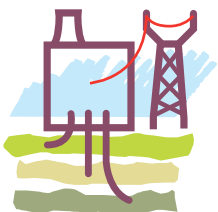


# CO<sub>2</sub> Capture and Storage (CCS)

Why it is essential to  
combat global warming

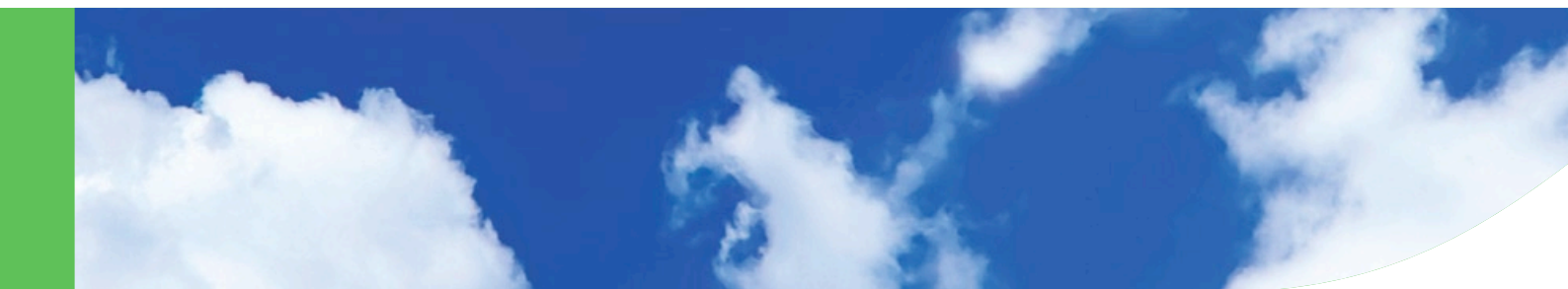






With CCS, Europe can  
grow its economy,  
ensure a secure energy supply  
*...and* meet its CO<sub>2</sub> emission targets





*“WWF believes that CCS has the potential to be an important part of the solution to stay below 2°C global warming and cut CO<sub>2</sub> emissions by more than 50% globally.”*

*James Leape, Director General, WWF International*

The IPCC<sup>1</sup> has confirmed that unless we take immediate and drastic action to reduce carbon dioxide (CO<sub>2</sub>) emissions, average global temperature is likely to rise by 2.4°C - 6.4°C by 2100. If we *fail* to keep below 2°C, irreversible climate changes will occur – with devastating consequences for mankind and the biosphere.

But with world energy demand expected to increase by over 50% by 2030,<sup>2</sup> and renewable energy likely to make up only a third of the energy mix by 2050,<sup>3</sup> the challenge will be enormous. It means we must act fast, using a portfolio of solutions, *no single solution being capable of reducing CO<sub>2</sub> emissions on the massive scale required*. This includes energy efficiency, a vast increase in renewable energy – and CO<sub>2</sub> Capture and Storage (CCS).

## CCS: a key solution to combating climate change

Indeed, if deployed to its full potential, CCS could reduce CO<sub>2</sub> emissions in the European Union (EU) by over 50% by 2050.<sup>4</sup> This includes a wide range of industry and transportation sectors, with a reduction of around 30% from the power sector alone.

It means power plants equipped with this technology will be able to reduce their CO<sub>2</sub> emissions *by around 90%* when fired with hard coal, lignite or natural gas.

Replacing fossil fuels with renewable energy is the ultimate goal, but as they currently account for 80% of global energy demand, it is not yet possible to do so *and* sustain even a basic standard of living. Indeed, although the volume of renewables is increasing at an enormous rate, it is still being outstripped by rising energy demand.

As a safe and efficient method of capturing and storing billions of tonnes of CO<sub>2</sub> underground for thousands of years, CCS therefore represents the bridge to a renewable energy system.



