Engineering Tripos Part IIB, 4M15: Sustainable Energy, 2016-17

Module Leader
Dr S Scott [1]

Lecturers
Dr S Scott, J Cullen and Mr J Platts

Lab Leader
Dr S Scott

Timing and Structure
Lent Term. 12 lectures + 2 examples classes.

Prerequisites
3A5 useful

Aims
The aims of the course are to:

• examine the sustainable production and use of energy, in order to provide sensible answers to questions such as "where is our future energy going to come from?" and "how best to use energy?"

Objectives
As specific objectives, by the end of the course students should be able to:

• analyse systems in terms of energy, material and exergy flows.
• understand the principles of sustainability and life-cycle analysis.
• have an understanding of renewable energy and other energy technologies, their limitations and possible contributions to future energy production.
• understand the wider issues associated with the supply and use of energy, and the role of energy policy.

Syllabus
Engineers need to be able to analyse systems, energy flows and their environmental impacts. This requires tools already familiar to engineers, such as the laws of thermodynamics, but also necessitates a holistic approach, i.e. looking at the impacts of a product or system over its entire lifecycle.

Introduction: Issues surrounding energy use and production (1 Lecture)
Sustainability, the carbon cycle, greenhouse gases, energy use patterns and the inequality in energy use.
Quantification of material and energy flows and the importance of thermodynamics (3 Lectures)

These lectures will use hydrogen production and fossil fuel technology as examples. Carbon separation and clean fossil fuel technologies (inc. advanced combustion technologies) will also be examined. This will include:

- Material and energy balances, i.e. being able to account for the all the energy and material flows, including when chemical reactions occur.
- The importance of the second law of thermodynamics. Irreversibilities and their quantification by Exergy analysis.
- Heat and power integration.

Making rational decisions based on sustainability (2 Lectures)

- Measuring sustainability
- Lifecycle analysis

Renewable Energy (3 Lectures)

The role of various renewable energy technologies (i.e. wind, wave, hydro, solar etc.) in meeting our future energy needs will be discussed. These lectures will look at the basic technologies and issues which these technologies must overcome if they are to replace fossil fuels.

End Use: Technologies for the transportation sector (2 Lectures)

Energy Policy (1 lecture)

Lecture on Energy Policy by John Cullen

Booklists

Please see the Booklist for Group M Courses [2] for references for this module.

Assessment

Please refer to Form & conduct of the examinations [3].

UK-SPEC

The UK Standard for Professional Engineering Competence (UK-SPEC) [4] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the 'Accreditation of Higher Education Programmes' (AHEP) document [5] which sets out the standard for degree accreditation.

The Output Standards Matrices [6] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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