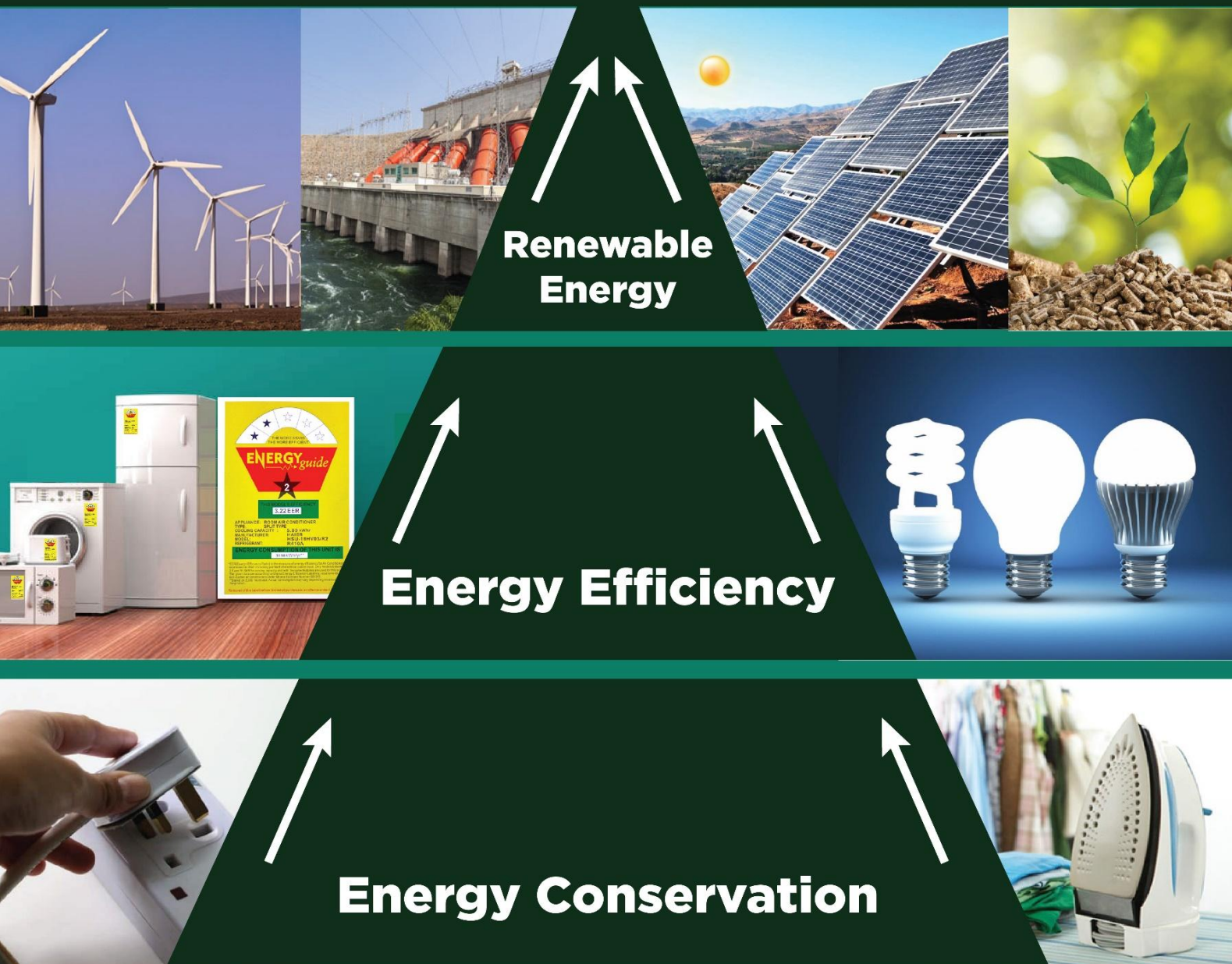


Energy Efficiency Pre-Tertiary School Curriculum Project Materials

Teacher Toolkit – Junior High School

Basic 7 - 9





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**Teacher Toolkit – Junior High School
(Final Draft I I)**

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Developed by:

Associates for Change (AfC) in association
with the National Council for Curriculum and
Assessment (NaCCA) and Development
Enviroenergy 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 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:

- Facilitate a change in behaviour towards energy efficiency and conservation at the pre-tertiary school level;
- Develop curriculum to ensure learners develop the right behavioural and attitudinal change to ensure sustainability of energy efficiency and conservation efforts at pre-tertiary levels both in schools and homes;
- Influence and change public behavioural 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 resource guides to teachers in the teaching and learning of EEC at the various levels. This Teacher Toolkit was developed by Associates for Change (AfC) in association with Development Energy 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 finalizing 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 Math 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, using electricity or oil for example, to provide light, heat and movement.

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

Renewable energy – Renewable energy comes from energy sources that are not depleted when used or are naturally replenished within human lifetime. These include biomass, wind geothermal, solar, and hydropower. 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 practicing 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; fuel includes materials that can be fashioned in a chain reaction to produce heat.

Electricity - 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 revised curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 7 (JHS 1) – Science			
Module 1: Sources and Forms of Energy	Strand 4: Forces and Energy Sub-Strand 1: Energy	B7.4.1.1 Demonstrate understanding of forms of energy and their daily application	B7.4.1.1.1 Identify the various forms of energy and show how they are related
	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B7.4.2.1 Demonstrate understanding of forms of electricity, its generation and effects on the environment.	B7.4.2.1.1 Describe the various forms of electricity generation
Module 2: Uses of Energy	Strand 4: Forces and Energy Sub-Strand 1: Energy	B7.4.1.1 Demonstrate understanding of forms of energy and their daily application	B7.4.1.1.2 Explain daily application of forms of energy
Module 3: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B7.4.3.1. Demonstrate understanding of the principle of conservation and conversion of energy and their application in real life situations	B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy
			B7.4.3.1.3 Know how energy could be conserved for future use in life
Module 6: Energy Transformation	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B7.4.3.1. Demonstrate understanding of the principle of conservation and conversion of energy and their application in real life situations	B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy
			B7.4.3.1.2 Demonstrate the conversion of energy into useable forms
Module 8: Climate Change	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B7.4.2.1 Demonstrate understanding of forms of electricity, its generation and effects on the environment.	B7.4.2.1.2 Explain the impact of electricity generation on the environment
	Strand 5: Humans and the Environment Sub-Strand 4: Climate Change and Green Economy	B7.5.4.1 Demonstrate understanding of sustainable energy choices and their impact on the environment	B7.5.4.1.1 Search for information on ways sustainable energy choices and scientific ideas are used to protect the environment.
Basic 8 (JHS 2) – Science			

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
Module 3: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B8.4.3.1 Evaluate the impact of conversion of energy and energy conservation on the environment	B8.4.3.1.1. Explain the importance of conversion of energy and energy conservation in daily life
Module 5: Renewable Energy	Strand 4: Forces and Energy Sub-Strand 1: Energy	B8.4.1.2 Show understanding of the sources of renewable energy and how to manage these sources in a sustainable manner	B8.4.1.2.1 Describe renewable and non-renewable forms of energy.
		B8.4.1.2 Show understanding of the sources of renewable energy and how to manage these sources in a sustainable manner	B8.4.1.2.2 Demonstrate how to manage sources of renewable energy sustainably
Module 6: Energy Transformation	Strand 4: Forces and Energy Sub-Strand 1: Energy	B8.4.1.1 Demonstrate the skill to evaluate the conversion of energy from one form to another	B8.4.1.1.1 Describe energy conversion B8.4.1.1.2 Discuss the importance of conversion of energy
		Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B8.4.2.1 Demonstrate knowledge of electricity transmission B8.4.2.1.1 Explain how electricity transmission occurs
	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B8.4.3.1 Evaluate the impact of conversion of energy and energy conservation on the environment	B8.4.3.1.1. Explain the importance of conversion of energy and energy conservation in daily life
	Module 7: Non-renewable Energy	Strand 4: Forces and Energy Sub-Strand 1: Energy	B8.4.1.2 Show understanding of the sources of renewable energy and how to manage these sources in a sustainable manner
Module 8: Climate Change	Strand 5: Humans and the Environment Sub-Strand 4: Climate Change and Green Economy	B8.5.4.1 Demonstrate understanding of the effects of climate change in the world and greening of other tropical countries including Ghana.	B8.5.4.1.1 Explain the concept of climate change and its effect on the environment
			B8.5.4.1.2. Describe climate change and green economy actions
Basic 9 (JHS 3) – Science			
Module 3: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 1: Energy	B9.4.1.1 Show understanding of the concept of conservation of energy and ways of conserving energy	B9.4.1.1 .1 List the ways such as ironing in bulk, using energy efficient appliances and switching off appliances when not in use to conserve energy.

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
			B9.4.1.1 .2 Explain the importance of energy conservation in daily life
	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B9.4.3.1 Show understanding of conversion and conservation of energy and their application to life	B9.4.3.1.1. Describe how energy can be converted from one form to another and show how conservation of energy occurs
Module 6: Energy Transformation	Strand 4: Forces and Energy Sub-Strand 1: Energy	B9.4.2.1 Construct electrical circuits and illustrate how electrical energy is transformed into other forms of energy and perform	B9.4.2.1.1 Demonstrate transformation of electrical energy to other forms of energy in both series and parallel circuits and perform simple calculations involving flow of current in circuits
	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B9.4.3.1 Show understanding of conversion and conservation of energy and their application to life	B9.4.3.1.1. Describe how energy can be converted from one form to another and show how conservation of energy occurs
Module 8: Climate Change	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B9.5.4.1 Demonstrate understanding of natural and human factors that influence climate change and green economy	B9.5.4.1.1 Examine various natural and human factors that influence climate change and green economy in their localities
SOCIAL STUDIES			
Basic 7 - Social Studies			
Module 1: Sources of Energy	Strand 1: Environment Sub-Strand 1: Environmental Issues	B7.1.1.2 Examine the sources of energy and demonstrate the skills of conserving energy in Ghana	B7.1.1.2.1. Examine the sources of energy
Module 8: Climate Change	Strand 1: Environment Sub-Strand 1: Environmental Issues	B7.1.1.1 Demonstrate skills in dealing with environmental challenges	B7.1.1.1.1. Examine ways of dealing with sanitation challenges in the environment
Basic 8 - Social Studies			
Module 1: Sources of Energy	Strand 1: Environment Sub-Strand 1: Environmental Issues	B8.1.1.2. Analyze the sources and ways of conserving energy in Ghana	B8.1.1.2.1. Examine the means of conserving energy
Module 8: Climate Change	Strand 1: Environment Sub-Strand 1:	B8.1.1.1 Demonstrate skills in dealing with environmental challenges	B8.1.1.1.1. Examine water pollution as an environmental challenge

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
	Environmental Issues		
Basic 9 - Social Studies			
Module 1: Sources of Energy	Strand I: Environment Sub-Strand I: Environmental Issues	B9.1.1.2 Evaluate the sources and ways of conserving energy	B9.1.1.2.1. Assess global sources and the means of conserving energy
Module 3: Conservation of Energy	Strand I: Environment Sub-Strand I: Environmental Issues	B9.1.1.2 Evaluate the sources and ways of conserving energy	B9.1.1.2.1. Assess global sources and the means of conserving energy

