C2 ACTIVITY 4: ENERGY SANKEYS

Background

Sankey diagrams represent the flow of energy visually by identifying energy stores, energy transfers, and points where energy could be wasted. It is important that the energy we use is not wasted, and knowing the energy transfer helps us to determine the efficiency of a device. Students may be familiar with various graphic representations of data such as bar charts, pie charts and scatter graphs. However, these representations often depend on the interpretation of the reader as well as the quantity of data used.

In 1898 an Irish man called Captain Matthew Sankey used a flow chart to show the energy efficiency of a steam engine. This type of flow chart is now referred to as a Sankey diagram, and is used to investigate the energy efficiencies of systems as well as the cash flow of businesses. The diagrams are constructed from data and represent the energy transfers involved, quantifying these transfers and thus highlighting the efficiency of the system in question.

A **Sankey diagram** is shown in Figure 4. The width of the arrows represents the quantity of energies involved, and their directions indicate where the energy flows. In Figure 4, the arrow to the right represents **useful** output and the downward arrow represents output of **wasted** energy. It also shows the conservation of energy: an input of 5 J results in a total output of 3.9 J + 1.1 J.

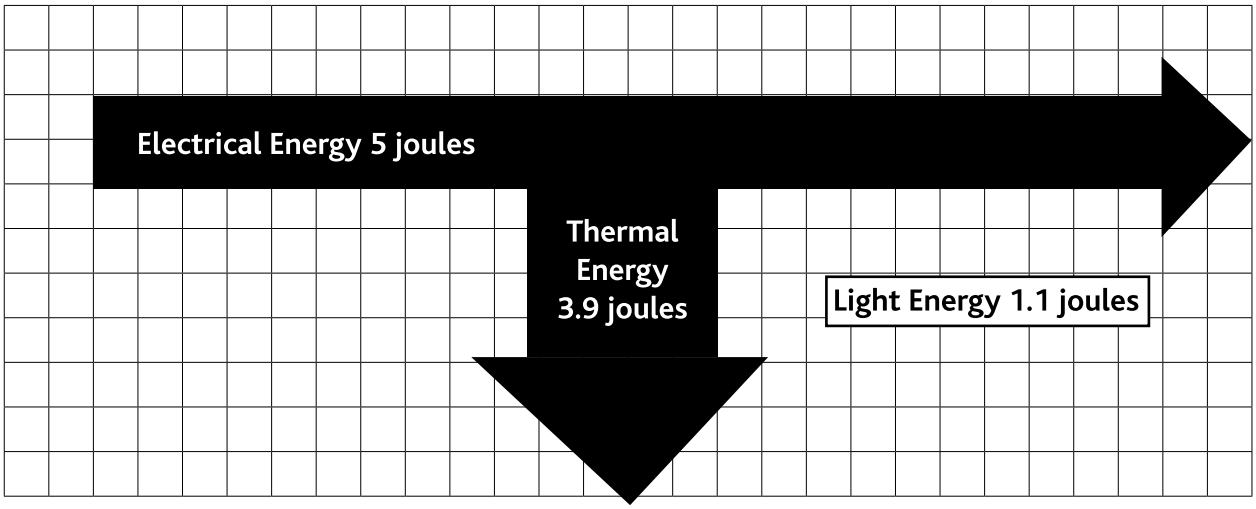

Figure 4

Suggested approaches:

- As an introduction to Sankey diagrams, ask students to describe the various types of graphs they use in other subjects such as maths, geography and business studies. Raise the following questions:
  - ? ***Why are these graphs used?***
  - ? ***What type of information do they give?***
  - ? ***What shapes do these graphs take?***
  - ? ***How do we interpret the resultant patterns?***
  - ? ***How useful are these graphs?***

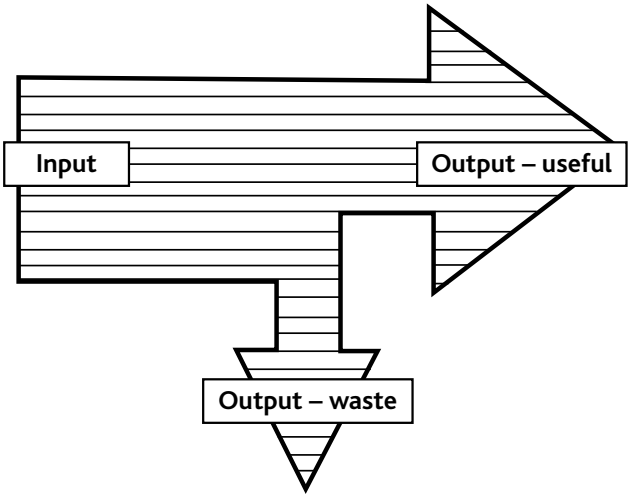

Figure 5

- Show Figure 5 to the class and ask for comments and questions. Ask a group of two or three students to compile a list of the questions that arise. This is a good opportunity to show the students how to construct a Sankey diagram using **C2 ACTIVITY 4 (I): CONSTRUCTING A SANKEY DIAGRAM** as a teaching aid. Afterwards, review the list of questions and ask the students if there are any they can now answer themselves.
- Ask the students to tell you what they understand by the terms efficiency and energy efficient. Put the following questions to them:

  ? ***In what circumstance might a microwave be more efficient than a cooker?***

  ? ***When would a microwave be more efficient than a kettle?***
- The efficiency of a device that transfers energy – its 'energy efficiency' – refers to the amount of the energy supplied (input) that is transferred into usable energy (output). The efficiency of an appliance is usually calculated as the percentage efficiency. Not all the input energy is transferred into usable energy. There will be some loss of energy through unwanted heat, sound, etc. Because of this energy loss an appliance will never be 100% efficient.

The energy efficiency of a device can be calculated using the following formula:

$$\text{\% Efficiency} = \frac{\text{Useful energy output x 100}}{\text{Total energy input}}$$

What Next:

- After establishing these basics, you may wish to move to the analysis and use it to prompt a discussion about energy efficient light bulbs. The following questions could be investigated, thus enabling students to hone their research and practise their presentation skills.

  ? ***Why has the EU eliminated the use of incandescent (filament) light bulbs?***

  ? ***What are the consequences of this law, intended or otherwise?***

  ? ***What about catalytic converters – are they efficient or do they simply reduce the emission of noxious gases?***

Resources:

- See SEAI website for tips on energy efficiency.
- See energy.gov for information on the history of the light bulb.