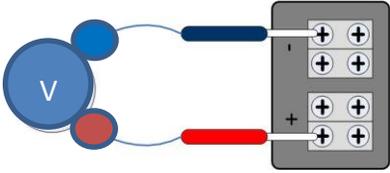


## J6 Science – Conversion of Energy (Solar Energy Conversion by Solar Panels)

### Lesson Plan

<b>Key Stage</b>	KS2
<b>Date (Duration)</b>	19 <sup>th</sup> June, 2024 (35 minutes) – STEM Room
<b>Prior knowledges</b>	<ul style="list-style-type: none"> <li>➤ Electricity can be produced with closed circuits. (J5 Science and Technology)</li> <li>➤ Volt is the electrical unit of voltage. (J5 Science)</li> <li>➤ Energy can be converted into different forms (e.g. Solar energy can be converted into electrical energy). (J6 Science)</li> <li>➤ Data collection and handling: averages and bar charts. (J6 Mathematics)</li> </ul>
<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>➤ recognise the factors affects the efficiency of conversion of solar energy into electrical energy by solar panels under activities (Technology) and hence to design the solar panel set-up to produce the highest energy conversion efficiency produced according to their findings. (next lesson) (Engineering).</li> <li>➤ master scientific process skills (Science), include observing, predicting, measuring, recording (Mathematics), identifying variables and interfering (Science).</li> </ul>
<b>Inquiry question</b>	<ul style="list-style-type: none"> <li>➤ How can we make the solar panels with high efficiency energy conversion to help us saving the non-renewable energy resources. What factors affect the efficiency of solar energy conversion?</li> </ul>

Teaching flow	Content
<b>Self pre-learning</b>  <b>And</b>  <b>Motivation</b>  <b>(3 minutes)</b>	<p><b>Questioning of solar energy conversion into electrical energy by solar panels</b></p> <ul style="list-style-type: none"> <li>➤ What is the energy conversion of solar panels under the light sources? Solar energy is converted into electrical energy.</li> <li>➤ What are the advantages and disadvantages of the application of solar panels?  Advantages                             <ul style="list-style-type: none"> <li>- Use of renewable energy; reduction of electricity bills and low maintenance cost.</li> </ul>                             Disadvantages                             <ul style="list-style-type: none"> <li>- Weather dependent; low efficiency of energy conversion and occupying a lot of space.</li> </ul> </li> <li>➤ What are the factors affecting the efficiency of energy conversion by the application of solar panels?  <i>e.g.</i> (1) direction between the Sun and the surface of solar panels; (2) the distance between the Sun and the solar panels; (3) the surface temperatures of solar panels; (4) the quantity of solar panels and (5) the weather condition (<i>e.g.</i> sunny days or cloudy days).</li> </ul>
<b>Introduction</b>  <b>(2 minutes)</b>	<p><b>Understanding factors which affect the solar panels efficiency of conversion of solar energy</b></p> <ul style="list-style-type: none"> <li>(1) the quantities of solar panels;</li> <li>(2) the distance between the light sources and the solar panels;</li> <li>(3) the weather conditions (<i>e.g.</i> sunny days or cloudy days).</li> </ul>

	<p>(4) the surface temperatures of solar panels; and</p> <p>(5) direction between the light sources and the surface of solar panels.</p> <ul style="list-style-type: none"> <li>➤ Teacher explains / students read the steps of the <b>Activity 1</b>.</li> <li>➤ Teacher asks students to predict the results before the activities starts.</li> <li>➤ Students conduct the activities according to the steps and then record the results.</li> </ul>
<p><b>Identifying variables</b> <b>(2 minutes)</b></p>	<p>In the fair tests, which of the following factors need to be <b>changed, measured or remain unchanged?</b> (independent variable, dependent variable and controlled variables)</p>
<p><b>Activities</b> <b>(1 - 2)</b> <b>(25 minutes)</b></p>	<div style="text-align: center;">  </div> <p><b>Hypothesis 1: More solar panels used, the higher the voltages generated.</b></p> <ul style="list-style-type: none"> <li>• Connect the voltmeter and the solar panel to make the closed circuit.</li> <li>• Record the readings (voltages) 3 times for each change (one panel, two panels (1 – in series) and two panels (2 in parallel)) of the variables.</li> <li>• Take averages of the data to show the results.</li> <li>• Discuss the results from the activities.</li> </ul> <p><b>Hypothesis 2: What are the other factors affecting energy conversion efficiency of solar panels?</b></p> <ul style="list-style-type: none"> <li>• Choose one of the factors to set the hypothesis and hence conduct the experiment.</li> <li>• Connect the voltmeter and the solar panel to make the closed circuit.</li> <li>• Record the readings (voltages) 3 times for each change of the variable.</li> <li>• Take averages of the data to show the results.</li> <li>• Discuss the results from the activities.</li> <li>• Students of different group share the results in the lesson.</li> </ul>
<p><b>Conclusion</b> <b>(3 minutes)</b></p>	<ul style="list-style-type: none"> <li>➤ Q1: Which condition does the solar panel produce the highest voltages (electrical energy) in each activity? Why?</li> </ul> <p>Suggest answers:</p> <p>A1: When the surface of solar panel perpendicular to the light source produced the highest voltage because solar panel received the highest solar energy.</p> <p>A2: When the shorter distance between solar panel and the light source produced the highest voltage because solar panel received the highest solar energy.</p>

	<p>A3: When no objects blocked the light sources, solar panel produced the highest voltage because solar panel received the highest solar energy.</p> <p>A4: When more solar panels connected to the closed circuit, higher voltage produced when the large area of the set-up receive more solar energy.</p> <p>A5: When the surface temperature was higher, solar panel produced less electrical energy because heat is resistant to reduce the energy conversion by solar panel.</p>
<p><b>Advanced questions</b></p>	<ul style="list-style-type: none"> <li>➤ A1: Why did the surface of solar panel parallel to the sunlight still produce electricity?</li> <li>➤ A2: Is that the distance between the sunlight and solar panel inversely proportional to the voltage produced?</li> <li>➤ A3: Why did the solar panel blocked by the white A4 paper still produce voltage?</li> <li>➤ A4: Is that the number of solar panel used directly proportional to the voltage produced?</li> <li>➤ A5: How can we solve the heat produced from the solar panel during receiving sunlight?</li> <li>➤ Can we design the set-up to facilitate the solar panel having the high efficiency of energy conversion. (Answer and conduct the experiment in the next lesson)</li> </ul>
<p><b>Reference books</b></p>	<ul style="list-style-type: none"> <li>➤ Photovoltaics: design and installation manual / Solar Energy International.</li> <li>➤ Consumer guide to solar energy: easy and inexpensive applications for solar energy</li> <li>➤ 3 小時讀通太陽能電池</li> <li>➤ 太陽電池 (未來能源的終極王牌, 太陽光發電技術)</li> </ul>