ENERGY IS LIFE

LET US EXPLORE ENERGY

Pupils work book

ENERGY IS LIFE

A Resource Book on Sustainable Energy Use

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INTRODUCTION

Today's realisation of the key importance of energy and water to our lives comes at a time when biomass that provides the largest energy source to about two thirds of the world's population, and the world's watersheds, have been recklessly cleared without replacement. This has led to fuelwood shortages in many parts of the world, drying up of water sources, totalloss of vegetation cover with same areas tuming into deserts, and an increase in global temperatures due to the lack of tree cover.

In Uganda alone, 93% of the country's energy needs are met through biomass products. If biomass users continue to harvest biomass products at the rate at wh ich they are doing today, without putting in place measures to increase fuelwood production while decreasing the rate at which they use it, Uganda could easily find itself in a serious fuelwood crisis.

The MoEMD, therefore, through its Energy Advisory Project, is launehing this Pu pils' Workbook, which is linked to the current energy topics in the Primary School Curriculum, to popularise the study of energy as a discipline in Ugandan schools. The overall goal of this Pupils' Workbook is to build interest in school communities and other stakeholders, which will evolve into a new culture of producing biomass products on their own land. The book is also intended to popularise and promote technologies that can reduce the rate at which biomass products are being used.

This Pu pils' Workbook has been designed to give students adequate knowledge and hands-on practical skills on improved energy use and conservation. This Pu pils' Workbook does so by addressing energy conservation related problems, and identifying practical solutions to the energy crisis in Uganda today.

The Pupils' Workbook is divided into six chapters:

Chapter One: Understanding Energy
Chapter Two: Types and Forms of Energy
Chapter Three: Sources of Energy
Chapter Four: The Production and Efficient Use of Energy
Chapter Five: Energy Conservation Technologies
Chapter Six: Energy and the Environment

We hope the users will find this Pupils' Workbook very enriching.

CHAPTER 1

UNDERSTANDING ENERGY

Activity 1: Energy News Time

• Write brief notes explaining what energy is, what we can use energy for, and energy problems in your community.

• Prepare news about energy, entitled ‘Energy News’. One may read out this news to the class, starting like this: “This is Radio Energy, 94.1 FM. Energy news read to you by Kamara Richard ...”.

After everyone has presented their Energy News, compile a list of “facts about energy” and a list of “energy problems in different communities”. You can place these lists on the class notice board under the topic: “ENERGY NEWS”.

Activity 2: Describe the Illustrations

• Look at each of the activities below.

• Each person is carrying out an activity.

• In the space provided, describe another way of doing the same activity, such that less energy is used by people.

Activities that use a lot of energy

Alternative activities that use less energy from our bodies

Activities that use a lot of energy	*Alternative activities that use less energy from our bodies*
	
	

Many different machines have made it easier to carry out activities, so that we use less energy from our bodies. Think of other machines that simplify our work.

Activity 3: Describe the Illustrations

- People and other living things need energy to do work.
- Look at the illustrations below.
- Describe what the living things are using their energy to do:

Illustration	*What are these living things using their energy to do?*
	

Illustration	*What are these living things using their energy to do?*
	
	
	
	

In groups, compare the many activities that people, animals and plants do with their energy. Are some of these activities similar?

CHAPTER 2

TYPES AND FORMS OF ENERGY

Activity 1: Fill in the Gaps

- We have leamt that there are different types and forms of energy.
- Can you remember all these types and forms of energy?
- You can test yourself by answering the questions below:

- There are two types of energy. Name them:

a) _____ b) _____

- What name is given to stored energy? _____

- List eight forms of energy:

i: _____ ii: _____

iii. _____ iv. _____

v. _____ vi. _____

vii. _____ viii. _____

- Why is heat called a form of energy? _____

_____

- Name the energy changes (or energy transformations) that take place:
  - ○ When running water turns turbines and generators

    _____
  - ○ When an electric bulb lights up

    _____
  - ○ In green plants during photosynthesis

    _____
  - ○ In a motor as the car moves

    _____
  - ○ When a paper bums to ash

    _____

- Name two forms of energy given out when a candle bums:

a) _____ b) _____

In groups, discuss and list thte differences between a type of energy, and a form of energy.

Activity 2: Describe the Illustrations

- A rock lying on top of a hill, and a rock rolling down a hill have different types of energy.
- Look at the illustrations below, and name the type of energy that each rock has:

_____energy

_____energy

Make a list of other events where one type of energi changes to another type of energy.

Activity 3: Making a Fire Using the Sun's Rays

- On a hot, sunny day you can make a piece of paper catch fire by using the sun's energy
- Get a magnifying glass, or a piece of curved glass (be careful when handling the glass!).
- Place the piece of dry paper on a flat surface, as shown in the illustration below.
- Then get the magnifying glass and direct the sun's rays onto the paper.
- Your hands must be stable to keep the rays on the same point on the paper
- What do you notice after a few minutes?

• After a few minutes, you should see a point on the paper turning black and eventually catching fire.

In groups, discuss the different energy changes that took place during the above activity.

Activity 4: Heating Rods

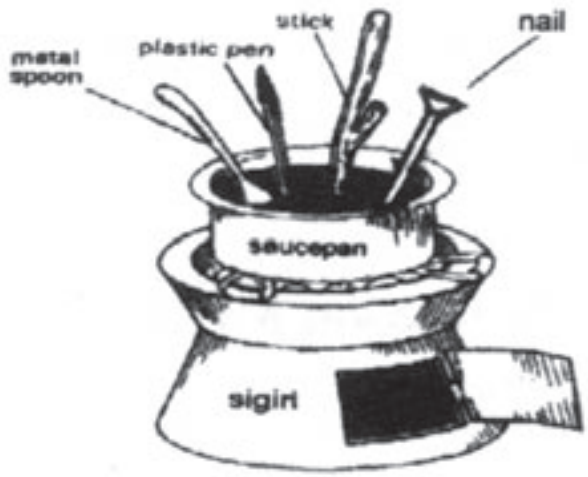
• Heat some water in a saucepan on a *"sigiri"*.

• When the water has boiled, put rods of different materials, such as wood, plastic, and metal in the saucepan.

• Feel the ends of the rods that are sticking out of the water.

• Which rod gets heats up quickly? Which rod heats the slowest?

• In the table below, put number 1 to represent the rod that heats the fastest, up to number 4 to represent the rod that heats the slowest.



Rod type	Order in which the rods heated up
Nail for construction	
Plastic pen	
Metal spoon	
Stick	

Compare your results with those of other groups. Are your results similar? What have you learnt about the relationship between heat and matter?

Activity 5: Describe the Illustrations

- We have learnt that energy can be transformed from one form to another.
- Look at the illustrations below, and describe the different energy changes or transformations taking place in each illustration:

Activity	What energy transformations are taking place?
	
	
	

Compare your list of energy transformations with other pupils'. Did you remember them all? In groups, discuss other events where several energy transformations take place.

Activitiy 6: Brain Teaser

- Give 3 examples of things that use mechanical energy:

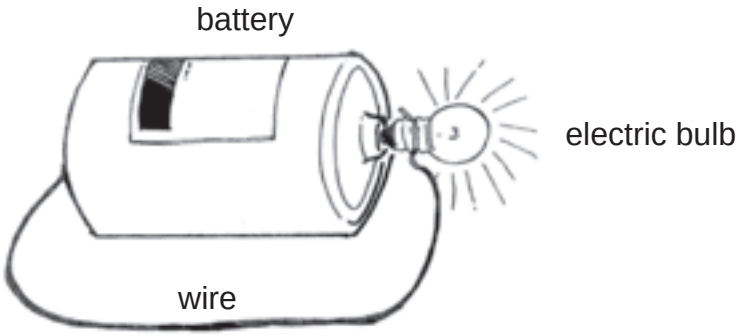
i. _____

ii. _____

iii. _____

Activity 7: Lighting a Bulb with Electricity

- You can light up an electric bulb using a battery and a wire.
- Connect a wire to both ends of the battery.
- At the positive end of the battery, place the bulb onto the live wire. What do you see?



