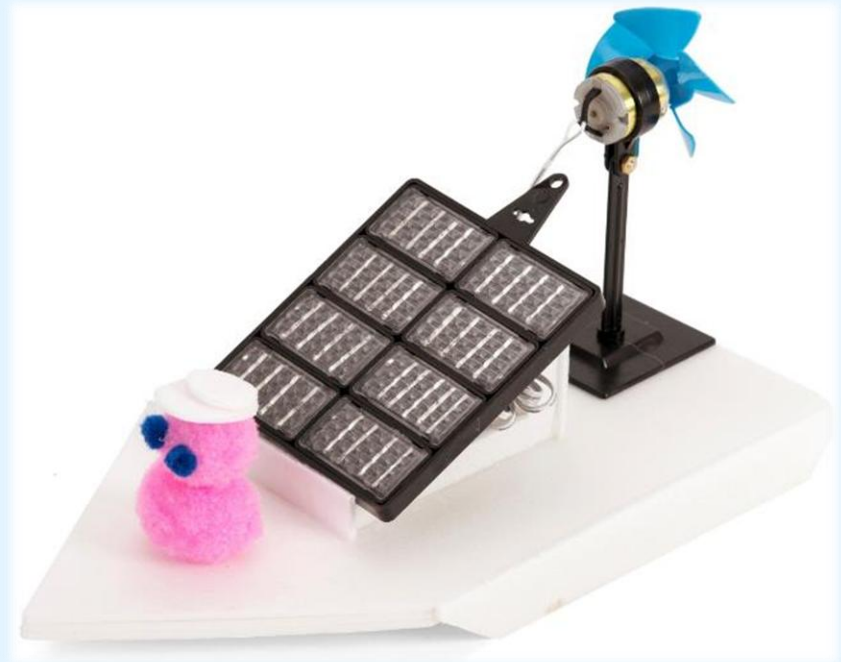


Renewable Energy – Module 3

What energy do we use for transport?

Could more of this be renewable energy?

