

The Further Education and Training Awards Council (FETAC) was set up as a statutory body on 11 June 2001 by the Minister for Education and Science. Under the Qualifications (Education & Training) Act, 1999, FETAC now has responsibility for making awards previously made by NCVA.



Module Descriptor

Renewable Energy Systems

Level 5 N22967

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1	Title	Overview of Renewable Energy Systems
2	Code	N22967
3	Value	1 credit
4	Level	5
5	Purpose	This module has been developed to provide the learner with an overview of renewable energy technologies and covers topics such as the non-technical issues, energy and services requirements, solar radiation, site suitability, micro-hydro systems, biomass, solar thermal systems, building design features, photovoltaics, domestic wind turbines and battery storage. It combines both theory and its applications to real situations.
6	Preferred Entry Level	Level 4 Certificate or equivalent
7	Special Requirements	None
8	General Aims	<i>Candidates who successfully complete this module will:</i>
	8.1	develop knowledge in energy system terminology
	8.2	develop an appreciation of sustainability issues (environmental, construction, social, economic, etc.)
	8.3	develop knowledge and understanding of solar energy source and its characteristics
	8.4	develop knowledge and understanding of wind energy source and its characteristics
	8.5	develop knowledge and understanding of hydro energy source and its characteristics
	8.6	develop knowledge and understanding of biomass energy sources and its characteristics
	8.7	develop knowledge and understanding of geothermal heating systems and their economics
	8.8	develop knowledge and understanding of energy efficient and sustainable building design and its principles
9	Units	Specific Learning Outcomes are grouped as nine units
	9.1	<i>Energy Systems, Services, and Terminology</i>
	9.2	<i>Sustainability Issues</i>
	9.3	<i>Solar Electric (PV) Energy</i>
	9.4	<i>Solar Thermal Energy</i>
	9.5	<i>Wind Energy</i>

- 9.6 *Hydro Energy*
- 9.7 *Biomass Energy*
- 9.8 *Geothermal Heating*
- 9.9 *Sustainable And Energy Efficient Building Design*

10 **Specific Learning Outcomes**

Unit 1 Energy Systems, Services, and Terminology

The learner should be able to:

- 1.1 Define the terms:
 - energy
 - temperature
 - power
 - energy efficiency
 - end use energy
 - primary energy
- 1.2 List the main renewable energy systems in use in Ireland
- 1.3 Differentiate between the different systems, noting which is electrical and which heating, listing their advantages and disadvantages.

Unit 2 Sustainability Issues

The learner should be able to:

- 2.1 Discuss the term “Sustainability” – it’s use and miss-use, how it relates to everyday life and everyday choices.
- 2.2 Describe the major non-technical issues and their impact on the application of a renewable energy technology, such as domestic solar hot water. etc..
- 2.3 List and discuss the main non-technical issues, i.e. economic, social, environmental and political.

Unit 3 Solar Electric Energy

The learner should be able to:

- 3.1 Define the items:
 - irradiation
 - irradiance
 - latitude
 - solar window
 - solar constant
 - tilt angle

- direct and diffuse radiation
- azimuth and altitude angles

- 3.2** Explain the effect and be able to determine the times if an obstacle will shade a given collector at a given site.
- 3.3** Explain how radiation varies throughout the year on the surface of a collector which is either fixed, single-axis tracking or double-axis tracking.
- 3.4** Describe the basic operation of solar electric (PV) systems

Unit 4 Solar Thermal Energy

The learner should be able to:

- 4.1** Detail the differences between flat plate collectors and evacuated tube systems.
- 4.2** Explain the benefits of solar thermal heating systems.
- 4.3** Describe thermosiphoning and the benefits for incorporating into a sustainable, energy efficient design ie: reducing dependency on electric pumps.

Unit 5 Wind Energy

The learner should be able to:

- 5.1** Discuss the planning exemptions for domestic wind turbines
- 5.2** Select a suitable minimum tower height for a wind system sited downwind from an obstacle.
- 5.3** Interpret isovent maps.
- 5.4** Describe, in general, suitable site locations for domestic wind turbines, taking into account turbulence from obstructions/buildings.

