

## Unit 5:

## Renewable Energy

<b>Unit code</b>	<b>F/615/1479</b>
<b>Unit level</b>	<b>4</b>
<b>Credit value</b>	<b>15</b>

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### 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 photovoltaic and solar thermal energy

Waste as energy

storage technologies

### 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

**LO4 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
<b>LO1</b> Explore potential renewable energy resources, including current storage and generation technologies		<b>D1</b> Provide supported and well justified recommendations for the adoption of the most widely used conventional and non-conventional renewable energy resources
<b>P1</b> Create schematic diagrams showing the working principle of the most widely used renewable energy systems	<b>M1</b> Explore the rates of adoption of the most widely used renewable energy resources	
<b>LO2</b> Determine the optimum combination and efficiencies of renewable energy technologies for a particular location		<b>D2</b> Summarise the efficiencies of a variety of combinations of renewable energy technologies for a chosen location
<b>P2</b> Describe how each renewable energy system could be connected with local energy systems	<b>M2</b> Discuss how renewable energy systems will bring benefit to the people living in the chosen area	
<b>LO3</b> Conduct a cost-benefit analysis to determine the most viable option between renewable and conventional energy sources		<b>D3</b> Conduct a cost-benefit critical analysis to determine the most viable option between all available renewable and conventional energy sources
<b>P3</b> Calculate the installation and construction costs of one renewable energy system from a renewable energy standpoint	<b>M3</b> Contrast the installation and construction costs of all available renewable energy sources	

Pass	Merit	Distinction
<p><b>LO4</b> Explain socio-economic, legislative and environmental factors involved in the consideration and selection of other approaches to renewable energy resources and technologies</p>		<p><b>D4</b> Provide supported and justified recommendations and original ideas for an effective environmental analysis of alternative approaches to the selection of renewable energy resources</p>
<p><b>P4</b> Examine how socioeconomic, legislative and environmental factors affect the selection, set-up and operation of renewable energy sources</p>	<p><b>M4</b> Evaluate environmental analysis and planning tools such as PESTLE to identify possible sources of conflicts of interest</p>	

## 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*.

### Websites

<https://www.theguardian.com>

The Guardian  
Renewable energy  
(Articles)

<http://www.energysavingtrust.org.uk/>

Energy Saving Trust  
Renewable energy  
(General Reference)

<http://www.gov.uk/>

Gov.UK  
Department of Energy & Climate Change  
(General Reference)

### 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*