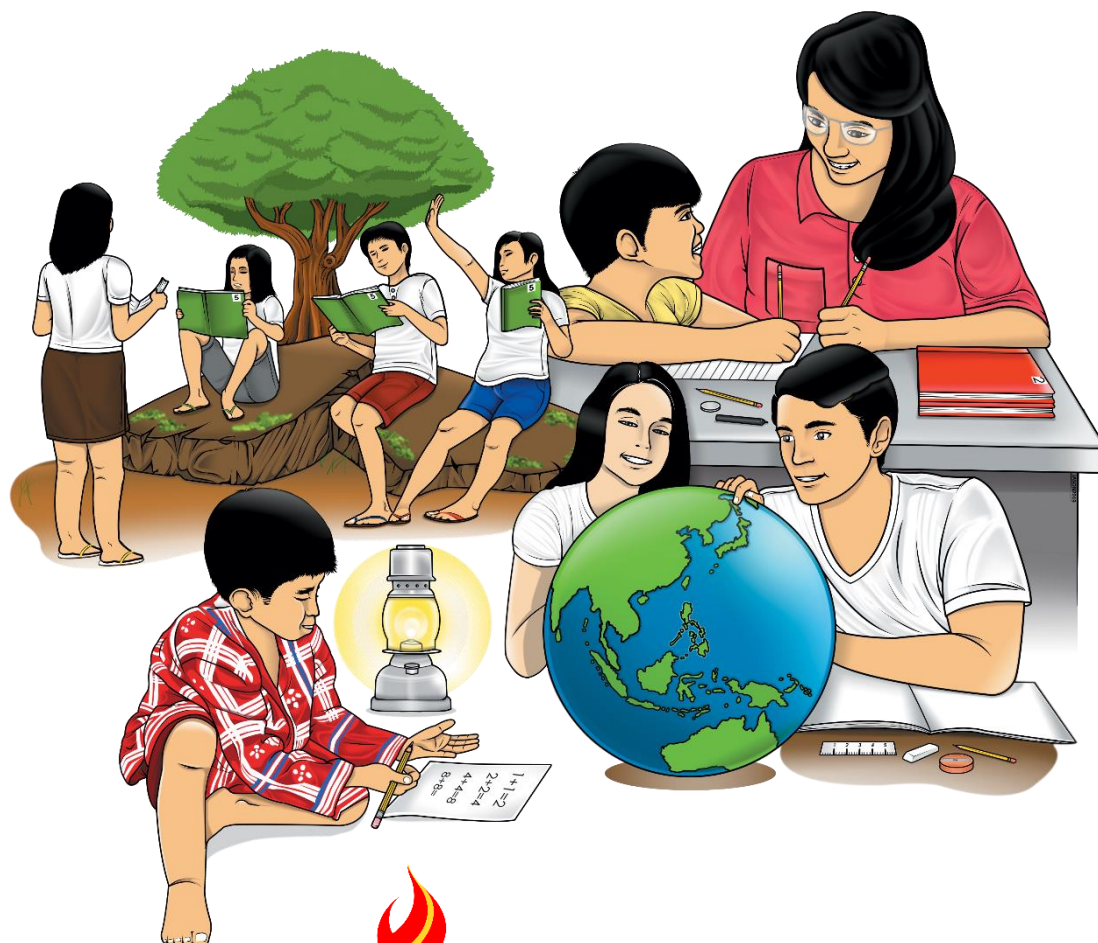


Senior High School

Earth Science for STEM

Quarter 1 – Module 8: Energy Resources



**Earth Science for STEM
Alternative Delivery Mode
Quarter 1 – Module 8: Energy Resources
First Edition, 2021**

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Quarter 1 – Module 8:

Energy Resources

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



What I Need to Know

This module was designed and written with you in mind. It is here to help you master the concepts on energy resources. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module is divided into two lessons, namely:

- Lesson 1 – Geothermal Energy Resource
- Lesson 2 – Hydroelectric Power Resource

After going through this module, you are expected to:

1. relate geologic processes and features to potentiality of a country to have geothermal and hydropower plant;
2. explain the processes of obtaining energy from underground heat and flowing water;
3. determine the possible effects of power plants to the environment; and
4. propose an action plan in Input-Process-Output (IPO) form to conserve energy.



What I Know

Read each item carefully. Analyze each statement and discriminate whether the statement express correct expression or not based on the underlined word/group of words. Write:

- A** – if the statement expresses correct idea
- B** – if the statement expresses incorrect idea
- C** – if the statement may be either correct or incorrect based on the situation

1. Heat can be created and converted into other forms.
2. Increase in heat and pressure is experienced as one goes deeper.
3. Most power plants that harness renewable energy resources use turbines and generators.
4. When hot spring is present in the area, then, a geothermal power plant can be built using the heat from it.
5. Philippines has low capability of producing electricity sourced from renewable resources.
6. Geothermal heat pump requires temperature range of 300 – 700 °F to make a building warm during winter.
7. In a power plant, the turbine directly generates the electricity sent to the transmission lines.
8. The country (Philippines) is largely dependent on non-renewable energy resources like fossil fuels.
9. The strength of water current (flow) is dependent on steepness of the path from the source.
10. Climate change affects hydropower generation.
11. Hydrologic cycle is the key to make electricity production possible using hydropower plants.
12. Among the types of hydropower plants, pumped storage facilities possess the most efficient process of generating electricity.
13. Between hydropower and geothermal power plant, the first one produces more harmful effects to the environment.
14. Large volume of water flowing from a source at great height produces large amount of electrical energy.
15. Hydroelectric plants convert electrical energy to mechanical energy.

Lesson

1

Geothermal Energy Resource

The Earth through its endogenic and exogenic processes exhibits different forms of energy that when harnessed can be transformed into sustainable energy resources. As the population rises year by year, the demand for energy supply is expected. Thus, scientists and technologists collaborate to find new ways on how existing energy on Earth can be converted into usable form applying the basic laws of nature.



What's In

From the previous lessons, you learned that energy can be transformed and conserved. There are different forms of energy around you that are simultaneously converted from one form to another. These energy transformations lead to different studies on how to make it usable by humans in making daily tasks easier with the use of modern technologies. At present, most technologies are possible due to electrical energy from different sources. From your knowledge about energy resources, as it is existing into two general forms such as renewable and non-renewable, the lessons below will expand your understanding about using energy under the principle of sustainability. As science progresses, the exploration on the possible source of energy is prioritized due to global demand of production of different goods and services. Thus, the current generation should use the available resources but not to the extent of sacrificing the need of the future generations.



