

## CCS Overview - Why CCS?

- CO<sub>2</sub> Transport and Storage

# CCS Overview - Why CCS?

## CONTENTS

- **Challenge & Targets**
- **Who got the idea?**
- **Capture**
- **Transport**
- **Storage**
- **Around the Globe?**

This is it!



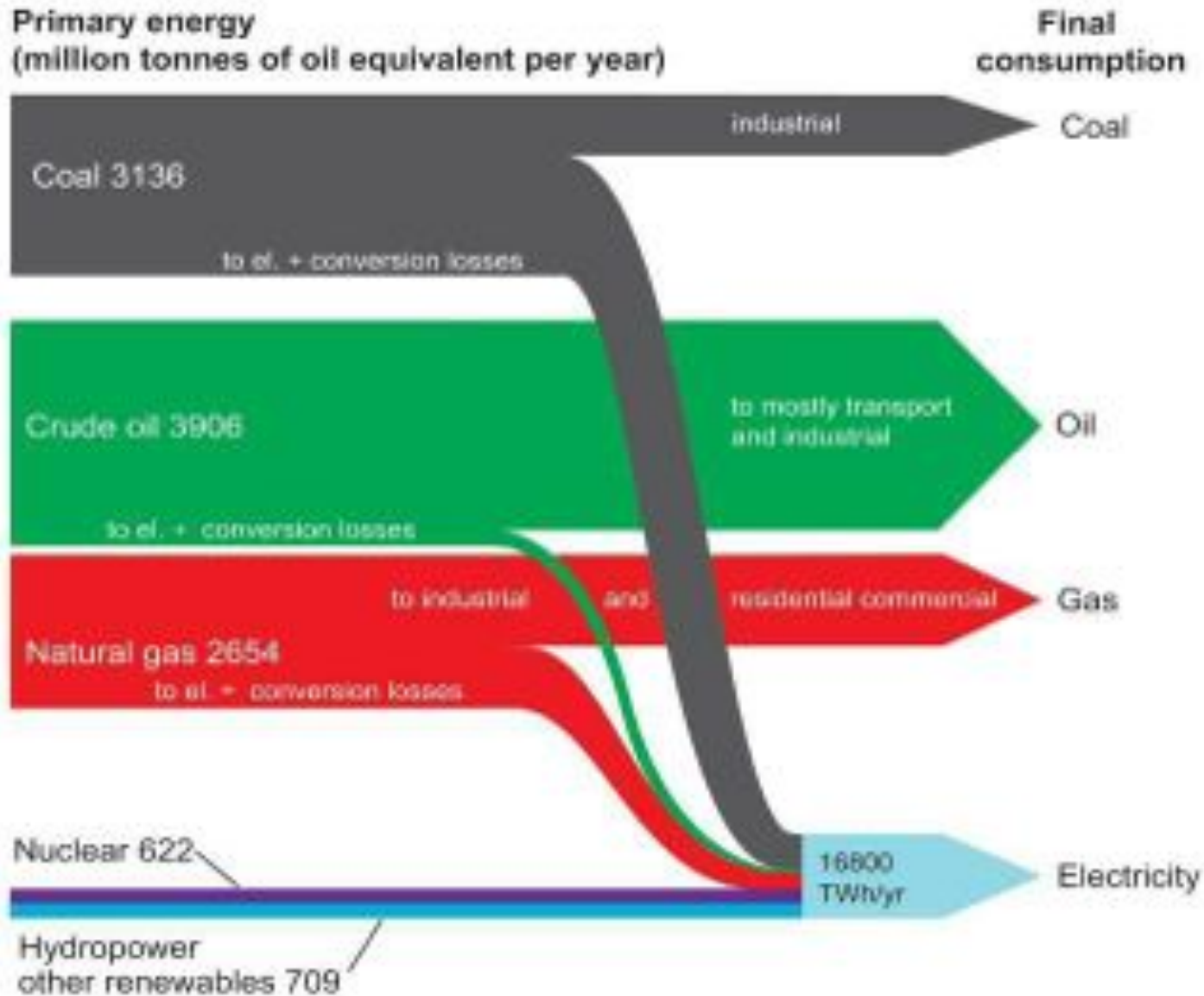
# IPCC – Climate is changing – Humans causing it

- **IPCC 5.th Assessment Report 2013-14:**

- IPCC = Intergovernmental Panel on Climate Change (WMO & UNEP)
- Reviewed by climate researchers – nominated by national sources
- All available, peer reviewed literature (Quality criteria)
- Open mail hearings with re-review -> 4 report parts.
- **95% certain that human activity is the cause** (80/20?)
- **emissions of CO<sub>2</sub>, CH<sub>4</sub> and other gases**

Summary for policymakers: [http://www.ipcc.ch/report/ar5/wg1/docs/WGIAR5\\_SPM\\_brochure\\_en.pdf](http://www.ipcc.ch/report/ar5/wg1/docs/WGIAR5_SPM_brochure_en.pdf)

# Simplified global energy flows 2007



Worst case scenario  
is business as usual!

