

Learning objectives

- ▶ To know what a biome is.
- ▶ To understand how the Earth's spheres interact to create biomes.
- ▶ To understand how biomes provide natural resources.

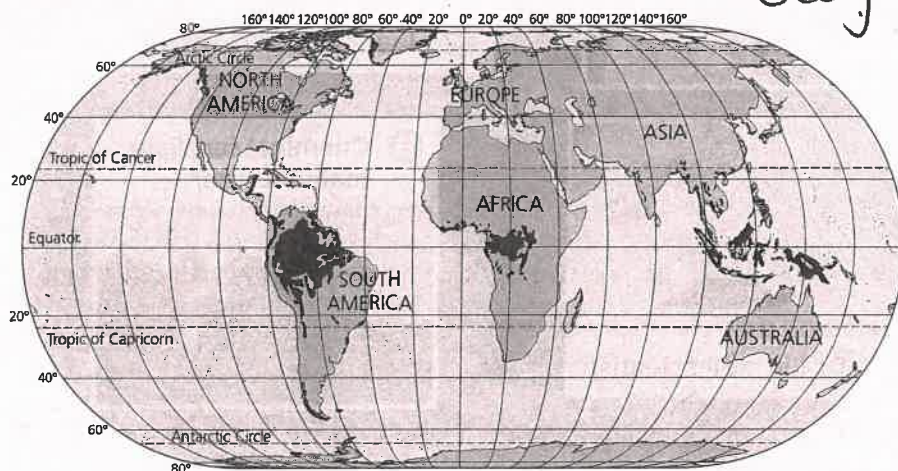
A **biome** is a large-scale community of organisms that has evolved from the interaction of the Earth's spheres. In this lesson you will investigate a rainforest biome, the most diverse and luxuriant environment in the biosphere. You will discover what natural resources it provides for people to use.

The rainforest biome

The rainforest biome, see Map A, contains 75 per cent of the world's plants, and about 50 per cent of the animals. The largest rainforest, the Amazon, is 5.5 million km². The different vegetation layers found in every rainforest are shown in Photo B. Plants and animals of the biosphere have to adapt to the conditions, coping with too much water, the poor soils, and lack of daylight on the forest floor. The dense trees protect the fragile soil from the rainfall. This is a system in harmony, with all of the Earth's spheres working together.

Lithosphere – rainforests tend to have poor soils, but the climate means that the top humus layer is rich in minerals, due to the rapid decay of vegetation on the forest floor

