



# Solar energy Lesson 5

This guide is designed to accompany and complement:

- Presentation: **Solar energy**
- Single page lesson plan: **Solar energy**
- Worksheet: **Solar energy** (including activities and possible extension tasks or homework)

The guide goes into greater detail than the single page lesson plan and includes suggested resources and elaborates on each slide in the presentation.

### Presentation Tips:

- When opening the PDF presentation, you can select how it is displayed. If you wish to **click through** as opposed to scrolling (which gives you more control as you progress and is more like a conventional ppt) it is best to show it in **'full screen mode'** (press 'escape' to exit).
- All associated documents are attached to the presentation. To find these, click on the **paperclip icon** in the left-hand toolbar.
- When viewing the presentation, presenter notes from this delivery guide are also available for reference if you hover the cursor over the small orange callout icon in the top left corner. **Fig.1**

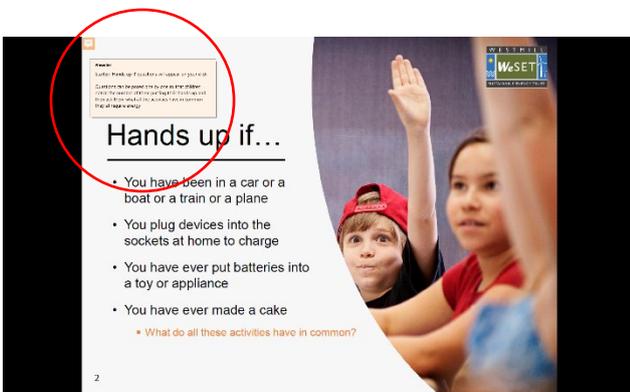
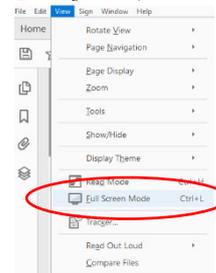


Fig.1

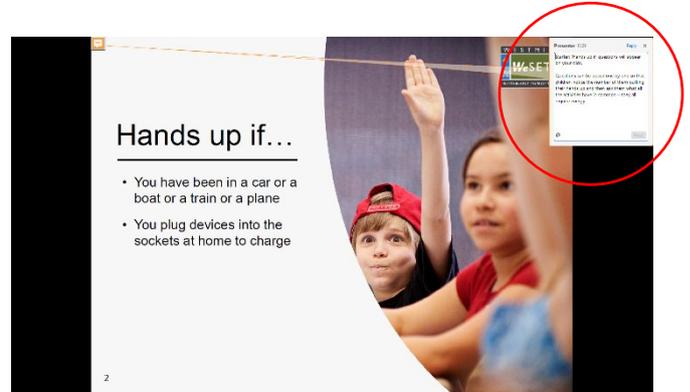


Fig.2

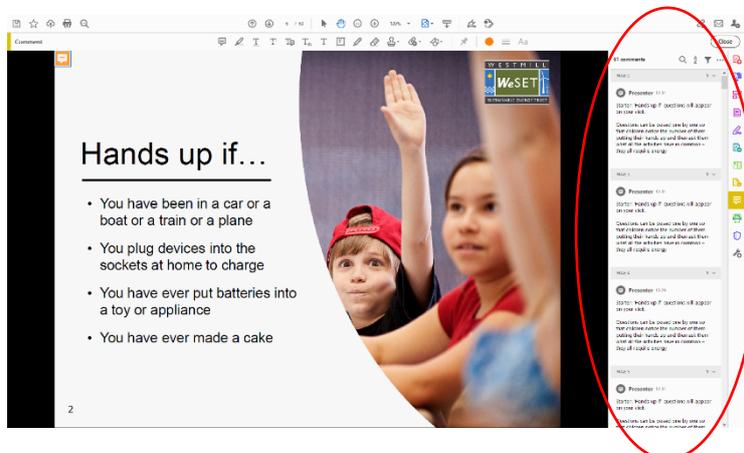


Fig.3

- If you **right click** on that icon it will open a small window showing presenter notes in the top right of the page. **Fig.2** If you right click and scroll down, you can also choose to click **'show comment app'** which opens a panel on the right of the page showing all the presenter notes as you scroll through. **Fig.3**

## 10 minutes to fill?

You could use the introduction and then show the 'what is energy?' video clip [5m00s] to start a discussion about energy and the ways we use energy in everyday life

Slide 2  
Slide 14

Slide number refer to the numbers on the slides themselves

This presentation is designed to allow the presenter/teacher to pitch it as appropriate to higher KS2 or lower KS3 (approximate age range 6 – 12 years). Questions that are on the slides have been differentiated by colour in this guide, with **red** being most challenging.