Need to get started now!



# Today's use of CO<sub>2</sub>

- Beer & Soft drinks
- Food packaging
- Fire extinguishers
- Refrigerators
- Feed for chemical industry
  
- **CO<sub>2</sub>-EOR / EGR**
  - USA, Brazil, Canada, Hungary, Turkey, ?



# Who got the idea?

and when and where?

- Erik Lindeberg
- and
- Torleif Holt
- Both Geo-scientists at
- SINTEF Petroleum in Trondheim, Norway
- Summer 1986

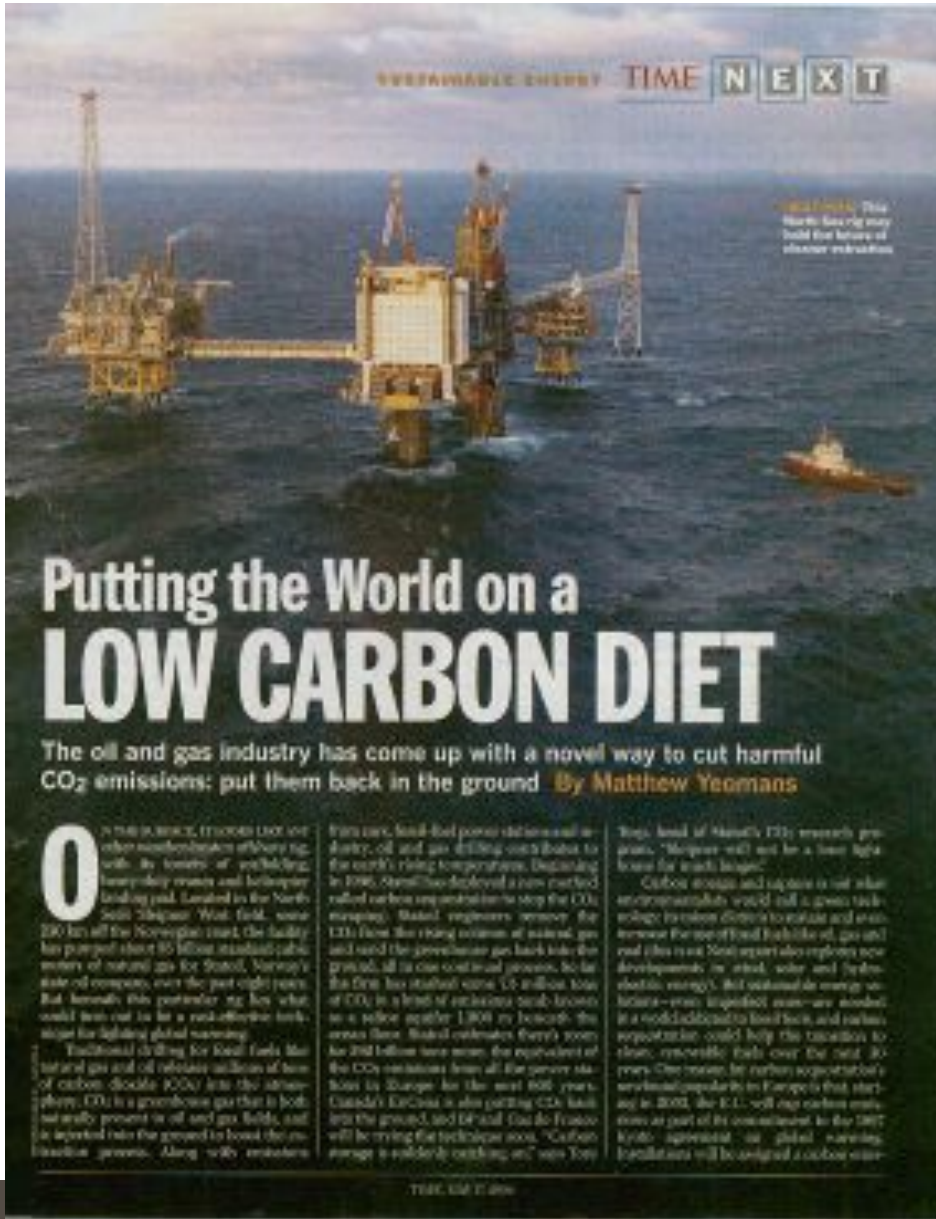
Documented in a report to Statoil R&D late 1986: "By the way "