A The location of the world's tropical rainforests

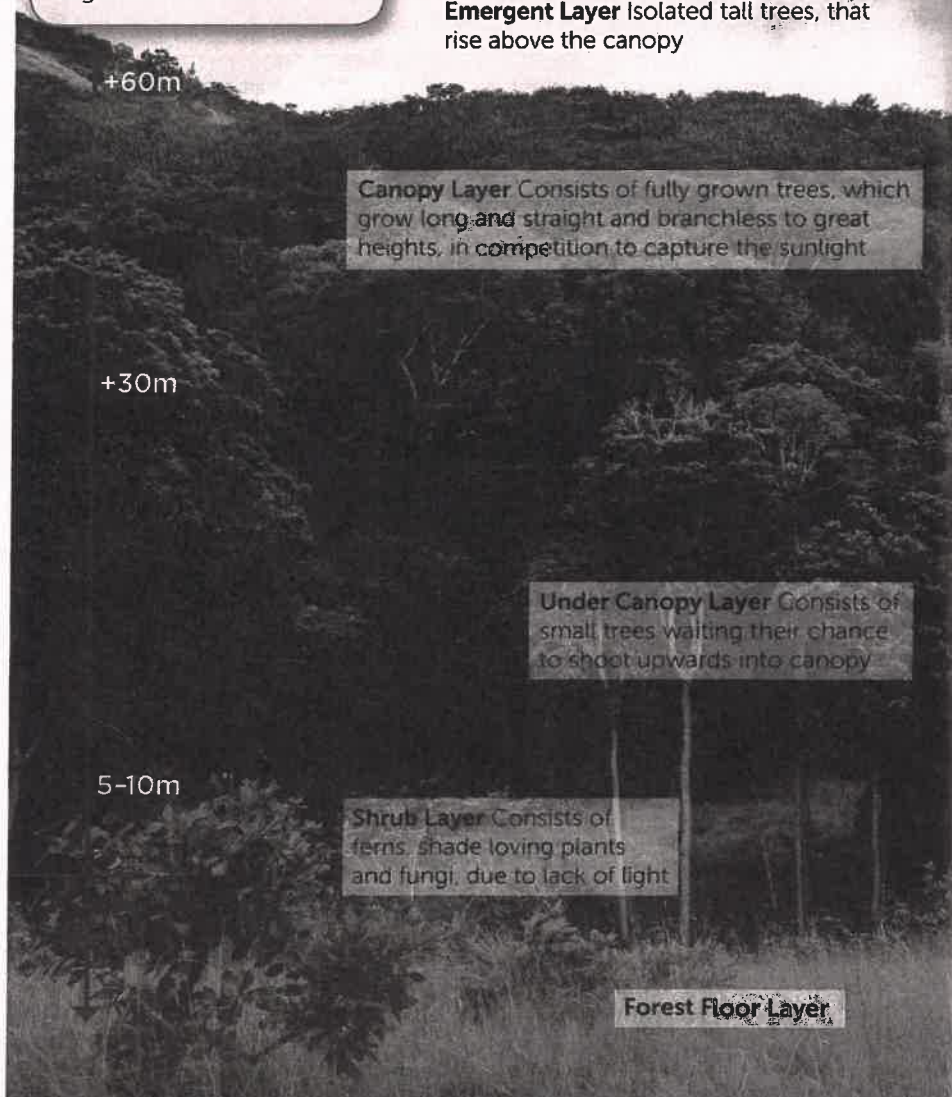


B The layers of a rainforest

Hydrosphere – high humidity in the air; heavy rainfall, water on the vegetation, and rivers

Atmosphere – almost daily heavy rainfall and high temperatures throughout the year, which is ideal for continual rapid plant growth

Emergent Layer Isolated tall trees, that rise above the canopy



Tropical rainforests in our daily lives

Do you think of tropical rainforests as faraway places that have nothing to do with your daily life? Think again. You rely on forests more than you know.

Food

The world's most popular fruit, the banana, comes from the rainforest as do avocado, cashews, Brazil nuts, spices like vanilla, and sugar, coffee, tea, and cocoa.

Medicine

Many of the Western medicines that we use today are derived from plants found in tropical forests including medications to treat or cure rheumatism, diabetes, muscle tension, surgical complications, malaria, heart conditions, skin diseases, arthritis, glaucoma and many others.

Timber

Tropical forests grow some of the most beautiful and valuable woods in the world, such as teak, mahogany, rosewood, balsa, sandalwood, and countless lesser-known species. We use this wood for furniture, doors and panelling. Other forest products show up in your home and office, too. Tropical forest fibres are found in rugs, mattresses, ropes, strings, and fabrics.

Cosmetics

Tropical oils are key ingredients in cosmetics, soaps, shampoos, perfumes, disinfectants and detergents.

Role in the Earth's system

Rainforest make a vital contribution to the Earth's systems. The thick vegetation protects the soil from the heavy rainfall. The dense forests absorb carbon dioxide from the atmosphere.

- C** Leaves with drip tips in the wet environment. These tips allow rainwater to run off the leaf quickly before the plant is damaged



- D** Trees roots are shallow, as most of the nutrients are in the humus layer of the soil. Trees develop with large buttress roots above the surface to add support

- E** Article from the Rainforest Alliance, 5 December 2017

Activities

- 1 What is a biome?
- 2 Look at Map A.
 - a) Locate the world's rainforests, by continent and latitude and longitude.
 - b) Write a paragraph to describe the distribution of the world's rainforests, using your answers from a).
- 3 Study Photos B–D.
 - a) Write five words to best describe your feelings towards the rainforest scene.
 - b) Draw your own sketch of the rainforest structure.
 - c) Annotate your sketch to show how the biome has evolved.
 - d) Use your sketch to describe the vertical structure of the rainforest.
 - e) Identify and explain the way that the vegetation has adapted to the environment.
- 4 Read the Rainforest Alliance article, E.
 - a) Create a table to summarise all the natural resources we get from rainforests.
 - b) Why is dense rainforest important for the atmosphere?
- 6 Is the rainforest a non-renewable or renewable source of natural resources?