One 1,600MW power plant supplies enough electricity to meet the needs of 4.6 million people

1 Intergovernmental Panel on Climate Change: Fourth Assessment Report, February 2007

2 The IEA World Energy Outlook, 2007

3 Shell Energy Scenarios

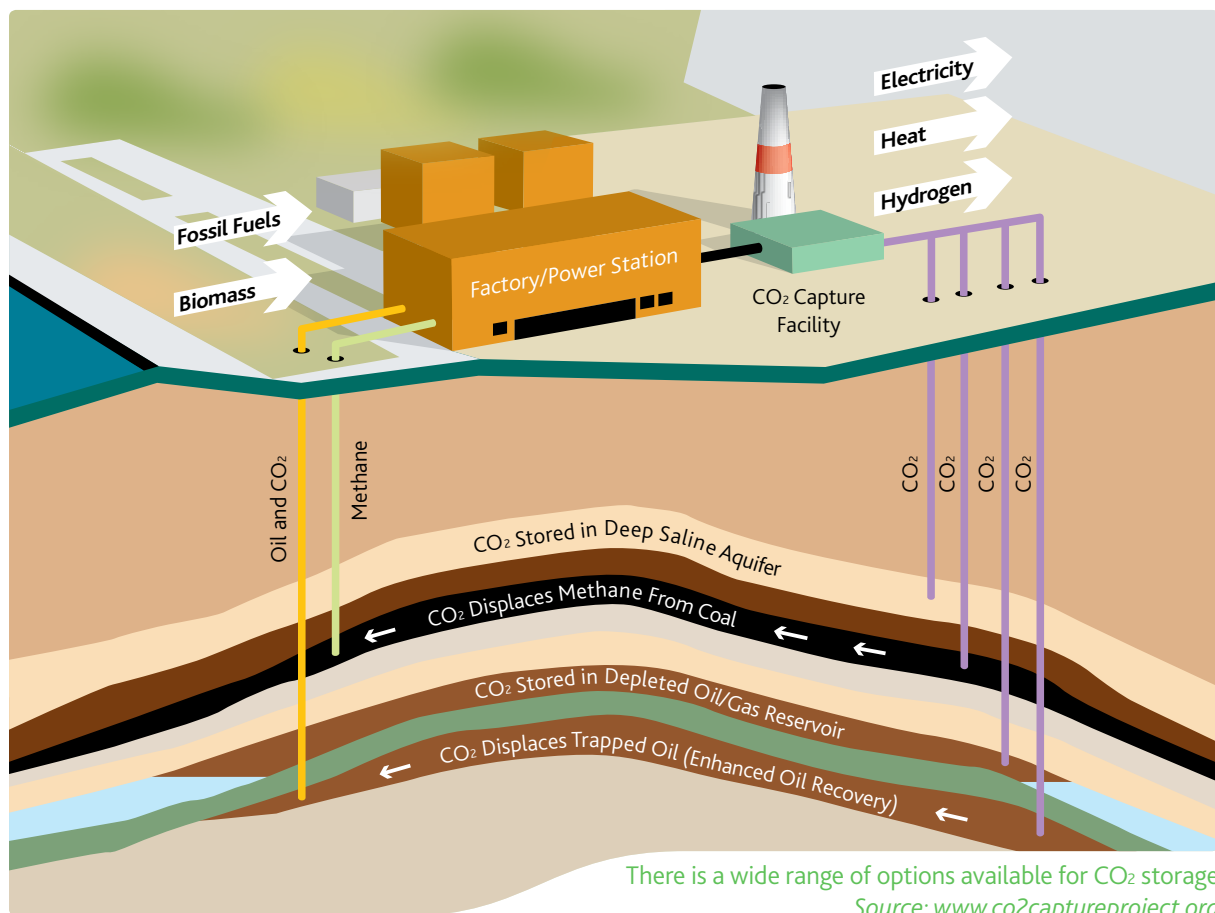
4 “A Model for the CO<sub>2</sub> Capture Potential”, by Dr Aage Stangeland, The Bellona Foundation, published in the International Journal of Greenhouse Gas Control, Volume 1, Issue 4, August 2007

## Proven technology...on a small scale

CO<sub>2</sub> Capture and Storage (CCS) could effect nothing less than a revolution in the way Europe meets its rising energy demand:

1. By producing power from fossil fuels with near-zero CO<sub>2</sub> emissions
2. By producing large volumes of clean hydrogen which could then be used for electricity or transport fuel – thus also facilitating a hydrogen economy
3. By co-firing power plants with biomass to achieve net *negative* emissions, because biomass also absorbs CO<sub>2</sub> from the atmosphere while it is growing.