- You should see the elcetric bulb lighting up.

What energy transformations have taken place in this activitiy? What is the final form of energy produced?

Activitiy 8: Sound Energy in a Drum

- In groups. carry out this activity to make sound energy using a drum.
- Place a coin on the top of a drum.
- If you hit the drum gently with a stick it will make a very small sound. The vibrations will be light.
- If you hit the drum harder, it will make a loud sound and the vibrations will be stronger.
- Did the coin move when the drum was hit hard or softly? If you place your finger on the drum skin, do you feel vibrations when it is hit hard or softly?

What has caused the coin to move on the drum's skin? What forms of energy do you notice in this activity?

Activity 9: Brain Teaser

- Using your knowledge on nuclear energy, answer the following questions:

i. What metallic element is needed to produce nuclear energy? _____

_____

ii. Is uranium found everywhere in the world? _____

_____

iii. In what part of the earth is uranium found? _____

_____

Activity 10: Magnetic Fields I

- Look at the magnets below. Which magnets will repel one another, and which ones will attract one another?
- Put a tick besides those objects that can be lifted by a magnet. Put a cross besides those objects that cannot be lifted by a magnet.

Why is it that certain magnets repelled each other, while others attracted each other?

Activity 11: Magnetic Fields II

- Using a magnet, try to lift the objects in the table below. Can the magnet lift all the objects?
- Put a tick besides those objects that can be lifted by a magnet. Put a cross besides those objects that cannot be lifted by a magnet.

Object	Tick OR Cross
Razor blade	
Handkerchief	
Nail for building	
Fork	
Shoe	
Saucepan	

Why is it that some objects were lifted by the magnet while others were not? In groups, discuss the relationship between magnets and other materials.

CHAPTER 3

SOURCES OF ENERGY

Activity 1: Brain Teaser

There are many sources of energy, which are either grouped as renewable energy sources or non-renewable energy sources.
Describe these sources of energy by completing the exercises below:

1. Renewable energy sources are called so because _____

_____

2. Give five examples of renewable energy sources:

i) ..... ii) .....

iii) ..... iv) .....

v) .....

3. Non-renewable energy sources are called so because _____

_____

_____

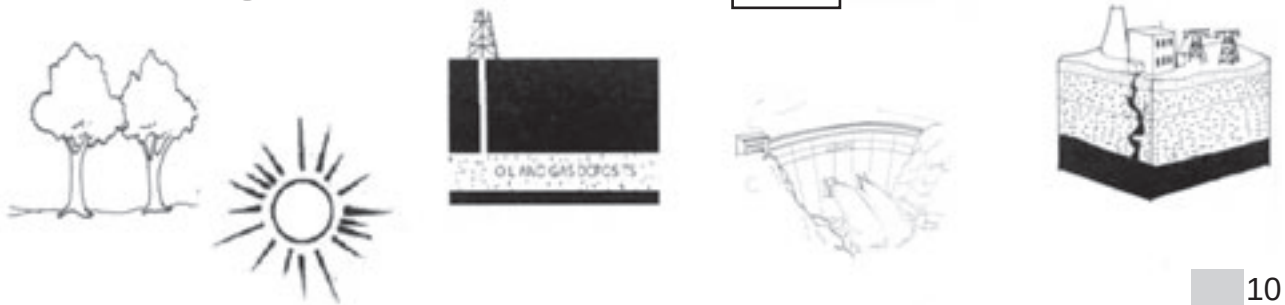
4. Give two examples of non-renewable energy sources:

i) ..... ii) .....

What is the major difference between renewable and non-renewable energy sources?

Activity 2: Circle or Square?

- Below are illustrations of renewable and non-renewable sources of energy.
- Draw a (circle) around the renewables and a [square] around the non-renewables

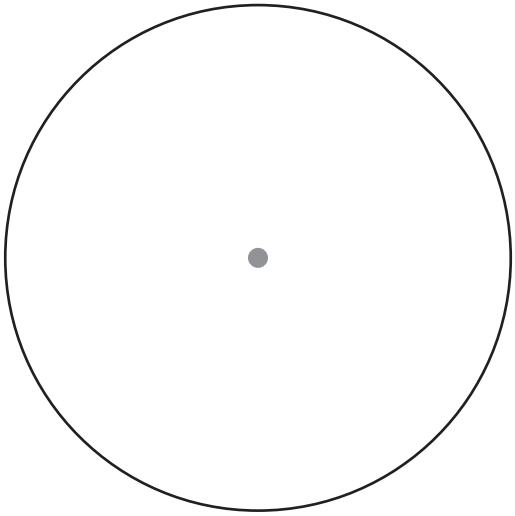


Activity 3: Drawing a Pie Chart

• The figures below show how much of he energy we use in Uganda that comes from renewable and non-renewable energy sources.

• Draw a pie chart using the figures and the circle below:

Sources of Energy in Uganda	**Percentage (%)**
Renewable	*94*
Non-renewable	*6*



• Shade the area of the circle for renewable and non-renewable resources in different colours, or with different patterns.

According to the pie chart above, which energy sources is Uganda most dependant upon? Why do you think this is so?

Activity 4: Who am I?

• In this game. pupils describe t emselves as a source of energy, and ask “Who Am I?”

• The rest of the class should guess what source of energy the student is representing. For example:

• *“I stand tall and beautiful. I provide energy for many people in Uganda. When I stand together with my friends, we are called a forest. But these days, people keep on cutting me down. who am I?”*

• *“I am the centre of all life, I send energy to you every second so that you can live. Without me nothing can move. Without me you cannot see during the day. Who am I?”*

• *“I am black and dirty, but I cook for you. Who am I?”*

In groups, make a list of the different “characteristics” or “features” of the different sources of energy that have been presented. These features will help you to identify easily one source of energy from another.

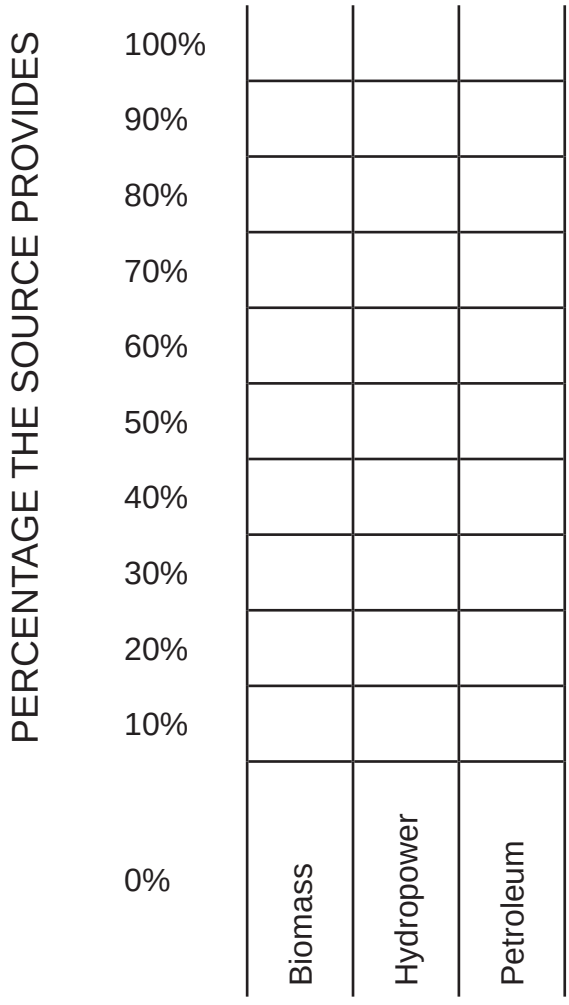
Activity 5: Drawing a Bar Graph

• In the table below are figures showing the percentage of energy each that source provides for Uganda.

• Make a bar graph using these figures.