Learning objectives

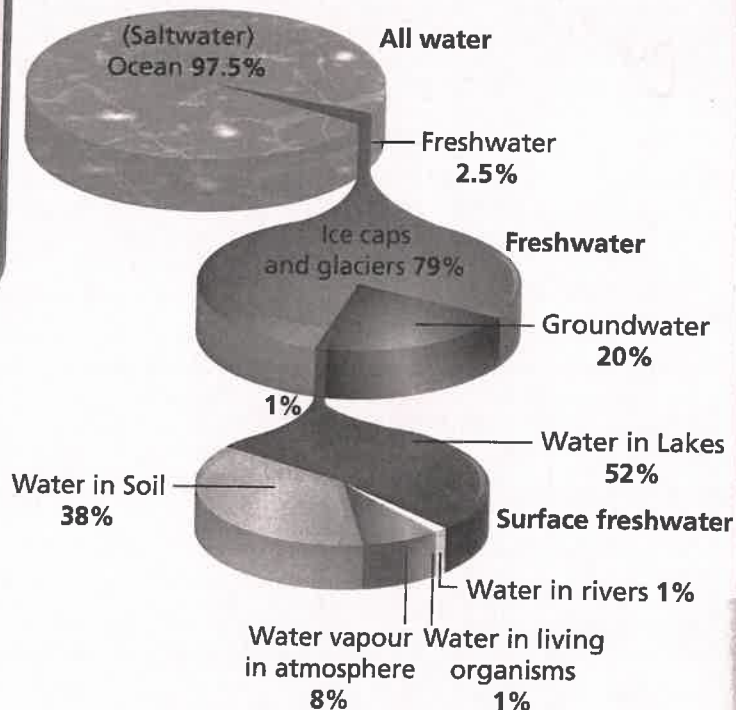
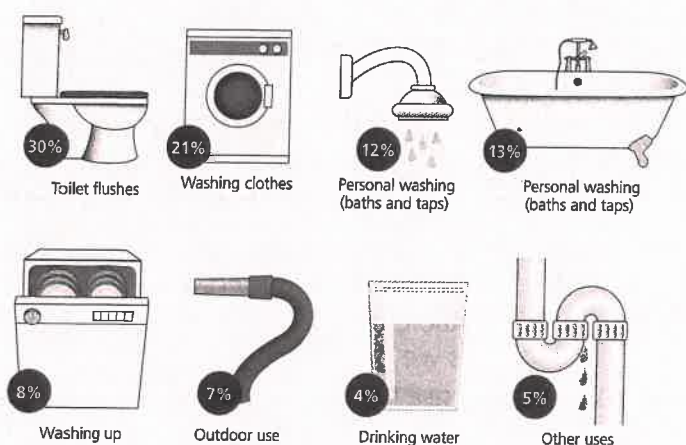
- ▶ To understand the importance of water to our Earth and to life on Earth.
- ▶ To identify which water can be used and where it is found.
- ▶ To appreciate the consequences of water insecurity.

Water is our most basic need. It accounts for 71 per cent of the Earth's surface. It exists in three states: gas, liquid and solid. Water lubricates the Earth's system, interconnecting its spheres. It is continuously flowing between the ocean, atmosphere and land, powered by the Sun, through the water cycle. You may have studied this at your primary school.

Until recently many people thought that water was limitless. However, 97 per cent of the Earth's water is saltwater and only 2.5 per cent is freshwater. Of this freshwater, 79 per cent is frozen in glaciers and polar ice caps. Only 0.01 per cent of Earth's water is freshwater that is easily accessible to us, in rivers and lakes, see B. About 2 billion people actually suffer water shortages.

A How we use our water

The average person uses 150 litres of water and this is how it is used:



B Where our planet's water is found

Water management in the UK

It was only from the late eighteenth century that most people in the UK had access to piped water. Today, over 50 million households receive good quality water, sanitation and drainage services. These services are provided by 32 water companies in England and Wales. This water is cleaned, treated and pumped from reservoirs, rivers and underground supplies, to your tap. We take for granted what seems like an endless supply of high-quality water, for use in the home, industry, farming and the generation of electricity. Our daily consumption of water increases with the development of new time-saving technologies, like dishwashers and washing machines. Many of our homes now have more than one toilet and bathroom.

Water is not evenly shared

There is a relationship between water availability – supply – and its use – demand. In many parts of the world water demand already exceeds supply. This is called **water scarcity**. Fresh water is not evenly spread around the world. In some places there isn't enough water to meet people's needs. This can be due to a number of factors such as low rainfall, too many people, or overuse of the

existing water. Some places have enough water but can't access the water due to poverty. These people can't afford the technology to pump and pipe water from underground supplies. In many parts of the world life is very different to ours, see C and D.

C Article from *The Guardian* online, 21 March 2018

More than 800 million people need to travel 30 minutes for safe water

Eight hundred million people need to travel and queue for at least 30 minutes to access safe supplies. By far the worst affected country is Eritrea, where only 19 per cent of the population have basic access to water. It is followed by Papua New Guinea, Uganda, Ethiopia, the Democratic Republic of the Congo and Somalia, all of which have rates of between 37 per cent and 40 per cent. Gender is also a key factor because women and girls bear the brunt of the burden of collecting water. The time-consuming task of fetching the UN-recommended 50-litres per day for a family of four takes the equivalent of two and half months each year, the report says. Collecting water reduces time in school and raises the risks of disease. Children are often the victims, with close to 289,000 dying each year from diarrhoeal illnesses related to poor sanitation, touching and drinking unsafe water.

D A girl in Ethiopia collecting water



E

I live in Ethiopia. Our village is near a desert – we don't get much rain. Early every morning I take our camel to collect water from wherever I can find it. I spend eight hours each day finding and collecting water.

