

CMP3207 Sustainable Energy Systems

Period per Week			Contact Hour per Semester	Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	PH	TH	CH	WTM	WEM	WCM	CU
60	00	00	60	100	60	40	4

Rationale

The Sustainable Energy Systems course is designed to equip graduates and working professionals with a broad training in, and understanding of, energy production, delivery, consumption, efficiency, economics, policy and regulation. These are considered in the context of the sustainability of energy supply and consumption patterns, both locally and globally. A unique feature of the course is its broad approach to the development of sustainable routes to the generation and supply of energy within which renewable energy is a key theme.

Objective

By covering the course in Sustainable Energy Systems, the student will be able to:

- Understand and evaluate alternative modes of energy supply, including fossil-fuelled, nuclear and renewables-based supply
- Appreciate the development of and constraints on carbon- and non carbon-based energy resources
- Understand the challenges and constraints on end-use efficiency of energy
- Appreciate the economic, policy and regulatory frameworks within which decisions on energy futures are made
- Be conversant with the problems of energy distribution and the constraints on present distribution systems.
- Critically analyse competing claims in the energy sector
- Evaluate options for energy supply, distribution, utilisation
- Articulate environmental sustainability of energy supply systems
- Analyse the technical-economic interaction of developments in the energy system

Subject Content

1. *Technologies for Sustainable Energy*

- Principles of operation of sustainable energy conversion by (i) wind; (ii) wave; (iii) tidal; (iv) solar; (v) biomass; (vi) geothermal; (vii) combined heat and power systems;
- Principal aspects of engineering design underpinning these technologies;

- constraints on each technology, both imposed by physical fundamentals, and by current levels of technology and market, supported by quantitative evidence where possible;
 - Fundamentals of grid connection of distributed generators and the problems and constraints associated with this;
2. ***Energy Efficiency, Resource and Environment***
- Availability of natural resources and the implications of finite fossil resources;
 - The concept of proved reserves and R/P ratios;
 - Techniques for energy efficiency in buildings, including passive solar design
 - Relationships between energy use and climate change.
3. ***Power Systems Engineering and Economics***
- Iterative methods of solution to non-linear nodal network analysis and use a load flow package;
 - Effects of AC network on transmission and distribution of electricity
 - Principles of power system economics and how market-based solutions can be applied to a previously centrally-controlled industry
 - Effects of network on marginal prices at different locations
 - Taking human reactions into account when designing engineering solutions

Recommended and Reference Books

- [1] Peter Gevorkian. *Sustainable Energy Systems Engineering*. - McGraw-Hill (2007) - ISBN 0071473599
- [2] Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (Germany. *World in Transition: Towards Sustainable Energy Systems*.) - Earthscan (2004)- ISBN 1853838020
- [3] Naim Hamdia Afgan, Naim Afgan, Maria da Graca. *Carvalho Sustainable Assessment Method for Energy Systems: Indicators, Criteria, and Decision Making Procedure*. Kluwer Academic (2000) - ISBN 0792378768