• Shade the columns in different colours to show the percentage that each source of energy provides:

Sources of Energy in Uganda	Percentage (%)
Biomass	93
Hydropower	1
Petroleum	6



ENERGY SOURCES

What does this table show about Uganda's use of renewable and non-renewable enemy sources?

Activity 6: Fill in the Gaps

- *Fill in the blank spaces with words in the box at the bottom of the page.*
- *Use each word only once.*

1. Solar comes from the word _____, which means sun.
2. The word _____ means light.
3. The sun produces heat from within, through a process called _____
4. _____ is energy that travels in rays.
5. Plants _____, or take in, radiant energy.
6. Solar energy is called a _____ energy source, because it will always be there.
7. The earth absorbs the sun's energy, which in turn warms the _____, or the air around the earth.
8. Plants take in solar energy and store it in their leaves and roots as _____.

atmoshpere	absorb	chemical energy	nuclear fusion
renewable	sol	photo	radiant energy

Using the words in the box above, write a short essay with the topic "Solar Energy and Planet Earth".

Activity 7: Brain Teaser

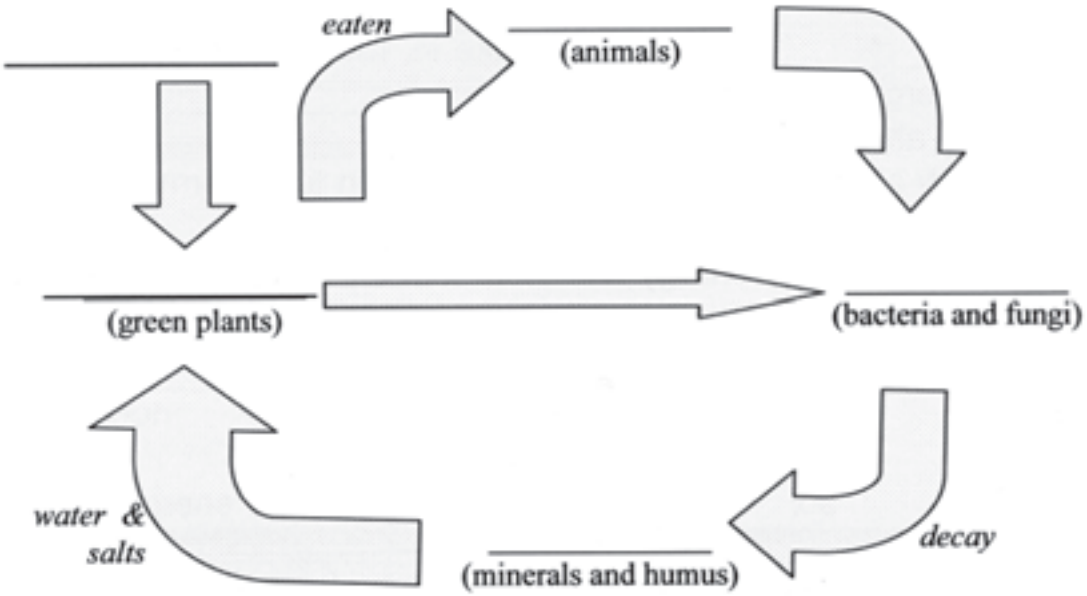
- Solar energy is important to people, plants and animals in many ways.
- Using the pictures below, list some of these importances.

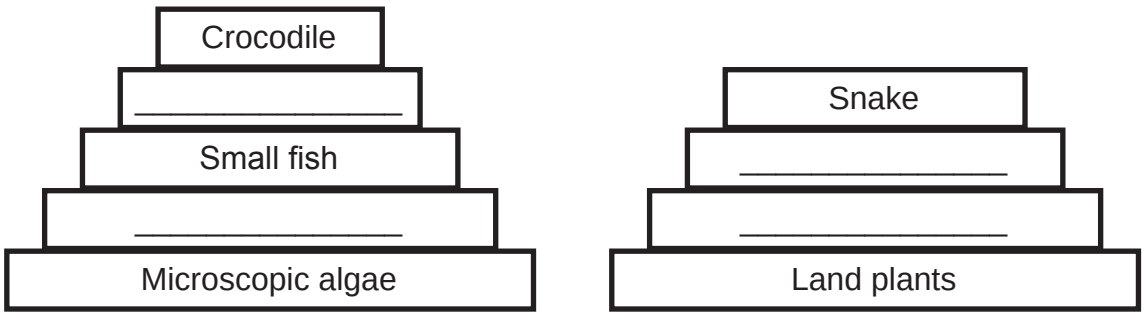
Importance to people	Importane to Plants	Importance to Animals

In groups , list other importances of solar energy to living things that you know of.

Activity 8: Fill in the Gaps

- Below are diagrams showing recycling in the ecosystem.
- Fill in the gaps to complete the diagrams.





In groups, discuss the differences and similarities between a food chain, a food web, and a pyramid of numbers.

Activity 9: Mock Debate

- This activity can be done out of the classroom, for example under a tree.
- Carry out a mock debate on the motion:

  “Human beings are more important than green plants.“
- Allow the class to take 3 positions:

  i. For the motion

  ii. Against the motion

  iii. Disagree with both i. and ii.
- Give time to each group to present their views.

Each group can make a list of their reasons for taking up their position. What conclusions are drawn at the end of the debate?

Activity 10: A “Food Chain” Short Play

- Each pupil can take a different role of the sun, green plants, caterpillar, a worm-eating bird and an eagle.
- Try to imagine what the sun may say as it sends rays down to earth. For example:

“To work now. I must send energy to earth for my plants and animals to survive. But they are so proud, they cannot even thank me all these millions of years.”

The green plant may then respond by saying:

“Oh! Thank you sun. With your energy, I can now make a little sugar in my body. I don’t have to go and dig or hunt.”

The caterpillar slowly moves to the green plant and grabs it:

“Got you! I am so hungry and you are now my food. I must get energy from you to do a lot of work”.

When the eagle eats the small bird, it falls down and ‘dies’. The rest of the class collect around it (bacteria) and Mr. Eagle decomposes. The materials that made Mr. Eagle go back to earth where they are picked up by plant roots.

What does this short play teach you about interdependency of all oganism in a food chain? Can any organism survive on its own? Can any ecosystem survive without the sun?

Activity 11: Fill in the Gaps

- Fill in the blank spaces with the words in the box at the bottom of the page.
- Use each word only once.

1. Biomass is any _____ that was alive a short time ago.
2. Biomass is a _____ energy source, because we can always grow more plants.
3. We _____ biomass to make heat.
4. We burn garbage in a _____ plant to make _____..
5. When biomass rots it forms a _____ called _____ which we can use for energy.
6. Biomass can be turned into a liquid fuel like gasoline, called _____..
7. Most of the biomass we use in Uganda is _____.
8. Plants _____ energy from the sun in their roots and leaves.
9. The major source of firewood in Uganda is from our _____.

forests	renewable	ethanol	methane	wood	
store	electricity	material	burn	gas	waste-to-energy

Activity 12: True or False?

- At the end of the statements below, put T to mean **true**, or F to mean **false**:

I. Renewable energy means energy which is new, not old. (...)

ii. Trees in forests can provide renewable energy. (...)

Ill. Sugarcane can provide renewable energy. (...)

iv. When a piece of wood burns, its energy can be renewed. (...)

v. Because we cut down the crops we grow for food, their leftovers such as leaves do not have any energy. (...)

vi. There has been a lot of derorestation in our forests like Mabira. For this reason, trees in Mabira Forest no longer have renewable energy. (...)

Activity 13: Fill in the Gaps

- Fill in the blank spaces with the words in the box at the bottom of the page.
- Use each word only once:

1. The _____ shines on the earth. The _____ heats up faster than the water. The warm air over the land _____. The _____ air over the water moves in to take its place. This _____ is wind.

