025.104333>

Module 6:

Bhattacharyya, S. C. (2019). *Energy economics: Concepts, issues, markets and governance*. Chs 10 -11, Springer.

Kumar, A. (2011). *Growth, Sustainable Development and Climate Change: Friends or Foes?* Utrecht University, Netherlands. . <https://princeclauschair.sites.uu.nl/wp-content/uploads/sites/688/2021/02/67Inauguraladdress.pdf>

Kesicki, F., & Ekins, P. (2012). Marginal abatement cost curves: a call for caution. *Climate Policy*, 12(2), 219-236. <https://doi.org/10.1080/14693062.2011.582347>

Michaelowa, A., Allen, M., & Sha, F. (2018). Policy instruments for limiting global temperature rise to 1.5° C—can humanity rise to the challenge?. *Climate Policy*, 18(3), 275-286. <https://doi.org/10.1080/14693062.2018.1426977>

Baranzini, A., Van den Bergh, J. C., Carattini, S., Howarth, R. B., Padilla, E., & Roca, J. (2017). Carbon pricing in climate policy: seven reasons, complementary instruments, and political economy considerations. *Wiley Interdisciplinary Reviews: Climate Change*, 8(4), e462. <https://doi.org/10.1002/wcc.462>

Dubash, N. K., Khosla, R., Kelkar, U., & Lele, S. (2018). India and climate change: Evolving ideas and increasing policy engagement. *Annual Review of Environment and Resources*, 43(1), 395-424. <https://doi.org/10.1146/annurev-environ-102017-025809>

Module 7:

Bhattacharyya, S. C. (2011). *Energy economics: Concepts, issues, markets and governance*. Ch 17, Springer.

Pfenniger, S., Hawkes, A., & Keirstead, J. (2014). Energy systems modeling for twenty-first century energy challenges. *Renewable and sustainable energy reviews*, 33, 74-86. <https://doi.org/10.1016/j.rser.2014.02.003>

Loulou, R., & Labriet, M. (2008). ETSAP-TIAM: the TIMES integrated assessment model Part I: Model structure. *Computational Management Science*, 5(1), 7-40. <https://doi.org/10.1007/s10287-007-0046-z>

Luxembourg, S. L., Salim, S. S., Smekens, K., Longa, F. D., & van der Zwaan, B. (2025). TIMES-Europe: An integrated energy system model for analyzing Europe's energy and

climate challenges. *Environmental Modeling & Assessment*, 30(1), 1-19.
<https://doi.org/10.1007/s10666-024-09976-8>

Fragkiadakis, K., Paroussos, L., Di Stasi, M., Tsiaras, S., & Uzagalieva, A. (2025). Soft linking the Italian energy and economic systems. *Energy Policy*, 206, 114764.
<https://doi.org/10.1016/j.enpol.2025.114764>

Van Vuuren, D. P., Stehfest, E., Gernaat, D. E., Doelman, J. C., Van den Berg, M., Harmsen, M., ... & Tabeau, A. (2017). Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm. *Global environmental change*, 42, 237-250.

Data Sources/Manual/Guidelines

British Petroleum. (latest edition). *Statistical Review of World Energy*

International Energy Agency. (latest edition). *Key World Energy Statistics*

International Energy Agency. (latest edition). *World Energy Balances: Overview*

International Energy Agency. (2004), *Energy Statistics Manual*,
<http://ec.europa.eu/eurostat/ramon/statmdnuals/files/Ene..gy> Statistics manual 2 004_ EN.pdf

Intergovernmental Panel on Climate Change (IPCC) (2006), *2006 IPCC guidelines for national greenhouse gas inventories* (H. S. Eggleston, L. Buendia, K. Miwa, T. Ngara, & K. Tanabe, Eds.). Institute for Global Environmental Strategies (IGES).

Ministry of Statistics and Programme Implementation (latest edition). *India Energy Statistics.*, Government of India

NITI Aayog (most recent release). *India Energy Dashboard*, Government of India

United Nations (2018), *International Recommendations for Energy Statistics (IRES)*, Department of Economic and Social Affairs, Statistics Division, UN