

Affordable clean energy

Understanding the opportunities for inclusive solar electricity through creativity, imagination and citizenship





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AFFORDABLE, CLEAN ENERGY FOR ALL

Understanding the opportunities for inclusive solar electricity through creativity, imagination and citizenship

WHAT YOU WILL FIND HERE

This resource supports you in developing students' core skills through the study of solar electricity. It is also designed to explore the United Nations Sustainable Development Goals, in particular Goal 7 which is to ensure access to affordable, reliable, sustainable and modern energy for all.

You can do this in the context of maths, English, citizenship, science, geography, design technology or other subjects. The materials can be used with or without an international partner school and instructions are provided on how to best use the resources.

On P5 you will find a planning template which will support you in adapting the materials and help you in evaluating the project if you are working with a partner school.

OVERVIEW

Sustainable Development Goal 7 aims to ensure access to affordable and clean energy for all by 2030. As the world population rises and many millions continue to move to urban areas, there is a huge increase in the demand for cost effective and reliable modern energy.

Our reliance on fossil fuels, which are major contributors to greenhouse gas emissions, is making drastic changes to our climate. Nevertheless, renewable energy is receiving more and more investment and is becoming increasingly cost effective, particularly in remote areas.

Two thirds of the population of Sub-Saharan Africa do not have access to electricity, and those that do often pay very high prices for an unreliable supply. Many people living in the region's most remote areas are unlikely to be connected to a grid system for decades yet. However, the high level of sunshine, fall in the price of photovoltaic cells, together with more efficient appliances (such as LED lights) mean that there is great potential for affordable, reliable, sustainable and modern energy that is accessible to everyone across the region.

The UK's Energy Africa access campaign aims to accelerate the delivery of off-grid solar energy to

households across Africa. The campaign, funded and managed by the UK government, was launched in 2015 to help Africa achieve universal access to energy by 2030. It will do this by helping countries to overcome financial hurdles and policy barriers, as well as make the most of the exciting developments in research and innovation to improve the market for solar energy across Africa. The campaign will involve key stakeholders, including African governments, donors, investors and lenders, industry, NGOs and the public.

One of the creative capacities of the Connecting Classrooms core skills course, creativity and imagination, is 'envisaging what might be'. The topic of off-grid solar energy offers great potential for students to visualize and design alternative solutions to a range of challenges. Similarly, the core skills citizenship course includes a session on 'sustainable development and sustainable

living'. Understanding how photovoltaic cells pay for themselves, not only financially but in energy terms, will help to raise students' awareness of one possibility for tackling climate change. Finally, the core skills course on critical thinking and problem solving includes 'evaluating evidence for and against different positions' as one of its four key features. Considering different energy options provides an opportunity to practice this skill.

The learning materials that have been created may be adapted to the context of each school and the needs of specific students. Some learning activities can be left out in order to enable deeper learning through other activities. Although it is an advantage to have access to ICT and the internet in the classroom, this is not essential.





LEARNING OBJECTIVES

This unit is designed to support the development of both knowledge and skills. Specific learning objectives are:

- to develop students' knowledge of renewable energy, specifically solar electricity
- to raise awareness of the Sustainable Development Goals, in particular Goal 7
- to give students the opportunity to use the core skills of creativity and imagination; citizenship; critical thinking and problem solving.

We recommend teachers identify opportunities within the school's curriculum where this knowledge and these skills can be taught, whether this is through English, citizenship, geography, maths, science or other subjects.



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DRAFT LEARNING OBJECTIVES

Overall, the aim of the project is to help students demonstrate enhanced knowledge, skills and understanding, and for them to know how to contribute responsibly to society, both locally and globally. We encourage you to add subject-related objectives and, if necessary, revise the following draft objectives to meet the needs of your students and your school's curriculum.

Creativity and imagination: to visualize alternative solutions.

Citizenship: to understand the possibilities for providing affordable, clean energy for all.

Critical thinking and problem solving: to evaluate evidence for and against different positions.