Teacher Resources Link to Curriculum

Name of Resource Material and Internet Link	Lesson	Module
<p>NEED Primary Info-Book</p> <ul style="list-style-type: none"> ▪ http://www.need.org/ ▪ http://www1.mwdh2o.com/DocSvcSPubs/Education_Site/publications.html ▪ https://www.climategen.org/our-core-programs/climate-change-education/curriculum/purchase-download-curriculum/thank-you/ 	What is energy, community, country use of energy? (page 6–9)	Module 2: Uses of energy
	Sources of Energy (page 10-29)	Module 1: Sources of Energy
	Renewable and Non-Renewable (page 12-29)	Module 5: Renewable Energy
	Renewable and Non-Renewable Energy (page 12-29)	Module 7: Non-Renewable energy sources
	Saving Energy (page 37-38)	Module 3: Energy conservation
	Saving Energy (page 30-34)	Module 6: Energy transformation
<p>Conservation Connection Water & Energy Southern California</p> <p>https://www.education.com/lesson-plan/renewable-and-non-renewable-energy/</p> <p>https://www.energystar.gov/buildings/tools-and-resources/k12-energyefficiency-student-toolkit_</p>	Energy Sources (page 14-19)	Module 1: Sources of Energy Module 5: Renewable Energy Module 7: Non-Renewable energy sources
	Energy Uses (page 20-22)	Module 6: Energy transformation
	Energy and the Future (page 23-27)	Module 3: Energy conservation Module 4: Energy Efficiency
<p>Next Generation Climate</p> <p>[https://www.ecfr.eu/article/commentary_climate_driven_migration_in_africa]</p>	Lesson 2: What factors have caused the rise in the global temperature over the last century? (page 27-53)	Module 8: Climate change
Our Changing Climate	Lesson 5: Regional Effects of Climate Change (page 49-60)	Module 8: Climate change

Educative, informative, participatory and interactive links, reference sources on EEC.

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: 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 -
3.	Module 3: Energy Conservation	<ul style="list-style-type: none"> ▪ www.sciencewiz.com (S.T.E.M Education Solutions) ▪
4.	Module 4: Energy Efficiency	<ul style="list-style-type: none"> ▪ www.energy.gov -Energy Detectives (3 Activities) Department of Energy
5.	Module 5: 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
6.	Module 6: Energy Transformation	<ul style="list-style-type: none"> ▪ Turtle-diary- YouTube. Science for Kids: Energy Transformation Video
7.	Module 7: Non-renewable sources of energy	<ul style="list-style-type: none"> ▪ https://www.generationgenius.com › videlessons › renewable-vs-non-renewable ▪ https://www.nationalgeographic.org/encyclopedia/non-renewable-energy/
8.	Module 8: Climate Change	<ul style="list-style-type: none"> ▪ https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/ ▪ https://www.kqed.org/lowdown/14318/the-inequalities-of-climate-change-visualized-in-one-fascinating-map-and-6-other-great-interactive-resources ▪ https://www.climateinteractive.org/tools/c-roads/

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

Note 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 and communicate in learning; and
 - expects all learners to communicate the results of their learning through a display of a product or performance regarding energy efficiency and conservation.
 - Encourage group presentations, debates, peer teaching, further reading (research), inclusive teaching and gender responsiveness. These will help quality, access and relevance of teaching and learning of energy efficiency and conservation (EEC) in our schools.
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 lesson should be learner-centered and not teacher-centered.
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.
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 learners identify with all Ghanaian children, and encourage them to aspire to creating a future where all live in cleanliness and comfort, conserving resources wisely for the benefit of all.

Module I: Sources of Energy

1.0 Introduction

Module I introduces the sources of energy and energy types that learners are expected to know about at the Junior High School level. This comprises both renewable and non-renewable sources of energy. Ghana's power supply sources are mainly from hydro-electricity, thermal energy fuelled by crude oil; natural gas and diesel, and solar power (Ministry of Energy, 2017). Other main sources of energy include dry cells or batteries, kerosene, fuel wood, and biomass.

All living things need energy; however, it is not only living things which need energy to move and carry out various processes. The machines and appliances in our world around us also need energy to do work. Where does the energy come from¹?

1.1 Learning Outcome:

1. Learners to show understanding of the different sources of energy.
2. Learners will develop their critical thinking and research skills to identify different sources of energy.

(Please refer to section 1.4 for detailed linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)

¹ <https://www.solarschools.net/knowledge-bank/energy/types>

Module I: Sources of energy	1. Demonstrate understanding and knowledge on the sources of energy including renewable and non-renewable 2. B7.4.1.1.1 Identify the various forms of energy and show how they are related 3. B7.4.2.1.1 Describe the various forms of electricity generation 4. B7 1.1.2.1. Examine the sources of energy 5. B9.1.1.2.1. Assess global sources and the means of conserving energy	B7 – B9	2-weeks (3-separate lessons of 45-minutes each)	Show and tell activity- Show videos, pictures, drawings and charts of different sources of energy Learners brainstorm on the different sources of energy they use in daily life Learners to bring samples of energy sources they use at home for discussion in class.	Videos on sources of energy Pictures of different energy sources, such as a gas stove Drawings of different energy sources Charts of different energy sources.	Learners can name the primary and secondary sources of energy used in Ghana. Learners can name 4-5 basic energy-using devices used at home and school, and can state the source of energy. For each.
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1.2 Key Concepts

1. The sun is the primary source of energy on earth through photosynthesis and energy flows.
2. Families, schools and communities depend on natural environments for energy in many ways.
3. There are different sources of energy including renewable and non-renewable.
4. There are benefits or consequences of using renewable and non-renewable energy sources.

Many substances and organisms store energy which can then be used. We call them **energy sources**. Energy sources have energy that is stored within them and can be used to make something happen; for example, energy stored in petrol can be used to make a car move. At the primary level, you learnt about the two main sources of energy: **renewable** and **non-renewable sources**. Do you remember what these terms mean?

Renewable sources are ones which can be recycled or reused. Non-renewable sources cannot be reused, and so there is a limited amount available. When that runs out, there will be none left. Let's do a quick revision to see how much you remember from Primary.

1.3 Activities

1. Identification and definition of sources of energy
2. Energy Detective

1.3.1 Activity I: Identify Sources of Energy

Learning and Teaching Strategies:

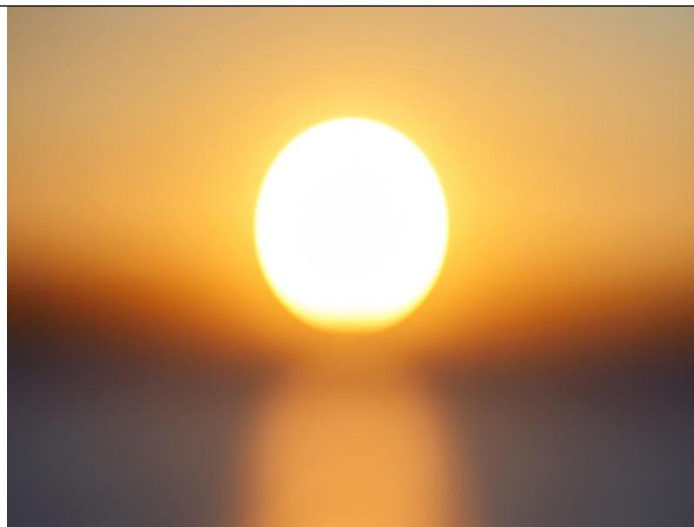
1. Teacher gives a photocopy of the picture on different sources of energy below to be passed from learner to learner where it is not possible to have one for each learner.
2. In addition, the teacher could make a simplified sketch of each on the board.
3. Show learners' charts or drawings of different sources of light for them to observe.
4. Engage learners to discuss the various forms of energy beyond what is presented in the pictures
5. Learners in convenient groups discuss and present to the class for general discussion and peer-review how the different sources/forms of energy are used in daily lives:



Natural gas burning on a stove top



Oil - An oil rig sinks a drill into the ocean floor to reach the oil deposits



Sunlight



Wood



Coal - A coal mine



Wind - wind turns this windmill

1.3.2 Activity: 2 Energy Detective

Concept: Energy is around us every day, but what is energy?

Goal: Learners will demonstrate understanding and knowledge of the various sources of energy by looking for energy sources/types, collecting “energy evidence” and then come up with their own definition of energy.

Resources required:

- Copies of a simple data sheet to aid learners in compiling energy sources they come up with (Detective Data Sheet, see Annex I)

Teaching Strategies:

Explanations:

The class teacher should provide brief explanations to learners before they start working on this activity. The following should serve as a guide:

1. Give each learner group a copy of the Detective Data Sheet (Annex I).
2. Indicate to learners the goal of the activity: to search for the answer to "What is energy?"
3. Ask learners to brainstorm and think of evidence that will help them identify and define different energy sources.
4. Once they have written each clue onto their Data Sheet, have each group come up with a definition of energy.
5. Have each group share its definition with the rest of the class.

After the phase I of this activity is done, the learner groups are to do the following:

6. **Learners discuss in their various groups:** How can we perceive energy? (Energy in wind can push against us and bend trees on a windy day or cause a boat to skip across a lake.) Can you see energy? (Yes, sunlight.) Can you hear energy?
7. **Learners look up the definition of energy in the dictionary** (examples: the capacity for vigorous activity; available power) and **compare with the physics definition** (the ability to do work). Learners discuss how the dictionary definitions compare with the definition given by the teacher.
8. Learners should come up with a list of clues that they can find at home that support the definition, "Energy is the ability to do work." (**Examples:** electricity causes the light bulbs to glow and get hot, etc.).

Reflections:

Have one learner in each group move to another group. That learner explains his/her knowledge about the sources of energy. The group listens and adds more ideas.

Note to the Teacher: In classes with learners having hearing or visual impairments, the teacher should use more of videos, pictures or assign a mate to support these children through the learning process and make more time for such learners.

I.4 Linkage to the current GES curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 7 (JHS 1) – Science			
Module 1: Sources and Forms of Energy	Strand 4: Forces and Energy Sub-Strand 1: Energy	B7.4.1.1 Demonstrate understanding of forms of energy and their daily application	B7.4.1.1.1 Identify the various forms of energy and show how they are related
	Strand 4: Forces and Energy Sub-Strand 2: Electricity and Electronics	B7.4.2.1 Demonstrate understanding of forms of electricity, its generation and effects on the environment.	B7.4.2.1.1 Describe the various forms of electricity generation
SOCIAL STUDIES			
Basic 7 - Social Studies			
Module 1: Sources of Energy	Strand 1: Environment Sub-Strand 1: Environmental Issues	B7.1.1.2 Examine the sources of energy and demonstrate the skills of conserving energy in Ghana	B7.1.1.2.1. Examine the sources of energy
Basic 8 - Social Studies			
Module 1: Sources of Energy	Strand 1: Environment Sub-Strand 1: Environmental Issues	B8.1.1.2. Analyse the sources and ways of conserving energy in Ghana	B8.1.1.2.1. Examine the means of conserving energy
Basic 9 - Social Studies			
Module 1: Sources of Energy	Strand 1: Environment Sub-Strand 1: Environmental Issues	B9.1.1.2 Evaluate the sources and ways of conserving energy	B9.1.1.2.1. Assess global sources and the means of conserving energy

I.5 Links to Web-Based Materials

Additional information for the module could be obtained from the following links:

1. <https://www.khanacademy.org/science/biology/energy-and-enzymes/the-laws-of-thermodynamics/a/types-of-energy>
2. <https://youtu.be/vnylqUaToHw>
3. <https://youtu.be/TitrRpMUt0l>
4. <https://youtu.be/3mier94pbnU>
5. <https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/a/energy-flow-and-primary-productivity>
<https://www.khanacademy.org/science/physics/work-and-energy/work-and-energy-tutorial/a/what-is-work>
6. <https://www.khanacademy.org/science/biology/energy-and-enzymes/the-laws-of-thermodynamics/a/types-of-energy>
7. <https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/v/flow-of-energy-and-matter-through-ecosystems>

Module 2: Uses of Energy

2.0 Introduction

Module 2 introduces the various uses of energy in everyday life. Energy usage varies by form and by location, and it is determined by the weather, technology, economic status and so forth. Energy use is generally divided into four key sectors: *residential, commercial, transportation, and industrial*. Lighting homes, schools and office buildings, driving cars and manufacturing the products we rely on in our daily lives are all functions that require energy. Residential uses of energy constitute the most basic uses of energy – including, washing clothes, cooking, lighting the home, working on a laptop computer, running appliances and watching television². Residential uses of energy account for almost forty percent of total energy use globally (Ministry of Energy, 2017).

