Unit 335: Environmental technology systems

Sample scheme of learning

Please revise the following text to suit your requirements.

This sample scheme of learning covers both classroom and workshop based learning for Unit 335. It is based on 30 hours over 10 sessions, plus additional hours for independent learning. Some suggestions of independent learning are made in the session plans. **This requires tutors to produce their own support material to enable the learners to achieve.**

This is only an example of a possible scheme of learning. You can use it as it is, adjust it or extract content to suit your delivery needs, or the needs of individual learners. We have endeavoured to make the schemes of learning as flexible as possible: where sessions may be taught out of order, this has been signposted. You may find it useful to use our lesson plan template to translate and adapt the sessions.

The schemes of learning are intended to be learner-focused, and they embrace current pedagogical methodology such as flipped and blended learning. They include the following types of learning tasks:

- **Pre-learning** – tasks for the learner to complete in advance of the session to allow for flipped learning
- **Active learning** – active, experiential and discovery learning approaches
- **Challenge focus** – stretching tasks to challenge more able learners
- **Independent learning** – tasks that learners can complete individually or collaboratively without tutor supervision. These tasks may be given as homework.

Reference is made within the scheme of learning to learning materials and other resources required for each session. **Materials will have to be produced by the tutor prior to delivering each session.** Ideas for support material can be found on the internet by using sites such as:
www.tripticoplus.com
www.asdan.org.uk
www.quizlet.com
www.wordsheetsworks.com
www.classtools.net
and adapting their base material to suit.

Resources consist of physical equipment required, as well as any technologies needed. Where possible we have included blended learning activities that make good use of technology so as to help centres fulfil the minimum amount of digital teaching recommended by the government.

The scheme of learning also signposts opportunities within the unit content to introduce the following wider skills and government initiatives:

- English, mathematics and ICT
- employability skills and behaviours
- British values (including the Prevent strategy).

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Centres should also incorporate the following themes, where appropriate. Although they are not specifically referred to in the scheme of learning, City & Guilds regards these as essential in the teaching of the qualification:

- spiritual, moral, social and cultural issues
- health and safety considerations, in particular the need to impress upon learners the fact that they must preserve the health and safety of others as well as themselves
- environmental education and related European issues.

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Unit 335: Environmental technology systems

Sample scheme of learning

Course/Qualification: _____ **Tutor's name**: _____

Number of sessions: 10 **Delivery hours**: 30 **Venue**:_____ **Group**: _____

Learning outcomes:	**To enable learners to**:
• Understand operating principles of micro-renewable energy and water conservation technologies • Understand the installation requirements relating to micro-renewable energy and water conservation technologies • Compare benefits and limitations associated with micro-renewable energy and water conservation technologies	• Understand what methods of water conservation are available • Understand what heat producing micro-renewable energy is • Understand how Building Regulations affect the use of renewable energy • Understand where can these technologies be used

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Session 1: Operating principles

Suggested Teaching Time: 3 hours

Learning Outcomes: 1. Understand operating principles of micro-renewable energy and water conservation technologies

Learners must describe the basic operating principles of heat producing micro-renewable energy technologies including:

- Energy Saving Trust
- ErP.

Topics: 1.1 – Heat producing micro-renewable energy

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to look at home for any efficiency measures taken and labelling of efficient appliances. If friends and neighbours have installations, ask questions about them and take some photos of component parts. Learners to **write notes** and **take photographs** of these appliances and measures to bring into class. **Active learning:** • Tutor to ask learners about efficiency measures that they've found. Tutor will generate a **group discussion,** incorporating all of the learners' observations, and then develop the outcomes, thoughts and ideas discussed into a basic understanding of renewables. • Tutor to produce and present **Presentation 1**, outlining the function of the Energy Saving Trust, along with energy related products. • Tutor to discuss the purpose of the Energy Saving Trust in relation to renewable systems and their function, and then instigate research on the Energy Saving Trust website: www.energysavingtrust.org.uk/?gclid=CMf7uYa1hM0CFUko0wod7OYGDA.	**Materials** For the tutor to devise in advance: • **Presentation 1** • **Worksheet 1** • **Worksheet 2** **Resources** • Computers and hand-held devices • Flip chart	• Group discussion to check if learners have correctly identified efficiency measures and efficient appliances, along with their basic understanding of renewables. • Assess what learners have understood by efficiency measures. • Tutor to ask key questions about the Energy Saving Trust and their role. • Assess learners' research on the Energy Saving Trust website and how the EST can help households to take efficiency measures. • Quality-check answers and notes from discussion concerning the Energy Saving Trust and their role. • Tutor to check answers to **Worksheet 1** and discuss outcome. • Tutor to assess and advise learners as they complete the questionnaire.

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Key learning activity/approach	Suggested materials and resources	Skills check
Learners to answer the question: 'How can the EST help people at home?' • Tutor to prepare and learners to complete **Worksheet 1**. Use the EST link to produce three key questions relating to the function of the EST for learners to research. • Learners to complete the questionnaire from the Energy Saving Trust site, basing the information on their own domestic circumstance: http://hec.est.org.uk/. • Tutor to prepare and learners to complete **Worksheet 2**. Use the EST link to the 'home check test', and get learners to complete the check, record results and discuss as a class. • Learners to discuss the outcome of the questionnaire in class. Tutor to guide the learners to think about energy saving and the ways in which this can be achieved. • **Tutor-led discussion** on the need to record and assess efficiency. • Tutor to continue discussion, highlighting the ErP directive and the use of calculating efficiency and correct labelling. Use the Dimplex explanation for discussion: www.dimplex.co.uk/products/renewable_solutions/certifications_and_regulations/erp/index.htm. • Tutor to **describe** the range of efficiency ratings. Relate the ratings to a variety of domestic appliances. Get learners to research ratings of appliances. • Learners to **discuss** the need to use renewables in relation to the efficiency drives by the EU and the UK Government. • Learners to **research** and list several manufacturers of renewable energy systems and list the variety of sources. Share the findings in class. • Tutor to follow on from the findings based on Worcester-		• Tutor to check answers to **Worksheet 2** and discuss outcome. • Tutor to ask key questions relating to ErP and the labelling system used in the UK. • Tutor to assess learners' understanding of the need for efficiency drives and measures within the domestic property. • Tutor to compile a list of renewable companies that learners have found. • Assess and discuss the outcome from learners' research on these companies. • Tutor to check the key points listed by the learners. • **Discuss and assess** individual solutions from learners involved with the Challenge focus.

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Key learning activity/approach	Suggested materials and resources	Skills check
Bosch: www.worcester-bosch.co.uk/products. • **Learners to get into groups** to research through the Worcester-Bosch website, using the appropriate links, and find five key facts on solar thermal and heat pumps. • **Groups** to report back their finds to the class and justify each of the key facts of solar thermal and heat pumps. **Challenge focus:** • More able learners to attempt to justify the findings from their personal Energy Saving Trust questionnaire to the Government 20% targets, as well as the possibility of using a renewable energy source. **Independent learning:** • Using the EST link below, find out how the EST calculations relate to the NEED –The National Energy Efficiency Data framework – and the usage of carbon emitting fuels (fossil fuel). List out the Kw used against basic efficiency measures: www.energysavingtrust.org.uk/facts-and-figures.		