As a global solution to combating climate change, CCS could also give a major boost to the European economy – creating jobs, promoting technology leadership and making European industry among the most competitive in the world.



## Commercialisation of CCS is achievable by 2020

To this end, European industry, environmentalists, scientists and geologists united to form the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP). Since the publication of its Strategic Research Agenda and Strategic Deployment Document in 2006, ZEP has established itself as a leading authority on all aspects of CCS, its recommendations adopted by both the European Commission and the European Council.

Its Vision? To enable near-zero emissions from European fossil fuel power plants by 2020. This involves implementing a complete CO<sub>2</sub> value chain – from the capture of CO<sub>2</sub>, its transportation to storage sites, to its storage in geological formations deep underground.

*“With the right incentives, the private sector can deliver solutions. Delay would be costly or dangerous.”*

*Lord Stern, The Stern Review, October 2006*

It is an ambitious goal, but an entirely feasible one. After all, CO<sub>2</sub> capture is already practised on a small scale, while the technology for CO<sub>2</sub> storage is almost identical to that used by the oil and gas industry for decades – to store natural gas or for enhanced oil recovery. CO<sub>2</sub> transportation is also well understood: it has been shipped regionally for over 15 years, while a 4,000km onshore network has been operating in the US for over 30 years.

## An EU Flagship Programme: the key to kick-starting CCS in Europe

It is therefore now time to scale up the technology, including full process integration and optimisation. This means implementing an EU Flagship Programme of 10-12 large-scale CCS demonstration projects across Europe by 2015 – as called for by the EU Heads of State.

This major technology initiative is vital in order to test the full range of CCS technologies, drive down costs, build public confidence – and kick-start the wide implementation of CCS in Europe. The goal: to ensure CCS is commercially viable no later than 2020. Such an initiative will also demonstrate Europe’s leading-edge technology and spur action by other countries, particularly large CO<sub>2</sub> emitters, such as India, China and the US.

**With over 20 demonstration projects already planned or being considered, Industry is more than ready; while experts within ZEP and the wider CCS community have already identified the technological specifications that require validation across the CCS value chain.**

The network of up to 12 large-scale CCS demonstration projects proposed by the European Commission<sup>5</sup> – and endorsed by the European Council – is an important stepping stone towards achieving an EU Flagship Programme. However, its scope will be limited to a few, Government-funded projects, with no guarantee of covering the full range of CCS technologies that need to be tested. Projects with a pan-European or international CO<sub>2</sub> transport/storage element will also be disadvantaged.

## Economic incentives are vital to close the cost gap

Industry has already declared its willingness to cover a major portion of the costs and risks of implementing an EU Flagship Programme. Nevertheless, the additional CCS-related costs of the first large-scale demonstration projects will be substantial, as all First Movers will incur:

- *Unrecoverable costs* from making accelerated investments in scaling up the technology
- *Market risk* because it is not yet known which CCS technologies will prove the most successful.

Mechanisms to stimulate private sector investment are therefore vital – for example, in the form of a specific incentive under the European Union Emissions Trading Scheme (EU ETS).

**Public funding should be restricted to an EU Flagship Programme only, after which experience and technology development should bring costs down. In fact, the European Commission estimates that by 2020 the cost of CCS should be less than that of buying Emission Unit Allowances under the EU ETS.**