 Those marked with this icon **may not appear on the slide** and are optional, higher level questions.

 Points marked with this icon **may not appear on the slide** but can be used as a starting point for a personal investigation activity and for extension where appropriate.

**Advisory!** All videos are linked to external players (usually YouTube) these have been chosen to complement and reinforce learning and have been chosen carefully. However, we would **advise that you watch them yourself prior to showing them** to ensure that you are happy that the content is right for your children or class.

Suggested resources

WeSet resources

2

Starter: Prompt children to imagine waking up one morning to find that the Sun hasn't risen.

- **Ask children to make a list of 5 things that you would miss most about the Sun – answers may include but are not limited to sunrises and sunsets, light to live and work by, the changing of the seasons, plants that rely on the sun to grow, warmth as the temperature would drop, the Moon which reflects light from the sun**

Possible answers will appear at the click of the mouse.

PDF presentation, worksheet and lesson plan

<p>3</p>	<p>The Sun is our closest star, it is at the centre of our ‘solar’ system. The word solar comes from the Greek word for Sun, Sol.</p> <ul style="list-style-type: none"> <li>• <b>What types of energy does the sun provide? – Heat energy, light energy</b></li> <li>☞ <b>You might like to ask children how we ensure our exposure to the sun is safe – whilst we need sunlight to help us make vitamin D amongst other things the sun’s energy is powerful and over exposure can be harmful. There are plenty of products that help protect us, from sunglasses to sunscreens. However, simply limiting exposure, covering up and keeping in the shade when the sun is strong are sensible precautions</b></li> <li>☞ <b>What is the sun made of? – The sun is composed of hot gasses, predominantly hydrogen with some helium and smaller amounts of other gasses</b></li> </ul>	<p>Any sun protection paraphernalia such as sun glasses, sunhats, sunscreen – these can prompt discussion of how they protect us and what they are protecting us from</p>	
<p>4</p>	<p>☞ <b>Is it the rotation of the earth or the rotation of the sun that means that we have day and night? – It is the rotation of the Earth that takes 24 hours to rotate</b></p> <p>The Earth is the third planet from the Sun and its path around the Sun is called its orbit; it takes the Earth one year to completely orbit the Sun.</p> <p>The Sun also turns and takes 25 days to complete one full rotation.</p> <ul style="list-style-type: none"> <li>• <b>How can the Sun be used to tell the time? – As the earth turns, the Sun moves across the sky and the shadows cast by objects and people will change in length and direction, these shadows can be used to chart the passage of time and so sundials were designed to do this dividing the day into segments or hours</b></li> </ul>	<p>There is a nice template for a paper sundial here <a href="https://www.blocklayer.com/sundial-pop.aspx">https://www.blocklayer.com/sundial-pop.aspx</a></p>	
<p>5</p>	<p>Referring to the starter, it is worth reiterating how vital the Sun is to life on earth. Without the Sun, within a week the temperature would plunge to well below 0 degrees Celsius and within a month the oceans would start to freeze over.</p> <ul style="list-style-type: none"> <li>• <b>Ask children in what ways we benefit from the Sun’s radiation – As well as giving us light and warmth, the Sun enables the growth of plants without which we could not survive</b></li> </ul>	<p>This BBC video clip explains the Earths orbit around the Sun <a href="https://www.bbc.co.uk/bitesize/clips/z6vfb9q">https://www.bbc.co.uk/bitesize/clips/z6vfb9q</a></p>	

6	<p>You can choose to show the video clip as it will only commence once you have <b>clicked on the 'play' icon</b></p> <p>The clip runs for [3m03s] and gives an overview of how the Sun's energy reaches the earth.</p>	<p><a href="https://www.youtube.com/watch?v=6FB0rDsr_rc">https://www.youtube.com/watch?v=6FB0rDsr_rc</a> [3m03s]</p>	Embedded clip in ppt
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## Hand out Worksheet 5 Solar energy