Make a solar powered electric boat



Electric Boat

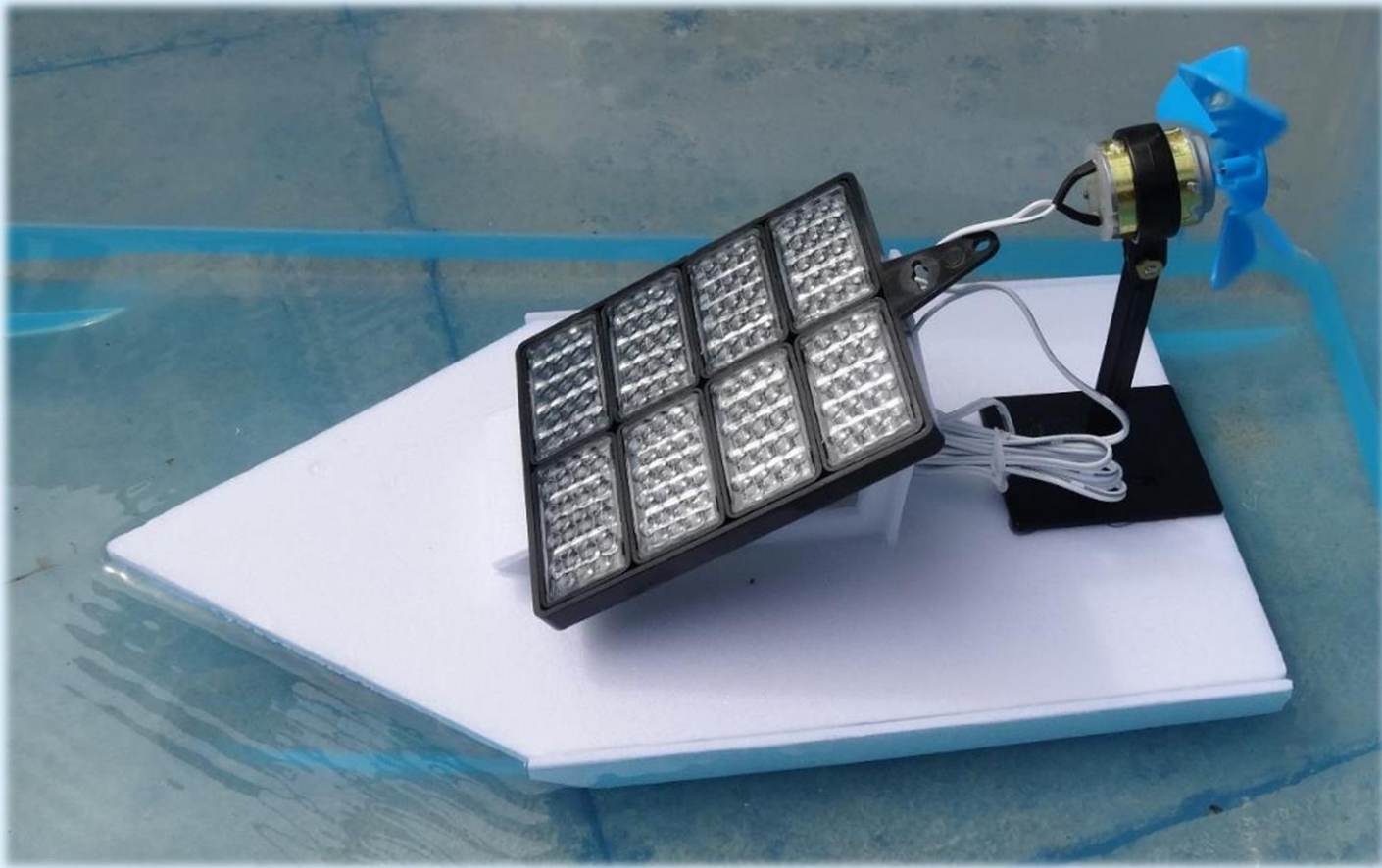


Energy used in transport

- About a quarter of our total energy is used in transport.
- About 90% of this comes from burning fossil fuels, causing climate change.
- Increasingly, people are using electric vehicles which include a large battery to store electricity.
- The electricity could be produced from renewable sources.



Make a solar powered electric boat



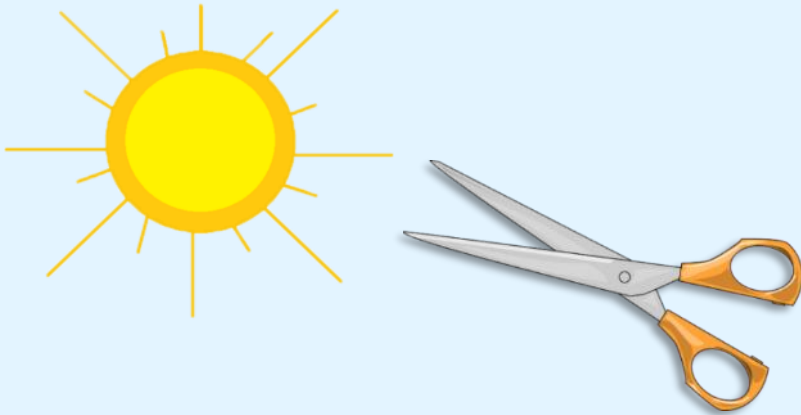
STEM Learning Objectives

- **Science:** *Materials* (give reasons for particular uses of everyday materials) and *Forces* (explore resistance in water by making and testing boats).
- **Technology** – design, make and evaluate a product.
- **Engineering** – understand propulsion, drag and streamlining.
- **Maths** – measure distance and time, calculate average speed.



Work Safely

Look at the tools and equipment. Can you spot any potential hazards?

