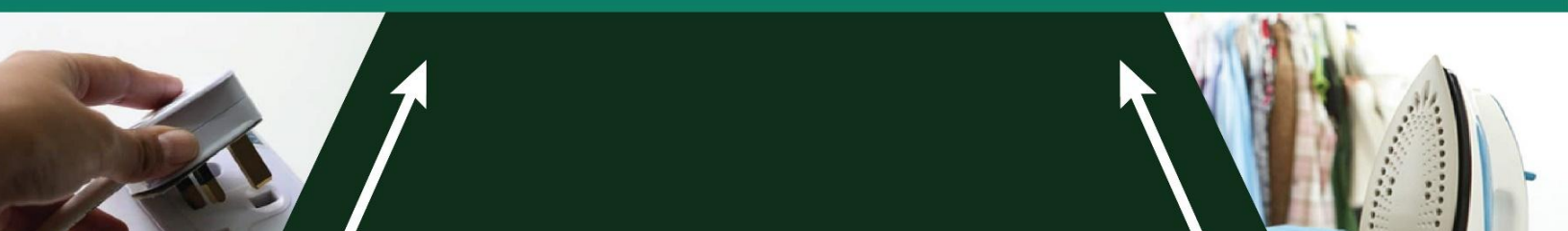
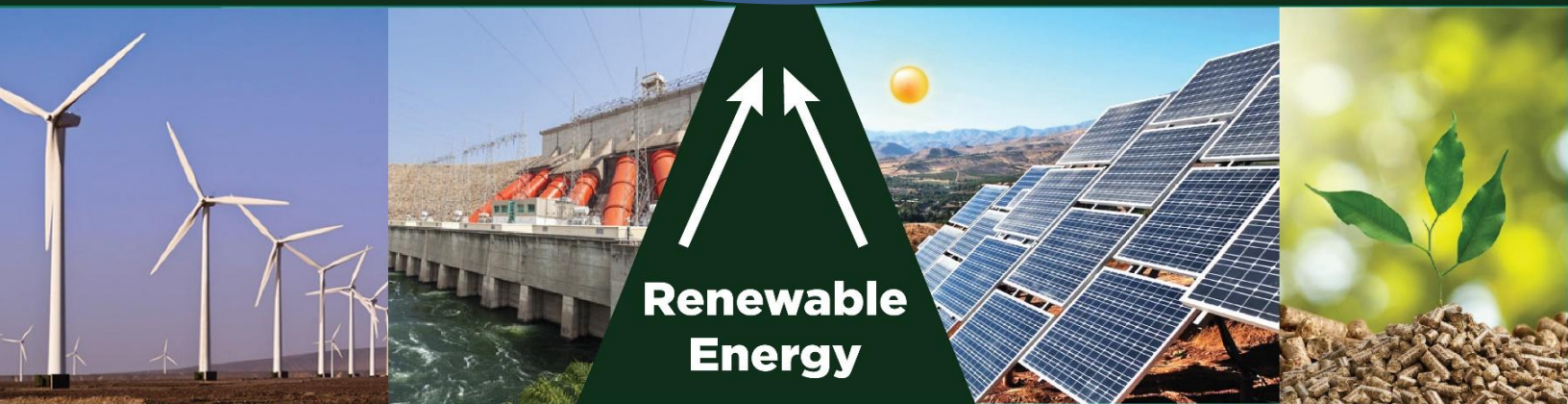


Energy Efficiency Pre-Tertiary School Curriculum Update

Energy Efficiency Pre-Tertiary School Curriculum Project Materials

Primary Teacher Tool Kit





Energy Efficiency Pre-Tertiary School Curriculum Project Materials

Teacher Toolkit – Primary Level

(Final Draft II)

11th June, 2020

Developed by:

Associates for Change (AfC) in association
with the National Council for Curriculum and
Assessment (NaCCA), Ministry of Education
and Development Environment Services
Limited (DESL)

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Preface:

The Republic of Ghana and the United States of America acting through the Millennium Challenge Corporation (MCC) have entered into a Millennium Challenge Compact with the Government of Ghana to facilitate poverty reduction through economic growth. The Millennium Challenge Corporation Compact (MCC) program consists of six projects one of which is the **Energy Efficiency and Demand Side Management Project (EE&DSM)**. The objective of the EE&DSM is to reduce energy waste by consumers, thereby increasing the reserve margin between electricity supply and peak demand, making electricity available to more consumers at a lower cost compared to developing new generation capacity.

Under the EE&DSM Project, MiDA is undertaking an Education and Public Information Activity. A sub-activity under the Education and Public Information Activity, involves the development of energy efficiency and conservation school curriculum upgrades/components to incorporate into the existing Pre-Tertiary Ghana Education Service (Ministry of Education) School Curriculum. This additional curriculum seeks to influence and change behaviour regarding energy efficiency and conservation at the pre-tertiary level. Specifically, the project seeks to achieve the following:

- Develop curriculum to ensure learners develop the right behavioral and attitudinal change to ensure sustainability of energy efficiency and conservation efforts at pre-tertiary levels both in schools and homes;
- Facilitate a change in behaviour towards energy efficiency and conservation at the pre-tertiary school level;
- Influence and change public behavioral patterns to ensure effectiveness of energy efficiency and conservation measures.

A key component of the EEC curriculum updates project is the development of supplementary materials including Teacher Tool Kits for Primary, Junior High and Senior High Schools to serve as a resource guide to teachers in the teaching and learning of EEC at the various pre-tertiary levels. This Teacher Toolkit was developed by Associates for Change (AfC) in association with Development Environenergy Services Limited (DESL) India and in close consultation with the National Council for Curriculum and Assessment (NaCCA) and the Internal Compact Team (ICT). A number of working sessions with the NaCCA curriculum review panel, subject leads and selected teachers across primary, JHS and SHS were organised to review, edit and validate this resource material.

This document is currently being reviewed by the NaCCA Curriculum Review Team together with selected classroom teachers to ensure content validity. The document is meant for piloting and is still in its draft stage. Hence, suggestions from the pilot will be incorporated in finalising the document before its final review and approval by NaCCA to be used in schools.

The EEC Teacher Toolkit provides standards of what learners at the pre-tertiary levels should know and be able to do regarding energy efficiency and conservation in their schools. This

resource material contains participatory problem-solving activities and can be used for Science, Social Studies, English and Mathematics subject deliveries to support uptake of content knowledge and promote behaviour change among learners.

Key Terminologies

Energy - Energy is defined as the ability to produce change or do work. For example, electricity or oil can do work such as producing light and heat.

Sources of energy - The major energy sources we use today are classified into two broad groups, non-renewable and renewable.

Renewable energy – Renewable energy sources are not depleted when used or are naturally replenished within human lifetime. These include biomass, wind, hydropower geothermal and solar power. They are called renewable energy sources because their supplies are replenished in a short time. In the future they could also include the use of ocean thermal, wave, and tidal action technologies.

Non-renewable energy - Non-renewable energy sources are natural resources that cannot be readily replaced by natural means at a quick enough pace to keep up with consumption. These include coal, petroleum, natural gas, propane, and uranium. They are used to generate electricity, to heat our homes, to move our cars, and to manufacture products from candy bars to cell phones.

Energy Efficiency – Energy efficiency is the practice of using less energy (electricity and/or natural gas) to perform the same function at the same level of quality.

Energy Conservation – Energy conservation is achieved by the practice of greater energy efficiency and also by decreasing the types of applications requiring electricity or natural gas to operate. It is also the effort made to reduce the consumption of energy by using less of an energy service. Using less energy for a constant service, like running a refrigerator, is an important aspect of energy conservation.

Fuel – Fuel is any substance that can be burned to produce heat, as well as materials that can be used in a chain reaction to produce heat.

Electricity – Electricity is the flow of electrons from one atom to another.

Energy Star - A designation given to a product or appliance that shows it meets tough government standards for energy efficiency. Products that have earned this designation have a special sticker on them with the ENERGY STAR name.

Hydropower - Also called “hydro energy,” this is electrical energy that comes from fast moving water

Solar energy – Solar energy is generated from the movement of light. Solar energy can be harnessed through photovoltaic cells to generate electricity.

Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Science – Lower Primary			
Basic 1 - 3			
Module 1 and 2: Sources and Forms of Energy	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B1.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B1.4.1.1.1 Understand energy and give examples of its uses
		B1.4.1.2 Show understanding of the concept of heat energy in terms of its importance, effects, sources and transfer from one medium to another	B1.4.1.2.1 Explain the terms hot and cold
	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B1.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms of energy	B1.4.2.1.1 Know the importance of electricity and identify common household appliances that require electricity to work
	Strand 4: Forces of Energy Sub-Strand 1: Sources and Forms of Energy	B2.4.1.1 Demonstrate understanding of the concept of energy, its various forms, sources and the ways in which it can be transformed and conserved	B2.4.1.1.1 Identify everyday applications of energy
	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B3.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B3.4.1.1.1 Know that light is a form of energy
	B3.4.1.2.1 Know heat is a form of energy and identify some sources of heat		
Module 3: Uses of Energy	Strand 4: Forces of Energy Sub-Strand 1: Sources and Forms of Energy	B2.4.1.1 Demonstrate understanding of the concept of energy, its various forms, sources and the ways in which it can be transformed and conserved	B2.4.1.1.1 Identify everyday applications of energy
		B2.4.2.1 Demonstrate knowledge of generation of electricity, its transmission	B2.4.2.1.1 Recognise the importance of safety when using electricity

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
		and transformation into other forms of energy	
Science – Upper Primary			
Basic 4 - 6			
Module 1 and 2: Sources and Forms of Energy	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B4.4.1.1 Demonstrate understanding of the concept of energy, its various forms, sources and how to transform and conserve it	B4.4.1.1.1 Identify the effect of heat on the change of state of substances
	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B5.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B5.4.1.1.1 Explain how energy is transformed from one form to another
	Strand 4: Forces and Energy Sub-Strand 1: Sources and Forms of Energy	B6.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B6.4.1.1.1 Compare renewable and non-renewable sources of energy
Module 3: Uses of Energy	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B4.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms	B4.4.2.1.1 Identify the uses of electricity
Module 4: Energy Efficiency	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B5.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B5.4.1.1.2 Know how to use electricity efficiently in the home
Module 5: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B4.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms	B4.4.2.1.2 Describe ways of conserving electricity
Module 7: Energy Transformation	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B5.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can	B5.4.1.1.1 Explain how energy is transformed from one form to another

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
		be transformed and conserved	
Our World, Our People			
Basic 1 - 3			
Module 1: Sources of Energy	Strand 4: Our Nation Ghana Sub-Strand 3: Responsible Use of Resources	B1.4.3.1. Demonstrate understanding of the importance of energy in our environment.	B1.4.3.1.1. Explore the importance of energy in the home, school and community
Module 5: Energy Conservation	Strand 4: Our Nation Ghana Sub-Strand 3: Responsible Use of Resources	B2.4.3.1. Exhibit knowledge of conserving energy	B2.4.3.1. 1. Describe ways of conserving energy in the home, school and community
		B3.4.3.1. Demonstrate knowledge of responsible use of energy	B3.4.3.1. 1. Explain ways of conserving energy
Creative Arts			
Basic 1 - 3			
Module 5: Energy Conservation	Strand 4: Visual Arts Sub-Strand 3: Thinking and Exploring Ideas	B3 1.1.1 Demonstrate understanding of how to generate own ideas for artistic expressions about the people, based on their history and culture, the environment and topical local/national/global issues	B3 1.1.1.4 Study and talk about visual artwork produced or found in other African communities that reflect topical issues in those areas in Africa
Module 4: Energy Efficiency	Strand 4: Visual Arts Sub-Strand 3: Thinking and Exploring Ideas	B3 1.1.1 Demonstrate understanding of how to generate own ideas for artistic expressions about the people, based on their history and culture, the environment and topical local/national/global issues	B3 1.1.1.4 Study and talk about visual artworks produced or found in other African communities that reflect topical issues in those areas in Africa
English Language (Basic 1 – 6)			
Module 1: Sources of Energy	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10
Module 3: Uses of energy	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10
Module 5: Energy Conservation	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10
	English Primary 6	Reading Topics	Topic 4

Teacher Resources Link to Curriculum

Curriculum Guide	Topic	Module
NEED Primary Info Book Alberta http://www.need.org/ https://www.energy.gov/eere/education/downloads/energy-detectives-3-activities https://www.energystar.gov/buildings/tools-and-resources/k12-energyefficiency-student-toolkit _	Forms of Energy; Light, Heat, Sound, Motion (page 6-17)	Module 2: Forms of Energy
	Sources of Energy (page 18-19)	Module 1: Sources of Energy
	Renewable and Non-Renewable (page 20-70)	Module 6: Renewable and Non-Renewable Energy
	Electrical Safety (page 71-74)	Module 3: Uses of Energy
	Saving Energy (page 75-82)	Module 5: Energy Conservation
Eco-Energy Energy and the Environment Activity Book Canada https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/files/pdf/teachers-guide-v2.pdf	Energy Basics (page 3-6)	Module 1: Sources of Energy
	Lighting and Energy (page 11-12)	Module 7: Energy Transformation
	Energy Efficiency brainstorming (page 14-16)	Module 4: Energy Efficiency
	Renewable Energy (page 21-22)	Module 6: Renewable and Non-Renewable Energy

Web-Links to educative, informative, participatory and interactive EEC resources (references).

S/N	MODULES	INTERACTIVE WEB LINKS
1.	Module 1: Sources of Energy	<ul style="list-style-type: none"> ▪ www.neok12.com - Energy Sources for Kids- Science Games and Videos-NeoK12. ▪ www.pbslearningmedia.org Energy Sources PBS Learning Media ▪
2.	Module 2: Forms of Energy	<ul style="list-style-type: none"> ▪ www.turtlediary.com – Energy Games Interactive Science Games Turtle Diary ▪ www.learnignamesforkids.com Heat Energy Learning Games for Kids ▪ www.e-education.psu.edu Activity: Identifying Forms of Energy. EGEE:102 Energy Conservation and Environmental Protection ▪ www.brainpop.com – Forms of Energy- BrainPOP
3.	Module 3: Uses of Energy	<ul style="list-style-type: none"> ▪ Kids Educ.- Kids Educational Games (YouTube)- Different Sources of Energy, Using Energy Responsibly, Educational Video for Kids -
4.	Module 4: Energy Conservation	<ul style="list-style-type: none"> ▪ www.sciencewiz.com (S.T.E.M Education Solutions)
5.	Module 5: Energy Efficiency	<ul style="list-style-type: none"> ▪ www.energy.gov -Energy Detectives (3 Activities) Department of Energy ▪
6.	Module 6: Renewable Energy Sources	<ul style="list-style-type: none"> ▪ www.alliantenergykids.com Renewable Energy- AE Kids. ▪ www.greenchildmagazine.com Green Child Magazine- (8 Awesome Facts About Renewable Energy)- ▪ www.greenkidcrafts.com Green Kid Crafts- (Green Kid: A Create, Play and Learn TEAM magazine for Kids: Green Energy.) ▪ www.wartgames.com ▪ www.wonderville.org (Free Online Energy Games Using Alternative Energy Sources for Kids- Wonderville ▪ www.generationgenius.com Renewable and Non-renewable Energy Video for Kids
7.	Module 7: Energy Transformation	<ul style="list-style-type: none"> ▪ Turtle-diary- YouTube. Science for Kids: Energy Transformation Video

How to use the Teacher Tool Kit

This document is to serve as a resource guide to teachers in the teaching and learning of EEC at the primary level. It provides standards of what learners at the primary level should know and be able to do regarding energy efficiency and conservation in their schools, homes and communities. This resource material contains participatory problem-solving activities and can be used for Science, Social Studies, Our World, Our People, English and Math subject deliveries to support uptake of content knowledge and promote behaviour change among learners.

Notes to the Teacher:

This is a supplementary guide that should be used to complement energy efficiency and conservation content in the revised curriculum. In using this resource guide, the teacher should take note of the following:

1. The teacher as a facilitator needs to create a conducive learning environment that:
 - helps learners to interact with varied sources of information regarding EEC in a variety of ways;
 - helps learners to identify EEC related problems suitable for investigation through project work;
 - encourages learners to collaborate in learning; and
 - Makes all learners to demonstrate the results of their learning through a product or performance regarding energy efficiency and conservation.
2. The teacher should make use of the resource links that have been provided in this document to gather more materials and organize practical sessions/assignments for the benefit of learners.
3. The lessons should be learner-centred and not teacher-centred.
4. In addition to the practical activities provided in this guide, the teacher is expected to include activities that suit the local school context including the following:
 - i. community research projects on EEC
 - ii. more energy debates
 - iii. video (including YouTube) /film shows/documentaries on energy conservation etc., especially those that reflect conditions and technologies of the realities in Ghana.
5. Given the broad spectrum of conditions in which the children of Ghana live, it is important for teachers to convey a realistic view of the limited energy resources available to the many, as compared to the few. Teachers should help and encourage all children to aspire to creating a future where all live in cleanliness and comfort, conserving resources wisely for the benefit of all.

Module 1: Sources of Energy

1.1 Introduction – What is Energy?

Module one (1) introduces learners at the Primary level to the sources of energy. Energy gives us the ability to do work such as climb a mountain, play soccer, and even think. There are many types of energy: some are stored in our muscles and brain cells, some are used to move around and play, while other types of energy are used to light a street lamp, cook our food, and power televisions, radios and cars.

Energy causes movement - Every time you see something move; energy is being used. A leaf moving in the wind, a pot of boiling water, and a school bus traveling to school are all evidence of energy being used.

