EUROPEAN COMMISSION

Community Research

# $CO_2$ Capture and Storage - R&D Activities within the EU

*Angel Perez Sainz*

**DG Research**

**European Commission – DG Research**

**Energy Production and Distribution Unit**

EUROPEAN COMMISSION

Community Research

# Structure of the Presentation

- Global Policy Context
- Energy Policy Context
- C+S R&D Policy
- Current R&D Portfolio
- Future Perspective
- International Activities

EUROPEAN COMMISSION

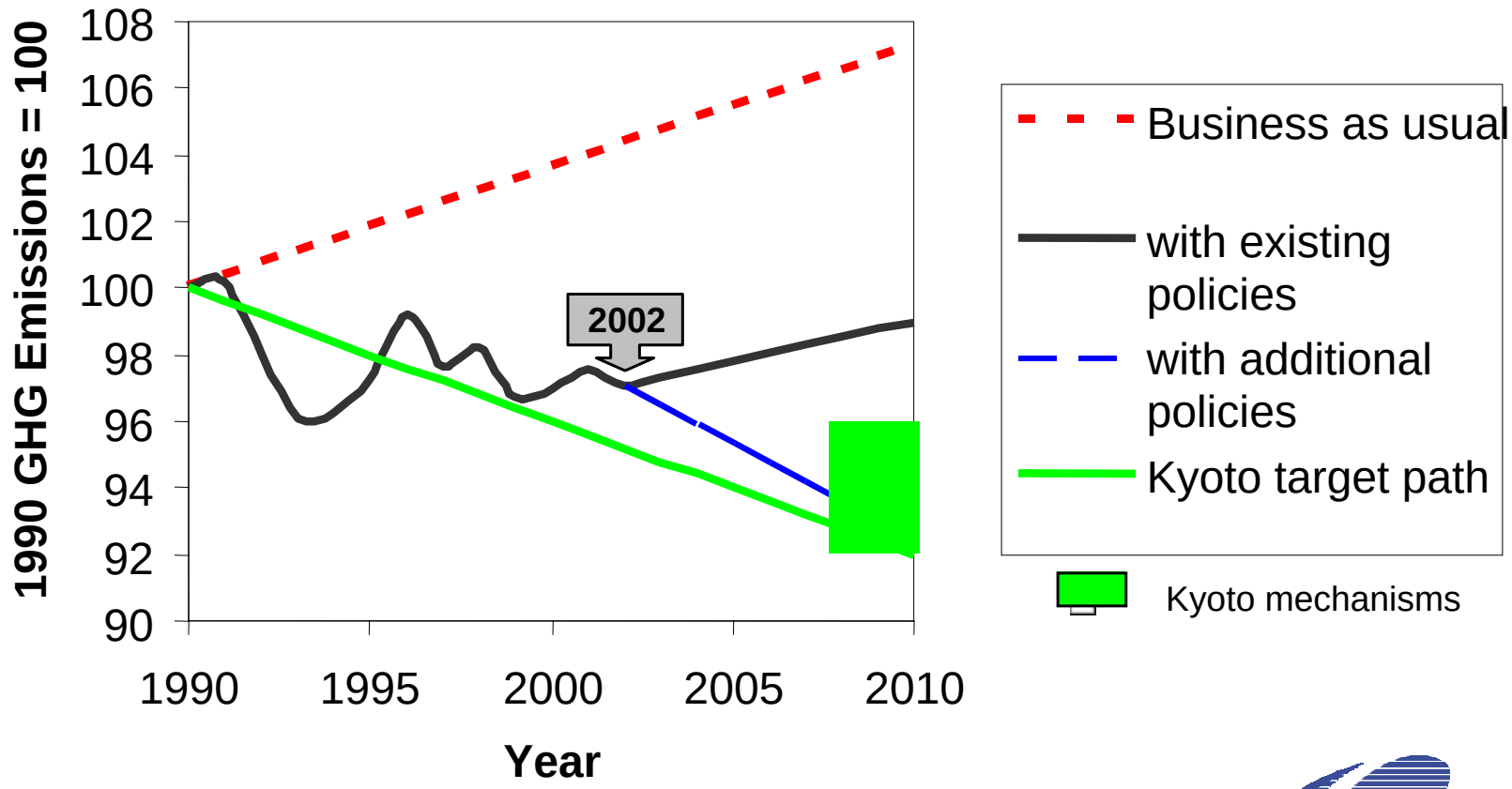
Community Research

# Global Policy Context

## Climate change

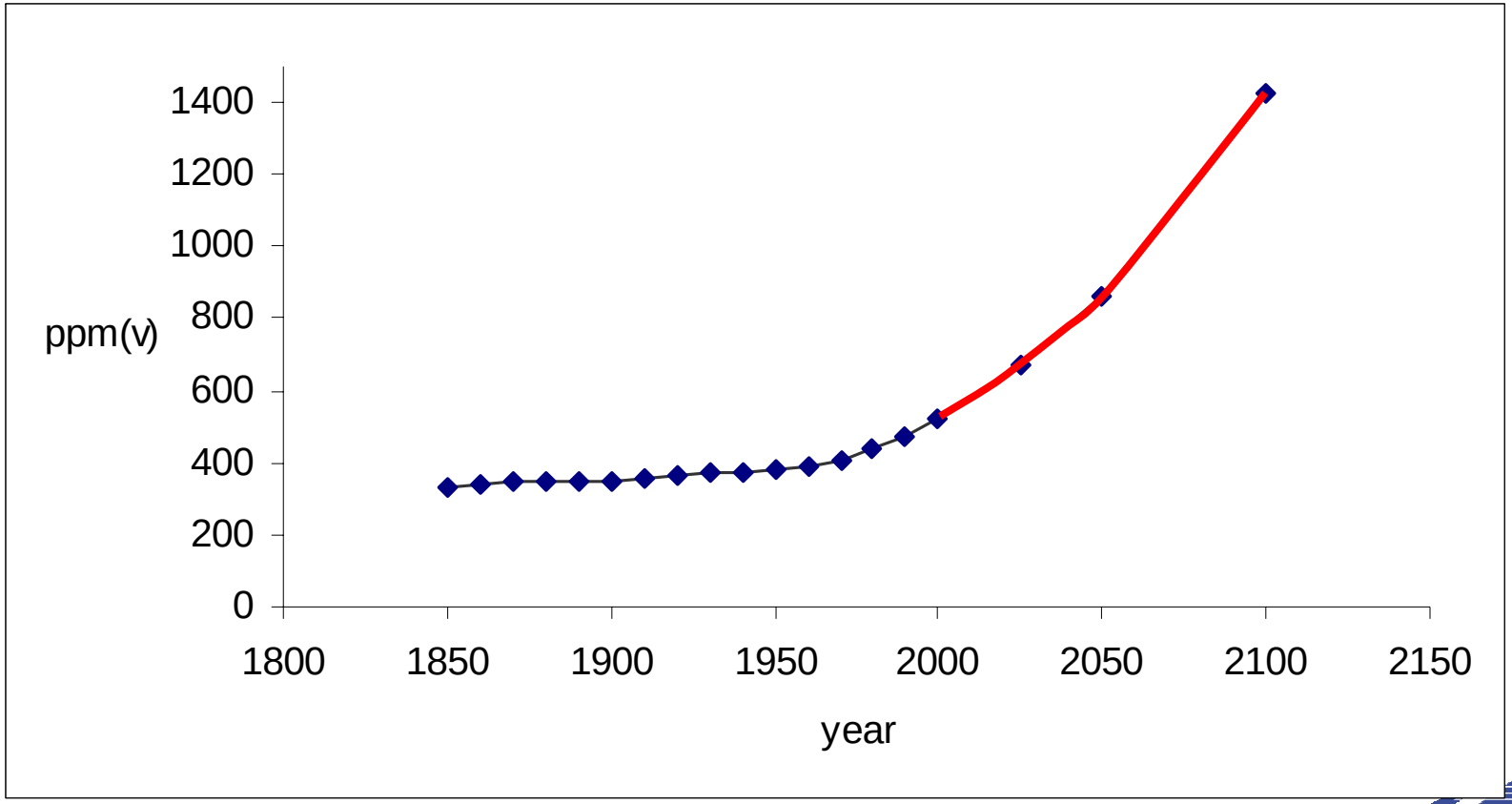
- Russia ratified Kyoto on Oct. 27, 2004. Protocol will be in force 90 days thereafter.
- EU set to decrease its GHG emission by 8% in 2008-2012 compared to 1990 under the Kyoto Protocol.
- Burden sharing agreement between Member States.
- On track so far, but target likely to be missed in business as usual scenario.
- European Climate Change Programme has identified most promising and cheapest routes.
- EU Greenhouse Gas Trading Directive – trading starting Jan 05
- “linking” directive transferring CDM and JI credits into the EU GHG trading directive.
- Kyoto is only a first step. A “Post Kyoto” strategy is required.

