Capturing and storing CO_2

The hard facts behind CCS

CO_2 Capture and Storage (CCS) is the only technology that can capture **at least 90%** of emissions from the world's largest CO_2 emitters.

All facts and figures in this document can be referenced at **www.zeroemissionsplatform.eu**

“CCS is **an essential part of the portfolio of technologies** needed to achieve substantial global emissions reductions.”

International Energy Agency

more

more more

more more

more

more more more more more more more more more more more more

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more

More people, more energy

Every day, we use energy and every day, we ask for more. And with global population set to rise from 7 to 9 billion by 2050, world energy demand is expected to **increase by 50%** over the next 20 years alone.

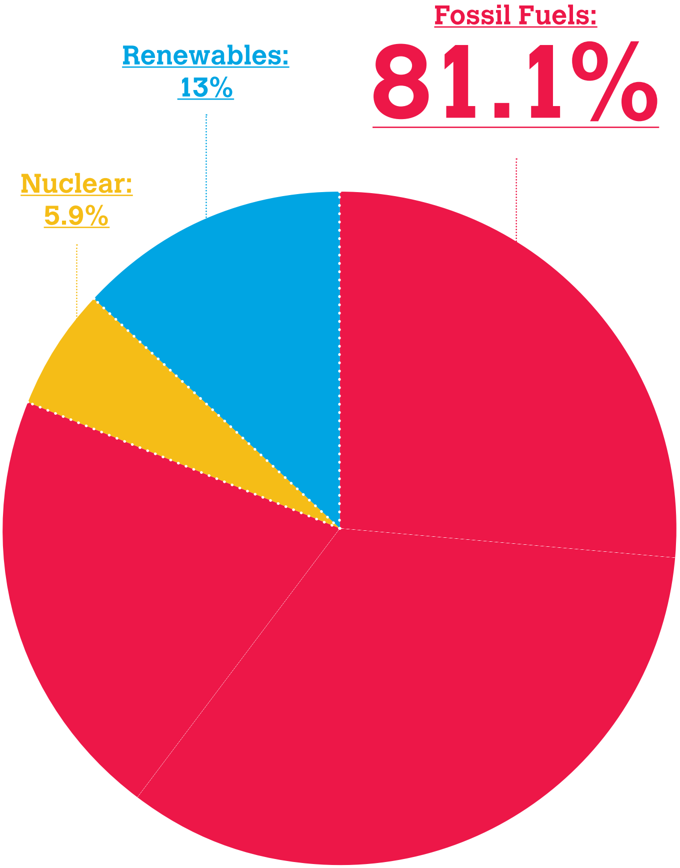
7 → 9 billion people

We still rely on fossil fuels

The challenge is that fossil fuels (coal, gas and oil) are our main source of energy and we emit enormous quantities of CO_2 when we burn them.

Today, renewables provide **13%** of our energy and this could climb to **30%** by **2030**. But the fact is, fossil fuels will remain our main source of energy for decades to come.

