solar for schools

Power Detectives Teacher Guide — Level: Secondary

Summary:
This is an online programme that will guide you and your students through a critical analysis of a school's electricity charts in order to identify trends. Ultimately, this programme will enable you and your students to brainstorm realistic solutions to help your school become more energy efficient.

Learning Objectives:
Through their participation in this programme, students will be able to…

- Read a bar chart
- Read a line chart
- Practice basic math skills, including fractions and percentages
- Learn about how much electricity a school uses and about its electricity sources
- Gain an understanding of how a school uses electricity over time
- Understand how a solar panel system generate electricity over time
- Understand when solar electricity replaces mains electricity
- Identify ways to help the school become more energy efficient

Outline/Flow of the programme:

1. Students are prompted to start the programme on the page: https://www.solarforschools.co.uk/gb/en/students/power-detectives

   On this page, students are given brief instructions and introduced to the Energy Bee that will share interesting information on our website.

   

   They are also prompted to choose a school to view its electricity charts (see NOTE below).

2. Once a school is selected, the school's project page will open. Each school has a unique project page. Specifically, the Overview of the project will open.

3. Towards the top of a school's project page, clicking on the Energy Bee will prompt the students to start a tour of the Overview page.

   The students will receive information about the solar panel system that is installed at the school and will be introduced to the impact of the solar panels so far, including how much electricity has been generated, the financial and environmental impacts as well as the social impact.

4. The students should then scroll down to view the charts and click on the magnifying glass to start a tour about how to use the charts.

Namely, students will be introduced to the 5 different charts: Day, Week, Month, Year and Lifetime.

They will also be given a brief description of the 5 fields shown in the charts: Consumption, Generation, Import, Export and Self Consumption.

5. Students should select a time period, as prompted by the activity you assign (suggestions below). They also will choose Lines or Bars to display the chart, according to the requirements of the activity.

   Be sure students choose time periods where there is complete data, i.e. the chart is full.

6. Students will then answer the questions and complete the activity (see below).
7. Congratulations! Your students have become Power Detectives! Expected duration of this activity is 30-45 minutes.

Suggested Activities: Below are some sample questions that you can use to build an activity for your students. The questions are divided by the type of chart used in the investigation.

Day chart

Choose a weekday and a weekend day and answer the following questions for each day:

1. What is the highest value shown on the chart? What is it: Generation, Consumption, Import, Export or Self Consumption
2. What is the lowest value shown on the chart that is not zero? What is it: Generation, Consumption, Import, Export or Self Consumption
3. Generation: What time of day did the solar panels generate the most electricity?
   Generation: What time of day did the solar panels generate the least electricity?
4. Consumption: What time of day did the school use the most amount of electricity?
   Consumption: What time of day did the school use the least amount of electricity?
5. Self Consumption: What time of day did the school use the most amount of solar electricity?
   Self Consumption: What time of day did the school use the least amount of solar electricity that is not zero?

Questions for reflection:

1. Looking at the chart, when do the solar panels generate no electricity? What part of the day is that? Using this information, what can you conclude that solar panels need in order to generate electricity?

2. What part of the day is it when the school is using the most amount of electricity? Are students in class? Eating lunch? Why is there so much electricity being used during that time?
3. What is the biggest difference between your findings about the weekday and about the weekend day?
4. What is similar between your findings about the weekday and about the weekend day?

Week chart

Choose a recent full week and select Bars.

1. Calculate the total Self Consumption for the whole week by adding up the daily amounts.
2. Calculate the total Import for the whole week by adding up the daily amounts.
3. Using your calculations from Question 1 and Question 2, calculate the total Consumption for the week using this formula:

   Total Consumption = Total Self Consumption + Total Import

   Check your answer by adding up the daily amounts of Consumption. You should get the same answer.
4. Calculate the percentage of the school's electricity that came from solar electricity during that week using this formula:

   *% from solar = (Total Self Consumption / Total Consumption) * 100*
5. Count the number of days during that week that there was solar electricity Export.