2.1 Learning Outcomes:

1. Learners to discuss about the various uses of energy in everyday life.
2. Learners to use games to demonstrate energy usage in different areas of human life.

(Please refer to section 2.4 for detailed linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 2: Uses of energy	<ol style="list-style-type: none"> 1. Explore different uses of energy 2. B7.4.1.1.2 Explain daily application of forms of energy 	B7	2-lesson periods (50-minutes each)	<p>Learners to watch videos and pictures on uses of energy</p> <p>Learners demonstrate understanding of the various uses of energy in daily lives</p> <p>Learners to explore the different uses of energy across different sectors</p>	<p>Videos, charts, drawings and pictures of different uses of energy</p> <p>markers card boards</p> <p>picture on forms of energy.</p>	Learners can name many different examples of energy use and identify the <u>sources</u> of energy for each use.

² <https://www.renewableenergyworld.com>

2.2 Key Concepts

1. There are various uses of different forms of energy in our lives (including heat, light, electricity, sound and mechanical) related to directly meeting human needs.
2. There are different ways individuals and groups utilize energy to meet their needs and wants.
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. Behaviour and design affect the amount of energy used by human society.
8. Decisions we make as consumers of energy have both direct and indirect economic and environmental costs.
9. Issues arise from energy systems and energy use at home, school and in our communities
10. 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 should also come up with different activities that may better suit the understanding of the learners, especially learners with visual and hearing impairment.

2.3 Activities

2.3.1 Activity 1: Uses of Energy

Goal: To assist learners to know and appreciate the various uses of energy across the different aspects of human life.

Materials: Videos, pictures, chart paper/whiteboard, and markers or crayons for each group of learners

Time: Approximately 30 minutes

Teaching Strategies:

Invite:

1. Begin with a think-pair-share activity. Instruct learners to sit in pairs.
 - a. **Think:** Learners brainstorm on ways in which energy is important in their everyday lives. They record their responses in their books.
 - b. **Pair:** Each learner discusses with a partner, ways in which they use energy.
 - c. **Share:** Teacher asks learners to share with the class some ways in which we use energy in our daily lives.

2. The teacher should then create a chart on the board with three equal columns.
3. The teacher asks the learners “What are the three most common sources of energy in your daily lives?” (Most likely, the response will be: **electricity, fuel, muscle power**) The teacher writes these as headings for the 3 columns.
4. The teacher then asks for examples of devices that use these types of energy, and records them under the appropriate columns on the chart/chalk board.
After the list is complete, the class teacher should ask learners and how energy usage changes our lives.

2.3.2 Activity 2: Group Project

Time: Approximately 1 hour (30 minutes to develop; 30 minutes to present)

CREATE:

1. Learners work in groups to create a collection or an oral report of two examples of changes caused by heat, light, or sound. The project may include examples of when there is too much or not enough heat, light, or sound.
2. To enhance understanding, the teacher should use a storytelling approach in showing learners how one type of energy is important to everyday life. Here is an example:

Ibrahim, Ama, and Christine are all in JHS in Ghana. It is March and very, very hot. Ibrahim lives in the city; Ama, in a small town, and Christine, in a small village. All of them are trying to read a book but cannot focus because it is so hot. Ibrahim turns on the air conditioner and reads in his bedroom. Ama opens the door and all the windows and reads in the sitting room. Christine folds a paper into a fan and reads, fanning herself, under the shade of a tree.

3. The teacher should assign equal numbers of groups one of these topics: heat, sound, cold. They should tell what Ibrahim, Ama and Christine each do when there is too much or too little heat, cold, or sound. (For the heat example, they should not use the example of air temperature, but rather, food temperature.)
4. The teacher gives each group a large paper and instructs them to draw a vertical line dividing the paper in two sections, one labelled *too much*; the other, *too little*.
They should then draw three equal rows horizontally, labelled *Ibrahim, Ama, and Christine*. In the boxes created by these lines, they should write or draw what each child did when there was too much or too little of the type of energy. (Remind them that Ibrahim is from a rich city-dwelling family; Ama, from mid-income town family; and Christine from a poor village family.)

Example of How Learner's Paper Should Look:

← energy source →

Too much _____	Too little _____
Ibrahim	
Ama	
Christine	

6. The teacher monitors the groups while they work to check their progress, provide feedback, review expectations, and offer assistance or guidance.

7. Each group should present its project to the class for discussions. If there are many groups, organize them into small bunches of groups, which present to each other.

Reflections:

Have one learner in each group move to another group. That learner explains his/her knowledge of the various uses of energy sources. The group listens and adds to the ideas.

2.4 Linkage to the current GES curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 7 (JHS I) – Science			
Module 2: Uses of Energy	Strand 4: Forces of Energy Sub-Strand I: Energy	B7.4.1.1 Demonstrate understanding of forms of energy and their daily application	B7.4.1.1.2 Explain daily application of forms of energy

2.5 Link to Web Based Materials

Additional information to the module could be obtained from the following links:

1. <https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/v/flow-of-energy-and-matter-through-ecosystems>
2. <https://www.khanacademy.org/science/biology/energy-and-enzymes/the-laws-of-thermodynamics/a/types-of-energy>

Module 3: Energy Conservation

3.0 Introduction

Module 3 introduces learners to what energy conservation is, key concepts, and ways of conserving energy. **Energy conservation** means using less energy whenever possible. We can all practice saving energy every day, for example by turning off lights when we leave the room. Every time we conserve energy, we help protect the environment.

3.1 Learning Outcomes:

At the end of this module, learners will be expected to:

1. Demonstrate and explain ways of saving/conserving energy in the immediate environment;
2. Discuss how social and technological innovation affects the amount of energy used by human society and give examples.
3. Invent stories that show how behavior and design affect the amount of energy used by human society

(Please refer to section 3.4 for detailed linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 3: Energy Conservation	<ol style="list-style-type: none"> 1. Demonstrate ways of conserving energy in everyday life 2. B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy 3. B7.4.3.1.3 Know how energy could be conserved for future use in life 	JHS 1, 2 and 3	2-lesson periods (45-minutes each)	<p>Learners to demonstrate practical ways of conserving energy in homes schools, and in communities</p> <p>Learners to brainstorm and explain ways of</p>	<p>Videos Pictures Markers Card boards Charts and Drawings of energy conservation</p>	Learners demonstrate behaviour/attitudinal change regarding energy use at school, and report on new conservation practices at home and other places outside of school.

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
	<p>4. B8.4.3.1.1. Explain the importance of conversion of energy and energy conservation in daily life</p> <p>5. B9.4.1.1 .1 List specific ways to conserve energy such as ironing in bulk, using energy efficient appliances and switching off appliances when not in use</p>			conserving energy using scenarios, drawings and charts showing energy conservation.		

Poster to use with this Module:

- Energy Pyramid
- Save Energy

3.2 Key Concepts

- There are ways of saving/conserving energy at home, at 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
- There are ways we can use energy more efficiently.

Notes to the Teacher:

Before the activities begin, the teacher should lead learners in discussing what energy conservation is and the various benefits in conserving energy. The discussions should be guided by the following benefits of energy conservation:

The top reasons to conserve and use energy more efficiently are:

- **Energy conservation saves money** - Buying energy-efficient appliances, making energy-saving home improvements, and taking actions that conserve energy every day can save hundreds of cedis each year.
- **Energy conservation improves the economy** - Energy efficiency projects (like building improvements and repairs) create jobs. Energy-efficient innovations lead to

breakthroughs in manufacturing. For instance, standards requiring light bulbs to be at least 25 percent more energy-efficient than traditional incandescent bulbs led to an array of new lighting products.

- **Energy conservation is good for the environment** - When we use less energy, we save natural resources and cut down on pollution.
- **Energy conservation improves national security** - Energy conservation safeguards our nation by decreasing the overall demand for energy, and therefore the need to import and transport energy/fuels.

3.3 Activities

1. Class discussions
2. Work sessions

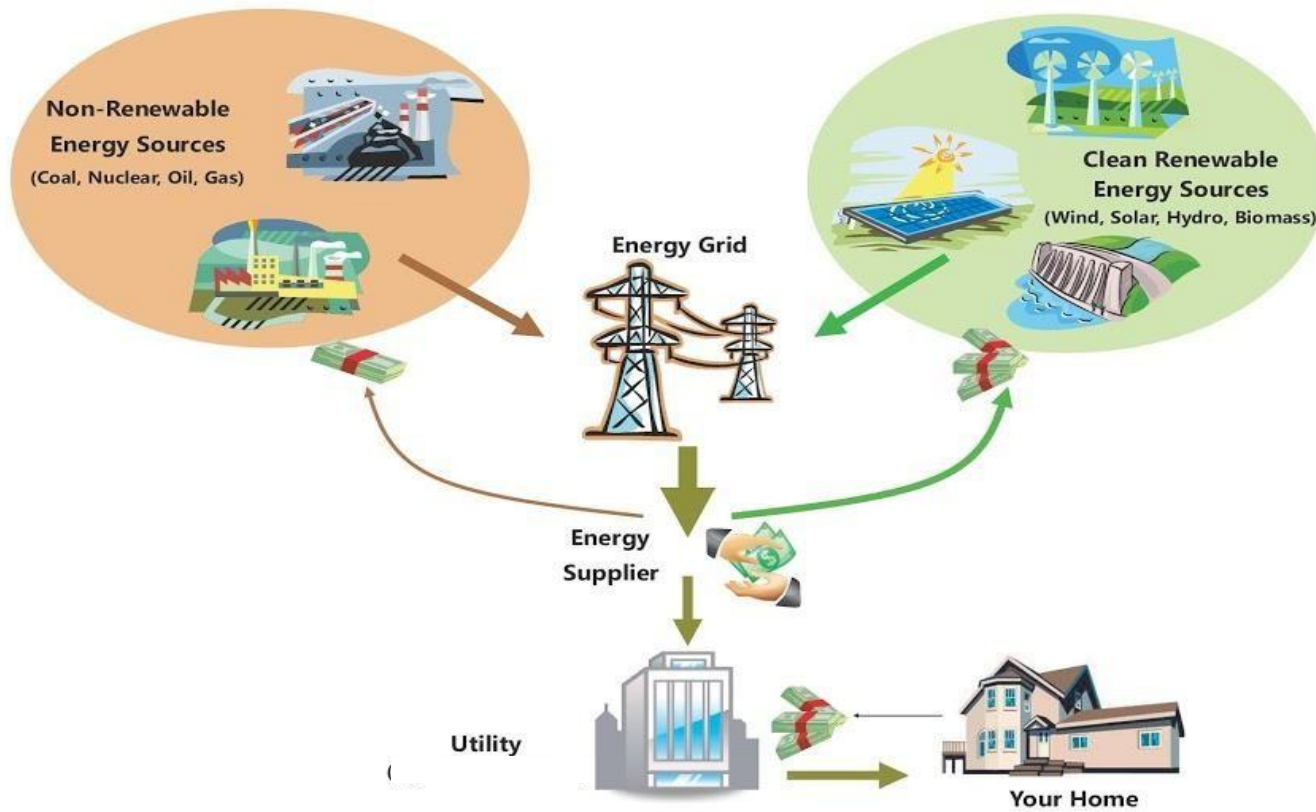
3.3.1 Activity I: Electricity cycle

Before this activity starts, the teacher should

1. show learners the electricity cycle as shown below;
2. inspire learners to study the diagram and come up with their own ideas on energy conservation based on the various elements in the diagram.