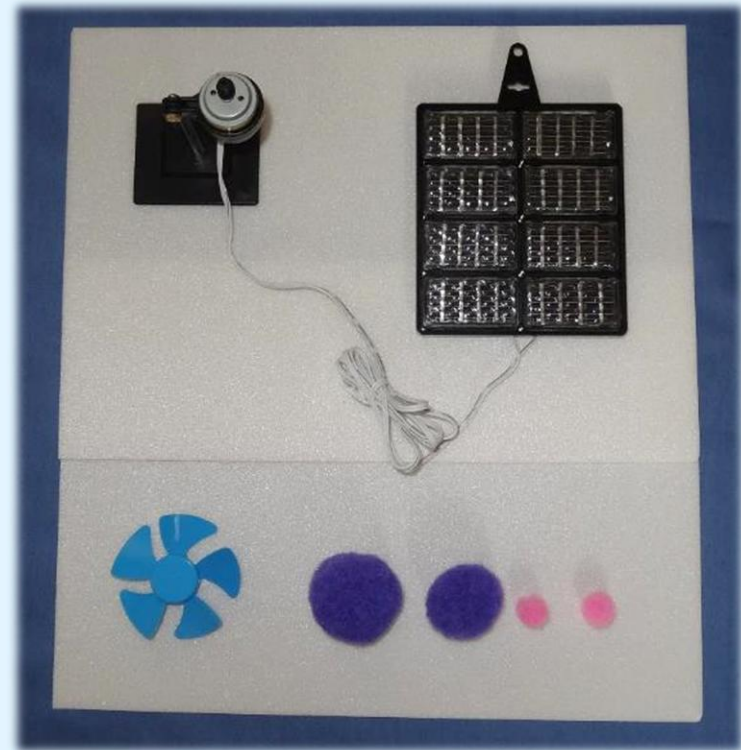


Can you think of ways to reduce the risks?

Collect your materials

You will need:

- A solar energy kit (fairground ride completed in module 2)
- 2 sheets of polystyrene foam
- A propeller
- Pompoms to make passengers and/or decorations



Assemble your tools

You will need:

- A ruler
- A felt tip pen
- A cylindrical pencil
- A pair of scissors
- A cool melt glue gun



Set design criteria

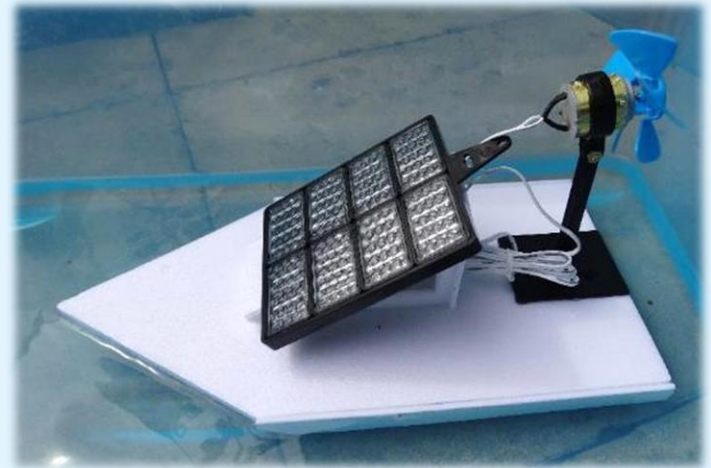
Discuss what your boat should do

- It ought to float!
- Should it go in a straight line?
- Carry passengers?
- Any more ideas?
- Write a list of design criteria in your workbook.



How will the boat work?

- What properties of the polystyrene foam sheet make it suitable for making a model boat?
- What force pulls the boat down onto the water?
- What force pushes the boat up?
- What happens if the force pulling it down is bigger than the force pushing it up?
- What will make the boat go along?
- What force slows the boat down?



Prepare the fan

1. Carefully peel the motor stand off the base.
2. Keep the base for use in module 4.
3. Pull the motor pulley off the motor shaft and store it safely.
4. Replace it with the propeller.
5. Use the plastic spanner from the solar energy kit to loosen the nut slightly on the motor stand.
6. Turn the motor so the shaft is horizontal and re-tighten the nut.