Notes to the Teacher

For better connection to the lessons, you may provide a video on discussing renewable and non-renewable energy resources through either downloading the material from a site (for students having no internet connection at home) or giving the link of the video (for students having available internet connection at home). Through the activity, the students may be able to have strong connection to the concepts to be tackled by this module.



What's New

Hot and Cold

Heat is one of the types of energy that is dynamic, transferable and can be converted into useful forms. It is the product of random motion of particles that are continuously colliding and vibrating. Heat results to certain level of temperature (hotness or coldness) of a given body. Observing the earth, as you go down, tremendous heat will be experienced. This is a result of radioactivity at its interior. The heat generated beneath the ground is called geothermal energy, that when harnessed can generate electrical energy for community use. This is possible when a geothermal power plant is established equipped with technology that runs the process of energy conversion.

Activity 1

Exploration for Geothermal Sites

The first step of harnessing geothermal energy into usable electrical energy is to look for the possible sites where the power plant can be situated. Study the figure 1.1-1.4 to figure out the area possible for the construction of the plant. Write your observation in the box provided after each picture.

Figure 1.1. The Hot Spring



For your information...

This is part of Mt. Hengill in Iceland with a total area of 100 sq. kilometer. It is extremely popular site for hiker and hot spring enthusiasts.

Source:

<https://guidetoiceland.is/nature-info/geothermal-areas-in-iceland>

What I observe in the picture...

Figure 1.2. The Fumarole



For your information...

It can be found around Mutnovsky Volcano in Russia. The site normally emits carbon dioxide, sulfur dioxide, hydrogen chloride, and hydrogen sulfide.

Source:

https://commons.wikimedia.org/wiki/File:Fumarole_in_the_Mutnovsky_Volcano_-_Kam%C4%8Datka,_Russian_Federation_-_Summer_1993_01.jpg

What I observe in the picture...

Figure 1.3. The Volcano



For your information...

This landform is the famous Taal which is one of most active caldera volcanoes in the country and in the world. It recently erupted last January 12, 2020.

Source:

<https://www.volcanodiscoveru.com/taal.html>

What I observe in the picture...

Figure 1.4. The Geyser



For your information...

This is a famous geyser called the Great Geysir in Iceland. The word geyser originates from Icelandic verb gjo'sa, meaning, 'to gush'.

Source:

<https://smartwatermagazine.com/blogs/magical-water-destinations/iceland-a-country-geysers>

What I observe in the picture...

Directions: Based on your description, choose the words that are strongly connected and common among the given pictures.

heat	eruption	temperature	hillside
energy	magma	forest	mountain
gases	water	smoke	fossil
rocks	hole	steam	

After giving your observation in each picture, let us find out the common in them. Answering the questions below will lead you to understanding about the site requirement for construction of a geothermal power plant.

How would you describe the areas (site) in the picture? What feature is common in them?

Using your knowledge about earth's endogenic processes and plate tectonic theory, where can we usually find the areas (sites) in the pictures?

What type of energy is present in the areas?

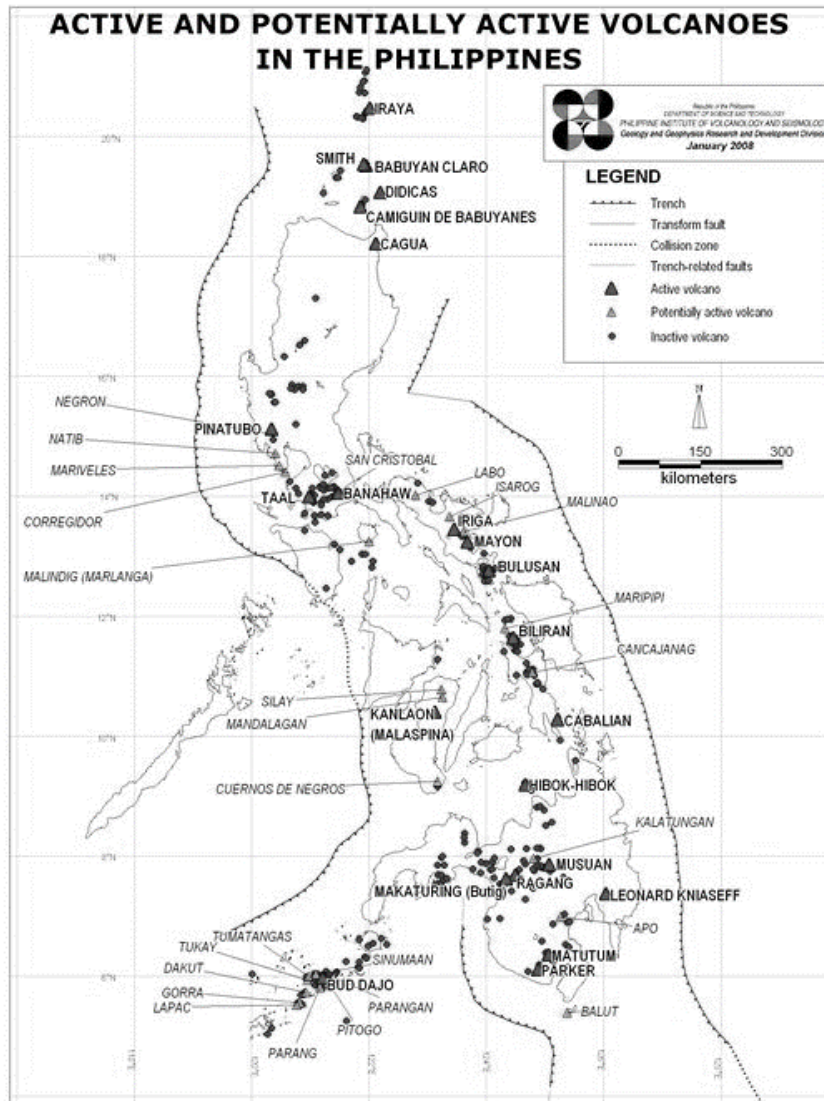
What are the possible uses of this energy?

Based on your observation, why do you think they have the potential to be the site for geothermal power plant? How do you say so?

Do you think the country has potential to have geothermal power plant? Why or Why not?

