



Primary Geography

Energy and sustainability

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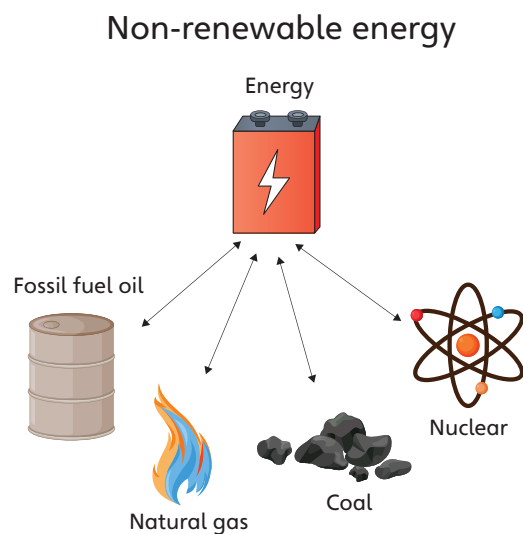
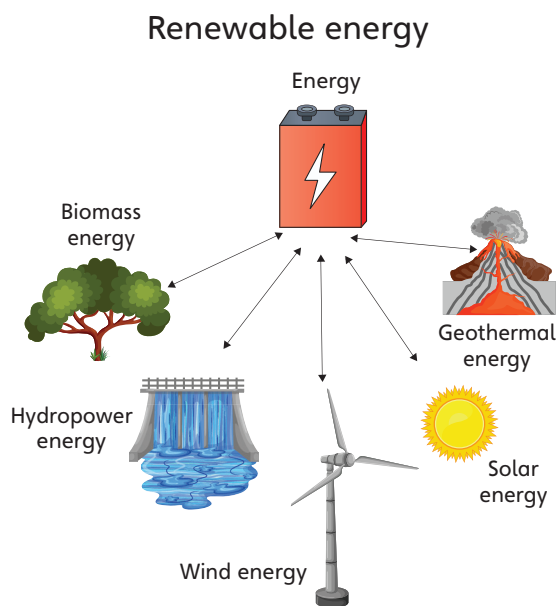
Class:

Knowledge organiser

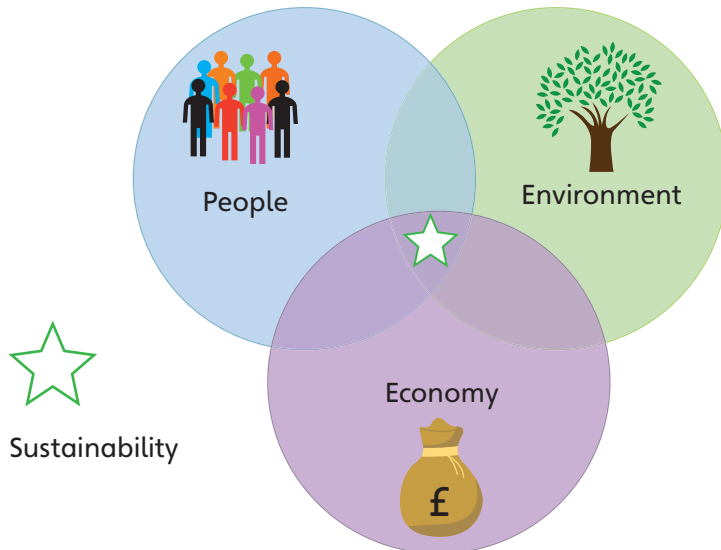
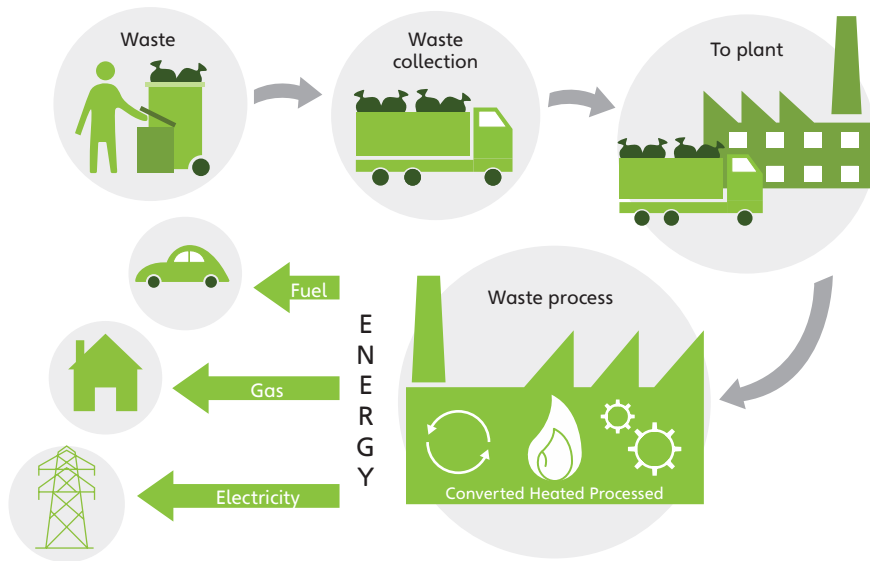
Vocabulary	
economic/economy	Relating to how money and resources are used in a society
fossil fuels	Coal, oil and gas etc – fuels that take millions of years to form
non-renewable energy	Energy sources that will run out, such as fossil fuels and nuclear energy
renewable energy	Energy sources that are replaced naturally and do not run out, such as solar and wind energy
sustainable	When something is good for people, the environment and the economy
technology	Tools and techniques that help solve problems
unsustainable	When something is not good for people, the environment and the economy