# EU-15 greenhouse gas emissions until 2002 and projections until 2010



# Total equivalent $CO_2$ concentration (all greenhouse gas) in the atmosphere as a function of time – past data and projection according to the IPCC is92a scenario

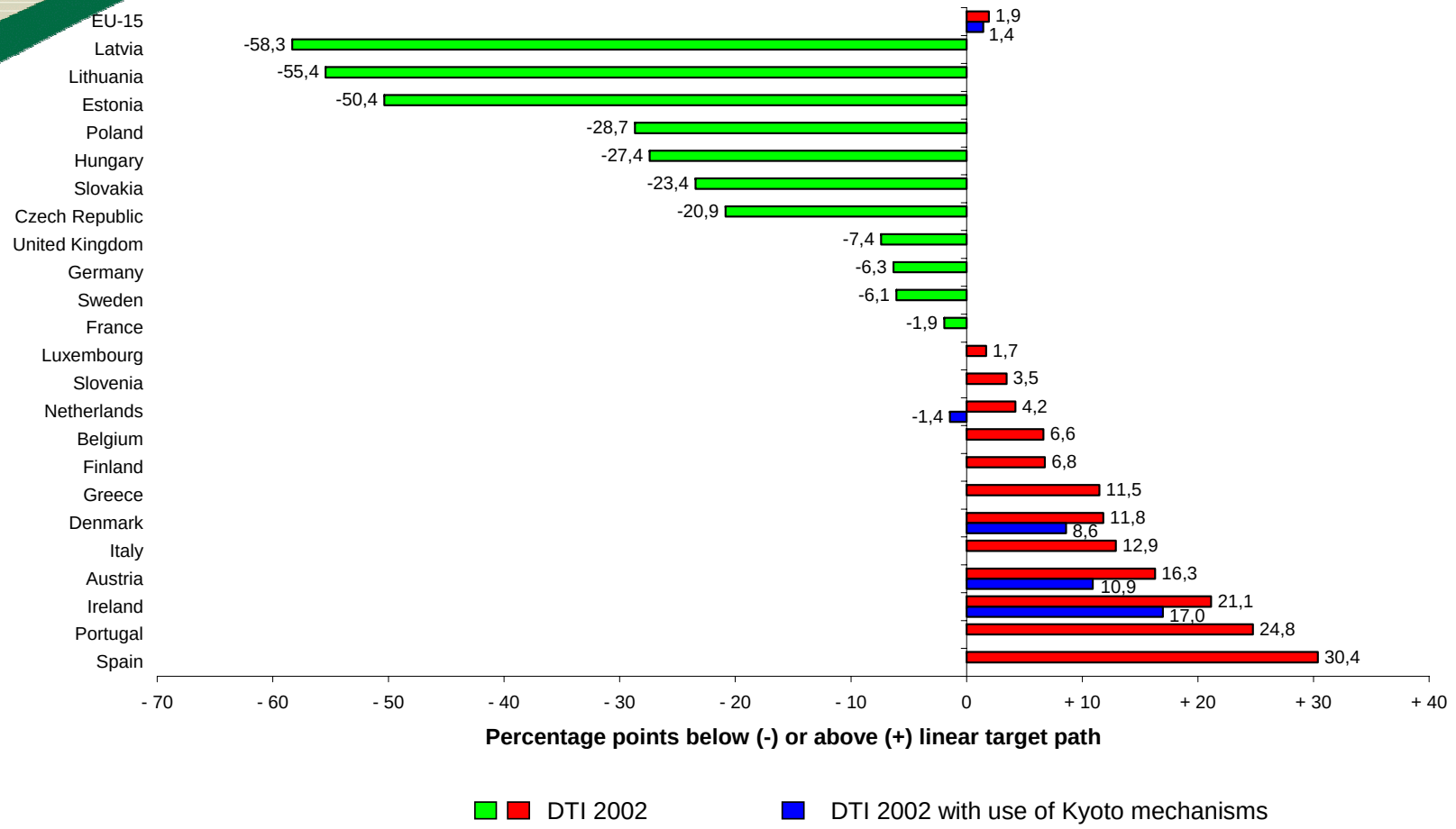
(subject to debate in GDP projections).



