



Module 1

The Environment and Me



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UP Department of Broadcast Communication
UP National Institute for Science and Mathematics Education Development



UP COLLEGE OF MASS COMMUNICATION
DEPARTMENT OF BROADCAST COMMUNICATION



DZUP EskweKalikasan: Para sa kabataan, kapaligiran, at bayan

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Funded by the Philippine Government under the General Appropriations Act for Fiscal Year 2019 through the initiative of the Office of Senator Loren Legarda.



Preface

Para sa bayan, kalikasan, at kabataan? Kayang-kaya!

The project **DZUP EskweKalikasan: Para sa kabataan, kapaligiran, at bayan** is a publicly-funded initiative of the academe, with support from the government and advocates, that aims to contribute to the initiatives to integrate climate change knowledge and concepts about the Philippine environment in formal education.

According to the Climate Change Commission (n.d.), “the Philippines is one of the countries at greatest risk from present and projected climate-related hazards such as tropical cyclones, floods, landslides, and droughts.” These teaching modules were designed to encourage students with a comprehensive examination of the issues confronting the environment. Recognizing the curriculum visions and the objectives of inquiry-based teaching and learning that are adopted and promoted by the Philippine Basic Science Education Curriculum, these modules go beyond increasing public awareness of the environment’s significance in sustaining life on Earth to examining the effects of human actions in the protection or degradation of the environment.

Results of the early studies of Belland, Glazewski, and Richardson (2012) claim that issue-based learning is closely linked with evidence-based learning. It is thus appropriate to use scientific argumentation to implement these modules. Embedded in the modules is the provision for students’ opportunities to deeply engage in evidence-based scientific argumentation while simultaneously developing their critical thinking and communication skills. Thus, the basic components of scientific argumentation such as **claim, evidence, and justification** were strategically presented in the teaching modules. The modules, identified in the Curriculum Entry Points section, can be used in the following Senior High School Core Curriculum Subjects: Earth and Life Science or Earth Science; Understanding Culture, Society, and Politics; and Disaster Readiness and Risk Reduction.

These modules use multimodal learning to create an engaging and exciting learning environment that recognizes diverse learning styles. The concepts and issues presented in each lesson are mirrored in the podcast “*Kayang-kaya!*” to supplement classroom discussion using aural storytelling. Case studies that highlight local experiences while recognizing the various contexts that surround environmental issues, particularly climate change, are made available so the students can better grasp the environmental challenges that we are facing and be acquainted with examples of adaptation and mitigation measures that are currently being practiced.

DZUP EskweKalikasan aims to contribute to the wider discussion of environmental issues and the impacts of climate change and disasters in our everyday life, and to enrich conversations about sustainable living, sustainable development, and mindful consumption. These modules aim to be of utmost help for teachers to supplement their resources in their implementation of the Senior Science Education Curriculum.



The Project

DZUP EskweKalikasan: Para sa kabataan, kapaligiran, at bayan is an on-air and online modular educational project about the environment for the youth. The UP Department of Broadcast Communication (CHED Center of Excellence for Broadcasting) and DZUP 1602 (the official radio station of UP Diliman) spearheaded the project with funding support from the Philippine Government under the General Appropriations Act for Fiscal Year 2019 through the initiative of the Office of Senator Loren Legarda. The UP Diliman Office of the Chancellor also provided additional funding support.

Ten modules were conceptualized and developed in collaboration with the UP National Institute for Science and Mathematics Education Development (UP NISMED).

- Module 1.** The Environment and Me
- Module 2.** The Philippine Environment
- Module 3.** Biodiversity Conservation
- Module 4.** Sustainable Living
- Module 5.** Climate Change
- Module 6.** Waste Management
- Module 7.** Management of Environmental Resources
- Module 8.** Environment and Disasters
- Module 9.** Renewable Sources of Energy
- Module 10.** The Youth, the Nation, and the Environment

Each of the teaching modules comes with a **Kayang-kaya!** podcast and an episode of **Go Teacher Go sa DZUP EskweKalikasan (GTG sa DZUP Eskwe)**.

The **Kayang-kaya!** podcast, developed and produced by the UP Department of Broadcast Communication, chronicles the adventure of three Senior High School students residing in Brgy. Luntian, as they seek to understand and uncover the issues confronting the environment.

Meanwhile, DZUP EskweKalikasan and UP NISMED's radio program Go Teacher Go, collaborated to produce **GTG sa DZUP Eskwe**, video guides for teachers in implementing the modules in their classes. **GTG sa DZUP Eskwe** also discusses tips on how to adjust the modules into different modes of learning, i.e. blended, online, remote, etc. All the teaching modules and other learning resources are available for download at www.dzup.org/eskwekalikasan.



How to use this module

The modules promote inquiry-based teaching and learning through scientific argumentation and were designed to encourage students to appreciate Mother Nature and examine the issues confronting our environment. Each module is composed of the following sections:

Introduction Page / Table

This page contains the general information about the teaching module and its corresponding podcast. These include the following: **module number** and **title, podcast topic**, main question in the podcast, **synopsis** of the podcast, and the **teaching module objectives**.

Curriculum Entry Points

The curriculum entry points serve as guides for the educators in the appropriate use of the teaching module. This will help the educators identify the student **grade level, subjects**, and **subtopics** that this material can be applied to, as well as the **content standard, performance standard**, and **learning competencies** from the Department of Education's curriculum guide. This part also contains the **prerequisite concepts** based on students' prior knowledge from previous grade levels.

Teaching and Learning Process

The teaching and learning process guides the teacher in inquiry-based teaching using argumentation. This section identifies the **teaching approach**, and the **materials** that will be used to teach this module. The modules adopt the guided inquiry-based approach through argumentation as a teaching approach. It is composed of two major parts: the **lesson procedure** proper and the **assessment**. Embedded in the lesson procedure in each module is the eliciting of the three main components of argumentation: claim, evidence, and justification. They are placed differently depending on how the concepts are formed whether inductively or deductively. Assessment is used in the module in three ways: for learning (formative assessment), as learning (on-going), and of learning (summative assessment).

Related Concepts

This part contains the science and other related concepts and their contextualized definitions depending on how they were used in the modules.

References

This contains all the references used by the writers in writing the modules. The educators may revisit these references for additional information.

Activity Sheets / Worksheets

Activity sheets may include **case studies** and **guide questions** to answer while listening to the podcast or for presentation purposes, and other types for individual and group activities.

Answer Keys

The activity sheet/worksheet in each module comes with the corresponding answer key that can help the educators in assessing the student outputs.





Teaching Module

Module No. and Title	Module 01. The Environment and Me
Podcast Topic	Carbon Footprint
Main Question	Ano ang carbon footprint?
Podcast Synopsis	<p>Kali realizes that everything she does contributes to the warming of the earth. Together with experts, they will talk about “carbon footprint” and its negative impact on the environment. Let’s find out which of our everyday activities and habits have high and low carbon footprints, and how we can minimize them. Join Kali and her friend Naya in discovering ways to save the environment.</p> <p><i>Maiisip ni Kali na lahat ng kanyang ginagawa araw-araw ay may naiaambag sa unti-unting pag-init ng mundo. Kasama ang mga eksperto, pag-uusapan nila ang “carbon footprint” at ang masamang epekto nito sa kapaligiran. Anu-ano kaya sa mga karaniwan nating ginagawa ang may mataas at mababang carbon footprint, at paano natin ito mababawasan? Samahan si Kali at ang kaibigan niyang si Naya sa pagtatanong at pagtuklas ng mga paraan para makatulong sa ating kalikasan.</i></p>
Podcast Objectives	<p>After listening to the podcast, the learners should be able to:</p> <ol style="list-style-type: none"> 1. describe a carbon footprint and its impact on our environment; 2. investigate the carbon footprint of his/her daily activities; and 3. recognize that the environment is our only home and we have an important role in protecting it.
Teaching Module Objectives	<p>(Adapted from the DepEd curriculum guides)</p> <p>At the end of this lesson, the learners should be able to:</p> <ol style="list-style-type: none"> 1. discuss what a carbon footprint is; and 2. explain how human activities affect the natural ecosystem through their carbon footprint.

