



Primary 7 Integrated Science

Term 1

Theme: The Environment

Topic 3/3 – Electricity and Magnetism

Learning Outcomes: The learner:

- develops awareness of different energy resources existing in the environment and their use.
- develops a sense of respect for the environment as a resource base.

Energy resources

An **energy resource** is anything in the environment that can be used to provide energy for work, light, heat, or movement.

Examples of Energy Resources and Their Sources:

1. The Sun (Solar Energy)

The sun is the **major source of energy** in the environment.

Solar energy is used for **drying crops, heating water, cooking, and generating electricity** with solar panels.

Advantages of Solar Energy

- (i) **Renewable and abundant:** The sun provides unlimited energy, especially in sunny regions like Uganda.
- (ii) **Environmentally friendly:** Produces no greenhouse gases or smoke during use.
- (iii) **Reduces electricity bills:** Once installed, solar panels generate free electricity.
- (iv) **Low maintenance:** Solar systems require little upkeep after installation.
- (v) **Versatile use:** Can power homes, schools, hospitals, and even remote villages without grid electricity.
- (vi) **Energy independence:** Reduces reliance on fossil fuels and unstable power supply.

Disadvantages of Solar Energy

- (i) **High initial cost:** Buying and installing solar panels and batteries is expensive.
- (ii) **Weather dependent:** Solar energy production drops on cloudy days and stops at night.
- (iii) **Energy storage needed:** Batteries are required to store power for use at night, and these can be costly.
- (iv) **Space requirement:** Solar panels need large roof or ground areas to produce enough electricity.
- (v) **Efficiency limits:** Conversion of sunlight to electricity is not 100%, so more panels may be needed.

Comparison Table

Aspect	Advantages	Disadvantages
Source	Renewable, abundant sunlight	Weather dependent, no power at night
Environment	Clean, no pollution	Panel production has some environmental impact
Cost	Saves money long-term	High upfront installation cost
Maintenance	Low maintenance	Batteries may need replacement
Accessibility	Useful in remote areas	Requires space for installation

How to Make a Solar Cooker (project)

Materials:

- A cardboard box
- Aluminium foil or a mirror
- Transparent plastic sheet or glass
- Black paper

Steps:



Aluminium foil/mirror reflect light into the box

- Line the inside of the box with **black paper** (to absorb heat).
- Cover the inner sides with **aluminium foil** (to reflect sunlight into the box).
- Place a **transparent plastic sheet or glass** on top to trap heat inside.
- Put food in a small pot inside the box.
- Place the box in direct sunlight ensuring that the foil/mirror reflect light into the box.

Result: The sunlight is reflected and trapped inside, heating the pot and cooking the food.

Exercise 1

- Name any one source of light energy.
- State any uses of light energy.
- Name one use of black line in solar heater

2. Energy from Water

- Hydro power:** electricity produced by moving water in dams.

- (ii) **Steam engines:** use heated water (steam) to drive machines.
- (iii) **Tidal energy:** energy from rising and falling sea tides.

Steam Energy Experiment

Materials: Small tin can with lid, water, candle or charcoal stove.

Steps:

- (i) Put a little water in the tin can.
- (ii) Heat it using a candle or stove until steam forms.
- (iii) Allow the steam to push the lid slightly or escape through a small hole.
- (iv) Observe the force of the steam.

Learning Point: Steam has energy that can push objects and was used in steam engines to drive machines.

3. Energy from Fossil Fuels

- (i) **Coal and petroleum** are burned to produce heat and electricity.
- (ii) Petroleum also powers vehicles and machines.

4. Energy from Plants

- (i) **Biofuel:** fuel made from crops like sugarcane.
- (ii) **Wood fuel:** firewood and charcoal for cooking.
- (iii) **Food:** gives humans energy to work.
- (iv) **Biogas:** made from plant residues.

5. Energy from Animals

- (i) **Animal energy:** animals like oxen and donkeys pull carts and plough fields.
- (ii) **Biogas:** made from animal wastes.

Steps to Make a Biogas Digester (project)

- (i) **Dig a pit or use a large drum** – this will act as the digester (the container where waste is stored).

- (ii) **Put animal waste and plant residues** (like cow dung, food remains, or crop residues) into the digester.
- (iii) **Add water** and mix well to make a slurry.
- (iv) **Cover the digester tightly** so that no air enters, but leave a pipe or opening for gas to escape.
- (v) **Fix a gas outlet pipe** from the digester to a storage bag or directly to a cooking stove.
- (vi) After some days, **microorganisms break down the waste** and produce biogas.
- (vii) The **biogas can be used for cooking or lighting**.