Study the map (Figure 1.5) below. Based on your understanding about the physical features of the site wherein geothermal power plant can be situated, what provinces in the country we can put up the plant?

Figure 1.5



Source: phivolcs.dost.gov.ph

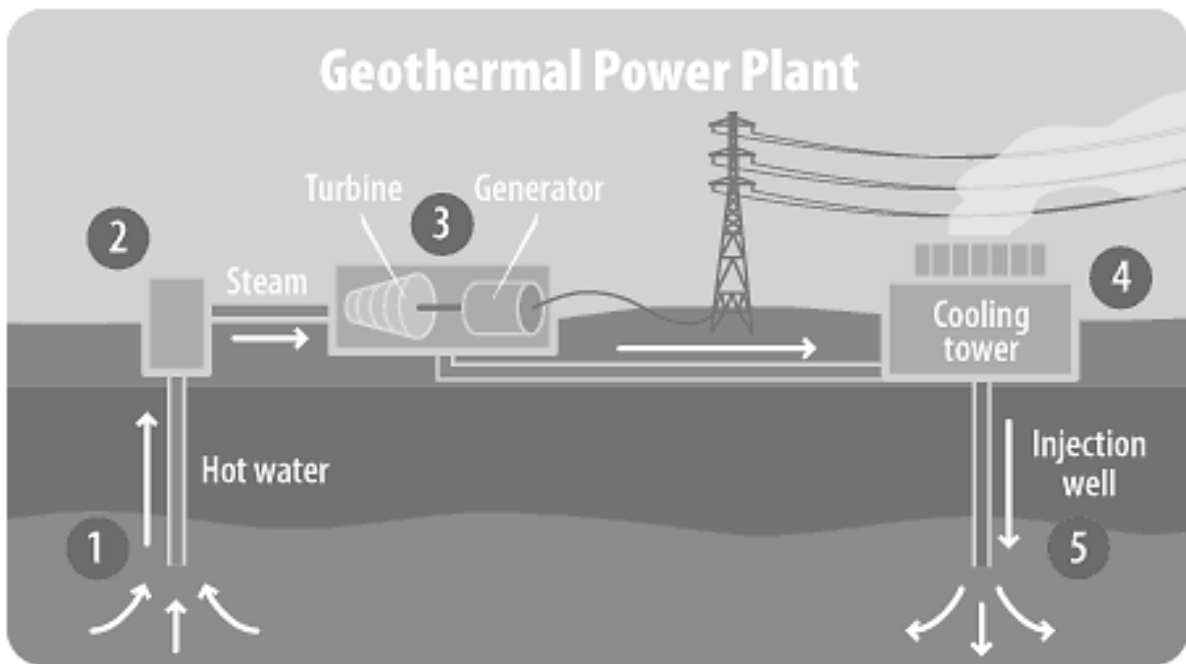
Luzon	Visayas	Mindanao

Why do you think the Philippines has a lot of volcanoes making most areas to be potential for the use of geothermal energy for the generation of electricity?

Activity 2 Harnessing Geothermal Energy

Getting down beneath the ground, you will experience increase in both temperature and pressure. Thus, in putting up a geothermal power plant, it is required to drill 1 to 2 miles deep to pump steam or hot water into the surface. At this depth, the power plant that uses hydrothermal resources (having both water and heat) can attain the required temperature that is about 300 °F to 700 °F. Figure 1.6 shows how a type of geothermal power plant works.

Figure 1.6 Geothermal Power Plant



Source: <https://archive.epa.gov/climatechange/kids/solutions/technologies/geothermal.html>

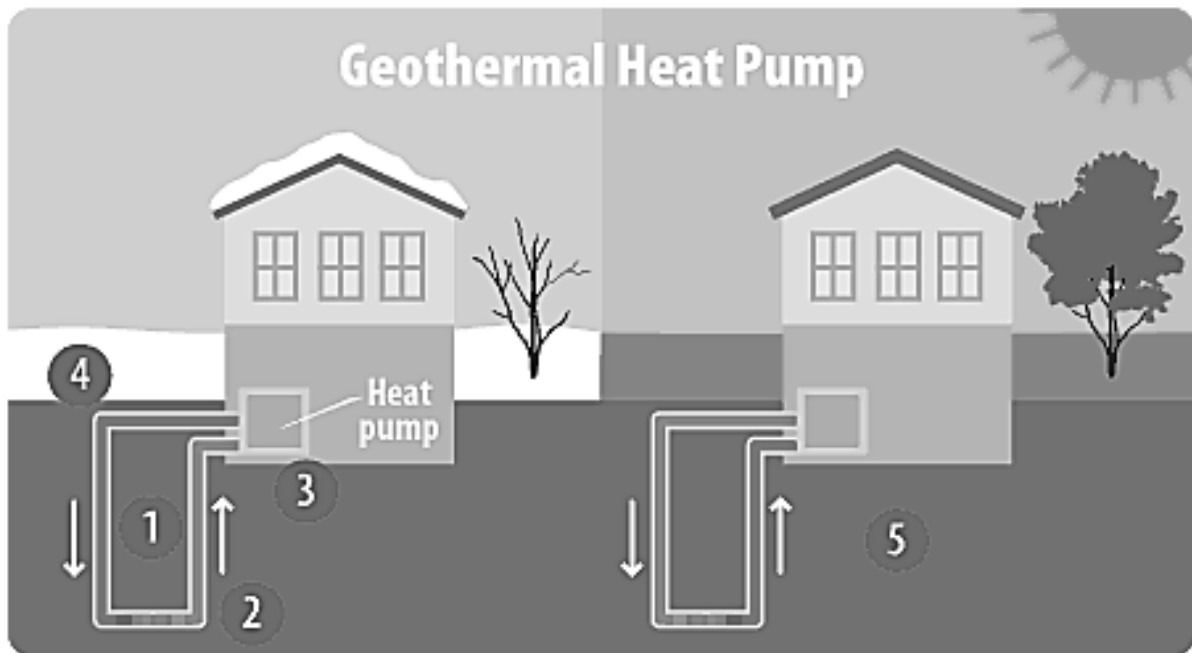
What are the basic parts of a geothermal power plant to produce electricity?

Following the numbers in the figure, how does a geothermal power plant work?

Geothermal energy is not only used by a power plant for electricity generation. Another way of using the energy is through heat pumps that can be installed at home. Heat pump works depending on the season using water or a refrigerant and obtaining the Earth's constant temperature (50 – 60 °F) below the ground.