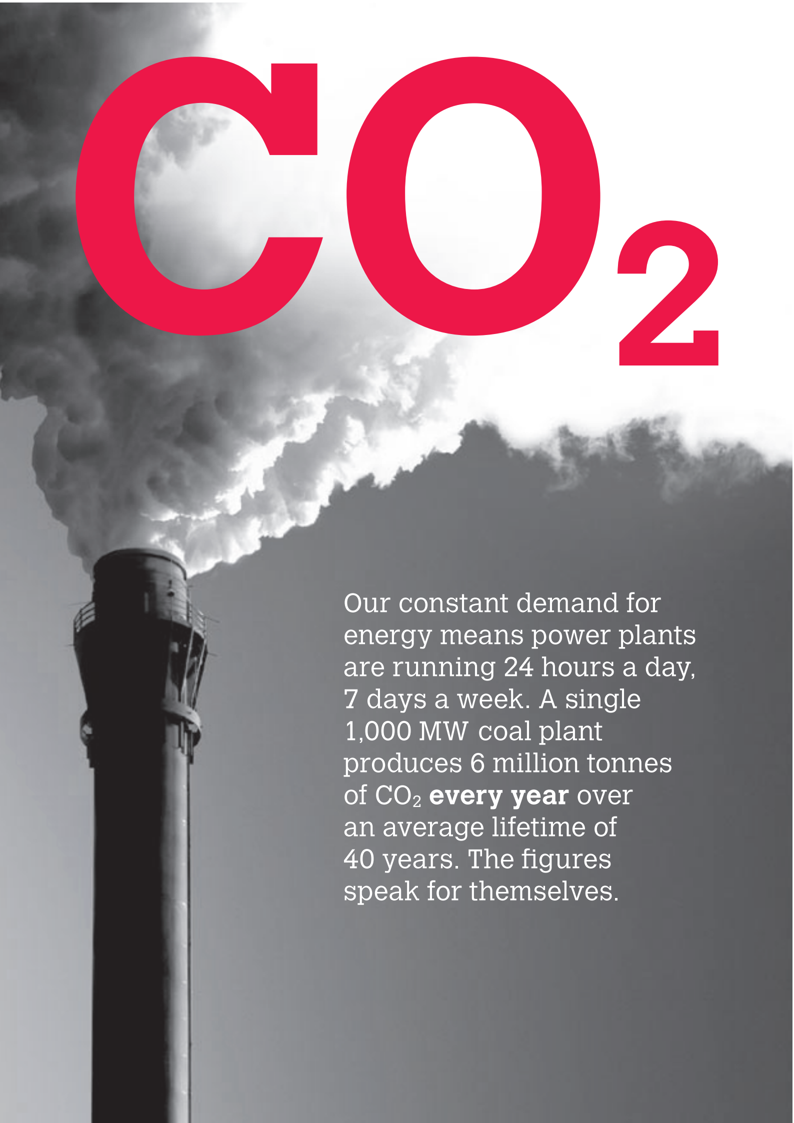
World Total Primary Energy Supply – 2007



Source: IEA, Key World Energy Statistics, 2009

Fossil fuels power the largest emitters of ...

Together, fossil fuel power plants and heavy industry are the largest emitters of CO_2, accounting for 52% of total CO_2 emissions worldwide or around 15 billion tonnes of CO_2 per year. It is these large fixed emitters that need to be most urgently addressed.



CO_2

Our constant demand for energy means power plants are running 24 hours a day, 7 days a week. A single 1,000 MW coal plant produces 6 million tonnes of CO_2 **every year** over an average lifetime of 40 years. The figures speak for themselves.

Beyond 2°C

Too much CO_2 is leading to global warming and this in turn is causing climate change. The world's leading scientists* have confirmed that unless the rise in average global temperature is kept **below 2°C**, devastating and irreversible climate changes will occur.

and we have irreversible climate change

* Intergovernmental Panel on Climate Change (IPCC).

The Challenge

CO_2 emissions need to come down… **fast.**

Energy consumption is going to **rise.**


A solution
CO_2

How do we meet this challenge?
By using a portfolio of solutions:

Energy efficiency

\+

Renewable energy

\+

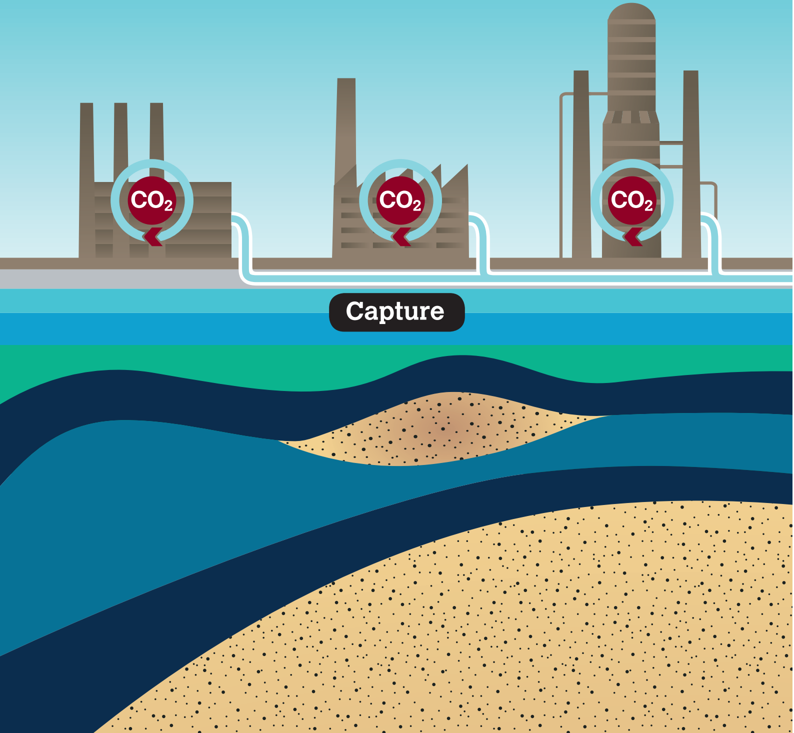
CO_2 Capture and Storage (CCS)

CCS alone will provide up to 20% of the reductions we need to make by 2050 and here's how it works ...

