Chapter 4: Resources

4.1 Resources on Earth are either renewable or non-renewable

Student book answers (pages 62–63)

Check your learning 4.1

Remember and understand

1 What are the two main groups of resources?

Renewable and non-renewable

2 Name one renewable resource that is continuous and one that is non-continuous.

• Continuous: any one of solar, wind, geothermal, oxygen, ocean waves

• Non-continuous: trees from forests, plants

3 List all the non-renewable resources you have used in the past hour.

Student answers will vary.

Apply and analyse

4 List all the resources from Figure 4.1. Place a tick next to the ones you think are well managed in Australia today and a cross next to those you are think are not well managed. Be prepared to discuss your analysis.

Student answers will vary according to which resources they think are well managed and which are not.

Evaluate and create

5 Evaluate Figure 4.1. Which resources do you think are the most important? Explain your answer using examples.

Student answers will vary.

6 How do you think the way we manage resources today differs from the way Indigenous Australians traditionally managed the Earth’s natural resources?

Student answers will vary.

4.2 Renewable resources can be quickly replaced

Student book answers (pages 64–65)

Check your learning 4.2

Remember and understand

1 Give an example of a non-renewable resource. Explain why it is considered non-renewable.

A non-renewable resource can be any one of the following: oil, coal, gas, minerals. They are non-renewable because they take a long time to replenish and are available only in limited supply.

2 Give an example of a renewable resource. Explain your reasoning.

A renewable resource can be any one of the following: solar, wind, geothermal, fast-growing trees and plants. They are renewable because they are made naturally and are available in a continuous and unlimited supply.

3 What is the time scale for formation of non-renewable resources? What about renewable resources?

Non-renewable resources are formed over hundreds of thousands or millions of years. They cannot be renewed in several human generations. Renewable resources are always being formed. It may take a few days (solar or wind power) or a few years (trees) to fully renew the resource, but it is well within the human lifespan.

4 What was Australia’s third-largest electricity production resource in 2007–08?

Hydro

Apply and analyse

5 Why is the time scale of a resource an important issue?

The time scale for a resource is important because some resources are not able to be replaced quickly and will run out in our lifespan. We need to consider the implications of using too much of resources that cannot be replaced. Reducing, reusing and recycling help prolong the time we have to use non-renewable resources.

Evaluate and create

6 What energy resources are found in the state of Western Australia or off the West Australian coast?

Natural gas, oil, uranium, geothermal, solar and wind occur in Western Australia or off the Western Australian coast.

4.3 Renewable resources can be harnessed to provide energy

Student book answers (pages 66–67)

Check your learning 4.3

Remember and understand

1 What are two advantages of hydroelectric power over fossil fuels?

Student answers will vary but may include: hydro can generate lots of power relatively cheaply; it is renewable; no waste or pollution is produced; electricity can be generated constantly; power can be increased or decreased very quickly as needed; once the dam is built, the energy is virtually free.

2 What is required for a successful hydroelectric power station?

Student answers will vary but may include that a successful hydroelectric power station requires a suitable location, usually in high-altitude areas; constant water flow; a dam to hold water; turbines; electricity cables to distribute the power generated.

Apply and analyse

3 A large group of wind turbines in the same location is called a wind farm. Where do you think is the most suitable location for a wind farm? List the important features of your chosen location.

Wind farms should be located near the coast, at the tops of rounded hills, on open plains, in mountain gaps or offshore (i.e. in windy places). They need to be in places where the wind is strong and reliable, and should be in open areas where multiple turbines can be placed.

4 Why do you think most wind turbines are mounted on towers 40–00 metres high?

Having the turbines high up exposes them to stronger winds and reduces the noise heard from them at ground level.

5 If the major hot dry rock resource is in Central Australia, what could be the disadvantages of this resource?

Student answers will vary, but typically include that, with the resource being in Central Australia, the electricity must be transported great distances and lots of electricity can be lost in transmission; lots of water must be pumped into the ground to generate steam, but there is little water in Central Australia; a large number of wells must be drilled, making it more expensive than coal and natural gas; setting up a geothermal plant may affect the stability of the local environment.

Evaluate and create

6 Coal-fired power stations in Victoria run 24 hours a day, 7 days a week. Is wind power as reliable a source of energy as coal? Explain your answer.

Student answers will vary, but could include that although wind doesn’t necessarily occur 24 hours a day, it is a renewable resource that will not run out. Coal-fired power stations can run continuously, but coal will eventually run out. This means that wind may be more reliable over time.

7 New Zealand produces a large amount of its energy from geothermal power. Why is this so different from Australia?

New Zealand is located in a geologically active area with volcanoes, hot springs, geysers and volcanic lakes. Australia is in a very stable geological setting and does not have these resources.