2. Wind is air in _____.

3. The sun will always shine; the wind will always blow. We therefore call wind a _____ energy source.

4. A _____ can capture the energy in the wind.

5. The spinning blades of a windmill turn a _____ to make _____.

6. Sometimes, there are many windmills together to make electricity. A place with many windmills is called a _____ .

7. In Uganda. windmills are found in _____.

Motion	Karamoja	renewable	sun	generator	electricity	
windmill	rises	wind farm	cool	moving	air	land

Is electricity from windmills common in Uganda? Make a list of possible reasons as to why Uganda does not have many windmills.

Activity 14: True or False?

- At the end of the statements below, put T to mean **true**, or F to mean **false**:

i. The illustration above is that of a geothermal power plant. (...)

ii. Geothermal energy is derived from the surface of the earth. (...)

iii. Electricity can be made from geothermal energy. (...)

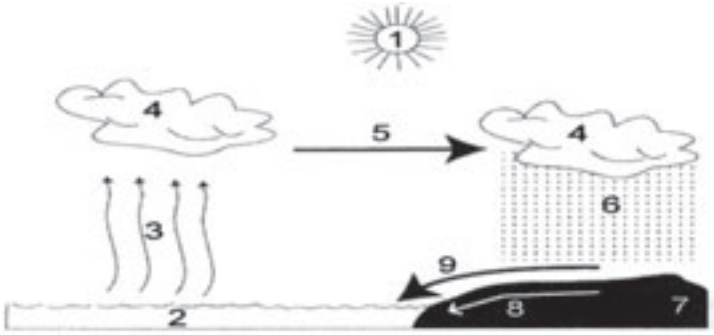
iv. Many districts in Uganda can exploit geothermal energy. (...)

v. Geothermal energy is a non-renewable source of energy. (...)

Try to recall those areas in Uganda where geothermal energy can be exploited. Why do you think the these areas in Uganda and not other areas can exploit geo-thermal energy?

Activity 15: Label and Describe the Illustration

- The picture below shows the water cycle is formed.



- Now fill in the gaps below for numbers 1 to 9, labelled in the diagram.

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____

Using the words labelled 1 to 10, describe the water cycle to your classmates or family.

Activity 16: Fill in the Gaps

- Fill in the blank spaces ith the words in thw box at the bottom of the page.
- Use each word only once:

1. Hydro means _____.
2. The water cycle can also be called the _____ cycle.
3. When water turns into a gas it is called _____.
4. The force that moves water from high ground to lower ground is _____.
5. We can build a _____ across a river to control the flow of water. When we do this a lake is formed called a _____.
6. In a hydropower plant, the water flows hrough a tube called a _____. This spins a _____, which turns a _____ to produce _____.
7. The water cycle will never stop; we therefore call hydropower a _____ energy source.

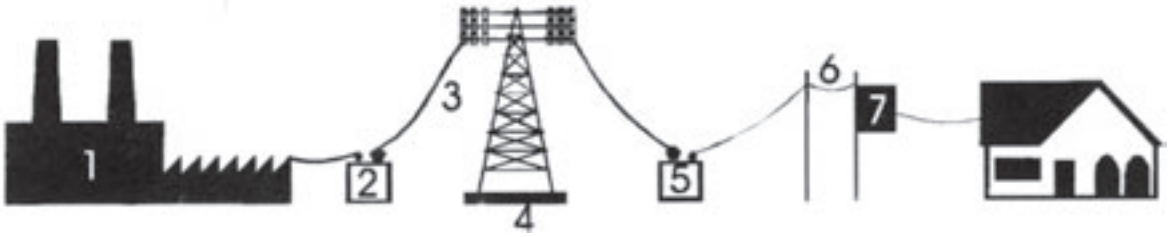
renewable water generator reservoir gravity sluice
water vapour turbine dam hydrological electricity

Describe the energy transformations that take place to change kinetic energy of running water to electricity.

Activity 17: Matching Game

• The diagram below shows hydropower is transported from power plants to our homes or schools.

• Using the diagram, match the different objects below with the correct number:



Distribution line	
Step-up transformer\	
Power tower	
Power plant	
Step-down transformer	
Neigbourhood transformer	
Transmission line	

Can you remember each stage above without looking at your book? Let a friend test your memory, then you can test your friend also.

Activity 18: Matching Game

• Below is a list of objects used to transport hydropower (on your left), and a list of descriptions of each object (on your right).

• Using arrows, match each object with the correct description:

Distribution line	Generates electricity
Step-up transformer	Lowers voltage to the voltage used by appliances used in homes and schools
Power tower	Carries lower voltage electricity to homes and schools
Power plant	Increases voltage to reduce transmission loss
Step-down transformer	Carries transmission lines
Neighbourhood transformer	Transports high-voltage electricity over long distances
Transmission line	Lowers voltage for smaller distribution lines

Using the terms and descriptions above, write a short essay entitled "The Process of Hydropower Transmission".

Activity 19: Brain Teaser

• We learnt that fossil fuels are made from decayed organic material (things that once had life, but later died). Which of the things below may have contributed to the formation of fossil fuels? Put a star  around those things that can help in the production of fossil fuels:

Fish	papyrus	shark	leaves	tree	battery
gas	tank	bottle	vehicle	jerry can	crocodiles

Why do you think some of the objects above can contribute to the formation of fossil fuels, while others cannot?

Activity 20: Fill in the Gaps

- FiII in the blank spaces with the words in the box at the bottom of the page.
- You may use each word more than once:

1. There are three types of fossil fuels, namely _____, _____, and _____.
2. Fossil fuels are _____ because more can not be made in a short time.
3. To reach fossil fuel that are deep underground, we must use a _____.
4. Another word for petroleum is _____.
5. Uganda does not produce petroleum of its own; all the petroleum we use in Uganda currently is _____ from other countries.
6. Natural gas is commonly used in _____ of _____ countries, like Britain, USA and Germany.
7. Both _____ and _____ are fossil fuels that are converted to electricity in power plants.
8. Burning petroleum products and coal releases fumes that cause air _____. This in turn can lead to increased heat all around the planet earth, which is called _____.

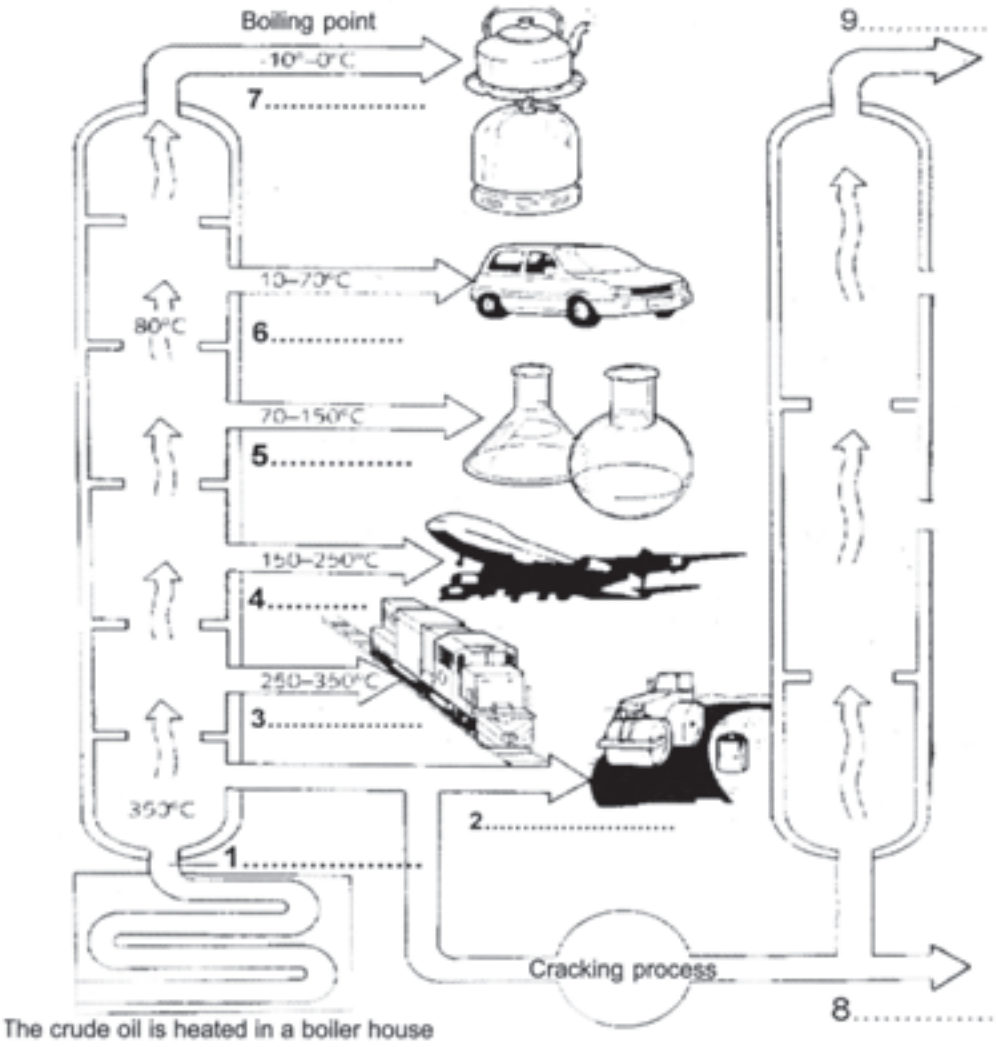
developed	coal	pollution	non-renewable	drill	petroleum	oil
natural gas	imported	factories/industries	global warming			