EUROPEAN COMMISSION

Community Research

# Distance-to-target indicators (in index points = percent) for EU-25




**Note:** DTI in percentage points relative to base year emissions (the bars) show the deviations between a hypothetical target (in 2002) and what has actually been achieved (in 2002), on the assumption that reductions as a percentage of base year levels take place on a linear basis. It assumes that the Member States meet their target entirely on the basis of domestic measures and does not therefore include the use of Kyoto mechanisms or sinks allowed for under the Kyoto Protocol. **Source:** EEA, 2004

EUROPEAN COMMISSION

Community Research

# Global Policy Context

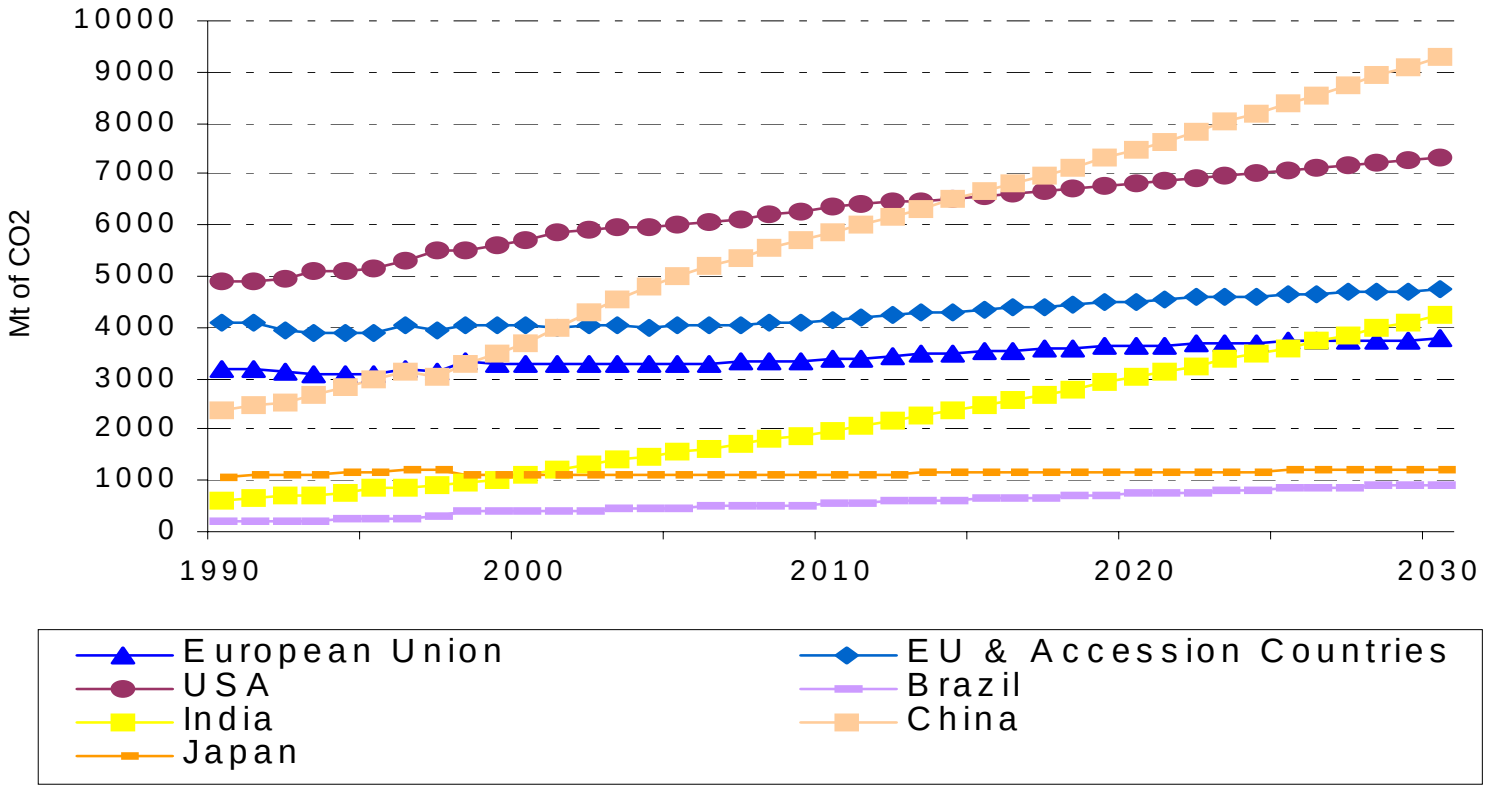
## Climate change - Post Kyoto

- More drastic reductions will be needed
  - ✓ max. 2°C increase, max. 450 ppmv,- 50 / 60% by 2050
  - ✓ from developed economies
  - ✓ also from economies in transition
    - Recognizing their right to development
  - ✓ Commission Communication expected in early 2005 – Consultation launched by DG ENV (http://europa.eu.int/comm/environment/climat/future_action.htm)