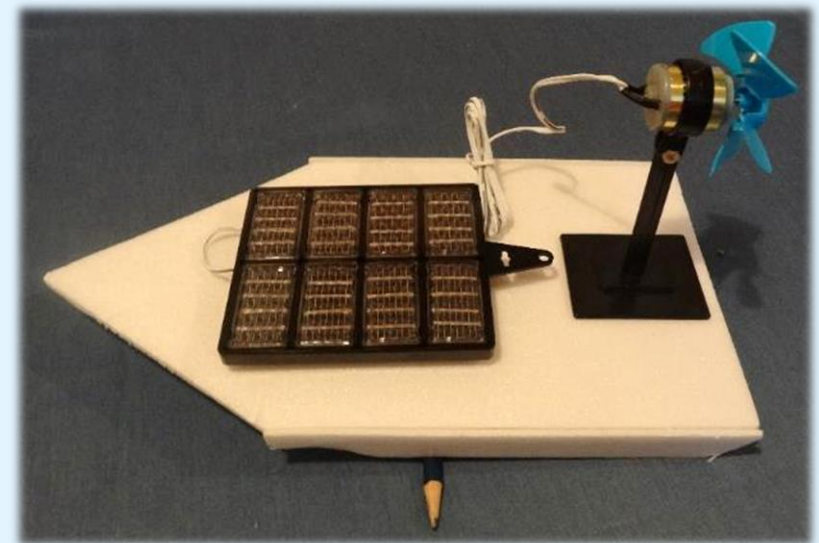
Design your boat

- Think about where the parts will go.
- How will you make sure the boat is balanced?
- The solar panel is very heavy – how will you stop the boat sinking?
- What is streamlining?
- How could you get the boat to go in a straight line?
- Where will your passengers go?
- Sketch a design for your boat.



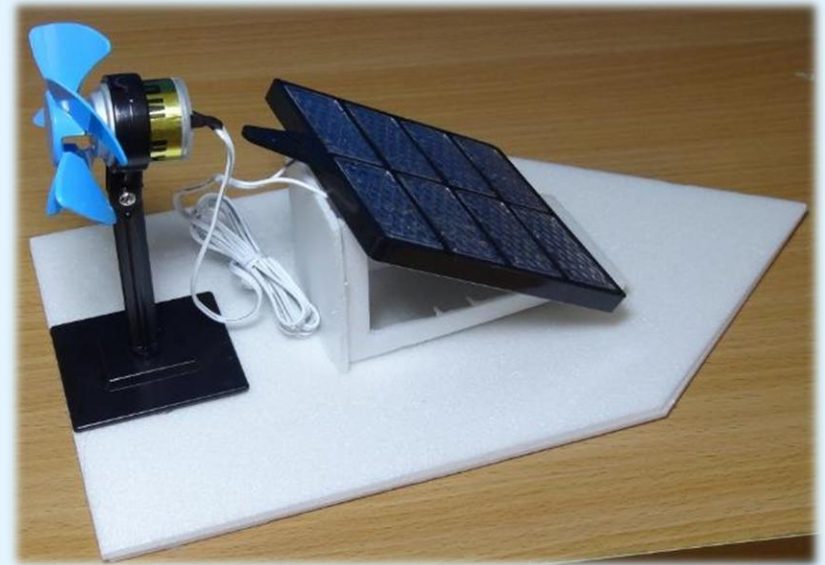
Construct your boat

1. Use the ruler and felt tip pen to mark out the parts for your boat base.
2. Check with an adult that your design looks feasible before you cut out the parts.
3. Glue the parts together.
4. Place the boat base on the cylindrical pencil. Adjust the position of the solar panel and fan to get the boat roughly balanced.



