UCL SUMMER SCHOOL

CLIMATE AND ENERGY

Key Information

Module code  ISSU0049
Taught during  Session One: Monday 1 July - Friday 19 July 2019
Module workload  45 teaching hours plus approximately 100 study hours
Module leader  Professor David Waters
Department  Physics
Credit  15 UCL credits, 7.5 ECTS, 4 US
Level  Level 2, second year Undergraduate
Pre-requisites  An understanding of Law, Mathematics or Physics to first year undergraduate level would be preferred: mathematics knowledge at the level of basic calculus, and physics knowledge at the level of basic classical mechanics & electricity. An understanding of classical thermodynamics would be useful but is not essential.
Assessment  Presentation (25%), Open-book class tests (75%)

Module Overview
What is the evidence for anthropogenic climate change? How can we generate low-carbon electricity from nuclear and renewable sources, and how can we make our transport infrastructure greener? If we fail to reduce greenhouse gas emissions sufficiently rapidly, will we need to intervene directly in the climate system through so-called “geoengineering”? This module will cover all of these topics, with a strong emphasis on the underlying physical principles and deriving simple estimates of the potential contribution of various low-carbon energy sources. In addition to attending lectures, students research one particular aspect of climate & energy in depth and present their findings in an essay and associated short presentation.

Week One:
- The Earth’s atmosphere and the basic physics of the greenhouse effect.
- The climate record & the evidence for anthropogenic climate change.

Week Two:
- The Earth’s atmosphere and the basic physics of the greenhouse effect.
- The climate record & the evidence for anthropogenic climate change.

Please note that this module description is indicative and may be subject to change.
Week Three:
- Energy storage and distribution.
- Geoengineering. Carbon dioxide removal and solar radiation management.
- Presentations.

Module Aims
Climate & Energy aims to provide an introduction to the basic science of climate change, the physics of energy generation and distribution by various means, and the possibility of intervening in the Earth’s climate system through geoengineering. The emphasis of the course is on the underlying physical principles, enabling the student to understand the potential contribution as well as the relative advantages and disadvantages of various low-carbon energy sources. By the end of the course, students will have the knowledge required to make their own critical judgments on scientific issues related to climate change and energy supply.

Teaching Methods
Interactive lectures and seminars, open class and small group discussions, group work and private study. Reading lists will be available online via the UCL library site. Students will be directed towards class materials, further support and discussion forums on the Virtual Learning Environment.

Learning Outcomes
Upon successful completion of this module, students will:
- Understand the basic energy balance of the Earth’s atmosphere, identify the most important means by which the Earth’s climate history has been reconstructed, and develop an ability to weigh the evidence for anthropogenic climate change
- Understand the basic science underlying power generation from thermal sources, hydro, tidal and wave power, wind power, solar energy, nuclear fission and fusion, and the operation of a power grid
- Appreciate for each source of energy the technical challenges, environmental impact and overall prospects
- Understand the leading proposals for intervening in the Earth’s climate through carbon dioxide removal and solar radiation management
- Have the requisite knowledge and understanding to make their own critical scientific assessments of current issues in climate and energy science.

Assessment Methods
- 10-minute presentation (25%)
- Open-book class tests (75%)

Key Texts
Global Warming – A Very Short Introduction, M. Maslin (OUP 2009)
Sustainable Energy – without the hot air, D. MacKay (UIT 2009 but also freely available online).
Geoengineering the climate, report of the Royal Society (2009; freely available online).

Please note that this module description is indicative and may be subject to change.