For instance, it makes the house warm during winter and cold during summer as shown in the Figure 1.7.

Figure 1.7 Geothermal Heat Pump



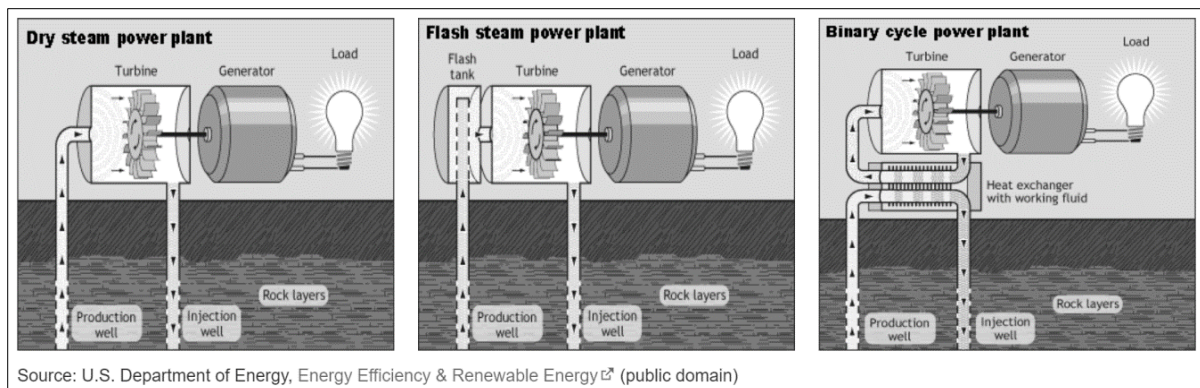
Source: <https://archive.epa.gov/climatechange/kids/solutions/technologies/geothermal.html>

How does a heat pump make a house warm during winter and cold during summer?

Based on the activity, what are the ways to harness geothermal energy into usable form?

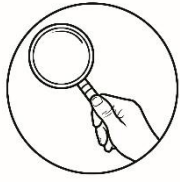
Figure 1.8 shows the different types of geothermal power plant with information in tabular form. What type of power plant is shown in figure 1.6? How do you say so?

Figure 1.8. Types of Geothermal Power plant



Type	Description
Dry Steam Plants	It sips directly hot steam beneath the ground through pipes to mobilize generator turbines.
Flash Steam Plants	It pipes high pressure hot water from geothermal reservoir and convert it into steam that turn generator turbines to produce electricity.
Binary Cycle Plants	It has a system that transfers heat from hot water sipped miles deep to other liquid. Exceedingly high temperature from geothermal water changes the other liquid into steam to drive the generator turbines.

Thousand years ago, ancient people like Romans, Chinese and Native Americans have used geothermal energy for daily activities such as cooking and bathing. At present, among the different countries around the world, geothermal energy is commonly used by people who are living in Iceland in heating water and building.



What is It

Read Me!

1. The country's potentiality to harness non-renewable energy resources is dependent on its geologic processes and features. For instance, the presence of geologic features such as volcanoes and fumaroles, hot springs, and geysers are indicators that there are available passages for geothermal energy to reach the surface of the earth. For hydropower, the process of hydrologic cycle is important for the replenishment of water in rivers and dams. The volume (density) and the steepness of the slope (gravity) affects the efficiency of the power plant to generate electricity.
2. Geothermal energy is the heat from the earth's core due to the slow decay of radioactive substances. Different layers of the earth possess different temperatures as the core found to be the hottest. This energy comes out to the surface through the tectonic plate boundaries and edges where most formation of volcanoes occurs. When molten materials (magma) come out through the spaces in between the plates, they heat up the ground water suspended in the porous rocks. The process produces steam (hydrothermal) that builds pressure needed to be emitted to the surface through volcanoes. In this case, Philippines, being one of the countries within the Ring of Fire that encircles the Pacific Ocean, is rich in renewable geothermal energy and has high potential to harness it into electricity.
3. To test the capability of the area, geologists apply several methods to determine whether an area has potentiality for geothermal reservoir. For instance, drilling a well and measuring the temperature (300 – 700 °F) is the most reliable method before putting up a power plant. If the obtained temperature is 50 – 60 °F, then, it can be used for household purposes only like warming a house and building during winter.
4. Applications of geothermal energy can be attained through either getting the surface heat for heating purposes or drilling miles beneath the ground for electricity generation. There are three main types of geothermal energy systems: 1) direct use and district heating, 2) geothermal power plants and 3) geothermal heat pumps.

5. Direct use and district heating systems use hot water from springs or reservoirs located near the surface of the earth. Ancient Roman, Chinese, and Native American cultures used hot mineral springs for bathing, cooking, and heating. Today, many hot springs are still used for bathing, and many people believe the hot, mineral-rich waters have health benefits. Geothermal energy is also used to directly heat individual buildings and to heat multiple buildings with district heating systems. Hot water near the earth's surface is piped into buildings for heat. A district heating system provides heat for most of the buildings in Reykjavik, Iceland. Industrial applications of geothermal energy include food dehydration (drying), gold mining, and milk pasteurizing.

6. Geothermal power plants are generally constructed where geothermal reservoirs are located, within a mile or two from the earth's surface. Geothermal power plants apply hydrothermal resources that have both water (hydro) and heat (thermal). People utilize these resources by drilling wells into the earth and then piping steam or hot water to the surface. The hot water or steam powers a turbine that generates electricity. Some geothermal wells are as much as two miles deep depending on the availability of sufficient geothermal source. There are three basic types of geothermal power plants: 1) dry steam plants, 2) flash steam plants and 3) binary cycle power plants.

7. Geothermal heat pumps apply the constant temperatures near the surface of the earth to increase and decrease the temperature of buildings or houses. Geothermal heat pumps transfer heat from the ground (or water) into buildings during the winter and reverse the process in the summer with the use of refrigerant.

8. The environmental effects of geothermal energy depend on how geothermal energy is consumed or how it is transformed into useful energy. Direct use applications and geothermal heat pumps have almost no negative effects on the environment. In fact, they reduce the use of energy sources that may have harmful effects the environment due to emission of greenhouse gases. Geothermal power plants do not burn fuel to generate electricity, so the levels of air pollutants they exhaust are low. Geothermal power plants emit 97% less acid rain-causing sulfur compounds and about 99% less carbon dioxide than fossil fuel power plants of similar size. Geothermal power plants use scrubbers to remove the hydrogen sulfide naturally found in geothermal reservoirs. Most geothermal power plants inject the geothermal steam and water that they use back into the earth. This recycling helps to renew the geothermal resource.

