

## Lesson Plan: Anthropogenic Environmental Changes and Climate

This is a lesson plan developed by the ARC Centre of Excellence for Climate Extremes ([CLEX](#)) and the Monash Climate Change Communication Research Hub ([MCCCRH](#)) with contributions by Dr Sanaa Hobeichi and Dr Ian Macadam (CLEX); Tahnee Burgess and Dr David Holmes (MCCCRH); Caitlin Bell ([John Forrest Secondary College](#)); Dr Melissa Hart (the Schools Weather and Air Quality ([SWAQ](#)) Citizen Science project); Andrew Rollin ([John Curtin College of the Arts](#)); and Ashleigh Lustica ([Fremantle College](#)). The lesson plan originated at the “Climate across the Curriculum: Educational Resources for Teachers” workshop at the Australian Meteorological and Oceanographic Society ([AMOS](#)) conference held in February 2020 in Fremantle, Western Australia. The workshop was supported by AMOS, CLEX, MCCCRH, SWAQ, [TROP ICSU](#) and [the University of Western Australia](#). A version of the lesson plan tailored for use in Australian classrooms is available at <https://www.monash.edu/mcccrh/projects/climate-classrooms>.

As a **high school Geography, Humanities or Social Sciences** teacher, you can use this set of computer-based tools to help you in teaching about **human-induced (anthropogenic) environmental changes** that challenge **sustainability** and could be responsible for global climate change.

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**.

Thus, the use of this lesson plan allows you to integrate the teaching of a climate science topic with a core topic in **Geography, Humanities or Social Sciences**.

Curriculum Code (Australia):

- **ACHGK070:** Human-induced environmental changes that challenge sustainability
- **ACHGK071:** Environmental world views of people and their implications for environmental management

Cross Curriculum Priority (Australia): **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.

Presumed Knowledge (Australia):

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

Use this lesson plan to help your students find answers to:

- What is your individual ecological footprint on Earth?
- What does your school's energy audit look like?
- How do the carbon emissions of your country compare with others/rest of the world?
- What actions can be taken by you to reduce energy usage?

## About the Lesson Plan

**Grade Level:** High School

**Discipline:** Geography, Humanities, Social Sciences

**Topic(s) in Discipline:** Ecological Footprint, Energy Use, Energy Audit, Sustainable Development Goals (SDGs)

**Climate Topic:** Climate and the Anthroposphere

**Location:** Global, Australia

**Access:** Online, Offline

**Language(s):** English

**Approximate Time Required:** 200 min (4 sessions)

# 1 Contents

## 1. Simulation (10 min)

A WWF Ecological Footprint calculator to calculate one's ecological footprint from lifestyle choices. This tool allows students to see how many planets would be required to support the Earth's population if everyone lived like them.

This can be accessed at:

<https://www.wwf.org.au/get-involved/change-the-way-you-live/ecological-footprint-calculator#gs.5k1d32>

## 2. Reading (20 min)

An article from the Sydney Morning Herald newspaper on the impact of hot days on electricity supply in the context of increased frequency of such occurrences according to climate projections.

This can be accessed at:

<https://www.smh.com.au/national/the-day-from-hell-why-the-grid-melts-down-in-hot-weather-20191216-p53khd.html>

## 3. Classroom Activity (50 min)

A full lesson by Cool Australia including an audit document for students to record and audit their school's energy use. It includes typical energy ratings for students to use in calculating energy consumption. Guidance is provided in the Teacher Worksheet.

Note: You will have to sign up for a Cool Australia Log In to access all teaching and student material.

This can be accessed at:

<https://www.coolaustralia.org/activity/6-school-energy-audit-grade-78-finding-out/>

#### 4. Visualization (5 min)

An interactive map and graph of per capita annual emissions of carbon dioxide (CO<sub>2</sub>) by Our World in Data, based on territorial emissions. The emissions data can be downloaded in a '.csv' format.

