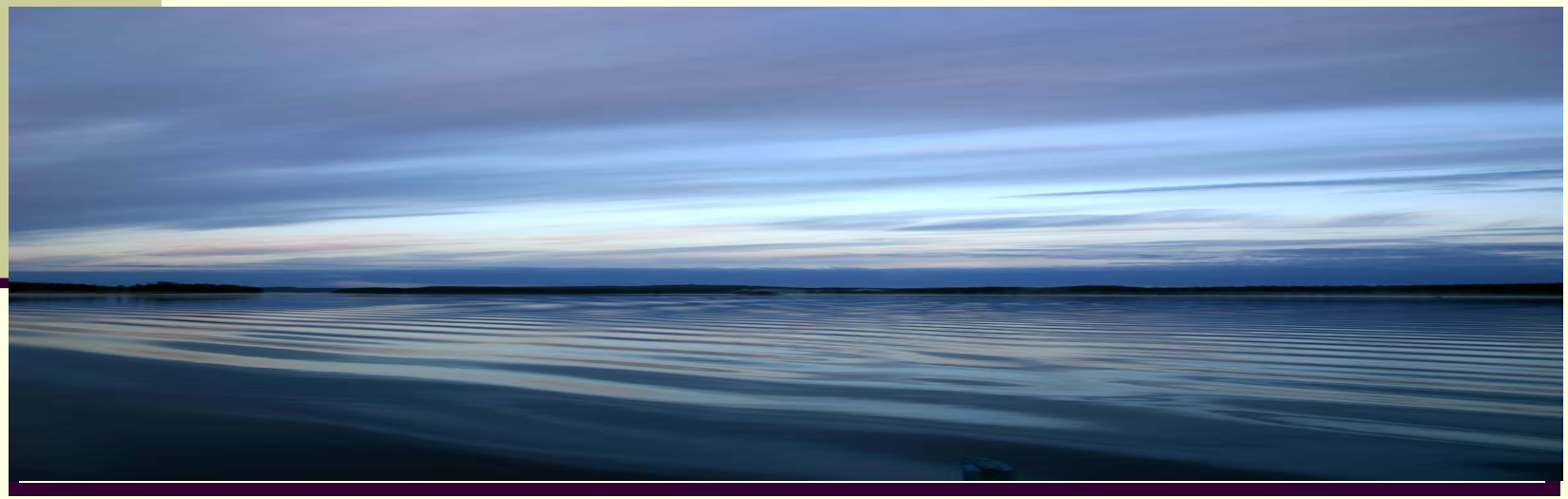
Recent amendments to the OSPAR Convention to permit carbon capture and storage



David Johnson, Executive Secretary
OSPAR Commission / Bonn Agreement 29 October 2007

Introduction

- the reality of human-induced climate change is beyond question [IPCC Fourth Assessment, 2007]
- simple physics - heat trapping gases into the atmosphere = heating planet [Swedish Nobel Prize-winner, Svante Arrhenius, calculations]
- Evidence of destabilisation, significant shift within last 3 – 5 years, predicted = observed
- Need for preventative action = inescapable


1999
2004
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1985
2002
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1859
2001
© GARY BRAASCH

Unprecedented

Evidence of profound change:

- 2002 – collapse of Larson B ice shelf, not happened in 10,000 years
- Frequency of intense hurricanes nearly doubled in last 35 years
- 2003 – heatwave in Western Europe, 14,800 elderly died in France, temperatures way above historical record
- Sea ice extent decreased by 8% per year since 1978
- Melt area of Greenland Ice Sheet increased by 1% /year since 1979
- Outlet glacier velocities increasing in the south of Greenland
- Relative sea-level rise, past 1500 years = 10cm/century, now doubled

Impacts

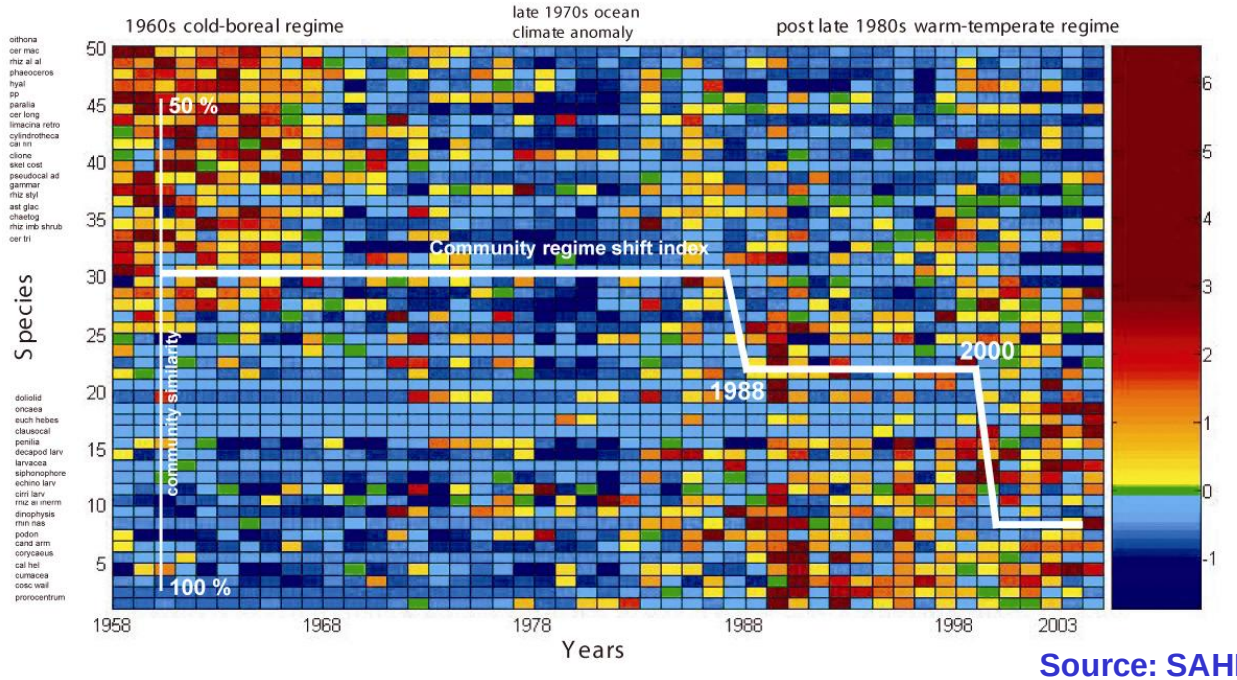
Potential associated impacts of higher temperatures, more energy, more violent weather:

- severe storms; floods; dust storms; landslides
- sea surges; coastal erosion; saltwater intrusion of groundwater; inundation of low lying land
- failing crops; dying forests; spread of endemic diseases; millions of environmental refugees

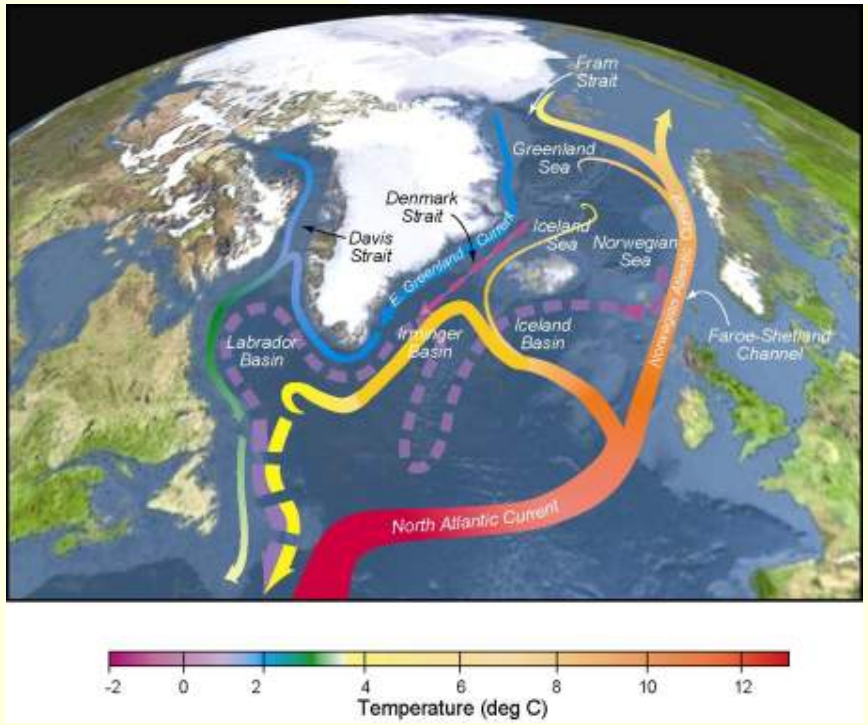
OSPAR

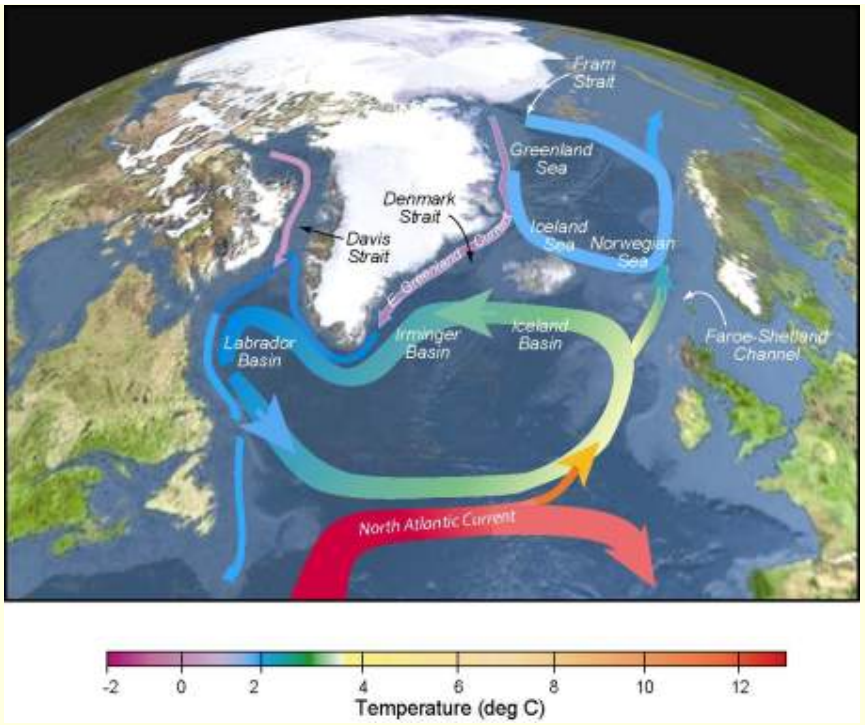
Maritime Area

Higher temperatures
Ocean acidification
Plankton regime shift
Ocean circulation?