7	<p><b>Task 1</b> This slide can be used alone or in conjunction with the differentiated worksheet where children can write their answers in the table provided for recorded formative assessment</p> <ul style="list-style-type: none"> <li>Ask children to use the words in the list to fill in the gaps in the sentences – <b>once you have gone through the task, the answers will appear one by one on the click of the mouse</b></li> </ul>		Worksheet 5 Solar energy
8	<p>Scientists measure solar radiation in order to study climate variations and change they also use these measurements to help to forecast the weather.</p> <p> <b>What does a meteorologist do? – A meteorologist is a scientist who studies the atmosphere, including environmental effects and changes and uses analysis and observation to understand, explain or forecast changes in the atmosphere and its effects on the Earth's weather</b></p> <p>A solar radiometer is a device used to measure the intensity of sunlight. Pyranometers measure all the radiation from the sun.</p> <ul style="list-style-type: none"> <li><b>Why might we need to measure light or heat energy levels? – For horticultural and agricultural applications, in order to make weather predictions and give UV warnings, to enable those working in solar energy to calculate how much electricity a solar energy installation will produce</b></li> </ul>	<p>If you know a keen photographer they may be able to lend you a light meter. If not, this is something we can use on your visit to Westmill.</p>	

<p>9</p>	<p>The first silicon based photovoltaic (PV) cell was created in 1954. It could power electrical appliances but was not as efficient as those we use now. Whilst not yet commonly used in the home, solar panels were used by NASA to power satellites. By the 1970s advancements in the technology had brought down the cost and since then they have become increasingly viable for applications ranging from domestic panels to solar farms, personal devices and technology and increasingly transport like cars and aircraft.</p> <ul style="list-style-type: none"> <li>• <b>Do solar panels need direct sunlight to work efficiently? - Solar panels don't need direct sunlight to work efficiently, they generate energy from daylight rather than direct sunlight which means they will work on cloudy days too.</b></li> </ul> <p>In domestic systems, inverters are often a sealed unit located either in the attic, garage or in a unit on an external wall.</p> <p>☞ <b>How can we utilise solar energy 24/7? - Although solar panels don't work at night, if a battery is installed, it enables solar energy to be used during the night as well.</b></p> <p>Domestic solar panel systems are now much more affordable. Unfortunately, this meant that the UK government decided to retire the Feed-in Tariff in March 2019.</p> <p>☞ <b>Do any of the children have a solar installation at home? If so, do they know where the inverter is located?</b></p>		
<p>10</p>	<p>As you go through each point on this slide, a click of the mouse will list the name of the relevant part on the left.</p> <p>A solar panel consists of layers of material each of which contributes towards the function and efficiency of the panel.</p> <ul style="list-style-type: none"> <li>• <b>What is the function of the blackout material layer? - The glass is coated with an anti-reflective material to maximize light absorption. This also reduces glare.</b></li> </ul> <p>Solar panels produce less glare than window glass!</p>	<p>An example of a PV panel or cell for example on a solar charger</p>	

<p>11</p>	<p>As you go through each point on this slide, a click of the mouse will locate the relevant part on the image.</p> <p>Each <b>PV cell</b> is made from two silicone layers and silver contacts sandwiched between glass.</p> <ul style="list-style-type: none"> <li>• <b>What do you think causes the flecks you can see under the surface of the panel? – The flecks you see are crystals of silicon</b></li> <li>• <b>Ask children if DC or direct current be run straight into our homes - direct current cannot be used straight from the solar panels, it is run through an inverter to convert it to the AC or alternating current we use in our homes. AC or alternating current is the standard for domestic use but is also easier to distribute through power lines and adjust to different domestic voltages</b></li> </ul> <p><b>🔊 The Westmill site consists of 30 acres of over 20,000 polycrystalline PV panels. The average UK household uses approximately* 3,100 kWh/year (=0.0031GWh/year), If the Westmill panels generate 4.8GWh/year how many average homes will it be able to supply? (you may round your answer up to the nearest 50) – Using these figures, 4.8GWh would meet the annual electricity consumption of around 1,548 (1,550) average homes which in turn would prevent more than 1,500 tonnes of carbon dioxide emissions annually</b></p> <p>* This figure is taken from <a href="https://selectra.co.uk/energy/guides/consumption/average-consumption-uk#">https://selectra.co.uk/energy/guides/consumption/average-consumption-uk#</a></p>	<p>An example of a PV panel or cell for example on a solar charger</p>	
<p>12</p>	<p>You can choose to show the video clip as it will only commence once you have <b>clicked on the 'play' icon</b></p> <p>The clip runs for [1m54s] and gives an overview of how the Sun's energy reaches the earth.</p>	<p><a href="https://www.youtube.com/watch?v=vbFJY&amp;feature=emb_logo">https://www.youtube.com/watch?v=vbFJY&amp;feature=emb_logo</a> [1m54s]</p>	<p>Embedded clip in ppt</p>
<p>13</p>	<p><b>Task 2</b> This slide can be used alone or in conjunction with the differentiated worksheet where children can write their answers in the spaces provided for recorded formative assessment</p> <ul style="list-style-type: none"> <li>• <b>Ask children to examine the image of the solar installation on the house pictured and see if they can answer the questions listed – answers will appear one by one on the click of the mouse</b></li> </ul>		<p>Worksheet 5 Solar energy</p>