Geography: to consider what is possible and what is the best solution within a particular geographical context.

Maths: to practice handling data and understand the different ways of recording and presenting data.



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COLLABORATING WITH COLLEAGUES AND ADAPTING THE MATERIALS



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Summary

Here are the suggested steps for planning the unit and collaborating with other teachers in your school and/or internationally:

- I. What do we want students to learn?
- 2. What would be the best way to learn this?
- 3. How would we know what they have learned?
- 4. What resources do we need?
- 5. What did students learn during the unit?
- 6. What other reflections do we have about the unit?



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LEARNING MATERIALS THAT HAVE BEEN CREATED FOR THIS UNIT:

What do we already know about electricity: how can it improve our wellbeing, where does it come from and what does it cost?



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TEACHER'S PLANNING TEMPLATE

This can be used individually, in collaboration with colleagues in your school or with teachers from another school teaching the same unit, either in your country or in another country.

Question	Notes	Your thoughts
I. What do we want students to learn?	 Think about the most important learning objectives for this unit. Read through the materials that have already been created and consider what is most important for your students to learn. Reflect on the objectives suggested around creativity and imagination, citizenship, critical thinking and problem solving. Revise them if necessary. Consider the standards of your National Curriculum and reflect: which standards can be met through this learning unit? Be realistic about the time that you have available for this unit and what can be achieved in this time. 	
2. What would be the best way for them to learn this?	Given the learning objectives you have decided on, think about the learning activities that would be most effective for your students. What is the best way for them to learn about the current state of affordable, clean energy in your community, country and internationally? How can they learn about the facts (data) and personal experiences (stories) that illuminate different aspects of the current situation? How can they learn about the various causes of energy shortage and climate change? How can the activities of people living far away from you contribute to climate change that directly affects you/your life? What should society do more broadly to mitigate these effects? How could this be used as an opportunity to practise creativity and imagination, citizenship, and critical thinking and problem solving? For example, to visualize alternative solutions, think about the provision of sustainable energy, and about evaluating evidence. How to learn about the potential solutions to tackle energy shortage and climate change, especially those that have been very successful in many countries. How to design a project that addresses energy shortage and sustainability in your community.	



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Question	Notes	Your thoughts
3. How will we know what they have learned?	Given the learning objectives you have decided on, think about assessment. How will you find out what your students already know about this topic before beginning the unit? Consider what sort of evidence you would need to see that students have learned the knowledge, skills or attributes you would like them to learn.	
4. What resources do we need?	Given the learning activities you are planning, think about the resources you will need. People – who would you like to engage in the unit so that students can learn more about the causes of energy shortage or scarcity, climate change, and potential solutions? Written materials, music, art – what additional materials would be beneficial to your students in this unit? Places – where would it be useful for your students to learn during this unit?	
5. What did students learn during the unit?	During and after the unit, think about what students are learning by using formative assessment and checking for understanding as students work through the activities. To what extent did students meet the learning objectives of this unit? What other, surprising things did students learn? What were students confused about?	
6. What other reflections do we have about the unit?	During and after the unit, think about what went well with this unit and what could have been done differently. Which learning experiences were particularly valuable? Were the learning activities appropriate? What worked well? What would you do differently next time? How can you use formative assessment (or Assessment for Learning: AfL) to help your students' learning or understanding to progress from this point?	





LESSON I

Affordable, reliable, sustainable and modern energy: electricity, its benefits, costs, and sources

STUDENTS WILL:

- consider how electricity can improve human wellbeing
- find out how much electricity costs in their country
- find out how electricity is generated in their country.

NOTES ON CORE SKILLS

This lesson relates to the core skill of critical thinking and problem solving as it involves evaluating reasons and evidence from different sources. There is also an opportunity to use some creative thinking and imagination in an extension activity, and for using digital literacy skills through online research.

