Unit 47: Sustainable and Renewable Land-based Practices

Delivery guidance

The overall focus of this unit is to give your learners all the skills required in order to work in an energy-efficient manner which best utilises waste products while working in the land-based industries. In this unit, learners will identify the renewable energy systems suitable for use in an agricultural environment and examine the feasibility of adopting technologies in different contexts. Learners will explore the environmental impacts of agriculture or horticulture on the land, water and air.

Approaching the unit

In order to inspire your learners, site visits are of the utmost importance and seeing as many different production methods as possible is vital. Where possible, talking to related industry representatives will give learners a firm understanding of the point of renewables and sustainability. Builders, water management operatives, geologists, meteorologists and engineers are often intrinsically linked to this industry and can give a different angle of approach to the delivery of this unit. Visiting speakers add an interesting outlook on the subject and, where a site visit may not be viable, a representative of a specific part of the industry may well be just as good. Consider all options available to you.

While site visits are strongly advised, perhaps not all systems may be available for you to visit and as such formal lectures form the other side of the delivery of your learners' education. Prepare presentations a few weeks in advance of your delivery with a view to adding relevant information, which may add impetus to something delivered in the weeks before, in the news or relevant to upcoming or developing legislation.

Some materials, which will be of service to you during the delivery of this unit, may include solar panels, wind turbines and biodigesters, as well as laboratories with access to water analysis equipment.

Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Explore waste and waste products arising from different land-based operations	**A1** Waste products arising from different agricultural or horticultural operations **A2** Waste management	An informative conference poster.
B Plan renewable environmental management strategies for land-based operations	**B1** Renewable energy for agriculture and horticulture **B2** Energy planning	A feasibility study and energy-planning document.
C Understand passive and active energy reduction technologies and their feasibility for implementation	**C1** Energy reduction	

Assessment guidance

There are two assessments for this unit – the first a poster and the second a feasibility study and planning document. In order to best deliver these assessments to the learners, they should each have a separate assignment brief.

The poster should be produced individually by learners on the waste products of an operation of their choosing. This should include how a waste product is produced, how it may adversely affect our environment and how it can be best managed, along with any other relevant information. Higher achieving learners should use a recognised referencing system to include works by others to back up or give evidence for what they are discussing. Learners may wish to use a specific operation they have visited or worked at to form the basis of their report; however, all aspects of the system must be discussed to ensure learning in all fields has taken place.

The feasibility study could be delivered in the form of a formal document or a presentation delivered to you and the learners' peers. It should be based on a plan which interests the individual learner or one that they wish to work in when they get into employment. It should be well referenced and relate to genuine systems that are in place, and contain plans of cost, effectiveness, expected energy production or saving, and any other data which can be interpreted to convey a finding.

Getting started

This gives you a starting place for one way of delivering the unit, based around the recommended assessment approach in the specification.

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Learners will explore the concepts of land-based waste products, use of renewable energy and energy reduction technology.

Learning aim A – Explore waste and waste products arising from different land-based operations

A1

- Have learners suggest as many waste products from land-based industries as they can think of. List these on the board and then go on to produce a mind map in order to make sense of this list. Have learners copy these notes down for future reference.
- Give a presentation on all of these different waste products, where they are produced in greatest amount, where they are best and worst dealt with, and their overall effect on our environment. Consider operations in other countries to get learners thinking about possible employment options overseas. Have learners make suggestions as to how they feel these waste products may be utilised, either for the creation of energy or for the sequestration of carbon.
- Go into further detail on each individual waste type. Discuss the individual waste issues such as the economic impact on a community, a business or a country as a whole. Consider with learners the long-term effects on the environment and, where possible, take learners to see where a waste product has caused a negative effect on it. Eutrophication can be demonstrated in laboratory conditions; however, the real thing will have more of an impact on learners. Look at the degradability of waste products, both organic and mineral in composition, and score waste products on their ability to degrade and their negative impacts on the environment.
- In addition to waste products, some land-based operations use polluting and hazardous chemicals, which may not actually be classed as a waste product. Have an agronomist or similar come in as a visiting speaker and explain to learners how different products can become damaging with improper use. Also, some production techniques may not produce waste, pollute or cause hazards but by their very implementation can have knock-on effects: pesticides may kill target species, which affects food chains, fuel consumption causes the production of greenhouse gases, and cultivation equipment can cause compaction in soil, which means drainage can be affected.