Aysha, 13

Activities

- 1 Why is water so important to us?
- 2 What is the water cycle?
- 3 Write a paragraph to explain how water interconnects the lithosphere, biosphere and atmosphere.
- 4 Look carefully at Diagram B. You have learnt that 71 per cent of the world is covered in water and yet only 0.01 per cent of the world's water is easily accessible freshwater. Use the diagram to help you write five sentences to explain this fact.
- 5
 - a) Think about a typical day. Write a diary including times, showing when and how you use water.
 - b) Compare your diary with the uses shown in Diagram A. List similarities and differences.
 - c) How does water get to your tap?
- 6
 - a) What is water scarcity?
 - b) List the reasons why, in many countries in the world, water demand exceeds supply.
- 7 Look carefully at D and E.
 - a) Describe what life is like for girls like Aysha.
 - b) How much time a day is spent finding water?
 - c) How does this affect access to education for girls in these countries?
- 8 Use an atlas or use the internet to research water scarcity.
 - a) Which parts of the world have water scarcity?
 - b) Which parts of the world do not have water scarcity?
 - c) Suggest three reasons for this distribution pattern.
- 9 Do you think water is a renewable or non-renewable natural resource? Justify your choice.

Stretch and challenge

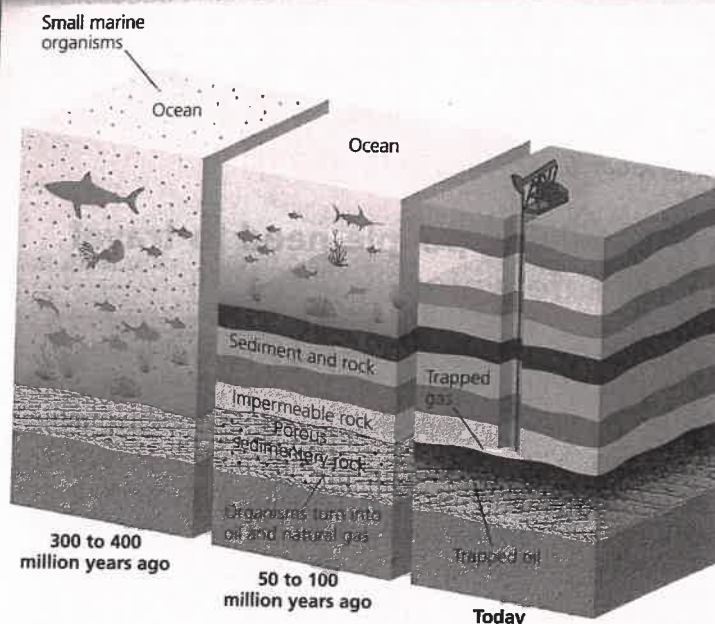
Find out how much your family pays a year for water and which water company supplies your home.

- a) Go to the company's website and find out what services your family receives for this cost.
- b) Do you think the service is worth the cost?

Learning objectives

- ▶ To understand what oil is and how it forms.
- ▶ To understand how oil is refined.
- ▶ To understand the varied uses of oil in our daily lives.

Oil is used to fuel cars, ships and planes, to generate electricity, and to produce plastics and fertilisers, even clothes, see Diagram C. However, up until the middle of the eighteenth century people burnt whale oil to produce artificial light with lamps. This almost led to the extinction of whales. In the USA at this time it was noticed that a black substance seeping from rocks had a slow-burning quality. People began to use this in lamps, calling it kerosene or coal oil. The invention of the car and the electric light bulb helped transform us into an oil-dependent world.



How petroleum and natural gas were formed

- Tiny sea plants and animals died and were buried on the ocean floor
- Over a long period of time they were covered by layers of sediment and rock
- Over millions of years the enormous heat and pressure from the layers pressing down on them turned them into oil and gas

