Module Title: Energy Provision	**Module Code: EV7108** **Level: 7** **Credit: 15** **ECTS credit: 7.5**	**Module Leader**: Tim Coleridge **Additional tutors:** Alan Owen Bryce Gilroy-Scott Frances Hill Jane Fisher Louise Halestrap Ruth Stevenson Siobhan Maderson Saskia Pagella

Pre-requisite: none	**Pre-cursor:** none
Co-requisite: none	**Excluded combinations :** none

Location of delivery: CAT/By distance learning

The main aims of the module are to enable students to:

Synthesise an informed understanding of the wider environmental and social benefits and limitations of the available energy provision technological options and energy reduction choices for transforming the current unsustainable ecosystems destructive energy provision systems, to systems that are locality applicable, low environmentally impacting and sustainable.

Form a critical appreciation of the technological aspects, functioning, practical aspects of small scale technologies, resource potential (and limitations), maintenance needs, associated carbon emissions and environmental impacts of the commonly perceived low environmentally impacting renewable resource technologies available.

Comparatively appraise the above in a holistic, objective and self reflective manner.

Develop an essential understanding of the primary need for energy use reduction and how energy distribution constraints, storage, supply and demand management, efficiency improvements, market drivers, planning processes, social and cultural aspects, governmental policy and financial support mechanisms, can affect the uptake of low environmentally impacting energy technologies, and determine demand reductions.

Main topics of study:

- Technological aspects of low environmentally impacting energy provision technologies;
    - Wind
    - Photovoltaic
    - Solar thermal, Heat Pumps and District heating
    - Hydroelectric (including marine)
    - Biomass and Biofuels
- Technological, Economic and Environmental Considerations related to;
    - Other Technologies (such as Nuclear, Carbon Capture and Storage)
    - Distribution (i.e. The Grid) and storage options (such as Batteries, Pumped Water Storage), including their future potential
- All of the below are with respect to the listed low environmentally impacting energy provision technologies under an adaptation transformation planning ethos;
    - Resource availability and limitations
    - Policy and economics issues (using UK for exemplar)
    - Planning, social and legislative aspects of energy provision
    - Energy security and wider Intermittency potential
    - Environmental impacts, waste implications and sustainability limits of low environmentally impacting technologies

Learning Outcomes for the module

At the end of this module, students will be able to:

Knowledge

1. Demonstrate a critical understanding of the fundamentals of the functioning of the listed technologies;

2. Form a synthesis of the benefits and limitations (e.g. intermittency) of transforming energy provision systems under an adaptation transformation ethos;

Thinking skills

3. Critically appraise the wider environmental impacts and carbon implications of installation, use and end of life outcome of the listed technologies;

4. Evaluate the ethical dilemmas when problem solving and decision making, in the context of energy provision in the current environmental change and adaptation transformation situation;

5. Appropriately discern the wider advantages and disadvantages to eco-systems, mitigation planning, societal systems and landscape disturbance when assessing the utilization of low environmentally impacting energy provision technologies;

Subject-based practical skills

6. Systematically analyse renewable (i.e. the wind, tides, sun) or sustainable (e.g. Biomass) energy resources availability in relation to demand trends and critically appraise utilising these sources of energy locally or at distance through grid networks;

7. Contextualise and appreciate the influences of social, political and environmental attitudes on low environmentally impacting energy provision and the influence these have this has on energy related planning processes;

Skills for life and work

8. Effectively communicate (written and oral) to a team, peer or a wider audience.

Teaching/ learning methods/strategies used to enable the achievement of learning outcomes:

The factual content of the module is taught through lectures, seminars, practical workshops, presentations, demonstrations and tutorials, and throughout this process an active exchange of views and opinions is encouraged. Both theoretical and practical aspects are covered. Students have access to Moodle discussion boards and to regular skype surgeries where they can meet with their peers and a tutor to discuss any academic issue. The summative coursework consists of an academic investigative essay and presentation of this.

There is formative learning element to the module to allow the students to receive critical feedback on their work without the pressure of marked assessment.

For distance learning (DL) students, learning will be supported through Internet-based lectures (of the onsite lectures), situation related practical exercises, seminars and tutorials.

All students also have access to Moodle discussion boards and regular Skype surgeries, where they can meet with their peers and a tutor to discuss any academic issue.

Lectures onsite and through DL highlight key concepts, models and frameworks, and integrate additional resources (such as journal articles). They encourage deep learning through the use of self-assessment

questions which encourage students to engage with the topic, to help students understand new topics and skills.		
Assessment methods which enable students to demonstrate the learning outcomes for the module:	**Weighting:**	**Learning Outcomes demonstrated:**
1. Critique of Paper (2,000 words max.)	65%	**1,2,3,4,5,6,7**
2. Individual Presentation, 15 minutes (1,000 word equivalent)	35%	**8**

Reading and resources for the module:

Core

Stephen Peake (Ed) (2017) *Renewable Energy: Power for a Sustainable Future.* 4th edition. Oxford University Press, Oxford.

MacKay, D. J. C., (2009) *Sustainable Energy - Without the Hot Air.* Cambridge: UIT. (* ***http://www.withouthotair.com***)

Twidell, J. and Weir, T. (2015) *Renewable Energy Resources.* 3rd edition. Taylor and Francis, Oxford. (and erratum-download)

Recommended

Bickerstaff, K, Walker, G. Bulkeley, H. (2013) *Energy Justice in a Changing Climate: Social Equity and low carbon energy.* Palgrave Macmillan, New York. (*)

Cantor J. and Harper G. (2011) *Heat Pumps for the Home*. The Crowood Press, Marlborough. (*)

Harvey, L. D. D., (2010) *Energy and the New Reality 1: Energy Efficiency and the Demand for Energy Services*. Earthscan. London,

Harvey, L. D. D., (2010) *Energy and the New Reality 2. Carbon-Free Energy Supply*. Earthscan. London

Jenkins, K. E. H. and Hopkins, D. (2018) *Transitions in Energy Efficiency and Demand (Open Access): The Emergence, Diffusion and Impact of Low-Carbon Innovation*. Routledge. (*)

Manwell J. F., McGowan A. G. and Rogers A. L. (2009) *Wind Energy Explained.* 2nd edition. Wiley-Blackwell, Oxford.

Messenger, R. & Ventre, J., (2010) *Photovoltaic Systems Engineering.* 3rd edition. CRC Press, Oxford.

van Loo, S. and Koppejan, J., (2008) *The Handbook of Biomass Combustion and Co-firing* Earthscan, London. (*)

Smith, A., Kern, F, Raven, R. and Verhees, B. (2013) Spaces for sustainable innovation: solar photovoltaic electricity in the UK. Technological Forecasting & Social Change. ISSN 0040-1625 (*)

Further relevant journals, websites and other relevant resources will be provided within reading materials that are made available for the module.

(*) Available as an e-book

Indicative learning and teaching time **(10 hrs per credit):**	**Activity**
1. Student/tutor interaction:	Lectures, seminars, tutorials, presentations, practicals / demonstrations **30 hours**
2. Student self learning and research time:	Seminar reading and preparation, assignment preparation, background reading, and research activities. **120 hours**
Total hours:	**150 hours**