Curriculum Entry Points

Grade Level: Grade 11/12 (Earth and Life Sciences)

Content: Interaction and Interdependence

Content Standard	Performance Standard	Learning Competency
<p><i>The learners demonstrate an understanding of:</i></p> <p>How human activities affect the natural ecosystem</p>	<p><i>The learners shall be able to:</i></p> <p>Prepare an action plan containing mitigation measures to address current environmental concerns and challenges in the community.</p>	<p><i>The learners:</i></p> <p>Describe how the different terrestrial ecosystems are interlinked with one another.</p>

Prerequisite Concepts

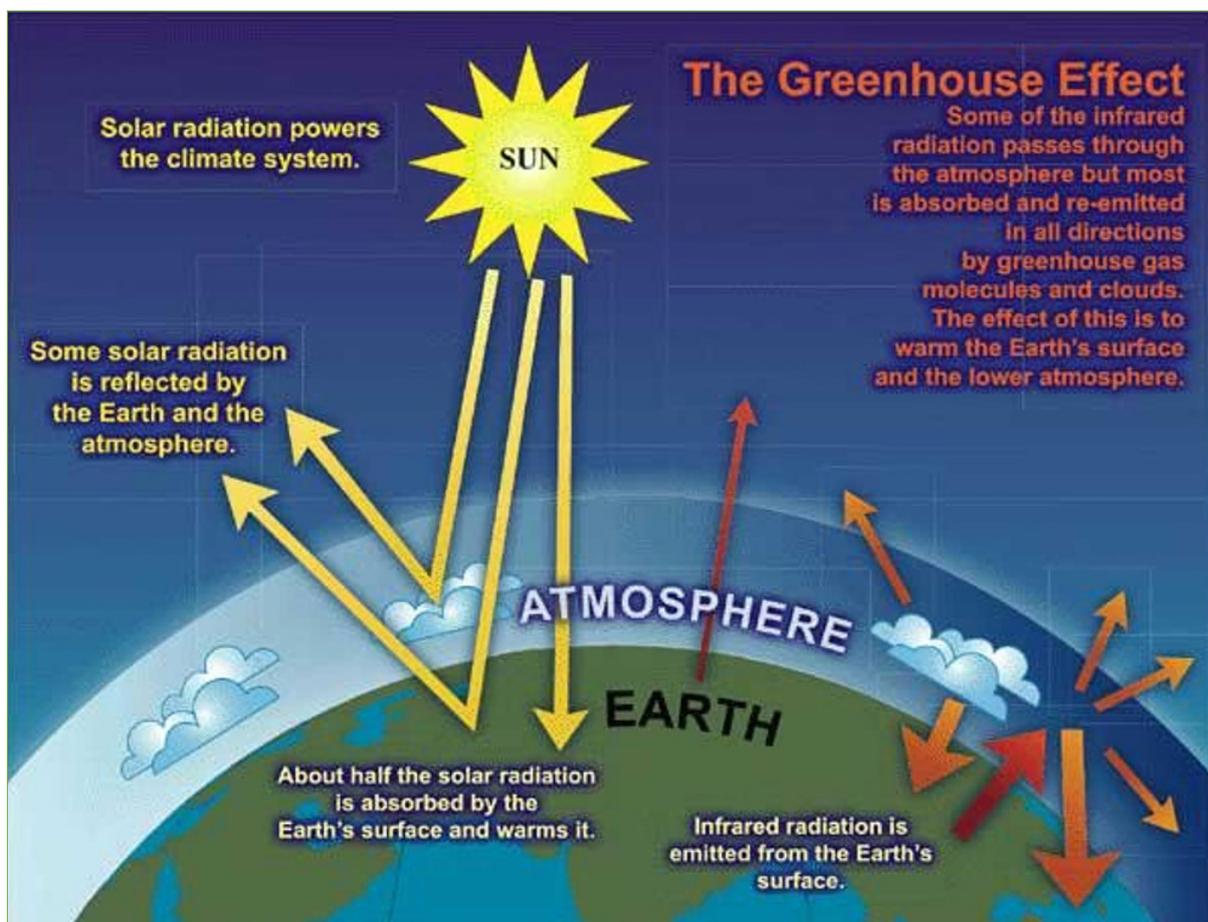
1. Greenhouse Effect and Global Warming (Grade 7)

Greenhouse Effect

- *Greenhouse effect* is considered a natural process that prevents the Earth's temperature from reaching below freezing point. When the Earth absorbs energy from the sun, it also bounces this back into the atmosphere as heat. However, before fully exiting the Earth's atmosphere, the heat may hit the greenhouse gas molecules in the atmosphere causing it to either bounce back to the Earth's surface, to another greenhouse gas molecule, or further out to space. This is what is called the greenhouse effect (University Corporation for Atmospheric Research, n.d.).

Global Warming

- With the increasing amount of greenhouse gases in the atmosphere, more and more heat is trapped within the Earth's atmosphere. This results in the increase of Earth's temperature called *global warming*.



Source: <https://hubpages.com/living/Greenhouse-effect-Acid-Rain>

Relationship of Greenhouse Effect and Global Warming with Carbon Footprint

- *Carbon footprint* is the total amount of greenhouse gases such as carbon dioxide and methane, generated by human activity and released into the atmosphere (The Nature Conservancy, n.d.). In calculating for carbon footprint, the unit gigatons of carbon (GtC) or tons of carbon dioxide equivalent (tCO₂e) is used. One gigaton of carbon (GtC) is equal to 1 billion tons of carbon. To convert carbon to carbon dioxide (CO₂), multiply the calculated GtC by 3.67.
 - By calculating an individual's or community's carbon footprint, scientists can also measure and predict the Earth's temperature change in the coming years. This also helps in identifying how to lessen the greenhouse effect and how to avoid rapid global warming.
2. Factors that affect climate and the effects of changing climate and how to adapt accordingly (Grade 9)

Climate Change and Carbon Footprint

- "Climate change refers to a change in climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer, whether due to natural variability or as a result of human activity." (Republic Act No. 9729, Section 3, (d)).
 - Climate change is one of the major effects of global warming, which, as previously discussed, is also an effect of too much release of greenhouse gasses in the atmosphere or carbon footprint. These concepts have interlinked connections among each other. Therefore, to try to solve climate change, there is also a need to track down the chain and do something about every individual's daily carbon footprint.
3. Power generation and the transmission and distribution of electrical energy from power plants to homes (Grade 9)

Generating Electricity

- Electricity is generated using different types of renewable and nonrenewable sources. In the Philippines, almost half of the total generated power is from coal power plants (*Business World Online*, 2018). Coal is a fossil fuel and a nonrenewable source. Other fossil fuels used in generating electricity are natural gas and petroleum. Power generation can also be from renewable sources such as solar energy, hydropower, wind energy, and geothermal power (*National Geographic*, n.d.).

Transmission and Distribution of Electricity

- From the electric power plants, electricity passes through transmission systems before being distributed to houses and industries. The generated voltage first has to be increased through a "step-up" transformer before being transmitted over long distances to reach the consumers. From the transmission systems, the voltage will then have to be lowered or "stepped down" through the distribution systems (these are the smaller transformers one can see on street posts) before being distributed to houses, offices, or industries (Nptel.ac.in, n.d.).

Relationship of Electricity Generation with Carbon Footprint

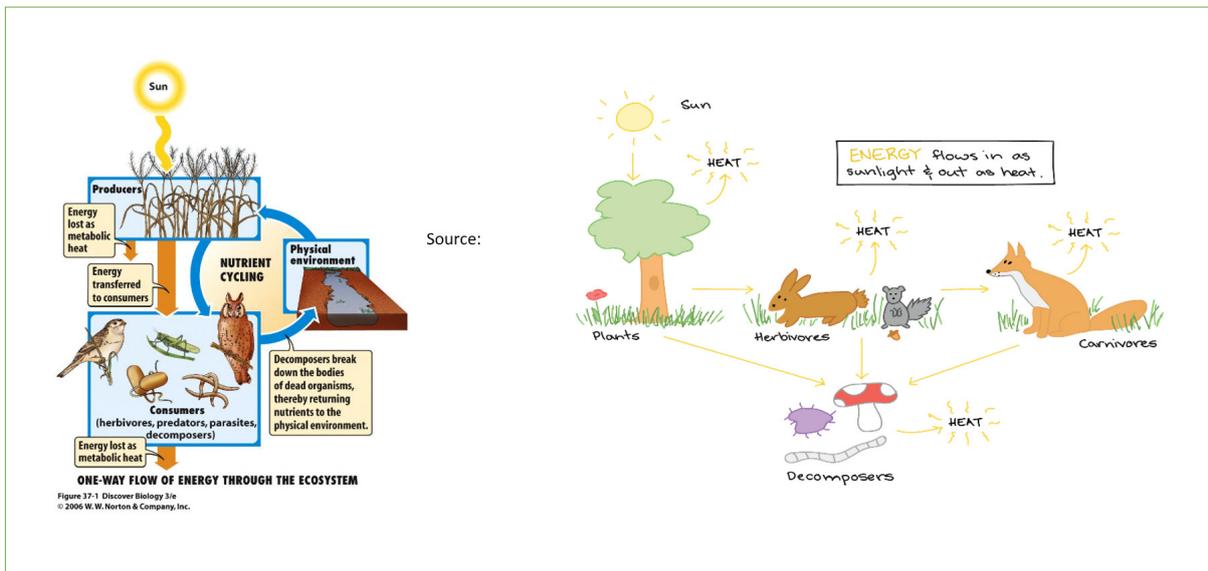
- As the world becomes more dependent on technology, people also become more dependent on electricity. The continuous generation of electricity means continuous release of greenhouse gases from the production sites/power plants, and up to the distribution systems. It is important to note that different sources of electricity have a different amount of carbon footprint. Understanding the everyday generation of electricity, let us be more aware of the importance of using less electricity in conserving the environment.

