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| **How to reduce your carbon footprint** | | | | | |
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| What could your school community do to save energy and reduce your carbon footprint? | | | | | |
| **Subject(s):** Science, Design & Technology, Mathematics  **Approx time:** 2-3 x 60 mins (including presentations) | |  | | **Key words / Topics:**   * carbon footprint * sustainability * energy savings * energy survey | |
| **Suggested Learning Outcomes** | |  | |  | |
| * To be able to explain what ‘carbon footprint’ means * To be able to describe and explain what sustainable technologies could be used in their school * To be able to design and carry out a survey to support an investigation they are carrying out * To be able to produce a presentation with an argument in support of their recommendations | | | | | |
| **Introduction** | |  | |  | |
| Students are frequently hearing the phrases ‘carbon footprint’ and ‘sustainable energy resources’. The ‘Energy Efficiency’ scheme of work explores what these two phrases mean and for students to research what they, as a school community, can do to save energy and reduce their carbon footprint.  The activities use the example of Howe Dell Primary School, which was designed with the principle of being a sustainable school. This provides a context to explore how well the students’ school compares, and what simple energy savings they could introduce to reduce their carbon footprint and save money as well. By using the example of Howe Dell Primary School, students have the opportunity to see how cutting-edge technology and science is being applied. | | | | | |
| **Purpose** | | | | | |
| In this activity, students will work in teams to investigate the measures that could be applied to reduce the carbon footprint of their own school. They will then prepare a presentation summarising their recommendations.  This activity could be used in either Design & Technology or Science. | | | | | |
| **Activity** | |  | | **Teacher notes** | |
| 1. Present the class with the following design brief  *‘Your Head Teacher is interested in updating the school building to lower its carbon footprint. They want you to research what design features could be included to transform your school into a low energy-use building. These features should be based on renewable-energy technologies.*  *The Head teacher wants you to present your findings to the board of governors, who often need a lot of convincing before they will spend money to change things. Your presentation can take any form but needs to show the present situation in the school, what features could be changed, and what savings these would bring. The presentation should end with your ethical argument as to why your changes should be implemented and a list of your recommendations.’*  Discuss how they go about collecting the information they need.  2. Research: Current Position  To establish the current situation within the school, each group should create and carry out a survey. This should aim to identify what energy is used for and sources of waste, and try to quantify these if possible. They should carefully consider who they want to respond to the survey (e.g. teachers, pupils, or the school site manager).  3. Research: Changes that could be made  This is a research-based task into possible renewable energy technologies that could be used in school. Each group should use the internet to identify possible changes. The ‘Green School’ video could be used to provide several ideas for this  4. Research: Savings that could be made  The students (or class teacher) should find out from the school bursar how much money is spent on heating and lighting per year.  5. Presentation  Each group produces a ten-minute presentation intended for the school governors.  Depending on the outcome of the team to team presentations, these could then be presented to the science department line-manager or used in a school assembly to raise the profile of this issue. | |  | | This activity could be extended to run for several additional sessions, depending upon the depth of the investigation that is carried out and the detail in the presentations.  This activity could be carried out in small groups (e.g. 4), which would could cover all three aspects of the investigation, managing their own work allocation. Alternatively, you could divide the class into large groups and then split these into subgroups so that each subgroup looks at one aspect of the investigation, with the sub-groups each preparing part of the presentation and coming together to agree the final recommendations.  Examples might include solar thermal water heating, living sedum green roof to insulate and promote biodiversity, wind turbines, natural ventilation systems to improve oxygen levels, low-energy, auto-dimming lighting, rainwater harvesting, sink tops and splash backs made from yoghurt pots, and bamboo flooring. Several possible sources of information are listed below, in the ‘additional websites’ section.  As well as using the internet, encourage the students to ask their school librarian for good, student-friendly books because often internet sites can be too technical.  Annually, on energy alone, Secondary schools spend an average of £4.70 per square meter of surface area.  Instead of whole class presentations (which take up all the class time, and are progressively harder for subsequent students to present to an engaged class, team to team presentations could be carried out in each corner of the room. Each team will present to the other, who will listen, ask questions and then give feedback according to the Energy Efficiency (Handout) and using the Peer Assessment Prompts (Handout). | |