# Vision

## DECARBONISATION OF FOSSIL FUELS TO ELECTRICITY AND HYDROGEN





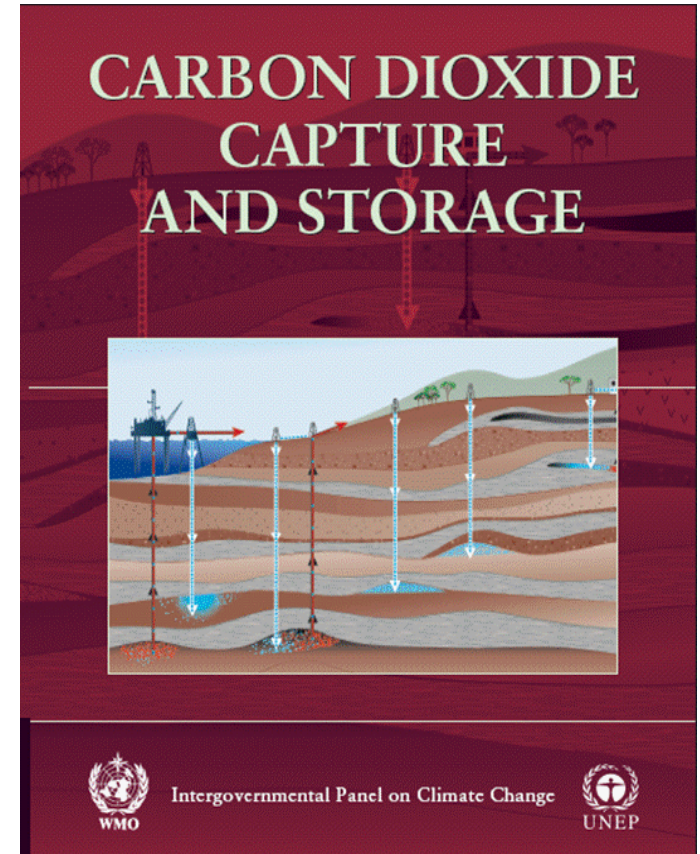
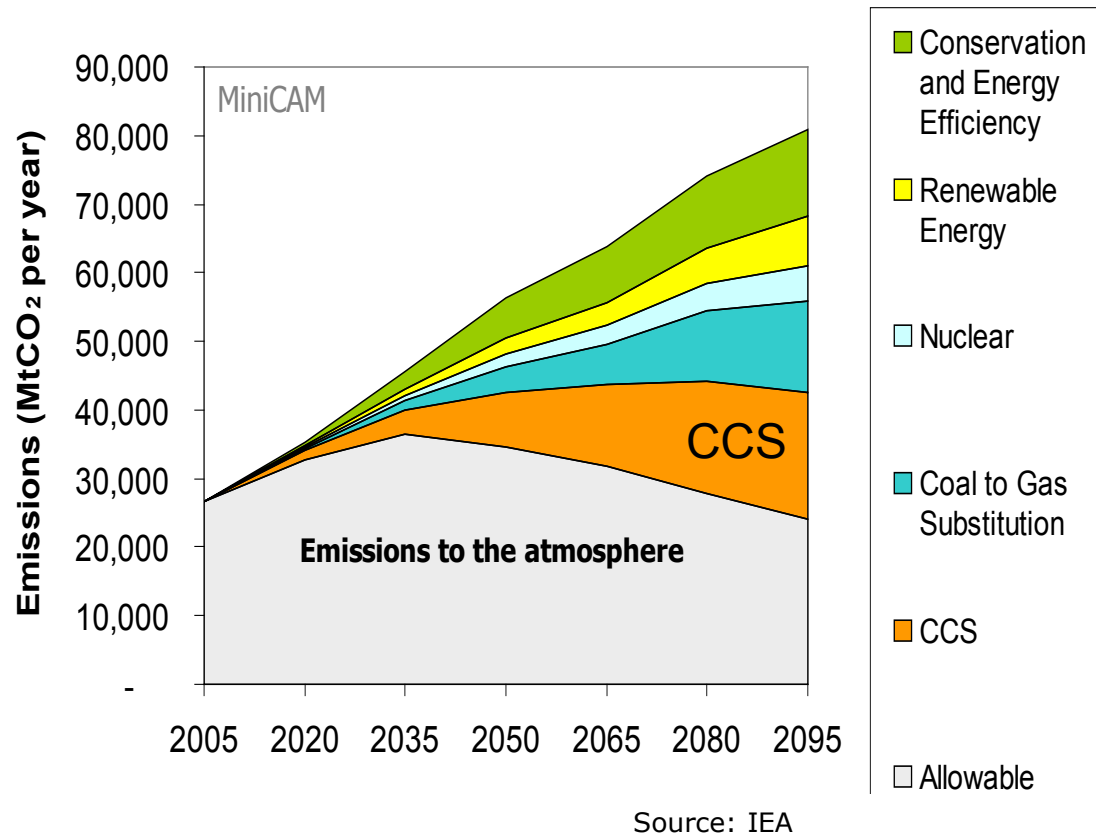
## Sleipner CO<sub>2</sub> injection:

- Decided in 1992
- In operation since 1996
- 1 million tonne CO<sub>2</sub>/year

Time Magazine,  
17. May 2004



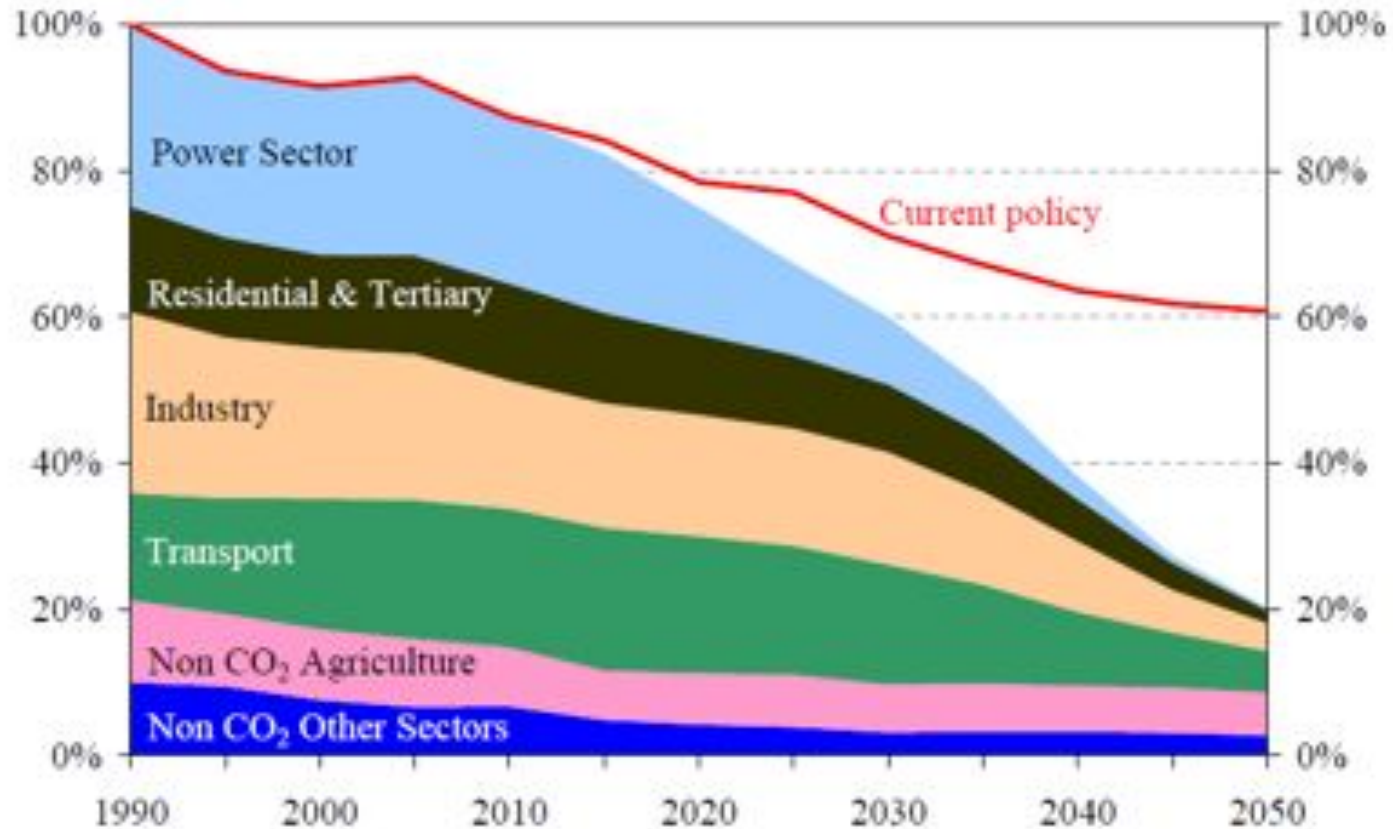
# Potential for CCS – Power and Industry



Source: IPCC - Special Report on CCS (2005)

# European Low Carbon Economy Roadmap

Figure 1: EU GHG emissions towards an 80% domestic reduction (100% = 1990)



# CAPTURE from large point sources

- **Power stations** – Coal and Natural Gas,
- **EII - Energy Intensive Industry** – Steel, Cement, Aluminium, Silicon,

# TRANSPORT

- **Ship & Car Tankers**
- **Pipelines**

## Yara CO<sub>2</sub>-tankers, 1500 m<sup>3</sup> capacity



Photo: Yara.