Inside CCS

Capture

We can capture **at least 90%** of the CO_2 emitted by power plants and heavy industry.

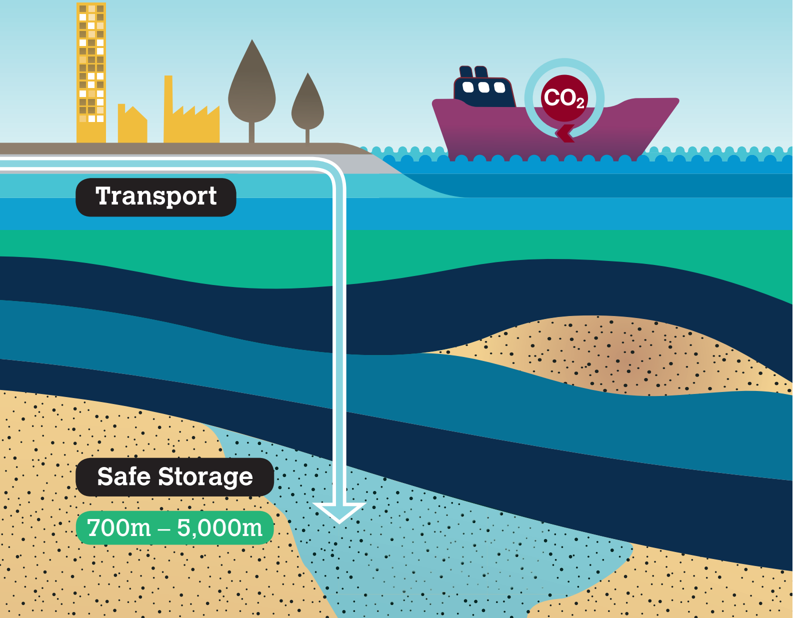


Transport

Liquid CO_2 has been transported by **pipeline** for decades.

Safe Storage

Using natural storage mechanisms, CO_2 is trapped between **700m and 5,000m** underground.



Capture

There are **three** technologies:

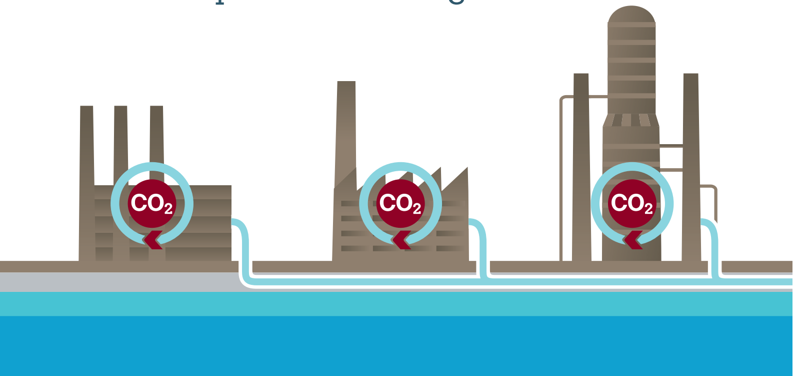
Pre-combustion:
where CO_2 is captured before fuel is burned

Oxy-fuel:
where CO_2 is captured during fuel combustion

Post-combustion*:
where CO_2 is captured after fuel has been burned

* Post-combustion technology can be retrofitted to existing power and industrial plants.

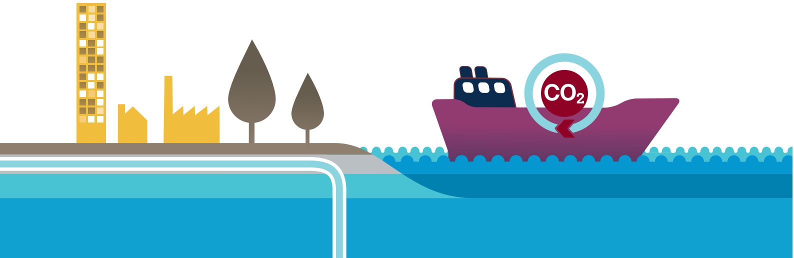
Once captured, the CO_2 is compressed into a **liquid** state and dehydrated for transport and storage.