A How petroleum and natural gas are formed

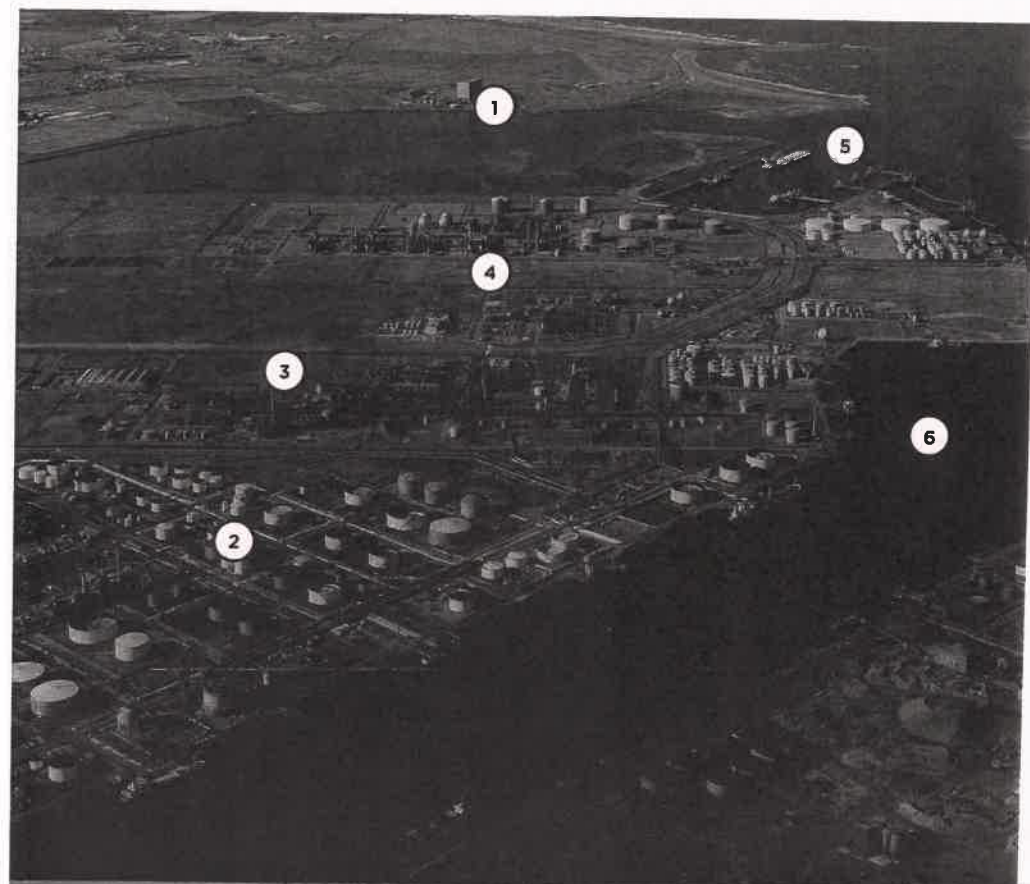
What is oil and how is it formed?

Oil and coal are fossil fuels. They are called this because they are formed from the fossils of plants and sea creatures, see Diagram A. Geologists search the planet to find traps of oil and gas to drill into and bring to the surface. While just about every country in the world depends on oil, not all countries produce it, as the deposits are unevenly spread globally. In future units of *Progress in Geography* you will investigate countries that produce oil.

Oil refineries

Crude oil is the term used to describe the oil extracted from the ground. Once brought to the surface, it is transported by ship or pipeline to an oil refinery (see Photo B). Here the crude oil is processed and separated into refined oil and other raw materials, shown in Diagram C. Petrochemical factories also tend to locate next to the refinery to make oil-based products. There are six operating oil refineries in the UK, all located on the coast. Teesside, shown in Photo B, stopped refining in 2009, due to a drop in world oil prices. Today, it is still used as an oil and gas depot.

B Teesside oil refinery



What can just one barrel of oil produce?



What can be made from the petrochemicals that are left?



Activities

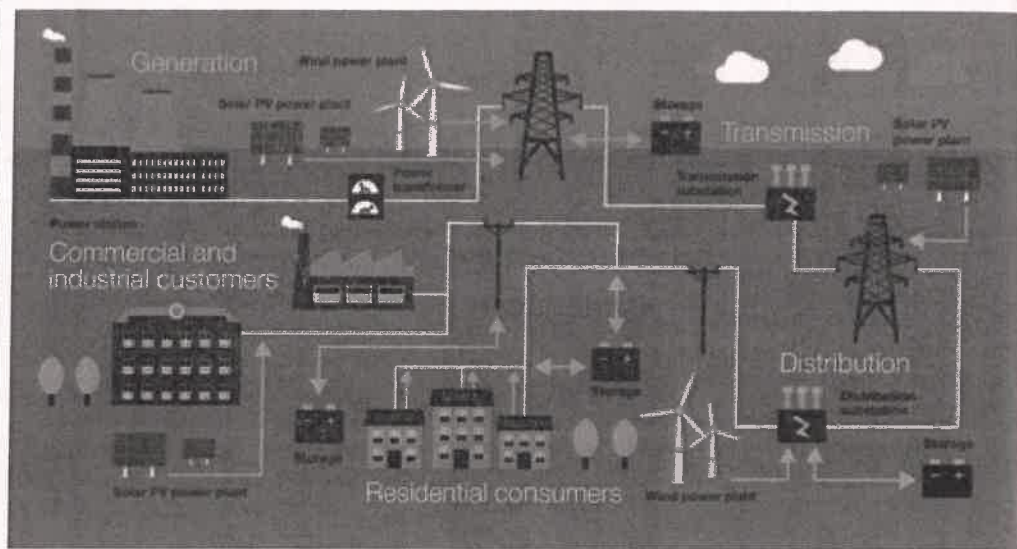
- 1 What are crude oil and natural gas?
- 2 Look carefully at Diagram A. Use it to help you draw your own annotated diagram to show how oil and gas are formed and extracted from underground.
- 3 Look carefully at Diagram C.
 - a) Write a list to show the different products we use oil for.
 - b) Use this list to identify all the ways you personally use oil.
- 4 Compare Photo B with Map-flap C.
 - a) Identify, name, and give the six-figure grid reference for features 1-6 on B.
 - b) In which direction was the camera pointing?
 - c) Use the map and photo to describe the oil refinery.
 - d) Why are UK oil refineries located on the coast? (Use evidence from the OS map to help you.)
 - e) Using the enquiry questions, describe what an oil refinery is like and what happens there.
 - f) Why are petrochemical works often located next to the refinery?