4. Flow of energy and matter in ecosystem (Grade 10)

According to the Khan Academy:

Flow of Energy and Matter in Ecosystem

- Energy flows among the members of the ecosystem—producers and consumers. As energy flows from the source and to each member of the ecosystem, this transforms into another form of energy. A major example of this is the solar energy that comes in from the sun and then released as heat. Each member of the ecosystem plays a vital role in maintaining balance. Disruption in the flow of energy (i.e., too much heat or lack of heat) can greatly affect the entire ecosystem. A simple example would be that, with too much heat, droughts may occur and plants may die. Many animals and people rely on plants for food production, which means that they may also get affected.



Source: <https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/energy-flow-primary-productivity>

Relationship of energy flow and ecosystem with the carbon footprint

According to the Khan Academy:

- In understanding the ecosystem, we learn how each member (living and nonliving organisms) is interconnected with each other and has important roles in maintaining balance in the ecosystem. By looking at the carbon cycle in the environment, we also realize how animals' and humans' natural by-products (such as carbon dioxide) become an essential need of the plants which then release the oxygen that we also need.

This interconnection between the members of the ecosystem shows that the carbon footprint is a natural part of the environment's natural processes. Therefore, it is impossible to achieve a total carbon footprint of zero. However, the environment also has natural ways to counteract the effects of these greenhouse gases, such as photosynthesis. Understanding this will help us realize that carbon footprint becomes a problem only when it is already too much for the environment to absorb.

Thus, solving this does not only mean minimizing the release of greenhouse gases but also preventing deforestation and planting more trees to help absorb carbon from the atmosphere.

5. Ways to prevent or mitigate the impact of land development, waste disposal, and construction of structures on control coastal processes (Grade 11)

Land development and construction usually come with cutting down of trees. Fewer trees means less carbon dioxide absorption, which may lead to a higher temperature. The cutting down of trees and the construction processes produce high carbon footprint. Similarly, the disposal of waste in dumpsites releases a high amount of methane. All these processes contribute to a higher carbon footprint.

Teaching Process

Teaching Approach	Inquiry-based approach through argumentation
Materials	<ol style="list-style-type: none"> 1. Podcast audio file 2. PowerPoint presentation 3. Printed household photos with a separate computed monthly carbon emission 4. Metacards and markers, masking tape <i>(Please visit www.dzup.org/eskwekalikasan to access the podcast, PowerPoint and/or student's worksheet.)</i>

Previous homework:

1. Ask the students to listen to the podcast as their homework.
2. Have the students research and list down at least five (5) other human activities with a high carbon footprint that are not discussed in the podcast.

I. LESSON PROCEDURE

A. Introduction: Review from the Podcast

1. Show **SLIDES 1 to 3** (Title slide, Introduction of the project, and the podcast). Briefly mention to the students what the podcast is about by showing slide 3 (Kayang-kaya! Podcast). Ask the students to write down one keyword they recall from the podcast. Tell the students to write their answers in the metacards. These words may be the ones that most intrigued or confused them. Distribute the metacards.

SLIDE 1



SLIDE 2



DZUP ESKWEKALIKASAN PROJECT

DZUP EskweKalikasan: Para sa kabataan, kapaligiran, at bayan is a publicly-funded initiative of the academe, with support from advocates and the government. It aims to raise awareness on emerging and evolving discussions about climate change, disaster risks, sustainable living and development and mindful consumption. Especially designed for senior high school teachers and students, the project has produced several teaching and learning resources such as modules, video guides, podcasts, and radio episodes that are available for free online at dzup.org/eskwekalikasan.

The project (whose title is a portmanteau of the Filipino words for school and nature) is spearheaded by the Department of Broadcast Communication of the University of the Philippines (UP) College of Mass Communication and DZUP 1602, in partnership with the UP National Institute for Science and Mathematics Education Development (UP NISMED) and the UP Diliman of the Office of the Chancellor. It is principally funded by the Philippine Government under the General Appropriations Act for Fiscal Year 2019 through the initiative of the Office of Senator Loren Legarda.

2 The Environment and Me

SLIDE 3**KAYANG-KAYA! PODCAST**

Kayang-Kaya! is a 10-episode podcast in Filipino that follows the adventures of three senior high school students, Kali, Naya, and Alab, as they seek to understand and uncover issues confronting the environment. As an educational tool, the podcast serves to supplement classroom discussion using aural storytelling.

In **Episode 1**, titled **"Ano ang carbon footprint?"**, Kali realizes that everything she does contributes to the warming of the earth. Together with experts, they will talk about "carbon footprint," and its negative impacts on the environment. Let's find out which of our everyday activities and habits have high and low carbon footprints, and how we can minimize them. Join Kali and her friend, Naya, in discovering ways to take care of our environment.

3 The Environment and Me

- **Question 1: What word/phrase was intriguing or confusing to you?**

Expected Answer/s: (Answers may vary.)

1. Tell the students to post the metacards on the board.
2. Call 3-4 random students. Each of them should pick one card/word posted that are not from him/her and give a brief description or explanation based on what and how he/she understand it from the podcast.
3. The teacher will supplement information provided by the students to expand understanding of the topic.
4. Show **SLIDE 4** (Topic: Carbon footprint).

SLIDE 4

WHAT IS CARBON FOOTPRINT?

4 The Environment and Me

- **Question 2: Based on the podcast, what is a carbon footprint?**

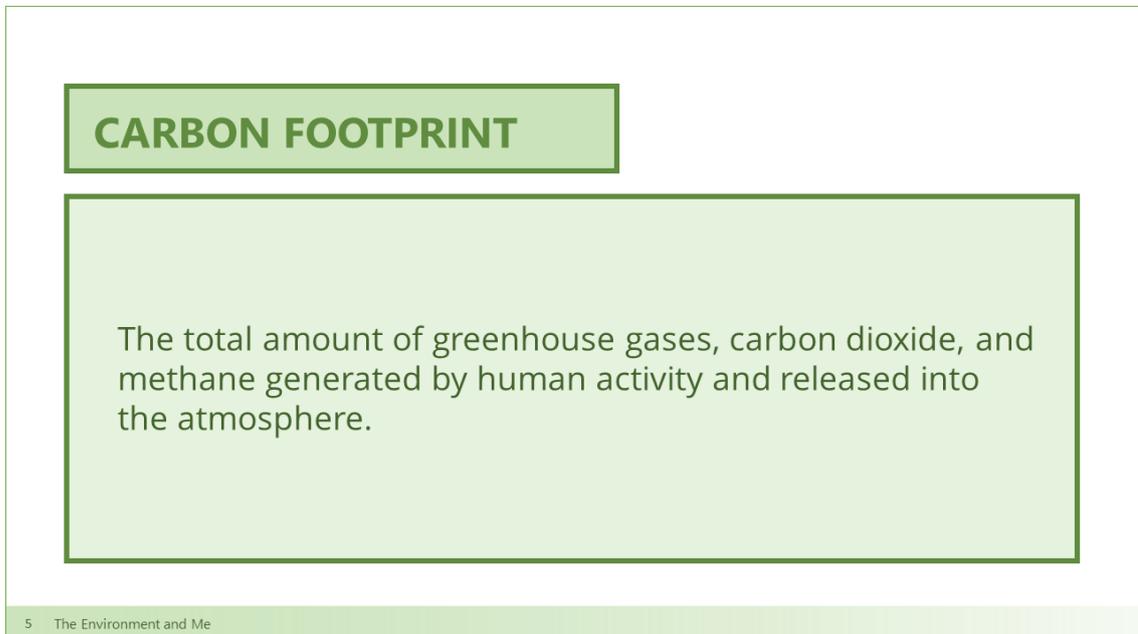
Possible Answer/s:

A carbon footprint is a measure of carbon emissions/greenhouse gas emissions in the atmosphere. It helps determine the level of Earth's temperature rise at a given time. Scientists use data from computing the global carbon footprint and the rate of its increase to determine the Earth's temperature in the future.

As the carbon footprint of communities rises, the Earth's temperature also rises. This rising temperature, called *global warming*, affects the environment in many ways.

6. Elicit answers from the students, then introduce the topic, and explain what carbon footprint is. Show **SLIDE 5** (Definition of carbon footprint).