EUROPEAN COMMISSION

Community Research

# Energy Related $CO_2$ Emissions (WETO - EC DG RTD)



EUROPEAN COMMISSION

Community Research

# Energy Policy Context

## Security of Supply (Green Paper)

- Diversification is the key, no single option is the solution and no option should be ruled out.
- Need to act on demand.

EUROPEAN COMMISSION

Community Research

# Energy Policy Context

## Industry Competitiveness

- EU industry must be placed in a position to compete in a post-Kyoto scenario addressing the emissions of developing countries

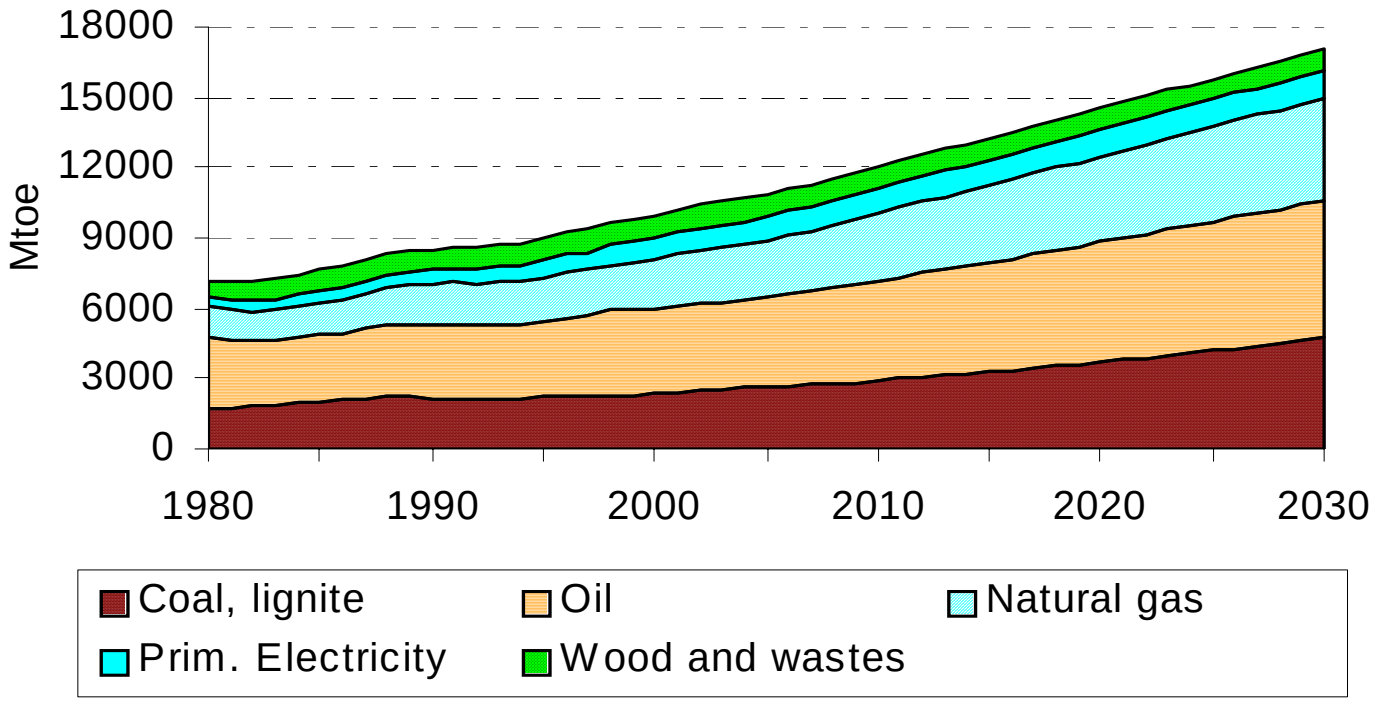
EUROPEAN COMMISSION

Community Research

# Energy Policy Context

## Scenarios and Projections (source : WETO)

## Still 90% fossil fuels worldwide by 2030



EUROPEAN COMMISSION

Community Research

# Complementarities with energy efficiency and Renewable Energy Sources

- CO2 C+S sometimes seen as fossil fuels back by the back-door
- But projections indicate fossil fuels are here to stay and will be used, especially in economies in transition
- RES and energy efficiency need to be supported, but will not be sufficient in the short to medium term, both in developed and developing economies
- RES, energy efficiency and CO2 C+S are complementary
  - ✓ from a timing point of view
  - ✓ from a generation mix point of view
  - ✓ from a costing / competition point of view
  - ✓ to ease the penetration of hydrogen as a vector