Source: SAHFOS





The Problem

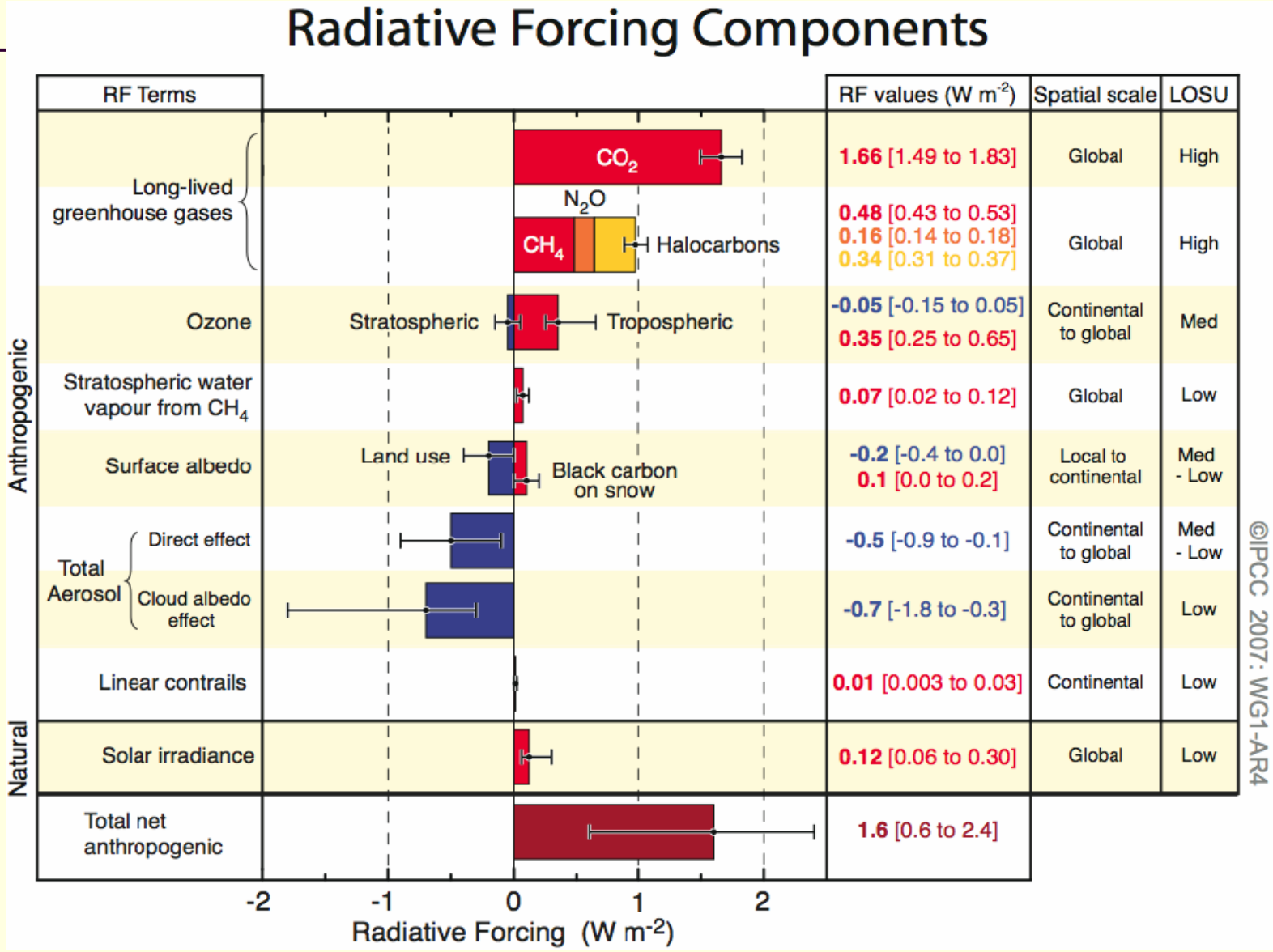
We know we are messing up all the mechanisms of climate control, with too much carbon dioxide, methane, nitrous oxide, forest destruction and desertification.

Known since Victorian times:

- **1827 French mathematician Joseph Fourier discovered that atmosphere absorbs heat**
- **1869 British physicist John Tyndall noted greenhouse effect**

How long can we abuse the system?