Note that the bio-digester must be tightly sealed:

- (i) **To keep out air (oxygen):** Biogas is produced by bacteria that work in the absence of oxygen. If air enters, the process will stop.
- (ii) **To prevent gas leakage:** Biogas is a fuel, so sealing ensures the gas is collected safely and not wasted.
- (iii) **For safety:** Escaping gas can be dangerous if it mixes with air, as it may cause fire or explosions.

To maintain pressure: A sealed digester allows gas to build up enough pressure to flow through pipes to where it is needed

Advantages of Biogas

- (i) **Cheap fuel** – made from animal and plant waste.
- (ii) **Renewable** – waste is always available.
- (iii) **Clean energy** – produces less smoke compared to firewood or charcoal.
- (iv) **Reduces pollution** – uses waste that would otherwise rot and smell.
- (v) **Provides fertilizer** – the leftover slurry can be used on farms.

Disadvantages of Biogas

- (i) **Needs a lot of waste** – large amounts of dung or plant residues are required.
- (ii) **Works slowly** – takes time for gas to be produced.
- (iii) **Requires special containers (digesters)** – which may be expensive to build.
- (iv) **Not easy to transport** – biogas is usually used near where it is produced.
- (v) **Depends on temperature** – works better in warm conditions than in cold ones.

Exercise 2

- (a) Name any two materials used to make biogas.
- (b) Explain why biogas is good for environment.

6. Energy from Wind

Uses of wind energy

- (i) **Sailing boats and ships** – wind pushes sails to move boats across water.
- (ii) **Drying clothes and grains** – natural wind helps reduce the need for fuel or electricity.
- (iii) **Pumping water** – traditional wind pumps use wind energy to draw water from wells.
- (iv) **Ventilation** – wind can cool houses and reduce the need for fuel-based cooling.
- (v) **Generating electricity with wind turbines** – modern use of wind to produce clean power.

Wind Energy Experiment

Materials: Paper, string, small sticks, or a toy windmill. **Steps:**

- (i) Make a simple paper windmill or pinwheel



- (ii) Place it outside or blow air on it.

(iii) Observe how the wind makes the blades turn.

Learning Point: Wind has energy that can be used to turn turbines and produce electricity.

Importance of Energy Resources

- Provide **light and heat**.
- Power **machines and transport**.
- Support **industries and farming**.
- Improve **healthcare and education**.
- Make work **easier and faster**.

Exercise 3

State any **three** uses of wind as energy resource.

Energy

Energy is the ability to do work.

It is measured in joules

Work is a product of force and distance

Work = force x distance

A **force** is a push or a pull

Exercise 4

Give the meaning of the following terms.

- (i) Energy
- (ii) Work
- (iii) force

Types of energy

Potential energy /stored energy

This is a form energy at rest or energy reserve. Stored energy cannot do any work unless released.

Stored energy is found in food, fuel, dry cells and car batteries as chemical energy.

Kinetic energy

This is energy possessed by moving objects, such as wind, kicked ball

Different forms of energy

They include

- (i) Light enables us to see and to make solar electricity
- (ii) Sound enables us to hear
- (iii) Electrical energy enable radio and television to work
- (iv) Heat energy make things hot
- (v) chemical
- (vi) magnet

Chemical energy

This is the energy contained in chemicals such as firewood food, fuel, dry cells and car batteries.

Example of fuels include firewood, charcoal, paraffin, candle wax, petroleum gas.

Sources of energy

The sources of energy are divided into two

- (i) Renewable sources of energy do not get exhausted easily for example solar, biogas, wind, ware fall, trees
- (ii) Non – renewable resources include coal, petroleum, and minerals

NB. Biogas is produced by mixing plant remains, dung and /or dead animals with water in absence of air.

Transformation of energy

Energy cannot be created or destroyed. It can only be converted or transformed from one type into another type of energy. Examples of devices or material that transform energy from one type to another type are shown in the table below:

Device	Energy transformation
Electric circuit	Chemical energy → electric energy → heat energy → light energy (in the wires) (bulb) (bulb)
Food	Chemical energy → heat (the food) (in the body)
Burning fuel	Chemical energy → heat energy → light energy → light energy (charcoal) (the burning charcoal) (flames)
Radio	Chemical energy → Electric energy → magnetic energy → sound energy (dry cells) (wires) (radio speakers)

Exercise 5

- (a) State any two energy transformation that can occur starting with
 - (i) Running water
 - (ii) Burning fuel

Revision exercise

2. In which one way wind is used as a resource
It turns turbines to generate electricity
3. (a) State two uses of sun as an energy resource
 - (i) Dries clothes
 - (ii) Generated electricity using solar panel
 - (iii) Boils water
 - (iv) Cooks food

(b) State any one reason why fire extinguisher are commonly painted red.