Electricity Cycle

By conserving energy and using it efficiently we can reduce the amount of electricity power stations have to make. This in turn helps to reduce the amount of pollution released into the environment.



Electricity Cycle

Instructions to Teacher:

Learner draws this image on the board and writes the caption.



Mr. A

Mr. B

Meet Mr. A and Mr. B. They both use the same appliances at home and have both received their electricity bill. One of them is happy and one of them is not.

Teacher writes these questions on the board, and the learners (individually) write their answers on a paper and hand them in. OR The learners could do the work in pairs. (Learners with visual and hearing impairments must be supported by the teacher to fully participate in these activities)

Mr. A does not use energy in the most efficient way while Mr. B uses energy in a wise way

Which one do you think has not been energy efficient? Explain your answer.

.....

Which one has caused the smallest amount of pollution? Explain your answer.

.....

3.3.2 Activity 2: Discovering Principles of Conservation

Materials: large sheets of paper (one per group) crayons and/or markers

This activity stimulates thinking about *principles* of energy conservation and activates creativity to think of *practical applications*.

Organize the learners in groups of four or five and give each a card with situations like the following written on them:

- 1) *Kodjo's mother heats eggs in a pot of water until it boils. Then she covers it tightly, wraps a thick cloth around the pot, and in 20 minutes, the eggs are hard-boiled.*
- 2) *Mensah's father likes to weave on his loom late at night in a little room. He needs to see tiny threads, but only one bulb hangs over his loom. He glues two mirrors (facing down) on the wood beam that the light bulb hangs from.*
- 3) *Issaka's father keeps AA batteries in a tightly closed plastic box, in a plastic bag in their fridge.*
- 4) *Lizzy's mother hangs clothes very straight on a rope to dry. She folds them carefully, pressing out the wrinkles with her hands. Then she stacks them for Lizzy's big brother to iron.*

The teacher tells the groups to draw a picture of the activity and think about what the parent is doing to conserve energy. Learners will try to think up similar actions, based on the same principle. Then each group will explain their picture to the class and act out at least one other energy-saving activity using the same principle.

The teacher walks around the room, answering questions and helping learners to discover principles of conservation. (For example, if you protect your energy source, it will give you more energy.)

If there are too many groups, have one group present to another group on a rotational basis.

3.4 Linkage to the current GES curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 7 (JHS 1) – Science			
Module 3: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B7.4.3.1. Demonstrate understanding of the principle of conservation and conversion of energy and their application in real life situations	B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy
			B7.4.3.1.3 Know how energy could be conserved for future use in life
Basic 8 (JHS 2) – Science			
Module 3: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B8.4.3.1 Evaluate the impact of conversion of energy and energy conservation on the environment	B8.4.3.1.1. Explain the importance of conversion of energy and energy conservation in daily life
Basic 9 (JHS 3) – Science			
Module 3: Energy Conservation	Strand 4: Forces and Energy Sub-Strand 1: Energy	B9.4.1.1 Show understanding of the concept of conservation of energy and ways of conserving energy	B9.4.1.1 .1 List specific ways to conserve energy such as ironing in bulk, using energy efficient appliances and switching off appliances when not in use
			B9.4.1.1 .2 Explain the importance of energy conservation in daily life
	Strand 4: Forces and Energy Sub-Strand 3: Conversion and Conservation of Energy	B9.4.3.1 Show understanding of conversion and conservation of energy and their application to life	B9.4.3.1.1. Describe how energy can be converted from one form to another and show how conservation of energy occurs
Module 3: Conservation of Energy	Strand 1: Environment Sub-Strand 1: Environmental Issues	B9.1.1.2 Evaluate the sources and ways of conserving energy	B9.1.1.2.1. Assess global sources and the means of conserving energy

3.5 Link to Web-Based Materials

Additional information to this module could be obtained from the following link:

https://youtu.be/kw_4Loo1HR4

Module 4: Energy Efficiency

4.0 Introduction

This Module introduces learners to the best ways of using energy through technology and use of energy efficient appliances. **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.

4.1 Learning Outcomes:

Learners are expected to:

1. Apply their understanding of energy efficiency in their daily lives.
2. Describe the energy requirements of using electrical appliances.
3. Undertake a project on energy efficiency in a chosen sector or in their communities

(Please refer to section 4.4 for links to web materials).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 4: Energy Efficiency	1. Demonstrate ways of using energy in efficient ways	Basic 7 – 9	3-lesson periods (45-minutes each)	Learners to watch videos and pictures on efficient energy appliances by the help of their teacher. Learners to identify new ways of using energy efficiently	Markers Card boards	Through speech, writing, drawing and behaviour, learners demonstrate a personal commitment change regarding conservative energy use

Posters to Use in this Module:

- Energy Pyramid
- Energy Saving at School
- Energy Saving at Home
- Saving Energy
- Turn off the Lights

4.2 Key Concepts:

Before this activity begins, the teacher should explain these key issues/concepts to learners as a base for knowledge uptake and to support learners in completing the activity in the best way possible.

- Energy efficiency involves the use of technology that requires less energy to perform the same function. Energy conservation includes any behavior 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.

4.3 Activities

4.3.1 Activity 1: Efficiency Check

Materials needed:

- **Energy Sources:** Crossword Puzzle, Clues, and Answers (see Annex 1 and 5)
- **Home Energy Use Checklist:** How Many Can You Check? (see Annex 2)

Duration: 30 - 45 minutes

1. Teacher will begin by sharing a story to introduce energy efficiency.
2. Following the story, learners discuss in groups and come up with a list of ways of using energy in efficient ways.
3. Each group then presents their findings to the class for further discussions.

CREATE:

1. Following the initial discussions, the teacher should introduce the matching game (home energy use checklist) and provide instruction and guidance to learners (Annex 2).
2. Learners should work together to match various energy-conserving and energy-wasting activities with their opposite.
3. Teacher should move around the room to make observations, check for understanding and provide support to the struggling learners.

At the end of the lesson, have learners take the Quiz: *Are You an Energy Expert?* (Home Energy Use Checklist). This can be completed in class or as homework (See annex for details).

4.3.2 Activity 2: Project work of energy efficiency

Procedure:

1. Learners to work in groups of four (4) depending on the class size
2. Each group identifies a challenge in their community related to the efficient use of energy
3. Each group works to come up with a solution to the identified challenge.
4. Based on the identified solution, learners are to educate and sensitize members of their communities on efficient uses of energy.

4.4 Link to Web-Based Materials

Additional information to this module could be obtained from the following link:

<https://www.iberdrola.com/environment/energy-efficiency-buildings>

<https://www.iberdrola.com/environment/energy-efficiency-buildings>

<https://e3p.jrc.ec.europa.eu/events/launch-european-energy-efficiency-platform>

Module 5: Renewable Energy

5.0 Introduction

This module introduces learners to what renewable energy sources are. Renewable energy, often referred to as *clean energy*, comes from natural sources or processes that are constantly replenished. The key source of renewable energy is the sun; energy harnessed directly from the sun is called ‘solar energy’. Solar power can also be defined as energy from the sun that is converted into thermal or electrical energy. Solar energy is the cleanest and most abundant renewable energy source available³. It is harnessed using a range of ever-evolving technologies such as *solar* heating, photovoltaics, *solar* thermal energy, *solar* architecture, molten salt power plants and artificial photosynthesis.

5.1 Learning Outcomes:

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

(Please refer to section 5.4 for detailed linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicator (Expected attitude & behavioural change)
Module 5: Renewable Energy Sources	<ol style="list-style-type: none"> 1. Identify renewable sources of energy as the new trend in energy usage 2. B8.4.1.2.1 Describe renewable and non-renewable forms of energy. 3. B8.4.1.2.2 Demonstrate how to manage sources of 	JHS I	2-lesson periods (45-minutes each)	<p>Learners to watch videos and pictures on renewable sources of energy.</p> <p>Learners to demonstrate understanding and knowledge of renewable sources of energy</p> <p>Learners to describe renewable and</p>	<p>Videos, pictures and drawings on renewable sources of energy</p> <p>markers card board or paper</p>	<p>Learners can explain renewable energy source.</p> <p>Learners can give examples of renewable energy source.</p>

³ <https://www.seia.org/initiatives/about-solar-energy>

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicator (Expected attitude & behavioural change)
	renewable energy sustainably			non-renewable sources of energy		

Posters to Use with this Module

- Non-Renewable Energy Resources
- Renewable Energy Resources
- Renewable and Non-Renewable Energy Resources

5.2 Key Concepts

- Sustainable energy choices have beneficial impacts on humans and the environment.
- There are potential renewable energy sources in various places in Ghana.

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 could also come up with different activities that would better suit the understanding of the learners.

5.3 Activities

5.3.1 Activity I: Class discussions and group work




Before the class begins, the teacher should show the pictures on renewable energy sources below to learners, explaining in detail what each source represents and how it is generated.

Instruction to teacher:

The pictures can be shown to the class by printing a photocopy and passing it from learner to learner.

AND/OR the teacher can draw a simple picture of each of these on the board.