This can be accessed at:

<https://ourworldindata.org/grapher/co-emissions-per-capita?country=AUS+CHN+IND+JPN+GBR+USA>

#### 5. Simulation (5 min)

An interactive electricity bill calculator for students to put in their energy usage and get suggestions on how to cut costs by using optimally or reducing energy use.

Note: This tool is specific to Australia. Teachers may use a region-specific tool for their lesson or use this for demonstration purposes.

This can be accessed at:

<https://www.synergy.net.au/Our-energy/Energy-tool/Reduce-your-bill?pid=pro:Reduce%20your%20bill#/>

#### 6. Suggested questions/assignments for learning evaluation

- What is your individual ecological footprint on Earth?
- What does your school's energy audit look like?
- How do the carbon emissions of your country compare with others/rest of the world?

- What actions can be taken by you to reduce energy usage?

## 2 Step-by-step User Guide

Here is a step-by-step guide to using this lesson plan in the classroom/laboratory. We have suggested these steps as a possible plan of action. You may customize the lesson plan according to your preferences and requirements.

### 1. Pre-lesson Activity

Before the first session, ask your students to calculate their ecological footprint using the WWF Australia '[What is your Ecological Footprint?](#)' calculator at home. Direct them to note down their results of:

- How many planets do we need if everybody lives like you?
- When is your personal Overshoot Day?

This can be accessed at:

<https://www.wwf.org.au/get-involved/change-the-way-you-live/ecological-footprint-calculator#gs.5k1d32>

### 2. Session 1: Starter Task- Think, Pair, Share

Start the first session by posing a few questions to your students:

- 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?

Use the reading, '[The day from hell: why the grid melts down in hot weather](#)' by Michael Bachelard, Sydney Morning Herald (SMH), 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. Direct your students to read the article to understand the impacts of extremely hot days on the electricity system.

This can be accessed at:

<https://www.smh.com.au/national/the-day-from-hell-why-the-grid-melts-down-in-hot-weather-20191216-p53khd.html>

Ask them how such hot days could impact their school day. Discuss ways of making better choices in daily energy use by identifying personal, industry, and government responsibilities.

### **Primer for Session 2:**

Ask the students to brainstorm about all the ways energy is used in the school, focusing in on cooling and heating. Organize them in pairs or small groups and guide them to plan for an energy audit activity using the following pointers.

- Decide how you are going to find out about the school's energy use in cooling and heating (e.g. observing and interviewing).
- Develop questions you might need to ask to find out what kind of AC/heating is used (e.g. split system, ducted), how long is it used, what temperature is it set at, when it is turned on/off (which outdoor temp?).
- Decide on 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, caretakers) and how you will get this information from them.

### **3. Session 2: Group Activity**

Distribute the Cool Australia [School Energy Audit workbook](#) to all groups of students. Alternatively, encourage students to focus on their own inquiry questions to guide their audit. Note: You will have to sign up for a Cool Australia Log In to access all teaching and student material.

This can be accessed at:

<https://www.coolaustralia.org/activity/6-school-energy-audit-grade-78-finding-out/>

Direct your students to follow the guidelines in the Cool Australia School Energy Audit workbook. Alternatively, carry out your own audit plan following your inquiry questions. Allow the students to use class time to conduct their surveys/interviews. As an extension, ask them to identify any current good practices such as use of solar panels, energy efficient devices, reflective films on windows, behavioral norms common to the school.

#### 4. Session 3: Extend Understanding

- A. Begin by allowing students to explore Our World in Data's interactive per capita emissions map, '[CO<sub>2</sub> emissions per capita, 2017](#)' and notice your country's place in per capita's emissions rankings (5 min).

This can be accessed at:

<https://ourworldindata.org/grapher/co-emissions-per-capita?country=AUS+CHN+IND+JPN+GBR+USA>

Use these reflection questions:

- What do you notice about the rankings?
- What is interesting or surprising to you?
- What can be done?

- B. Invite groups to present the findings of their school energy audits (15 min).

Collate all findings and display them for analysis and discussion – on posters, on a gallery walk or on a shared online document projected for whole class to see.