Using the words in the box above, write a short essay entitled "The Origin, Uses and Dangers of Fossil Fuels".

Activity 21: Label the Diagram

• The illustration below shows the refining process of crude oil or petroleum, and the products that we can get trom it.

• Complete the labelling in the illustration by filling in the gaps:



The crude oil is heated in a boiler house

How is it possible to separate the different products of crude oil during the refining products?

Activity 22: Fill in the Table

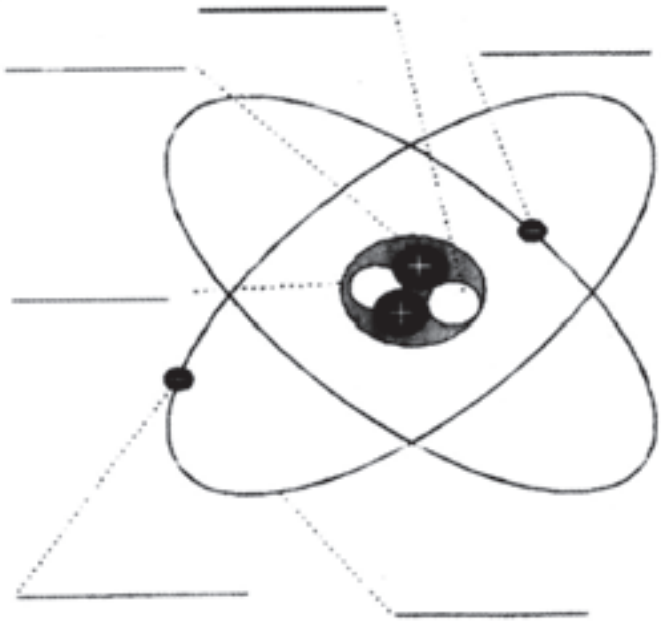
• We have learnt about the derivatives or products that we can get from coal.

• Complete the table below by filling in the gaps:

Derivatives of coal	Uses of coal derivatives
▯□⟹	
▯□⟹	
▯□⟹	

Activity 23: Label the Parts of an Atom

- Nuclear energy is made by splitting the atoms of an element called uranium.
- Label the diagram below of an atom:



Activity 24: Fill in the Gaps

- FiII in the blank spaces with the words in the box at the bottom of the page.
- Use each word only once:

1. Everything in the world is made up of moieculest which can be split further into _____.

2. At the centre of an atom is the _____. It is made of _____ and _____.

3. Moving around the nucleus are _____.

4. The energy stored in the nucleus of an atom is _____.

5. Uranium is buried underground. We cannot make more, so we call uranium a _____ energy source.

6. Uranium atoms can be split; we call this _____.

7. When uranium atoms are splitt energy is released as _____ and _____.

8. In a nuclear power plantt we split uranium atoms and use the heat to make _____.

non-renewable	heat	nucleus	fission	atoms	radiation
protons	nuclear	energy	electrons	neutrons	electricity

What are some dangers of producing nuclear energy? Discuss examples of what or who can get hurt by nuclear energy, and in what way.

CHAPTER 4

THE PRODUCTION AND EFFICIENT USE OF ENERGY

Activity 1: Brain Teaser

• We leamt that energy sometimes has to be transformed to another form before we can use it.

• In the table below, give examples of how we can use solar energy directly, or after changing it to another form:

Direct use of solar energy	Uses of solar energy after changing it to another form
❖	❖
❖	❖
❖	❖
❖	❖
❖	❖

In groups, discuss other sources of energy that can be used either directly or after being changed to another form.

Activity 2: Drawing

• In the spaces below, draw different kinds of energy-giving foods:

What is the importance of eating the types of food you have drawn in the boxes above?

Activity 3: Class Project – Setting Up a Backyard Garden

• You can do this activity at school with the help of your teacher, then at home with the help of your farnily or friends.

Procedure:

• *'First mix your soil with manure, for example from goats and cows, or with chicken droppings. Plant any local vegetables you find, which are rich in iron, such as dodo, buga (red), nakati, and egg-plants. Plant them in neat rows and each in its own section as iIlustrated below.*

Children planting vegetables in a backyard

• *Plant at least 5 sugarcane plants in one corner of the garden, which has good rainwater drainage.*

Children planting sugar cane in a backyard

• *Plant your 10 cassava stems in a line and leave at least 1 metre in between each stem.*

Children planting cassava in a backyard

• *Plant fruit trees in your compound and around your garden boundary.*

• *Remember to water your plants every morning before sunrise, and every evening, especially during the dry seasons.*

Fruit trees growing in a compound

Watch the progress of your crops every week. You can get a notebook to record the changes you see in your crops, until they are ready to be harvested.

Activity 4: Brain Teaser

• Beside each illustration below, suggest ways of doing the same activity so that less energy is used by the people.

Illustration *Alternative activities that use less energy*

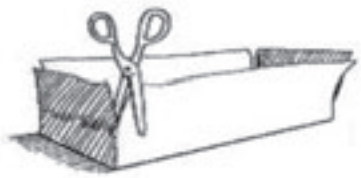
In groups, discuss other activities that use a lot of energy, and ways that you can use less energy to do the same activity.

CHAPTER 5

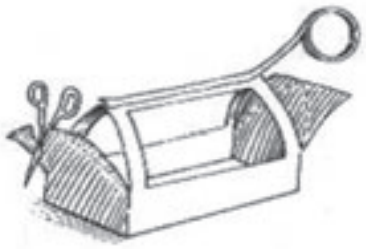
ENERGY CONSERVATION TECHNOLOGIES

Activity 1: Do-it-yourself Greenhouse

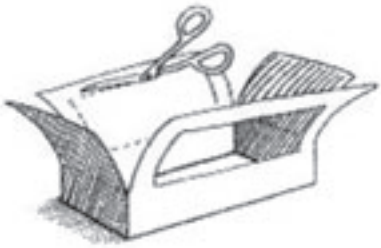
- Follow these simple instructions to make a mini-greenhouse



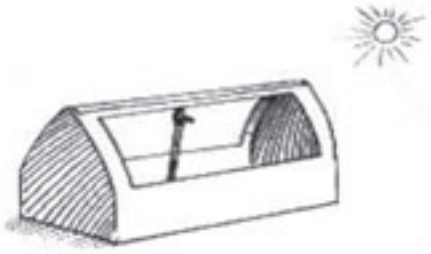
1. Cut down the corners ot the box to form flaps. Leave about 4 cm from the base to help maintain rigidity.