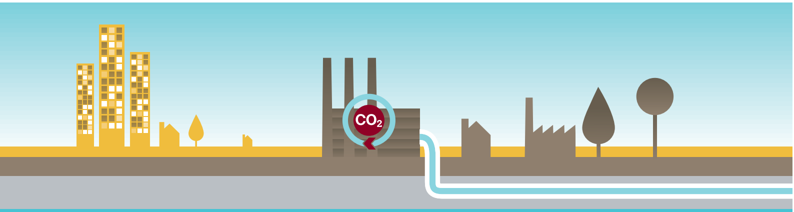


Transport

We already transport CO_2 by **pipeline** and ships are used when a source of CO_2 is too far from a suitable storage area.

The widespread deployment of CCS will require an equivalent CO_2 pipeline network.





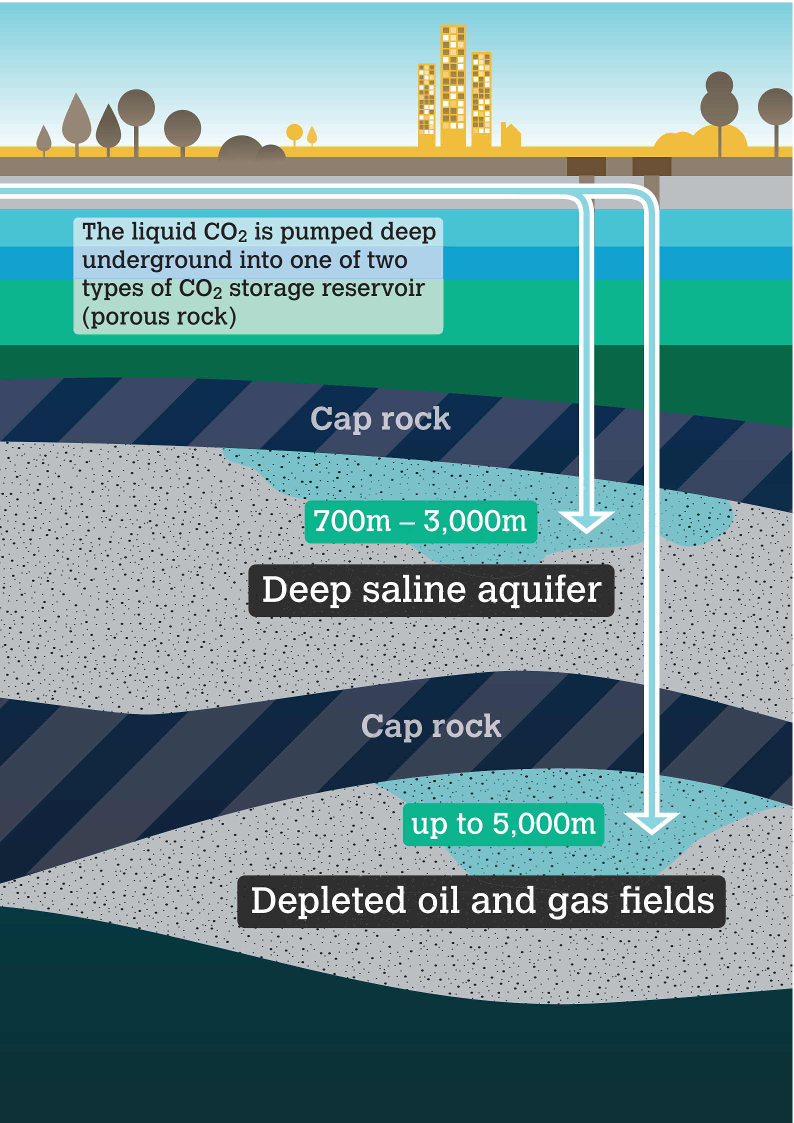
Safe storage

How do we ensure that captured CO_2 is **safely** and **permanently** stored?

Using natural mechanisms

By storing CO_2 underground, we are using a natural process that has trapped CO_2, gas and oil for millions of years.

Both oil and gas fields and deep saline aquifers have the same key geological features required for CO_2 storage: a layer of **porous rock** to absorb the liquid CO_2 and an impermeable layer of cap rock which seals the porous layer underneath, trapping the CO_2.