#### Think, pair, share:

- Analyze audit data, e.g. averages of temperature, number of hours devices are used, behaviors around heating and cooling energy use.
- Identify the rooms/places in the school outside the average, both high and low. Discuss why this might be happening.
- Determine an appropriate temperature most conducive to learning (classroom vs gym vs lunchroom).
- Locate which rooms/places in the school are above (heating) or below this temperature (cooling) to target your action.
- 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, '[Reduce your bill](#)'.

This can be accessed at:

<https://www.synergy.net.au/Our-energy/Energy-tool/Reduce-your-bill?pid=pro:Reduce%20your%20bill#/>

- C. Classroom Discussion (10 min):

Encourage the students to think critically about positive changes they recommend, and how best to communicate the energy audit findings.



- Ask them what specific and positive changes can they recommend around reducing use of heating or cooling in our school? What broad suggestions will reduce energy use?
- Question them further about what they can personally do to decrease energy use with the information they have now gathered?

**D. Further Action Plan (10 min):**

Use the following pointers-

- Who needs to know about the proposed changes (e.g. Individual teachers, students, school administration)?
- How should you communicate these changes, so they are adopted by these different groups? (infographic, create a how-to video, presentations)?
- What information would you include to convince them that this is the best for your local and global community?
- How would you persuade them?

**E. Reflection Questions on Action Plan (10 min):**

- What are the possible advantages/disadvantages of your proposed action for the school to take?
- How have your feelings about our carbon emissions and impacts changed since completing this investigation?
- How do you feel now about your carbon emissions and the negative impacts it has?

**F. Homework Assignment:**

Ask your students to create a presentation that shows their proposed actions and details, giving reasons for choosing these actions and details of the advantages and disadvantages of implementing them.

## **5. Session 4: Group Presentation**

Direct your students to present their action plan to the school in a format appropriate to their audience, inclusive of evidence and explanation as to why such changes are important. Emphasize how this reduced energy use will be beneficial in the larger context of anthropogenic or human-induced impacts on climate change.

## 6. Questions/Assignments

Use the tools and the concepts learned so far to discuss and determine answers to the following questions:

- What is your individual ecological footprint on Earth?
- What does your school's energy audit look like?
- How do the carbon emissions of your country compare with others/rest of the world?
- What actions can be taken by you to reduce energy usage?

## 3 Learning Outcomes

The tools in this lesson plan will enable students to:

- learn about energy use in school
- understand how lifestyle choices impact energy use
- discuss what actions can be taken to decrease energy use
- learn about sources of energy use
- understand how energy use impacts greenhouse gas emissions and the climate
- discuss greenhouse gas emissions from electricity usage to heat and cool their school

## 4 Additional Resources

If you or your students would like to explore the topic further, this additional resource will be useful.

### 1. Simulator; 'Climate Change Solutions Simulator'

An interactive tool by Climate Interactive, MIT Sloane, 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 their understanding of what works to address climate change

This can be accessed at:

<https://www.climateinteractive.org/tools/en-roads/>

## 5 Credits/Copyrights

All the teaching tools in our collated list are owned by the corresponding creators/authors/organizations as listed on their websites. Please view the individual copyright and ownership details for each tool by following the individual links provided. We have selected and analyzed the tools that align with the overall objective of our project and have provided the corresponding links. We do not claim ownership of or responsibility/liability for any of the listed tools.

**1. Simulation; 'What is your Ecological Footprint?'**

Provided by [WWF Australia](#).

**2. Reading; 'The day from hell: why the grid melts down in hot weather'**

By Michael Bachelard, [Sydney Morning Herald \(SMH\)](#).

**3. Classroom Activity; 'School Energy Audit workbook'**

Provided by [Cool Australia](#).

**4. Visualization; 'CO<sub>2</sub> emissions per capita, 2017'**

By [Our World in Data](#).

**5. Simulation; 'Reduce your bill'**

Developed by [Synergy](#), Australia.

**6. Additional Resources**

[Climate Interactive](#), MIT Sloane.