Relative importance of CO_2



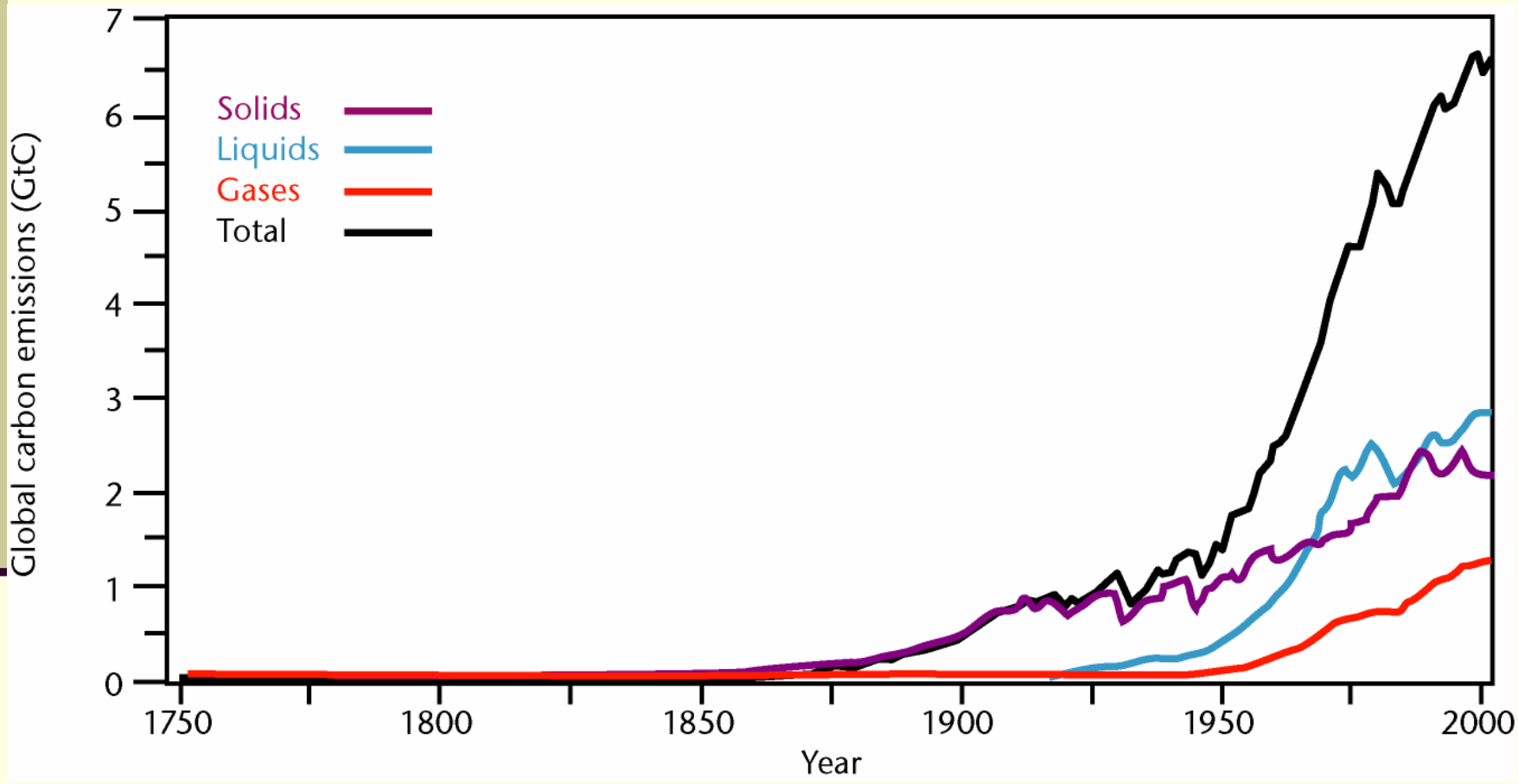
energy

industry

domestic

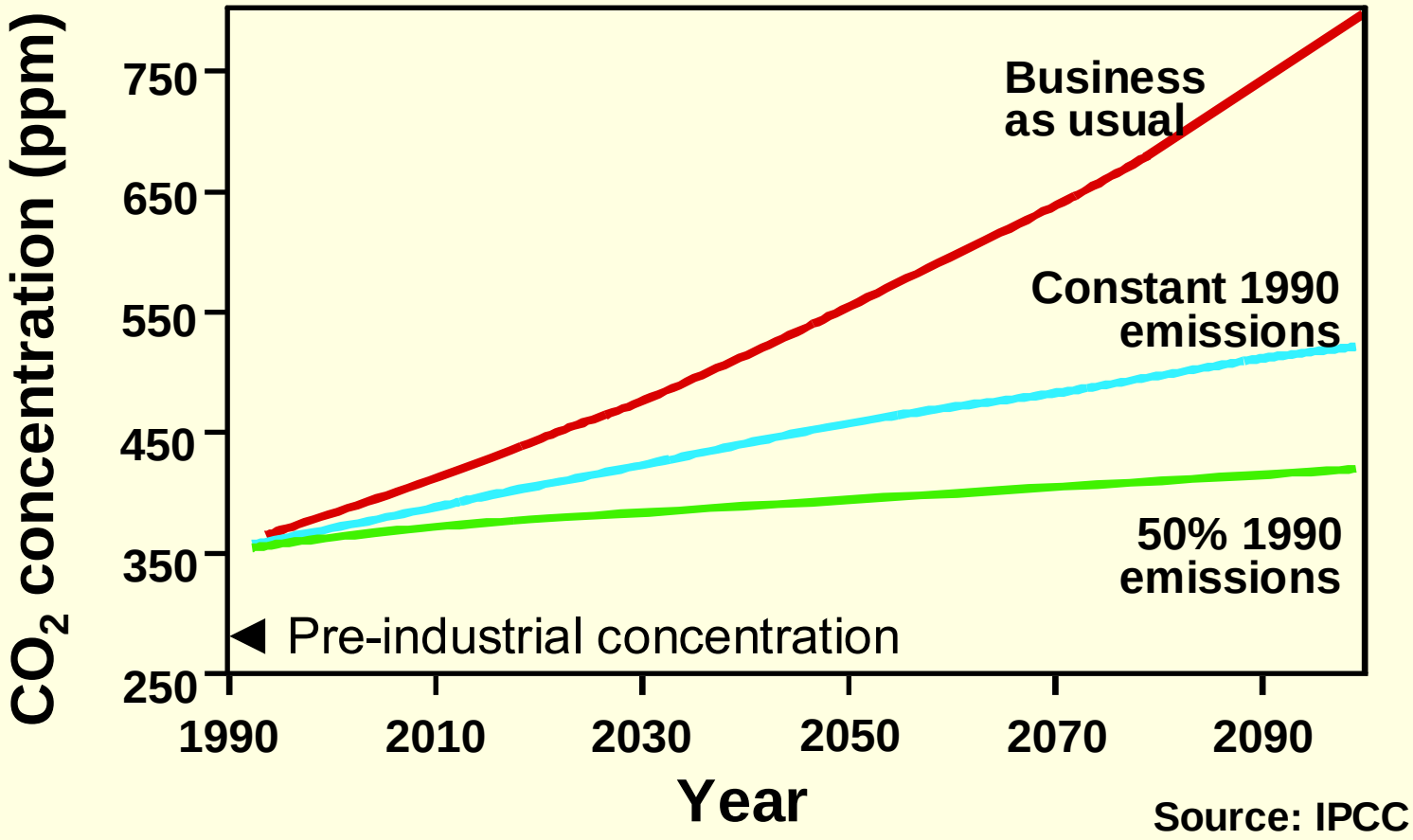
transport

CO_2 from fossil-fuel burning



Source: CDIAC, ORNL

Predicted increases



Source: IPCC

Sequestration

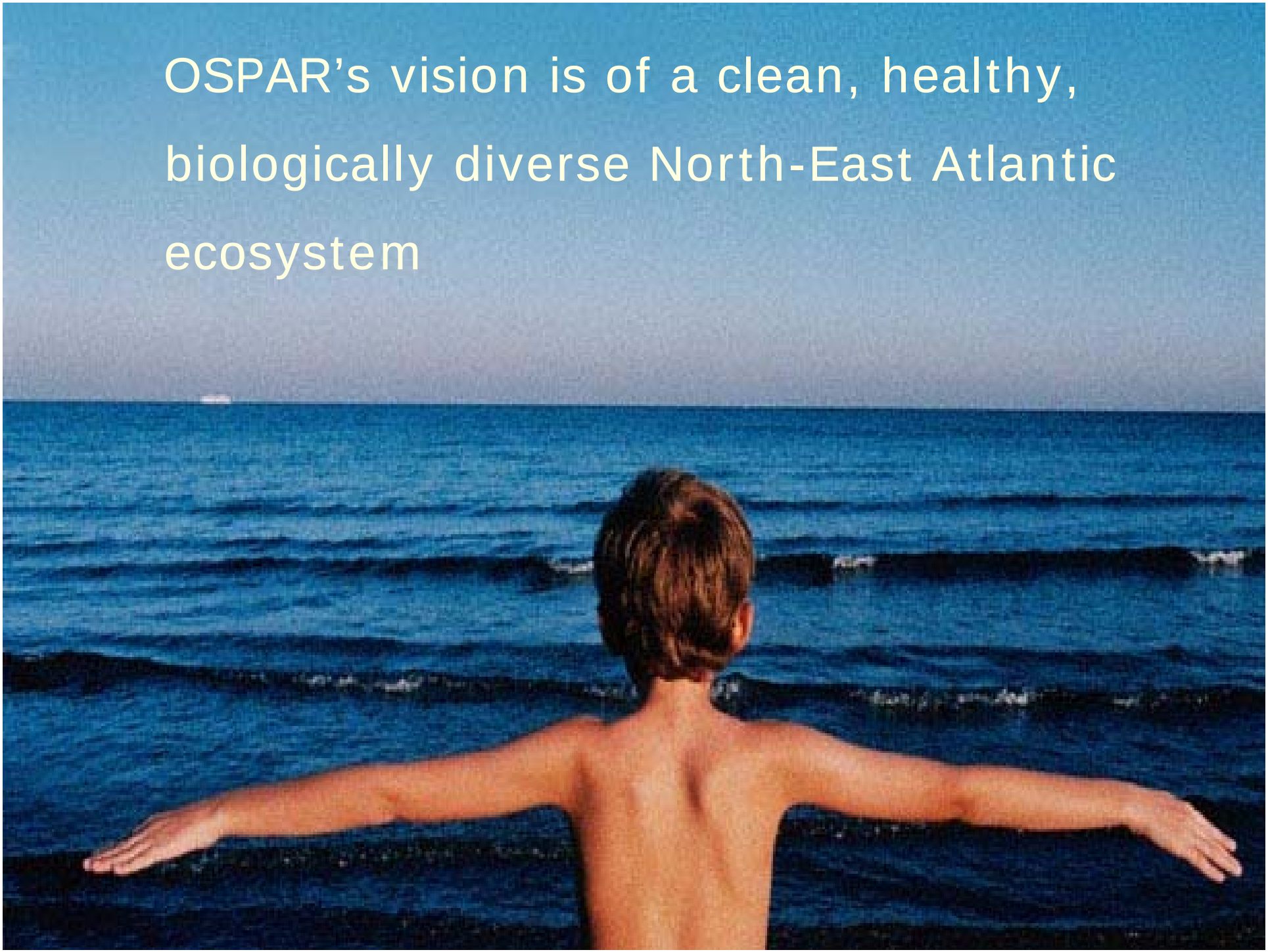
Carbon sequestration and storage (CCS) must be seen as part of a portfolio of measures alongside:

- Reducing energy demand
- Achieving greater energy efficiency
- Investment in non-carbon energy sources and low emission technologies

How?

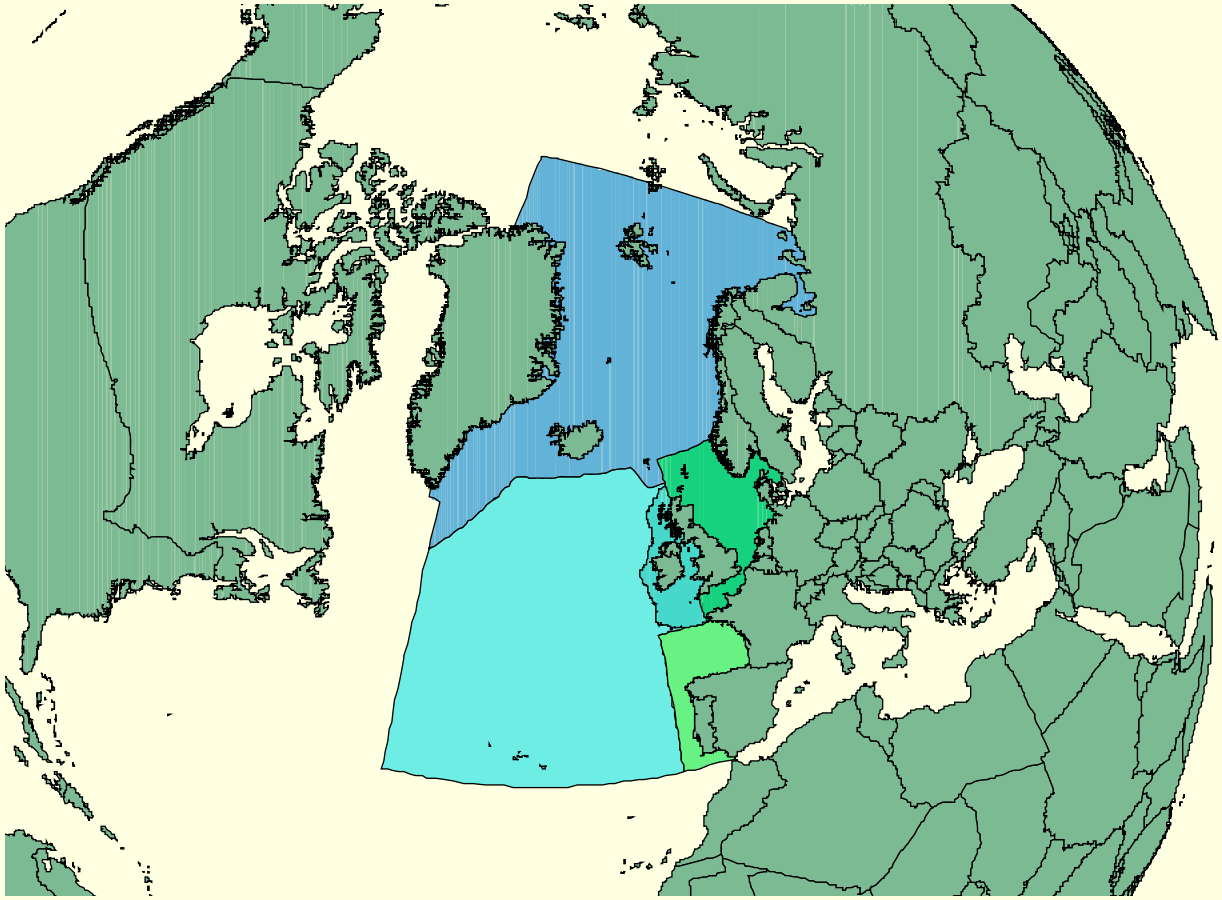
- As biomass
- As minerals – combining with magnesium silicate
- In the ocean – already happening with adverse impact on ocean ecosystems
- In deep geological formations