Renewable and non-renewable energy

All types of energy have advantages and disadvantages.
 For example:
 Solar energy
 + Little pollution; can be used in remote areas
 - Very expensive; require a lot of daylight
 Countries can ensure their energy security by moving towards using more **renewable energy**.



Waste to energy



Curitiba, Brazil



Freiburg, Germany

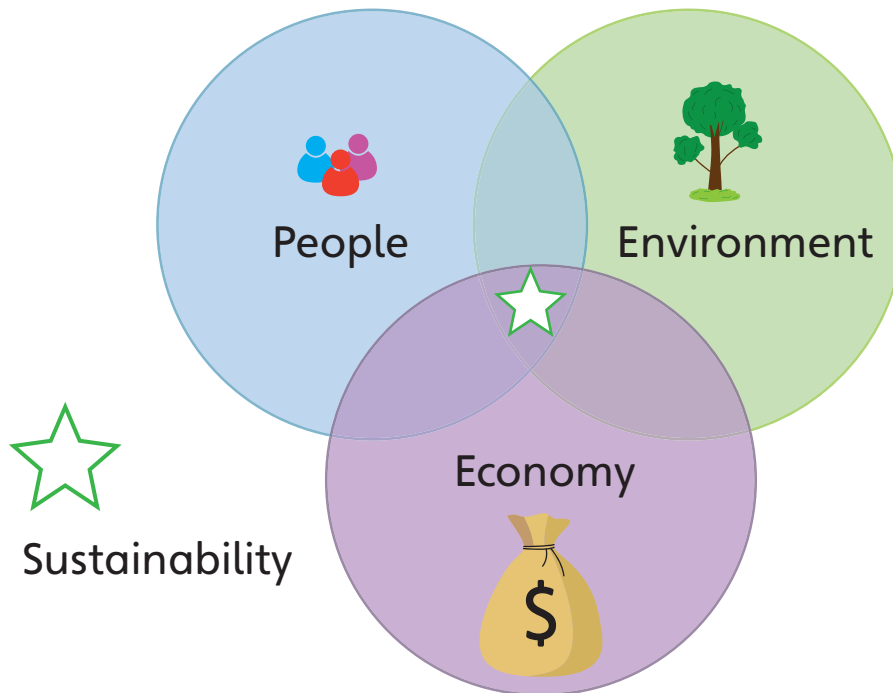


4 Learning review

Lesson	Lesson question	You will learn...	Learning review
1	What is sustainability?	<ul style="list-style-type: none"> • Why the environment is under so much pressure today. • Examples of sustainable and unsustainable practices. • What new technology is encouraging sustainability. 	<hr/> <hr/> <hr/> <hr/> <hr/>
2	Are fossil fuels sustainable?	<ul style="list-style-type: none"> • The ways humans can generate energy. • What 'renewable' and 'non-renewable' forms of energy are. • What fossil fuels are. 	<hr/> <hr/> <hr/> <hr/> <hr/>
3	What are renewable sources of energy?	<ul style="list-style-type: none"> • Which countries rely on renewable energy a lot. • What kinds of renewable energy there are. • How renewable energy is generated. 	<hr/> <hr/> <hr/> <hr/> <hr/>
4	What can we learn from Curitiba?	<ul style="list-style-type: none"> • Why it was sustainable to make the centre of the city pedestrian. • How the parks in Curitiba are sustainable. • How Curitiba's public transport system is sustainable. 	<hr/> <hr/> <hr/> <hr/> <hr/>
5	What can we learn from Freiburg?	<ul style="list-style-type: none"> • Where Freiburg is. • The sustainable measures Freiburg has taken. • How these measures support each other. 	<hr/> <hr/> <hr/> <hr/> <hr/>
6	Assessment: 'Humans are not capable of living sustainably.' How much do you agree with this statement?		<hr/> <hr/> <hr/> <hr/> <hr/>