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| **Differentiation** |  | | |  | | | | |
| **Basic** |  | | | **Extension** | | | | |
| In Task 2, a list of possible sources of waste could be provided, as a basis for the questionnaire. An exemplar of a questionnaire for a different project should be provided to illustrate what is required.  In Task 3, a list of possible options to consider could be provided, so that the groups only have to identify what each option means and how it could be implemented. |  | | | The analysis of the brief in Task 1 could be extended to include a mind map or fishbone diagram, to identify the key constraints and design criteria.  In Task 2, students could adapt a school map to show places where energy loss is high.  Task 4 could be extended to include a greater maths element. Students could calculate the actual savings that could be made from making some simple changes, such as saving 5% of the heating bill by reducing the temperature by 1 degree. | | | | |
| **Resources** |  | | | **Required files icon-docicon-pdficon-ppt** | | | | |
| * Access to documents from the internet (hard copies or online) for the research task |  | | | icon-doc Energy Efficiency (Handout)  icon-doc Peer Assessment Prompts | | | | |
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| **Additional websites** |  | | |  | | | | |
| * Energy Saving Trust: <http://webarchive.nationalarchives.gov.uk/20130401151715/http://www.education.gov.uk/publications/eOrderingDownload/00368-2007LEF-EN.pdf> * Centre for Alternative Technology (CAT) Information Service: <http://info.cat.org.uk/> * WRAP: [www.wrap.org.uk](http://www.wrap.org.uk) * Keep Britain Tidy – End Waste: <https://www.keepbritaintidy.org/our-cause/end-waste> | | | | | | | | |
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| **Related activities (to build a full lesson)** | | |  | | | |  | | |
| **Starters** (Options)   * ACTIVITY: Energy Efficiency 1 * ACTIVITY: Photovoltaic cells - Intro   **Main** (Options)   * ACTIVITY: **Energy Efficiency 2** * ACTIVITY: Photovoltaic cells – Investigating circuits * ACTIVITY: Photovoltaic cells – Design & Make | | | | | **Extension** (Options)   * ACTIVITY: Photovoltaic cells - Modifications   **Plenary**   * Opportunities within activity for presentations, peer/self assessment * Reflection on Objectives and PLTS skills used | | | | |

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| **The Engineering Context** film |
| * **The story** Green School * **How it works?** Interseasonal Heat Transfer (IHT) * **Who makes it work:** Chani Leahong |

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| **Curriculum links and PLTS** | |
| **England**  Science   * KS3 3a, 3b, 3f, 4c, 23b, 23d, 23e, 24b   Design & Technology   * KS3 1a, 1e, 3a, 3d | **Northern Ireland**  Technology & Design  (Objective 1) Developing pupils as Individuals   * Mutual understanding   (Objective 2) Developing pupils as Contributors to Society   * Explore technical inventions and designs that have met a social need cost-effectively * Ethical awareness   (Objective 3) Developing pupils as Contributors to the Economy and the Environment   * Pursue design solutions using environmental friendly materials and energy sources * Identify product needs and pursue sustainable harmonious design solutions in a local outdoor/indoor context * Education for Sustainable Development   Learning Outcomes   * Research and manage information effectively to investigate design issues, using Mathematics and ICT where appropriate * Show deeper understanding by thinking critically and flexibly, solving problems and making informed decisions, using Mathematics and ICT where appropriate * Demonstrate creativity and initiative when developing ideas and following them through * Work effectively with others * Communicate effectively in oral, visual (including graphic), written, mathematical and ICT formats showing clear awareness of audience and purpose |
| **Scotland**  **Technologies**   * **TCH 3-02a, TCH 3-04a, TCH 3-14a** | **Wales**  **Design & Technology**   * **4.1, 4.2, 4.4, 4.5** |
| **GCSE D&T**  **AQA D&T**   * **3.1.1, 3.1.2, 3.2.1, 3.2.3, 3.3.2**   **Edexcel D&T**   * **1.2.4, 1.3, 1.14.2, 1.14.3, 1.14.4, 1.14.8, 1.15.1g**   **Eduqas D&T**   * **2.1 Core: 1, 2, 3** * **2.2 Core: 4**   **OCR D&T**   * **2.1a vi, 2.2, 3.1a i/iii/iv, 3.2, 3.3a i/iv, 5.2c iii, 5.3d, e** | **GCSE Engineering**  **AQA Engineering**   * **3.1.3** |
| **GCSE Science**  **AQA Combined Science Trilogy**   * **5.9.2, 6.1.3**   **AQA Combined Science: Synergy**   * **4.4.1.3, 4.4.1.4, 4.4.1.5, 4.8.2.4**   **Edexcel Combined Science**   * **Chemistry: 8.24, 8.25a, 8.26** * **Physics: 3.13**   **Eduqas Combined Science**   * **2.2: 12d, e, f, g** * **2.3: 1.2f**   **OCR Gateway Science: Combined Science A**   * **C6.2c, d, e** * **P6.2a**   **OCR 21st Century Science: Combined Science B**   * **C1.3** * **P2.2: 1, 2** | **GCSE Chemistry**  **AQA Chemistry**   * **4.9.2**   **Edexcel Chemistry**   * **8.24, 8.25a, 8.26**   **Eduqas Chemistry**   * **12d, e, f, g**   **OCR Gateway Science: Chemistry A**   * **C6.3c, d, e**   **OCR 21st Century Science: Chemistry B**   * **C1.3** |
| **GCSE Physics**  **AQA Physics**   * **4.1.3**   **Edexcel Physics**   * **3.13**   **Eduqas Physics**   * **1.2f**   **OCR Gateway Science: Physics A**   * **P8.2a**   **OCR 21st Century Science: Physics B**   * **P2.2: 1, 2** |  |

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| **Personal, learning & thinking skills (PLTS)** |
| * Creative thinker * Independent enquirer * Reflective learner * Team worker * Self manager * Effective participator |