Examples of renewable energy:

Wind turbines use wind to generate electricity.	Details
	<p>Wind is moving air and it can be used as a source of energy. The energy from wind energy is used to turn large turbines. The turbines are connected to a generator which produces electrical energy⁴.</p> <p>You need a steady, strong wind blowing in order to produce a large, consistent amount of electricity. This means that wind farms cannot be put up in areas where there is not a lot of wind. Wind farms are noisy and many people do not like the look of them.</p>
Hydropower - A large hydroelectric power station.	Details
	<p>Water can also be used as an energy source. This is called hydropower. The energy from falling water is used to drive turbines in a power station. Unlike coal power stations, the water does not need to be heated and the water can be reused. These power stations must be at waterfalls or dams because there is the need to be a strong flow of water to harness the energy.</p>
Solar panels on a rooftop	Details
	<p>There is a lot of energy in sunlight. Solar panels are used to absorb the radiant energy from the Sun and to transform the energy from the Sun into stored potential energy. The Sun is a star and the lifetime of a star is measured in billions of years. This means that our Sun can provide energy to the Earth for millions of years to come. Sunlight is considered a renewable energy source because it will not run out in the foreseeable future.</p>

⁴ <https://www.siyavula.com/read/science/grade-7/sources-of-energy/11-sources-of-energy>

Group work:

After the class discussions, the teacher should put learners into groups of 3 or 4 depending on the class size. The teacher should task the groups to do the following:

1. Each group should come up with local ways of generating renewable sources of energy.
2. Each group should present their findings in class for discussion.
3. The teacher may also choose to guide learners into refining their projects for presentation at a school science fair.

5.3.2 Activity 2: Renewable Energy in Ghana

Introduction to Activity 2– the teacher should pose these key questions to learners:

1. Where do we get our energy in Ghana?
2. Why should we shift to renewables?
3. What would a shift to renewable energy look like?

This lesson introduces learners to renewable energy in the local context. The activities will help learners understand the differences between renewable and non-renewable energy, as well as locally relevant renewable energy sources.

Learning Outcomes

By the end of this activity, learners will:

- Explain how local renewable energy sources could substitute for fossil fuel energy to meet community needs
- Describe local strategies to (1) decrease non-renewable energy use (2) increase the use of renewable energy.

Teaching Strategies:

1. Teacher should ask learners what they think of when they hear the word “energy.” Have them write down their answers.
2. As a class, come up with a definition for the word “energy” and the term “energy source.” Standard definitions are:
 - **Energy:** the ability to do work, or the power behind all activity
 - **Energy source:** something that can be tapped to provide heat, electricity, chemical, mechanical, nuclear, or radiant energy

3. Ask the learners to think about the time from when they woke up until they got to school this morning. What types of energy did they use? Have learners write down everything they can think of. Encourage every learner in class to participate.
4. Ask learners to write the types of energy they use on a daily basis and create a list for presentation to the class. Examples of energy types learners are likely to come up with:

▪ human energy	▪ tidal	▪ wood	▪ natural gas
▪ sunlight	▪ water	▪ electricity	▪ nuclear
▪ geothermal heat	▪ diesel	▪ oil	▪ batteries
▪ wind	▪ gasoline	▪ coal	▪ food (plants and animals)

5. Engage learners in comparing energy sources: renewable and non-renewable. Provide learners the following definitions:

- **renewable:** energy generated from natural processes that do not deplete or are replenished within a human's lifetime
- **non-renewable:** energy sources that are limited and will eventually run out; these sources of energy cannot be replaced within a human's lifetime

6. Then brainstorm to add to this list as a class. Are there any renewable or non-renewable sources learners may have missed?

Additional note on the types of renewable and non-renewable sources of energy

Renewable Energy	Non-renewable Energy
Solar	Oil
Geothermal / geo-exchange	Coal
Hydro-power	Natural gas
Tidal energy	
Biomass	
Plants and animals	
Waste heat	
Air exchange	

5.3.3 Activity 3: Generation of Electricity- Making electricity with a magnet

Learning Outcome To understand and demonstrate the generation of electricity.

Goal: Learners will realize that to generate electricity, something has to “turn the turbine” (Examples: steam from burning coal, oil, or heating from sunlight (solar-thermal); or falling water; or wind; etc.)

Materials: 100 cm of copper wire; bar magnet; electric meter (i.e., galvanometer or milliammeter, hollow tube such as a toilet paper roll;

Note: In most cases, the teacher will need to ask the school to provide these materials. However, if the learners are affluent, they can be asked to bring these materials to school themselves.

Teaching Strategies:

1. Ask learners where the electricity comes from to light the lights in the room, to power the television, to run the refrigerator, to charge their mobile phones etc.
2. Write key vocabulary words on the board as they use them.

Project approach:

1. Depending on how-many sets of project materials you have, organize groups so that each group has a set. If the teacher has only one set, he/she will need to demonstrate for the group and let learners take turns manipulating the materials.

Introduction:

Of course, you know how a magnet can pick up small metal objects. You can actually make a tack jump to the magnet by holding them close together.

Magnetism is a form of energy. It can push or pull things. It can even push or pull some of the tiny particles that make up matter: electrons. And when you push or pull electrons, you get electricity. Electricity can be generated using either renewable or non-renewable energy sources.

Let's try making electricity with a magnet.

Materials:

- 100 cm of bare copper wire
- 1 bar magnet
- 1 electric meter
- 1 cardboard tube

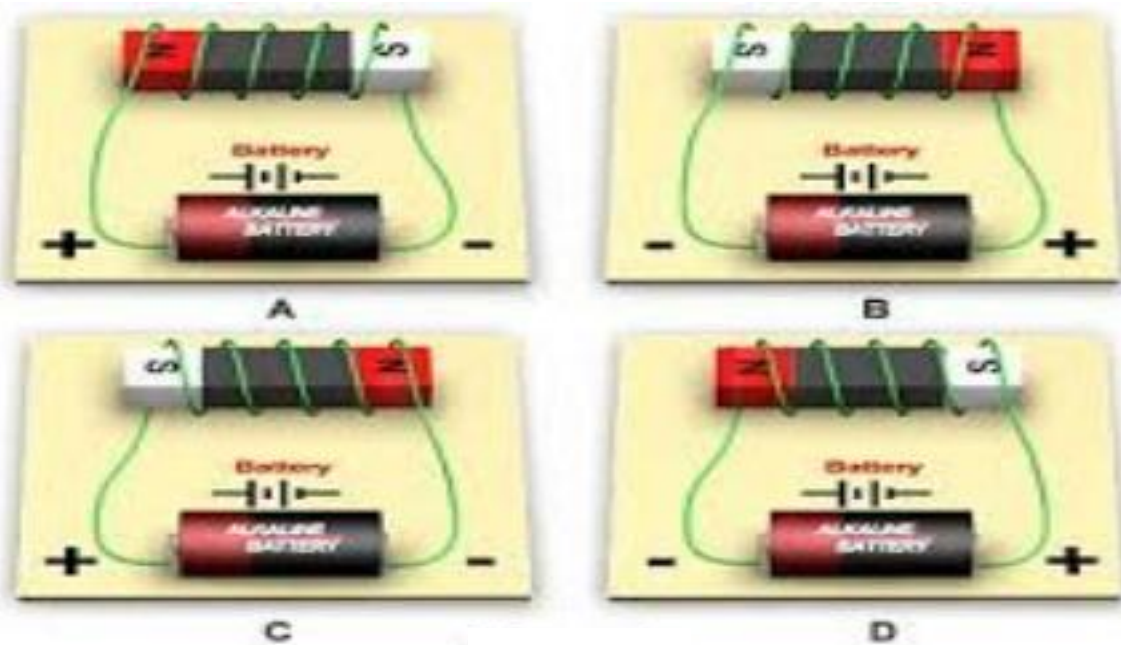
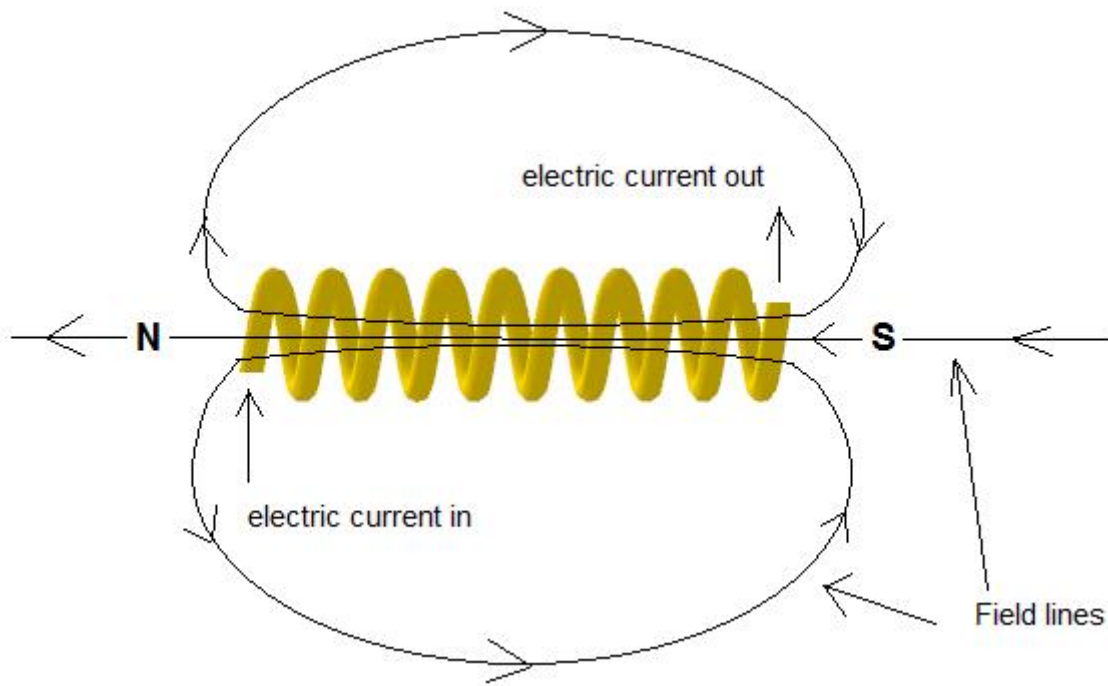


Figure 5.1: making electricity through magnet board

1. Wind the wire around the tube about 20 times
2. Connect both ends of the wire to the meter, as shown by your teacher.
3. Take the magnet and move it near the coil but not through it. Observe the meter.
4. Move the magnet in various directions around the coil.
5. As learners work through the activity, introduce the idea that an electric current is a flow of electrons. A magnet can pull tacks or nails, it can also pull electrons.
6. Move the magnet through the coil, back and forth. Make more than one trial doing this. Try moving the magnet at different speeds. Move the coil over the magnet, keeping the magnet still.
7. Ask learners the following questions:
 - In which step did the meter move the most?
 - When the meter made the greatest movement, in what direction were you moving the magnet?
 - Was there a difference between moving the magnet through the coil, or moving the coil over the magnet?
 - Was there a difference when you moved the magnet faster?

- The lines of force on a magnet would look something like this (if we could see them).



- What happened to those force lines when you moved the magnet inside the coil?
- Can you think of a way that you could make the magnet spin fast inside the coil?
- Are there any other things you can think of that might change the amount of current produced?"

8. Once learners have completed answering these questions, ask them to construct a turbine generator using renewable energy (e.g. water) to do the turning.