SLIDE 5



The slide features a title box at the top left containing the text "CARBON FOOTPRINT". Below this is a larger text box containing the definition: "The total amount of greenhouse gases, carbon dioxide, and methane generated by human activity and released into the atmosphere." At the bottom left of the slide, there is a small footer that reads "5 The Environment and Me".

B. Short Activity to Open the Discussion (Matching Type Activity)

1. Post photos of the three different floor plan / interior sketches of a household.

HOUSEHOLD NO. 1



DESCRIPTION

1. The couple living here unplugs their appliances when not in use.
2. They take the bus going to and from work which is 2 hours away from their house.

Appliances:

- 2 television sets
- 4 electric fans
- 1 refrigerator
- 1 rice cooker

Weekly waste disposal:

FOOD	PAPER	GARDEN
2 kg.	6 kg.	1 kg.

HOUSEHOLD NO. 2

DESCRIPTION

Appliances:

- 2 television sets
- 1 desktop computer
- 2 electric fans
- 2 air conditioners
- 1 refrigerator
- 1 microwave oven
- 1 electric stove



1. The appliances are not unplugged.
2. The members of the family ride a jeepney going to work, which is 1 hour away from home.

Weekly waste disposal:

FOOD	PAPER	GARDEN
2 kg.	6 kg.	1 kg.

HOUSEHOLD NO. 3 with two (2) air conditioners



DESCRIPTION

1. The appliances are not unplugged.
2. The couple living here makes a two-hour drive from home using two separate cars fueled by diesel going to work back and forth.

Appliances:

- 1 television set
- 2 electric fans
- 2 air conditioners
- 1 refrigerator
- 1 rice cooker
- 1 electric stove



Weekly waste disposal:

FOOD	PAPER	GARDEN
0.5 kg.	2 kg.	0.5 kg.

- **Question 3: Observe the photos carefully. What do you think are the common activities done by the residents in the different households?**

Expected Answer/s: *(Answers may vary.)*

2. On the opposite side of each photo, post the computed monthly carbon emission (83.04 kgs of CO₂, 228.25 kgs of CO₂, 260.28 kgs of CO₂) of each of these households in random order.
3. Ask for student volunteers to match the correct computed carbon emission to its corresponding household based on their initial knowledge about carbon footprint.

Expected Answer/s:

Household No. 1: The estimated carbon emission is 83.04 kilograms of CO₂ per month.

Household No. 2: The estimated carbon emission is 228.25 kilograms of CO₂ per month.

Household No. 3: The estimated carbon emission is 260.28 kilograms of CO₂ per month.

- **Question 4: How did you decide on the carbon footprint for each household?**

Possible Answer/s: *(Answers may vary. The teacher will accept the students' ideas without judgment.)*

- Then teacher will say, "You will learn and understand about this as we go through the discussion." (Processing will be done during the classroom discussion.)

II. Discussion

Concept Development / Eliciting Evidence

A. Carbon Footprint

- Question 5: When you were in Grade 9, did you discuss electricity generation?**

Possible Answer/s: Yes

- Question 6: Can you recall how we generate electricity?**

Possible Answer/s: Yes

- Elicit answers from students and facilitate a short discussion about coal power plants, coal as a fossil fuel and nonrenewable source, and the disadvantages of coal usage to the environment.

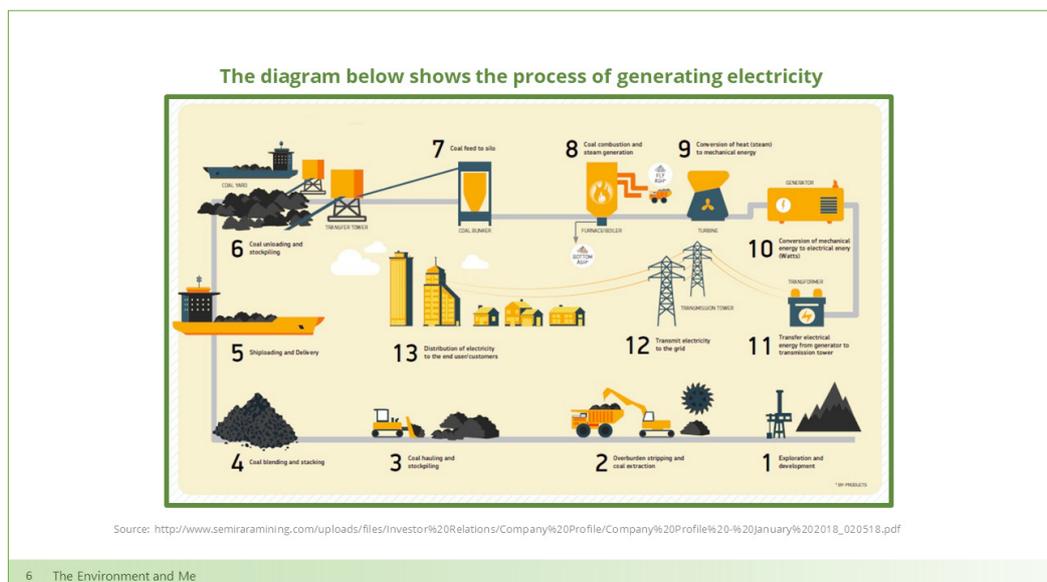
- Question 7: What do we need to generate electricity?**

Possible Answer/s:

Power plants are needed in generating electricity. The Philippines, however, is highly dependent on coal as a source for electricity generation. Coal is a nonrenewable fossil fuel.

- Recall how electricity is generated using coal. Show **SLIDE 6** (Process of generating electricity).

SLIDE 6



- **Question 8: Based on the diagram, which stage has the highest carbon emission? Why?**

Possible Answer/s:

It is Stage 8. It is because coal is being burned in this stage to produce steam that will turn the turbines.

- **Question 9: When carbon emission is high, what does it contribute to the environment?**

Possible Answer/s:

Greenhouse gases

B. Greenhouse Gas

1. Recall the concept about greenhouse gas. Ask the following questions:

- **Question 10: What is a greenhouse gas?**

Possible Answer/s:

These are gases in the atmosphere that can absorb solar heat and reradiate it back to the surface of the Earth, thus warming the atmosphere/Earth (*National Geographic*, n.d.).

- **Question 11: What are the different types of greenhouse gases?**

Possible Answer/s:

Carbon dioxide, methane, nitrous oxide, fluorinated gas (United States Environmental Protection Agency, n.d.).

