

RWE

Carbon Capture & Storage

KS2 Workbook



Name:

Class:

How is energy generated?

Energy can be generated in many ways to power our schools and homes.

For example, some power plants generate energy by burning fossil fuels like coal and gas. They use these fuels to heat water and make steam, which then turns turbines that create electricity. However, burning these fuels can hurt the planet and is a big cause of climate change, which is why scientists and engineers are finding ways to reduce the pollution they cause.

We can also generate energy from renewable sources like wind and sunlight. Wind turbines have blades that spin when the wind blows, turning generators to produce electricity. Biomass power plants generate energy by burning natural materials, while solar panels capture sunlight to produce electricity. All these types of energy travel through wires to power lights, computers, TVs, and more.

How does energy travel through wires?



Generation

Electricity can be generated from sources like coal, gas, wind, or sunlight.

Transmission

The electricity then travels long distances through high-voltage power lines.

Distribution

This electricity reaches our schools and homes through lower-voltage lines, powering lights, TVs, and other devices we use every day.



Can you turn the lights in the classroom on and off and discuss how that works?



Can you guess these energy sources?



Introduction to climate change

Climate change refers to the usual pattern of weather changing over a long period of time. It includes factors like temperature changes, how much it rains and even how windy it gets. So, what causes climate change?



Climate Change

The Earth's climate has changed naturally over time. For example, the Earth has experienced ice ages and warmer periods long before human activities began impacting the climate. However, humans are causing the climate to change faster than it naturally would.



Human Impact

Human activities such as farming, deforestation, and burning huge amounts of fossil fuels greatly contribute to climate change. We burn fossil fuels such as coal, oil, and gas to make electricity and power cars. But when we burn these fuels, they release something called "greenhouse gases" into the atmosphere.



Greenhouse Gases

These gases trap heat from the sun and make our Earth warmer than it should be. This extra warmth is causing big changes in our climate and we're seeing some damaging impacts. Some places are getting hotter, some colder, some wetter, and some drier. This can lead to extreme weather, melting ice caps, rising sea levels, and animals having to find new homes.



Fighting Climate Change

But here's the thing, we can make changes to help our Earth. Simple things like using less electricity, walking instead of driving, and planting trees can all make a difference in slowing down climate change. As well as bigger environmental changes made by the government and businesses like capturing carbon. There are many positive actions currently being taken worldwide to fight climate change.



List three positive actions your school can take to help fight climate change...

1.

2.

3.

What is CO₂? (Carbon Dioxide)

Carbon dioxide is a gas that is all around us. It's invisible, so we can't see it, but it's there in the air we breathe.

CO₂ is naturally present in the atmosphere and is released through various natural processes. For example, when we exhale, we release a mixture of gases, including carbon dioxide. Additionally, CO₂ is released through a process called outgassing, where warm water releases CO₂ into the air.

CO₂ is also released through unnatural processes, such as burning fossil fuels like coal, oil or gas. These fuels generate energy for activities like producing electricity, flying aeroplanes, driving cars, and heating our homes. Electricity often comes from power plants that produce CO₂ because they burn coal or gas. Similarly, driving a car produces CO₂ because it burns fuel.

However, as we just learnt, burning these fuels releases greenhouse gases like CO₂ into the atmosphere, which can be bad for the environment. Now, CO₂ isn't necessarily bad in small amounts. In fact, plants love it! Just like we need air to breathe, plants need CO₂ to grow.

But too much CO₂ can be a problem. When there's too much CO₂ in the atmosphere, it acts like a blanket and traps heat from the sun. This can make the Earth warmer, and that's what we call global warming. Global warming can change the Earth's climate in ways that might not be good for us or for the animals and plants we share the planet with.



Can you circle some of the places on the diagram that show where CO₂ comes from?



What is CCS & how does it work?

Carbon Capture and Storage (CCS) is like a big shower that washes out the CO₂.

Too much CO₂ in the atmosphere can be a problem as it traps heat from the sun, causing temperatures to rise and resulting in global warming. So, scientists are looking for ways to catch some of this extra CO₂ before it enters the atmosphere. That's where CCS comes in! CCS is a three-step process starting with capturing the CO₂.

1

Producing CO₂

Coal and gas-fired power plants produce gases containing CO₂.



RWE's CCS projects could produce enough low-carbon electricity to power 5 million homes during winter!

2

Capturing CO₂

To capture the CO₂, these gases are showered with a special liquid that traps and contains the gas.