Unit 6 Hydro Energy

The learner should be able to:

- 6.1** Distinguish between different micro hydro systems in terms of their physical and operating characteristics.
- 6.2** Describe the features of different types of micro hydro systems used for electricity generation and water pumping applications.

Unit 7 Biomass Energy

The learner should be able to:

- 7.1** Define the terms:
- biogas
 - producer gas

- biofuels
 - feedstock.
- 7.2** List five common biofuels and their specific energy contents
Develop knowledge in biomass (biofuels) and their properties, particularly wood fuels
- 7.3** Describe the method of production of one of these five biofuels including:
- source of raw material/feedstock
 - conversion process
 - yield.
- 7.4** Research site assessment for biomass heating systems
- 7.5** Understand the criteria for choosing and sizing hydraulic cycles in typical installations situations
- 7.6** Develop skills in educating consumers on biomass heating systems, their uses, advantages and disadvantages.

Unit 8 Geothermal Energy

The learner should be able to:

- 8.1** Describe how a geothermal system works
- 8.2** Discuss the economics of running a geothermal system
- 8.3** Differentiate between a ground source heat pump system and an air source heat pump system

Unit 9 Energy efficient building design

The learner should be able to:

- 9.1** Explain the terms:
- passive system
 - active system
 - aspect of the site
 - orientation of the building
 - thermal systems
 - sustainable design
- 9.2** Describe the climate factors which affect sustainable and energy efficient building design.
- 9.3** Explain the following:
- the relationship between thermal comfort and climate
 - the relationship between the seasonal variation of the sun's path and the heat gain of the building elements (roof, walls, windows, floor)
 - the effect of the thermal conductivity of building materials on heat flows to and from the building
 - the use of thermal mass in reducing temperature variations within the building
 - the use of ventilation.

9.4	Discuss where and how the current building regulations and planning regulations help or hinder sustainable, energy efficient design.
9.5	Select a suitable site of land and locate a building on the block taking into consideration microclimate, shading and aspect.
9.6	Describe the use of insulation, glazing, orientation, shading devices, thermal mass and ventilation in building design.
9.7	Describe some building systems suitable for sustainable building.
11	Assessment
Summary	Project Based 100%
11.1	Technique
Mode	Project Based Assessment
Weighting	Centre-based with external moderation by FETAC
Components	100%
	Choose one project from the following:-
	<p>Project 1 Sustainable and/or Energy Efficient House design Evidence Required: Diagrams/photos of a site chosen by the student showing best orientation for a house, recommendations for building material, window position and window type for max energy efficiency and sustainability and recommend at least one renewable energy system.</p> <p>Project 2 Research and Design An Alternative Space Heating System Evidence Required: Document research and provide design diagrams/photos/model Discuss advantages and disadvantages A working model may be build for demonstration purposes</p>
12	Performance Criteria
12.1	Project Based Assessment
	The performance criteria are detailed in the accompanying Individual Candidate Marking Sheets C?????/MS?
13	Grading
	Pass 50-64% Merit 65-79% Distinction 80-100%

Individual Candidate	Introduction to Renewable Energy Systems
Marking Sheet 1	N22967
	Project 100%

Candidate _____ **PPSN** _____

Centre _____ **Centre No.** _____

Performance Criteria	Maximum Mark	Candidate Mark
Thorough investigation of topic using appropriate research	20	
Appropriate and effective use of equipment and techniques in the design and construction process	40	
Excellent technical, visual and aesthetic quality to the finished product/design giving appropriate recommendations	20	
Critical evaluation of the finished design/product	20	
Total	100	

Assessors Signature _____ **Date** _____

External Authenticator Signature _____ **Date** _____

Individual Candidate Module Results		Renewable Energy Systems N22967 Results Summary Sheet
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Elements of Assessment
Max marks per element

Project		Grade*
100%		

Forename

Surname

Assessor: _____ Date: _____

External Authenticator: _____ Date: _____

This sheet should be completed by the Assessor, retained in the centre and presented to the external Authenticator.

Grade*

D: 80 - 100%

M: 65 - 79%

P: 50 - 64%

U: 0 - 49%

W: students who did not present for examination