Opportunities to develop maths, English, ICT and wider skills:

English: • Learners demonstrate **reading** skills in the peer task, as they **identify** the **correct information** to answer the comprehension questions about renewable energy systems and their functions which are found at home or in the workplace. • **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' observations in the pre-learning	**British values:** • Remind learners about **staying safe online** and raise awareness of the potential risk of radicalisation as part of the government's '**Prevent strategy**'. • Talk about how learners may come into contact with wider **public institutions**, such as The National Energy Efficiency Data framework, the need for learners to **respect** them, and why they

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task, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about operating principles.	are **important** when considering the usage of carbon emitting fuels (fossil fuels). **Employability:** • Learners can experience **working in a team** as part of the group research task into solar thermal and heat pumps. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately. • Learners should gain an understanding of the **wider plumbing industry** when they are discussing the need to use renewables in relation to the efficiency drives by the EU and the UK Government. • Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when learning about renewables, which is a growing market in the industry.

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Session 2: Operating principles

Suggested Teaching Time: 3 hours

Learning Outcomes: 1. Understand operating principles of micro-renewable energy and water conservation technologies

Learners must describe basic operating principles of heat producing micro-renewable energy technologies including:

- solar thermal.

Topics: 1.1 – Heat producing micro-renewable energy

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to look at home for any solar thermal panels on roof lines. Make a note of them and take some pictures of the panels. If friends and neighbours have installations, ask questions about them and take some photos of component parts. Examine how the system is controlled, and try to identify individual component parts. Learners to write notes and take photographs of installations, pipework, components and panels; discuss the systems and functionality. **Active learning:** • Tutor to ask learners about their thoughts and understanding of solar thermal systems. • Tutor to prepare and present **Presentation 2** on solar thermal systems and their working principles. Identify all of the component parts of a solar thermal system and their functions**.** • Tutor to facilitate a discussion with learners about solar thermal products using the Worcester-Bosch link: www.worcester-bosch.co.uk/products. • Learners to split into groups and use the Worcester-Bosch website to identify and list the component parts within a solar	**Materials** For the tutor to devise in advance: • **Presentation 2** • **Worksheet 3** **Resources** • Computers and hand-held devices • Flip chart	• Tutor to check learners' initial understanding of a solar thermal system and its use. • Tutor to ask key questions about solar thermal systems and how their basic operating principles work. • Tutor to ask questions about component parts of the solar thermal system and their function within the system. • Assess learners' research from the Worcester-Bosch website concerning solar thermal systems. • Tutor to list out the component parts that learners have compiled. • Tutor to question on the function of each of the component parts of a solar thermal system. • Assess learners' understanding for the

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Key learning activity/approach	Suggested materials and resources	Skills check
thermal system. Learners to report back to the group, outlining their findings. • Tutor to lead **discussion** regarding the function of the component parts of a solar thermal installation. • Learners to **identify** the need for and use of a twin coil (or multi coil) cylinder. Learners to research and compare prices of a single coil cylinder and a dual coil cylinder, in order to gain an understanding of component prices. • Tutor to prepare and learners to complete **Worksheet 3** on the key parts of a basic solar thermal system. Use a diagram and get the learners to identify all of the major component parts. • Learners to work individually and complete the Energy Saving Trust hot water calculator (www.energysavingtrust.org.uk/domestic/water-energy-calculator) to find out their use of hot water within their own home and relate back to the group the individual savings that could be made. • Learners to **work in pairs** and explore how solar thermal systems and savings can vary from property to property. Then report back their finds for the tutor to lead a discussion: www.worcesterenergyhomes.co.uk/energy-savings-in-action/energy-homes. • Learners to read the *Which* article on solar water heating and report back on what solar panels are: www.which.co.uk/energy/creating-an-energy-saving-home/guides/how-to-buy-solar-panels/how-does-solar-water-heating-work/. • Tutor-led discussion on the typical installation, purpose and function of a solar thermal system within a domestic property.		need of a twin coil or multi-coil cylinder and the installation of either. • Tutor to check the research form the Energy Saving Trust hot water calculator that the learners have completed in relation to their own property. • Reflect on the response from the learners about the savings that can be made from the installation of a solar thermal system. • Tutor to ask key questions concerning the control and measurements within a solar thermal system based on the *Which* article. • Check more able learners' answer to the question set in the Challenge focus task.

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Key learning activity/approach	Suggested materials and resources	Skills check
Challenge focus: • More able learners to get into pairs to produce a **presentation**, answering the question: '*What are the key components of a solar thermal system?*' **Independent learning:** • Learners to conduct **online research** and find out about the costs and the savings available to customers who install a solar thermal system. Write a **short report** of their findings.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' thoughts and understanding of solar thermal systems, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. **Math:** • Learners to practise calculations involving **money and time** in a plumbing context, as part of the independent learning task. Learners will need to use **addition and subtraction** in their calculations. Learners should be encouraged to use **checking procedures** to ensure that their answer is correct. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about operating principles.	**Employability:** • Learners can experience **working in a team** as part of the group research task into components within a solar thermal system. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately. • Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when learning about renewables, which is a growing market in the industry.

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• More able learners could use appropriate **presentation software** to create a PowerPoint in order to answer the question: '*What are the key components of a solar thermal system?*'	

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Session 3: Heat pumps

Suggested Teaching Time: 3 hours

Learning Outcomes: 1. Understand operating principles of micro-renewable energy and water conservation technologies

Learners must describe basic operating principles of heat producing micro-renewable energy technologies including:

- ground source heat pumps
- air source heat pumps.

Topics: 1.1 – Heat producing micro-renewable energy

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to look for newbuild properties in the area. Ask the sales or site offices whether the properties have any renewable energy systems installed. With permission and where appropriate, **take photos and videos** of any heat pumps and components that are associated with heat pump systems. **Active learning:** • Tutor to ask learners to compare their findings regarding renewable energy systems that have been installed in newbuild properties. Discuss their thoughts as a class. • Tutor to prepare and present **Presentation 3**, containing details about heat pump systems along with an outline of their operating principles. Identify all of the component parts of a ground and air source heat pump and their various functions. • Tutor to lead on the Energy Saving Trust link (www.energysavingtrust.org.uk/domestic/ground-source-heat-pumps) based on: 'How do ground source heat pumps work?' and 'Is a ground source heat pump suitable for me?' • Tutor to go through the schematic diagram of a ground source heat pump, explaining the working principles.	**Materials** For the tutor to devise in advance: • **Presentation 3** • **Worksheet 4** • **Worksheet 5** • **Activity 1** **Resources** • Interactive whiteboard • Computers and hand-held devices • Photos and videos from home	• Tutor-led discussion on the pre-learning exercise; tutor to check and help with identifying and organising information into photo reel sequence or video clip editing when presented in class. • Group discussion for tutor to confirm key points of heat pump working. • Check learners' recognition of different types of loops used in the installation of a ground source heat pump. • Tutor to assess **Worksheet 4**. • Tutor to ask key point questions regarding the loops' use within the installation of ground source heat pumps. • Tutor to assess **Worksheet 5**. • Check for correct understanding of closed and open loop systems within the design and installation of ground source heat