Step I

 In pairs or small groups, ask students to answer the question 'What do you already know about electricity?' Then ask them 'What do you want to find out?' Record their responses using an enlarged version of the KWL Charv

- 2. As a stimulus to prompt ideas, you may wish to display some photographs. Possible examples to download can be found in the 'Sources of further information' section at the end of this resource. You may also wish to broaden the discussion with prompt words from Sustainable Development Goal 7: Affordable, reliable, sustainable and modern energy for all.
- 3. Share with students the expected learning outcomes (re-word them if necessary) and discuss what they might mean:
- Creativity and imagination: to visualize alternative solutions.
- Citizenship: to understand the possibilities for providing affordable, clean energy for all.
- Critical thinking and problem solving: to evaluate evidence for and against different positions.



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Step 2

- Ask students to come up with a list of basic human needs. This can be done as a whole class or as a small group, with students making suggestions on separate pieces of paper. Their suggestions can be accompanied by simple drawings.
- There might be some discussion about what constitutes a basic survival need (like clean water) and what constitutes a right (like education). Allow students to extend the definition to include rights, but not luxuries. A list of rights can be found on page 14 of the Gender Equality template project.
- 3. The needs, written on the pieces of paper, are then sorted by students into two groups: those needs which can be more easily met with the help of electricity and those for which electricity would make no difference.
- 4. Invite students to explain why they have sorted the needs in the way that they have. Allow other students to challenge or question the reasons until there is general consensus about the grouping of the needs.

Step 3

 It is likely that students will have many needs which can be more easily met with the help of electricity. Ask students to each choose one of these needs and to think of a way of measuring how much electricity might be used to meet it.

- 2. Distribute printouts of the table below, or Slide 4, for students to complete to help them work out how much electricity (measured in Watts) is likely to be used by different appliances to meet the different needs in a year. Students could work out an estimate based on their own personal needs (taking into account the electricity needs of their household, divided by the number of people). If they do not use electricity, then they could use the table to estimate the cost for someone who does.
- Find out, or ask a student to find out, the cost of a kilowatt-hour (kWh) in the country in which they live

 links to figures for the prices in different countries can be found in the 'Sources of further information' section at the end of this resource.
- 4. Ask students to estimate the total number of kilowatt-hours they or someone else might use per day to meet their basic needs (not luxuries) from the agreed class list and how much this would cost.
- 5. Students should also list the particular benefits of the electrical appliance. In some cases a nonelectrical appliance, such as a fuel efficient stove, might be a better use of money.

Human need	Household appliance	a) Power needed (Watts)	b) Hours used per day (hours)	c) Energy used per day, kWh (a x b)	d) Cost per kWh	e) Cost per day (c x d)	f) Cost per year (e x 365)	Benefits
To see in the evening to cook etc	Light (comp. fluor) E	28 watts X	6 hours A	0.17 M	I5р Р	2.6р L	£9.49 E	No air pollution in household
Clean water	Well pump	500						
Fresh food	Fridge	200	8 (fridges cycle on and off, even if on all day)	1.6				
Contact	Mobile phone	2						
Healthy temperature	Electric fan							
	TOTAL:							





Sources of further information Background and context Big IdEAs: Mary Robinson: www.youtube.com/watch?v=LTlfm jqqUs Lesson I Step I: possible photograph stimuli from Solar Aid: www.solar-aid.org/assets/ssresources/sunny-schools/5-photocards.pdf Step 2: a list of rights can be found on page 14 of the Connecting Classrooms Gender Equality Template Project: https://schoolsonline.britishcouncil.org/classroom-resources/list/gender-equality Step 3: information on the power consumption of other appliances from Daft Logic: www.daftlogic.com/information-appliance-power-consumption.htm Statista, global electricity prices: www.statista.com/statistics/263492/electricity-prices-in-selected-countries/ Energy Use Calculator, global electricity prices (including taxes): http://energyusecalculator.com/global electricity prices.htm Step 4: Energy Atlas, electricity generation by country: http://energyatlas.iea.org/?subject=-1118783123# International Energy Agency, electricity generation by