Lesson 1

What is sustainability?



- 🔍 I. What is the diagram suggesting about **sustainability**? Write your answer.

I think the diagram is suggesting that sustainability is

Our common future

In 1987, the United Nations produced an important report called 'Our Common Future'. It explained a lot about sustainability and development.

The report said that the environment is the space where we all live, and that development is what we can do to improve our experience living in it.

The environment is under a lot of pressure from population growth, poverty and uneven development. Because of this pressure, the planet's natural resources are being used up and its waters, forests and lands are being damaged or polluted.

The report recommended growing the world's **economy** to pay for widespread development. This would improve our experience of living in the environment, but this development should be sustainable.

Sustainable development is able to meet the needs of the present population and also the needs of future generations.



2. Why is it important for humans to protect and think about the environment carefully? Write your answer.



3. In what ways is the environment under so much pressure today? Write your answer.



4. Why should we try to be sustainable? Write your answer.



5. Why have humans produced so many plastic bags? Write your answer, giving two reasons.



6. Why is the use of plastic bags considered **unsustainable**? Write your answer, giving two reasons.



7. Why are electric cars considered to be a more sustainable option than fossil-fuel-powered cars? Write your answer, giving two reasons.



A Tesla Model 3 electric car

Tesla's wind farm

Tesla is a **technology** company. It has built wind farms to generate energy. This is a form of sustainable development because it generates renewable energy but does not damage the environment through pollution or by destroying the landscape. Wind farms also avoid the costs needed to take **fossil fuels** out of the Earth.

In addition to the wind farms, Tesla is building the world's largest battery to store energy generated by the wind farm. The battery is basically the same as a normal battery, just on a much bigger scale. Tesla hopes the battery will be able to store enough energy to power 30,000 homes in times when there is less wind.



Energy is created when wind turns the blades of a turbine. The rotation drives the generator to create electricity.

8. Name three ways that Tesla's new technology is sustainable.
Write your answer.

Lesson 2

Are fossil fuels sustainable?



Quiz

1. What is sustainable development? Tick the correct answer.
 - a. Development that produces as much wealth as possible at any cost
 - b. Development that meets our needs for the immediate future
 - c. Development that meets our needs without limiting future generations meeting their own
 - d. Development that does nothing for us in the present but meets the needs of future generations

2. Fill in the blanks to complete these sentences.

polluted population growth damaged
uneven development natural resources

The environment is under a lot of pressure from _____, poverty and _____. Because of this pressure, the planet's _____ are being used up and its waters, forests and lands are being _____ or _____.

3. Name a company that is designing new sustainable technology. Write your answer.

4. Name two examples of unsustainable activities. Write your answer.
5. Read the statement below. Tick 'True' or 'False'.
Fossil-fuel-powered cars are more sustainable than electric cars. True False

Generating energy

For thousands of years, humans used natural resources to produce energy. Wind was used to travel on ships. Wood was burnt for heat. Water and wind were used to power simple machines like watermills and windmills.

Over time, humans found new ways to generate energy. In the 1700s, Thomas Newcomen and James Watt invented the steam engine. The steam engine allowed people to travel further and transport more goods than travelling by horse.

In 1880, a coal-powered steam engine was used to generate electricity for the first time. Thomas Edison's invention of the light bulb provided the first electric light. By 1881, water was being used to generate electricity, and then humans discovered how fuels such as oil and gas could be burnt to generate electricity and power cars.

The amount of energy we could produce for our needs was now much larger.



1. Name four ways that humans can produce energy. Write your answer.

Fossil fuels

Coal, oil and gas are fossil fuels. They are made from the remains of small life forms that have changed into chemicals, having been buried underground for millions of years. We release energy by burning fossil fuels.

