

Unit 5: Renewable Energy

Unit code	F/615/1479
Unit level	4
Credit value	15

Introduction

With the increasing concerns regarding climate change arising from increasing carbon dioxide levels and other adverse environmental impacts of industrial processes, there are widespread economic, ethical, legislative and social pressures on engineers to develop technologies and processes that have reduced carbon and environmental impact.

The aim of this unit is to introduce students to renewable energy resources and technologies, including current storage and generation technologies, and explore their advantages and limitations.

On successful completion of this unit students will be able to determine the optimum combination of renewable energy technologies and evaluate their efficiencies, describe how to conduct a cost–benefit analysis to determine the most viable option between renewable and conventional energy sources, and consider the relevant political, socio-economic and legal factors that influence the selection of appropriate energy technologies.

Learning Outcomes

By the end of this unit students will be able to:

1. Explore potential renewable energy resources, including current storage and generation technologies.
2. Determine the optimum combination and efficiencies of renewable energy technologies for a particular location.
3. Conduct a cost–benefit analysis to determine the most viable option between renewable and conventional energy sources.
4. Explain socio-economic, legislative and environmental factors involved in the consideration and selection of other approaches to renewable energy resources and technologies.

Essential Content

LO1 **Explore potential renewable energy resources, including current storage and generation technologies**

Alternative energy sources, their respective merits and drawbacks:

Wind energy, ocean and tidal energy, biomass, geothermal energy, hydropower, solar and thermal energy.

Waste as energy.

LO2 **Determine the optimum combination and efficiencies of renewable energy technologies for a particular location**

Energy demand and security of supply:

Energy consumption changes, intensity and trends (domestic, industrial, transport, services sectors).

Factors affecting changes in energy consumption and demand.

Future demand planning based on trends and needs analysis.

Risk analysis for energy supplies for UK and local areas.

Energy capacity margins analysis related to changes in demand.

Alternatives for locally used energy sources.

Energy reduction and efficiency approaches:

Energy systems available for a given location.

Energy legislation and standards.

Energy saving and reduction schemes, energy saving technologies available.

Energy efficiency approaches for domestic energy use.

Grants and government schemes, and the effects of such schemes on supply and demand.

LO3 **Conduct a cost–benefit analysis to determine the most viable option between renewable and conventional energy sources**

Financial and environmental implications:

Cost–benefit analysis.

Socio-economic factors.

Financial implications of renewable and conventional energy.

L04 Explain socio-economic, legislative and environmental factors involved in the consideration and selection of other approaches to renewable energy resources and technologies

Environmental factors of the set-up and operation of renewable technologies:

Legislative and commercial considerations, including carbon taxes and national and international climate change legislation.

Evaluation planning tools such as PESTLE analysis.

Learning Outcomes and Assessment Criteria

Pass		Merit	Distinction
L01 Explore potential renewable energy resources, including current storage and generation technologies			D1 Provide supported and well justified recommendations for the adoption of the most widely used conventional and non-conventional renewable energy resources.
P1 Create schematic diagrams showing the working principle of the most widely used renewable energy systems.	M1 Explore the rates of adoption of the most widely used renewable energy resources.		
L02 Determine the optimum combination and efficiencies of renewable energy technologies for a particular location			D2 Summarise the efficiencies of a variety of combinations of renewable energy technologies for a chosen location.
P2 Describe how each renewable energy system could be connected with local energy systems.	M2 Discuss how renewable energy systems will bring benefit to the people living in the chosen area.		
L03 Conduct a cost-benefit analysis to determine the most viable option between renewable and conventional energy sources			D3 Conduct a cost-benefit critical analysis to determine the most viable option between all available renewable and conventional energy sources.
P3 Calculate the installation and construction costs of one renewable energy system from a renewable energy standpoint.	M3 Contrast the installation and construction costs of all available renewable energy sources.		
L04 Explain socio-economic, legislative and environmental factors involved in the consideration and selection of other approaches to renewable energy resources and technologies			D4 Provide supported and justified recommendations and original ideas for an effective environmental analysis of alternative approaches to the selection of renewable energy resources.
P4 Examine how socio-economic, legislative and environmental factors affect the selection, set-up and operation of renewable energy sources.	M4 Evaluate environmental analysis and planning tools such as PESTLE to identify possible sources of conflicts of interest.		

Recommended Resources

Textbooks

ANDREWS, J. and JELLEY, N. (2013) *Energy Science: Principles, Technologies and Impacts*. 2nd Ed. Oxford University Press.

BOTKIN, D. (2010) *Powering the Future*. Pearson.

BOYLE, G. and Open University (2008) *Renewable Energy*. 3rd Ed. Oxford: Oxford University Press.

EVERETT, B., BOYLE, G. and PEAKE, S. (2011) *Energy systems and sustainability: Power for a Sustainable Future*. 2nd Ed. Oxford University Press.

TESTER, J. (2005) *Sustainable Energy: Choosing Among Options*. London: MIT Press.

Journals

Renewable Energy Focus Journal.

The Open Renewable Energy Journal.

Journal of Renewable and Sustainable Energy.

Renewable Energy: An International Journal.

Electronic

The Guardian:

<http://www.theguardian.com/environment/renewableenergy>

Energy Saving Trust:

<http://www.energysavingtrust.org.uk/domestic/content/renewables>.

Department of Energy and Climate Change:

<https://www.gov.uk/government/organisations/department-of-energy-climate-change>.

Links

This unit links to the following related units:

Unit 4: Managing a Professional Engineering Project

Unit 44: Industrial Power, Electronics and Storage

Unit 51: Sustainability