2. Show **SLIDE 7** (The greenhouse effect) illustrating how greenhouse gases trap heat inside the Earth.

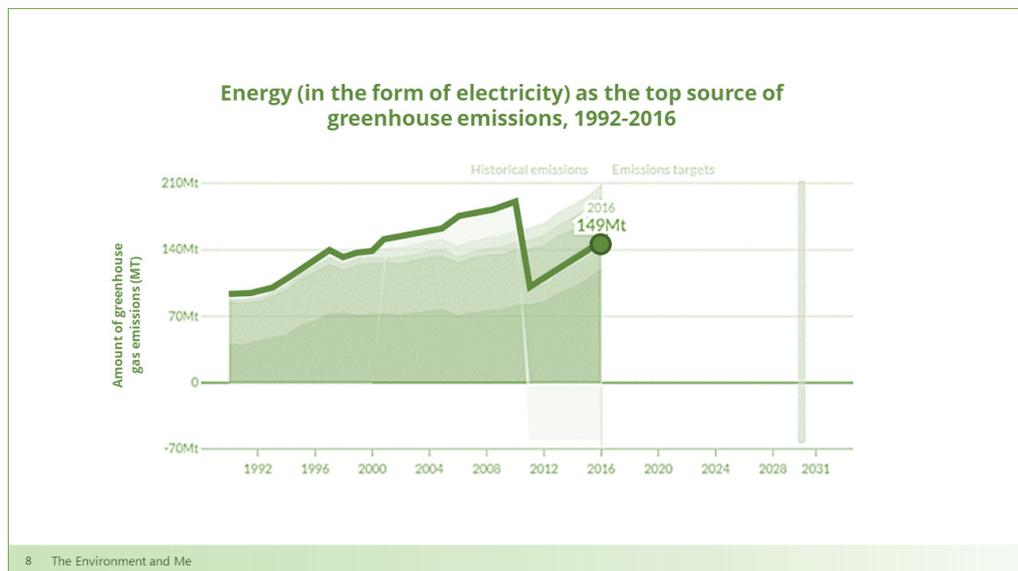
SLIDE 7

7 The Environment and Me

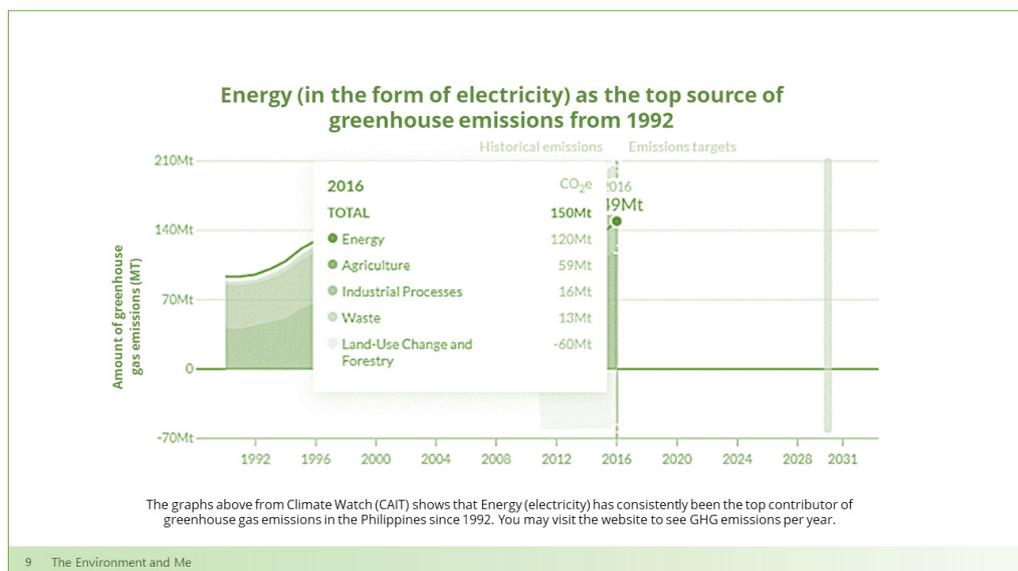
Explanation: The solar energy reaching the Earth’s surface from the sun is released as heat. Some of the heat bounces off from the Earth’s surface back to space; some heat may hit the greenhouse gases in the atmosphere upon escaping to outer space causing it to bounce back to the Earth’s surface. When this repeatedly occurs, the heat is trapped inside the Earth.

- The teacher will say, “Since you remember about greenhouse gases, let us find out how electricity consumption and greenhouse gas emission are related.”
- Show **SLIDE 8** and **SLIDE 9** which illustrate how electricity use is directly related to greenhouse gas emission. Use this as an example to show how greenhouse gases are produced, which contribute to a higher carbon footprint.

SLIDE 8



SLIDE 9



The graphs above from Climate Watch (CAIT) shows that Energy (electricity) has consistently been the top contributor of greenhouse gas emissions in the Philippines since 1992. You may visit the website to see GHG emissions per year.

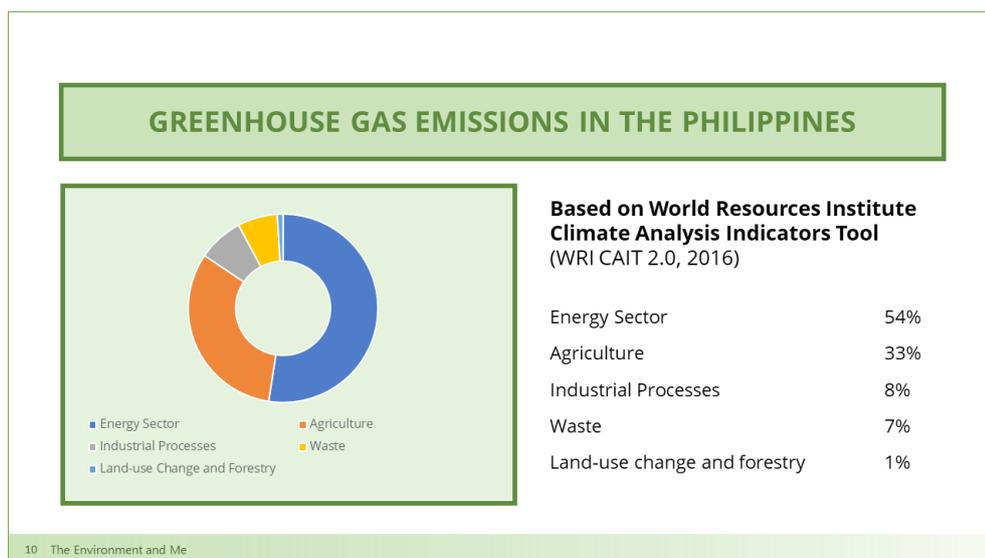
- **Question 12: Observe the picture. How do you think the consumption of electricity is related to greenhouse emission and carbon footprint?**

Possible Answer/s:

Every kilowatt of electricity we use at home corresponds to a certain amount of greenhouse gas emission. The more electricity we use, the more is generated by power plants, and more greenhouse gases are released.

5. Show **SLIDE 10** (Greenhouse gas emissions in the Philippines).

SLIDE 10



C. Processing of Matching Type Activity

1. Elicit students' answers in the matching type activity.

- **Question 13: How much carbon is emitted in every household?**

Possible Answer/s:

Household No. 1: The estimated carbon emission is 83.04 kilograms of CO₂ per month.

Explanation based on the Household Carbon Footprint Calculator (Rappler, 2017). One must plant ten (10) trees to capture the amount of carbon emission for the household. Each tree captures eight (8) kilograms of CO₂ per year.

Household No. 2: The estimated carbon emission is 228.25 kilograms of CO₂ per month.

Explanation based on the Household Carbon Footprint Calculator (Rappler, 2017). One must plant twenty-nine (29) trees to capture the amount of carbon emission for this household. Each tree captures eight (8) kilograms of CO₂ maximum per year.

Household No. 3: The estimated carbon emission is 260.28 kilograms of CO₂ per month.

Explanation based on the Household Carbon Footprint Calculator (Rappler, 2017).

One must plant thirty-three (33) trees to capture the amount of carbon emission for this household. Each tree captures 8 kilograms of CO₂ maximum per year.

2. Refer to the households in the previous matching type activity.

- **Question 14: What factors did you consider in determining which household has the highest or the lowest carbon footprint?**

Possible Answer/s: (Answers may vary, but lead the students to infer the following factors.)

According to Rappler's Household Carbon Footprint Calculator:

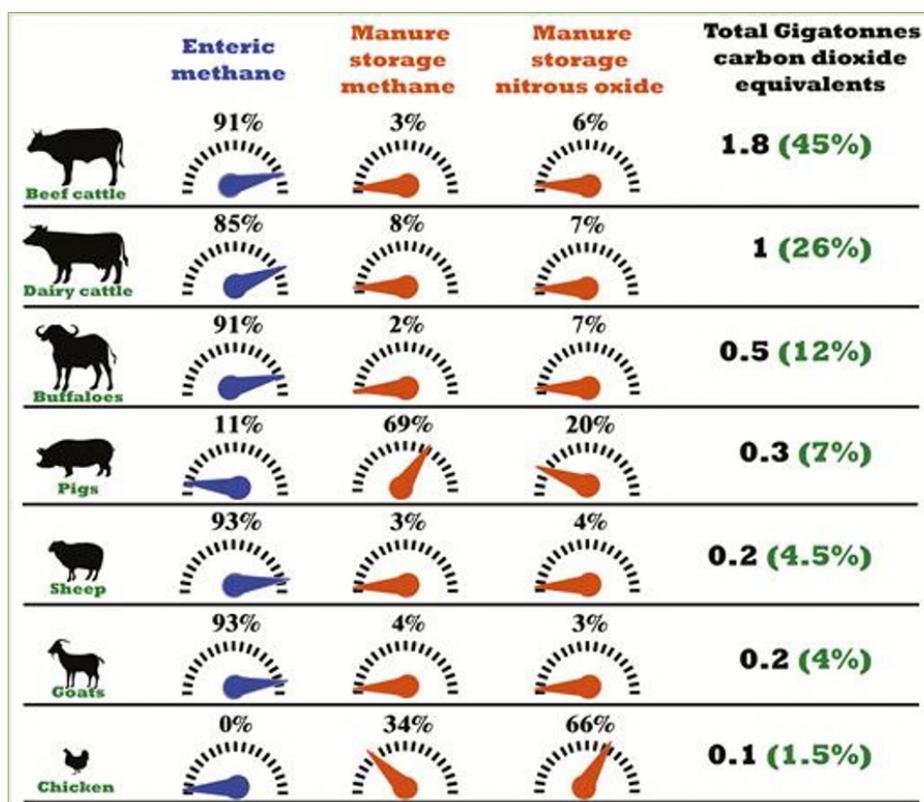
- Electric Consumption* – It means that the frequent use of electric appliances and gadgets has more greenhouse gases produced. Thus, the higher the carbon footprint.
(You may highlight that keeping the appliances plugged when not in use adds up to the electric consumption and carbon footprint.)
- Mode of Transportation* – Some families have multiple cars, which they use for daily activities like when they go to work or fetch their children from school. Parents may even own separate cars in some instances. Cars utilize fossil fuels and emit greenhouse gases as one of its by-products.
- Waste* – When the organic part of waste decomposes, it emits methane, another kind of greenhouse gas. Methane traps more heat in the atmosphere than CO₂ does, although CO₂ stays longer in the atmosphere.