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Key learning activity/approach	Suggested materials and resources	Skills check
• Tutor to get learners to research, in pairs, each component part in the ground source heat pump system: loop, cylinder, heat exchanger and heat pump unit. • Learners to research in pairs the working parts and report back. • Tutor to prepare and learners to complete **Worksheet 4**. Use a diagram of a ground source heat pump, and get learners to identify all of the key components and their various functions. • Tutor to describe the four different loops styles connected to ground source heat pumps used in the UK – vertical, pond, slinky and horizontal. • Learners to research in pairs the benefits and disadvantages of each type of loop and the style of properties they can be attached to. Case studies are available. • Learners to complete **Worksheet 5**. Use a basic diagram of a property, and get learners to draw out the different loop systems. • Learners to download the Carbon Trust guide to ground source heat pumps (www.carbontrust.com/media/147462/j8057_ctl150_how_to_implement_guide_on_ground_source_heat_pumps_aw__interactive.pdf). Learners to research and report back on open loop and closed loop systems, and ground source heat pump applications**.** • Tutor-led **discussion** on the feedback from the learners' research. • Learners to individually use the GSHP website (www.gshp.org.uk/ground_source_heat_pumps.html) to research the 'performance' of a ground source heat pump system. • Tutor-led discussion on the feedback from the learners' research on CoP (Coefficient of Performance).		pumps. • Tutor to assess learners' understanding of the 'performance' of a ground source heat pump. • Group discussion for tutor to confirm key points of air source heat pumps. • Tutor to confirm knowledge of: 'How do air source heat pumps work?' • Tutor to confirm knowledge of: 'Is an air source heat pump suitable for me?' • Tutor-led discussion to confirm correct identification of component parts and their function. • Tutor to check learners' understanding of the technologies and applications of air source heat pumps within a domestic property. • Tutor to discuss with learners about the 'future' for air source heat pumps. • Tutor to assess answers in **Activity 1**. • Tutor to assess answers to oral questions to assess learners' understanding.

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Key learning activity/approach	Suggested materials and resources	Skills check
• Tutor to download and give learners the following PDFs: 1. Domestic Ground Source Heat Pumps: Design and installation of closed-loop systems: www.icax.co.uk/pdf/Domestic_Ground_Source_Heat_Pumps_Design_Installation.pdf 2. Grant UK Guide to air source heat pumps: www.grantuk.com/wp-content/uploads/2015/05/Grant-Guide-to-Air-Source-Heat-Pumps-September-2011.pdf. • Tutor to introduce air source heat pumps and their working principles. • Look at the Energy Saving Trust video clip on air source heat pumps (www.energysavingtrust.org.uk/domestic/air-source-heat-pumps). • Learners to work in small groups to use the Energy Saving Trust website to research and report back on: 'How do air source heat pumps work?' and 'Is an air source heat pump suitable for me?' • Tutor-led discussion on the working principles of an air source heat pump, and all the component parts and their function: heat pump unit, control panel, heat exchanger, etc. • Learners to research each part and their function within the system. Research from manufacturers' websites. • Tutor to compile results from learners' research. • Learners to download the Carbon Trust guide to air source heat pumps: www.carbontrust.com/media/147466/j8058_ctl151_how_to_implement_guide_on_air_source_heat_pumps_aw.pdf. Learners to research and report back on the technology and applications for air source heat pumps. • Tutor-led discussion on the feedback results. • Learners to download and use the 'Grant UK' technical leaflet (www.grantuk.com/wp-content/uploads/2015/05/Grant-		

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Key learning activity/approach	Suggested materials and resources	Skills check
Aerona3-Air-Source-Heat-Pump-Range-2016-1.pdf) to create a report on how air source heat pumps work, what the future holds and how air source heat pumps can affect heating costs. • Tutor to compile feedback from learners. • Tutor to prepare and learners to complete **Activity 1**, which is made up of 15 multiple choice questions based on all the subject areas. • Learners to complete additional questions set by the tutor by responding in an open class. **Challenge focus:** • More able learners to use the Energy Saving Trust link (www.energysavingtrust.org.uk/domestic/sites/default/files/reports/Heat%20pumps%20-%20getting%20the%20most%20out%20of%20your%20heat%20pump.pdf) to find out more material on understanding heat pump systems. Create a **presentation** and report back to the whole group. **Independent learning:** • Learners to **read** the Energy Saving Trust website on heat pumps (www.energysavingtrust.org.uk/renewable-energy/heat/air-source-heat-pumps) and make notes on the features of the various case studies, noting installation. They can also turn to the relevant page in their **textbooks** regarding heat pumps and their usage.		

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Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' thoughts and understanding of heat pumps, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. • Learners demonstrate **reading** skills in the independent learning task, as they **identify** the **correct information** to make notes about heat pumps and their usage. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about heat pumps. • More able learners could use appropriate **presentation software** to create a PowerPoint about understanding heat pumps.	**Employability:** • Learners can experience **working in a team** as part of the group research task into how air source heat pumps work. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately. • Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when learning about renewables, which is a growing market in the industry.

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Session 4: Water conservation technologies **Suggested Teaching Time**: 3 hours

Learning Outcomes: 1. Understand operating principles of micro-renewable energy and water conservation technologies

Learners must explain working principles of water conservation technologies including:

- rainwater harvesting
- greywater re-use.

Topics: 1.2 – Water conservation

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to look at Building Regulations Part G (Approved Document G) concerning alternative water sources that are permissible. They should research the respective daily consumption of water per person. **Active learning:** • Tutor to prepare and present **Presentation 4** about water conservation technologies, including rainwater harvesting and greywater re-use technologies, their layouts and component parts. • **Group discussion** to identify the daily consumption of water per person, as set out in Building Regulations G and internet research. Discuss the use of water in domestic WCs and the amount that could possibly be used in one day by a family, highlighting savings that could be made: http://webarchive.nationalarchives.gov.uk/20151113141044/http://www.planningportal.gov.uk/uploads/br/br_pdf_ad_g_2015.pdf. • Learners to **research** the use of tap aerators and their use, flow restrictors and their use, the need for showers to be installed instead of baths, and the dual flush/no water	**Materials** For the tutor to devise in advance: • **Presentation 4** • **Worksheet 6** • **Worksheet 7** • **Worksheet 8** • **Worksheet 9** • **Activity 2** **Resources** • Interactive whiteboard • Computers and hand-held devices • Photos and videos from home • Various websites	• Tutor to check that learners have correctly identified the recommended daily usage of water and where they have gained the information form. • Tutor to ask questions regarding water conservation to check learners' initial understanding of the technologies. • Check learners' knowledge of other methods of water conservation within the domestic property. • Tutor to check answers to **Worksheet 6**. • Tutor to ask key point questions regarding **Worksheet 6** to reinforce knowledge and understanding. • Tutor can evaluate comprehension of both rainwater and greywater technologies. • Tutor to ask searching questions as to where the rainwater can be used within a domestic property. • Check learners' understanding of