Questions for reflection:

1. What percentage of the school's electricity did you think comes from the solar panels? After you calculated the percentage, were you surprised by your finding? Why or why not?
2. Why was solar electricity exported on some days and why was it not on others? What do your observed about the data on the days when there was a solar electricity Export?
3. Do you observe any trends in electricity use or generation over this week? If so, describe them.

Month chart

Choose a recent full month and select Lines.

1. Identify the day of the month with the most Consumption and the day of the month with the least Consumption. Write down those values and calculate the difference between them.
2. Identify the day of the month with the most Generation and the day of the month with the least Generation that is greater than zero. Write down those values and calculate the difference between them.
3. List the top 5 days with the highest Generation. Looking at a calendar for that month, identify what days of the week (M-T-W-Th-F-Sa-Su) those dates were.
4. Identify the day with the most Self Consumption. Looking at a calendar for that month, identify what day of the week that was.

5. List the 5 days with the lowest Self Consumption that is greater than zero. Looking at a calendar for that month, identify what days of the week those dates were.
6. List the top 5 days with the highest Export. Looking at a calendar for that month, identify what days of the week those dates were.

Questions for reflection:

1. What is the trend for the days of the week when there is the most Self Consumption? What does solar electricity Self Consumption depend on?
2. What is the trend for the days of the week when there is the most Export? What does solar electricity Export depend on?
3. Do you observe any trends in electricity use or generation over this month? If so, describe them.

Year chart

Choose a full year and select Bar.

1. Identify the month with the most Consumption and the month with the least Consumption. Write down those values and calculate the difference between them.
2. Identify the month with the most Generation and the month with the least Generation that is greater than zero. Write down those values and calculate the difference between them.
3. Identify the top 3 months with the highest Generation.
4. Identify the top 3 months with the highest Consumption.
5. Identify the top 3 months with the highest Self Consumption.
6. Identify the 3 months with the lowest Self Consumption.

Questions for reflection:

1. What do you think caused the difference in the amount of Consumption between the month with the lowest and the month with the highest Consumption?
2. During which season(s) were the top 3 months with the highest electricity Consumption? Why is that?
3. During which season(s) were the top 3 months with the highest solar electricity Generation? Why is that?

Lifetime chart

1. Calculate the total Self Consumption for the lifetime by adding up the annual amounts.
2. Calculate the total Import for the lifetime by adding up the annual amounts.
3. Using your calculations from Question 1 and Question 2, calculate the total Consumption over the lifetime using this formula:

   Total Consumption = Total Self Consumption + Total Import

   Check your answer by adding up the annual amounts of Consumption. You should get the same answer.
4. Calculate the percentage of the school's electricity that came from solar electricity over the lifetime of the solar panels using this formula:

   *% from solar = (Total Self Consumption / Total Consumption) * 100*

Questions for reflection:

1. What percentage of the school's electricity did you think comes from the solar panels? After you calculated the percentage, were you surprised by your finding? Why or why not?
2. Are there any trends in electricity use or generation that you can identify over the Lifetime of the solar panels? If so, describe them.

How to lead your students through the programme:

Students should have access to a computer or tablet with stable internet.

To start off the programme, send a link to our Student page to your students, https://www.solarforschools.co.uk/gb/en/students (or you can send a direct link to the start page of the programme, listed above).

Define the student activity. Create a question list to guide their investigation (see suggestions above). Be sure to include Questions for Reflection in order to gauge your students' understanding of their findings.

NOTE: You should encourage your students to examine electricity charts from a school with multiple years of complete data. To ensure that students are looking at a school's electricity profiles with complete data, you can assign the students to review one of these following schools' charts:

- Schools in the UK: Mattishall Primary School, The Dassett CofE Primary School, Kingfisher Hall Primary School, Heron Hall Academy, Seven Hills Primary School, Whitworth Park School & Sixth Form College
- Schools in Germany: AWO Kindertagesstätte Wawuschel
- Schools in India: Padma Subramaniam Bala Bhavan Matriculation Higher Secondary School, Loyola College

Background information about solar panels and energy from our partners to share with your students to enhance this programme:

- Video Lab from Switch Energy Alliance: https://www.solarforschools.co.uk/gb/en/students#videos
- Knowledge Bank from Solar Schools Australia: https://www.solarschools.net/knowledge-bank