D. Other Human Activities That May Indirectly Contribute to Carbon Footprint

1. Group the students based on the number of practices given below. Each group will explain the contribution of these practices to the carbon footprint. You may say, "Humans affect the environment through their different activities and lifestyles. The following practices may directly or indirectly affect the atmosphere. Explain how these contribute to the carbon footprint."
 - a. Frequent meat consumption (raising farm animals releases a lot of greenhouse gases)

Livestock agriculture produces a high carbon footprint from the methane and nitrous oxide released by animal wastes. Transporting and preserving processes also adds up to its total carbon footprint.

To illustrate, the figure below shows the greenhouse gases incidence of enteric fermentation and manure storage by animal type, expressed as gigatons of carbon dioxide equivalents.



Source: Oxford Academic 2018.

- b. Using electric bikes especially if the electricity is produced through coal (unless the electricity is solar generated).

Most people think that using electric bicycles are more environment-friendly compared to using fuel-powered motorbikes. However, electric bikes still heavily contribute to carbon footprint because they use electricity. In most places, like the Philippines, electricity is generated mainly using coal, a nonrenewable fossil fuel. Burning coal to generate electricity releases a high amount of carbon.

There is less carbon footprint in a community or household that generates electricity from solar energy. Therefore, using electric bikes powered by renewable sources is better than those of fuel-powered motorbikes.

- c. Frequent use of light paper bags over sturdy plastic bags

Using paper bags over plastic bags is highly promoted nowadays. Frequent use of light paper bags, however, is not a real solution to save the environment.

Cutting of trees (less trees, less absorption of carbon dioxide > transporting of trees (vehicle has carbon footprint) > use of machines to make paper bags (use fuel and electricity) > Transport of paper bags to stores > the more paper wasted, the higher the carbon footprint)

All these steps in the process of making paper—from getting the raw material up to being bought from a store—add up to the total carbon footprint.

Use and reuse readily available bags as many times as possible. Refrain from frequent buying new paper bags, eco-bags, or plastic bags and constantly putting them to waste.

d. Conversion of a forest to a row-crop agriculture

The carbon stored in land and in trees will be released to the atmosphere. In addition to this, the manner in which the land is cleared to convert it may contribute more to carbon footprint, e.g., slash-and-burn (Salam & Noguchi, 2005).

e. Use of charcoal in grilling barbeque

Charcoal is usually used in slow and low cooking, such as grilling barbecue. Although charcoal is from a renewable source (wood) compared to propane (from fossil fuel), it is still not free from carbon footprint. While some charcoal manufacturers use scrap wood, there are still some who take down trees for charcoal. With fewer trees, more carbon dioxide molecules float in the atmosphere. Aside from this, the actual burning of charcoal also emits carbon dioxide. Since it is used for slow cooking, the longer it burns, the more carbon emitted.

• **Question 15: Which among the above activities do you usually practice?**

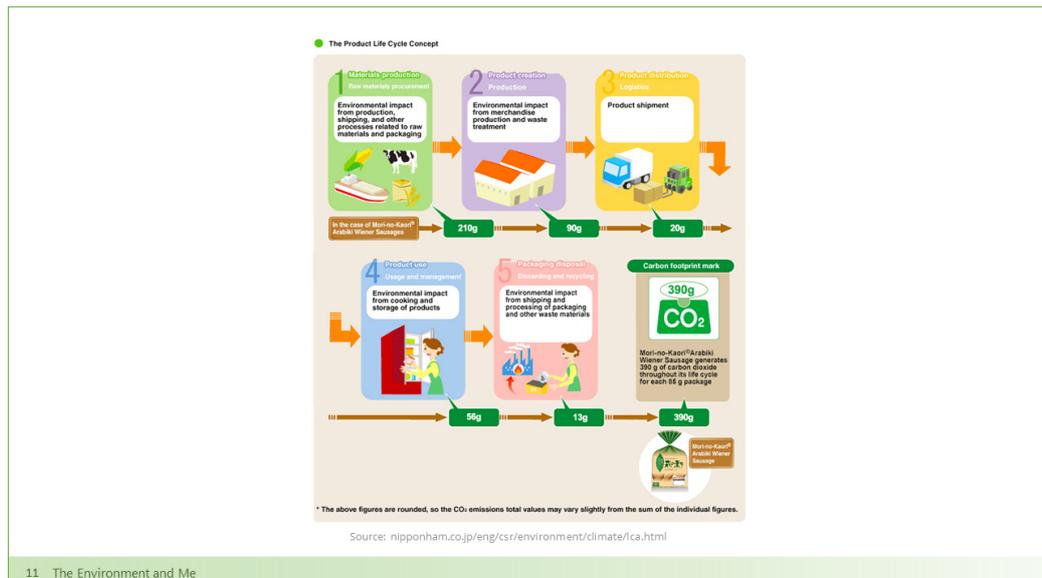
Possible Answer/s: (Answers may vary.)

• **Question 16: What other activities do you do that you think contribute to the global carbon footprint?**

Possible Answer/s: (Answers may vary.)

2. Show **SLIDE 11** (The Product Life Cycle Concept) with a photo map tracing how common human activities emit greenhouse gas/carbon footprint.

SLIDE 11



E. Interrelation of Topics Discussed

1. Connect the consequences of high carbon footprint to the environment.

- **Question 17: How do you think the consequences of the carbon footprint from human activities affect the natural environment?**

Possible Answer/s:

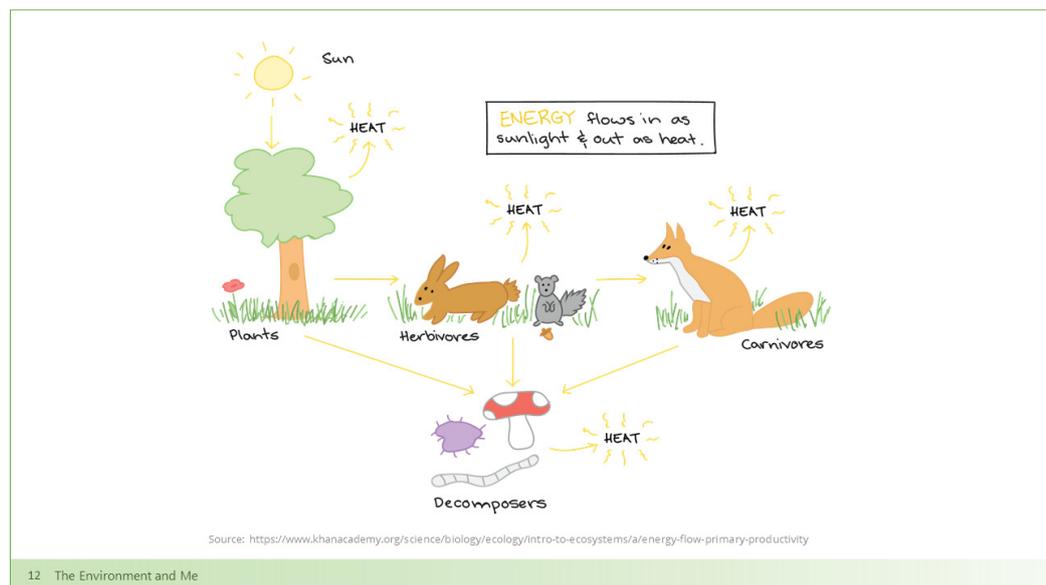
Most human activities, like the ones being discussed, usually increase greenhouse gases in the atmosphere, thus the increase in the carbon footprint. A carbon footprint is the amount of greenhouse gases given off into the atmosphere by a particular entity (e.g., humans, animals).

Greenhouse gases could cause global warming, which may eventually lead to climate change. As the earth receives radiation energy from the Sun, some of it bounces back to the atmosphere and space in the form of heat. But even before fully exiting the Earth's atmosphere, the heat may hit the greenhouse gas molecules already in the atmosphere, causing it to either bounce back to the Earth's surface, hit other greenhouse gas molecules, or escape to space.

With the increasing amount of greenhouse gases in the atmosphere, more and more heat gets trapped within the Earth's atmosphere. It results in the increase in Earth's temperature which is called *global warming*.