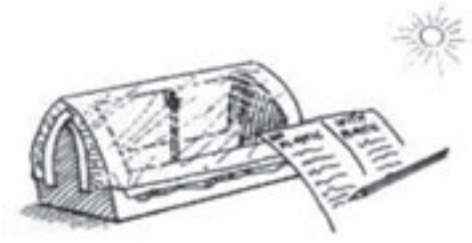
2. Join the two frames together along the top. Now trim the end flaps and tape them in place.



3. Fold the flaps outward and on the two longest sides cut out a rectangle leaving a 2 cm 'frame'.



4. Place the greenhouse in the sun. Suspend a thermometer from the apex of the greenhouse frame. Take a reading trom the thermometer



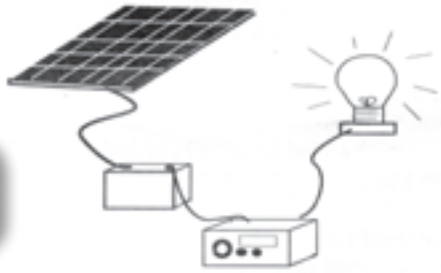
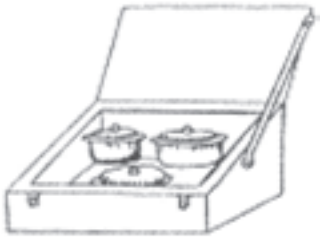
5. Tape clear plastic over the window frames and place the greenhouse back in the sun.

- Take new readings trom the thermometer every 5 mintues. Note the changes in temperature. What does this tell you?

What is the importance of a greenhouse, and how does it function?

Activity 2: Describe the Illustrations

- Name and describe each of the following solar energy conservation technologies:

Name the illustration	*Illustration*	*Describe what this technology does*
		
		
		
		
		

The technologies above are alternatives to the traditional way of doing the same activity e.g. warming water, cooking, etc. Can you remember the traditional way of doing the same activities? Which methods save more energy?

Activity 3: An Outdoor Game

• Try this game with your friends and decide If biomass as an energy source is sustainable under conditions of cutting with replacement, and cutting without replacement.

▪ Have three pupils volunteer to play the game. One of them must be a girl unless it is a girls' school. The three are John, James and Agnes, each with a bundle of straws.

▪ At the start of the game, the teacher blows the whistle.

▪ John and James pick two drinking straws from their bundles and take to the teacher. At the same time, Agnes brings two straws and puts them together with James' straws. All the three go back to where their straws are.

▪ The teacher blows the whistle again. Repeat what was done in step 3 above. The teacher must blow the whistle five times.

▪ After the fifth whistle, ask John and James to bring the straws they have to you. How many straws do they each have?

If each straw represented a tree from the forest, and the teacher was using them to cook food, what lesson do you leam from this game? Who is using the firewood efficiently, and who is not?

The class can now decide whether cutting a forest with replacement, or cutting it without replacement are sustainable ways of using biomass energy.

Activity 4: Fill in the Gaps

• Answer the following questions in the spaces provided:

i. Name two forests in Uganda that have been encroached upon in search of timber and new farmlands.

_____ and _____.

ii. What do you think should be done to people who cut trees without planting their own?

_____

iii. Why is it that we sometimes run out of energy, yet we are saying that energy is everywhere?

_____

iv. Why is it important to produce and use energy efficiently?

_____

_____

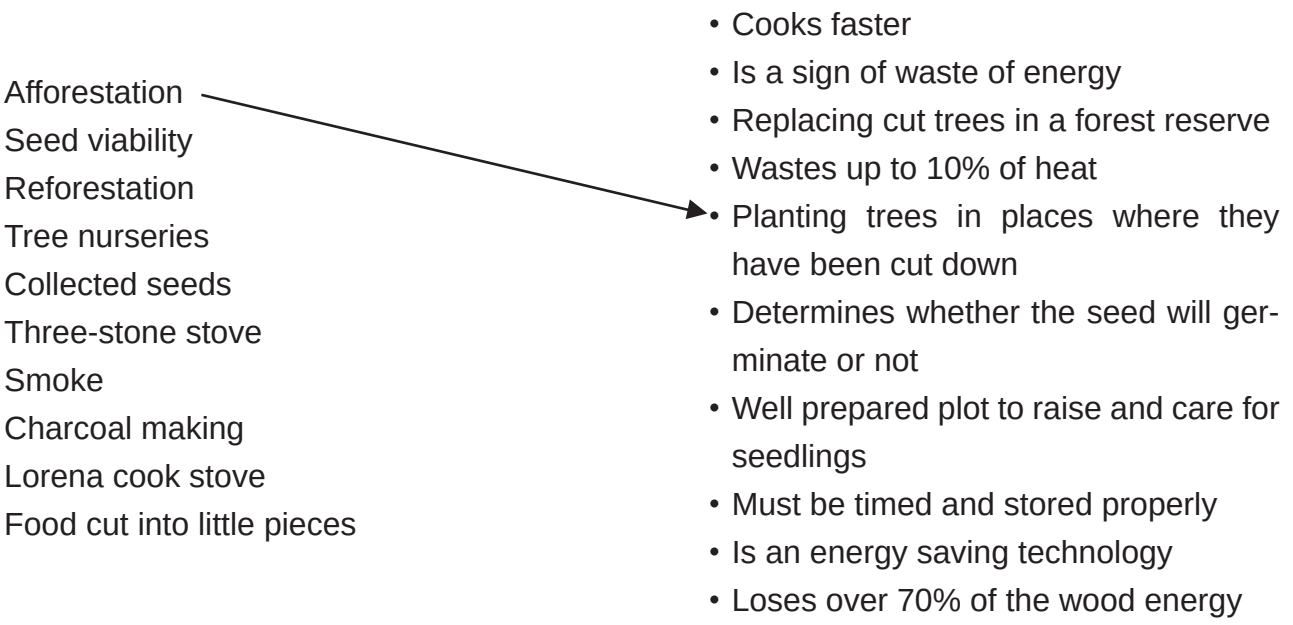
v. What can you do to help save biomass?

_____

_____

Activity 5: Matching Game

- Try to recall what the words below mean.
- Draw an arrow from left to right to indicate the matching statements.
- Use the example given:



Activity 6: Class Project: Establishing a Tree Nursery

- You can do this activity at school with the help of your teacher, then at home with the help of your family or friends:

Consider the following points when choosing the seeds to plant in your tree nursery:

- Decide on which tree species you want to plant in your plot
- Collect and dry the seeds. Pick seeds only from a healthy mother plant.
- These are seeds that you collect locally from a forest or elsewhere. They are not pre-treated. Be selective and timely when collecting such seeds, and collect form the best parent trees. If one delays to collect such trees in time, they may not lose their viability soon. Do not mix seeds of different species as each of them has specific viability and germination conditions.
- Those seeds, which need to be extracted from their container, must be done carefully so that we can store the seed. If seeds are in cones, such as those of pines, dry the cones and gently thrush them to get the seeds out. Some seeds come out dirty after extractions. Clean them before storage. If there is need to store seeds, put them in a dry, cool, and possibly dark place. Label each container, the type of seeds and date of collection.
- Seed viability refers to the ability of the seed to germinate when planted to find out whether your seeds are viable, drop them in water. More often than not, bad seeds will float while the good one will sink to the bottom.

Consider the following points when siting where your nursery should be:

○ It should be near where you are going to plant the trees permanently.

○ The ground should be level or terraced.

○ Water must be near and always flowing.

○ Soil must be fertile.

○ For proper distribution of light, align the nursery on the east-west direction.

○ Fence it out to keep out intruders and some domestic animals. Ensure manpower is always enough.

Follow these steps when preparing your seed beds:

○ Clear the area of all weeds. Select an area with good loam soils.

Loosen up the soil by digging, and especially remove all scotch grass and any roots of other plants.

○ Measure out your seedbeds at 3 feet wide and 10 to 30 feet long. Leave 1 or 2 feet between each seedbed.

○ Add a mixture of sand and manure to your soil and mix. Manure should be 2 basins to one of sand, to about 10 basins of ordinary loam soil. Mix the soil well in each sand bed with a hoe or spade.

