Energy In Action

An introduction to energy efficiency across the energy strands of the Junior Cycle Science Specification.

Learning Outcomes

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- PW 7 – ***<u>Design,</u>*** **build and test a device that transforms energy from one form to another** in order to perform a function; ***<u>describe</u>*** the energy changes and **ways of improving efficiency**
- PW6 –Explain energy conservation and **<u>analyse</u> processes in terms of energy changes and dissipation**
- NoS 10 – **<u>Appreciate</u> the role of science in society**; and its personal, social and global importance; and how society influences scientific research.

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STE(A)M box

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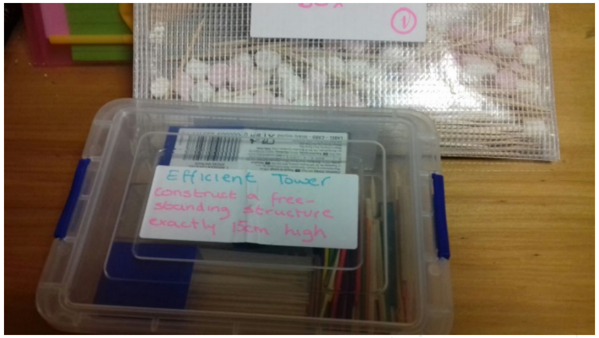
Efficiency Tower – Time: 8-10 minutes (approximately)

- What is in the STE(A)M box?
  - Unlimited mini marshmallows and toothpicks.
  - Scissors allowed but no cellotape



- What to do
  - Ask students to work in teams to design and build a free standing tower(s), exactly 15cm high. They can use as much or as little of the materials. They should spend 2 to 3 minutes designing their tower and then 5 to 6 minutes making the tower or towers

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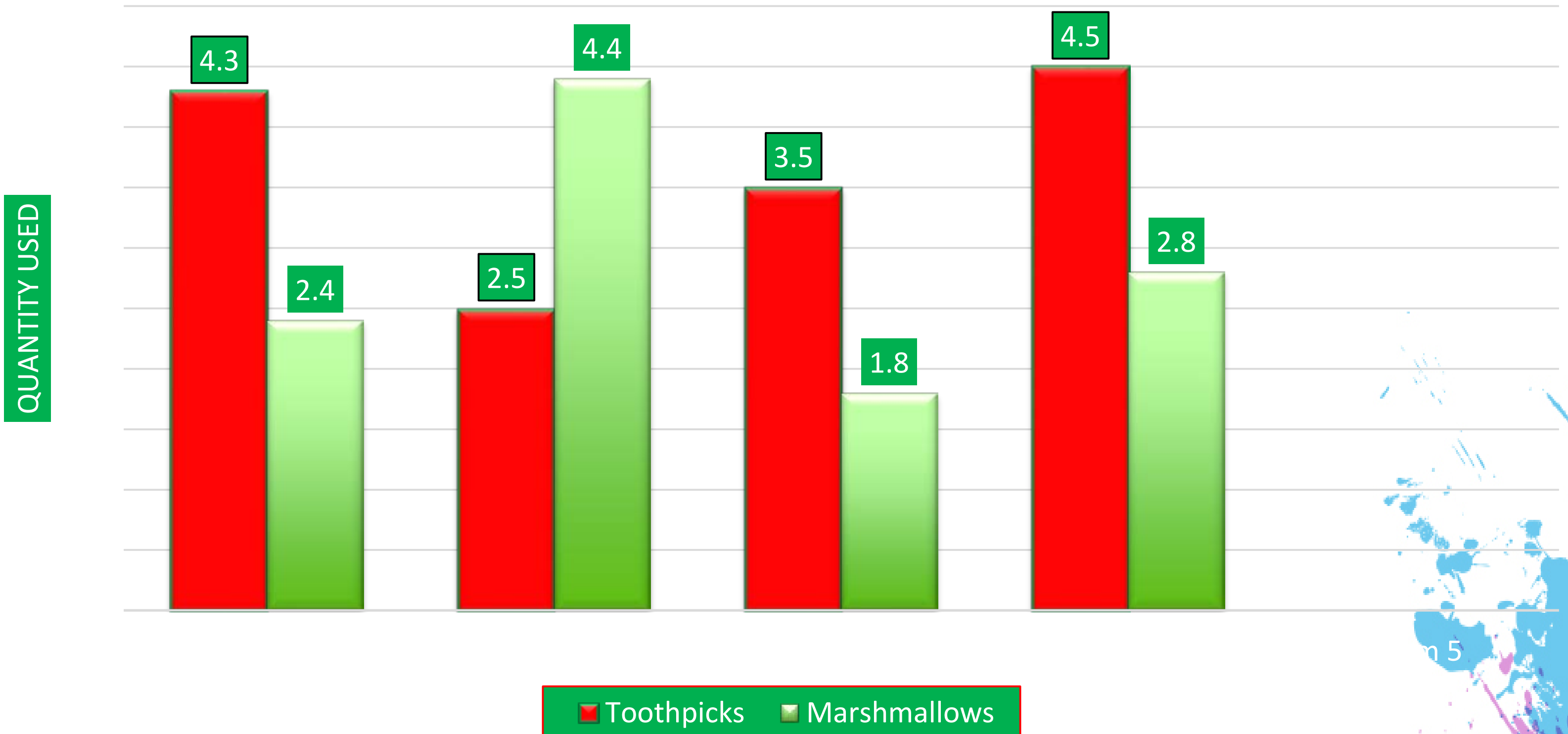
Number of marshmallows & toothpicks used



