

Human-induced environmental changes that challenge sustainability

Year 10 - Geography

Energy use, greenhouse gas emissions and sustainability

1. About the lesson plan

Grade Level	Year 10
Discipline	Humanity and Social Sciences (HASS) Geography
Topic in Discipline	Human-induced climate change and changes that challenge sustainability
Australian Curriculum code	ACHGK070: Human-induced environmental changes that challenge sustainability ACHGK071: Environmental world views of people and their implications for environmental management
Climate Topic	Energy use, greenhouse gas emissions and climate
Cross Curriculum Priority	Sustainability: Building capacities for thinking and acting in ways that are necessary to create a more sustainable future. Promote reflective thinking processes in young people and empower them to design action that will lead to a more equitable and sustainable future.
Lesson Length	200 min (4 lessons)



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2. Brief introduction to the Lesson Plan

This lesson engages students in learning activities that enable them to understand how local actions can have global effects. They will see how their choices can impact the environment and climate change positively or negatively.

Students will carry out an energy audit of their class/school for air conditioning or heating use. They will develop inquiry questions to learn about their school's energy use. They can then suggest actions that individual classrooms, buildings, or the whole school can take to decrease energy use.

3. Learning Outcomes

The tools in this lesson plan will enable students to understand:

- Energy use in school.
- How lifestyle choices impact energy use.
- What actions can be taken to decrease energy use.

4. Introduced climate science concepts

The tools in this lesson plan will expose students to:

- How we use energy.
- How energy use impacts greenhouse gas emissions and the climate.
- Greenhouse gas emissions from electricity usage to heat and cool their school.

5. Presumed knowledge

- Students understand what emissions are, how they are produced, and how emissions impact climate change.
- Students understand how to read a map.



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6. Contents of the Lesson Plan

Tool ID	Type of Tool	Name and web link to the Teaching Resources	Brief Description	Credits
R1	Online simulation	<p>WWF Ecological Footprint calculator</p> <p>(Students need to enter their emails before they can take the quiz)</p>	<p>Calculator of one's ecological footprint from lifestyle choices. Allows students to see how many planets would be required to support the Earth's population if everyone lived like them.</p>	World Wide Fund for Nature WWF-Australia
R2	News article	<p>The day from hell: why the grid melts down in hot weather</p> <p>The Day from Hell</p>	<p>Reading material on the impact of hot days on electricity supply</p>	The Sydney Morning Herald Michael Bachelard 17.Dec.2019
R3	Worksheet	<p>School Energy Audit</p> <p>Cool Australia Energy Audit</p>	<p>A full lesson including audit document for students to record and audit energy use. It includes typical energy ratings for students to use in calculating energy consumption.</p> <p>Guidance is provided in a Teacher Worksheet on the Cool Australia website</p>	Cool Australia
R4	Online interactive map	<p>CO₂ emissions per capita</p> <p>Our World in Data: Emissions by country</p>	<p>Interactive map and graph of per capita annual emissions of carbon dioxide (CO₂), based on territorial emissions. Emissions data can be downloaded in a '.csv' format which can be opened with Microsoft Excel.</p>	<p>Our World In Data</p> <p>Global Change Data Lab</p>



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R5	Online simulator	Synergy Reduce your bill	An interactive tool by Synergy. Users put in their energy usage, then suggestions on how to cut costs are simulated	Synergy Western Australia's leading provider of electricity and gas
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7. Step-by-step lesson plan activities

Teacher activities and student tasks	Tool ID	Timing
<p>Pre-lesson activity (at home)</p> <p>Students calculate their ecological footprint using the WWF Ecological Footprint calculator. They note down their results for:</p> <p>How many planets do we need if everybody lives like you?</p> <p>When is your personal Overshoot Day?</p>	R1	10 min (at home)
Lesson 1		
<p><i>Think, pair, share</i></p> <p>Starter task</p> <p><i>“What were your results in the WWF Ecological Footprint? What do you think are the main ways people use energy in their lives? In what ways do you think you could personally reduce your energy use? What would be the easiest ways to reduce vs. the most impactful?”</i></p>		10 min
<p>Students read about the impacts of extremely hot days on the electricity system. They use their devices if possible.</p>	R2	20 min



