



# ENERGY RESOURCES, ECONOMICS AND ENVIRONMENT

**PROF. RANGAN BANERJEE**

Department of Energy Science and Engineering  
IIT Bombay

**TYPE OF COURSE** : New | Elective | UG/PG

**COURSE DURATION** : 12 weeks (27 Jan' 20 - 17 Apr' 20)

**EXAM DATE** : 25 Apr 2020

**PRE-REQUISITES** : Nil

**INTENDED AUDIENCE** : Masters students of Energy Systems Engineering. UG students of Mechanical Engineering, Electrical Engineering, Chemical Engineering and those interested in Energy

**INDUSTRIES APPLICABLE TO** : Nil

**COURSE OUTLINE :**

This course will equip students with the tools necessary for economic analysis and quantification of impacts of energy systems. We will review the availability of energy resources and study methods for quantification of resource depletion and scarcity. The course will cover basic concepts in economics and their application to energy systems. Tools and techniques for project economics for an individual/company perspective and macro-decision making for society will be introduced. We will discuss basic concepts of welfare economics and environmental economics that are necessary for energy systems analysis and their environmental impacts.

**ABOUT INSTRUCTOR :**

Rangan Banerjee is the Forbes Marshall Chair Professor and Head of the Department of Energy Science and Engineering at the Indian Institute of Technology Bombay. He works on energy efficiency and renewable energy, modelling of energy systems, energy planning and policy

**COURSE PLAN :**

- Week 1:** Issues related to Energy systems- Energy and growth, Country Energy Balance, India and World- Disaggregation by supply, end use
- Week 2:** Energy and Quality of Life, Energy and Equity, Energy and Environment, Kaya Identity
- Week 3:** Energy Economics - Simple Payback Period, Time Value of Money- discount rate, Criteria for Assessing Energy Projects -IRR, NPV
- Week 4:** Life Cycle Costing, Cost of Saved Energy, Cost of Energy generated
- Week 5:** Resources & Reserves Growth Rates in Consumption, Estimates of Duration of Fossil Fuels, McKelvey Diagram, Peak oil, Hubbert's model
- Week 6:** Energy Chain, Primary energy analysis, Net Energy Analysis Examples, Energy Cost of Energy, Life Cycle Analysis of Bioenergy
- Week 7:** Utility function, Indifference curve, Public goods, private goods, Pareto Optimality, Intergenerational Equity
- Week 8:** Quantifying Environmental impacts, DALY, Emission factors, Emission inventories
- Week 9:** Energy Economy models- Input Output Analysis
- Week 10:** Economics of natural resources – scarcity, non-renewable resources, Hotelling's rule, renewable resource economics
- Week 11:** Financing Energy – Debt/ Equity- Sources of funds, innovative financing models
- Week 12:** Energy Policy, Future Sustainable Energy Systems