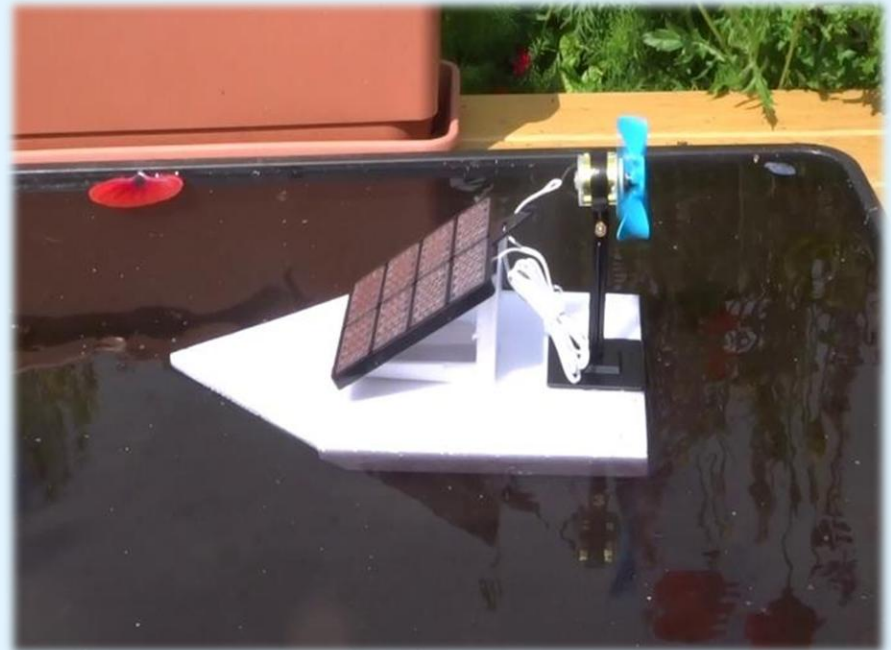
Mount the solar panel and fan

- Work out how to mount your solar panel.
- It will work best if it is at right angles to the sun.
- You can use the angle you measured in module 1 or you can assume a default angle of 30° .
- Glue the fan stand and solar panel on so they don't fall in the water.
- Don't put too much glue on the solar panel as you can damage it, and you will need to peel it off the boat to use in module 4.



Try out the boat

- Place the boat in the water tray or paddling pool.
- Hold on to it until you are sure it floats!
- Try out the boat with the solar panel facing the sun
- Does it meet your design criteria?
- Do you need to make any improvements?



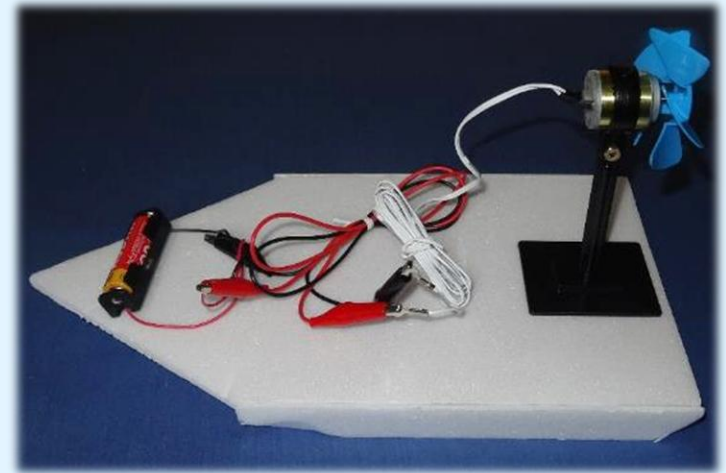
Compare the boats' performance

1. Time how long it takes for each boat to travel the length of the paddling pool.
2. Compare the times.
3. Measure the distance travelled.
4. Divide the distance travelled by the time taken to work out the average speed.
5. Which boat goes fastest?



Extension activity (optional)

- Remove the solar panel from the boat and disconnect the two motor contacts (put the nuts and washers back on so you don't lose them).
- Use two crocodile leads to connect the battery to the motor contacts.
- Check the fan is blowing air away from the motor – otherwise swap over the crocodile leads.
- Try out the boat – compare the performance with that obtained using the solar panel.



What did you learn?

- How much of our energy is used in transport?
- How is most of this energy produced?
- What is the problem with this?
- What forces act on a fan boat, and in which direction?
- Why is polystyrene foam sheet useful for making a model boat?
- Did you make any improvements to your boats?
- Which features of the fastest boats do you think helped them go faster?
- Which part of the activity did you enjoy the most?