Lesson

2

Hydroelectric Power Resource

The quest for sustainable energy is at top priority of most country. As the demand for energy continues to increase, different alternatives that focus on renewable energy resources are best options around the globe. Natural resources such as solar, wind and water are some of the alternatives that most scientists and technology developers are eying for. Based on researches, these means not only secure the supply of energy of a country, but also preserve the environment for future generations.



What's In

Water is life. Different life processes within and outside the body requires water to perform biological and ecological tasks. Aside from these essentialities, its nature and mechanism in the environment can be harnessed to add up to the supply of energy needed by the community. The key to this energy conversion is water cycle. Through the unending process of evaporation, condensation and precipitation, the water in streams, lakes, rivers, and falls are replenished. Due to its ability to flow, current is occurred based on the slope (gravitational) and other external forces (wind).



Notes to the Teacher

Before the formal discussion of the target concepts in this lesson, the teacher may devise a simple activity on water cycle the students may perform at home. The activity should have proper steps and precautionary measures. Videos or link of videos on how different bodies of water are formed may be provided to students. This task may effectively give them important concepts that are strongly connected to the topic to be tackled.



What's New

Energy in Current

One requirement for water to become energy resource is the presence of current. Current in streams and rivers is largely affected by gravity based on the steepness of slope of the runways and the obstacles that may hinder the flow. Since the water is flowing down the sea level, it possesses certain amount of potential energy which is directly proportional to the density and height where the source is located. To convert this energy into usable form (electrical energy), a hydroelectric power plant must be established.

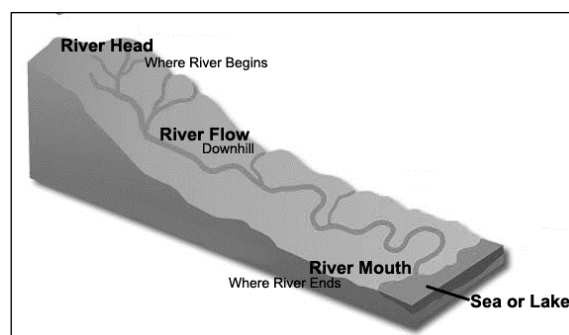
Activity 1

Tracing the Running Water

The process of converting mechanical energy from running water to electrical energy is called hydroelectricity. Since 71% of the earth is water, this energy resource is considered renewable and is dependent on hydrologic cycle that involves the heat from the sun to change liquid water into vapor. Looking back to the history, the use of running water is for milling process (grinding grains).

To understand the conversion of mechanical energy to electrical energy, Figure 2.1, and 2.2 will give you clue on what part of the river the power plant may perfectly situated. Study the figures and describe the strength of the current based on the given features. Write your description in the box.

Figure 2.1

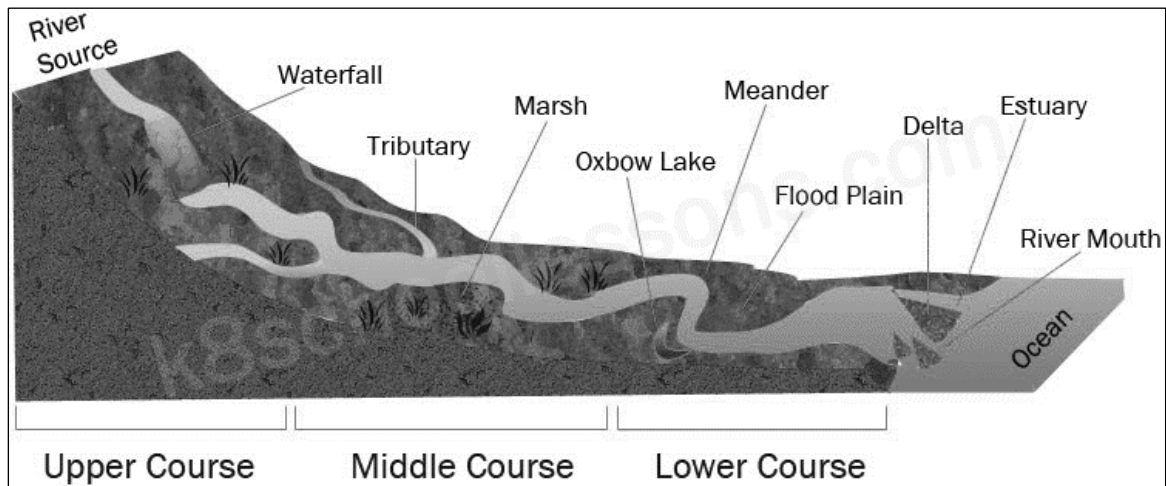


Which part of the river possesses the strongest water current? How do you say so?

Which part has the weakest current? Why?

Where do you think the power plant can be possibly situated? Why?

Figure 2.2



How do you describe the strength of the water current from the river head to the river mouth?

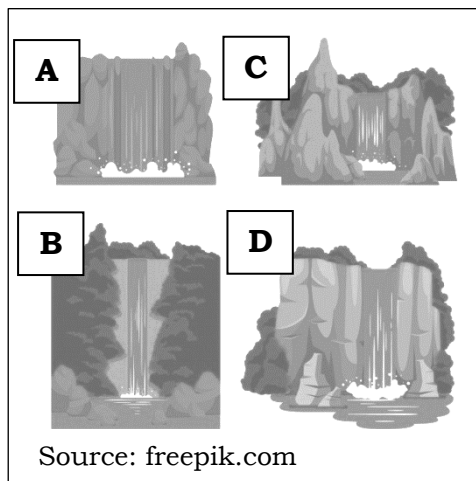
At what course the water possesses the strongest water current? Why?

What factor affects the strength of water current? How do you say so?

Based on the figure, what part of the river a power plant can be most possibly situated? Why?