5.4 Linkage to the current GES curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 8 (JHS 2) – Science			
Module 5: Renewable Energy	Strand 4: Forces and Energy Sub-Strand I: Energy	B8.4.1.2 Show understanding of the sources of renewable energy and how to manage these sources in a sustainable manner	B8.4.1.2.1 Describe renewable and non-renewable forms of energy.
		B8.4.1.2 Show understanding of the sources of renewable energy and how to manage these sources in a sustainable manner	B8.4.1.2.2 Demonstrate how to manage sources of renewable energy sustainably

5.5 Link to Web Based Materials

Additional information for the module could be obtained from the following links:

1. <https://www.khanacademy.org/science/biology/energy-and-enzymes/the-laws-of-thermodynamics/a/types-of-energy>
2. <https://youtu.be/vny1qUaToHw>
3. <https://youtu.be/TitrRpMUt0I>
4. <https://youtu.be/3mier94pbnU>
5. <https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/a/energy-flow-and-primary-productivity>
<https://www.khanacademy.org/science/physics/work-and-energy/work-and-energy-tutorial/a/what-is-work>
6. <https://www.khanacademy.org/science/biology/energy-and-enzymes/the-laws-of-thermodynamics/a/types-of-energy>
7. <https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/v/flow-of-energy-and-matter-through-ecosystems>

Module 6: Energy Transformation/Production

6.0 Introduction

An **energy transformation** is the change of **energy** from one form to another. **Energy transformations** occur everywhere every second of the day (see pictures below). There are many different forms of **energy** such as electrical, thermal, nuclear, mechanical, electromagnetic, sound, and chemical.

6.1 Learning Outcomes:

At the end of this module, learners will

1. Explain and demonstrate processes of energy transformation and give examples of them.
2. Demonstrate the processes of energy conversion

(Please refer to section 6.4 for detailed linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 6: Energy Transformation	<ol style="list-style-type: none"> 1. Explain the processes of energy transformation 2. B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy 3. B7.4.3.1.2 Demonstrate the conversion of energy into useable forms 	Basic I - 3	2-weeks (3-separate lessons of 45-minutes each)	<p>Learners to watch videos and pictures on energy transformation processes</p> <p>Learners to explain and demonstrate energy transformation processes using charts, drawings and cut-out pictures of energy transformation.</p>	<p>videos pictures markers cardboard or paper, posters cut-out pictures drawings and charts of energy transformation.</p>	Learners will explain (or draw) at least 3 examples of energy transformation from one form to another

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
	4. B8.4.1.1.1 Describe energy conversion					

Poster to Use in This Module

- Energy Transformations

6.2 Key Concepts

1. Energy cannot be created or destroyed. It can only change from one form to another.
2. Various processes are used to transform energy for human purposes.
3. Energy production, supply, demand and usage vary in different countries.
4. There are environmental impacts and issues related to energy production, supply, demand, and usage (e.g. climate change, grey energy)

6.3 Activities

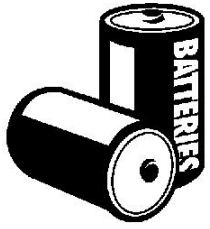
6.3.1 Activity I: Energy Transformation

Learning Outcome: learners will explain the energy transformations that are illustrated in pictures, using correct terms, and brainstorm to describe similar energy transformations they see in daily life.

Materials:

- Poster on Energy Transformation from Primary Curriculum.
- Pictures on Energy Transformation (see below). Alternatives: One copy enlarged to poster size; or the same pictures drawn and labelled on the board; or a set of the pictures photocopied for each learner.

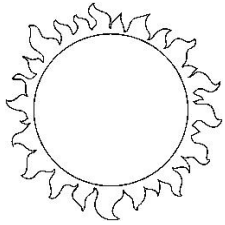
Pictures on energy transformation:



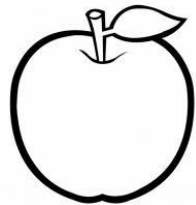
**Chemical
Energy**



**Radiant
(light)**



**Radiant (light)
Energy**



**Chemical
Energy**



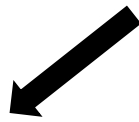
**Mechanical
Energy**



**Chemical
Energy**



**Electrical
Energy**



**Radiant
(Light)**



**Sound
Energy**



Teaching Strategies:

1. Explain that energy is useful to people when we can "turn it into" some other kind of energy. For example, electricity is useful when we can use it to light a bulb. Food energy, like a candy bar, is useful when we eat it and let our stomach digest it so we can move.
2. Use the **Primary poster on energy transformation**, to elicit the names of the different forms of energy (chemical, mechanical, radiant, electrical, thermal)
3. Call on learners to explain each change of energy that is illustrated in each picture on the **poster**. For each kind of change, ask "What other examples of *this* kind of change can you think of?" Help to clarify their understanding.
4. Organize the learners into groups of 4 or 5. Referring to the **pictures above**, (on an enlarged poster, **or** a drawing on the board, **or** individual handouts) instruct the group members to describe the transformation taking place in each sequence.
5. Then, back in the whole group, check for understanding, by calling on a representative from each group to state the transformation taking place in each picture.
6. As homework, instruct each learner to draw and label an energy transformation that he/she sees in the local environment.

Note to the Teacher: Your activities should cater for children with learning difficulties. Involve all learners with different abilities in your activities.

6.3.2 Activity 2: Energy Conversions

Energy cannot be created or destroyed. It can only change forms.

Learning outcome: Learners will use sensory experiences to create an energy conversion grid.

Materials: Solar cell, light bulb, battery, electric motor, "Energy Changes Worksheet" (one for each learner)

Teaching Strategies:

1. Begin by asking learners to name some examples of energy forms. Provide positive feedback to learners as they mention their answers.
2. Explain that energy is useful to people when we can "turn it into" some other kind of energy. For example, electricity is useful when we can use it to light a bulb. Food energy, like a chocolate, is useful when we eat it, it gives us energy to move.

Brainstorm Ideas Practice Techniques

3. Hand out "Energy Transformation" worksheet. (below)
4. Point out that the worksheet lists three of the energy forms that were just talked about. Tell learners that you are going to demonstrate some ways that energy changes into a different kind of energy. Learners are to figure out into which box the demonstration belongs. Answers to this brainstorming session provided in annex 3.

Energy Transformation: Learner's Worksheet

	Form of energy	→	Form of energy
Solar cell		→	
Light bulb		→	
Motor		→	
Hard Candy (Lifesaver)		→	

See Annex 5 for Answers to the energy transformation worksheet

6.4 Linkage to the current GES curriculum

Section in Toolkit	Strands and Sub-Strand	Content Standards	Indicators
SCIENCE			
Basic 7 (JHS 1) – Science			
Module 6: Energy Transformation	Strand 4: Forces and Energy	B7.4.3.1. Demonstrate understanding of the principle of conservation and conversion of energy and their application in real life situations	B7.4.3.1.1 Explain the principle underlying conservation and conversion of energy
	Sub-Strand 3: Conversion and Conservation of Energy		B7.4.3.1.2 Demonstrate the conversion of energy into useable forms
Basic 8 (JHS 2) – Science			
Module 6: Energy Transformation	Strand 4: Forces and Energy	B8.4.1.1 Demonstrate the skill to evaluate the conversion of energy from one form to another	B8.4.1.1.1 Describe energy conversion
	Sub-Strand 1: Energy		B8.4.1.1.2 Discuss the importance of conversion of energy
	Strand 4: Forces and Energy	B8.4.2.1 Demonstrate knowledge of electricity transmission	B8.4.2.1.1 Explain how electricity transmission occurs
	Sub-Strand 2: Electricity and Electronics		
Strand 4: Forces and Energy	B8.4.3.1 Evaluate the impact of conversion of energy and energy conservation on the environment	B8.4.3.1.1. Explain the importance of conversion of energy and energy conservation in daily life	
Sub-Strand 3: Conversion and Conservation of Energy			
Basic 9 (JHS 3) – Science			
Module 6: Energy Transformation	Strand 4: Forces and Energy	B9.4.2.1 Construct electrical circuits and illustrate how electrical energy is transformed into other forms of energy and perform	B9.4.2.1.1 Demonstrate transformation of electrical energy to other forms of energy in both series and parallel circuits and perform simple calculations involving flow of current in circuits
	Sub-Strand 1: Energy		
Strand 4: Forces and Energy	B9.4.3.1 Show understanding of conversion and conservation of energy and their application to life	B9.4.3.1.1. Describe how energy can be converted from one form to another and show how conservation of energy occurs	
Sub-Strand 3: Conversion and Conservation of Energy			

6.5 Link to Web Based Materials

Additional information for the module could be obtained from the following links:

- <http://www.need.org/>
- http://www1.mwdh2o.com/DocSvcsPubs/Education_Site/publications.html
- <https://www.climategen.org/our-core-programs/climate-change-education/curriculum/purchase-download-curriculum/thank-you/>

Module 7: Non-Renewable Energy Sources

7.0 Introduction

Module 7 introduces learners to non-renewable sources of energy. Non-renewable energy comes from sources that will run out or will not be replenished in our lifetimes—or even in many, many lifetimes. The non-renewable energy sources most commonly used in our world today are **fossil fuels**. Fossil fuels are the non-renewable sources: oil, coal and natural gas. Why do you think they are called **fossil** fuels?

7.1 Learning Outcome:

1. Learners will state the various non-renewable sources of energy and give an example of each.
2. Learners will research into the various non-renewable sources of energy and their uses.

(Please refer to section 7.4 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: Non-Renewable Energy Sources	<ol style="list-style-type: none"> 1. Explain non-renewable sources of energy. 2. B8.4.1.2.1 Define renewable and non-renewable forms of energy. 	Basic 7	2-weeks (3-separate lessons of 45-minutes each)	<p>Show and tell activity - show pictures of renewable & non-renewable energy resources. Ask learners to talk about the pictures.</p> <p>Learners to work in groups on the different sources of energy to help them differentiate between renewable and non-renewable energy sources.</p>	<p>videos pictures markers card board posters drawings cut-outs of non-renewable and renewable energy sources.</p>	<p>1. Learners can explain non-renewable energy sources. Deleted[Jones A. Frimpong]: Deleted[Jones A. Frimpong]:</p> <p>2. Learners give 3 examples each of renewable and non-renewable Deleted[Jones A. Frimpong]:</p> <p>3. Learners can differentiate between renewable and non-renewable energy sources. Sources of energy. 3. Actively practice energy-saving at school and home. Deleted[Jones A. Frimpong]:</p>

Posters to Use with this Module

- Non-Renewable Energy Resources
- Renewable Energy Resources
- Renewable and Non-Renewable Energy Resources

7.2 Key Concepts

Petrol and diesel are used mainly as fuel for cars, trucks and motorbikes. They are produced from **crude oil**, which is a fossil fuel formed from the remains of dead prehistoric organic material (plants and animals). Crude oil contains a lot of energy which can be used. Crude oil is a non-renewable energy source because it takes millions of years to produce; we cannot produce more when the existing reserves are finished.

Coal is most commonly used as a source of energy by power stations to generate electricity. We will learn more about this later in the term. Coal can also be burned in fires to warm us or in coal stoves to cook our food.

Natural gas is the common name used to describe a mixture of gases. Natural gas is found in deep underground rock formations and usually with other fossil fuels, such as oil and coal. The biggest part of the gas mixture is a gas called **methane**. Methane burns easily and releases a lot of energy when it is burnt. Natural gas is used for cooking, heating and producing electricity.