Icebreaker

Last activity was an introduction into the term efficiency.

Our focus now and for the remainder of the workshop is on energy efficiency (emphasise ENERGY).

Show the picture on the next slide:

What messages is the picture sending? Allow the students to consider the image and after a few minutes encourage discussion.

Prompt discussion with question

Definitions

- With **energy efficiency**, you don't have to sacrifice comfort to save energy
- **Energy conservation** involves a change in behaviour to save energy.
- Examples?

STE(A)M Box 2

Mobile Challenge

- What is in the STE(A)M box? Contents vary on how you develop the challenge towards fair test and calculations but initially,
  - 4 x polo mints, 5 x paper clips, 2 x straws, 1 x sheet of paper,
  - 1 x pipe cleaner (optional), 1 x balloon (optional)
  - 1 x 48cm ribbon/thread tied (optional)
- What to do
  - Construct a mobile vehicle that can travel horizontally on a flat track – it must be self propelled.
  - **Before you make,** draw two variations of your design and discuss in your group.
  - You can use scissors and sellotape if needed. Not all contents need to be used!

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Discussion

- What propelled your vehicle?
- What were the energy conversions taking place?
- Were all the energy conversions useful?

Think about…Discuss…Write down..

- If we were to replace the balloon with a hairdryer as a propeller what energy conversions are now taking place throughout the system?
- Are all energy conversions here working as useful energy within the system? Where is energy being changed into another form that is not useful?

For you to do…

- Test your vehicle – how long does it take to travel 2m? *How could you make this a more precise measurement*?
- The Kinetic energy of your vehicle is calculated as follows:

$$\frac{1}{2} \times \text{mass} \times \text{velocity}^2$$

- This is the **useful energy output.**
- You **may not** change the mass of your vehicle.
- Can you change its' design to make it more efficient? i.e. increase its useful energy output. How would you test this?

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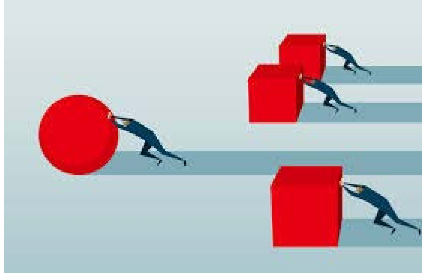
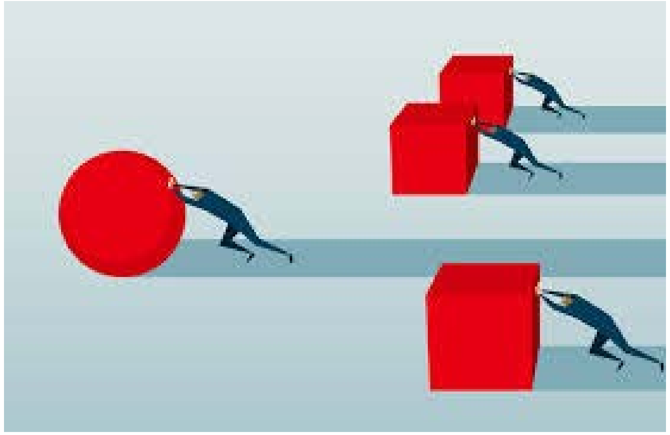
Energy Conversion and Dissipation

- Did all vehicles get the same input of energy from the hair dryer?
- Did they all travel the same distance?
- Was all the energy converted into useful Kinetic Energy?



Dissipation of Energy

In most systems some energy is dissipated, that is it is converted into forms which are not useful and which cannot be recovered.