1.2 Learning Outcome

Learners understand the various sources of energy including renewable and non-renewable. (Refer to section 1.5 for linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 1: Sources of energy	<ol style="list-style-type: none"> Learners understand the different sources of energy including renewable and non-renewable B1.4.1.1.1 Understand energy and give examples of its uses B1.4.2.1.1 Know the importance of electricity and identify common household appliances that require electricity to work B6.4.1.1.1 Compare renewable and non-renewable sources of energy 	Basic 1 – 3 (Primary 1, 2, 3)	2 - weeks (45-minutes per lesson)	<p>Learners to watch videos and pictures on energy sources and give examples</p> <p>Learners to identify the local names of the various sources of energy</p> <p>Learners to draw and colour some sources of energy including the sun, rivers</p>	<p>Videos and pictures on sources of energy</p> <p>Markers Card boards Crayons</p>	<p>-Learners can state the basic difference between renewable and non-renewable energy sources and name (or draw) an example of each.</p> <p>- Learners can name (or draw) at least 5 sources of energy.</p>

1.3 Key Concepts

What is Energy?

Energy helps us to do work¹. Work is referred to as the movement of mass when a force is applied to it. In simpler terms, work requires energy, and energy spent performs work.

What are renewable sources of energy?

Renewable sources of energy are the resources that are replenished by the environment over relatively short periods of time. Examples of the renewables include *solar energy*, *wind energy*, energy from *water sources*, *biofuels*, *geothermal energy* and others.

What are non-renewable sources of energy?

Non-renewable sources are the resources that are not easily replenished by the environment in a short period of time. This type of energy sources includes oil (petroleum), natural gas, coal, and uranium (nuclear).

- We know energy exists because we can see or feel what it does. Energy moves cars, makes machines run, heats ovens, lights our classrooms, and even takes off roofs. *(Teacher should provide familiar ideas on basic energy resources for easy comprehension of learners and elicit ideas from learners).*
- One form of energy can be changed into another form. When we stand in the sun, light energy is changed into heat. When you turn on a flashlight/torchlight, chemical energy stored in the battery is changed into light and heat.

Notes to the Teacher:

=

- Teacher should get videos or pictures on the basic sources of energy before the class to aid learners to understand energy efficiency concepts better.
- Teacher should assist learners to brainstorm on the basic sources of energy resources.

1.4 Activities

- Brainstorming sessions on the sources of energy
- Invite-Explore and Discover-Create-Games
- Think-Pair-Share Games
- Learner presentations
- Reflection/plenary

¹ Primary energy Infobook by NEED. www.need.org

1.4.1 Activity 1: Sun-Beams

Concept: The primary source of energy is the sun

Goal: Learners will identify ways in which the sun's energy comes to them.

Materials (per student): The following items must be provided by the teacher: scissors, glue, markers, string, yellow circles cut-out, yellow "sunbeams" cut-out. (Use yellow cardstock or yellow paper.)

Note to the Teacher:

The teacher should cut out sunbeams and suns ahead of time.

If these supplies (materials) are lacking, the teacher can cut out circles (sun) and strips (beams) from plain paper. The children can colour them yellow. The white "juice" in the stems of certain plants-like yellow cup flowers- can be used as glue.

Learning and Teaching Strategies

INVITE LEARNERS

1. Learners should begin this activity with a song (possibly related to the sun).

EXPLORE AND DISCOVER

2. Write or draw a picture of the sun on the board. Write the word "Energy" in it and ask: What kinds of energy do we get from the sun?
3. Write the responses of learners on the board. It's important to accept all reasonable examples of energy. The idea is for children to see that the sun is the primary source for a lot of secondary energy sources (i.e., food, wood, coal, oil, gas, light, plants, trees, heat, wind). You may need to explain some of the less obvious connections between their energy example and the sun.

CREATE – Learner Activities

4. Learners write "Energy" on their suns. You can also have learners design their own suns.
5. Give each learner 7-8 "sunbeams"
6. Learners write examples of the secondary energy sources (from the board) on each sunbeam.
7. Glue the beams around the edge of the circle.
8. Punch a tiny hole in the sun, insert a piece of string, and hang it from the ceiling or attach the sun to a bulletin board.

EXPLAIN AND TAKE ACTION

9. Have learners share their “drawings” with others in the class. Look for unique or common examples of energy from the sun².

Sub-activities: these could be given to learners as take-home assignments and presented in class.

1. Draw and colour a windmill
2. Draw and colour solar panel
3. Draw and colour a pile of charcoal near a coal-pot

1.4.2 Activity 2: Matching Energy Pictures with Words¹

GOAL: Learners will match pictures of energy sources with energy words.

Materials: crayons, coloured pencils, a copy of “Energy Classification” (below)

Teaching Strategies:

INVITE LEARNERS

1. Review with learners the different kinds of energy. Be sure they understand the distinction between renewable and non-renewable energy.

EXPLORE AND DISCOVER

2. Give each learner a copy of “Energy Classification” below. Ask them to identify the word on the sheet with its matching energy picture.

CREATE

3. Colour the pictures of those energy sources matched.
4. Have learners do ALL OF THE ABOVE using coloured pencils or crayons. (Refer to annex I for activity worksheet on ‘Sun Circle’).

² Activity worksheet (Sun circle) is found in the annex

ENERGY CLASSIFICATION

Directions: Choose a word from the list below and copy it under the picture it matches.

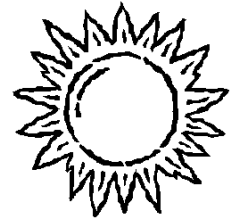
Word List: **WOOD** **FOOD** **COAL** **OIL** **WATER**
SUN **GASOLINE** **WIND**



A. _____



B. _____



C. _____



D. _____



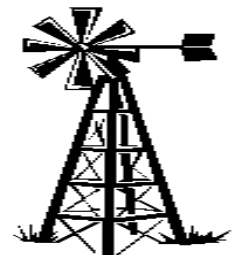
E. _____



F. _____



G. _____



H. _____

1.4.3 Activity 3: Group work on how energy is or could be of benefit to learners in the classroom, at the school level in general, and their homes.

Goal: This activity aims to enable learners to think ‘outside the box’ with regards to how beneficial energy is to their study life.

Materials: Crayons, coloured pencils

Teaching Strategies:

INVITE LEARNERS

1. Put learners into groups of 4 or more depending on the class size (consider gender and intellectual ability in forming the groupings...)

EXPLORE. DISCOVER

2. Ask each group to come up with at least 5 benefits each of energy sources to the school and to their homes.

CREATE

3. Each group should be given the opportunity to present their work to the entire class.
4. The various group presentations should trigger class discussions on what happens if learners/people do not have access to energy at home or in school.

1.5 Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators	
Science – Lower Primary				
Basic 1 – 3				
Module 1: Sources of Energy	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy Replenished	B1.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B1.4.1.1.1 Understand energy and give examples of its uses	
		B1.4.1.2 Show understanding of the concept of heat energy in terms of its importance, effects, sources and transfer from one medium to another	B1.4.1.2.1 Explain the terms hot and cold	
	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B1.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms of energy	B1.4.2.1.1 Know the importance of electricity and identify common household appliances that require electricity to work	
	Strand 4: Forces of Energy Sub-Strand 1: Sources and Forms of Energy	B2.4.1.1 Demonstrate understanding of the concept of energy, its various forms, sources and the ways in which it can be transformed and conserved	B2.4.1.1.1 Identify everyday applications of energy	
	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B3.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B3.4.1.1.1 Know that light is a form of energy	
			B3.4.1.2.1 Know heat is a form of energy and identify some sources of heat	
	Science – Upper Primary			
	Basic 4 - 6			
Module 1: Sources of	Strand 4: Forces and Energy	B4.4.1.1 Demonstrate understanding of the	B4.4.1.1.1 Identify the effect of heat on the change of state of	

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Energy	Sub-Strand 1: Sources and forms of Energy	concept of energy, its various forms, sources and how to transform and conserve it	substances
	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B5.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B5.4.1.1.1 Explain how energy is transformed from one form to another
	Strand 4: Forces and Energy Sub-Strand 1: Sources and Forms of Energy	B6.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B6.4.1.1.1 Compare renewable and non-renewable sources of energy
Our World, Our People			
Basic 1 - 3			
Module 1: Sources of Energy	Strand 4: Our Nation Ghana Sub-Strand 3: Responsible Use of Resources	B1.4.3.1. Demonstrate understanding of the importance of energy in our environment.	B1.4.3.1.1. Explore the importance of energy in the home, school and community
English Language (Basic 1 – 6)			
Module 1: Sources of Energy	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10

1.6 Web-Links to educative, informative, participatory and interactive EEC resources (references).

S/N	MODULES	INTERACTIVE WEB LINKS
I.	Module 1: Sources of Energy	<ul style="list-style-type: none">▪ www.neok12.com - Energy Sources for Kids- Science Games and Videos-NeoK12.▪ www.pbslearningmedia.org Energy Sources PBS Learning Media

Module 2: Forms of Energy

2.1 Introduction

Module Two (2) introduces learners to the various forms of energy around us. Energy can be found in many things and can take different forms. For example, kinetic energy is the energy of motion, and potential energy is energy due to an object's position or structure. Energy is never lost, but it can be converted from one form to another.