Note to the Teacher:

Teach this module using a class discussion approach. Start by reviewing thoroughly all sources of non-renewable energy sources as shown below:

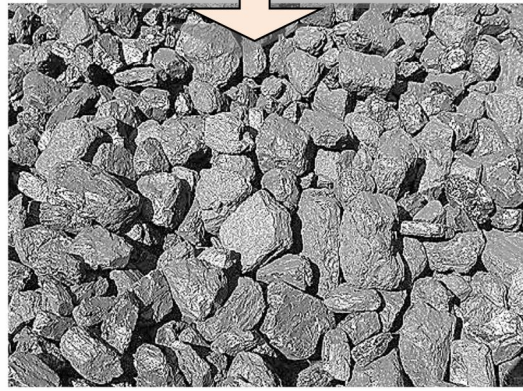
Fossil fuels

Learners brainstorm: Where do we most often see fossil fuels in our everyday lives? (Show the two photos for clues, or draw two simplified images on the board.)

Putting petrol into a car at a petrol station.



Coal



7.3 Activity

7.3.1 Activity I: Search for non-renewable sources of energy

Materials and preparation

- internet
- videos
- computer
- notebooks

Learning and Teaching Strategies

Homework Assignment:

1. This activity should be given to learners as a take home assignment
2. Learners explore the various sources of non-renewable energy used in their homes
3. Learners list the various forms of non-renewable energy being used and where they observed it.

Class Session:

4. Learners present their findings to the class for discussion
5. Learners brainstorm in pairs about what non-renewable sources of energy mean. After the brainstorming session, learners should present their definitions to the class for discussion.

ASSESSMENT

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

Instructions: Write and draw what you have learnt about non-renewable energy sources.

7.4 Linkage to current GES curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 8 (JHS 2) – Science			
Module 7: Non-renewable Energy	Strand 4: Forces and Energy Sub-Strand 1: Energy	B8.4.1.2 Show understanding of the sources of renewable energy and how to manage these sources in a sustainable manner	B8.4.1.2.1 Define renewable and non-renewable forms of energy.

7.5 Link to Web Based Materials

Additional information for the module could be obtained from the following links:

- (<https://www.education.com/lesson-plan/renewable-and-non-renewable-energy/>)
- <https://www.energystar.gov/buildings/tools-and-resources/k12-energyefficiency-student-toolkit>
- <http://www.need.org/>
- http://www1.mwdh2o.com/DocSvcsPubs/Education_Site/publications.html
- <https://www.climategen.org/our-core-programs/climate-change-education/curriculum/purchase-download-curriculum/thank-you/>

Module 8: Climate Change

8.0 Introduction

Environmental quality is impacted by energy choices. Unwise human decisions about energy production, supply and usage can degrade the environment (e.g. climate change, grey energy). Sustainable energy choices can enhance the quality of human life and the environment.

Human activities have increased the concentration of the greenhouse gases on the earth and have negatively affected the environment and the climate. As the world industrializes, the energy resources are exploited, increasing the emission of gases. Some of the electricity sources which are environmentally friendly are not fully developed. Module 8 seeks to develop the learners understanding of climate change and how environmental degradation can be prevented.

8.1 Learning Outcomes:

Learners will:

1. Research using open educational resources on climate change and variability
2. Research into evidences of climate change in their schools

(Please refer to section 8.4 for detailed linkages to the New Curriculum).

Module Summary

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
Module 8: Climate Change	<ol style="list-style-type: none">1. Explain climate change and the impact on everyday life.2. B7.4.2.1.2 Explain the impact of electricity generation on the environment3. B7.5.4.1.1 Search for information on ways sustainable energy choices and scientific	JHS I	2-weeks (3-separate lessons of 45-minutes each)	<p>Learners to watch videos and pictures on climate change</p> <p>Learners to demonstrate understanding of climate change</p> <p>Learners to discuss the impact of climate change on everyday life</p>	Videos Pictures	Learners can explain climate change. Learners explain, in speech, writing and drawing the causes of climate variability and change, giving local examples.

Module Title	Learning Indicators	Level	Time	Exemplars	Resources	Performance Indicators (Expected attitude & behavioural change)
	<p>ideas are used to protect the environment.</p> <p>4. B8.5.4.1.1 Explain the concept of climate change and its effect on the environment</p> <p>5. B8.5.4.1.2. Describe climate change and green economy actions</p>					

8.2 Key Concepts

What is Climate Change?

Climate Change which can also be referred to as global warming is the rise in the earth's temperature due human and abiotic factors. For example, human use of fossil fuel results in carbon dioxide and other greenhouse gases being released into the environment, which also traps heat (www.takepart.com/flashcards/what-is-climate-change/index).

What are greenhouse gases?

Greenhouse gases are a combination of gases that are able to trap heat in the atmosphere, keeping the Earth's surface warmer than it would be if they were not present. These gases cause the greenhouse effect. They are carbon dioxide, methane, nitrous oxide and fluorinated gases..

What is greenhouse effect?

The greenhouse effect is a natural process that occurs when gases in Earth's atmosphere trap the sun's heat. This process makes Earth much warmer than it would be without an atmosphere. The greenhouse effect is one of the things that make Earth a comfortable place to live. However, certain human activities intensify this process, thus creating global warming and causing climate change. (climatekids.nasa.gov/greenhouse-effect). Violent storms, droughts, rising sea levels and unpredictable weather are just a few examples of climate change.

8.3 Activities:

- Questions and Answers

8.3.1 Activity I: Global Climate Change

Instruction:

- Teacher can draw or show the three images in the table below on the board or photocopy it to be passed on from one learner to the other.
- Use the images as a basis for the discussion, question and answer sessions.
- Use the questions in the table below as a guide.

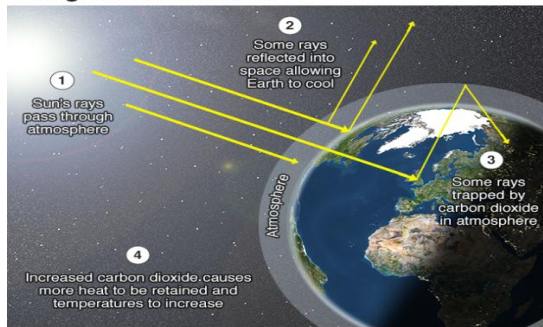
Describe the phenomenon known as global climate change:

What are some of the indications in your community that suggest there might be climate change?

How is carbon dioxide produced naturally?



The greenhouse effect



What action, or behavior change, could positively affect the rate of climate change (slow it down)?

How is carbon dioxide produced by humans?



Why is climate change a global, or international, issue?

Climate change is a “hot topic” debated by politicians and scientists. In your opinion, does climate change matter? Should your generation be concerned or not? Support your opinion with facts or data from your reading.

8.3.2 Activity 2: Energy Global Change Assessment⁵

QUESTIONS

The teacher helps the learners to form groups of 3 or 4, depending on the class size, and asks each group to work on the following questions using open data resources and then present their findings to the class:

APPLICATION QUESTIONS

1. What is the best thing to do with a glass container when you finish using it? Why?
2. What is the best thing to do with an aluminium Coca Cola can when you are finished using it? Why?
3. What is the best thing to do with a glass light bulb when it has burned out? Why?
4. How can you separate aluminium from steel cans?
5. How does using a waste-to-energy plant affect the environment?
6. Should old, high-polluting vehicles be banned from roadways? What are the advantages and disadvantages of the ban on old and high - polluting vehicles?

8.3.3 Activity 3: Individual Assessment on the Greenhouse Effect

QUESTIONS: Teacher writes the following on the boards, asks learners to write their answers, and collects these papers. In reading them, the teacher will have a better idea how individuals are grasping the concepts.

1. What are greenhouse gases?
2. Which greenhouse gas is the most important? Why?
3. What is the greenhouse effect?
4. below your answer, sketch a model of the greenhouse effect.

⁵ Source: Assessment Question Bank Secondary Conservation and Efficiency Comprehension

Note to the Teacher: You can give each learner a brief “evaluation” of his/her work by printing the “plant growth” graphic (see Annex 4) and circling the appropriate image to indicate the quality of the learner’s.

8.3.4 Activity 4: Project work of climate change

Procedure:

1. Learners to work in groups of three (3) depending on the class size
2. Each group identifies evidences of climate change in their school or communities
3. Each group presents their findings to the class for discussion.
4. challenge in their community related to the efficient use of energy
5. Each group works to come up with a solution to the identified challenge.
6. Based on the evidences of climate change, learners should come up with solutions and educate and sensitise members of their communities on how to reduce the rate of climate change in our communities.

8.4 Linkage to the current GES curriculum

Section in Toolkit	Strands and Sub-Strands	Content Standards	Indicators
SCIENCE			
Basic 7 (JHS 1) – Science			
Module 8: Climate Change	Strand 4: Forces and Energy	B7.4.2.1 Demonstrate understanding of forms of electricity, its generation and effects on the environment.	B7.4.2.1.2 Explain the impact of electricity generation on the environment
	Sub-Strand 2: Electricity and Electronics		
	Strand 5: Humans and the Environment	B7.5.4.1 Demonstrate understanding of sustainable energy choices and their impact on the environment	B7.5.4.1.1 Search for information on ways sustainable energy choices and scientific ideas are used to protect the environment.
	Sub-Strand 4: Climate Change and Green Economy		
Basic 8 (JHS 2) – Science			
Module 8: Climate Change	Strand 5: Humans and the Environment	B8.5.4.1 Demonstrate understanding of the effects of climate change in the world and greening of other tropical countries including Ghana.	B8.5.4.1.1 Explain the concept of climate change and its effect on the environment
	Sub-Strand 4: Climate Change and Green Economy		B8.5.4.1.2. Describe climate change and green economy actions
Basic 9 (JHS 3) – Science			
Module 8: Climate Change	Strand 4: Forces and Energy	B9.5.4.1 Demonstrate understanding of natural and human factors that influence climate change and green economy	B9.5.4.1.1 Examine various natural and human factors that influence climate change and green economy in their localities
	Sub-Strand 3: Conversion and Conservation of Energy		
SOCIAL STUDIES			
Basic 7 - Social Studies			
Module 8: Climate Change	Strand 1: Environment	B7.1.1.1 Demonstrate skills in dealing with environmental challenges	B7.1.1.1.1. Examine ways of dealing with sanitation challenges in the environment
	Sub-Strand 1: Environmental Issues		
Basic 8 - Social Studies			
Module 8: Climate Change	Strand 1: Environment	B8.1.1.1 Demonstrate skills in dealing with environmental challenges	B8.1.1.1.1. Examine water pollution as an environmental challenge
	Sub-Strand 1: Environmental Issues		

8.5 Link to Web Based Materials

Additional information for the module could be obtained from the following links:

- <http://www.need.org/>
- http://www1.mwdh2o.com/DocSvcPubs/Education_Site/publications.html
- <https://www.climategen.org/our-core-programs/climate-change-education/curriculum/purchase-download-curriculum/thank-you/>
- [https://www.ecfr.eu/article/commentary_climate_driven_migration_in_africa]

ANNEXES:

ANNEX 1:

MODULE 1, ACTIVITY 2: ENERGY DETECTIVE

DETECTIVE DATA SHEET



CLUES

1. Energy can make things change.
2. Heat comes from energy.
3. Movement comes from energy.

EVIDENCE

We know that energy was here because.....	Energy Source (sun? wind? electricity? other?)

REPORT FROM THE
“

DETECTIVE AGENCY”

After you have collected energy evidence, have each person in your group make up a definition for energy. Write definitions in the spaces below. Next, have your whole group agree on one definition and write it at the bottom of the page.

DETECTIVES' NAME	DEFINITION OF ENERGY

GROUP TO ANSWER: WHAT IS ENERGY?