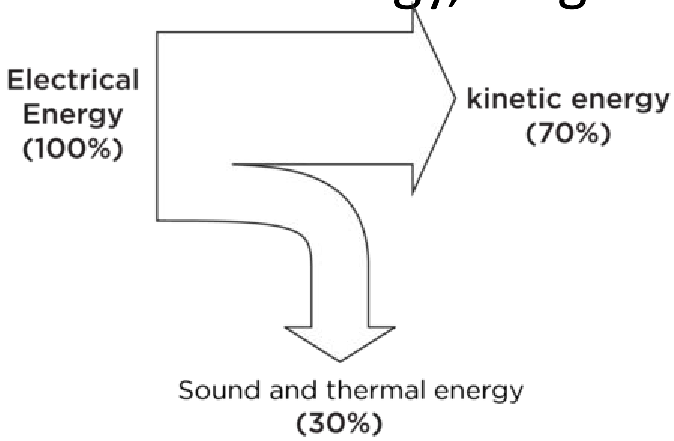
Discuss and decide

- If we were to race all the vehicles over 2 metres could we say that the winning vehicle was the most efficient?

Representing energy changes and dissipation

Sankey Diagrams:

- These give a visual of input and output energy
- Width represents total energy, length doesn't matter



Activities on Sankey Diagrams

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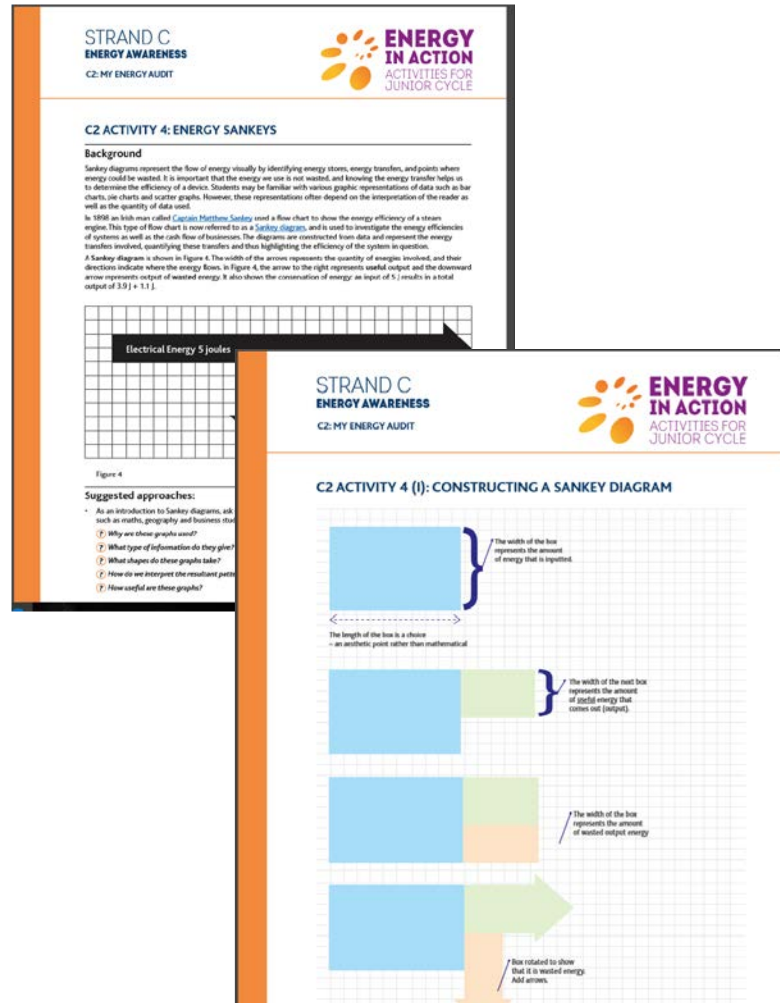
- Activities for Junior Cycle students
- Download from www.seai.ie/energyinaction


STRAND C
ENERGY AWARENESS
C2: MY ENERGY AUDIT
ENERGY IN ACTION
ACTIVITIES FOR JUNIOR CYCLE
C2 ACTIVITY 4: ENERGY SANKEYS
Background
Electrical Energy 5 joules
Figure 4
Suggested approaches:

STRAND C
ENERGY AWARENESS
C2: MY ENERGY AUDIT
ENERGY IN ACTION
ACTIVITIES FOR JUNIOR CYCLE
C2 ACTIVITY 4 (I): CONSTRUCTING A SANKEY DIAGRAM