OSPAR’s vision is of a clean, healthy, biologically diverse North-East Atlantic ecosystem



Convention Area

35-year track record



- 1992 : 5 Annexes
- 15 states + EC
- NGOs / observers
- 1994 : 5 regions
- 1998 : 6 Strategies
  - **Hazardous substances**
  - **Eutrophication**
  - **Radioactivity**
  - **Offshore industries**
  - **Biodiversity**
  - **Assesment & monitoring**

Strategy implications (1)

Aspect / Impact	OSPAR Strategy implication
Acidification	BDC calcium and aragonite availability reduced
Temperature rise	EUC nutrient flux and cycling changes EUC altered nutrient uptake and requirements HSC pollutant toxicity increase BDC species distribution (regime shifts – phytoplankton, fish) BDC reduction in zooplankton productivity BDC invasive species distribution/dominance BDC Human use changes including shipping routes, mariculture options and disease susceptability OIC Arctic exploitation options
Increased storminess (storm surges)	HSC remobilization of pollutants BDC breeding success (e.g. seals, seabirds nesting close to edge such as terns, sandeel habitat at risk) BDC risks to human uses (e.g. shipping) OIC risks to offshore structures
Relative sea-level rise	HSC mobilisation of terrestrial wastes (e.g. coastal landfills) BDC coastal squeeze impact on key habitats BDC risks to tourism, ports,

Strategy implications (2)

Aspect / Impact	OSPAR Strategy implication
Atlantic Meridional Overturning Circulation weakening	RSC plume direction changes BDC movement of fish from spawning grounds to nursery areas
Stratification	EUC reduced mixing favours HAB species
Salinity reduction	BDC Habitats and species
Rainfall patterns	EUC Increased runoff/episodic river flows EUC Potential increase in HABs HSC Storm water containing pollutants BDC Changes to tourism patterns
Mitigation urgency	RSC possible push for more nuclear power OIC CCS-SSGF BDC Impetus for renewables
Whole ecosystem change (combinations of the above)	Interaction and synergies (processes + links) Trophic mismatches, competition, seasonality Compounded by other stresses

OSPAR Convention Annexes

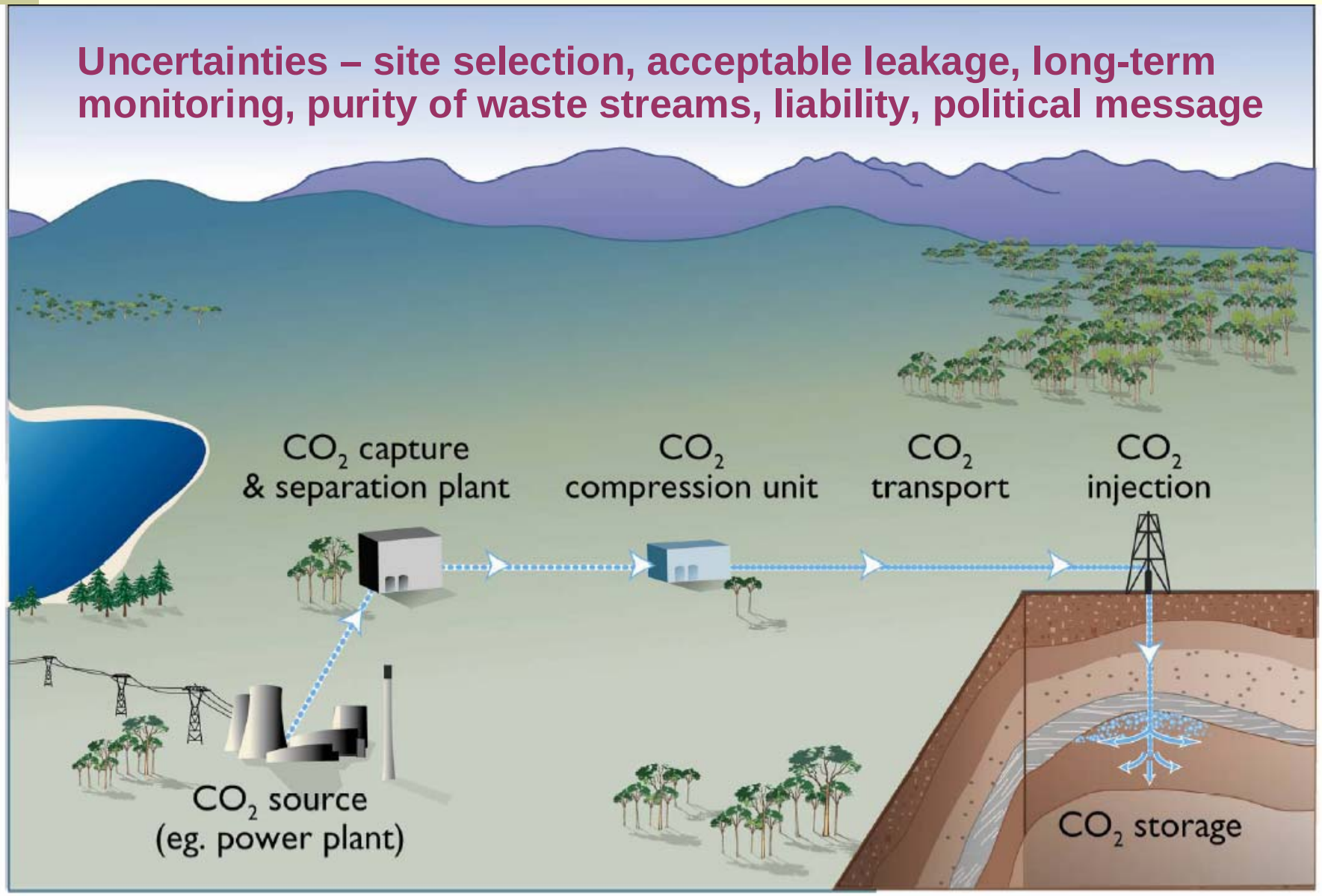
Annex II: on the prevention and elimination of pollution by dumping or incineration