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Key learning activity/approach	Suggested materials and resources	Skills check
WCs/urinals. Learners to write a **report** on the application of restricted water use. • Learners to complete **Worksheet 6** on the description of water conservation technologies. Learners to write out a full description of both rainwater harvesting and grey water conservation. • Learners to **discuss** in groups the function and operation of rainwater harvesting technology and where these systems can be attached and used. • Tutor to lead a discussion on the reason why rainwater cannot be used at any domestic outlet and the potential for contamination within the property. • Tutor to describe in full the diagram illustrating the rainwater technology system and the component parts. • Learners in pairs to list out each component part and their respective function within the system. Learners to research from the internet and report back to the group. • Learners to complete **Worksheet 7** on the key parts of the rainwater harvesting technology. This can show a basic diagram of a rainwater harvesting installation for learners to identify component parts. • Tutor to outline the importance of preventing contamination. Refer to The Water Regulations, BS 806 and BS 6700. Outline the importance of rainwater pipework being labelled to prevent contamination: www.rainwaterharvesting.co.uk/accessories/150mm-x-25m-rainwater-identification-tape-105. • Learners to outline the reasons why contamination should be prevented. Learners should be able to list out the five categories of water, 1 being mains wholesome water and 5 being harvested rainwater. • Learners to download the guide to rainwater harvesting and		'contamination' and the term 'crossover'. • Check learners' knowledge of the component parts that make up a rainwater harvesting installation. • Check learners' knowledge of the function of the component parts that make up a rainwater harvesting installation. • Tutor to check the answers for **Worksheet 7**. • Check learners' knowledge of the term 'contamination' with regard to water conservation technologies. • Tutor to confirm that learners know the categories of water. • Tutor can evaluate comprehension of greywater technologies. • Tutor to ask searching questions as to where the greywater can be used within a domestic property. • Check learners' knowledge of the component parts that make up a greywater re-use installation. • Check learners' knowledge of the function of the component parts that make up a greywater re-use installation. • Tutor to check the answers for **Worksheet 8**. • Tutor to go over the PowerPoint presentations produced by the learners and the facts contained within them. • Tutor to check the answers in **Worksheet 9**.

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Key learning activity/approach	Suggested materials and resources	Skills check
compile a report on the design aspects that need to be considered: www.revolutionpower.co.uk/pdf/Stormsaver%20BS%208515%20Rainwater%20Harvesting%20Made%20Easy.pdf. • Tutor to lead a **discussion** on the future, outlining why water conservation technologies are going to play a far more important role than in the past. • Learners to use the article on 'towards sustainability' to report back on the style of storage required, the importance of darkness, temperature control and capacity. • Learners to use the same article to work in small groups to go through the design calculations for the storage capacity of the underground tank. • Learners to **discuss** in groups the function and operation of greywater re-use technology and where these systems can be attached and used. • Tutor to lead a discussion on the reason why greywater cannot be used at any domestic outlet and the potential for contamination within the property. • Tutor to describe in full the diagram illustrating the greywater re-use technology system and the component parts. • Learners to complete **Worksheet 8** on the key parts of the greywater recovery technology. This can show a basic diagram of a greywater conservation installation for learners to identify component parts. • Learners in pairs to list out each component part and their respective function within the system. Learners to research from the internet and report back to the group. • Tutor to outline the importance of preventing contamination. Refer to The Water Regulations, BS 806 and BS 6700. Outline the importance of greywater pipework being labelled to prevent contamination:		• Tutor to check the answers in **Activity 2**.

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Key learning activity/approach	Suggested materials and resources	Skills check

www.rmlabels.com/acatalog/Greywater-Pipe-Identification-Tape-ID166T50G-IDT132.html.
• Learners to download the guide to greywater re-use produced by the Environment Agency (www.sswm.info/sites/default/files/reference_attachments/ENVIRONMENT%20AGENCY%202011%20Greywater%20for%20Domestic%20Users.pdf). In small groups, learners should produce a PowerPoint presentation on the following:
  • type of systems from section 2
  • regulations from section 4.
• Tutor to lead a discussion and ask learners to present the findings from their research.
• Learners to complete **Worksheet 9** based on an article in the *Guardian* newspaper (www.theguardian.com/lifeandstyle/2014/jul/21/greywater-systems-can-they-really-reduce-your-bills). Using the article, learners need to identify the five key things that customers need to know about greywater conservation systems.
• Tutor to download and give learners the following PDFs:
  1. Harvesting rainwater for domestic uses: an information guide: http://webarchive.nationalarchives.gov.uk/20140328084622/http:/cdn.environment-agency.gov.uk/geho1110bten-e-e.pdf
  2. Greywater for domestic users: an information guide: www.sswm.info/sites/default/files/reference_attachments/ENVIRONMENT%20AGENCY%202011%20Greywater%20for%20Domestic%20Users.pdf
• Tutor to describe and reinforce the need to save water, especially on newbuild properties. Discuss the requirements and function of component parts to fulfil this need.
• Learners to complete **Activity 2,** which includes 15 multiple		

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Key learning activity/approach	Suggested materials and resources	Skills check
choice questions based on rainwater and greywater systems. Feed back answers to class as tutor goes through them. **Challenge focus:** • More able learners to explore the five things that you need to know about these systems form the *Guardian* article and report back to the group: www.theguardian.com/lifeandstyle/2014/jul/21/greywater-systems-can-they-really-reduce-your-bills. **Independent learning:** • Learners to investigate and relate the '*Five things you need to know'* about greywater re-use systems with their own property and create a **presentation** to show the rest of the group.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' thoughts and understandings of water conservation technologies, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. • Learners can demonstrate **writing** skills when completing **Worksheet 6** in the description of water conservation technologies. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. • Learners demonstrate **reading** skills when looking at the articles	**British values:** • Talk about how learners may come into contact with wider **public institutions**, such as the Environment Agency, and the need for learners to **respect** them, and why they are **important** in a plumbing context. **Employability:** • Learners can experience **working in a team** as part of the group task about the design calculations for the storage capacity of the underground tank. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately.

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about water conservation technologies, as they **identify** the **correct information** to make notes. **Math:** • Learners can practise using **whole numbers** in a plumbing context, as part of the tank capacity task. Learners will need to use **addition and multiplication** in their calculations. Learners should be encouraged to **check their answer** is correct by using a different calculation method. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about water conservation technologies. • Learners could use appropriate **presentation software** to create a PowerPoint about the '*Five things you need to know'* about greywater re-use systems.	• Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when learning about renewables, which is a growing market in the industry.

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Session 5: Building location and features

Suggested Teaching Time: 3 hours

Learning Outcomes: 2. Understand requirements relating to micro-renewable energy and water conservation technologies

Learners must explain how building location and features influence the suitability of installing micro-renewable energy and water conservation systems with consideration to:

- structure
- orientation
- Listed Buildings
- environmental conditions
- adjacent structures and obstructions.