© The products that can be made from one barrel of oil

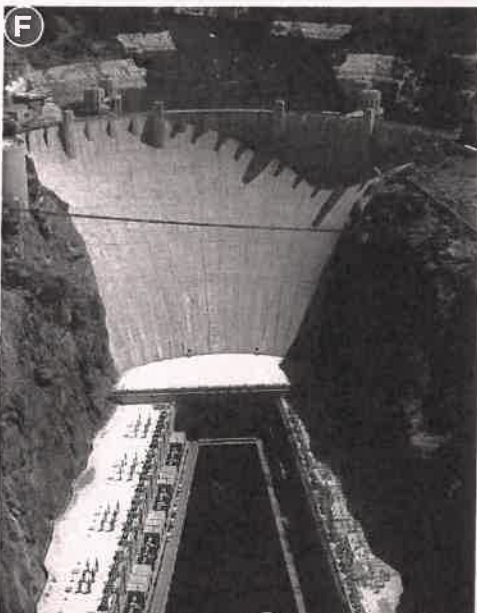
Learning objectives

- ▶ To identify sources of generating electricity.
- ▶ To classify these sources into renewable and non-renewable groups.
- ▶ To evaluate the advantages and disadvantages of each source.

Heat, light and cooking all require energy. At the flick of a switch we can have instant energy in our homes and at school and work. Electricity plays a huge part in our everyday lives. Diagram A shows how this energy is produced, and supplied to our homes. Many different natural resources can be used to generate electricity (Photos B–I, and text J). Each resource has both advantages and disadvantages in their use. Governments need to make decisions about which methods to use for energy, now and in the future.



A The National Grid carries electricity from power stations to customers



J Natural resources that can generate electricity

Solar power is the conversion of the Sun's energy into electricity. This method is ideal in hot, cloudless conditions, but less effective in areas that have a lot of cloudy days or are located at high latitudes, which effects the angle of the Sun. Locations at mid-latitudes are more suitable.

Wind power is becoming more and more common. The wind turns the large turbine blades to generate electricity. The turbines need to be located in areas with regular strong winds. This method will obviously only generate electricity when there is wind, so it is inconsistent. Wind farms are expensive to build and they have a negative visual impact on the landscape.

Hydroelectric power uses fast-flowing water to turn generators to produce electricity. A reliable supply of fast-flowing water is needed. This may be near a waterfall. The dams are expensive to build and can lead to the flooding of farmland. There is a limited choice of locations with the necessary requirements. This method produces very little pollution.

Nuclear reaction releases energy. Atoms of the mineral uranium are split creating heat energy, which turns water to steam and drives huge turbines to create electricity. This is expensive to build and there are risks of radioactive leaks.

Fossil fuels such as natural gas, coal and oil are all used to produce electricity on a large scale. They can generate huge amounts of electricity in just a single location. They are efficient and have been cheap. They can keep generating all the time. The process involves burning the fuel to produce steam that drives the turbines. This unfortunately pollutes the atmosphere. The fossil fuel reserves are also running out, and are expected to last only another 100 years, given our current rate of consumption.

Geothermal energy uses heat produced continuously inside the Earth's crust. Hot rocks present below the Earth's surface heat up the water that produces steam. The steam is then captured to turn the turbines. There are limited locations where this is possible. These power stations are expensive to build and maintain and these sorts of locations are prone to volcanoes and earthquakes.

Tidal energy uses the rise and fall of tides to convert incoming and outgoing tides into electrical energy. Barrages have to be built across coastal estuaries and this can be expensive, disruptive for shipping and damaging to the environment. There are also limited coastal locations with a wide enough tidal range.

Biomass burns plants, trees and organic matter to heat steam to drive turbines. This method releases a lot of carbon dioxide, a greenhouse gas, into the atmosphere.

Activities

- 1 Write a list of all the different ways you have used electricity so far today.
- 2 Look carefully at Diagram A.
Write a paragraph to explain how electricity gets from the power station to your home.
- 3 Compare Photos B–I with the descriptions in J.
 - a) Match the photos to the descriptions for eight natural resources that can be used to generate electricity.
 - b) Copy and complete the table below to compare each natural resource. The first method, shown in Photo B, has been done for you.