2. Show **SLIDE 12** (Energy Flow and Primary Productivity).

SLIDE 12



- **Question 18: Knowing that members of ecosystem are interrelated with each other, how are they affected by the consequences of high carbon footprint?**

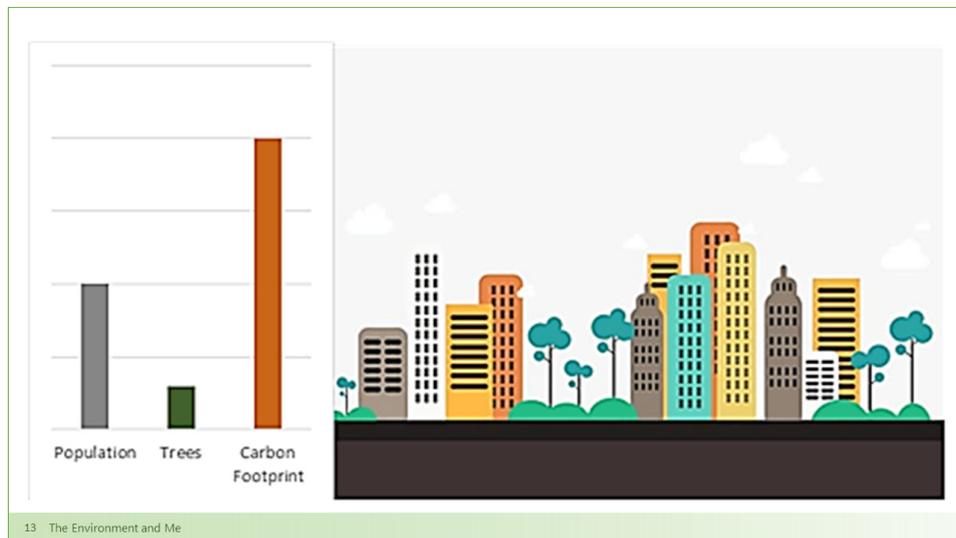
Possible Answers: (Answers may vary. The teacher may also point out and elaborate on the ideas below.)

Every action we do has always an impact on the environment—whether it is a positive or a negative impact. Even in our simple breathing, as we exhale, we leave something to the environment. When we continue with our activities that have a high carbon footprint, we also continue to make the Earth warm. We can already see its effects in our ecosystem, such as on coral bleaching, thawing of polar ice caps and rising sea levels, and bushfires in Australia. These may result in loss of biodiversity, destruction of habitats, and scarcity of food sources. These are clear examples of the impact that greatly affects animals, forests, coasts, and all members of the planet.

F. Bridge to Argumentative Statement

1. Show **SLIDE 13 to 15** as a bridge to the argumentative statement. These slides show that as trees increase, the carbon footprint decreases.

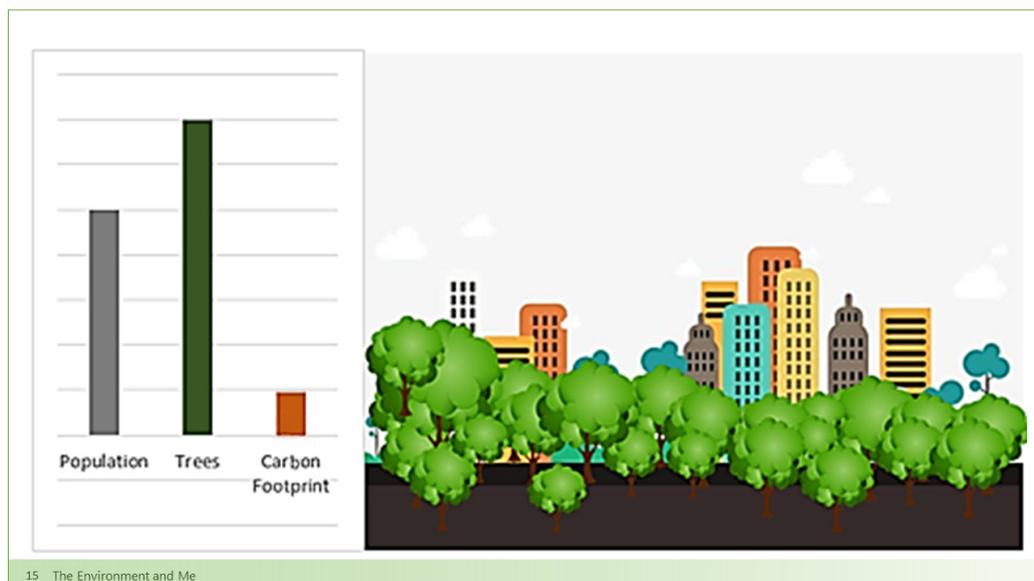
SLIDE 13



SLIDE 14



SLIDE 15



2. Solicit students' opinions about these slides.

- **Question 19: Describe what the presentation implies.**

Possible Answers: *(Answers may vary.)*

- **Question 20: Based on our lessons today, do you think it is possible to have negative carbon footprint?**

Possible Answers: *(Answers may vary.)*

Eliciting Claims from the Argumentative Statement

Argumentative Statement:

Bhutan is the first country to have a negative carbon footprint (Climate Council, 2019). Supposing all countries can have a negative carbon footprint, would this be good for the environment? If yes, why? If no, why not?

Note: If in case the argumentative statements are not answered, the alternative questions below may be asked to elicit the students' argument/s.

1. What is a carbon footprint?
2. How are greenhouse gases formed?
3. What are their sources? How are they produced?
4. What is the effect of greenhouse gases in the atmosphere?

5. Does having a negative footprint have a good/bad effect on our environment?

Good Effect: e.g., less pollution, decrease in global temperature (this can be positive or negative), less acid rain, etc.

Bad Effect: less carbon dioxide for plants, less methane for fuel, Earth's temperature may be too low like what happened during the Ice Age, etc.

Concluding Statements for Justification

Greenhouse gases are important to regulate the temperature of the Earth. The Earth will be too cold to live in without these gases, just like what happened during the Ice Age. However, too much greenhouse gases will lead to global warming. So it is important to maintain the balance of temperature by regulating our carbon footprint.

Optional Activity: Game

A. Preparation

Play Segment 03: Fact or Bluff of the podcast (Only the first one or two items. This is just to refresh the students about how the game is played.)

Show Slides 16 and 17.

SLIDE 16



III. ASSESSMENT

1. Show the following slides.

SLIDE 18



The following are common practices that contribute to carbon footprint.

Explain how each practice contributes to carbon footprint.

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SLIDE 19



1. Farmers clear stocks of rice straw every after harvesting rice grains.

Open-burning of rice straw residue pollutes the air and contributes to global warming through emissions of greenhouse gases (GHGs).

Image Source: <https://www.facebook.com/brigadakoronadal/photos/a.624413097585996/1072744279419500/?type=3&theater>

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SLIDE 20



2. Pig carcasses affected by African Swine Fever were just dumped along river channels to decay.

Decaying pig carcasses release methane, a potent greenhouse gas, into the atmosphere.

Image Source: <http://dzhnews.com.ph/50-pig-carcasses-found-floating-in-marikina-river/>head12:977/

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SLIDE 21



3. Frequent use of private jets with just a few passengers

This contributes to air pollution, air traffic, and depletion of nonrenewable resource.

Image Source: <https://www.arabianbusiness.com/private-jet-iquette-10-dos-don-ts-of-flying-563873.html>
<https://www.businessinsider.com/most-popular-private-jet-destinations-bahamas-ibiza-puerto-rico-philippines-2019-7>

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IV. ASSIGNMENT

1. Show **SLIDE 22** (Assignment)

SLIDE 22

ASSIGNMENT

- Visit <https://r3.rappler.com/brandrap/interactive/161318-household-carbon-footprint-calculator-ph>
- Compute your households' carbon footprint using the provided link.
- From the results of the household carbon footprint calculator, write a 300-word reflection paper. The paper should answer/cover the following:
 1. What is the importance of tracking your own daily carbon footprint?
 2. What did you realize from your household carbon footprint?
 3. What actions can you do as an individual to help minimize your carbon footprint?
 4. What actions/solutions can you suggest to the government and business sector to mitigate the effects of global warming?

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SLIDE 23



You may listen to this podcast episode at dzup.org/eskwekalikasan. Catch all ten episodes of *Kayang-kaya!* Podcast at dzup.org.

Episode 1: Ano ang carbon footprint?
Episode 2: Kakaunti na lang ba talaga ang mga isda natin sa Pilipinas?
Episode 3: Ano ang kahalagahan ng pagtatanim ng punò sa tao at sa kapaligiran?
Episode 4: Ano ang epekto ng "fast fashion" sa ating kalikasan?
Episode 5: Bakit kayâ summer na pero bumabagyo pa rin sa barangay namin?
Episode 6: Mapupunò ba ng basura ang barangay namin?
Episode 7: Bakit walang lumalabas na tubig sa gripo?
Episode 8: Paano maghahanda ang buong barangay laban sa disaster?
Episode 9: Paano napapagana ang cellphone ng hangin at tubig?
Episode 10: Bakit kailangang lumahok ang kabataan sa environmental movement?

