

Year 9 Science – 60 minutes

Lesson plan

Curriculum link: Processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.

Learning Objective: To explore job roles linked to the energy changes and transfers part of the KS3 science curriculum.

Learning Outcomes:

- To understand why knowledge of energy changes and transfers is important for an automotive engineer to know
- To understand how knowledge of energy changes and transfers can be useful in other jobs

Success Criteria:

1. **Describe** – what does an automotive engineer do?
2. **Understand** – how is knowledge of energy changes and transfers important for an automotive engineer to know?
3. **Apply** – calculate the energy efficiency of the cars to determine the most efficient.
4. **Analyse** – how can different jobs and skills help in publicising energy efficiency and influencing others?
5. **Reflect** – were there opportunities or roles that interested you?

Timing s	Activity	Details	Resources
5 mins	Starter – What do you see?	<p>Starter: In your pairs discuss 2 learnings you can share from this graph.</p> <p>Extension: How does this impact society?</p> <p>Link this chart to energy losses in food chains (biology).</p> <p>Explain that the diagram is used to show how unwanted energy transfers happen during the transfer of energy from raw materials through to the final product. It is important to consider how we can reduce unwanted energy transfers to reduce the amount of energy we use and its inevitable impact on climate change.</p>	Slide 3



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		<p>Explain that the transfer from primary to secondary can be very inefficient, particularly in powerplants where up to 2/3 of the primary energy is wasted as heat. More information on the chart can be found here: Primary, secondary, final, and useful energy: Why are there different ways of measuring energy? - Our World in Data</p> <p><i>Energy losses (unwanted energy transfers) occur during multiple steps of the process of turning raw materials into products. Transport and distribution (whether electricity transmission around the national grid or physical transport via road/rail/sea. Energy for the end user or product is often a fraction of that in the raw material)</i></p>	
3 mins	Introduction – What's the problem?	<p>Facilitator to ask a student to read out the statement on the board. Ask pairs to discuss why they think this is a problem.</p> <p>Get feedback, all answers welcome. <i>(We need to reduce the amount of energy we consume and the number of products we buy. This will help reduce greenhouse gases being produced which are causing climate change. The amount of energy wasted/ unwanted energy transfers contributes to the energy total we use)</i></p> <p>The challenge <i>'How can you help Amy work out which of the 10 shortlisted designs is the most energy efficient?'</i></p> <p>So, who are the kinds of people who might want to tackle this exact problem in their day to day lives? Introduce the challenge for the students today and the role of an automotive engineer Amy, and her designer client Tom.</p>	Slides 4,5
7 mins	Describe – what do automotive engineers do?	<p>Introduce the role of an automotive engineer.</p> <ul style="list-style-type: none"> Show the video embedded in the PowerPoint (link 	Slides 6,7 Video



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		https://www.youtube.com/watch?v=m3FELmu1Cgk <ul style="list-style-type: none"> And/or give the students a printout of the BBC article from here: https://www.bbc.co.uk/bitesize/articles/zvk3jhv <p>True or false quiz about what an automotive engineer does <i>Can be done with mini-white boards, hands up, standing in certain area of classroom etc</i></p>	Case study printout (optional)
5 mins	Understand - how is knowledge of energy stores and energy transfers necessary for an engineer?	<p>Automotive engineer for a day! Discuss challenge and the meaning of the term 'energy efficiency'.</p> <p>Slide 9 – discuss the importance of energy efficiency in motorsport as well as in everyday life. Discuss emission from cars and how a more energy efficient car will have lower emissions.</p>	Slide 8,9 Mini whiteboards (optional)
20 mins	Apply – calculate the energy efficiency of the cars to determine the most efficient.	<p>Challenge task</p> <p>Pupils calculate the energy efficiency of each car. Some will need support with the calculations as some lines have missing information that needs to be calculated before they can calculate energy efficiency.</p> <p>Students then decide what information would be needed on an infographic used to explain why it is important to drive cars that are as energy efficient as possible.</p>	Slides 10,11,12,13 Worksheet 1
10 mins	Analyse – how can different jobs and skills help in	<p>Now that the groups have carried out their calculations return to the challenge question - 'How can you help Amy work out which of the 10 shortlisted designs is the most energy efficient?'</p>	Slides 14,15,16,17,18, 19 Worksheet 2 (optional)



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	publicising energy efficiency and influencing others?	<p>Amy will need the help and skills of other professionals to help her encourage people to choose more energy efficient products.</p> <p>Give students the selection of job roles and descriptions.</p> <p>Focus is on how students justify inclusion of job role. For those that could be involved students need to say how they would be involved and why knowledge of carbon off-setting would be beneficial.</p> <p><i>Depending on the class this can be done in one of two ways. Either:</i></p> <ul style="list-style-type: none"> Teacher uses the accompanying slides to describe the different roles to the whole class. Have a class discussion to think about the answers to the questions, then students fill in the worksheet individually. OR if students are working at different paces within the class, then give worksheet 2 to students that are ready to start. The worksheet has the same descriptions as the PowerPoint slides so students can use these to make their own decisions and fill in the worksheet. 	
5 mins	Reflect – were there opportunities or roles that interested you?	Students should reflect on these questions individually and make a note of their answers in their exercise book.	Slide 19
	Optional extensions if more time or can be set as homework	<p>Task 1 Consider how you could reduce the amount of energy you use at home and at school. Make a list of two things you are going to commit to change.</p> <p>Task 2</p>	Slide 20



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		Research the energy efficiency of different types of car. Which make of car is the most efficient?	
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