The liquid CO_2 is pumped deep underground into one of two types of CO_2 storage reservoir (porous rock)
Cap rock
700m – 3,000m
Deep saline aquifer
Cap rock
up to 5,000m
Depleted oil and gas fields

The safety of stored CO_2 actually **increases over time** ...

... due to **three natural mechanisms**:

1

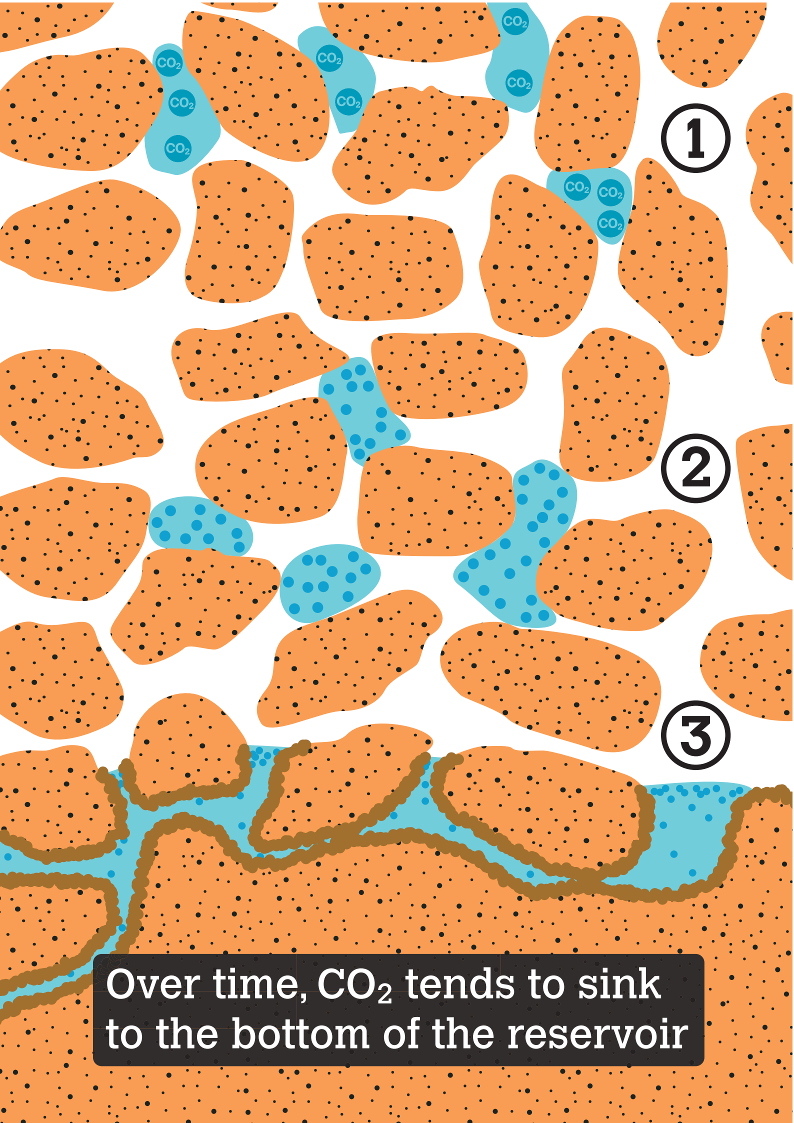
Residual trapping
Some of the injected CO_2 becomes trapped in the tiny pores of the rocks and simply cannot move, even under pressure.

2

Dissolution trapping
A portion of the CO_2 dissolves into the surrounding salt water.