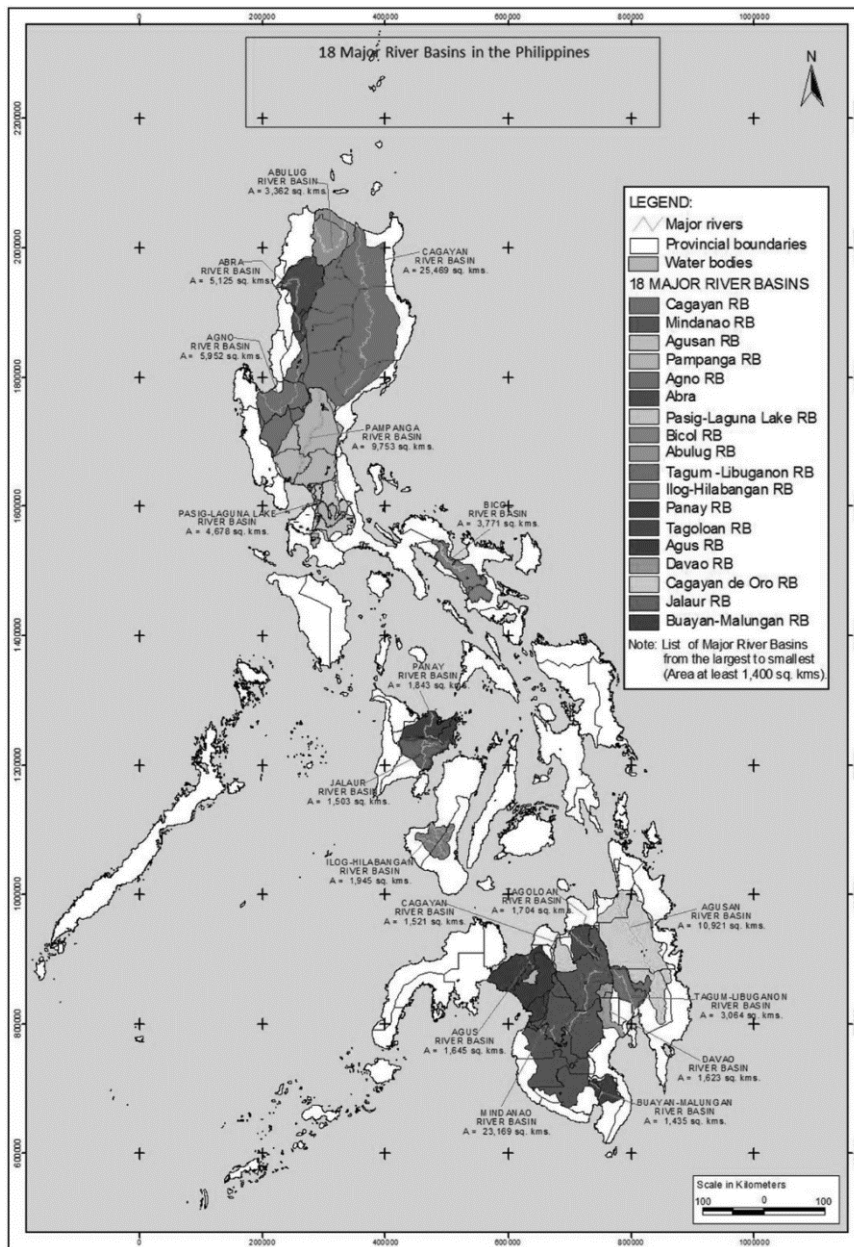
Can we put up a power plant at the middle course or lower course? How?

Figure 2.3



The figure shows different forms of falls. If these falls have the same height, which of them has the best potential to be site of hydroelectric power plant? How do you say so?

Figure 2.4. Philippine River Basins



Source: http://www.nwrb.gov.ph/images/Site_image/Water-Resources-Region_Map

Our country is composed of different bodies of water. Based on your understanding about the geologic requirements and looking at the map, what provinces or places in the Philippines a hydroelectric power plant may be situated?

Luzon	Visayas	Mindanao

Activity 2

Running Water to Electricity

The strength of the current is a good reference on where the power plant may be constructed. Understanding riverscape, it can be concluded that the current (mechanical energy) is affected by the volume of water flow and the steepness of the landscape. Rivers with high volume of water flowing at great height possess the best potential to be sources of hydropower. Hydropower constitutes the highest energy percentage (about 6.7%) among renewable energy resources. Study Figures 2.5 and 2.6 showing different types of a hydropower plant (hydroelectric power plant). Partially explain how they work.

Figure 2.5. Impoundment Facilities

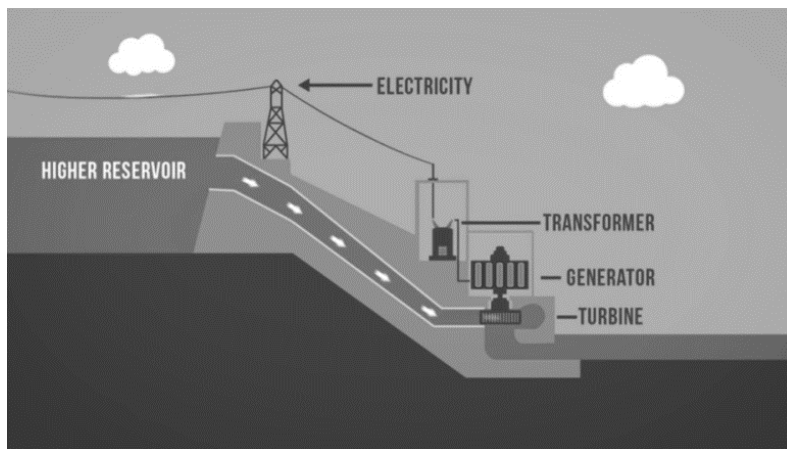


Figure 2.6. Pumped Storage Facilities

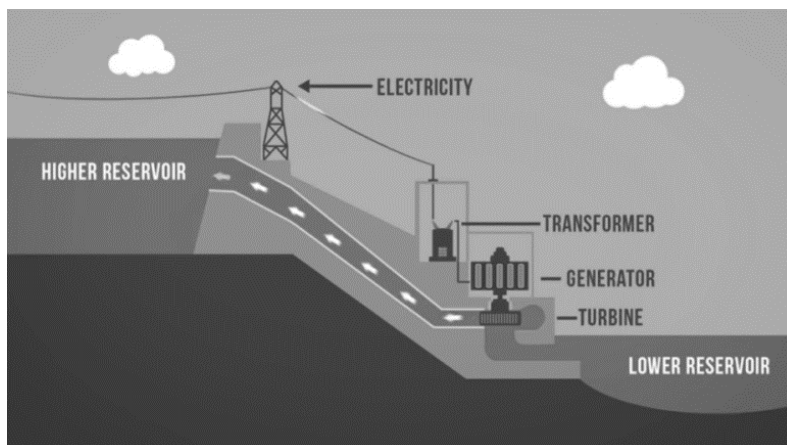


Figure 2.7. Run-of-river Facilities

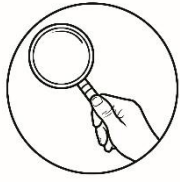


Which of the figures has greatest advantage in terms of efficiency in generating electricity? Explain your answer.