2.2 Learning Outcome

Learners are expected to: define, identify, explore and learn about different forms of energy and to relate specific energy types to different things. (Refer to section 2.5 for linkages to the New Curriculum).

= Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 2: Forms of energy	<ol style="list-style-type: none"> Learners explore different forms of energy B1.4.1.1.1 Understand energy and give examples of its uses B3.4.1.1.1 Know that light is a form of energy B3.4.1.2.1 Know heat as a form of energy and identify some sources of heat B4.4.1.1.1 Identify the effect of heat on the change of state of substances 	Basic 1 – 3	2- lesson periods (50- minutes each)	<p>Show and tell activity-</p> <p>Show pictures of the different forms of energy resources to learners.</p> <p>Learners draw and colour some forms of potential and kinetic energy</p>	<p>Videos and pictures on forms of energy,</p> <p>markers, cardboard, crayons, construction paper,</p> <p>poster on forms of energy.</p>	Learners can name the different forms of energy and state (or draw) an example of each.

2.3 Key Concepts

Forms of Energy

Many forms of energy exist, but they all fall into two basic categories:

- Potential energy
- Kinetic energy

a. Potential energy

Potential energy is stored energy and the energy of position. For example, energy can be stored in a battery, and there is potential energy provided by a slanted surface.

b. Kinetic energy

Kinetic energy is the energy possessed by a body in motion, for example, the movement of waves, electrons, atoms, molecules, substances, and objects (*See annex for chart on energy forms*).

2.4 Activities

2.4.1 Activity I: Creating an energy-picture collection

Goal: Learners will create an energy-picture collection that classifies different forms of energy.

Materials: Scissors, markers, glue, construction paper, poster on forms of energy, and any magazines or other print media with pictures (newspapers, advertisements, labels, packaging, old calendars, etc.)

Notes to the Teacher – Teacher to define/explain basic concepts:

This lesson can be completed over one or two 30-minute lesson-periods depending on the time you give learners for each activity. During this lesson, learners will work in groups to sort pictures according to different forms of energy. After sorting the pictures, the teacher and learners will come together to discuss and define the different forms of energy and which category of energy (kinetic or potential) each picture can be placed under. Then have them create more categories (such as renewable and non-renewable) and re-sort the pictures.

Teaching and Learning Strategies:

INVITE LEARNERS

1. The teacher should review the different kinds of energy that come from the sun using the learners' "sunbeams".
2. Review the main terms introduced in this activity: energy, form, source, renewable and non-renewable.

EXPLORE AND DISCOVER

3. Show learners a poster of forms of energy (see annex). Explain that these are *forms of energy*.
4. Tell learners that these forms of energy can change from one to another. Illustrate this by having learners rub their hands together really fast (motion changes to heat).

CREATE

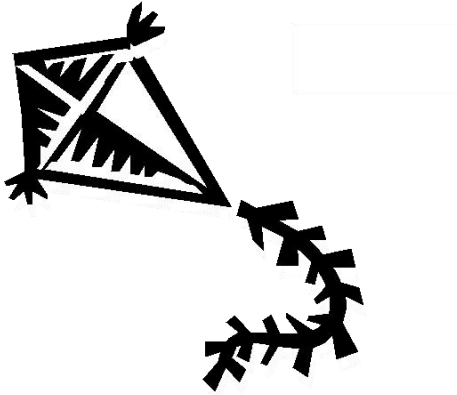
5. Have learners cut out pictures from any printed papers which illustrate the different forms of energy. Encourage them to look for some unusual examples.
6. Give each learner a piece of construction paper and a marker. Have learners work in small groups to share ideas.
7. Have learners create their own classification system using their cut-out pictures glued onto construction paper. Learners can classify pictures by form, source, renewable, non-renewable, electrical, heat, light, mechanical, sound, etc. Use markers to make connections, add vocabulary, organize the collage, etc.

OR

Learners could make a class collage by cutting out pictures and gluing them on large papers that are labelled and taped to a chalkboard using the frame below:

WORK SHEET I: WHERE DOES IT GET ITS ENERGY?

Kite



.....

Lamp



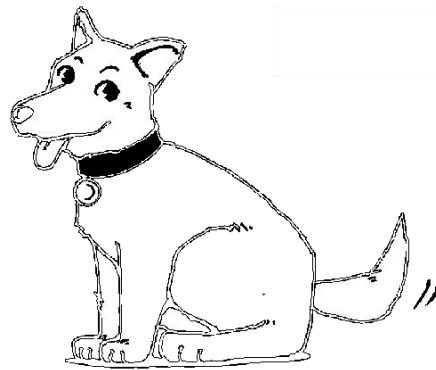
.....

Car



.....

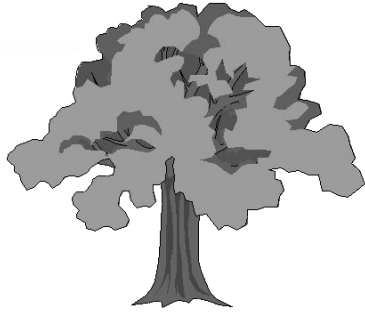
Dog



.....

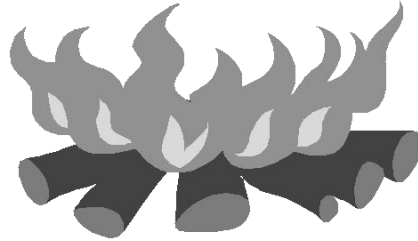
WHERE DOES IT GET ITS ENERGY?

Tree



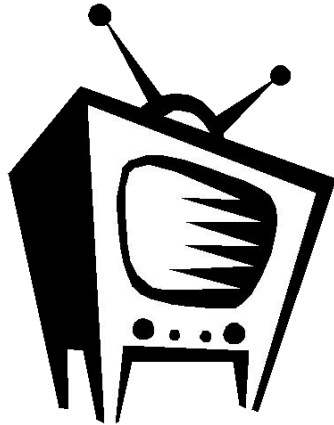
.....

Fire



.....

Television



.....

Sailboat



.....

WHERE DOES IT GET ITS ENERGY?

Directions: Cut out the energy words and paste them below the pictures they match.

Gasoline	Sun
Wind	Electricity
Wind	Food
Electricity	Wood

2.5 Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Science – Lower Primary			
Basic 1 - 3			
Module 2: Forms of Energy	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B1.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B1.4.1.1.1 Understand energy and give examples of its uses
		B1.4.1.2 Show understanding of the concept of heat energy in terms of its importance, effects, sources and transfer from one medium to another	B1.4.1.2.1 Explain the terms hot and cold
	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B3.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B3.4.1.1.1 Know that light is a form of energy
			B3.4.1.2.1 Know heat as a form of energy and identify some sources of heat
Science – Upper Primary			
Basic 4 - 6			
Module 2: Forms of Energy	Strand 4: Forces and Energy Sub-Strand 1: Sources and forms of Energy	B4.4.1.1 Demonstrate understanding of the concept of energy, its various forms, sources and how to transform and conserve it	B4.4.1.1.1 Identify the effect of heat on the change of state of substances
	Strand 4: Forces and Energy Sub-Strand 1: Sources and Forms of Energy	B6.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B6.4.1.1.1 Compare renewable and non-renewable sources of energy
English Language (Basic 1 – 6)			
Module 2: Forms of Energy	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10

2.6 Web-Links to educative, informative, participatory and interactive EEC resources (references).

S/N	MODULES	INTERACTIVE WEB LINKS
1.	Module 2: Forms of Energy	<ul style="list-style-type: none">▪ www.turtlediary.com – Energy Games Interactive Science Games Turtle Diary▪ www.learnignamesforkids.com Heat Energy Learning Games for Kids▪ www.e-education.psu.edu Activity: Identifying Forms of Energy. EGEE:102 Energy Conservation and Environmental Protection▪ www.brianpop.com – Forms of Energy- BrainPOP

Module 3: Uses of Energy

3.1 Introduction

Energy usage varies by form and location, and it is determined by the weather, technology, economic status and so forth. The rate of energy usage has an effect on the environment, especially on renewable energy sources. It is necessary to identify the various ways in which energy is exhausted to help know the level of consumption. The purpose of this module is to refresh the minds of learners on the uses of energy and its importance and how much we waste without thinking about it. At the end of this, learners should demonstrate conservation-consciousness while using energy for various activities.

3.2 Learning Outcomes

- Learners are to understand and appreciate the various uses of different forms of energy in human endeavours.
- Learners should be able to identify uses of energy resources at home and school.