EXTRA CLUES FOR PUZZLED DETECTIVES

- Electrical and solar energy give us light.
- Sun energy grows our food.
- Lightning is a natural form of electrical energy.
- Gasoline, made from crude oil, gives us energy to make cars go.
- Energy heats our homes and school.
- Energy keeps our refrigerator cold.
- Boats need wind energy.



EXTRA CLUES FOR PUZZLED DETECTIVES

- Electrical and solar energy give us light.
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- Energy heats our homes and school.
- Energy keeps our refrigerator cold.
- Boats need wind energy.



EXTRA CLUES FOR PUZZLED DETECTIVES

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3. Lightning is a natural form of electrical energy.
4. Gasoline, made from crude oil, gives us energy to make cars go.
5. Energy heats our homes and school.
6. Energy keeps our refrigerator cold.
7. Boats need wind energy.



ANNEX 2

MODULE 4 ACTIVITY: Home Energy Use Check List

Name _____

Date _____

Home Energy Test: How Much Are You Conserving Energy?

Here are easy steps that you can take to reduce your energy use at home. For each activity you complete or help complete, check it off on the list below. At the end, see which light bulb best describes how you conserve energy!

- | | |
|---|--|
| <input type="checkbox"/> Turned off light or nightlight when not needed | <input type="checkbox"/> Helped do laundry with cold water |
| <input type="checkbox"/> Helped make dinner in a crockpot | <input type="checkbox"/> Opened the curtains for natural light |
| <input type="checkbox"/> Asked to use sleep setting for computer | <input type="checkbox"/> Didn't keep the fridge door open too long |
| <input type="checkbox"/> Turned off my radio/iPad when done | <input type="checkbox"/> Made sure the dishwasher was full |
| <input type="checkbox"/> Told someone else how to save energy | <input type="checkbox"/> Cleaned the dryer lint filter |
| <input type="checkbox"/> Turned off water when I brushed my teeth | <input type="checkbox"/> Hung laundry to dry instead of using dryer |
| <input type="checkbox"/> Turned off the TV when no one was watching | <input type="checkbox"/> Kept the front and back door closed |
| <input type="checkbox"/> Used a ceiling fan instead of air conditioning | <input type="checkbox"/> Unplugged video game console |
| <input type="checkbox"/> Unplugged my cell phone or tablet charger | <input type="checkbox"/> Helped check our air filters |
| <input type="checkbox"/> Helped clean the air vent in my room | <input type="checkbox"/> Checked water heater for an insulating blanket |
| <input type="checkbox"/> Unplugged a kitchen appliance we weren't using | <input type="checkbox"/> Helped change a light bulb to an LED light bulb |
| <input type="checkbox"/> Asked to lower/raise the thermostat one degree | <input type="checkbox"/> Made sure windows were properly sealed |

ANNEX 3

MODULE 6 ACTIVITY - Energy Transformation: Learner's Worksheet

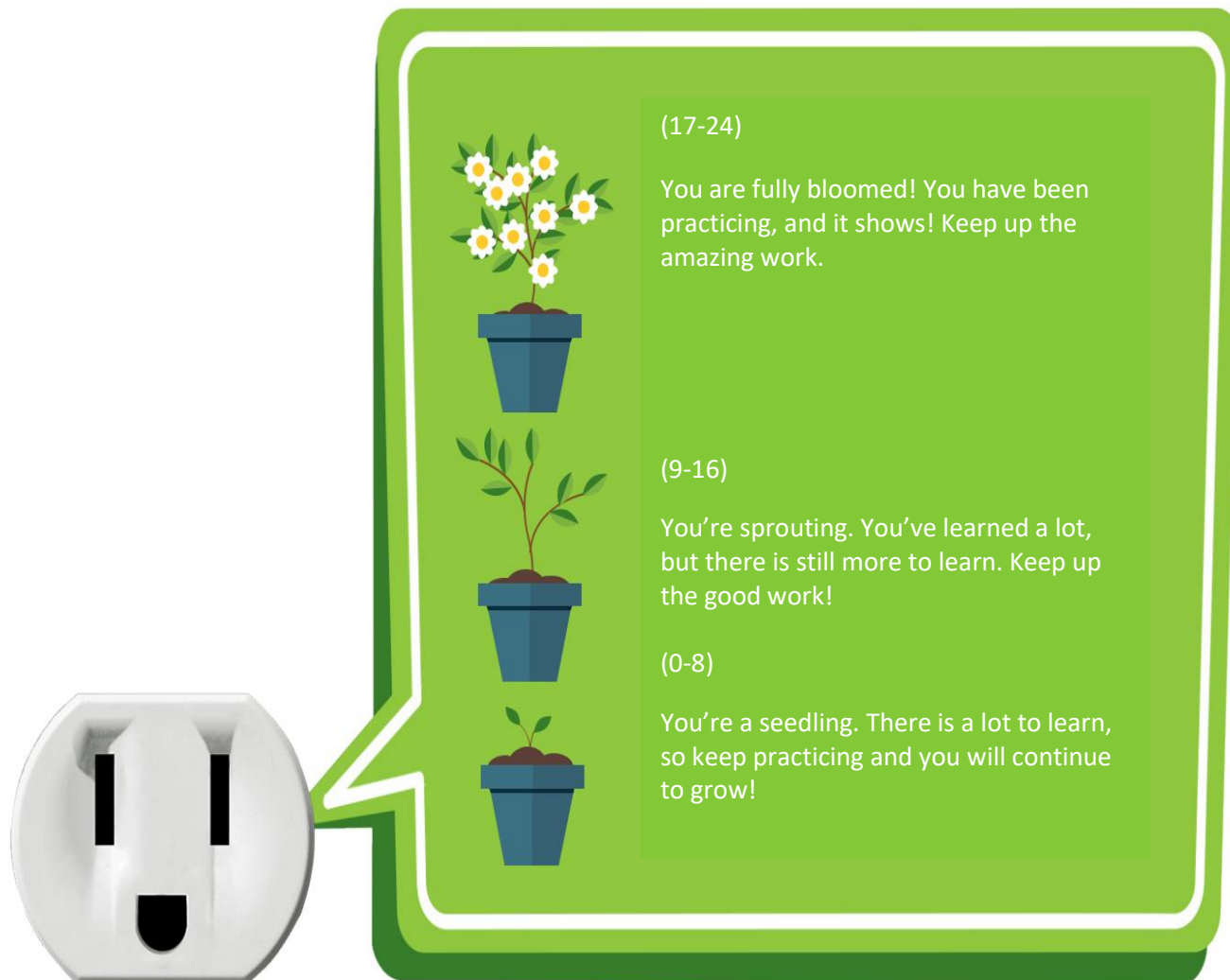
	Form of energy	→	Form of energy
Solar cell		→	
Light bulb		→	
Motor		→	
Hard Candy (Lifesaver)		→	

Energy Transformation: Teacher's Answer Sheet

	form of energy	→	form of energy
Solar cell	radiant	→	electric
Light bulb	electric	→	radiant
Motor	electric	→	mechanical
Hard candy (Lifesaver)	mechanical	→	electric

ANNEX 4

MODULE 8 ACTIVITY: GREENHOUSE EVALUATION DIAGRAM



ANNEX 5

MODULE 4 ACTIVITY: ENERGY SOURCES WORKSHEET – CROSSWORD PUZZLE

Guidelines / Instructions: The group leader hands out copies of the crossword puzzle. Depending on the number of learners in the group, the leader should divide the members into pairs (or if the number is uneven, make one group of three). The pairs use the words below to answer the questions and fill in the crossword puzzle. When all the pairs have finished, they compare their answers with the rest of the group.

- Battery
- Energy
- Gasoline
- Non renewable
- Renewable
- Solar
- Wind

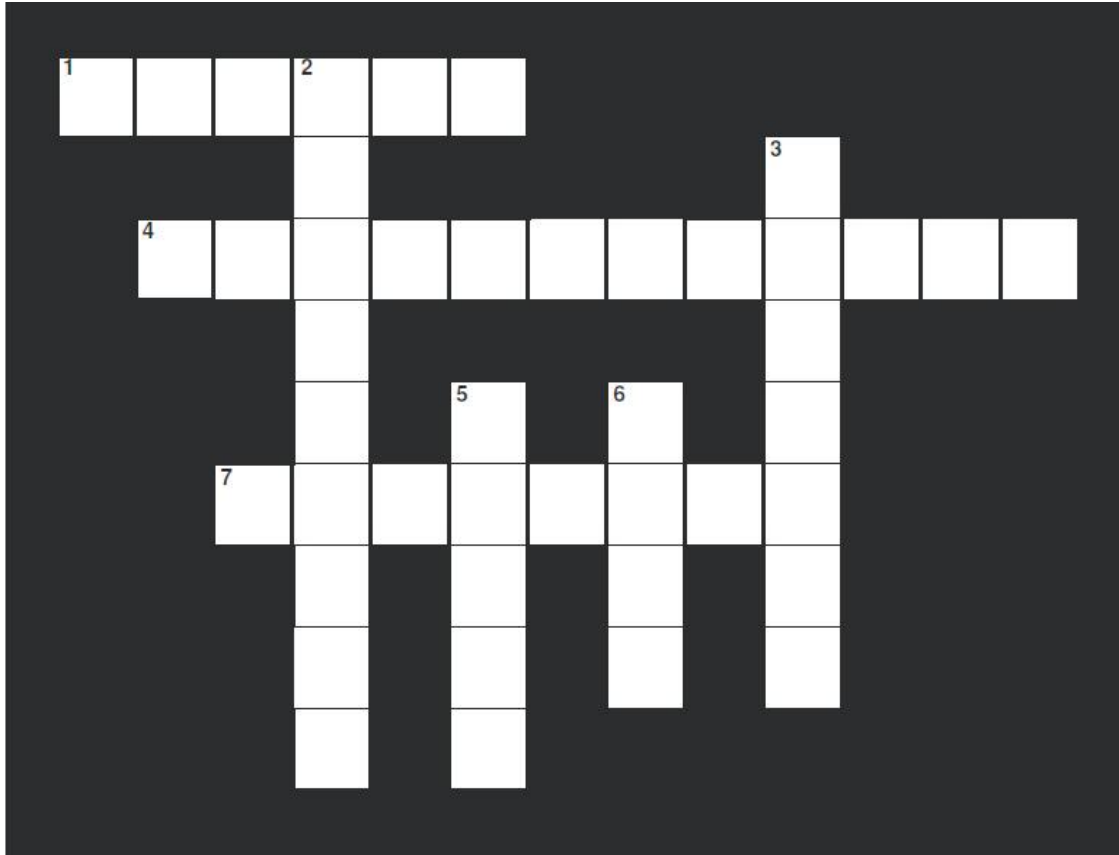
Partners should use the words above to answer the questions. They write the correct answer (word) in the crossword puzzle:

ACROSS:

1. What do we need to work and play?
4. Energy source that can run out.
7. Energy source we use in a car

DOWN:

2. An energy source that will never run out
3. An energy source used in flashlights and cell phones
5. Energy that comes from the sun
6. Energy source that uses windmills



REFERENCES

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<https://www.climategen.org/our-core-programs/climate-change-education/curriculum/purchase-download-curriculum/thank-you/>

(<https://www.education.com/lesson-plan/renewable-and-non-renewable-energy/>)

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