What about the one having the least advantage in efficiency? How do you say so?

In building the dams for hydropower, what do you think is/are the advantage/s aside from power generation? Disadvantage/s?

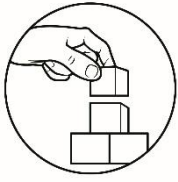
Advantages	Disadvantages



What is It

Read Me!

1. Hydropower or hydroelectricity is the conversion of flowing water (mechanical energy) into electrical energy. Using this renewable (can be replaced within human life span) energy resource, water (hydrologic) cycle that requires solar energy dictates precipitation that can be collected by streams and rivers when falls in the form of rain or snow. The amount of water in the area determines the efficiency in generating electrical energy. Thus, irregularities in seasons and climate change that may result to droughts directly affects the hydropower production. In terms of actual production, the volume of water and the height of the source determines the rate of power generation.
2. There are three main types of hydro plants. 1) **Impoundment facilities** are the most common technology which uses a dam to create a large reservoir of water. Electricity is made when water passes through turbines in the dam. 2) **Pumped storage facilities** are similar but have a second reservoir below the dam. Water can be pumped from the lower reservoir to the upper reservoir, storing energy for use later. 3) **Run-of-river facilities** rely more on natural water flow rates, diverting just a portion of river water through turbines, sometimes without the use of a dam or reservoirs. Since run-of-river hydro is subject to natural water variability, it is more intermittent than dammed hydro.
3. However, there are many concerns with hydropower, particularly large dam facilities. Damming a river has a significant impact on the regional ecosystem, by flooding upstream landscapes, disrupting habitats for wildlife, blocking fish passages, and often displacing local communities. In addition, dam failures can be catastrophic, further disrupting landscapes and claiming the lives of those living downstream. Finally, hydro plants are not completely free of greenhouse gas emissions. As with most forms of energy, carbon dioxide emissions occur during construction, particularly because of the large quantities of cement used, and loss of vegetation in flooded areas creates methane, another greenhouse gas, as its matter decays underwater.



What's More

Word Matters! Understanding Matters!

The key to understanding scientific concepts is to be familiar with its terminologies. This activity will test your vocabulary power.

Identify the term/word based on the given definition in each item. Supply the set of boxes with letters to form the mystery word.

1. Power plants that use heat from deep inside the Earth to generate steam to make electricity.

	E				E				
--	---	--	--	--	---	--	--	--	--

2. Tap into heat close to the Earth's surface to heat water or provide heat for buildings.

H						U		
---	--	--	--	--	--	---	--	--

3. Found in this area are best locations for geothermal energy.

		N						I		
--	--	---	--	--	--	--	--	---	--	--

4. Renewable energy source because heat is continuously produced inside the earth.

		O					M		
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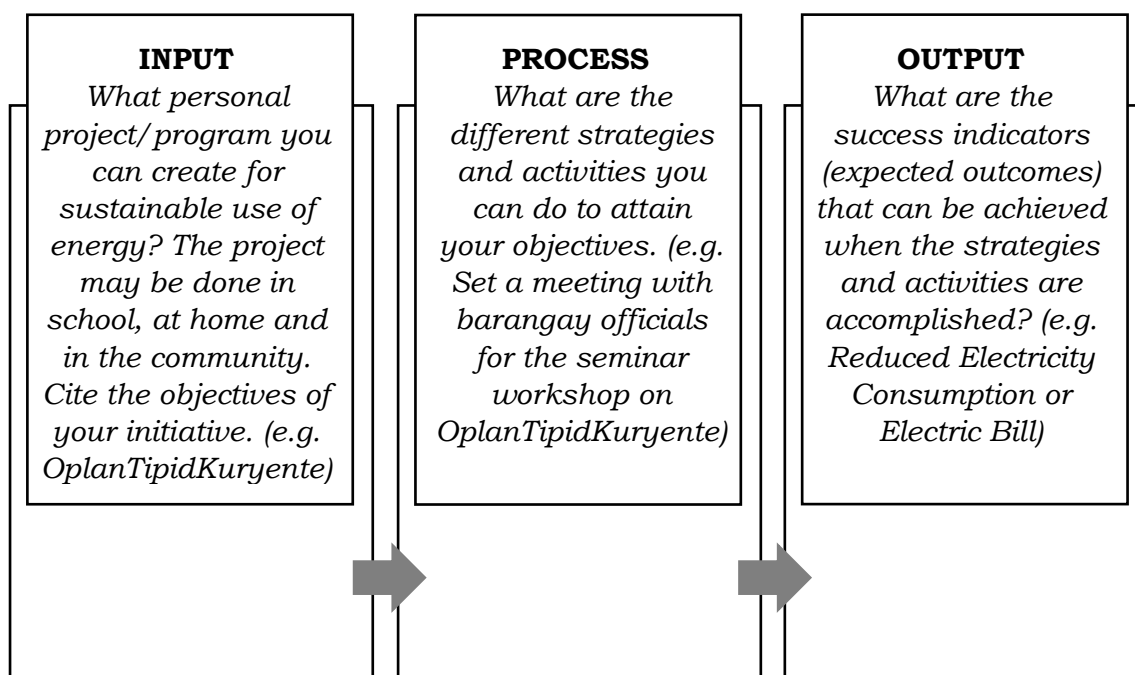
5. Naturally occurring areas of hydrothermal resources.

		T		R				R		R			S
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6. Holes in the earth where volcanic gases are released.

		C		N				F			O		S
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Since the country still primarily dependent on non-renewable energy resource (coal), what actions as citizen you can do to support sustainable use of energy? Below is an IPO model that represents how you will become a “Power Filipino”.