(Refer to section_3.5 for linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 3: Uses of energy	1. Learners explore different uses of energy 2. B2.4.1.1.1 Identify everyday applications of energy 3. B2.4.2.1.1 Recognise the importance of safety when using electricity 4. B4.4.2.1.1 Identify the uses of electricity	Basic 4-6	2-lesson periods (45-minutes each)	Show and tell activity- Teacher shows pictures of the different uses of energy resources to learners. Learners to create poster on different uses of energy	Videos on uses of energy. markers cardboard crayons poster on uses of energy.	Learners can name several types of energy used at school and at home

3.3 Key Concepts

1. There are various uses of different forms of energy in our lives (including heat, light, electricity, sound and mechanics) related to directly meeting human needs.
2. There are different ways individuals and groups utilize energy to meet their needs and wants in different ways.
3. Decisions concerning the use of energy resources are made at many levels.
4. Human demand for energy is increasing the world over.
5. There are processes and devices for measuring and metering energy consumption.
6. Social and technological innovation affects the amount of energy used by human society.
7. There are gender issues related to energy production, supply and usage.

Note to the Teacher:

A number of activities have been provided to stimulate knowledge on the various uses of energy across different sectors. The teacher is encouraged to relate these activities to the local context of the school and should use local examples. The teacher could also come up with different activities that will better suit the understanding of the learners.

3.4 Activities

3.4.1 Activity 1: Energy Uses/Limits

Goal: Learners will create a poster illustrating an energy-using device, its purpose, and safety rules to follow when using it.

Materials: The items listed in bold type must be supplied by the teacher. Butcher paper (**about 2' X 3' piece per learner**), **crayons, markers, experiment chart, and assessment rubric**. (Learners can also bring materials from home to build an "appliance").

Learning and Teaching Strategies

INVITE LEARNER

1. Ask learners: What appliances save us time by:
 - Cooling us on a hot day?
 - Cooking our food
 - Washing dishes?
 - Washing clothes?
 - Getting us to the school?
 - Helping us to read?

2. Then ask: What are some safety rules to remember when using these appliances?
3. Be sure learners see that using energy can save us time and make us more comfortable but that there are safety rules to remember.
4. In groups, distribute the experiment chart to learners so that they can observe and note their observations

Have learners mention the steps in the scientific process.

EXPLORE AND DISCOVER

5. Put learners into groups of four. Hand out pieces of paper. Learners can use markers.
6. Present learners with a problem: (choose one of these or make up one of your own)
7. Task learners to design an imaginary time-saving appliance that can do the dishes, dry and put them away/ design an imaginary time-saving appliance that can sweep your compound/ design an imaginary time-saving appliance that can make your bed / design an imaginary time-saving appliance that can play a drum, score a goal in football, etc. / design an imaginary time-saving appliance that can transport you anywhere.

Note to the Teacher: The only rule is that this imaginary time-saving appliance must use some kind of energy. Include at least 3 safety rules to follow when using this imaginary appliance.

8. Hand out and review the rubric with learners.

CREATE

9. Each learner's picture must fill up the available space and should include the name for their appliance, the type of energy that is used, an explanation of what the appliance does, and how it saves time, and at least three safety rules.

EXPLAIN AND TAKE ACTION

10. Have learners show their posters to the rest of the class and explain what the appliance is, how it saves time (or increases comfort), what kind of energy it uses, and which safety rules to follow.

3.5 Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Science – Lower Primary			
Basic 1 - 3			
Module 3: Uses of Energy	Strand 4: Forces of Energy Sub-Strand 1: Sources and Forms of Energy	B2.4.1.1 Demonstrate understanding of the concept of energy, its various forms, sources and the ways in which it can be transformed and conserved	B2.4.1.1.1 Identify everyday applications of energy
		B2.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms of energy	B2.4.2.1.1 Recognise the importance of safety when using electricity
Science – Upper Primary			
Basic 4 - 6			
Module 3: Uses of Energy	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B4.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms	B4.4.2.1.1 Identify the uses of electricity
English Language (Basic 1 – 6)			
Module 3: Uses of energy	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10

3.6 Web-Links to educative, informative, participatory and interactive EEC resources (references).

S/N	MODULES	INTERACTIVE WEB LINKS
1.	Module 3: Uses of Energy	<ul style="list-style-type: none"> ▪ Kids Educ.- Kids Educational Games (YouTube)- Different Sources of Energy, Using Energy Responsibly, Educational Video for Kids -

Module 4: Energy Efficiency

4.1 Introduction

This module introduces learners to the best ways of using energy through technology and the use of energy-efficient appliances. Energy efficiency is the use of technology that requires less energy to perform the same function. For example, a compact fluorescent light bulb uses less energy to produce the same amount of light as an incandescent light bulb. The florescent bulb is *energy efficient*. As individuals, our energy choices and actions can result in a significant reduction in the amount of energy used in each sector of the economy. Careless use of energy can degrade or destroy our environment. Thus, it is important to manage our energy consumption.

4.2 Learning Outcomes

Learners are to:

- Demonstrate broad knowledge about energy efficiency in their everyday lives
- Describe the energy saving requirements of using electrical appliances
- Develop critical thinking and problem-solving skills, communication and collaboration, creativity and innovation, and leadership and personal development, as well as skills in reading, writing, researching, public speaking, and the arts (Core skills).

(Please refer to section 4.5 for details of linkages to the new curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 4: Energy Efficiency	<ol style="list-style-type: none"> 1. To inculcate in learners the habit of using energy efficiently 2. B3 I.I.I.4 Study and talk about visual artworks produced or found in other African communities that reflect topical issues in those areas in Africa 	Basic 1-3	2-lesson periods (50-minutes each)	<p>Watch videos, or show pictures/posters on efficient uses of energy and on energy efficient appliances</p> <p>Learners come up with ways of using energy efficiently in their schools and homes</p>	<p>markers card board crayons poster energy-efficient appliances</p>	<p>Demonstrate improved behaviour/attitudinal changes toward energy use by turning off fans, lights, battery-operated devices, etc. when not needed</p>

4.3 Key Concepts

- **Energy efficiency** means using energy as wisely as possible. Sometimes this means using less energy to do the same job. For example, an energy efficient light bulb gives off the same amount of light but uses less electricity than traditional bulbs. It uses less energy to do the same job. Also, if you feel hot, you can open doors and windows and use a paper fan instead of turning on an electric fan.
- Energy efficiency involves the use of technology that requires less energy to perform the same function. Energy conservation includes any behaviour that results in the use of less energy. For instance, an LED (light-emitting diode) bulb that uses much less energy to produce the same amount of light as an older incandescent bulb is an example of an efficient way of using energy.

Note to the Teacher:

- Before this activity begins, the teacher should explain these key issues/concepts to learners in a way they can understand and also encourage learners to brainstorm to examples and related ideas of their own. This will prepare them to complete the activity with greater creativity and retention.
- The activities should be adapted to suit learners with any form of learning disability. For example, audios could be used for learners with hearing impairment etc.

4.4 Activities

4.4.1 Activity 1: Energy Saving Brochure

Learners will make a simple brochure for customers of an electrical shop showing the devices customers can buy and the actions customers can do in order to save energy in their homes.

Steps:

- Learners fold a piece of paper into 3-parts to create a trifold brochure. Design a colourful, inviting front cover (refer to image below)
 - Inside, plan to create these three sections:
1. Draw three energy saving products, or technologies, customers can buy from a store to reduce energy usage at home. Include a brief explanation and reasonable price for each.
 2. Describe three actions customers can adopt to help save energy in general.
 3. Describe three ways to specifically use less electricity at home.

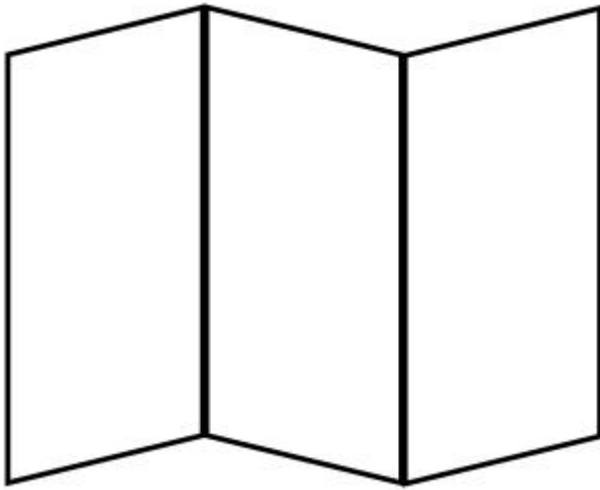


Figure 1: Illustration of how to fold the paper to create a brochure

4.4.2 Activity 2: Drawing and Role Play in group

1. Draw ways of saving energy on a sheet of paper or cardboard and colour it.
2. Make up a fun song to describe ways of saving energy.

4.5 Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Creative Arts			
Basic 1 - 3			
Module 4: Energy Efficiency	Strand 4: Visual Arts Sub-Strand 3: Thinking and Exploring Ideas	B3 1.1.1 Demonstrate understanding of how to generate own ideas for artistic expressions about the people, based on their history and culture, the environment and topical local/national/global issues	B3 1.1.1.4 Study and talk about visual artworks produced or found in other African communities that reflect topical issues in those areas in Africa

4.6 Web-Links to educative, informative, participatory and interactive EEC resources (references):

S/N	MODULES	INTERACTIVE WEB LINK
1.	Module 4: Energy Efficiency	<ul style="list-style-type: none"> ▪ www.energy.gov - Energy Detectives (3 Activities) Department of Energy

Module 5: Energy Conservation

5.1 Introduction

Module five (5) introduces learners to what energy conservation is, key concepts, and ways of conserving energy. Human demand for energy is increasing, and one way to manage energy resources is through conservation. The earth has limited energy resources, and social and technological innovation affects the amount of energy used by human society. Everyone’s help is needed to save energy and not waste it. Conserving energy resources today saves them for use tomorrow.