- Deliberate disposal in the maritime area
- Specific exceptions (e.g. dredging)
- Authorisation and regulation, associated guidelines

Annex III: on the prevention and elimination of pollution from offshore sources

- Prohibition of dumping of wastes or other matter from offshore installations
- Use of Best Available Techniques and Best Environmental Practice

Capture, transmission and storage



OSPAR 2006 reports

Placement of Carbon Dioxide in Subsea Geological Structures:

- Reviewed risk characterisation for selection of potential sites
- Reviewed appropriate monitoring and surveillance mechanisms

Effects on the marine environment of ocean acidifcation resulting from elevated levels of carbon dioxide in the atmosphere:

- Changes in ocean carbon chemistry (acidity, carbon saturation state)
- Rapidity of change
- Knowledge gaps

Extensive discussions

Technical and legal issues were tackled during the 2006/7 meeting cycle

- Risk characterisation and risk management?
- Jurisdictional responsibility?
- Transboundary pollution?
- Implementation reporting?
- Record keeping over very long timescales?
- Net reductions in carbon dioxide emissions?

OSPAR 2007

Agreed to adopt by consensus:

- Amendments Annexes II and III
- OSPAR Decision 2007/1 to Prohibit the Storage of Carbon Dioxide Streams in the Water Column or on the Sea-bed
- OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations
- OSPAR Guidelines for Risk Assessment and Management of Storage of CO_2 Streams in Geological Formations including a framework for Risk Assessment and Management of Storage of CO_2 Streams in Geological Formations (FRAM).

Strategic achievement

OSPAR's achievement has been:

- Not merely to allow the storage of carbon dioxide but rather to set rules for this activity to ensure that the marine environment is not damaged, including preventing any carbon dioxide placement in either the water column or on the sea bed.
- OSPAR will input to the forthcoming meeting of the London Protocol on 5-9 November 2007 that will consider:

  a. adopting specific guidelines for Assessment of Carbon Dioxide streams for disposal into Sub-seabed Geological Formations;

  b. concern re large scale ocean iron fertilization operations;

  c. transboundary issues; and

  d. development of a reporting format.

Experience to date

Information from Tony Espie, BP:

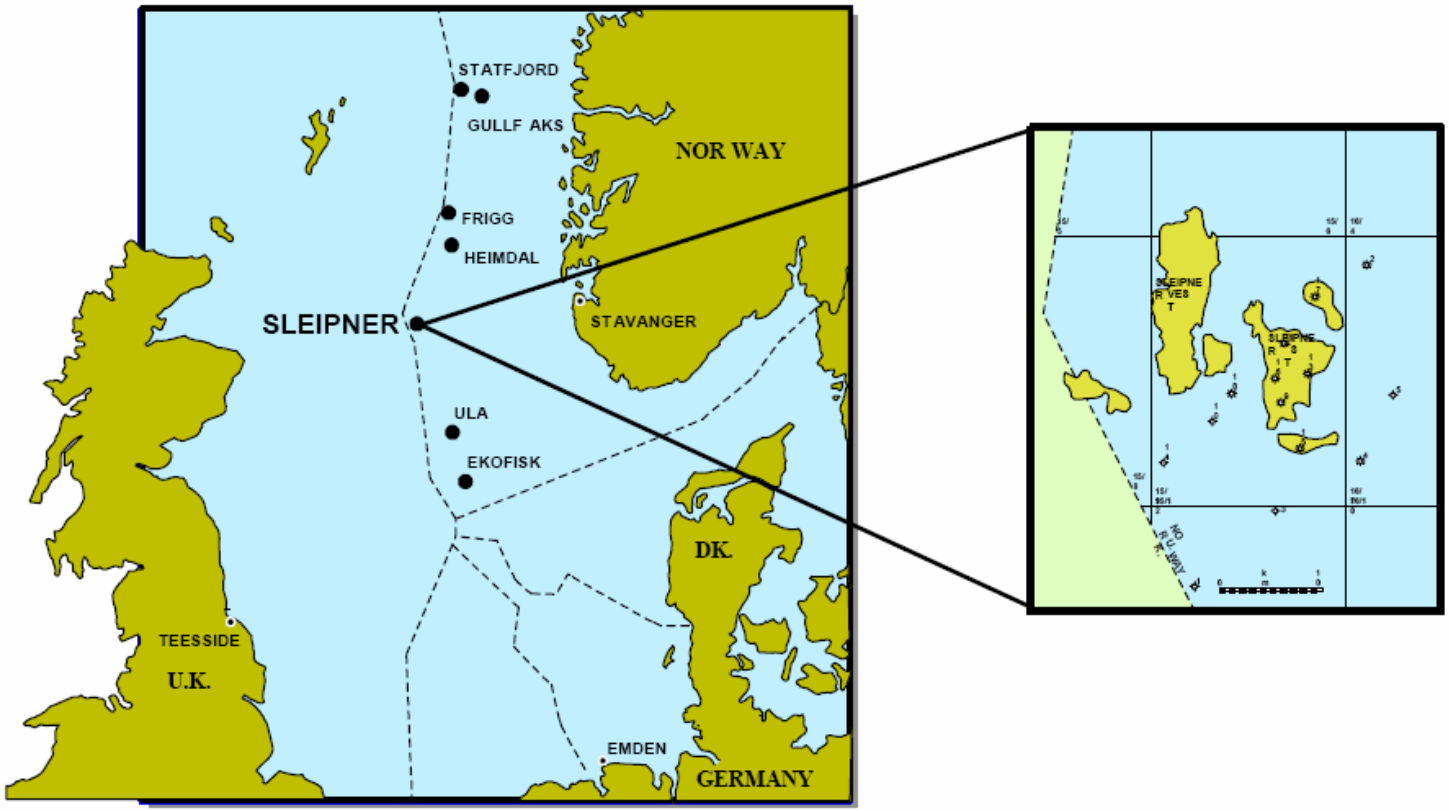
- Carbon dioxide enhanced oil recovery – 30 years of operation in the Permian Basin
- Industrial scale carbon dioxide storage – Sleipner, In Salah
- Natural gas storage – around 100 years experience
- Acid gas disposal – over 40 projects in Canada
- Natural analogues – demonstrate storage over millions of years