Coal is brought out of the ground by mining, oil by drilling, and gas by fracking (using drilling and high-pressure water to release gas from rocks). These methods either damage the landscape or risk damaging the environment when things go wrong, like an oil spill.

Most of the energy we produce and use up is from fossil fuels. In 2015, 80% of the world's energy was provided by fossil fuels. Many people are looking for other ways to generate energy that do not use fossil fuels.



2. Read the statements below. Tick 'Advantage' or 'Disadvantage' for each one.

- | | |
|---|---------------------------------------|
| We have already created the technology for collecting fossil fuels. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |
| Fossil fuels release pollution into the air when burnt, which creates global warming. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |
| Oil spills damage the environment. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |
| Oil and gas are likely to run out within the next 100 years. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |
| Fossil fuels produce a lot of energy cheaply. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |
| It is easy to safely move oil and gas around through pipelines. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |
| Fossil fuels can be found easily. | <input type="checkbox"/> Advantage |
| | <input type="checkbox"/> Disadvantage |



3. Fill in the blanks to complete these sentences.

moved around cheaply run out found
 pollution technology environment global warming

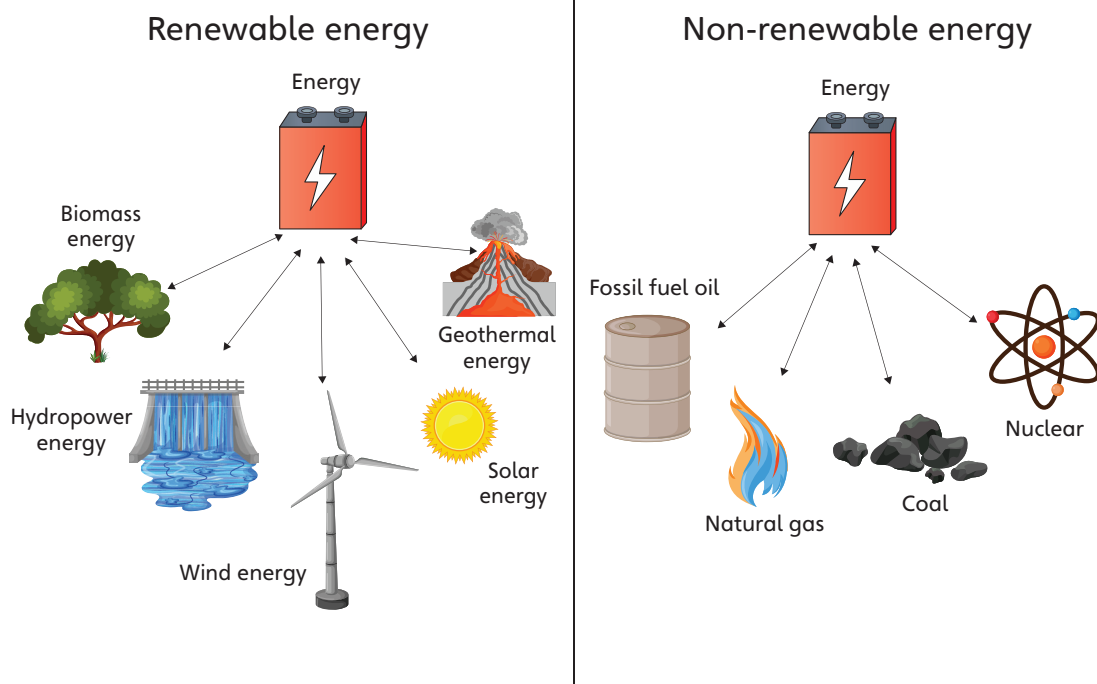
Fossil fuels have many advantages, like that they produce a lot of energy _____. We already have the _____ for collecting oil, gas and coal. These sources of energy can be _____ easily and _____ safely.

However, fossil fuels damage the _____. When we burn fossil fuels, we release _____ into the air, which creates _____.

In the end, all fossil fuels will _____.



4. Why are fossil fuels not sustainable? Write your answer.



5. Match each term to its definition. Draw a line between them.

Fossil fuels	These are sources of energy that will run out. Once they have been used up, there will be none left, because they take millions of years to form and humans have used them up much quicker than the time it takes for them to form.
Non-renewable energy	These are sources of energy that will not run out. They keep on being generated by the planet because they are part of the planet's natural processes.
Renewable energy	Coal, oil and gas are examples of these. They take millions of years to form. Coal is formed by dead plants, and oil and gas are formed by marine (ocean) plant and animal remains.