4.4 Non-renewable resources are limited

Student book answers (pages 68–69)

Check your learning 4.4

Remember and understand

1 What are fossil fuels? Give three examples.

Fossil fuels are fuels formed millions of years ago by the remains of living organisms. Three examples are coal, oil and gas.

2 What conditions are necessary for coal to form?

For coal to form there must be trees that died and fell into a swamp and huge pressure and heat.

3 What does radioactive mean?

For something to be radioactive means it can spontaneously decay into other substances without heat or reacting with anything else.

4 Why are minerals classified as non-renewable resources?

Minerals are considered non-renewable because they form slowly over thousands or millions of years by geological processes, and they take a long time to replenish once they are used.

Apply and analyse

5 How is a nuclear power station different from a coal-fired power station? How are they similar?

Nuclear and coal-fired power stations are different because in a coal-fired power plant the heat to make steam comes from burning coal, whereas a nuclear power plant uses radioactive fission to make heat. The two are similar in that steam is used to turn turbines and generate electricity.

6 What is the difference between a mineral and an ore?

A mineral is a compound that forms as a crystal inside the Earth, like copper sulfate. An ore is a piece of rock that contains large amounts of the mineral without many other unwanted components.

Evaluate and create

7 Why do you think Australia has not turned to nuclear power yet?

Student answers will vary but may include any of the following: Australia has not yet turned to nuclear power because the political parties cannot agree about the use of nuclear power; Australia has extensive coal and gas reserves that can be mined relatively cheaply; the problem of nuclear waste treatment and storage remains unsolved; it is expensive to set up nuclear power stations; the public is concerned about nuclear safety.

4.5 Soil is one of our most valuable resources

Student book answers (pages 70–71)

Check your learning 4.5

Remember and understand

1 What are the basic components of soil?

The basic components of soil are clay, silt, sand and humus. Soil is also composed of minerals plants need to survive.

2 How are soils formed?

Soils are formed by the weathering of rocks over extremely long periods of time and by the decomposition of organic matter.

Apply and analyse

3 How would your life be affected if there was no soil?

Student answers will vary, but may include: soil is a valuable resource because it contains everything plants need to grow and live, and plants supply food to our domestic animals and to us. There are also microorganisms that live in and rely on soil, forming an important part of the food web. Without soil, we would not have any mineral resources, fossil fuels or food.

4 What are four things good gardeners might do to improve their soil?

Gardeners may improve their soil by adding fertilisers, organic matter, wetting agents or chemicals. They may also monitor soil microorganisms.

Evaluate and create

5 Should a good soil drain water quickly or slowly?

A good soil should not drain water too quickly or too slowly. If soil gets waterlogged, it has the potential to drown the plant, but if it drains too quickly the plant may not be able to absorb enough water.

4.6 Our future depends on careful management of resources

Student book answers (pages 72–73)

Check your learning 4.6

Remember and understand

1 What is a hybrid car?

A hybrid car has both a petrol engine and an electric motor.

2 Where does ethanol fuel come from?

Ethanol fuel comes from sugar cane.

3 Why are BlueGen fuel cells more efficient than other gas-burning devices?

BlueGen fuel cells burn natural gas in an efficient closed system.

Apply and analyse

4 Some people do an audit of all the energy they consume. Suggest a reason why a person might do an energy audit of their home.

A person might do an energy audit of their home to find out where they could save money on energy costs.

Evaluate and create

5 Would it be practical for you to use an electric car in your area? Why or why not?

Student answers will vary. The main limitations on electric cars are their range (in kilometres) and the time taken to recharge. (The Tesla electric car is the world leader in both these facets at the moment.)

4.7 Science as a human endeavour: Green jobs will increase in the future

Student book answers (pages 74–75)

Extend your understanding 4.7

1 Examine your local area. This might be within 10 kilometres of your home or further if necessary – you or your teacher will choose your distance. List all the natural resources you can locate. Identify what each is used for. Present your findings on a large map in the classroom where every student can contribute their research.

Student answers will vary.

2 Focus on one resource from your list that really interests you. Develop a case study for that resource. A case study looks in detail at:

**•** the history of the resource

**•** how it is extracted or used

**•** what humans use it for

**•** the impact on the environment of developing that resource

**•** issues that affect that resource, now and into the future.

Student answers will vary.

Review 4

Student book answers (pages 76–77)

Remember and understand

1 What is the difference between renewable and non-renewable energy sources?

Renewable resources are always being formed. It may take a few days (solar or wind power) or a few years (trees) to fully renew the resource, but it is well within the human lifespan. Non-renewable resources are formed over hundreds of thousands or millions of years. They cannot be renewed in several human generations.