○ Put tree planks or banana sterns around each seedbed. This is to stop the mixture from being washed away by rain or scratched away by the chicken. Hold the plants or banana sterns firmly using pegs on the outside.

○ Use a rake or your hands to spread out the soil evenly.

○ Erect a shade for each seedbed to stop the sunshine or direct rain from reaching your soil mixture. Cut your tree support 5 feet in front and 4 feet at the back. Dig holes of 1 foot and put it in the supports. The shade should be built in such a way that the higher side faces where the sun comes in. This will allow the mild morning sunshine to reach your seedlings. The shorter supports of 4 feet should be at the back. This will allow the shade cover to stop the strong afternoon sun from hitting and damaging the plantlets. Build a shade with cross beams and cover with grass or dry banana leaves. The thatching on top should not be too close. This is to allow some bits of sunshine and rain to reach your plants.

○ When sowing the seeds, use a stick or your forefinger to scratch straight lines lengthwise in your soil mixture. The lines should be about 1 centimetre deep. Spread your selected seeds along the deep lines in the soil.

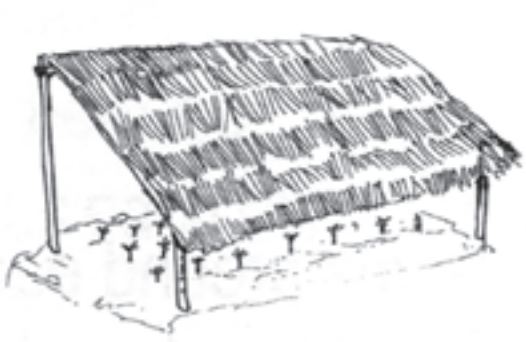
○ Cover the seeds with soil again or with a thin layer of the soil mixture.

○ Mulch or cover the seedbed with dry grass after sowing the seeds.

○ Water the seedbed using a watering can. If you have no watering can, get an old tin and make small holes with a nail. Keep filling the can from a basin full of water and let the water drip through the button holes of the can. If you cannot find a can, use your hands to sprinkle the water all over the seedbed. Avoid pouring handfuls of water on the seedbed.

○ Keep watering twice a day, early morning or late evenings, especially during the dry season. Make sure you water the seedbed at least once a day. If it is a rainy season, there is no need to water.

○ Keep removing the grass mulch to check if the seeds have sprouted. As soon as the seeds sprout and start growing, remove the mulch.



○ If you have polythene pots you can transport the seedlings into pots full of soil mixture and keep watering them. You can make pots from banana fibres, put soil and transplant them. Do not allow any weeds to grow. However, if you have no pots, do not worry. Do not remove the seedlings at all. Make sure in sowing you leave a bit of space between the seeds. Allow the seeds to grow normally. During the wet season, dig holes and scoop your seedlings with some soil, carry it in a basin and plant it. It will grow normally.

Watch the progress of your seedlings every week. You can get a notebook to record the changes you see in seedling, until they are ready to be transplanted.

Make a strong campaign to make sure that your school plants a woodlot. Also make sure every parent and child at home learns how to grow seedlings, and how to plant trees in the family plot.

Activity 7: Constructing a Lorena Stove

- Here are some simple instructions on how to construct a Lorena stove.
  - First prepare the clay mixture by mixing clay and sawdust to the ratio 1:1.

Clay *Sawdust*

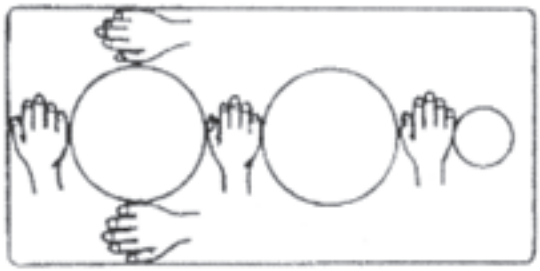
- Soak potato leaves in water until it becomes sticky, then remove the leaves and mix the water into the clay and sawdust. This forms the clay mixture. You can determine how strong your clay mixture is by rolling a piece of the mixture and seeing how easily it breaks.

If it breaks easily, there is too much sawdust

If it does not break easily, there is too much clay

If it bends over and then breaks, the mixture is good

- Choose 2 or 3 cooking pots that are used most at home. Une them up where you will construct the stove, separating them by a distance of your palm's width. Use them in order of the pot that needs the most heat, to that which needs the least heat.

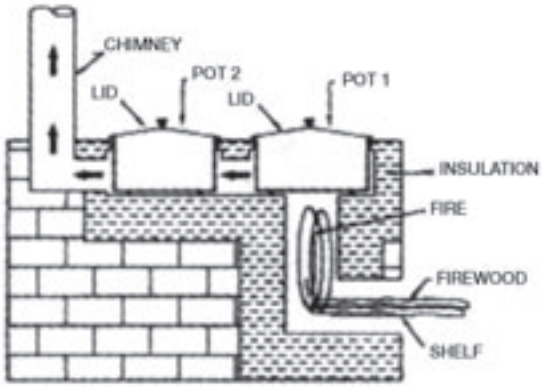


- Make a map of the area the stove will cover, leaving an allowance for the chimney. The firebox should be opposite the door entrance, so that wind coming through the door helps to light up the fire.
- Dig a small trench for the foundation of the stove, and lay a few bricks or stones in the trench.
- Place a banana stem to mark out the area where the firebox will be. This should be directly below that saucepan that requires a lot of heat.
- On top of the foundation, pile up the clay mixture to a desirable height. Level and smoothen the tope of the pile.
- Get the two or three pots that you used at the beginning to make a map of the stove, and outline where they will rest on top of the clay mixture. These will make your pot rests. Also outline the position of the chimney.

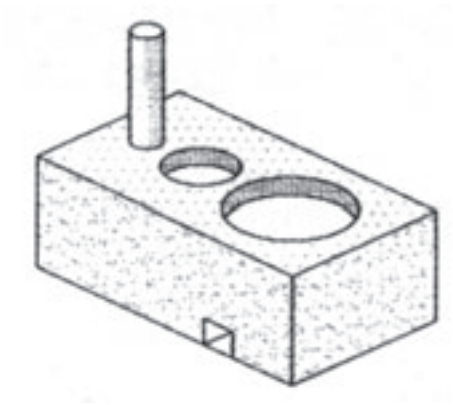
○ Dig out the clay in the area where your pots will rest. The pot rest should be 5 cm deep. You can smoothen the area by wetting the sides of the pots rests, and twisting the pots until they fit comfortably.

○ Remove the banana stem and smooth out the tunnel, to connect the first pot rest to the second and third pot rests.

○ Scoop a tunnel from the last (third or second) pot rest to the chimney, leaving a slanting wall. This slant will stop hot smoke trom moving out of the stove to quickly. Construct the chimney using the same clay mixture as the rest of the stove. The chimney should be 10 cm wide and 1.5 ft long, and should lead the smoke out of the kitchen.



A cross section of the stove



The completed stove

○ Leave the stove to dry for 4 weeks. For the first 3 days, continue twisting the saucepans in the pot rests to maintain the shape and size of the rests. Only start using the stove when it is completely dry.

○ After using the stove for same time, it may begin to develop same cracks. Repair these cracks with a clay and sawdust mixture. Also clean the chimney regularly with a flexible stick, to remove all soot that can block the air flow.

Make a list of the advantages of a Lorena stove over the open 3-stoneflre.

Activity 8: Class Project: Making a Fireless Cooker

• You can do this activity at school with the help of your teacher, then at home with the help of your family or friends:

1. Put the insulation material into the bottom of the basket, to about 8-10 cm high

2. Put your cooking pot on a large piece of heavy cloth or sacking

3. Pull the cloth over the pot, so that the pot is wrapped in the cloth

4. Put the wrapped cooking pot in the basket, on top of the insulation layer. Put more insulation around the wrapped pot, right up to the top of the pot. Pack it tightly with insulation.