Lesson 3

What are renewable sources of energy?



Quiz

1. Read the statement below. Tick 'True' or 'False'.

Fossil fuels are **non-renewable** sources of energy, because they will run out. Once they have been used up, there will be none left, because they take millions of years to form.

True False

2. Name three examples of fossil fuels. Write your answer.

3. What sustainable practices has Tesla made? Tick the correct answer.

- a. The world's largest solar panel
- b. The Model 3 electric car and wind-farm battery
- c. A process for recycling plastic bags
- d. A method for drilling for oil without risking an oil spill

4. Name one advantage of fossil fuels. Write your answer.

5. Name one disadvantage of fossil fuels. Write your answer.

Fossil fuel data

This data is from the World Bank. It shows the eight countries that used fossil fuels for less than 60% of their total energy production in 2015 and what the UK used in the same year.

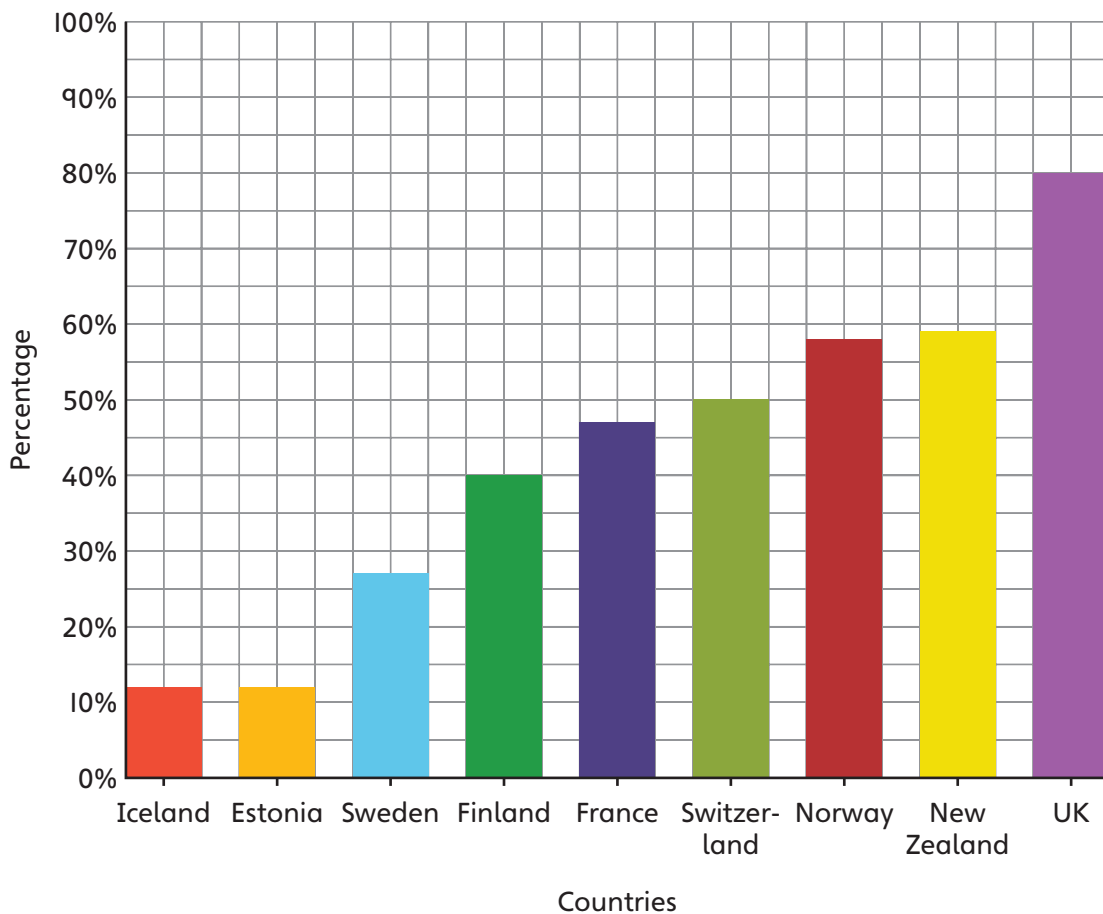
For example, Iceland used fossil fuels for only 12% of its energy production, compared to the UK, which used fossil fuels for 80% of its energy production.