5.2 Learning Outcomes

- Learners identify and demonstrate ways of conserving energy
- Learners know the value of saving energy

(Please refer to section 5.5 for details of linkages to the New Curriculum)

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 5: Energy Conservation	1. To inculcate in learners the habit of conserving energy 2. B4.4.2.1.2 Describe ways of conserving electricity 3. B2.4.3.1. 1. Describe ways of conserving energy in the home, school and community 4. B3.4.3.1. 1. Explain ways of conserving energy	Basic 4 – 6	2- lesson periods (50- minutes each)	Learners use games to learn about various ways of conserving energy	YouTube videos, Pictures Markers Card boards Crayons	Learners can name ways to conserve energy use in their local environment. For example, in the city: use cross-ventilation of rooms instead of electric fans. In rural areas: make solar-design cook stoves of recycled materials instead of chopping down branches or trees to make charcoal

5.3 Key Concepts

- There are ways of saving/conserving energy at home, school, and in the community.
- Social and technological innovation affects the amount of energy used by human society
- Behaviour and design affect the amount of energy used by human society

Note to the Teacher:

Before the lesson starts, the teacher should lead learners in discussing and brainstorming about what energy conservation is and the various benefits in conserving energy. The discussions should be guided using local and familiar contexts.

5.4 Activities

5.4.1 Activity 1: Saving Energy

Materials: Marker, large piece of cardboard or paper, drinking straws and tape (optional), "Savers or Wasters?" chart and "Energy Use at Our Home" sheet (1 per learner). Both of these are printed below; "I Save Energy" Badge -one per learners - (teacher can make these - optional), Assessment Rubric (See Annex, Module 7).

Learning and Teaching Strategies

INVITE LEARNERS

1. Ask learners to come up with ways to save energy.
2. Ask Learners to come up with some ways to make batteries and candles last longer. Ask, "WHY is it important to make them last longer?"

EXPLORE AND DISCOVER

3. Learners read each statement on the 'savers' and 'wasters' sheet and decide whether the statement is an energy saver (mark the blank with an **S**) or an energy waster (mark the blank with a **W**).

CREATE

4. Assign learners to work groups of about four. Give each learner a piece of card board (or paper) and a marker. Have them come up with a list of ways to save energy. You can make this a game where one child comes up with an energy-saving idea, writes it down, and then passes the marker to the person on their left and that child comes up with a different energy-saving idea. Move clockwise around the group until each child has at least four ideas. (Learners should come up with ideas of their own, not copy others' ideas).

EXPLAIN AND TAKE ACTION

5. Have learners share their lists with the class.

6. Distribute “Energy Use at Our Home” sheet below. Explain that learners are to take this sheet home and with the help of a parent, draw, name or explain the objects that use energy in each place. Colour the box representing the place that has the most energy-using objects. Challenge them to explain what energy forms are used, i.e., electricity, heat energy, chemical (natural gas), etc.
7. When learners return to the class the next day, put a classroom bar chart on the board (or use a large piece of paper). Have each learner create the graph by colouring in only one appropriate block. For example, data for eleven children might look like the chart below. The twelfth learner, whose cooking-area is the highest energy user at home, would take a marker and colour in the block above “cooking area” and next to “6”.

Which Room Uses the Most Energy at Your House?

7				
6				
5				
4				
3				
2				
1				
# Of learners	Cooking area (kitchen)	Sleeping area (bedroom(s))	(bathing area and latrine (bathroom))	Common area/compound (living room)

8. Discuss the chart so that learners can see patterns in the data they created.
 - a. Ask why a particular place was the greatest energy-user.
 - b. Ask about ways to save on some of the energy used in this place.
 - c. How can they save on the energy used in all the places?
 - d. What form of energy is used the most? (electricity/batteries? fuels?)
 - e. Why do we need to save energy? How much of the energy used in renewable?
9. Use this exercise as a task assessment to be sure that learners understand ways to save energy and why it’s important NOT to waste it.

FOLLOW UP

10. Ask learners to explain why their parents put off lights or extinguish kerosene lamps.
11. Have learners make posters using their best energy-saving ideas.
12. Teacher can create “I Save Energy” Badge as an award for each learner after they have successfully followed their energy-saving tips (either at home or at school).
 - a. Get parents involved.
 - b. Learners can write on the back of the badge how they saved energy.
 - c. Have learners tape the badge to a drinking straw and share with the rest of the class, i.e., a play or skit.

This activity can be used simultaneously as an Assessment (see Module 7 chart in Annex. However, you may find it more useful to conduct your own assessment.

Develop some poems or songs on how people can save energy at home or at the school.

WORKSHEET 1: SAVERS OR WASTERS?

Directions: Mark each sentence with an “S” if it SAVES ENERGY.

Mark each sentence with a “W” if it WASTES ENERGY.

- _____ 1. I open the windows instead of switching the fan on to keep the room cool.
- _____ 2. I leave the phone charger plugged in the socket after the phone is charged
- _____ 3. I turn off the TV when nobody is watching.
- _____ 4. I close the outside door on a warm day when an air conditioner is turned on.
- _____ 5. I stand in front of an open refrigerator while I decide what to eat.
- _____ 6. I stand in front of an open refrigerator while I decide what to eat.
- _____ 7. My parents always use firewood for cooking.
- _____ 8. Some people in this community produce charcoal by burning wood from the forest.

NAME OF LEARNER: _____

WORKSHEET 2: ENERGY USE AT OUR HOUSE

To the parent: Your child is participating in a class project that involves ways to save energy at home. Please assist your child in completing the chart below.

Directions: While at home, go into each of the places listed below. Look for items that USE ENERGY (electricity, natural gas, solar, batteries, motion (like a ticking clock, kerosene, candles, charcoal, etc.) Draw, name, or explain the objects in the blanks. Remember to take this paper back to school with you.

COOKING AREA (kitchen)	SLEEPING AREA (bedroom/s)
BATHING AREA AND LATRINE (bathroom)	COMMON AREA(S)/COM POUND (living room)

5.5 Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Science – Upper Primary			
Basic 4 - 6			
Module 5: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B4.4.2.1 Demonstrate knowledge of generation of electricity, its transmission and transformation into other forms	B4.4.2.1.2 Describe ways of conserving electricity
Our World, Our People			
Basic 1 - 3			
Module 5: Energy Conservation	Strand 4: Our Nation Ghana	B2.4.3.1. Exhibit knowledge of conserving energy	B2.4.3.1. 1. Describe ways of conserving energy in the home, school and community
	Sub-Strand 3: Responsible Use of Resources	B3.4.3.1. Demonstrate knowledge of responsible use of energy	B3.4.3.1. 1. Explain ways of conserving energy
English Language (Basic 1 – 6)			
Module 5: Energy Conservation	English Lower Primary	Reading Topics	Topic 10
	English Upper Primary	Reading Topics	Topic 10
	English Primary 6	Reading Topics	Topic 4

5.6 Web-Links to educative, informative, participatory and interactive EEC resources (references).

S/N	MODULES	INTERACTIVE WEB LINKS
I.	Module 5: Energy Conservation	<ul style="list-style-type: none"> ▪ www.sciencewiz.com (S.T.E.M Education Solutions)

Module 6: Renewable Energy Sources

6.1 Introduction

Module Six (6) introduces learners to various renewable sources of energy. Energy is an essential part of our daily lives, but the resources that power the Earth are being threatened. In this lesson, learners learn about renewable resources. Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly reproducing themselves. The key source of renewable energy is the sun; energy harnessed directly from the sun is called ‘solar energy’.

6.2 Learning Outcomes

Learners to:

1. differentiate between renewable and non-renewable resources.
2. classify resources as renewable or non-renewable.

(Please refer to section 6.5 for details on interactive links)

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 6: Renewable Energy Sources	I. To help learners know about renewable sources of energy as the new trend in energy sources.	Basic 4-6	2-lesson periods (50-minutes each)	learners watch videos and/ or pictures/posters showing various renewable sources of energy – including the ones not yet in use in Ghana Learners to search online for different renewable sources of energy	Videos and pictures on renewable energy, Markers, Cardboard Poster on renewable sources of energy.	Learners can explain the basic difference between renewable and non-renewable energy sources and give examples of local use of these.

6.3 Key Concepts

- Sustainable energy choices have impacts on humans and their environment

- There are potential renewable energy sources in various places in Ghana

Note to the Teacher:

A number of activities have been provided to stimulate knowledge on renewable energy sources. The teacher is encouraged to relate these activities to the local context of the school and should use local examples. The teacher can also come up with different activities that would better suit the understanding of the learners. Learners must also be introduced to renewable sources of energy that are currently available in Ghana.