EUROPEAN COMMISSION

Community Research

# CO2 C+S R&D Policy

## A Priority in Long Term Energy R&D in FP6 (2002-2006)

- *Capture and sequestration of $CO_2$, associated with cleaner fossil fuel plants.*

  - ✓ *Targets: reduce the cost of $CO_2$ capture from 50-60 € to 20-30 € per tonne of $CO_2$ captured, whilst aiming at achieving capture rates above 90%, and assess the reliability and long term stability of sequestration.*

EUROPEAN COMMISSION

Community Research

# CO2 C+S R&D Policy

- Capture R&D - Objectives
  - ✓ 70-80 % of total cost - therefore primary objective is to decrease the cost of capture (to below 20 €/ton).

- Capture R&D - Ways:
  - ✓ pre-combustion capture
  - ✓ post-combustion capture
  - ✓ oxyfuels

EUROPEAN COMMISSION

Community Research

# CO2 C+S R&D Policy

- Sequestration R&D - Objectives

  - ✓ to study long term stability;
  - ✓ to study safety aspects;
  - ✓ to build public confidence to ensure acceptability;
  - ✓ to map geological storage potential.

EUROPEAN COMMISSION

Community Research

# CO2 C+S R&D Policy

- Sequestration R&D - Ways:

  - ✓ geological (saline aquifers, depleted oil and gas fields, unminable coal beds, EOR, ECBM);
  - ✓ chemical;
  - ✓ other innovative ways.

  - ✓ Other ways
    - oceans - environmentally questioned in Europe;
    - biospheric sinks - doubtful long term value.

EUROPEAN COMMISSION

Community Research

# FP5 Project Portfolio

| Project | Topic | | cost (m€) | funding (m€) | co-ord. |
|---|---|---|---|---|---|
| **CAPTURE** | AZEP | Advanced membrane cycles | 9.3 | 3.4 | Alstom |
| - | GRACE | Capture in processes | 3.2 | 2.1 | BP |
| **SEQUESTRATION** | GESTCO | Sequestration Potential | 3.8 | 1.9 | GEUS |
| - | CO2STORE | SACS2 follow-up on land | 2.4 | 1.2 | Statoil |
| - | NASCENT | Natural storage analogues | 3.3 | 1.9 | BGS |
| - | RECOPOL | Enhanced coal bed methane | 3.4 | 1.7 | TNO |
| **SEQ. MONITORING** | WEYBURN | Weyburn monitoring | 2.2 | 1.2 | BGS |
| - | SACS2 | Monitoring Sleipner | 2.1 | 1.2 | Statoil |
| **NETWORKING** | CO2NET | ERA Dimension - networking | 2.1 | 1.4 | Tech. |