3

Compressing CO₂

The special liquid is then heated to release only the CO₂ gas, allowing it to be cleaned and compressed for storage. The special liquid is recycled and reused in the process.

What happens to carbon after it's captured

After CO₂ is captured from power plants and factories, it is transported to special storage sites using various methods.



As a class, discuss the advantages and disadvantages of the different methods of CCS transportation.

Transport

Once the CO₂ is captured, it needs to be transported to a storage site, typically through pipelines, similar to how oil or gas is transported. Sometimes, CO₂ may be transported by trucks, trains or ships, especially if the storage site is far away.

HINT...
Think about how easy each method is to control and how fast it can go.

Storage

The captured CO₂ is then injected deep underground into rock formations, where it is securely stored and cannot escape into the atmosphere, preventing it from contributing to climate change.

CCS Quiz



1. What is CCS short for?

5. Why do we capture CO₂?

2. Name the three main stages of CCS?

1. _____

2. _____

3. _____

6. List three ways of transporting CO₂?

1. _____

2. _____

3. _____

3. What greenhouse gas does CCS capture?

7. Where do we store CO₂?

4. Where does CCS capture CO₂ from?

8. Why is CCS important?



Well done!
You completed the quiz.

The benefits of CCS

CCS can help fight climate change by reducing CO₂ but also offers many environmental and social benefits.



Protecting the Planet

CCS can help to reduce the amount of heat-trapping gases in the atmosphere. By capturing CO₂ before it enters the atmosphere, we can slow down climate change, helping to protect the planet.



Saving Animals

CCS can help protect the environments animals need to survive. By reducing the amount of CO₂ we prevent the earth from getting too warm and extreme weather events like melting ice caps and rising sea levels from destroying animals' homes.



Cleaner Air

CCS can help to keep the air cleaner by capturing CO₂. By reducing the amount of CO₂ in the air, we can make it healthier for everyone to breathe.



Creating New Jobs

CCS can create new job opportunities for people all around the world. Building and operating CCS facilities requires people to work in many fields, like engineering, science and technology.



Preserving Nature

CCS can help protect forests, oceans and other natural habitats by reducing the need to cut down trees or damage ecosystems for energy production. This allows nature to thrive and provides homes for plants and animals.



List three ways you could reduce your own carbon footprint...



Keep up the good work!

1.

2.

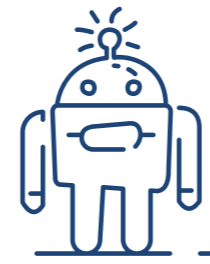
3.



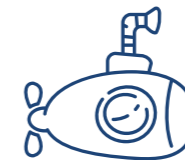
If you could invent something to capture CO₂ and help fight climate change, what would it be?

Draw it below and label how it would work.

Here are some ideas...



CO₂ catching robot



CO₂ detector



CO₂ storage

CCS in the UK & around the world

CCS projects can be found in many countries, including the United Kingdom, United States, Canada, Norway, Australia, and China.