14	<p>Many relatively low-cost products now incorporate solar technology. Most familiar may be items like calculators, solar chargers, garden lighting and radios.</p> <ul style="list-style-type: none"> <li>• <b>What do you think the term solar array means? – This is the term used for a group or rows of multiple solar panels</b></li> <li>• <b>Can children identify any items they may have at home that are solar powered?</b></li> </ul>	Any small solar powered products	
15	<p>The possible concerns listed will be discussed in the following slide.</p> <ul style="list-style-type: none"> <li>• <b>Do you have any worries about solar panels? – It is good to discuss children concerns if there are any. There is some sensationalist negative information online much of which is not fact based and so it is easy to hear false propaganda.</b></li> </ul>	An example of a PV panel or cell for example on a solar charger	

<p>16</p>	<p>They cause dangerous glare – <b>because solar panels are designed to absorb light and usually incorporate blackout materials, they reflect relatively little light, less than domestic window or even snow!</b></p> <p>Solar panel can't be recycled – <b>If solar panels are removed to be replaced by more up-to-date models they are often refurbished and re-used. They can also be dismantled and split into their component parts consisting of glass, plastic, aluminium, silicon and other metals which can all be recycled.</b></p> <p>They require a lot of maintenance - <b>Solar panels are constructed to withstand harsh weather and require very little maintenance however the panels need to be clean and checked occasionally to ensure there is nothing blocking them from efficiently absorbing the sunlight (bird poo, leaves etc!) Ours are washed twice a year.</b></p> <p>They don't work when it is cold or cloudy – <b>these days solar panels do not need direct sunlight but can operate in daylight so even when it is cloudy. They can also operate in low temperatures, in fact panels are more efficient on a sunny winter's day than a hotter one.</b></p> <ul style="list-style-type: none"> <li>• <b>How can fields with solar panels in be used to attract biodiversity? – Whilst fields used for solar panels can still be grazed, they can also be left meadow which attracts insects, butterflies, birdlife and small mammals</b></li> </ul> <p><i>☞</i> <b>What are the advantages of increased biodiversity? – This is beneficial for rare or endangered plants and wildlife. In terms of flora, biodiversity can improve soil and air quality. Biodiversity of insects increases pollination opportunities</b></p>		
<p>17</p>	<p>You can choose to show the video clip as it will only commence once you have <b>clicked on the 'play' icon</b></p> <p>The clip runs for [2m50s] and whilst not the Westmill site, it shows the construction of a Solar array at Landmead Oxfordshire.</p>	<p><a href="https://www.youtube.com/watch?v=aVPIKsb-f00&amp;feature=emb_logo">https://www.youtube.com/watch?v=aVPIKsb-f00&amp;feature=emb_logo</a> [2m50s]</p>	<p>Embedded clip in ppt</p>