A2

- Use video and site visits to show learners how waste products are processed in land-based industries. Consider slurry separation systems which work in conjunction with anaerobic digesters and other biomass energy production methods. Discuss incineration plants with energy recovery systems and have learners suggest how this technology may be best adapted or utilised within different systems.
- Have learners research what incentives are available to people working in land-based

industries to help with reducing waste. What are the benefits, and how can these help with best practice methods which then follow the legal requirements? Learners could produce a small presentation, acting as advisors to land-based industries on the methods they should implement to increase their sustainability.

Learning aim B – Plan renewable environmental management strategies for land-based operations

B1

- Introduce the different types of renewable energies. Visit solar, wind, hydro and biogas energy production plants and have site representatives explain how and why they use the methods they do in the production of energy. Have learners consider how they could apply these renewable methods to land-based businesses that they know.
- Even renewable energy production can have a negative effect on the land, water and air. Use case studies and videos to show learners where and how energy production methods have adversely affected the environment. Have the learners debate whether they feel this is justified when compared to the energy produced by traditional, more destructive methods of energy production. Consider the effect on bird life, flight paths, feeding grounds, rivers, lakes and air quality. From all of this, have your learners suggest which they feel is the most sustainable approach to producing renewable energy and have them argue the reasons behind their opinions. This could be done as a written task, which you can use to ensure learning is taking place.

B2

- Building on the previous task, learners could formalise their ideas in a classroom session in order to plan an energy production system linked to a good quality case study or known business. This should include research of appropriate financial sources and means of recovering energy from any wasted during the process.
- After a lecture on measuring carbon footprints, learners should work out the reduction in carbon emissions from the using of the waste. In addition, they should work out the carbon footprint of the manufacture of the implemented energy production system, and its carbon payback time over the course of its life.

Learning aim C – Understand passive and active energy reduction technologies and their feasibility for implementation

C1

- Visit a range of land-based operations and have learners note down where they feel energy is being wasted or not best utilised. Have learners produce a presentation in groups on the common features between different land-based operations that are wasteful. They should give alternatives and ways of reducing this waste.
- Give a presentation on the latest methods and technology, which best reduce energy wasted through land-based operations. Use videos and graphs to show the difference before and after energy reductions are set in place. Have learners suggest how systems could be retrofitted to existing systems and look at some of the methods for carrying this

out on common systems within the industry.

- Have a visiting speaker give a lecture to the learners on the incentives to install these different systems. Learners could develop key communication skills and confidence through interaction with visiting speakers.
- Give learners case studies of operations, which do not have any renewables or energy-saving measures, and have them use the incentives they know to exist to suggest what methods they will put in place and at what cost.
- Have a renewables engineer review a site with the learners that they are familiar with, and compare a plan produced with the learners with that of the engineer. This plan should be made up of the suggested changes in order to best increase the sustainability and energy efficiency of the site. Have the engineer suggest developments to the learners' plans, picking the best plan and explain why it would be most effective. The payback time on both cost and carbon production should be worked out for these systems.

Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to:

- Unit 3: Understanding Environmental Management
- Unit 5: Operational and Environmental Activities in Land-based Enterprises.

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC Internationals in Agriculture/Horticulture/Land-based subjects. Check the Pearson website (http://qualifications.pearson.com/endorsed-resources) for more information as titles achieve endorsement.

Textbooks

Carson, R – *Silent Spring* (Penguin Classics, 2000) ISBN 9780141184944.
A classic book forming the foundation for the effects on the environment as a result of land-based industry.

Chiras, D – *Power from the Wind: A Practical Guide to Small-Scale Energy Production*, 2nd edition (New Society Publishers, 2017) ISBN 9780865718319. The completely revised and updated edition of the go-to guide for individuals and businesses interested in installing small wind energy systems. Written for the layperson, this practical guide gives an accurate and unbiased view of all aspects of small wind energy systems.

Websites

WWF Footprint calculator – a website dedicated to working out your carbon footprint.

Energy Saving Trust; search 'Generating energy from waste: how it works' – a website which details how to produce energy from waste.

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling students to access them through the school/college intranet.