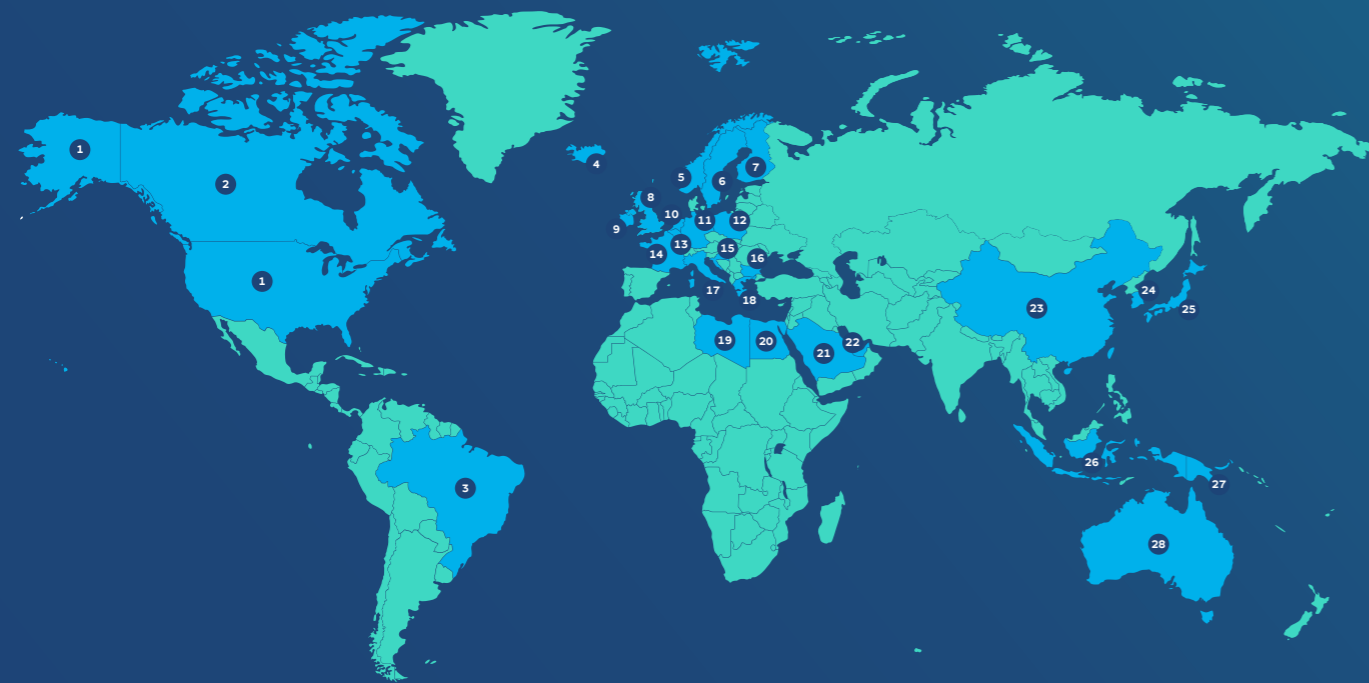
Some CCS projects are actively capturing CO₂, while others are still in development or undergoing testing. In the UK, RWE is currently developing 4 CCS sites. Worldwide, approximately 395 projects are operating, in development, or testing the technology.

Scientists and engineers are working on improving CCS technology to make it more efficient and affordable. There are plans to build more CCS projects in the future to help fight climate change.



As a class, name the locations of these CCS projects across the UK & around the world?

RWE CCS UK locations



Countries developing or using CCS

True or false CCS



Decide whether these CCS statements are true or false...

		True	False
1.	CCS can help to remove greenhouse gases like CO ₂ from the air.	<input type="checkbox"/>	<input type="checkbox"/>
2.	CCS can help to make the air cleaner and safer.	<input type="checkbox"/>	<input type="checkbox"/>
3.	CCS can help protect animals by fighting climate change.	<input type="checkbox"/>	<input type="checkbox"/>
4.	CCS can create new job opportunities for people.	<input type="checkbox"/>	<input type="checkbox"/>
5.	CCS doesn't have any benefits for the environment.	<input type="checkbox"/>	<input type="checkbox"/>
6.	CCS can only capture CO ₂ from cars.	<input type="checkbox"/>	<input type="checkbox"/>
7.	CCS can only be used in certain countries.	<input type="checkbox"/>	<input type="checkbox"/>
8.	CCS captures CO ₂ and releases it back into the atmosphere.	<input type="checkbox"/>	<input type="checkbox"/>
9.	CCS makes the air dirtier and more polluted.	<input type="checkbox"/>	<input type="checkbox"/>
10.	CCS stands for "Carbon Capture and Storage".	<input type="checkbox"/>	<input type="checkbox"/>

Find out more...

Here are some fun, educational resources for you to learn more about CO₂ and its impact on the environment.

Online Learning and Games:

These websites offer educational resources and interactive games covering various subjects, including climate change, the carbon cycle and greenhouse gases.

WWF Carbon Footprint Calculator
<https://footprint.wwf.org.uk/>

NASA Climate Kids
<https://climatekids.nasa.gov/>

BBC Bitesize
<https://www.bbc.co.uk/bitesize>

Educational Videos:

These YouTube channels offer educational videos on various topics including climate science and environmental issues.

National Geographic Kids
<https://www.youtube.com/@natgeokids>

TED-Ed:
<https://www.youtube.com/@TEDEd>

BBC Teach:
<https://www.youtube.com/@bbcteach/>

Reading Materials:

Climate Rebels by Ben Lerwill (2020)

The Bear in the Stars by Alexis Snell (2020)

How You Can Save the Planet by Hendrikus van Hensbergen (2021)

The Green Planet by Leisa Stewart-Sharpe & Kim Smith (2022)

The Greatest Show on Earth by Mini Grey (2022)



CCS completion certificate



This is to certify that

has successfully completed an introduction to CCS

Signed



My climate change promise is...