18	<p>Like other technologies, solar technology is improving and developing all the time making it more efficient and viable. It is suggested that if we could cover roughly 1% of the Sahara Desert with photovoltaic solar panels then we would be able to generate all of the world's electricity requirements as the sun shines brighter in the Sahara Desert than anywhere else on Earth.</p> <p><i>☞</i> <b>Why do you think this strategy (building solar farms in the Sahara) has not yet been implemented?</b> – There are logistical issues, sand is not an easy surface to build on, it gets very hot which can reduce the efficiency of the panels and, sandstorm mean that panels would become obscured and need constant cleaning. It would also be difficult to transmit the electricity to where the demand is (the Sahara has relatively low habitation)</p> <ul style="list-style-type: none"> <li>• <b>What countries could benefit particularly well from solar power?</b> – Countries and continents with a higher number of sunny days per year like India, Africa etc, large countries/war impacted areas/geographically hard to reach areas where it is logistically difficult to install a grid network</li> </ul>		
19	<p>Little Sun's story serves as an excellent case study looking at the difference solar innovation can make to individuals and communities without easy access to electricity from the grid. For every Little Sun product purchased the same product is made available to someone without access to electricity at a locally affordable price.</p> <ul style="list-style-type: none"> <li>• <b>How could small portable solar lights improve the lives of school children?</b> – Improving safety, giving them personal lights to help them on long walks to and from school, often done in the dark. Enabling them to do homework in the light without straining their eyes</li> </ul> <p><i>☞</i> <b>How does a product like this contribute toward greater gender equality?</b> – *"Little Sun is passionate about the role we play in providing better personal safety to women and girls after dark, and we are working particularly hard to provide a greater impact on refugee camps. Access to light means a safer life and better healthcare for women and girls including reliable light for delivering babies at night."</p> <p>*Taken from <a href="https://littlesun.com/impact/">https://littlesun.com/impact/</a></p>	<a href="https://littlesun.com/shop/">https://littlesun.com/shop/</a>	

20	<p>You can choose to show the video clip as it will only commence once you have <b>clicked on the 'play' icon</b></p> <p>The clip runs for [2m13s] and shows Little Sun products in use.</p>	<a href="https://littlesun.com/education/[2m13s]">https://littlesun.com/education/[2m13s]</a>	Embedded clip in ppt
21	<p><b>Task 3</b> This slide can be used alone or in conjunction with the differentiated worksheet for recorded formative assessment.</p> <p>This can be done in pairs or larger teams for brain storming.</p> <ul style="list-style-type: none"> <li>• <b>Ask children to design solar streetlight that could be used on pathways and roads between villages in areas that are not on the grid to light children's way making it safer when they walk to school.</b></li> </ul> <p>Each streetlight will be powered by a solar panel.</p> <p>You can decide if you wish to set parameters in terms of scale and aesthetics, these could include: <b>Designing a streetlight that uses biomimicry to blend into or complement its environment or creating a design with a secondary purpose for example as a plug in device charger.</b></p> <p><b>Children might like to incorporate energy saving aspects like a motion sensor.</b></p> <p>An indicative solution is shown on the <b>Worksheet 5 Solar energy Answers</b> sheet</p>		Worksheet 5 Solar energy
22	<p>You can choose to show the video clip as it will only commence once you have <b>clicked on the 'play' icon</b></p> <p>The clip runs for [2m43s] and shows the difference street lighting can make.</p>	<a href="https://www.youtube.com/watch?v=-ftwSikaiU">https://www.youtube.com/watch?v=-ftwSikaiU</a> [2m43s]	

<p>23</p>	<p><b>Plenary Quiz - What have you learnt?</b></p> <p>This can be done as a quick-fire hands up quiz or pupils can be given time to write down their own answers for formative assessment.</p> <ul style="list-style-type: none"> <li>• <b>Is solar energy renewable or non-renewable energy? - Renewable</b></li> <li>• <b>The Earth orbits the Sun, how does this affect our calendar year? – It gives us seasons</b></li> <li>• <b>A light meter is used to measure what? – The intensity of light on a surface</b></li> <li>• <b>Solar panels are made up of many PV cells. What does PV stand for? - Photovoltaic</b></li> <li>• <b>What is used to convert direct current from solar panels into alternating current to be used in homes? – An Inverter</b></li> <li>• <b>What term is used for a group of solar panels grouped together? – An Array</b></li> </ul>		
<p>24</p>	<p>All images used are royalty free, 'Creative Commons' and free to use for non-commercial purposes</p> <p>Sources include:  <a href="https://www.freeimages.com">https://www.freeimages.com</a>  <a href="https://pixabay.com">https://pixabay.com</a>  <a href="https://unsplash.com">https://unsplash.com</a>  <a href="http://westmillsolar.coop/">http://westmillsolar.coop/</a>  <a href="http://www.weset.org/">http://www.weset.org/</a></p> <p>Microsoft online pictures search (Creative Commons only)</p> <p>To arrange a site visit, please go to  <a href="http://www.weset.org/?page_id=126">http://www.weset.org/?page_id=126</a></p> <p>Or email <a href="mailto:education@weset.org">education@weset.org</a></p> <p>These materials are free to use and reproduce however we respectfully ask that you do not edit them</p>		