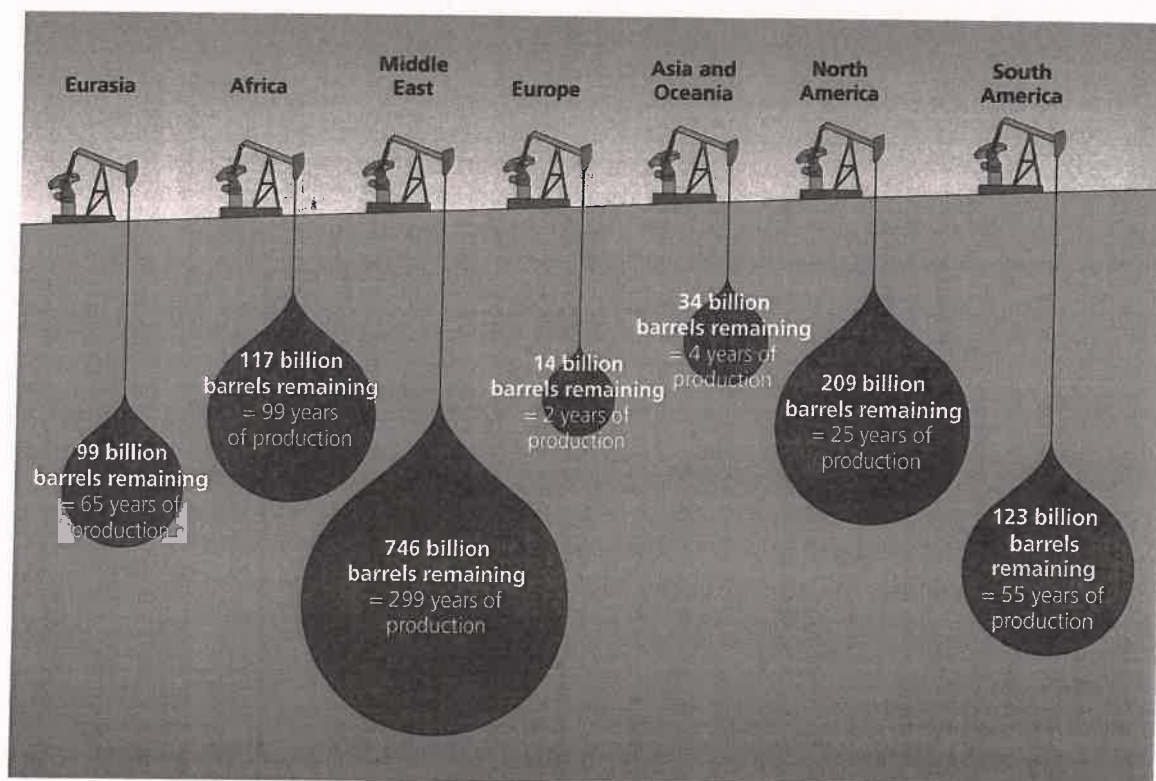
Photo	Natural resource	Renewable or non-renewable	Earth's sphere	Advantages	Disadvantages
B	Uranium, nuclear	Non-renewable	Lithosphere	Efficient, can produce electricity on a large scale and continuously	Radioactive leaks Expensive to build

- c) Work with a partner to consider and discuss the advantages and disadvantages of renewable and non-renewable energy sources in your table.
- d) Imagine you are a government adviser. Formulate a recommendation for the UK's future electrical energy generation.

Learning objectives

- ▶ To understand the idea of sustainability.
- ▶ To consider the UK Government's energy policy.
- ▶ To identify a global challenge to the Earth's future.

Sustainability is an important concept for geographers. They use the term to investigate how natural and human systems work, and to understand how resources can be managed in such a way that they will be available in the future. As you have discovered, non-renewable resources, such as oil, are being used up very quickly, see A. In this lesson you will consider the challenges the world faces because of this, and what actions can be taken to create energy sustainability. Your understanding of this concept will be progressed in future units of *Progress in Geography*.



A Production remaining on global oil reserves

How can we use resources sustainably?

Sustainability encourages us to think more carefully about different types of natural resources, the ways in which they are formed, and the speed at which they are being used. For example, we could slow down the rate we use non-renewable resources, or consider ways of recycling them, rather than just throwing them away once used. Actions to improve sustainability can operate at a number of levels.

- **Local** – by individuals, schools and communities, for example recycling resources as part of waste disposal or saving energy by using low-energy lightbulbs.
- **National** – the UK Government has begun to encourage sustainable use of energy by offering incentives to companies and people to use renewable energy sources.
- **International** – organisations like the United Nations are working with countries to encourage them to work together to tackle global issues. You will investigate actions at this scale in future units.