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Let's have a go

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STRAND C
ENERGY AWARENESS

C2: MY ENERGY AUDIT

ENERGY IN ACTION
ACTIVITIES FOR JUNIOR CYCLE

C2.4 WORKSHEET H: READING A SANKEY DIAGRAM

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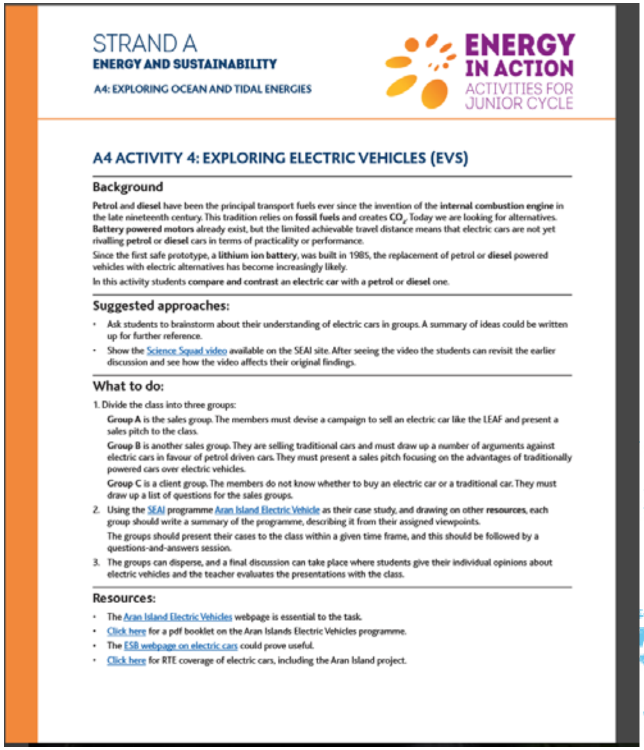
Activity on Electric Vehicles

- Activities for Junior Cycle students
- Download from www.seai.ie/energyinaction


STRAND A
ENERGY AND SUSTAINABILITY
A4: EXPLORING OCEAN AND TIDAL ENERGIES

ENERGY IN ACTION
ACTIVITIES FOR JUNIOR CYCLE

A4 ACTIVITY 4: EXPLORING ELECTRIC VEHICLES (EVS)

Background

Petrol and **diesel** have been the principal transport fuels ever since the invention of the **internal combustion engine** in the late nineteenth century. This tradition relies on **fossil fuels** and creates CO_2. Today we are looking for alternatives. **Battery powered motors** already exist, but the limited achievable travel distance means that electric cars are not yet rivalling **petrol** or **diesel** cars in terms of practicality or performance.

Since the first safe prototype, a **lithium ion battery**, was built in 1985, the replacement of petrol or **diesel** powered vehicles with electric alternatives has become increasingly likely.

In this activity students **compare and contrast** an **electric car** with a **petrol** or **diesel** one.

Suggested approaches:

- Ask students to brainstorm about their understanding of electric cars in groups. A summary of ideas could be written up for further reference.
- Show the Science Squad video available on the SEAI site. After seeing the video the students can revisit the earlier discussion and see how the video affects their original findings.

What to do:

1. Divide the class into three groups:

   Group A is the sales group. The members must devise a campaign to sell an electric car like the LEAF and present a sales pitch to the class.

   Group B is another sales group. They are selling traditional cars and must draw up a number of arguments against electric cars in favour of petrol driven cars. They must present a sales pitch focusing on the advantages of traditionally powered cars over electric vehicles.

   Group C is a client group. The members do not know whether to buy an electric car or a traditional car. They must draw up a list of questions for the sales groups.

2. Using the SEAI programme Aran Island Electric Vehicle as their case study, and drawing on other **resources**, each group should write a summary of the programme, describing it from their assigned viewpoints.

   The groups should present their cases to the class within a given time frame, and this should be followed by a questions-and-answers session.

3. The groups can disperse, and a final discussion can take place where students give their individual opinions about electric vehicles and the teacher evaluates the presentations with the class.

Resources:

- The Aran Island Electric Vehicles webpage is essential to the task.
- Click here for a pdf booklet on the Aran Islands Electric Vehicles programme.
- The ESB webpage on electric cars could prove useful.
- Click here for RTE coverage of electric cars, including the Aran Island project.

What is our role as Educators in reducing global demand for energy?

- Discuss 5 things in your school or at home that use energy – heat, electrical etc. State the energy conversions involved.
- How can you calculate the % efficiency of 2 devices?
- Record ways of increasing the efficiency of the 2 devices.

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seai one good idea

Abstract for Winners 2017: Raising awareness of energy ratings for household appliances, among adults in their community.

www.seai.ie/onegoodidea

Clean, renewable energy

Saving water saves energy

Reduce your food miles

Saving energy at home / school

Greener fashion

Greener travel

Climate action

Stay in touch

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- Visit our website www.seai.ie

Tower Challenge

- Idea 1
- Idea 2

UNLIMITED MATERIALS: MARSHMALLOWS AND TOOTHPICKS

Mobile Vehicle Challenge

- Idea 1
- Idea 2

STRAWS X2, POLO MINTS X4, PIPE CLEANER, BALLOON, UNLIMITED PAPER

RACE RESULTS

	Time (s)	Distance (m)
Trial 1		
Trial 2		
Trial 3		
Average		

Calculations

$$\text{Efficiency} = \frac{\text{Useful Energy Output}}{\text{Energy Input}} \times 100\%$$

$$\text{Efficiency} = \frac{\text{Useful Power Output}}{\text{Power Input}} \times 100\%$$