5. Pull the cloth away from the top of the pot. The edges of the cloth should touch the edges of the basket.

6. Remove the pot, and sew the cloth to the sides of the basket.

7. Sew some cloth into a round bag that is big enough to fit over the cooking pot. Fill the bag with insulation material and sew up the top. This makes a cushion to cover the pot.

8. Make another cushion that fits inside the basket cover. Sew it onto the basket cover.

What advantages and disadvantages does a fireless cooker have? Write a short essay entitled "The Costs and Benefits of the Fireless Cooker".

Activity 9: Pair-Up

- You can play this game with your friends, under the instruction of your teacher.
- In this case, we shall use the example of 10 students.

i. Write out 10 correct statements about biomass on small strips of paper. For example, "*methane is a biogas produced by the action of bacteria*"

ii. Cut the sentence on the paper into two. E.g. "methane is a biogas produced by" then "the action of bacteria".

iii. Do this for the rest of the 10 sentences. Now you have 20 pieces of paper.

iv. Mix them up in a paper box or basket, then ask 20 pupils to each pick one piece of paper.

v. Ask the pupils to look for their correct partner by comparing the half sentences. E.g. a pupil who has "*methane is a biogas produced by ...*" should pair up with another pupil who has "*... the action of bacteria*".

vi. Ask the pupils to look for their correct partner by comparing the half sentences. For example, a pupil who has "*methane is a biogas produced by*" should pair up with another pupil who has "*the action of bacteria*".

Activity 10: Fill in the Gaps

- Use the words at the bottom of the page to fill in the gaps below:

i. When something can catch fire easily, we say it is _____.

ii. The most known type of biogas is _____ gas.

iii. To produce biogas, a process called _____ must take place.

iv. Biogas is made in such as the _____.

v. The by-product of biogas production is called _____.

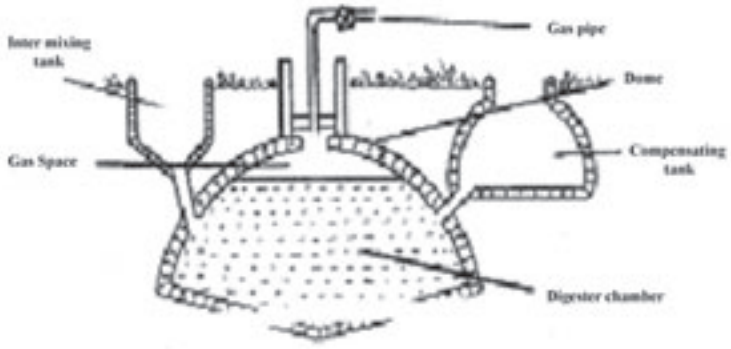
vi. Biogas is often said to be _____ friendly, because it does not _____ the atmosphere.

inflammable	anaerobic digestion	methane
environmentally	fixed dome digester	slurry
biogas digesters	pollute	

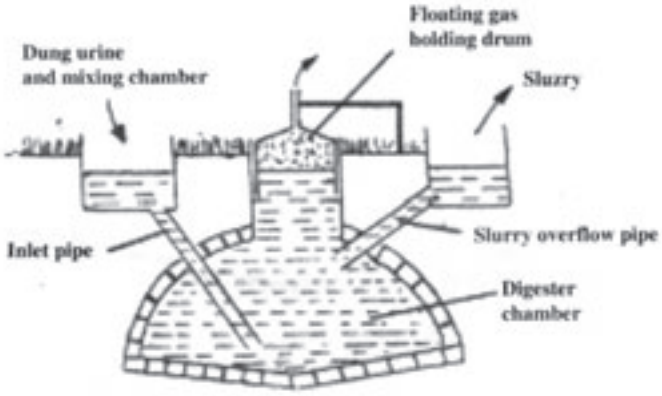
Make a list of the advantages and disadvantages of biogas digesters. You can discuss this with your classmates and show your work to your teacher.

Activity 11: Matching Game

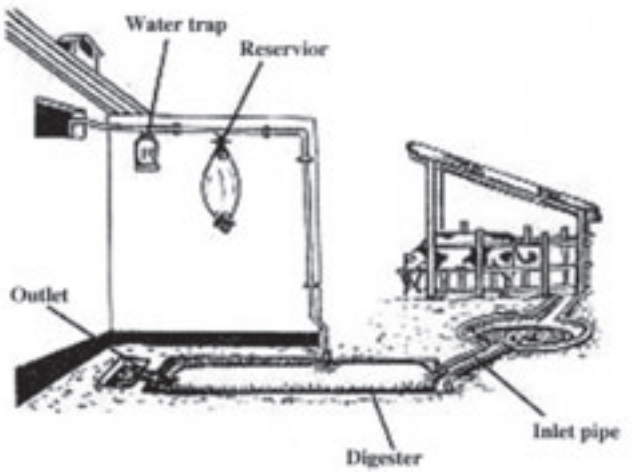
- Using arrows, match the illustrations of biogas digesters with their correct names:



Floating Drum Digester



Tabular Plastic Bio-Digester



Fixed Dome Digester

In groups, discuss the different characteristics of each of the biogas digesters above.

CHAPTER 6

ENERGY AND THE ENVIRONMENT

Activity 1: Matching Game

- Using arrows, match each description on the right with one of the terms on the lett:

Deforestation	• A gas released during the buming of fuelwood, that is also harmful to human beings
Carbon monoxide	• A horne for living things
Global warming	• Living things trom which energy can be derived
Habitat	• The act of cutting down trees in a forest
Carbon dioxide	• A result of huge amounts of heat-trapping gases remaining in the atmosphere
Biomass	
Habitat	• A heat trapping glass released by plants
	• Peoples surroundings

Using the table above, write a short essay entitled "Planet Earth and the Threat of Pollution".

Activity 2: Brain Teaser

- The illustration berow shows how burning biomass can impact negatively on people.
- What negative impacts do you notice in the illustration?
- What is causing these reactions in the people?

In groups, discuss other ways of cooking that have a smaller impact on people's health.

Activity 3: Fill in the Gaps

- Fill in the blank spaces with the words in the box at the bottom of the page.
- You may use each word more than once:

1.There are three types of fossil fuels, namely _____, _____, and _____.

2. Fossil fuels release _____ or _____, which contain dangerous gases.

3. Fossil fuels can damage man's _____, _____, and _____.

4. Burning fossil fuels is the greatest source of _____ in the world.

5. _____ is formed when acids released by fossil fuels mix with rain in the atmosphere.

6. _____ spills can cover the surface of land and water, and suffocate the plants and animals beneath.

7. A _____ can cause these spills over water, while a can cause these spills over land.

heart	lorry	smoke	natural gas	pollution	acid rain	coal
eyes	petroleum	oil	fumes	ship	global warming	lungs

Discuss the different types of fossil fuels and their dangers to the environment, including people.

Activity 4: True or False?

- At the end of the statements below, put T to mean true, or F to mean false:

i. Nuclear energy does not release chemicals that are harmful to man. (...)

ii. Only adults can be physically affected by nuclear energy. (...)

iii. Nuclear energy can only affect one's heart and no other part of the body. (...)

iv. Only Europe has experienced the bad impacts of nuclear energy. (...)

v. A nuclear bomb hit Japan during World War One, killing many people. (...)

Activity 5: Brain Teaser

- Answer the following questions in the gaps provided:

i. What do you understand by the term “clean and green” sources of energy?

_____

ii. List 4 sources of energy that are considered to be clean:

- _____
- _____
- _____
- _____

iii. Give 3 problems that result from constructing hydropower dams:

- _____
  _____
- _____
  _____
- _____

iv. Although solar electricity is a clean energy source, one of the parts used to produce it is harmful to the environment. Which part is this?

_____

v. When deciding on whether to exploit wind or solar energy, two climatic elements must be present. What are these elements and why are they important?

	Climatic Element	*Its importance in exploiting energy*
Solar Energy		
Wind Energy		

As a class, or in a group, make a fable showing the impacts of each source of energy on the environment, and possible ways of overcoming these negative impacts.