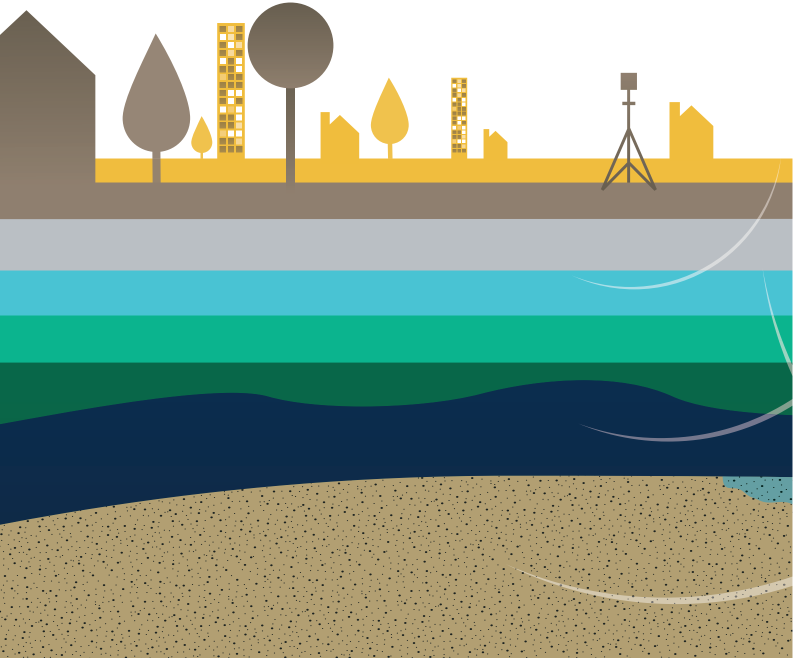
3

Mineral trapping
After dissolution, some of the heavy CO_2-rich water sinks to the bottom of the reservoir, where over time it may react to form minerals such as those found in limestone.

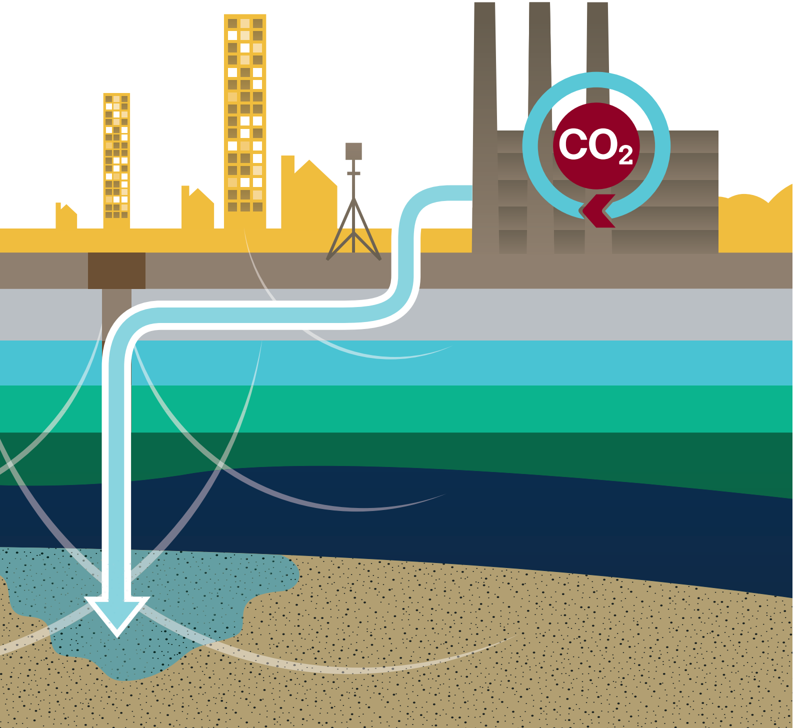

CO_2
1
2
3
Over time, CO_2 tends to sink
to the bottom of the reservoir

Rigorous monitoring

To ensure that a CO_2 storage site functions as it should, a rigorous monitoring process begins at the reservoir selection stage and continues for as long as required.



Monitoring continues even after a CO_2 injection well is closed and EU legislation requires that stored CO_2 is kept **safely** and **permanently** underground.



Rapid & widespread deployment

The potential of CCS is enormous and the size of the challenge considerable – but possible.

We need to move from the successful small-scale CCS projects in operation today to **building 3,400 commercial-scale projects worldwide by 2050 if CCS is to provide 20% of the CO_2 reductions needed*.**

* IEA –Technology Roadmap, Carbon capture and storage

Enabling CCS to be commercially viable by 2020 means validating the technology through large-scale demonstration programmes that require:

1. **sufficient and flexible funding**
2. **clear knowledge-sharing principles to maximise learnings**
3. **appropriate and comprehensive legislation**
4. **accelerated permitting processes**

Any global climate change agreement must also recognise the critical role CCS will play and include it in specific mechanisms.

While CCS technologies have existed for decades, including the safe storage of CO_2, there is an urgent need to dramatically increase public understanding and awareness of the technology through CCS demonstration programmes.

Alongside more renewables and greater energy efficiency, CO_2 Capture and Storage will help us get to the sustainable energy systems of the future.

Our climate depends on it.

Zero emissions platform

European Technology Platform for Zero Emission Fossil Fuel Power Plants

www.zeroemissionsplatform.eu

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