Topics: 2.1 – Factors influencing installation of systems

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to conduct online research about what factors could have an influence on the installation of micro-renewable and water conservation systems to report to the whole group. **Active learning:** • Tutor to prepare and present **Presentation 5** about building location and factors that influence the suitability of installing systems, including building structure, Listed Buildings, orientation, environmental considerations and obstructions. • Learners to get into groups and discuss how each of the factors listed could potentially influence the installation of a micro-renewable or water conservation system and report back to the whole group. • Tutor to lead group discussion concerning the considerations that need to be made at the design stage prior to installation. • Learners to get into pairs and brainstorm as to why the five	**Materials** For the tutor to devise in advance: • **Presentation 5** • **Worksheet 10** **Resources** • Interactive whiteboard • Computers and hand-held devices • Photos and videos from home • Various websites	• Tutor to verify learners' initial understanding of factors that influence the installation of micro-renewable and water conservation technologies. • Check quality of responses from the learners after discussing the factors that influence installation. • Tutor to ask key questions about the factors that need to be considered prior to any installation. • Check learners' understanding of inspections being made at the design stage and prior to installation. • Ask learners to list the five considerations that need to be made. • In light of these five considerations,

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Key learning activity/approach	Suggested materials and resources	Skills check
considerations could affect the performance of a solar thermal installation, eg orientation, roof area, roof angle, loading on roof and shading; then tutor to lead discussion. • Groups to inspect a solar thermal panel installation onsite or locally to qualify these points. Discuss the effect that the time of day may have and the season of the year. • Learners to work individually to research the local planning laws concerning the installation of solar panels on a Listed Building. Try your local council planning office website or use: www.planningportal.co.uk/. • Use this information to report back to the whole class. • Learners to research Listed Buildings that have had a solar thermal installation and how the panels have been installed. • In pairs, learners are to produce a PowerPoint **presentation** outlining the key five points of installation for a solar thermal system. Each group should use a different manufacturer's website to collate the material. Present to the class in groups. • Learners to complete **Worksheet 10**, listing the five important considerations prior to installing a solar thermal system. • Tutor to lead a discussion on the factors affecting heat source pumps, concentrating on the disruption to existing properties, loop size and potential noise. • Tutor to use the internet to show the relevant information regarding the potential installation of a heat pump in a property: www.planningportal.co.uk/. • Tutor to lead discussion regarding the potential installation of a rainwater or greywater system, concentrating on the disruption to an existing property and the room required for the tank. • Learners to research possible options for an installation to an existing house, concentrating on above ground tanks.		discuss the findings of the groups that have seen a local installation. • Tutor to check that learners understand the importance of using the planning portal and local planning offices regarding Listed Buildings. • Tutor to check learners' understanding of the definition of a Listed Building. • Tutor to engage with learners whilst they are preparing their presentations. • Tutor to check answers for **Worksheet 10**. • Check learners' understanding of the disruption caused within an existing property. • Check learners' understanding of the potential loop style and size, along with the need for sufficient area around the property. • Check learners' understanding regarding the noise created by an air source heat pump.

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Key learning activity/approach	Suggested materials and resources	Skills check
Challenge focus: • More able learners to locate different size tanks that are available for both below and above ground systems. **Independent learning:** • Learners to get into pairs and conduct **online research** to write a **short report**, comparing manufacturers nationwide and local installers for solar thermal, rainwater harvesting systems and greywater re-use systems.		

Opportunities to develop maths, English, ICT and wider skills:

English:

- **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' thoughts and understanding of factors influencing the installation of systems, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**.
- Learners can demonstrate **writing** skills when completing a **short report** on manufacturers nationwide and local installers for solar thermal, rainwater harvesting systems and greywater re-use systems. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used.
- Learners demonstrate **reading** skills when looking at the articles about water conservation technologies, as they **identify** the **correct information** to make notes.

ICT:

- Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources

British values:

- Talk about **appropriate learner behaviour** both at college and at work when inspecting solar thermal panel installations onsite.
- Talk about how learners may come into contact with wider **public institutions**, such as the Local Council, and the need for learners to **respect** them, and why they are **important** in a plumbing context.

Employability:

- Learners can experience **working in a team** as part of the group task about factors that could potentially influence the installation of a micro-renewable or water conservation system. Check that learners are **working well together** (letting one another have input, being positive, motivated, etc) and all are **contributing** appropriately.
- Learners to develop their **self-knowledge**, **self-esteem** and **self-confidence** when learning about renewables, which is a growing market in the industry.

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that provide suitable information about water conservation technologies. • Learners could use appropriate **presentation software** to create a PowerPoint outlining the key five points of installation for a solar thermal system.	

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Session 6: Permitted developments

Suggested Teaching Time: 3 hours

Learning Outcomes: 2. Understand requirements relating to micro-renewable energy and water conservation technologies

Learners must describe what is typically classified as 'permitted development' under town and country planning regulations in relation to the deployment of technologies.

Topics: 2.2 – Permitted developments

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to prepare for the session by asking their local planning office about 'permitted developments' with regard to technologies. **Active learning:** • Tutor to lead a discussion regarding learners' understanding of permitted developments. • Tutor to prepare and present **Presentation 6**, outlining the factors for permitted developments. • Tutor to ask a local planning officer to attend the session to outline planning laws regarding technologies to be installed on differing domestic properties. • Learners to get into pairs and write a **report** based on the planning officer's information. • Learners to get into small groups to brainstorm to identify what is meant by a 'designated area'. • Tutor-led discussion as the learners feed back their finds on 'designated areas' and their restrictions with regard to the installation of technologies**.** • Learners to work in small groups to research what is meant by a permitted development with regard directly to a solar thermal installation	**Materials** For the tutor to devise in advance: • **Presentation 6** • **Worksheet 11** **Resources** • Interactive whiteboard • Computers • Hand-held devices • Photos and videos from home • Various websites	• Tutor to confirm learners' initial understanding of 'permitted developments'. • Tutor to monitor progress of learners during tutor-led discussions by observing, asking and answering questions. • Check accuracy of learning by asking key point questions on permitted developments. • Tutor to monitor progress of learners' understanding of permitted developments as the session progresses. • Tutor to actively get involved with the learners' report writing to ensure that facts are correct. • Tutor to confirm learners' initial understanding of 'designated area'. • Tutor to monitor learners' progress during tutor-led discussions by observing, asking and answering questions. • Tutor to continually assess learners' awareness of specific criteria regarding

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Key learning activity/approach	Suggested materials and resources	Skills check
(www.planningportal.co.uk/info/200130/common_projects/51/solar_panels). Learners to report back to the whole group with their findings. • Learners to work in small groups to research what is meant by a permitted development with regard directly to a ground source heat pump installation (www.planningportal.co.uk/info/200130/common_projects/27/heat_pumps). Learners to report back to the whole group with their findings. • Learners to work in small groups to research what is meant by a permitted development with regard directly to an air source heat pump installation (www.planningportal.co.uk/info/200130/common_projects/27/heat_pumps/2). Learners to report back to the whole group with their findings. • Learners to complete **Worksheet 11** on permitted developments for each installation; can use the planning portal links to get learners to write down what they think is meant by 'permitted development' for each installation: www.planningportal.co.uk/info/200130/common_projects/51/solar_panels www.planningportal.co.uk/info/200130/common_projects/27/heat_pumps www.planningportal.co.uk/info/200130/common_projects/27/heat_pumps/2 • Learners to complete additional questions set by the tutor in pairs, and tutor to go through answers at the end of the session. **Challenge focus:** • More able learners attempt a further task: discuss which		the installation of solar thermal technologies. • Tutor to continually assess learners' awareness of specific criteria regarding the installation of ground source heat pump technologies. • Tutor to continually assess learners' awareness of specific criteria regarding the installation of air source heat pump technologies. • Tutor to check answers to **Worksheet 11**. • Tutor to check answers to the additional questions.