Relatively long-term, costly and requires significant economic investment

Sleipner field – CO_2 Treatment & Injection

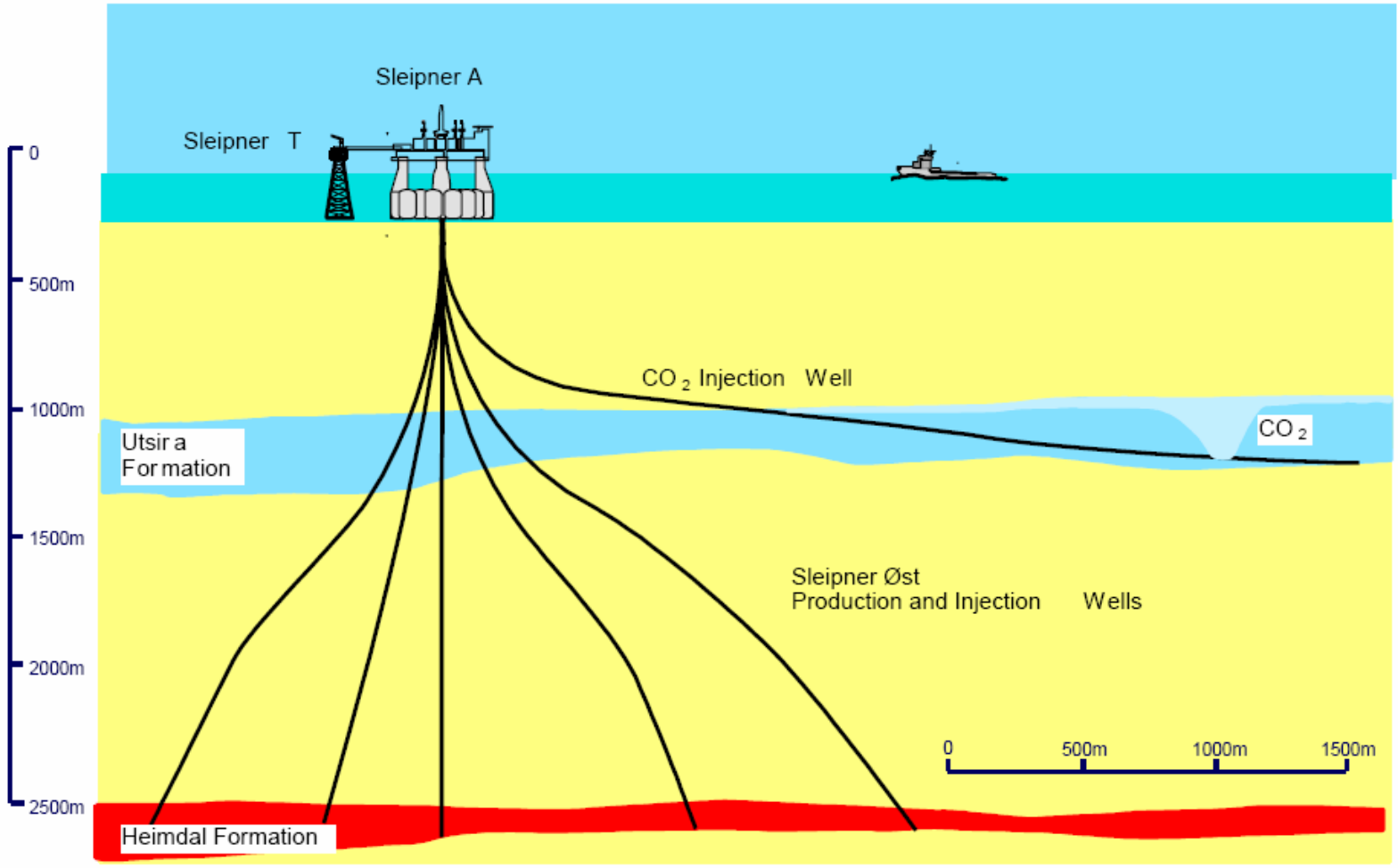
STATOIL

Sleipner Field Map



CO_2 Injection Well in "Utsira"

STATOIL



Unexpected vertical and horizontal flows, reservoir more heterogeneous than expected, velocities poorly modelled….

Snow White : Barents Sea

Associated issues for OSPAR:

- Marine Spatial Management
- Renaissance of nuclear power
- Sustainability science
- Knowledge transfer

Oil, gas and seabird areas

Philippe Rekacewicz, UNEP/GRID-Arendal, Barentswatch Atlas 1998

Conclusions

Legal and regulatory framework:

- OSPAR Convention consistent with Protocol to London Convention
- Clarity re requirements for long-term stewardship

Stakeholder engagement

- Global portfolio of demonstration projects
- Sharing of information

Commercialisation of CCS

- Driving down capture costs
- Mechanisms for cost recovery