Iceland	Estonia	Sweden	Finland	France	Switzerland	Norway	New Zealand	UK
12	12	27	40	47	50	58	59	80



1. Represent the data as a bar chart. Draw a column for each country to show the percentage of fossil fuels used.

Amount of fossil fuels used by countries in 2015

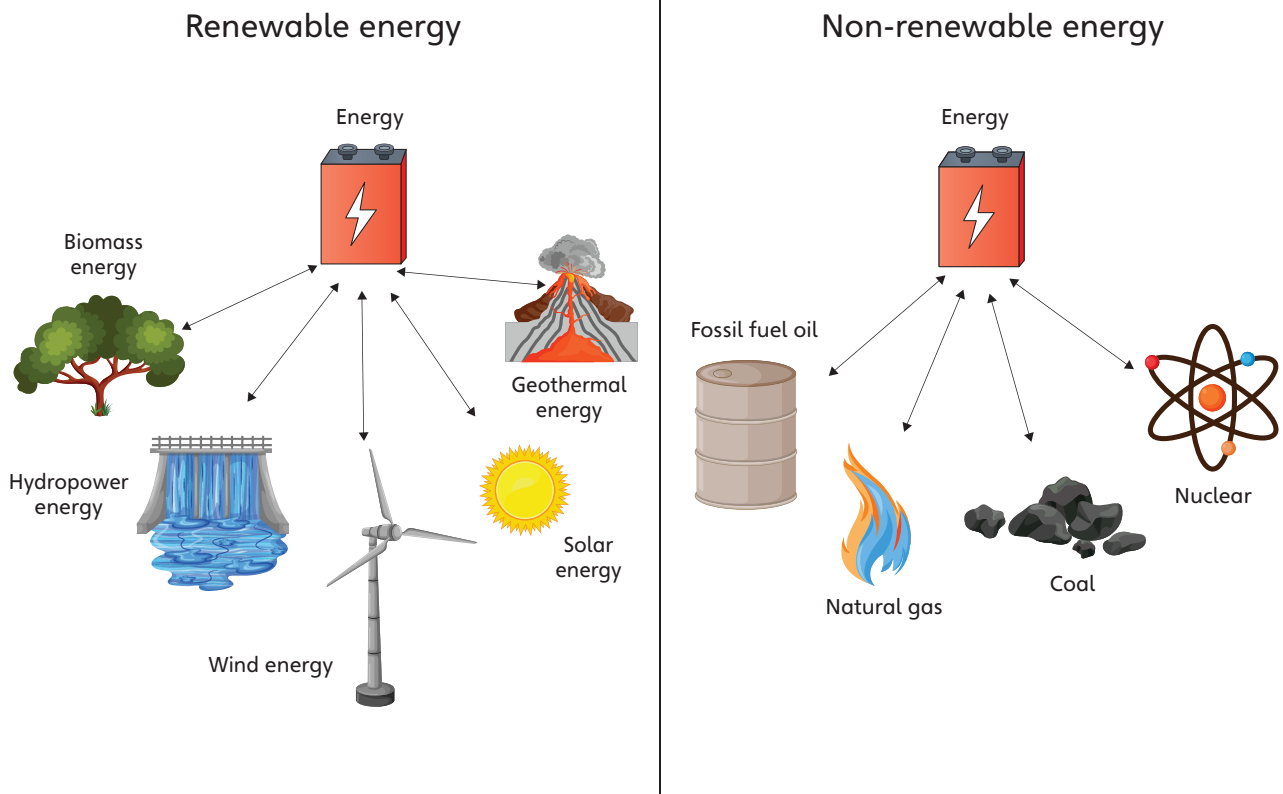


2. According to the information, which countries used the most renewable energy? Write your answer.

3. How many countries on the graph used non-renewable energy for more than half of their energy production? Write your answer.

4. How much more renewable energy did France use than the UK? Write your answer.

5. How much more renewable energy did Estonia use than France? Write your answer.



6. What other types of energy sources were these countries probably using to generate power? Write your answer.



7. Match the energy type to its description. Draw a line between them.



Solar farm in Thailand



Wind farm in Yorkshire, UK



Hydroelectric dam in Hubei, China



Micro-hydro plant in Mbuiru, Kenya

Energy is generated by water flowing into turbines. Turbines are machines that produce electricity when huge sets of magnets are pushed around.

Lots of water is stored in a dam to keep it flowing into the turbines and producing more energy.

Little pollution is made once this is up and running, but dams are expensive to build and often involve flooding large areas of land.

Energy is absorbed from sunlight on large panels.