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Key learning activity/approach	Suggested materials and resources	Skills check
systems can be fitted to an existing property and outline the potential disruption to a customer. **Independent learning:** • Learners to conduct **online research** on their local areas that are considered to be 'designated areas'.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' thoughts and understanding about permitted developments, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. • Learners can demonstrate **writing** skills when completing a **short report** based on the local planning officer's talk. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. • Learners demonstrate **reading** skills when looking at the articles about permitted developments, as they **identify** the **correct information** to make notes. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about permitted developments.	**Employability:** • Learners should gain knowledge and understanding of the wider industry when able to question the planning officer about regulations, how they are enforced and the officer's role in the process. • Learners should be encouraged to use newly acquired knowledge regarding permitted developments and designated areas when in communication with customers and offering advice about installations.

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Session 7: Regulations and standards

Suggested Teaching Time: 3 hours

Learning Outcomes: 2. Understand requirements relating to micro-renewable energy and water conservation technologies

Learners must know the regulations and standards affecting installation of micro-renewable energy and water conservation systems including

- building regulations
- town and country planning regulations.

Topics: 2.3 – Building regulations and building standards

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to list out potential Building Regulations that may be connected to the installation of micro-renewable energy and water conservation systems. **Active learning:** • Tutor to prepare and present **Presentation 7**, introducing the Building Regulations connected to the installation of micro-renewable energy and water conservation systems. • Tutor to ask a local Building Control Officer to attend the session to **give a talk** about the Building Regulations associated with the installation of micro-renewable energy and water conservation systems. • Learners to get into pairs and write a **report** based on the Building Control Officer's information. • Tutor to outline each Building Regulation and the relevance it has to an installation: www.planningportal.co.uk/info/200135/approved_documents. • Learners to download a copy of Building Regulations A, E, G, H and L. • Tutor to outline the relevance of Building Regulations A with	**Materials** For the tutor to devise in advance: • **Presentation 7** • **Worksheet 12** **Resources** • Approved Document A • Approved Document E • Approved Document G • Approved Document H • Approved Document L	• Tutor to check learners' initial knowledge concerning Building Regulations. • Tutor to ask key point questions about Building Regulations associated with micro-renewable and water conservation technologies. • Tutor to assess learners' understanding of the Building Control Officer's role. • Tutor to monitor learners' progress during tutor-led discussions by observing, asking and answering questions. • Check accuracy of learning by asking key point questions on Building Regulations. • Tutor to monitor learners' progress in understanding Building Regulations as the session progresses. • Tutor to actively get involved with learners' report writing to ensure that facts

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Key learning activity/approach	Suggested materials and resources	Skills check
regard to the property's structure when installing a new system. • Learners to highlight relevant pages within Approved Document A. • Tutor to outline the relevance of Building Regulations E with regard to the passage of sound (noise) when installing a new system. This is particularly relevant to air source heat pumps. • Learners to highlight relevant pages within Approved Document E. • Tutor to outline the relevance of Building Regulations G with regard to hygiene when installing a new system. This is particular relevant to rainwater harvesting and greywater re-use systems. • Learners to highlight relevant pages within Approved Document G. • Tutor to outline the relevance of Building Regulations H with regard to drainage and waste disposal when installing a rainwater harvesting or greywater re-use system**.** • Learners to highlight relevant pages within Approved Document H. • Tutor to outline the relevance of Building Regulations L with regard to conservation of fuel and power when choosing and installing a renewable energy system. • Learners to highlight relevant pages within Approved Document L. • Tutor to reinforce that the Approved Documents are approved by Parliament and form part of UK law, and therefore they must be adhered to or the installer could face prosecution. • Tutor to lead a **group discussion** on the importance of following Building Regulations and the role of the Building Control Officer.		are correct. • Tutor to verify learners' understanding of the terms 'Building Regulations' and 'Approved Document'. • Tutor to question the relationship of Approved Document A and an installation. • Check that relevant pages in Standard have been highlighted. • Tutor to question the relationship of Approved Document E and an installation of an air source heat pump. • Check that relevant pages in Standard have been highlighted. • Tutor to question the relationship of Approved Document G and an installation. • Check that relevant pages in Standard have been highlighted. • Tutor to question the relationship of Approved Document H and an installation. • Check that relevant pages in Standard have been highlighted. • Tutor to question the relationship of Approved Document L and an installation. • Check that relevant pages in Standard have been highlighted. • Tutor to ensure that learners have fully understood the fact that Building Regulations form part of UK law.

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Key learning activity/approach	Suggested materials and resources	Skills check
• Tutor to produce and learners to complete **Worksheet 12** on Building Regulations (Approved Documents). This can involve learners using a table to list the Building Regulations, their title and a brief description. **Challenge focus:** • More able learners to research manufacturers of renewable energy and water conservation technologies to list the British Standards associated with the technologies. **Independent learning:** • Learners to **research** the job role and qualifications required to become a Building Control Officer, and write a **short summary**.		• Ask learners questions about the role that the Building Control Officer plays within the installation process. • Tutor to check the answers to **Worksheet 12**.

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about learners' thoughts and understanding on the importance of following Building Regulations, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. • Learners can demonstrate **writing** skills when completing a **short report** based on the Building Control Officer's talk, as well as a **summary** of the job role and qualifications research. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. **ICT:** • Learners have the opportunity to use **advanced search**	**British values:** • Remind learners about the **importance** of the **laws of England**, and their **purpose** to **protect citizens**, when looking at Building Regulations and standards. **Employability:** • Learners should demonstrate they can **actively listen** during the Building Control Officer's talk, **understand** what has been said and **respond/act** accordingly by making relevant notes. Learners should be encouraged to use techniques to ensure they understand the talk, eg **repeating back** what was said, **summarising** or **asking clarifying questions**. • Learners should gain an understanding of the **wider** plumbing

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techniques to **locate, select and evaluate** relevant online sources that provide suitable information about regulations and standards.	**industry** when they are introduced to the **range of job roles** during the Building Control Officer's talk.

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Session 8: Regulations and standards

Suggested Teaching Time: 3 hours

Learning Outcomes: 2. Understand requirements relating to micro-renewable energy and water conservation technologies

Learners must know the regulations and standards affecting installation of micro-renewable energy and water conservation systems including:

- building regulations
- town and country planning regulations.