2 Give two examples of each of:

a renewable resources

Any two of solar, wind, geothermal, fast-growing trees and plants.

b non-renewable resources

Any two of oil, coal, gas and minerals.

3 Examine Figure 4.3 on page 65. Locate a resource that is close to your area. What type of resource is it? What would this resource be used for?

Student answers will vary.

4 Describe three different uses of energy.

Student answers will vary.

5 What is a generator?

A generator is a device that converts chemical energy into mechanical energy and then into electrical energy.

6 How is coal used to generate electricity?

Coal is burnt and the heat is used to boil water to make steam. The steam turns a turbine that then turns a generator, producing electricity.

7 Give a definition of geothermal energy.

Geothermal energy is the heat energy generated and stored in the Earth.

8 What factors can affect the amount of electricity generated by a solar panel?

Factors affecting the amount of electricity generated by a solar panel include the efficiency (or quality) of the panel, its angle to the sun, how clean it is, the weather conditions and if it is day or night.

9 What are the advantages and disadvantages of using uranium as an energy resource?

• Advantages: uranium is the most common radioactive element on Earth; it is plentiful in Australia; there are hardly any carbon dioxide emissions; there is good energy output for a low mass of uranium.

• Disadvantages: it is non-renewable; splitting produces radioactive waste; it takes a long time to become safe or stable; accidents can be harmful to the environment and to humans (e.g. Chernobyl and Fukushima).

Apply and analyse

10 What advantages and disadvantages do electric vehicles have over petrol-driven cars?

Advantages of electric vehicles include no carbon dioxide emissions, no fuel use and they can be charged using household power points. Disadvantages are that they can only go a certain distance (limited range), have a long recharging time, there is currently a lack of infrastructure for recharging and the high purchase price.

11 What is wind farming? Are there any disadvantages to this method of energy production?

Wind farming involves having a large number of wind turbines in the one location. Disadvantages include: the power output of the whole farm depends on the wind strength at that one location; some people find a large group of turbines unsightly; extreme weather events or natural disasters could be very costly.

12 Suggest one reason why it is important for soil to be ‘water-loving’.

Student answers will vary, but typically water-loving soil will nourish the plants grown with a good supply of water.

13 What is the difference between a mineral and an ore?

A mineral is a compound that forms as a crystal inside the Earth, like copper sulfate. An ore is a piece of rock that contains large amounts of the mineral without many other unwanted components.

14 How does clearing plants from soil cause salt to come to the surface? Why is this a problem?

Without plants to absorb water from the soil, when it rains the salty groundwater rises and brings the salt to the surface with the water, increasing the salt content of the soil.

Evaluate and create

15 Why are coal, oil and gas described as fossil fuels?

Coal, oil and gas are described as fossil fuels because they are formed by the remains of dead organisms that became fossils.

16 If coal is so widely used for generating electricity, why are some people concerned about building new coal-fired power stations?

Student answers will vary, but may include concerns about the impact on the environment, carbon dioxide emissions from the station, the effects of coal mining on the environment, the fact that there are more sustainable options for power generation etc.

17 Is a hybrid car a low-emissions vehicle or a zero-emissions vehicle? Explain your answer.

A hybrid car is a low-emissions vehicle because it uses a combination of an electric motor and a petrol engine. The petrol engine still produces emissions of carbon dioxide and other gases.

18 Coal is considered to be a non-renewable fossil fuel. Is this really true? Explain in relation to the changes that are required for coal to form.

Coal takes many thousands or millions of years to form and because it is not regenerated in a short time it is considered to be non-renewable.

19 Produce an A4 fact sheet with a diagram of your own electricity company (give it a name), describing how electricity is produced at your power station. Justify your choices.

Student answers will vary.

20 Write a letter to the Federal Minister for Resources, Energy and Tourism, suggesting changes you would like to see happen in Australia. In your letter, include evidence that you know the current sources being used and have an understanding of the advantages and disadvantages of all options. You might like to prepare a renewable energy plan for Australia and explain how your plan will be more sustainable than current uses of our country’s energy sources.

Student answers will vary.

Ethical behaviour

21 What is Greenpeace’s attitude towards coal and nuclear power? What alternatives do they support for Australia?

Student answers will vary.

22 Do you think nuclear power will be used in Australia in the future? Explain.

Student answers will vary.

23 Passenger cars, like those your parents drive, are responsible for a significant amount of the population’s energy consumption. Should people consider walking, cycling or taking public transport to reduce their energy consumption? What issues might they consider?

Issues for alternative transport include safety (public transport is probably safer than driving; walking and cycling are not), time taken to commute, physical ability to walk or cycle, availability of public transport, cost, ability to transport goods (like groceries) and weather (for walking or cycling) etc.