EUROPEAN COMMISSION

Community Research

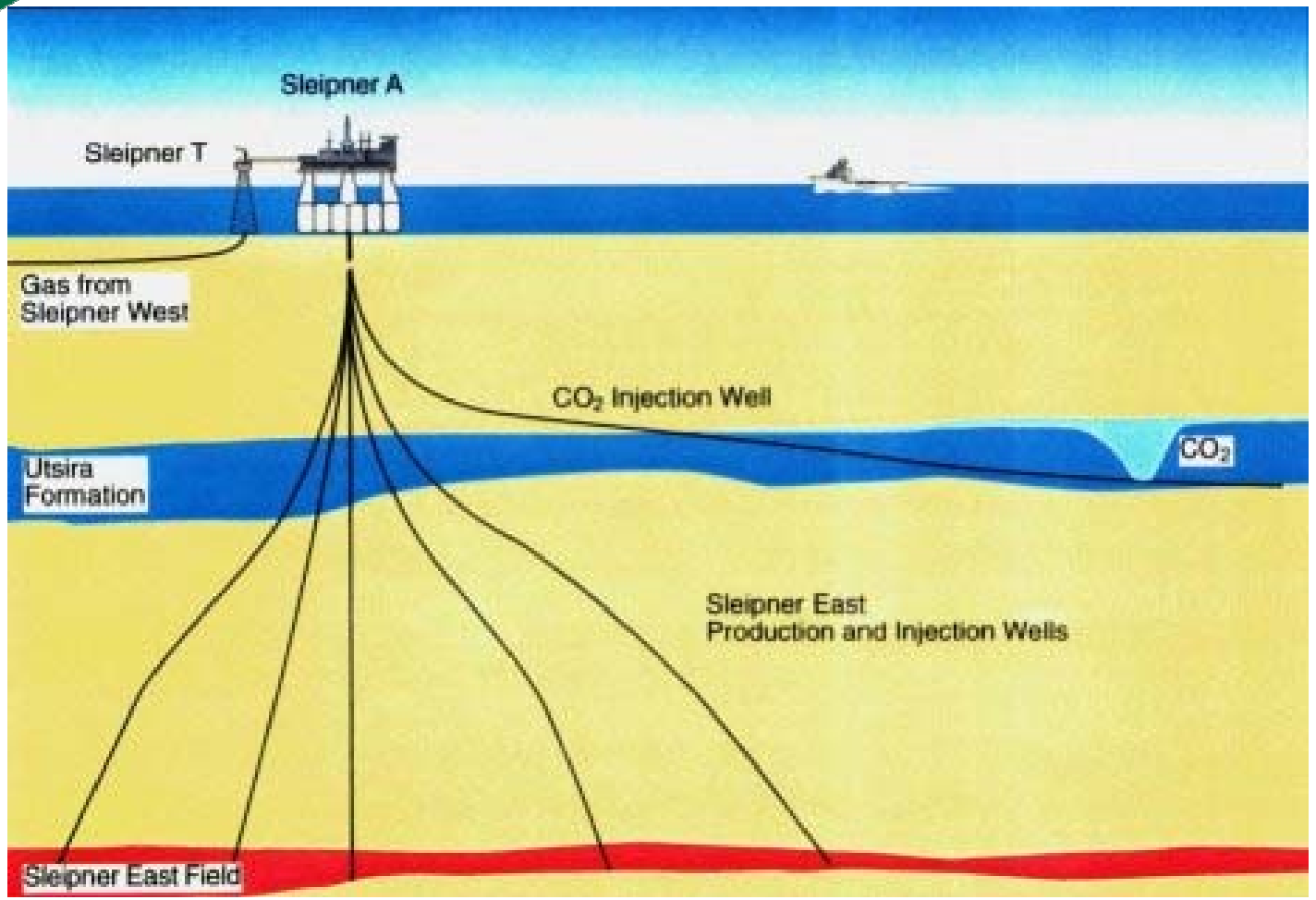
# FP5 Project Portfolio

## A Flagship Project : SACS2

- ✓ Support of European teams monitoring the behaviour of $CO_2$ injected in the Sleipner project in the North Sea. This is providing useful data on transport rates, geophysical properties and potential leakage and/or natural sealing mechanisms.
- ✓ Has delivered a BEST PRACTICE manual
- ✓ EC Funding 1.2 m€ - Cost 2.1 m€
- ✓ Co-ordinator STATOIL
- ✓ Started 1 April 2000 for 24 months

# Sleipner - CO2 injection into the Utsira formation –

source : Statoil.



# Sleipner – source : Statoil.

EUROPEAN COMMISSION

Community Research

# FP6 – on-going projects

| Acronym | Funding | Co-ordinator | Started |
|---|---|---|---|
| CO2SINK | 8.7 m€ | Postdam Research C. | 1/4/2004 |

Pilot scale capture and storage test of CO2 in an existing natural gas storage facility in the Berlin area and in a deeper on-land saline aquifer; monitoring thereof.

| | | | |
|---|---|---|---|
| ENCAP | 10.7 m€ | Vattenfall | 1/3/2004 |

New pre-combustion techniques and processes for power generation based on fossil fuels, including coal. Pre-combustion, oxyfuel combustion, chemical looping, high temperature oxygen generation and novel concepts.

