

Unit 5018: Sustainability

Unit Code: **Y/615/1519**

Level: **5**

Credits: **15**

Introduction

Living and working in the 21st century will bring a range of sustainability challenges that our society has not seen before. For many people on our planet key resources such as food, water and energy will be in short supply, whilst the effects of climate change will be felt by everyone.

The Brundtland Commission of the United Nations on 20th March 20th 1987 defined sustainability as: 'sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Engineers will be in the frontline of the battle to overcome the challenges of creating a sustainable economy, but no single discipline will have the capability to tackle the problems alone. Sustainability is a multidisciplinary challenge, and engineers of the future will have to work collaboratively with a whole range of other stakeholders, such as scientists, politicians and financiers, if they are to be able to produce the practical and technological solutions required within the necessarily urgent time scales.

This unit is designed to support the Professional Engineering and Professional Engineering Management core units at Level 4 and 5. On successful completion of this unit the student will possess a wide range of knowledge and understanding of the issues and topics associated with sustainability and low carbon engineering.

Learning Outcomes

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

- LO1 Determine the nature and scope of the technical challenges of ensuring sustainable development
- LO2 Articulate the importance of collaborating with other disciplines in developing technical solutions to sustainability problems
- LO3 Evaluate the use of alternative energy generation techniques in relation to their contribution to a low carbon economy
- LO4 Analyse a variety of data sources to estimate the carbon footprint of a socio-technical scenario.

Essential Content

LO1 Determine the nature and scope of the technical challenges of ensuring sustainable development

The scope and social context of sustainability:

- Sustainable development
- Brundtland definition
- Global demographics, trends and predictions
- Population growth
- Standard of living, actual and expected
- Urbanisation and the balance of urban/rural space
- Sustainable design.

Environmental issues:

- Climate change, planetary energy balance, carbon cycle science, the 2°C climate change obligation
- Carbon capture and sequestration
- Pollution, pollution prevention and management
- Carbon trading
- Eco-systems and habitat.

Resources:

- Food, water, energy and raw materials.

LO2 Articulate the importance of collaborating with other disciplines in developing technical solutions to sustainability problems

Systems thinking and socio-technical systems:

- The politics and economics of sustainability
- Kyoto Protocol
- UN Climate Change Conference (COP)
- European Union Emissions Trading Scheme.

Sustainable infrastructures:

- Low carbon transport systems
- Sustainable cities
- Green building
- Power storage and distribution
- Sustainable logistics
- Waste and recycling.

LO3 Evaluate the use of alternative energy generation techniques in relationship to their contribution to a low carbon economy

Alternative energy resources:

- Nuclear, solar, wind, tidal and wave, geothermal, biomass and bioenergy
- Whole life cycle costing
- Precautionary principle.

LO4 Analyse a variety of data sources to estimate the carbon footprint of a socio-technical scenario.

Types of carbon footprint:

- Organisational
- Value chain
- Product
- Carbon footprint science
- Calculation methodologies: direct and indirect
- System boundaries
- Case study examples.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Determine the nature and scope of the technical challenges of ensuring sustainable development		
P1 Determine the nature and scope of the technical challenges of ensuring sustainable development, considering environmental, resource and demand issues.	M1 Review existing sustainable development plans to identify the way technical challenges are met and overcome.	D1 Critically analyse how the interrelationship between the three key areas of technical challenges can be managed systemically to ensure maximum sustainability.
LO2 Articulate the importance of collaborating with other disciplines in developing technical solutions to sustainability problems		
P2 Articulate the interdisciplinary issues associated with the construction of sustainable infrastructures, with attention to the competing pressures within these infrastructures.	M2 Analyse how political and economic issues can impact upon technical solutions.	D2 Critically analyse how a systemic approach can be used to support interdisciplinary collaboration in developing sustainable infrastructures.
LO3 Evaluate the use of alternative energy generation techniques in relation to their contribution to a low carbon economy		
P3 Evaluate the issues that need to be considered when selecting alternative low carbon energy sources.	M3 Analyse the difficulties in the evaluation and selection of alternative energy generation techniques for a low carbon economy.	D3 Critically analyse the selection of alternative energy generation techniques for a low carbon economy within the wider socio-technical sustainability agenda.
LO4 Analyse a variety of data sources to estimate the carbon footprint of a socio-technical scenario.		
P4 Evaluate a variety of data sources to estimate the carbon footprint of a number of socio-technical scenarios. P5 Describe the process of calculating a carbon footprint.	M4 Apply appropriate data from a range of options to calculate the carbon footprint of a socio-technical scenario.	D4 Analyse the alternative types and methods available for calculating the carbon footprint of a sociotechnical scenario, and make justified recommendations, selecting a best-fit method for effective comparison of systems.

Recommended Resources

Note: See HN Global for guidance on additional resources.

Print Resources

Bakhshi R. B. (2019) *Sustainable Engineering: Principles and Practice*. 3rd Ed. Cambridge University Press.

Berners-Lee, M. (2019) *There Is No Planet B: A Handbook for the Make or Break Years* Cambridge University Press

Berners-Lee, M. (2010) *How Bad Are Bananas?* Profile Books.

Boyle, G. (2012) *Energy Systems and Sustainability: Power for a Sustainable Future*. Oxford University Press.

Everett B., Peake S., and warren J. (2021) *Energy Systems and Sustainability*. 3rd Ed. Oxford University Press.

Fenner, A. and Ainger, C. (2013) *Sustainable Infrastructures: Principles into Practice*. ICE Publishing.

Helm, D. (2015) *The Carbon Crunch: Why we are Getting Climate Change Wrong and How to Fix It*. Yale University Press.

Hone, D. (2014) *Putting the Genie Back: 2°C Will Be Harder Than We Think*. Whitefox Publishing.

Morris P. and Therivel R. (2009) *Methods of Environmental Impact Assessment*. 3rd Ed. London Routledge.

Websites

http://www.carbontrust.com	Carbon Trust Carbon foot printing (General Reference)
http://www.fern.org/	FERN Trading Carbon How it Works and Why it is Controversial (Ebook)
https://www.populationinstitute.org	Population Institute Demographic Vulnerability report (Report)
http://www.un.org/	United Nations Integrating Population Issues into Sustainable Development (Report)

<http://www.unwater.org/>

United Nations Water Annual World
Water Development Report
(Report)

<https://sustainabledevelopment.un.org/>

United Nations Sustainable
Development Knowledge Platform
(General Reference)

Links

This unit links to the following related units:

Unit 4004: Managing a Professional Engineering Project

Unit 5002: Professional Engineering Management.