These panels produce no pollution and the energy can be easily transported somewhere else.

The panels are expensive to make. A lot of panels are needed, and they only produce energy when the sun is out.

Energy is generated by water flowing into turbines from a steep, fast-flowing river.

This is done on a much smaller scale than a dam, so it is much cheaper to build, but it does produce less energy.

Energy is generated by the wind pushing the blades of turbines.

These create little pollution and the surrounding land can still be used.

They do, however, change the landscape and can make a lot of noise.

Wind farms can be built on land or offshore in the ocean.

Unit progress check in



1. Fill in the blanks to complete the sentence.

needs meets limiting

Sustainable development is development that _____ the needs of the present, without _____ the ability of future generation to meet their own _____.

2. Give one example of how the company Tesla is designing sustainable technology. Write your answer.

3. Read the statement below. Tick 'True' or 'False'.

Renewable energy sources take millions of years to form, from the remains of life forms buried under the Earth.

True False

4. Name one type of non-renewable energy. Write your answer.

5. Cross out the incorrect words to complete this sentence.

It is **an advantage** / **a disadvantage** that fossil fuels release pollution into the air when burnt.

6. Cross out the incorrect words to complete this sentence.

It is **an advantage** / **a disadvantage** that fossil fuels are cheap to use.

Lesson 4

What can we learn from Curitiba?



Quiz

1. Fill in the blanks to complete the sentences.

natural processes run out

Renewable energy does not _____. It is generated by the planet's _____.

2. Match the names of the renewable energy to the methods used to generate it. Draw a line between them.

solar power
hydroelectric power
micro-hydro power

steep, fast-flowing rivers
large panels for absorbing sunlight
dams storing up large quantities of water

3. Cross out the incorrect word to complete the sentence.

Coal, gas and oil are known as fossil fuels. They are types of **renewable / non-renewable** energy.

4. Read the statement below. Tick 'True' or 'False'.

In 2015, the UK used more renewable energy than fossil fuels.

True False

5. In 2015, which countries used the most renewable energy, according to the information in Lesson 3? Write your answer.

Curitiba

Curitiba is a city in Brazil that has become a global example for sustainability. Curitiba has been called ‘the green capital’ and ‘the greenest city on Earth’.


The city grew quickly between the 1940s and 1960s, with the population increasing from 140,000 to 360,000. As a result, slums (over-crowded living areas) were building up around the edge of the city and it became very polluted due to all the vehicles moving around the city.


In 1971, an architect named Jaime Lerner became the mayor and he changed a busy shopping street in the city centre into a pedestrian area, with no vehicles allowed.

There were lots of protests as people were very unhappy about the change. Lerner and his team were able to transform the street in a record-breaking 72 hours. Because the changes happened so quickly, the community realised what a positive change it was.



Curitiba, Brazil

-  1. What problem was Curitiba facing between the 1940s and 1960s? Write your answer.

-  2. Why was it more sustainable to make the centre of the city pedestrian? Write your answer.

Green spaces

As well as making a major pedestrian shopping district in the city centre, Curitiba has a lot of parks and green space for its population to access. Jaime Lerner had the layout of the parks across the city specially designed.

There are 28 parks and wooded areas in Curitiba. The parks are all connected so they get used a lot. The parks ring the city to give easy access to green space wherever you are in Curitiba. Some parks were built in just two months.

Access to green spaces make the environment more pleasant for people in crowded cities. Curitiba has more than 50 m² of green space per person. Parks also improve air quality, support plant and animal life, and stop space being taken up by roads and factories that pollute the environment.

3. Look at these photographs of the parks in Curitiba. What evidence of sustainability do you see in each one? Write your answers in the boxes below and provide two examples.



Barigui Park in Curitiba, Brazil



The Botanical Gardens
in Curitiba, Brazil

Curitiba's transport system

Curitiba built a sustainable transport system. The planners designed an overground metro system, which was much cheaper and easier to build than an expensive underground system.

The system uses special bi-articulated buses, meaning they can bend into two sections. Each bi-articulated bus can carry up to 270 people.

During busy travel times, the buses run every 50 seconds along separate bus lanes, which means they do not get stuck in traffic. Special bus stops help people get on and off the buses more quickly, in organised queues.

The cheapest and quickest way to travel around Curitiba is by bus. It is used by about 85% of the city's population. Around 300 other cities across the world are now using Curitiba's transport system as their model.