Topics: 2.3 – Building regulations and building standards

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to **research** what is meant by 'Town and country planning', and report their findings to the group. **Active learning:** • Prior to the session, the tutor needs to invite a local planning officer. • Tutor to prepare and present **Presentation 8** about town and country planning and the specific regulations associated with micro-renewable systems and water conservation systems. • Learners to listen to a local planning officer regarding the town and country planning regulations, and how they affect the installation of a domestic micro-renewable energy system and water conservation systems. • Learners to work in pairs and compile a **report** based on the facts given by the planning officer. This can be in the form of a formal report, PowerPoint or information document for a customer. • Learners to report back and present their work to the group. Discuss different ways of presenting the same information. • Tutor to outline the goals of the town and country planning laws and emphasise that they can vary across the United	**Materials** For the tutor to devise in advance: • **Presentation 8** **Resources** • Interactive whiteboard • Computers • Smartphones and tablets • Various websites	• Tutor to check learners' initial understanding of the town and country planning laws. • Tutor to ask key point questions about town and country planning laws associated with micro-renewable and water conservation technologies. • Tutor to assess learners' understanding of the local planning officer's role. • Tutor to monitor learners' progress during tutor-led discussions by observing, asking and answering questions. • Check accuracy of learning by asking key point questions on town and country planning associated with the installation of domestic systems. • Tutor to ensure that learners work in pairs to present the information in different formats correctly. • Tutor to check learners' understanding of

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Key learning activity/approach	Suggested materials and resources	Skills check
Kingdom. • Learners to research and list out any town and country planning laws they can find. • Tutor to list out the town and country planning laws associated with micro-renewable energy and water conservation systems. • Learners to research which is the main Act associated with micro-renewable energy and water conservation systems, and find the section outlining the requirements: www.legislation.gov.uk/uksi/2015/596/pdfs/uksi_20150596_en.pdf. • Learners to answer the following questions: *Why is planning the renewables important? Are all energy developments handled by the local authority? What are the planning considerations?* www.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf Learners to report back their findings. • Tutor to reinforce the fact that the Town and Country Planning Act is law and the consequences of not following it could lead to prosecution. • Learners to research the planning laws for the installations of domestic solar thermal systems. http://solar-panels-cambs.co.uk/wp-content/uploads/2015/01/Amendment-of-Town-Country-Planning-permitted-development.pdf • Learners to research the planning laws for the installations of domestic ground source heat pump systems. www.legislation.gov.uk/uksi/2015/596/schedule/2/part/14/cro		the goals of the town and country planning laws. • Tutor to check that learners have listed any town and country planning laws. • Tutor to ask key point questions as to which regulations are associated with these systems. • Tutor to assess the facts that the learners report back. • Assess whether learners understand the consequences of not following these laws. • Tutor to check accurate feedback from learners' research on the planning laws for each individual system. • Tutor to check learners' responses to questions set.

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Key learning activity/approach	Suggested materials and resources	Skills check
ssheading/class-c-installation-or-alteration-etc-of-ground-source-heat-pumps-on-domestic-premises/made?view=plain • Learners to research the planning laws for the installations of air source heat pump systems**.** www.legislation.gov.uk/uksi/2011/2056/made • Learners to research the planning laws for the installations of water conservation systems**.** http://webarchive.nationalarchives.gov.uk/20140328084622/http:/cdn.environment-agency.gov.uk/geho1110bten-e-e.pdf. Learners to compile their findings and report back to the group. • Tutor to reinforce the good practice principle of always checking with the local authority in case of any limitations. • Learners to complete additional questions set by the tutor in pairs, and tutor to go through the answers at the end of the session. **Challenge focus:** • More able learners to attempt some further questions set by the tutor: outline the correct and full process, from enquiry to handover, for all the systems. **Independent learning:** • Learners to **research** and report back on any forms required by the planning officer for the installation of micro-renewable energy and water conservation systems.		

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Opportunities to develop maths, English, ICT and wider skills:

English: • Learners can demonstrate **writing** skills when completing a report, PowerPoint or information leaflet using formal and informal language with the same information. Learners to discuss the different ways of presenting the same information. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about regulations and standards.	**British values:** • Remind learners about the **importance** of the **laws of England**, and their **purpose** to **protect citizens**, when looking at building regulations and standards. **Employability:** • Learners should demonstrate they can **actively listen** during the local planning officer's talk, **understand** what has been said and **respond/act** accordingly by making relevant notes. Learners should be encouraged to use techniques to ensure that they understand the talk, eg **repeating back** what was said, **summarising** or **asking clarifying questions**. • Learners should gain an understanding of the **wider** plumbing **industry** when they are introduced to the **range of job roles** during the local planning officer's talk.

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Session 9: Benefits and limitations

Suggested Teaching Time: 3 hours

Learning Outcomes: 3. Compare benefits and limitations associated with micro-renewable energy and water conservation technologies

Learners must describe, compare and contrast the benefits and limitations associated with micro-renewable energy and water conservation technologies including:

- solar thermal (hot water)
- ground source heat pump
- air source heat pump.

Topics: 3.1 – Benefits of systems; 3.2 – Limitations of systems

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to think about potential benefits and limitations for a solar thermal or heat pump system if it was fitted in their property and report them to the group. **Active learning:** • Prior to the session starting, the tutor will need to invite a representative from a renewable manufacturer to attend the session. • Learners to get into groups and discuss any potential benefits that may be associated with solar thermal. • Tutor to prepare and present **Presentation 9**, outlining the benefits and limitations of domestic solar thermal systems, along with ground and air source heat pumps. • Tutor to lead discussion around anyone who has a system installed in their property or by using case studies from the representative. • Representative to outline any benefits from a solar thermal system. Tutor to qualify with representative as to why they are a benefit to the customer and how these points can be	**Materials** For the tutor to devise in advance: • **Presentation 9** **Resources** • Interactive whiteboard • Computers • Smartphones and tablets • Various websites	• Tutor to verify learners' initial understanding of potential benefits of renewable energy systems. • Tutor to question learners on their understanding of limitations and benefits of renewable energy systems. • Check learners' understanding of benefits as described by the representative. • Ask questions related to the promotional material that groups have been looking at. • Discuss with learners the potential benefits that may be associated with ground source and air source heat pumps. • Tutor to assess learners' understanding of the limitations posed by solar thermal systems. • Tutor to check learners' understanding of the solar thermal system as outlined by

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Key learning activity/approach	Suggested materials and resources	Skills check
used as a marketing tool. • Group to look at promotional material from manufacturer to gain an understanding. Then learners to get into groups and discuss any potential benefits that may be associated with ground or air source heat pumps. • Tutor to lead a discussion around anyone who has a system installed in their property or by using case studies from the representative. • Representative to outline any benefits from heat pump systems. Tutor to qualify with representative as to why they are a benefit to the customer and how these points can be used as a marketing tool. • Group to look at promotional material from manufacturer to gain an understanding. • Learners to get into groups and discuss any potential limitations that may be associated with solar thermal systems and report back. • Representative to outline any limitations from a solar thermal system. Tutor to qualify with representative as to how they approach the limitations with the customer. • Learners to get into groups and discuss any potential limitations that may be associated with heat pump systems. • Representative to outline any limitations form a heat pump system. Tutor to qualify with representative as to how they approach the limitations with the customer. • If the training centre has any renewables, with permission, visit the installation and question the facilities manager concerning the installation. • Learners to provide feedback in pairs and comment on what they believe to be the most important benefit and the most restrictive limitation.		the representative. • Tutor to engage with learners in their group work to confirm potential limitations of a heat pump installation. • Tutor to ask key point questions about the limitation of systems. • Tutor to check learners' understanding of the heat pump system as outlined by the representative. • Check key points with the centre's facilities manager. • Tutor to check more able learners' research into manufacturers and what they state in their material.