Rubrics:

	Beginning	Developing	Accomplished	Exemplary
Issue description and importance	Does not describe the issue. Does not explain the importance of the issue.	Briefly describes issue and its importance.	Describes issue and explains the importance of the issue.	Thoroughly describes the issue. Thoroughly describes the importance of the issue.
Current action and organizations	Does not list current action being taken or organizations taking action.	Lists current actions being taken and organizations, but does not elaborate.	Lists and describes current actions being taken and organizations taking action.	Thoroughly describes current action and organizations taking action at a variety of levels.
Action Proposal	Does not list action.	Lists action but does not explain it or its importance.	Explains action proposal and outlines steps to achieve it. Explains the importance of the action.	Clearly explains action proposal and details steps to achieve it. Thoroughly explains importance of the action.



Assessment

Multiple Choice. Read each item carefully. Choose the letter of the best answer.

1. Geothermal energy and hydropower are examples of renewable resources because:
 - a. they are sourced from nature.
 - b. they can be replenished within human life span.
 - c. they can sustain electricity to the community.
 - d. they never harm the environment.

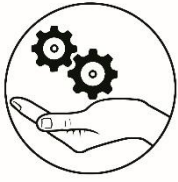
2. The Philippines is one of the world's top producers of geothermal power. This is because the country:
 - a. is abundant in natural gas.
 - b. is located along the Pacific Ring of Fire.
 - c. has many rocky and high mountains.
 - d. has numerous streams and rivers

3. Analogy: Heat pump: 50 – 60 °F; _____ : 300 – 700 °F
 - a. Dry Steam Plants
 - b. Flash Steam Plants
 - c. Binary Cycle Plants
 - d. All of the above

4. At a geothermal power plant, wells are drilled 1 or 2 miles deep into the Earth. How does it work?
 - I. The cooled water is pumped back into the Earth to begin the process again. (5)
 - II. When the water reaches the surface, the pressure is dropped, which causes the water to turn into steam. (2)
 - III. Hot water is pumped from deep underground through a well under high pressure. (1)
 - IV. The steam cools off in a cooling tower and condenses back to water. (4)
 - V. The steam spins a turbine, which is connected to a generator that produces electricity. (3)
 - a. III – II – V – IV – I
 - b. III – V – II – IV – I
 - c. III – II – IV – V – I
 - d. III – IV – II – V – I

5. Which of the following is NOT a geologic indicator for building geothermal power plant?
- I. volcano
 - II. geyser
 - III. hot spring
 - IV. rocky mountain
 - V. trench
- a. I, II, and IV only
 - b. I, II, and III only
 - c. I and II only
 - d. IV and V only
6. Geothermal energy comes from deep inside the earth due to:
- a. slow decay of radioactive particles in the earth's core.
 - b. friction between tectonic plates.
 - c. rotation of the earth in its axis.
 - d. absorption of solar energy.
7. The following are uses of geothermal energy EXCEPT:
- a. bathing
 - b. heating
 - c. milling
 - d. power generating
8. Which of the following is NOT true about the impact of geothermal energy resource to the environment?
- a. Geothermal power plants do not burn fuel to generate electricity, so the levels of air pollutants they emit are low.
 - b. Geothermal features in national parks, such as geysers and fumaroles, making the site promotes sustainability.
 - c. Most geothermal power plants inject the geothermal steam and water that they use back into the earth for recycling purposes.
 - d. The construction of geothermal power plants destroys natural habitat disrupting ecological niche.
9. People have a long history of using the force of water flowing in streams and rivers to produce mechanical energy for
- a. milling
 - b. cutting
 - c. sewing
 - d. molding

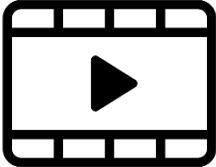
10. Which of the following are factors in generating hydropower?
- I. Amount of precipitation
 - II. Height of the source
 - III. Density of substance
 - IV. Steepness of slope
- a. I, II and III only
 - b. II, III, and IV only
 - c. I and II only
 - d. I, II, III and IV
11. Which of the following types of hydropower relies more on the natural water flow rates, diverting just a portion of river water through turbines, sometimes without the use of a dam or reservoirs?
- a. Impoundment facilities
 - b. Pumped storage system
 - c. Run-of-river facilities
 - d. All of the above
12. Hydropower plants are completely free of greenhouse gas emission. The statement is:
- a. True, because hydropower is a renewable energy resource.
 - b. True, because power generation is dependent on water cycle only.
 - c. False, because carbon gas emission occurs during construction.
 - d. False, because the energy conversion depletes the oxygen content of the water.
13. Hydropower is largely dependent on
- a. Carbon Cycle
 - b. Nitrogen Cycle
 - c. Water Cycle
 - d. Nutrient Cycle
14. Assessing the impact of plants, which of the following is TRUE about geothermal and hydropower in terms of environmental concerns?
- a. Geothermal is more environment friendly than hydropower plant.
 - b. Hydropower is more environment friendly than geothermal plant.
 - c. Both geothermal and hydropower plants are environment friendly.
 - d. The impact of the power plants to the environment depends on the situation.
15. Both geothermal and hydropower plants require
- a. Turbine
 - b. Generator
 - c. Transformer
 - d. All of the above



Additional Activities

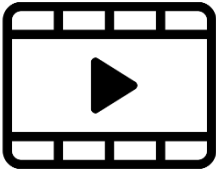
Video Mode

If internet is available, you may watch the following videos using the link below:



Video on Geothermal:

<https://www.studentenergy.org/topics/geothermal>



Video on Hydropower:

<https://www.studentenergy.org/topics/hydro-power>



Answer Key

<p style="text-align: center;">Assessment</p> <p>1. b 2. b 3. d 4. a 5. d 6. a 7. c 8. d 9. a 10. d 11. c 12. c 13. c 14. a 15. d</p>	<p style="text-align: center;">What's More</p> <p>1. Geothermal 2. Heat Pumps 3. Ring of Fire 4. Geothermal 5. Geothermal 6. Volcanos/Pumaroles 7. Tectonic Plate 8. Hydroelectricity 9. Impoundment 10. Solar 11. Facilities</p>	<p style="text-align: center;">What I Know</p> <p>1. b 2. a 3. a 4. b 5. b 6. b 7. b 8. a 9. a 10. a 11. a 12. a 13. a 14. a 15. b</p>
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<https://www.eia.gov/energyexplained/geothermal/geothermal-power-plants.php>

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