 - (i) **Visibility:** Red is a bright, eye-catching color that can be easily seen in emergencies.
 - (ii) **Warning signal:** Red is universally associated with danger and urgency, reminding people of fire hazards.
 - (iii) **Standardization:** Using one common color helps people quickly identify fire extinguishers anywhere.
4. (a) Mention any two materials that can be used in a digester to produce biogas.
 - (i) Cow dung
 - (ii) Human feces
 - (iii) Plant remainings
 - (iv) Left over food

(b) Give a reason why a biogas digester should be tightly sealed.

 - (iv) **To keep out air (oxygen):** Biogas is produced by bacteria that work in the absence of oxygen. If air enters, the process will stop.
 - (v) **To prevent gas leakage:** Biogas is a fuel, so sealing ensures the gas is collected safely and not wasted.
 - (vi) **For safety:** Escaping gas can be dangerous if it mixes with air, as it may cause fire or explosions.
 - (vii) **To maintain pressure:** A sealed digester allows gas to build up enough pressure to flow through pipes to where it is needed.

(c) State one advantage of using biogas

 - (i) **Cheap fuel** – made from animal and plant waste.

- (ii) **Renewable** – waste is always available.
- (iii) **Clean energy** – produces less smoke compared to firewood or charcoal.
- (iv) **Reduces pollution** – uses waste that would otherwise rot and smell.
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5. (a) What form of energy is store in wood fuel?

Chemical energy

(b) Name any one form of energy produced when wood burns

Heat

Light

(c) State two practices carried out at home to conserve wood fuel.

- (i) **Use improved cooking stoves** that require less firewood and retain heat longer.
- (ii) **Cook with covered pots** so food cooks faster and uses less fuel.
- (iii) **Use dry wood** instead of wet wood, because dry wood burns more efficiently.
- (iv) **Cut food into smaller pieces** to reduce cooking time.
- (v) **Cook several foods at once** or in succession while the stove is still hot.

6. Name one source of solar energy

Sun

7. State one characteristics of nonrenewable energy.

Cannot be replaced once used

8. (a) Name the component of air used for;

- (i) Respiration - oxygen
- (ii) Putting out fire- carbon dioxide

(b) Mention two dangers of wind

It can fell trees and these may hurt people

Strong wind fell housed

Strong with damage crops

9. What is the importance of the black lining inside a solar drier?

Absorbs heat

10. How does covering of food during cooking help to conserve wood fuel?
- (i) **Heat is trapped inside the pot**, so food cooks faster.
 - (ii) **Less steam escapes**, meaning less energy is wasted.
 - (iii) **Cooking time is reduced**, so less firewood is needed.
 - (iv) **Fuel efficiency increases**, making the wood burn more effectively.
11. How is water as a renewable resource replaced in environment?
Through precipitation
Through spring
12. Why is biogas regarded as an environmentally friendly source of energy?
(i) Uses waste into clean fuel,
(ii) reduces pollution,
(iii) helps conserve forests and natural resources.
13. Why is water grouped under renewable resource?
It can be replaced when used
14. The diagram below shows how electricity is produced. Use it to answer the question that follow



What source of energy is used to produce the electricity?

Wind

15. Give one way in which the use of solar energy is good to our environment.

- (i) **Reduces deforestation** – people use less firewood and charcoal, helping to conserve trees.
- (ii) **No smoke or harmful gases** – unlike burning fossil fuels, solar energy does not pollute the air.
- (iii) **Clean and renewable** – sunlight is unlimited and does not harm the environment when used.
- (iv) **Reduces waste and dependence on fossil fuels** – lowers the need for coal, petroleum, and other polluting fuels.
- (v) **Supports sustainable living** – solar energy can power homes, schools, and hospitals without damaging nature.

16. A part from running wind mills, give one other way wind is used as an energy resource.

- (i) **Sailing boats and ships** – wind pushes sails to move boats across water.
- (ii) **Drying clothes and grains** – natural wind helps reduce the need for fuel or electricity.
- (iii) **Pumping water** – traditional wind pumps use wind energy to draw water from wells.
- (iv) **Ventilation** – wind can cool houses and reduce the need for fuel-based cooling.

Thank You

Dr. Bbosa Science