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<p>The teacher uses the reading to prompt a discussion about people’s reliance on energy in their day-to-day lives and what it might feel like to have restrictions on energy use</p> <p><i>“How would equally hot days impact us in a school day? Discuss ways of making better choices in daily energy use: can you identify personal, industry, and government responsibilities?”</i></p>		
<p><i>Class discussion</i></p> <p>Students brainstorm all the ways energy is used in the school, focusing on cooling and heating</p>		5 min
<p><i>Group activity</i></p> <p>The teacher organises students in pairs or small groups and guide them to make a plan for the energy audit activity.</p> <p><i>“Decide how you are going to find out about the school’s energy use in cooling and heating (e.g. observing and interviewing) then develop questions you might need to ask to find out (e.g. what kind of AC/heating is used (split system, ducted), how long is it used, what temperature is it set at, when it is turned on/off (which outdoor temp?)”</i></p> <p><i>“Decide on a spot audit (proportion of rooms if in a large school) or complete audit if possible. Consider who you may need to get information from (individual teachers, administration, care-takers, etc.) and how you will get this information from them.”</i></p>		15 min
<p>Lesson 2</p>		
<p>The teacher distributes the Cool Australia School Energy Audit workbook to all groups of students.</p> <p><i>Group activity</i></p> <p><i>“Follow the guidelines in Cool Australia School Energy Audit workbook. Alternatively, carry out your own audit plan following your inquiry questions.”</i></p>		50 min



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<p>Extension: <i>'Identify any current good practices such as use of solar panels, energy efficient devices, reflective films on windows, behavioural norms common to the school, etc.'</i></p> <p>Students are given class time to conduct their surveys/interviews. They can follow the guidelines in the Cool Australia School Energy Audit workbook. Alternatively, they can carry out their own audit plan.</p>		
Lesson 3		
<p>Pair work</p> <p>Students use their devices to explore the interactive per capita emissions map and notice Australia's place in per capita emissions rankings.</p> <p>Reflection:</p> <p><i>'What do you notice about the rankings? What is interesting or surprising to you? What can be done?'</i></p>	R4	5 min
<p>The teacher invites groups to present the findings of their audits.</p> <p>The teacher collates all findings and displays them for analysis and discussion. This could be done on posters on a gallery walk or by contributing to a shared online document projected for the whole class to see.</p> <p>Think, pair, share</p> <p><i>"Analyse audit data, e.g. averages of temperature, number of hours devices are used, behaviours around heating and cooling energy use."</i></p> <p><i>"Identify the rooms/places in the school outside the average, both high and low. Consider why this might be happening."</i></p> <p><i>"Determine an appropriate temperature most conducive to learning (classroom vs gym vs lunchroom)."</i></p> <p><i>"Locate which rooms/places in the school are above (heating) or below this temperature (cooling) to target your action."</i></p>	R3	20 min
	R5	



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<p><i>“Calculate the hours or energy saved by reducing energy use in specific areas. Consider monetary savings by reducing energy use. Students can use the Synergy online simulator.”</i></p>		
<p><i>Class discussion</i></p> <p>The teacher encourages students to think critically about positive changes they recommend, and how best to communicate energy audit findings.</p> <p><i>“What specific and positive changes can you recommend around reducing use of heating or cooling in our school? What broad suggestions will reduce energy use?”</i></p> <p><i>“What can you personally do to decrease energy use with the information you have now gathered?”</i></p> <p><i>“Who needs to know about the proposed changes? (e.g. individual teachers, students, school administration)”</i></p> <p>Direct Action</p> <p><i>“How should you communicate these changes so they are adopted by these different groups? (infographic, create a how-to video, presentations)”</i></p> <p><i>“What information would you include to convince them that this is good for your local community and the global community?”</i></p> <p><i>“How would you persuade them? What communication techniques could you use?”</i></p>		15 min
<p><i>Independent work</i></p> <p>Reflection:</p> <p>Students write their reflection on Direct Action (discussed above)</p> <p><i>“What are the possible advantages/disadvantages of your proposed action for the school to take?”</i></p> <p><i>“How have your feelings about the carbon emissions of your class/school and impacts changed since completing this investigation? How do you feel now about your carbon emissions and the negative impacts that they have?”</i></p>		10 min



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<p>Assignment: Students need to create a group presentation that shows their proposed actions and details, give reasons for choosing these actions and detail the advantages and disadvantages of implementing them.</p>	<p>60 min (at home)</p>
<p>Lesson 4</p>	
<p>Follow-up: Group presentation Students present their action to the school in a format appropriate to their audience, inclusive of evidence and explanation as to why change is important.</p>	<p>50 min</p>

8. Additional Resources:

If you or your students would like to explore the topic further (e.g. homework), these additional resources will be useful.

Type of Tool	Name and web link to the Additional Teaching Tool	Brief Description	Credits
Online simulator	EN-ROADS Climate Change Solutions Simulator	An interactive tool that helps users to explore the likely consequences of energy, economic growth, land use, and other policies on global warming. The goal of this tool is to improve understanding of what works to address climate change	Climate Interactive
News article	NSW residents urged to cut power use as fire threatens Snowy Hydro	Fires impact electricity supplies, thousand lose power, plea to reduce energy consumption to preserve power.	The Sydney Morning Herald Peter Hannan 04.Jan.2020
Online simulation	Carbon Footprint Calculator	Simplified online Carbon Footprint Calculator based on lifestyle choices (uses Imperial Units)	Conservation International



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Acknowledgment

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