4. What is sustainable about the way Curitiba's transport system was built? Write your answer.



5. How does Curitiba's transport system meet the needs of the people? Write your answer.



6. How does Curitiba's transport system help the environment? Write your answer.

Lesson 5

What can we learn from Freiburg?



Quiz

1. In which country is the city of Curitiba located? Write your answer.

2. Name two ways in which Curitiba has become a more sustainable city. Write your answer.

3. What are the special buses in Curitiba called?

4. Read the statement below. Tick 'True' or 'False'.

Curitiba is a global example of sustainability. Roughly 300 cities have taken up methods that Curitiba used to make itself more sustainable.

True False

5. Fill in the blanks to complete the sentences.

animal life green air quality pleasant crowded

Access to _____ spaces make the environment more _____ for people in _____ cities. Parks improve _____, and support plant and _____.

Where is Freiburg?



Freiburg, Germany

Freiburg's people

In 1970, Freiburg set itself the goal of becoming a sustainable city. The aim was to balance the needs of the environment, the people and the economy. The planners consulted the local community on things like building what would be Germany's first solar-powered football stadium. As a result, the locals felt involved in improving their city. Now, the city spends less money cleaning up pollution because there is less of it. The money saved is used to help people to live sustainably at home.

Freiburg helps its population buy and install solar panels. People are rewarded with money for composting their food waste and using recyclable items like cloth nappies for babies. Tickets for music, sports or cultural events are valid on the tram network for free travel.



1. How does the city encourage people to use renewable energy and other sustainable methods at home? Write your answer, giving two examples.

Freiburg's economy

The city has focused on making sure that there are lots of jobs for people. People visit Freiburg to attend conferences on sustainability, which provides many jobs to the locals.

Over 10,000 people in Freiburg are employed in sustainable technology businesses. For example, 1,000 people are employed by the solar energy industry.

Parking is very expensive in the city. This encourages people to use the tram instead of using their cars. This reduces traffic and the amount of pollution made by cars. Money raised from the expensive parking is used to make the trams cheap to use.



2. How does the city encourage people to use public transport? Write your answer.

Freiburg's environment

The community has focused on very high levels of recycling and has reduced the amount of waste they produce.


Freiburg has a biogas digester. This is a machine which processes food and garden waste to produce energy. This energy powers thousands of homes in Freiburg.

Buildings have been built to environmentally-friendly standards. These buildings need less heating during the winter.

Over 44,000 trees have been planted and 43% of the city is covered by forest. The city uses wood from the forest but never more than what will grow back.



A Freiburg tram

-  3. Name three ways that Freiburg reduces the amount of waste and energy used by the city. Write your answer.



4. Read the statements below. Match the sustainable activities to the benefit they provide. Draw a line between them.

Building a biogas digester	Encourages people to use public transport, reducing pollution from cars.
Expensive parking and cheap trams	Saves people money as they use renewable energy.
Consulting people on changes to the city	Turns food and garden waste into energy for homes.
Help buying solar panels	Lets people make decisions that keep them healthy and happy.

Lesson 6

Unit check out



‘Humans cannot live sustainably.’ How much do you agree with this statement?

Key words

development	fossil fuels	renewable energy
economic	non-renewable energy	sustainable
environment	pollution	unsustainable

Title: ‘Humans cannot live sustainably.’ How much do you agree with this statement?	<hr/> <hr/> <hr/>
Introduction <ul style="list-style-type: none">• What is sustainability?• What is sustainable living?	<hr/> <hr/> <hr/>
Paragraph 1 <ul style="list-style-type: none">• What are non-renewable fuels?• How do humans use non-renewable fuels?• Why do humans use non-renewable fuels?	<hr/> <hr/> <hr/> <hr/>

<p>Paragraph 2</p> <ul style="list-style-type: none">• What are renewable fuels?• How do humans use renewable fuels? (2–3 examples)• Why do humans use renewable fuels?	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Paragraph 3</p> <ul style="list-style-type: none">• What evidence is there of humans living in a non-sustainable way? (2–3 examples)• How and why is damage being caused to the planet?	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Extension</p> <ul style="list-style-type: none">• How can humans live sustainably? (2–3 examples from Curitiba and Freiburg)• How does each example show that humans can live sustainably?	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Conclusion</p> <ul style="list-style-type: none">• Overall, what does the evidence suggest about whether or not humans are able to live sustainably?• How might the situation change (for better or worse) in the future?	<hr/> <hr/> <hr/> <hr/> <hr/>

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Energy and sustainability

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