6.4 Activities

6.4.1 Activity I: Energy Classification

Materials and preparation

- Board Markers
- Mix and Match Worksheet
- Non-Renewable vs. Renewable Energy Worksheet
- Notebooks
- Lined Paper
- Coloured Pencils

Learning and Teaching Strategies

INVITE LEARNERS

1. Begin the lesson by asking a learner to switch off the light in the classroom (*if there is a light in the classroom*), if there is no light, either close the eyes or the windows. Explain that in a world without energy, many of the things we depend on every day—including lights, cars, and phones—would not exist.
2. Learners brainstorm in pairs about what the word energy means. After the brainstorming session, learners should present their definitions to the class.
3. Learners further brainstorm, discuss and present to the class the term *renewable* energy. Explain that renewable refers to something that can be replaced.
4. Ask for a volunteer to tell you what the word non-renewable means, based on the use of the prefix ‘non’. If no one correctly defines it, explain that non-renewable refers to something that can’t be replaced.

EXPLORE AND DISCOVER

5. Pass out a copy of the renewable versus non-renewable worksheet to each learner (see *Annex on Module 6*).
6. Review the worksheet together, asking why each example is renewable or non-renewable. Encourage your class to come up with their *own* reasons as to why each source of energy is renewable or non-renewable.
7. Once learners have shared their input, explain to the class why each type of energy is classified.

For example: Solar energy is renewable since it comes from the sun. The sun provides energy every day for all living things, and it is inexhaustible. Petroleum is non-renewable, since there is a limited supply of it left on Earth. We use a lot of wood and charcoal in preparing meals in our homes etc.

CREATE

8. Pair off learners, either assigning each a partner or asking them to find a partner to work with.
9. Assign each pair the Natural Resources 'Match and Mix worksheet' (see *Annex, Module 6*) to complete together. Review instructions for the worksheet together.
10. Independent working time (30 minutes): Ask your pairs to complete the Renewable Energy worksheet independently of the other pairs. Walk around the class to answer questions and guide learners toward the answers they're looking for through use of examples.
11. Once everyone has finished, review the worksheet as a class.

DIFFERENTIATION

Enrichment: Ask your learners to think of ten actions they do every day that require either renewable or non-renewable energy. Have them write three complete sentences for each action. The first sentence should describe the action. The second sentence should describe the resources required to complete the action. The third sentence should state whether the energy used is renewable or non-renewable. An example could be drinking water as the action, water as the resource required and renewable as the type of energy required. Explain to your learners that some actions may require both types of energy.

Review the renewable versus non-renewable worksheet. Ask the learners to think of some other examples of renewable and non-renewable resources. Ask your learners to draw two columns in their books or on a sheet of paper, and label the columns *renewable* and *non-renewable*. Ask your learners to write the examples you discussed in the appropriate column.

ASSESSMENT

Give each learner a piece of paper divided horizontally into two sections: *Write* and *Draw*.

Instruct them to show what they have learned about renewable and non-renewable energy sources, by writing in the top section and drawing examples in the bottom section.

Reflection

Ask learners to share ways they use renewable energy every day. Great answers include, drinking water, pumping water and riding a bicycle.

Invite the class to share ways they use non-renewable energy each day. Great answers include riding in a car, reading with a kerosene lamp, using a battery-operated toy or radio.

6.5 Web-Links to educative, informative, participatory and interactive EEC resources (references).

S/N	MODULES	INTERACTIVE WEB LINKS
I.	Module 6: Renewable Energy Sources	<ul style="list-style-type: none"> ▪ www.alliantenergykids.com Renewable Energy- AE Kids. ▪ www.greenchildmagazine.com Green Child Magazine- (8 Awesome Facts About Renewable Energy)- ▪ www.greenkidcrafts.com Green Kid Crafts- (Green Kid A Create, Play and Learn TEAM magazine for Kids: Green Energy.) ▪ www.wartgames.com ▪ www.wonderville.org (Free Online Energy Games Using Alternative Energy Sources for Kids- Wonderville ▪ www.generationgenius.com Renewable and Non-renewable Energy Video for Kids

Module 7: Energy Transformation

7.1 Introduction

This module introduces learners to the various processes through which one form of energy changes to another. Energy transformation is the change of energy from one form to another. Energy transformations occur everywhere every second of the day.

7.2 Learning Outcomes

Learners understand the different processes of energy change and transformation.

(Teachers to refer to section 7.5 for detailed linkages to the New Curriculum)

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 7: Energy Transformation	<ol style="list-style-type: none"> Learners to know about how energy is transformed from one form to another B5.4.1.1.1 Explain how energy is transformed from one form to another) 	Basic 4 – 6	2-lesson periods (50-minutes each)	Games- Learners to use g games to depict the various processes of energy change and transformation	Videos Markers Card boards	Learners can explain that energy can change form and give at least two examples.

7.3 Key Concepts

- There are various processes used to transform energy for human purposes.
- Energy production, supply, demand and usage varies in different countries.
- There are environmental impacts and challenges related to energy production, supply and usage (e.g. climate change, grey energy)

7.4 Activities

7.4.1 Activity I: Energy Conversion

Concept: Energy occurs in many forms, and one energy form can be changed into another energy form.

Goal: Learners will complete a chart of energy conversion examples.

Materials: Energy Transformation Worksheet, Assessment Rubric.

Learning and Teaching Strategies

INVITE LEARNERS

1. Tell your learners you are going to perform a magic trick. Turn off the lights in the classroom (*where possible*) Then turn them on. Ta da! The magic trick you have just performed was changing electricity into light. Strike a match. You just performed another trick --chemical energy into light energy and heat energy! (take care to place the match in water)

Note to the Teacher: In communities without access to electricity in the classroom, teacher could use a flash light or rechargeable lamp to demonstrate the transformation of energy from one form to the other.

EXPLORE AND DISCOVER

2. Have a learner run around his/her seat two or three times. They just performed a change process in energy by changing chemical energy (digesting what they had for breakfast) into mechanical or motion energy

OR

Use a rubber band to shoot a small paper ball across the room. Ask the learners where the energy came from (your muscles-powered by food and the stored-energy in the elastic. Together they transformed into the sudden motion of the paper ball.

CREATE

3. Work in groups of two or three. Older children can work independently. Give learners a copy of "Worksheet 7" (see below) and be sure they have a pencil. Explain the directions.

EXPLAIN AND TAKE ACTION

5. Depending on your rubric for assessment, you can have learners present their examples to the class and explain them; or you can have the class classify each learner's example as to whether it uses renewable or non-renewable energy sources. Alternately, you can expand the idea and have them design an imaginary device that converts one form of energy into another.

Remember that these assessment-tasks serve as guidelines only. You may wish to alter the task to suit the needs of your learners.

Name _____

Work Sheet I

Directions: The word on the left names one form of energy. Next to it, write in another form of energy. Then, draw or name an object that would change the first form of energy into the second form. If one doesn't come to mind, invent one. Explain what this new object does. (Include a safety rule!)

I. ELECTRICAL ENERGY changes into _____ ENERGY.

EXAMPLE:

SAFETY RULE:

I. RADIANT (LIGHT) energy changes into _____ ENERGY.

EXAMPLE:

SAFETY RULE:

Rubric for Task Assessments

Fun with the Sun

General Scale for Scoring Learner Performance

Score	Description
5	Beyond expectations – quality of work is usually high and beyond expectation
4	Meets expectation-skill is mastered to the level of expectation
3	Almost there—skill is almost mastered but with minor problems
2	The skill is present but with errors and omissions
1	The skill is absent

7.5 Linkage to the current curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Science – Upper Primary			
Basic 4 - 6			
Module 7: Energy Transformation	Strand 4: Forces and Energy Sub-Strand I: Sources and forms of Energy	B5.4.1.1 Demonstrate understanding of the concept of energy, its various forms and sources and the ways in which it can be transformed and conserved	B5.4.1.1.1 Explain how energy is transformed from one form to another

