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| **Going Nuclear** |
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| Role play about the advantages and disadvantages of nuclear energy. |
| **Subjects:** Design & Technology, Engineering**Approx. time:** 35 - 50 minutes |  | **Key words / Topics*** electricity
* electrical energy
* fossil fuels
* non-renewable
* nuclear energy
* nuclear fission
* Radioactive waste
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| **Stay safe** Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for: •        ensuring that any equipment used for this activity is in good working condition•        behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others  Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠  |
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| **Suggested Learning Outcomes**  |  |  |
| * To understand how electrical energy is generated from nuclear fuel.
* To understand the advantages and disadvantages of generating electrical energy from nuclear fuel.
* To apply knowledge of the issues surrounding electrical energy generation in a realistic context.
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| **Introduction** |  |  |
| This is one of a series of resources designed to support the delivery of the new 9-1 GCSEs in Design & Technology and Engineering, first taught from September 2017. Each resource covers a key topic from one or more of the specifications for these subjects. This resource focusses on the advantages and disadvantages of generating electrical energy using nuclear fuel.Every day we rely on the use of mains electricity, from lighting our homes, to charging up our mobile smartphones, to powering the latest games console. All the electrical energy that we use must be generated and nuclear fuel is increasingly being used as a means of achieving this. It can however be a controversial choice.  |
| **Purpose of this activity**In this activity, learners will discuss and debate a proposal to construct a new nuclear power station in their local area. It will build knowledge and understanding of nuclear energy generation and its advantages and disadvantages.This could be used as the second part of a two-lesson mini unit of learning, with the activity ‘Generating Electricity’ as the first activity. It could also be used to build on the existing ‘Green School’ suite of activities. Alternatively, it could be used as a one off main lesson activity to build knowledge and understanding of the topic. |

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| **Activity**  |  | **Teacher notes** |
| **1. Recap of nuclear power generation (5-10 mins)**Teacher to recap how nuclear power is generated and the main advantages/disadvantages of using this method compared to fossil fuels and/or renewable options. This could be conducted through structured questioning of students and class discussion.**2. Situation (5-10 mins)**Teacher to introduce the situation that learners are to discuss and debate:*It has been proposed that a new nuclear power station is constructed and opened close to a local town. This will provide enough electrical energy for the whole of the nearby county, but local resident groups have expressed concern about the dangers of having the facility so close to their homes.**A meeting has been called where a representative from the power company and a resident group leader will debate the proposal.***3. Group role play (20 mins)**Teacher to put learners into groups of three and explain/assign group roles: * One person will chair the meeting. They must remain neutral and ensure everybody has a fair chance to make their points. They will then decide if the proposal is to go ahead.
* One person will represent the power company. They must make the case for the proposal.
* One person will represent concerned residents. They must make the case against the proposal.

Learners to complete the role play and debate the issues by fulfilling their assigned roles. **4. Class feedback (5-10 mins)**The chairperson should come to an overall decision about whether they think the proposal should go ahead and feed this back to the class. Reasons and justifications should be given for their choice. |  | **Prior knowledge**Depending on prior knowledge teacher may need to recap how electrical energy is generated using different methods (fossil fuels, renewables etc) and how nuclear power compares to these. If learners already have this knowledge, then this stage can be kept brief.**Considerations for the discussion and debate**Learners tasked with making the case for the power plant could talk about the need to generate more energy and how nuclear power reduces the need for fossil fuel based power stations, which produce greenhouse gases. They could also empathise the increased job opportunities for the local area.Learners tasked with making the case against could talk about the potential health and safety risks associated with radioactive waste and the disruption that construction of the plant could make to the local environment.It is important that group members stick to their roles and that the chairperson remains neutral during the discussion, so they can come to a fair decision at the end.However, if time allows during the debate, learners could swap roles within their groups so that each learner has an opportunity to play each one and make each case.**Feedback**Encourage learners to justify and give reasons for the decisions made regarding the proposal. Although this will be led by the chair, other group members may also be able to contribute some useful points.There is no set right or wrong answer to this scenario – the important thing is that the issues are well considered and the overall decision can be justified. |

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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| Use discussion prompts for lower ability learners. These can be given to the chairperson of the meeting to use if those conducting the debate are struggling to make relevant points. For example – prompts could be related to safety issues, environmental impact, the need for energy in the local area, job opportunities etc. |  | Learners could research the events that led to the Chernobyl and Fukushima nuclear disasters and their subsequent impact. What went wrong and how can these mistakes be avoided in the future? |
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| **Resources** |  | **Required files** icon-docicon-pdficon-ppt |
| * Projector/Whiteboard
* Tables and chairs set up for group-based discussion
* Pens and paper for any notes that are made
 |  | icon-ppt Nuclear energy debate presentation |
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| **Additional websites** |  |  |
| The following websites can be used for additional background information or to aid with the activity: * **GCSE Bitesize – Fossil fuels and nuclear power:** Revision notes explaining how energy is generated from fossil fuels and nuclear power.

<https://www.bbc.co.uk/education/guides/zpp4jxs/revision> * **YouTube – Chernobyl disaster:** Video explaining the events that led to the Chernobyl nuclear disaster in 1986, and its subsequent impact. <https://www.youtube.com/watch?v=7VBGoXs7czQ>
* **EDF Energy – Nuclear power:** Explanation of how nuclear power is generated. <https://www.edfenergy.com/future-energy/energy-mix/nuclear>
* **Nuclear Energy - Advantages and disadvantages:** Explanation of the advantages and disadvantages of nuclear energy generation. <https://nuclear-energy.net/advantages-and-disadvantages-of-nuclear-energy.html>
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| **Related activities (to build a full lesson)** |  |  |
| **Starters*** Identify types of renewable and non-renewable sources of energy and where they are found

**Main*** ACTIVITY: Generating Electricity
 | **Plenary*** ACTIVITY: Going Nuclear
* Discuss advantages and disadvantages of generating electricity using renewable and non-renewable sources
* Reflection on Objectives and PLT skills used
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| **The Engineering Context** film |
| Generating electricity is a core topic in all GCSE Design and Technology 9-1 courses and required learning as part of the GCSE Engineering 9-1 course.The knowledge gained can also be used when choosing appropriate sources of energy for powering electronic products and systems designed in the future. |

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| **Curriculum links**  |
| **England: National Curriculum**Design & Technology * KS3 1a, 3d
 | **Northern Ireland: Curriculum**Technology & Design* KS3 Objective 3: Pursue design solutions using environmental friendly materials and energy sources.

Learning Outcomes:* Research and manage information effectively to investigate design issues, using Mathematics and ICT where appropriate.
* Work effectively with others.
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| **Scotland: Curriculum for Excellence**Technologies* TCH 3-07a
 | **Wales: National Curriculum**Design and Technology* KS3 Skills: Designing 2, 4
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| **GCSE D&T**AQA D&T* 3.1.2

Edexcel D&T* 1.3.1

Eduqas D&T* 2.1 Core: 3

OCR D&T* 3.2
 | **GCSE Engineering**AQA Engineering* 3.1.3
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| **Assessment opportunities** |
| Regular questioning throughout the activity, formal teacher assessment of findings and summaries produced by each group. |
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| **Personal, learning & thinking skills (PLTS)** |
| * Independent enquirer
* Self-manager
* Effective participator
* Reflective learner
* Team worker
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