If you'd like to know more about carbon footprint and other related topics, you may listen to the radio episodes of DZUP EskweKalikasan's Module 1. Environment and Me:

Radio Episode 1. The Environment and the Youth
 Guest: Mitzi Jonelle Lim Tan

Radio Episode 2. Environmental Science
 Guests: Francis Darwin Tangpuz Eugenio and John Paulo Simballa Quitariano

Radio Episode 3. Environmental Problems
 Guest: Mitzi Jonelle Lim Tan

Radio Episode 4. My Carbon Footprint
 Guest: John Leo C. Algo

Radio Episode 5. Eco-Anxiety
 Guest: John Leo C. Algo

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Related Concepts

1. Carbon Footprint

- It is a measurement of carbon emissions/greenhouse gas emissions in the atmosphere (Takepart, n.d.).

2. Coal

- It is one of the primary fossil fuels, a solid carbon-rich material that is usually brown or black and most often occurs in stratified sedimentary deposits.
- It has more than 50 percent by weight (or 70 percent by volume) carbonaceous matter produced by the compaction and hardening of altered plant remains—namely, peat deposits.

Source: Encyclopedia Britannica (2020).

3. Ecosystem

- It is a geographic area where plants, animals, and other organisms, as well as weather and landscape, interact together (*National Geographic Encyclopedia*, n.d.).

4. Fossil Fuel

- It is a group of energy sources that were formed from ancient plants and organisms during the Carboniferous Period, approximately 360 to 286 million years ago, before the age of dinosaurs.
- Carbon-based fuels from fossil hydrocarbon deposits, including coal, peat, oil, and natural gas.

Source: Student Energy (n.d.).

5. Global Warming

- It is the increase in average air temperatures on earth (*Britannica*, n.d.).
- It occurs when greenhouse gasses and air pollutants in the atmosphere collect and absorb sunlight and solar radiation that bounced off from the surface of the Earth, keeping the heat inside the planet.

Source: Natural Resources Defense Council (2016).

6. Greenhouse gas

- It refers to the gradual increase, observed or projected, in global surface temperature, as one of the consequences of radiative forcing caused by anthropogenic emissions (IPCC, 2018).
- It also occurs when anthropogenic emissions and other greenhouse gasses and air pollutants in the atmosphere collect and absorb sunlight and solar radiation that bounced off from the surface of the Earth, keeping the heat inside the planet. (Natural Resources Defense Council, 2016).

7. **Nonrenewable Energy**

- It comes from sources that do not replenish in our lifetimes—or even in many, many lifetimes.
- Examples of nonrenewable energy sources are fossil fuels such as coal, petroleum, and natural gas.

Source: National Geographic (n.d.).

8. **Renewable Source of Energy**

- Any form of energy from solar, geophysical, or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use. Examples of these are Bioenergy, Solar energy, Hydropower, Ocean, Geothermal, and Wind energy (Allwood, et al., 2014).

References

- Allwood J.M., V. Bosetti, N.K. Dubash, L. Gómez-Echeverri, and C. von Stechow, 2014: Glossary. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-i.pdf.
- Belland, B. R., Glazewski, K. D., & Richardson, J. C. (2012). Problem-based learning and argumentation: Testing a scaffolding framework to support middle school students' creation of evidence-based arguments. *Instructional Science*, (39), 667-694. <https://doi.org/10.1007/s11251-010-9148-z>
- Carbon Trust. (n.d.). Carbon footprinting guide. <https://www.carbontrust.com/resources/guides/carbon-footprinting-and-reporting/carbon-footprinting/>
- Climate Change Projections. Climate Change Commission. (n.d.). <https://climate.gov.ph/climate-change-projections-our-future-through-the-looking-glass>
- Climate Council*. (2019, July 17). Bhutan is the world's only carbon negative country, so how did they do it? <https://www.climatecouncil.org.au/bhutan-is-the-world-s-only-carbon-negative-country-so-how-did-they-do-it/>
- Cunningham, W. P., & Saigo, B. W. (1990). *Environmental science: A global concern*. C. Brown Publishers.
- Epa.gov. (2020, September 08). Overview of greenhouse gases. Retrieved from <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>
- Global Carbon Emissions. (2020, January 8). *CO2.earth*. Retrieved from <https://www.co2.earth/global-co2-emissions>
- Glossary*. Global Warming of 1.5 °C. (n.d.). <https://www.ipcc.ch/sr15/chapter/glossary/>.
- Grossi, G., Goglio, P., Vitali, A., & Williams, A. G. (2019). Livestock and climate change: impact of livestock on climate and mitigation strategies. *Animal Frontiers*, 9(1). <https://doi.org/10.1093/af/vfy034>
- Institute for Energy Research. (n.d.). Electricity distribution. <https://www.instituteforenergyresearch.org/electricity-distribution/>
- Khan Academy. (n.d.). Energy flow & primary productivity. <https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/energy-flow-primary-productivity>
- Kopp, O. C. (n.d.). Coal. *Britannica*. Retrieved from <https://www.britannica.com/science/coal-fossil-fuel>
- MacMillan, A. (2016, March 11). Global Warming 101. *NRDC*. Retrieved from <https://www.nrdc.org/stories/global-warming-101>
- Mann, M. E., & Selin, H. (2019, September 20). Global warming. *Britannica*. Retrieved from <https://www.britannica.com/science/global-warming>
- Maqsood, F. (2021, January 04). Climate change due to greenhouse effect and acid rain. <https://discover.hubpages.com/living/Greenhouse-effect-Acid-Rain>

- National Geographic*. (n.d.). Ecosystem. <https://www.nationalgeographic.org/encyclopedia/ecosystem/>
- National Geographic*. (n.d.). Non-renewable energy. Retrieved from <https://www.nationalgeographic.org/encyclopedia/non-renewable-energy/>
- National Geographic*. (n.d.). Renewable resources. <https://www.nationalgeographic.org/encyclopedia/renewable-resources/>
- National Geographic Society. (2019, March 27). Climate Change. Retrieved from <https://www.nationalgeographic.org/encyclopedia/climate-change/>
- Nature Conservancy. (n.d.). Calculate your carbon footprint. <https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/>
- Nptel.ac.in. (n.d.). Generation, transmission and distribution of electric power: An overview. [https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-02\(TB\)\(ET\)\(\(E\)NPTEL\).pdf](https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-02(TB)(ET)((E)NPTEL).pdf)
- Official Gazette of the Republic of the Philippines*. (n.d.). The K to 12 Basic Education Program. <https://www.officialgazette.gov.ph/k-12/>
- Oxford Academic. (2018, November 12). Livestock and climate change: Impact of livestock on climate and mitigation strategies. <https://academic.oup.com/af/article/9/1/69/5173494>
- Rappler. (2017). Household carbon footprint calculator. <https://r3.rappler.com/brandrap/interactive/161318-household-carbon-footprint-calculator-ph>
- Republic Act No. 9729: GOVPH*. Official Gazette of the Republic of the Philippines. (2009, October 23). <https://www.officialgazette.gov.ph/2009/10/23/republic-act-no-9729/>.
- Romasanta, R. R., Sander, B. O., Gaihre, Y. K., Alberto, M. C., Gummert, M., Quilty, J., & Wassmann, R. (2017, January 24). How does burning of rice straw affect CH₄ and N₂O emissions? A comparative experiment of different on-field straw management practices. *ScienceDirect*. <https://www.sciencedirect.com/science/article/pii/S0167880916306302>
- Salam, A., & Noguchi, T. (2005). Impact of human activities on carbon dioxide (CO₂) emissions: A statistical analysis. *SpringerLink*. <https://link.springer.com/article/10.1007/s10669-005-3093-4>
- Scied.ucar.edu (n.d.). The greenhouse effect. Retrieved from <https://scied.ucar.edu/learning-zone/how-climate-works/greenhouse-effect>
- Semirara Mining and Power Corporation. (2018, January). Company profile. <http://bit.ly/37aynf1>
- Student Energy. (n.d.). Fossil fuels. <https://www.studentenergy.org/topics/fossil-fuels>
- Takepart. (n.d.). What is a carbon footprint? <http://www.takepart.com/flashcards/what-is-a-carbon-footprint/index.html>
- United Nations. Goal 13: Take urgent action to combat climate change and its impacts. (n.d.). <https://www.un.org/sustainabledevelopment/climate-change/>
- United States Environmental Protection Agency, n.d.
- University Corporation for Atmospheric Research, n.d.