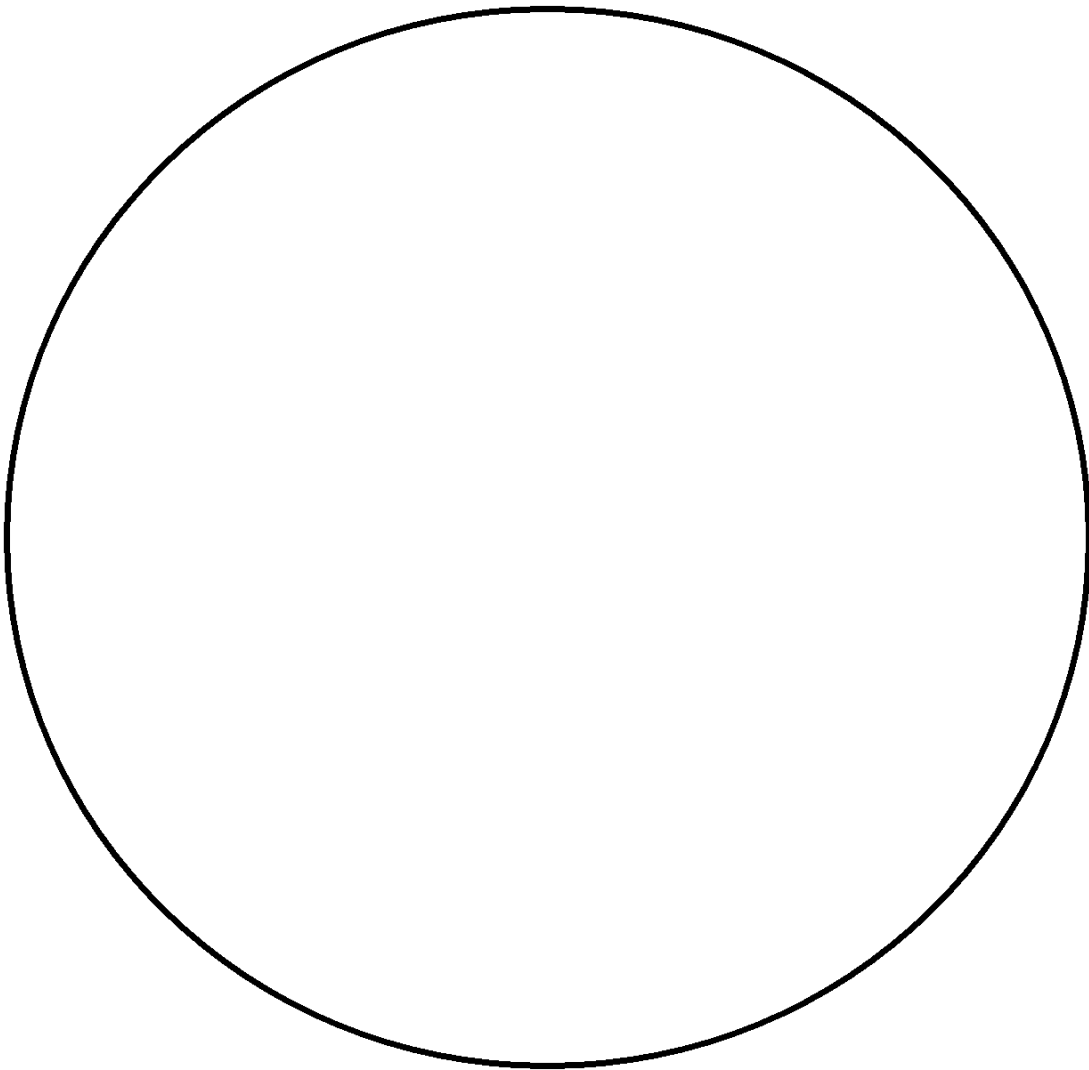
7.6 Web-Links to educative, informative, participatory and interactive EEC resources (references)

S/N	MODULES	INTERACTIVE WEB LINKS
1.	Module 7: Energy Transformation	<ul style="list-style-type: none"> ▪ Turtle-diary- YouTube. Science for Kids: Energy Transformation Video

ANNEXES

Use in Module I: Activity I

CIRCLE CUT-OUT



Use in Module 1: Activity 1: SUN BEAMS CUT-OUT

	glue
	glue
	glue
	glue
	glue
	glue
	glue
	glue
	glue

Use in Module 2: Activity 1

Module 2: Forms of Energy: Potential and Kinetic Energy

KINETIC ENERGY

Electrical energy is the movement of electrons by applying a force. Electrons moving through a wire are called electricity.

Example: Lightning



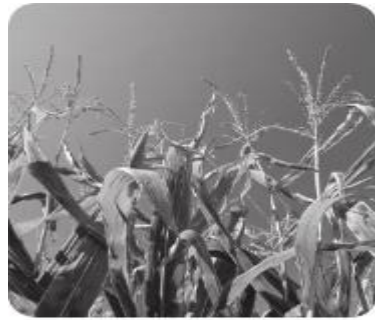
Thermal energy, also known as heat is the internal energy in substances—the vibration and movement of atoms and molecules within substances. The faster molecules and atoms vibrate and move within a substance, the more energy they possess and the hotter they become.

Example: Geothermal energy



POTENTIAL ENERGY

Chemical energy is the energy that holds bonds of atom and molecules together. Examples Foods we eat, biomass, petroleum, natural gas, and propane



Nuclear energy is an energy stored in the nucleus of an atom—the energy that binds the nucleus together. The energy can be released when the nuclei are combined or split apart.



Radiant energy is an electromagnetic energy that travels in transverse waves. Radiant energy includes visible light, x-rays, gamma rays, and radio waves.

Example: Solar energy



Motion /Mechanical energy is the movement of objects and substances from one place to another. According to Newton's Laws of Motion, objects and substances move when an unbalanced force is applied.



Example: Wind energy.

Elastic energy is an energy stored in objects by the application of a force.

Examples: Compressed springs and stretched rubber bands



Gravitational potential energy is the energy of position or place. A television resting on top of a table contains gravitational potential energy because of its position.



Sound energy is the movement of energy through substances in longitudinal (compression/rarefaction) waves. Sound is produced when a force causes an object or substance to vibrate.



Hydropower is a gravitational potential energy that turns running water to produce electrical energy. An example is water in a reservoir behind a dam.



Use in Module 6

MODULE 6: ACTIVITY WORKSHEETS-UPPER PRIMARY ONLY

RENEWABLE VERSUS

NON-RENEWABLE ENERGY

Energy is all around us in nature. Some sources of energy will never run out so that energy is known as renewable energy. Other sources of energy are available in specific amounts and will not regenerate, so they make non-renewable energy; it is energy from a source that will run out.

RENEWABLE ENERGY



BIOMASS, WIND, WATER, GEOTHERMAL, SOLAR

Efforts are being made today to use more of these energy sources which are sometimes called “green energy” sources.

NON-RENEWABLE ENERGY



COAL, NATURAL GAS, PETROLEUM (OR CRUDE OIL), PROPANE, URANIUM

Coal, petroleum, natural gas and propane are known as fossil fuels because of the way they were formed.

RENEWABLE ENERGY

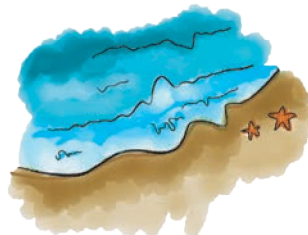
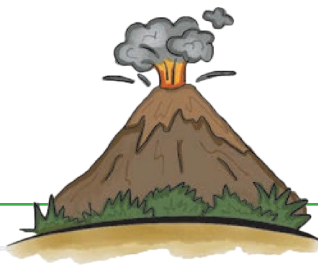
review

ANSWER THE FOLLOWING QUESTIONS ABOUT RENEWABLE ENERGY.

1. Why is it important to try to use as many renewable resources as possible?

2. Name all 5 renewable energy sources and give a brief description of each.

LOOK AT THE FOLLOWING PICTURES AND LABEL THEM ACCORDING TO WHICH RENEWABLE ENERGY SOURCE THEY DEMONSTRATE.



RENEWABLE ENERGY

review

ANSWER THE FOLLOWING QUESTIONS ABOUT RENEWABLE ENERGY.

ANSWERS MAY VARY

1. Why is it important to try to use as many renewable resources as possible?

It is important to use renewable resources because they'll always be available. Non-renewable energy sources, like fossil fuels, will eventually run out.

2. Name all 5 renewable energy sources and give a brief description of each.

Geo-thermal: This type of energy is produced by hot rocks deep beneath Earth's surface.

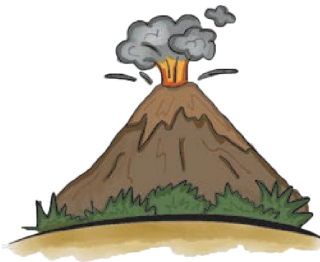
Wind: The wind's energy is converted to electricity through the use of turbines.

Biomass: This type of energy comes from living things like trees and plants.

Water: Hydro power is created by converting the energy of moving water into electricity.

Solar: This type of energy comes from the Sun.

LOOK AT THE FOLLOWING PICTURES AND LABEL THEM ACCORDING TO WHICH RENEWABLE ENERGY SOURCE THEY DEMONSTRATE.



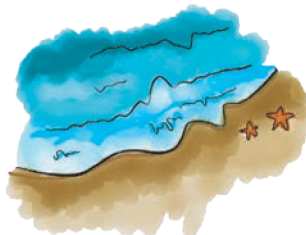
geo-thermal



wind



biomass



water



solar

Natural Resources Mix and Match

Renewable resources are resources that can be replaced in a few years or decades, at about the same rate they are being used. Nonrenewable resources are resources that are being used up faster than they can be replaced. These resources can take anywhere from hundreds to millions of years to regenerate—and in some cases they never will.

Use the chart below to classify each resource as renewable or nonrenewable.

Renewable	Nonrenewable

NATURAL GAS

TREES

AIR

WATER

OIL

WIND

SUN

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