EUROPEAN COMMISSION

Community Research

# FP6 – on-going projects

| Acronym | Funding | Co-ordinator | Started |
|---|---|---|---|
| CASTOR | 8.5 m€ | IFP | 1/2/2004 |

Post-combustion capture technologies and sequestration confidence-building, including strategy for CO2 reduction, post-combustion capture, infrastructures and logistics, geological sequestration, risk management and corrective actions.

| | | | |
|---|---|---|---|
| STREP | | | |
| ISCC | 1.9 m€ | Univ. Stuttgart | 1/1/2004 |

Simultaneous gasification and carbon capture of brown coal

EUROPEAN COMMISSION

Community Research

# FP6 – on-going projects

Successful NOE

| Acronym | Funding | Co-ordinator | Started |
|---|---|---|---|
| CO2GEONET | 6 m€ | BGS | 1/4/2004 |

Integration of a critical mass of 13 research institutes in the area of underground CO2 storage, covering

- predictive numerical tools
- rock and fluid behaviour experiments
- enhanced hydrocarbon recovery
- monitoring techniques
- risk and uncertainty management

EUROPEAN COMMISSION

Community Research

# FP6 – Third call – deadline 8th Dec 2004

## Activity code SUSTDEV 1.2.7.

- CO2 capture and hydrogen production from gaseous fuels (IP)
- The monitoring and verification of CO2 geological storage (IP)
- Preparing for large scale H2 production from decarbonised fossil fuels including CO2 geological storage (IP) (HYPOGEN PHASE1)
- Advanced separation techniques (STREP)
- Mapping geological CO2 storage potential matching sources and sinks (STREP)
- European co-ordination and networking activities in CO2 capture and storage (CA)

EUROPEAN COMMISSION

Community Research

# Co-ordination of Member States Activities

- As part of its ERA strategy, FP6 provides ways to co-ordinate MS activities in block III of the framework programme:
  - ✓ An ERA-NET SSA (FENCO) has been running on the co-ordination of large scale power generation programmes, lead by Germany (BMWA) and the UK (DTI), together with Greece and Portugal, plus Denmark, Austria, Poland expressing interest.
  - ✓ An ERA-NET CA proposal is likely to follow involving at least 13 Member States

EUROPEAN COMMISSION

Community Research

# HYPOGEN

- The Quick-start Programme of the European Initiative for Growth identifies the Hydrogen Economy as one of the key areas for investment in the medium term (2004-2015). In particular, two main programmes are planned in this field:
  - ✓ *Hypogen* – large scale test facility for production of hydrogen and electricity; from decarbonated fossil fuels
  - ✓ *Hycom* - a limited number of "hydrogen communities" around the Union, using hydrogen for heat and electricity production and as fuel for vehicles.
- A pre-feasibility study (JRC / ESTO) report will shortly be available

EUROPEAN COMMISSION

Community Research

# INTERNATIONAL

- The Commission is actively involved in the IEA
  - ✓ Working Party for Fossil Fuels
    in defining its ZETS (Zero Emission Technology) strategy
  - ✓ Greenhouse Gas Implementing Agreement
    specifically looking at CO2 C+S
  - ✓ Clean Coal Center Implementing Agreement
    which has many CO2 C+S activities
- Ongoing Projects with International Presence- WEYBURN
- Bilateral Collaboration programmes (e.g. with the US DOE)

EUROPEAN COMMISSION

Community Research

# INTERNATIONAL

- The Carbon Sequestration Leadership Forum
  - ✓ A US initiative, 15 countries invited, including the UK, Italy, Germany, France and Norway, plus the EC.
  - ✓ A charter to promote research in CO2 C+S, signed in Washington on June 25, 2003 (by VP L de Palacio for the EC).
  - ✓ Preparatory and co-ordination meetings with Member States held before each CSLF event.
- The Commission has expressed interest in the FutureGen project
  - ✓ Another US initiative, for a 1 billion USD coal gasification to hydrogen with CO2 C+S - 250 MW plant

EUROPEAN COMMISSION

Community Research

# Stay Informed

**Energy Research on Europa**

**http://europa.eu.int/comm/research/energy/index_en.html**

**CORDIS 6th framework programme – EC research programmes and projects**

**http://www.cordis.lu/fp6/**

**Energy helpdesk:**

**rtd-energy@cec.eu.int**

EUROPEAN COMMISSION

Community Research

# *Thank you for your attention*


***Angel Perez Sainz***

***European Commission***

***Directorate General for Research***

***Energy Production and Distribution Unit***

***Rue de la Loi 200 – CDMA 5-199***

***B - 1049 - Brussels - Belgium***

***phone : 32-2-29-61596***

***fax : 32-2-29-64288***

***email : angel.perez-sainz@cec.eu.int***