How do we ensure our green and pleasant land is protected both to respect the efforts of generations past and as a responsibility to generations to come? Investment in renewables has increased by 42 per cent since 2010. In 2014, 30 per cent of all of Europe's renewable energy investment took place in the UK. We remain committed to new nuclear power in the UK – to provide clean, secure energy, preparing for a fleet of new nuclear stations. And we made a commitment to closing inefficient coal-fired power stations.

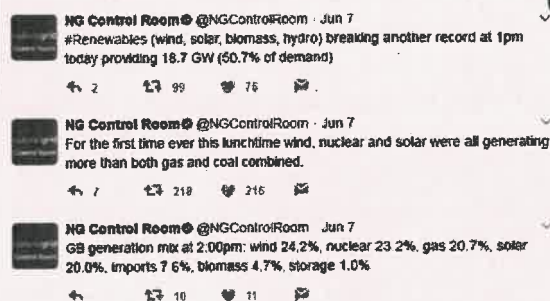
B Home Secretary, Amber Rudd's, speech outlining the government's energy policy, 29 June 2016

The National Grid is responsible for transporting gas and electricity from where it is produced to where it is consumed. This involves overhead lines, underground cables and substations. Every day, on the National Grid control room Twitter feed, they publish the energy balance between renewable and non-renewable sources. On 7 June 2017, they announced a historical event, never before achieved in the UK.

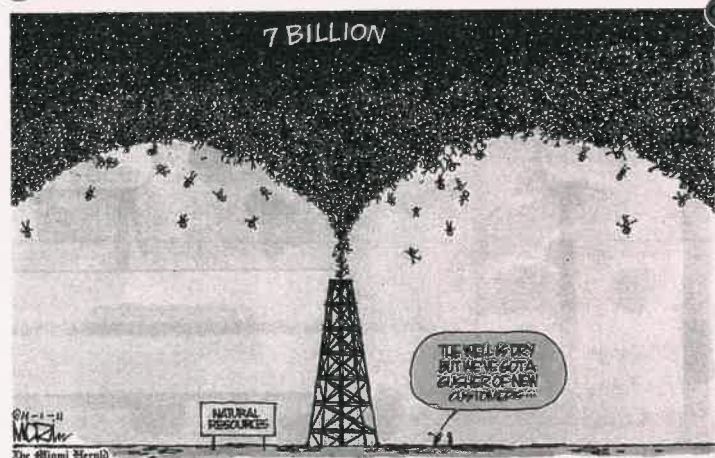
Challenges to the planet

The human relationship with our planet is constantly evolving. In Lesson 1.2 (pages 4–5) you investigated how we got to know our planet. We have now developed new ways to locate, extract, transport and use natural resources, all at a much larger scale. Today we have the same needs as our ancestors, but there are far more of us – the world's population has doubled in the last 50 years – and we also want more than we need. As a result, some of our actions are threatening the harmony of the Earth's systems, using natural resources too quickly.

D Cartoon on the world's natural resources



C National Grid Twitter feed, 7 June 2017



Activities

- 1 Write a definition of sustainability.
- 2 Look carefully at Diagram A.
 - a) Create a table to show the distribution of the world's oil reserves. For each location, show the size of the remaining oil reserve and how many years production it has left.

Location of oil reserve	Size of remaining oil reserve (billions of barrels)	Remaining years of production

- b) Explain what major world issue is shown in A.
- 3 How does sustainability help us think about the way we use natural resources?
- 4 What actions do you and your family take at a local level to use resources sustainably?
- 5 Read Speech B.

Explain how the UK Government is acting to improve sustainability.

- 6 Look carefully at C.
 - a) What is the National Grid?
 - b) What historically important information did they publish on their Twitter feed in 2017?
 - c) Draw a pie chart to show the energy generation mix on that day.
 - d) Visit their Twitter feed and find out the energy mix for today. Is it similar or different?
- 7 How are people challenging the sustainability of the Earth's system and spheres?
- 8 Look carefully at Image D.
 - a) What do you think '7 billion' refers to?
 - b) What point of view is being made by the cartoonist?

In this unit, you have learnt:

- ▶ the different elements that make up our planet and how they interact
- ▶ how rocks and soils form and their importance to life
- ▶ what a biome is and how the rainforest biome works
- ▶ how people use the Earth's natural resources such as water, oil, food and energy supplies
- ▶ the difference between renewable and non-renewable resources.

Let's see what you have remembered and understood!

A

Most important

Least important

The diagram consists of ten empty rounded rectangular boxes arranged in a grid-like pattern. The boxes are organized into four rows. The top row has one box. The second row has two boxes. The third row has three boxes. The fourth row has two boxes. The bottom row has one box. The boxes are intended for students to place or write natural resources, sorting them by importance from 'Most important' at the top to 'Least important' at the bottom.