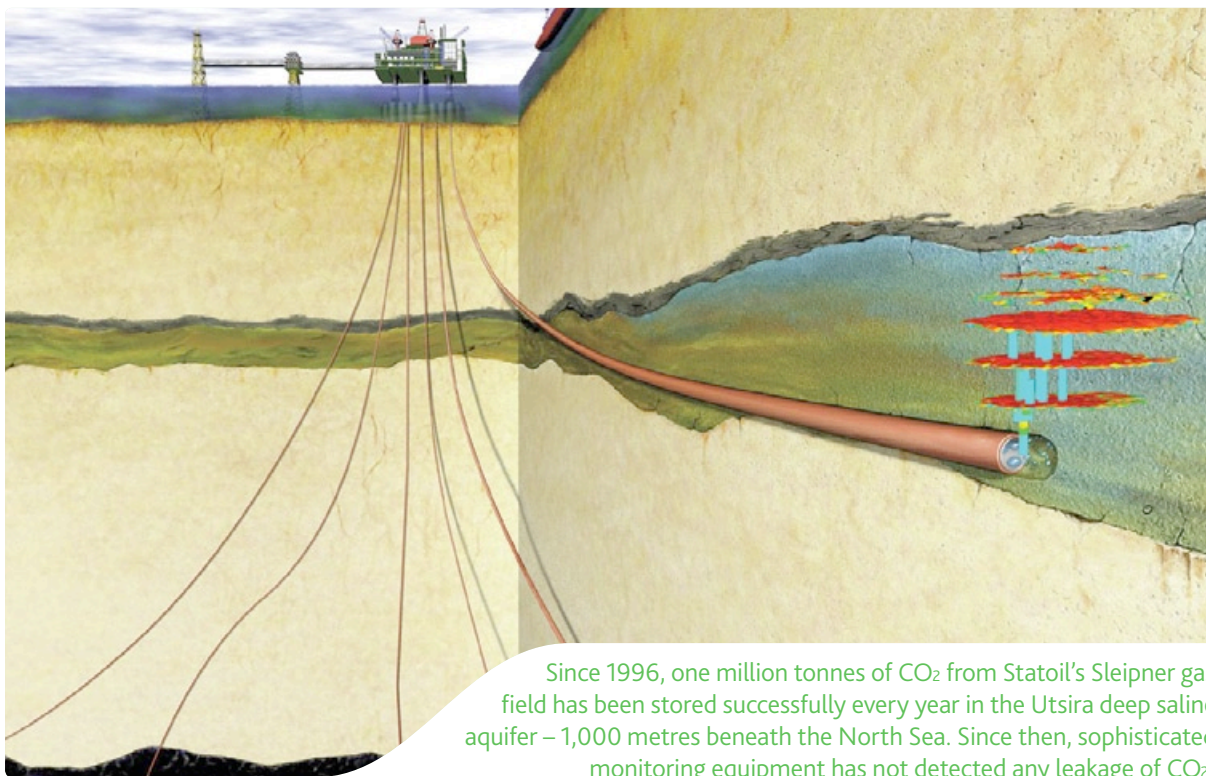
5 EC Communication on “Supporting Early Demonstration of Sustainable Power Generation from Fossil Fuels”, 23 January 2008

## CO<sub>2</sub> storage is already happening successfully worldwide

Scientists agree that CO<sub>2</sub> storage should pose no health, safety or environmental hazard – either in the short or long term. Indeed, it is simply imitating nature, using the same natural trapping mechanisms that have kept large 'stores' of CO<sub>2</sub> underground for millions of years.

Nor is underground gas storage new – there are already hundreds of natural gas storage sites worldwide, many found in the most densely populated areas in Europe. The IPCC therefore confirms it “very likely that the fraction of CO<sub>2</sub> retained will be more than 99% over the first 100 years and likely... (to) be more than 99% over the first 1,000 years”.<sup>6</sup> This is borne out by the experience of CO<sub>2</sub> storage demonstration projects already taking place across Europe, Africa and North America.

## Putting the carbon back where it came from...



Since 1996, one million tonnes of CO<sub>2</sub> from Statoil's Sleipner gas field has been stored successfully every year in the Utsira deep saline aquifer – 1,000 metres beneath the North Sea. Since then, sophisticated monitoring equipment has not detected any leakage of CO<sub>2</sub>.

6 Special Report on Carbon Dioxide Capture and Storage, 2005

This document has been prepared on behalf of the Advisory Council of the European Technology Platform for Zero Emission Fossil Fuel Power Plants. The information and views contained in this document are the collective view of the Advisory Council and not of individual members, or of the European Commission. Neither the Advisory Council, the European Commission, nor any person acting on their behalf, is responsible for the use that might be made of the information contained in this publication.

**European Technology Platform for  
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