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Key learning activity/approach	Suggested materials and resources	Skills check
Challenge focus: • More able learners to conduct **online research** as to which benefits and limitations are stated by UK manufacturers. **Independent learning:** • Learners to look for renewable installations on the way home and relate the benefits and limitations to those installations.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about benefits and limitations of renewables, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. **ICT:** • More able learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about manufacturers.	**British values:** • Talk about **appropriate learner behaviour** both at college and at work when visiting the installation. • Remind learners about the **importance** of the **laws of England**, and their **purpose** to **protect citizens**, when looking at legislation about the benefits and limitations of renewables. **Employability:** • Learners should demonstrate they can **actively listen** during the renewable manufacturer representative talk, **understand** what has been said and **respond/act** accordingly by making relevant notes. Learners should be encouraged to use techniques to ensure that they understand the talk, eg **repeating back** what was said, **summarising** or **asking clarifying questions**. • Learners should gain an understanding of the **wider** plumbing **industry** when they are introduced to the **range of job roles** during the renewable manufacturer representative talk.

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Session 10: Benefits and limitations

Suggested Teaching Time: 3 hours

Learning Outcomes: 3. Compare benefits and limitations associated with micro-renewable energy and water conservation technologies

Learners must describe, compare and contrast the benefits and limitations associated with micro-renewable energy and water conservation technologies including:

- rainwater harvesting
- greywater re-use.

Topics: 3.1 – Benefits of systems; 3.2 – Limitations of systems

Key learning activity/approach	Suggested materials and resources	Skills check
Pre-learning: Learners to think about potential benefits and limitations for a water conservation system if it was fitted in their property and report them to the group. **Active learning:** • Prior to the session, tutor to invite a manufacturer representative to attend. • Learners to get into groups and discuss any potential benefits that may be associated with a water conservation system. • Tutor to prepare and present **Presentation 10** on the benefits and limitations of installing rainwater and greywater systems. • Tutor to lead discussion around anyone who has a system installed in their property or by using case studies from the representative. • Representative to outline any benefits from a rainwater harvesting system. Tutor to qualify with representative as to why they are a benefit to the customer and how these points can be used as a marketing tool.	**Materials** For the tutor to devise in advance: • **Presentation 10** • **Worksheet 13** **Resources** • Computers • Interactive whiteboard • Smartphone and tablets	• Tutor to verify learners' initial understanding of potential benefits of water conservation systems. • Tutor to question learners on their understanding of limitations and benefits of water conservation systems. • Check learners' understanding of benefits as described by the representative. • Ask questions related to the promotional material that groups have been looking at. • Discuss with learners the potential benefits that may be associated with rainwater harvesting systems. • Tutor to assess learners' understanding of the limitations posed by rainwater harvesting systems. • Tutor to check learners' understanding of the limitations of a rainwater harvesting system as outlined by the representative.

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Key learning activity/approach	Suggested materials and resources	Skills check
• Group to look at promotional material from the representative to gain an understanding. • Learners to get into groups and discuss any potential benefits that may be associated with a greywater re-use system. • Representative to outline any benefits found from a greywater re-use system. Tutor to qualify with representative as to why they are a benefit to the customer and how these points can be used as a marketing tool. • Group to look at promotional material from manufacturer to gain an understanding. • Learners to get into groups and discuss any potential limitations that may be associated with rainwater harvesting systems and report back. • Representative to outline any limitations from a rainwater harvesting system. Tutor to qualify with representative as to how they approach the limitations with the customer. • Learners to get into groups and discuss any potential limitations that may be associated with a greywater re-use system. • Representative to outline any limitations form greywater re-use systems. Tutor to qualify with representative as to how they approach the limitations with the customer. • If the training centre has rainwater or greywater systems, with permission, visit the installation and question the facilities manager concerning the installation. • Tutor to prepare and learners to complete **Worksheet 13** on the benefits and limitations of micro-renewable and water conservation technologies. Learners can list the three main benefits from each technology in a table outlining all five systems.		• Tutor to engage with learners in their group work to confirm potential limitations of a rainwater harvesting system. • Tutor to ask key point questions about the limitation of systems. • Tutor to check learners' understanding of the benefits of a greywater re-use system as outlined by the representative. • Tutor to check learners' understanding of the limitations of a greywater re-use system as outlined by the representative. • Check key points with the centre's facilities manager. • Tutor to check answers from **Worksheet 13**. • Check learners' responses to additional questions. • Engage with more able learners as they check systems used in other countries.

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Key learning activity/approach	Suggested materials and resources	Skills check
• Learners to provide feedback in pairs and comment on what they believe to be the most important benefit and the most restrictive limitation. • Learners to complete questions set by the tutor. **Challenge focus:** • More able learners to examine systems used in other countries – for example, systems that charities use in developing countries – and write a **short report**. **Independent learning:** • Learners to get into pairs to **research** the percentage of properties in the UK that now have one of these systems installed and write a **short summary** of their findings.		

Opportunities to develop maths, English, ICT and wider skills:

English: • **Speaking and listening** skills can be demonstrated in developing the **discussion** about benefits and limitations of renewables, **giving a point of view** as well as **allowing** and **responding** to **others' opinions**. • More able learners can demonstrate **writing** skills when producing a **report** about systems used in developing countries. Check that learners have used **formal language** appropriately. Ensure that correct **spelling**, **punctuation** and **grammar** have been used. **Math:** • Learners will need to **extract** the **relevant data** from the information provided by the **tables/charts**, when researching online the percentage of properties that have one of these systems	**British values:** • Talk about **appropriate learner behaviour** both at college and at work when visiting the installation. • Remind learners about the **importance** of the **laws of England**, and their **purpose** to **protect citizens** when looking at legislation about the benefits and limitations of renewables. **Employability:** • Learners should demonstrate they can **actively listen** during the company representative talk, **understand** what has been said and **respond/act** accordingly by making relevant notes. Learners should be encouraged to use techniques to ensure that they understand the talk, eg **repeating back** what was said, **summarising** or **asking clarifying questions**.

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installed. **ICT:** • Learners have the opportunity to use **advanced search techniques** to **locate, select and evaluate** relevant online sources that provide suitable information about the percentage of properties in the UK that now have one of these systems installed.	• Learners should gain an understanding of the **wider** plumbing **industry** when they are introduced to the **range of job roles** during the company representative talk.

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