Dr. Ing. Tore A. Torp, CO2 Storage Adviser



# CO<sub>2</sub> transport

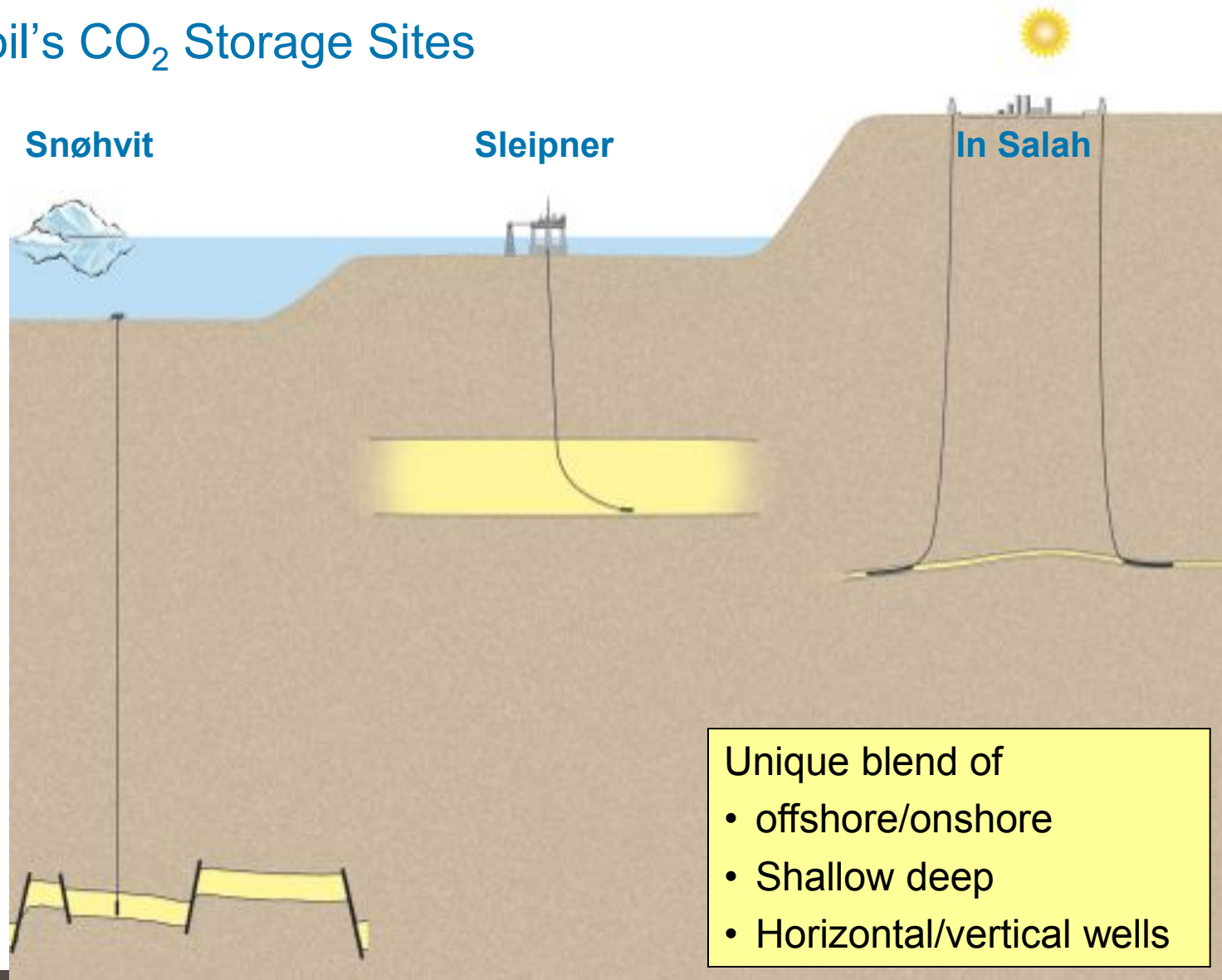
Snøhvit pipeline is 153 km with diameter of 0.2 m



## **STORAGE for thousands of years**

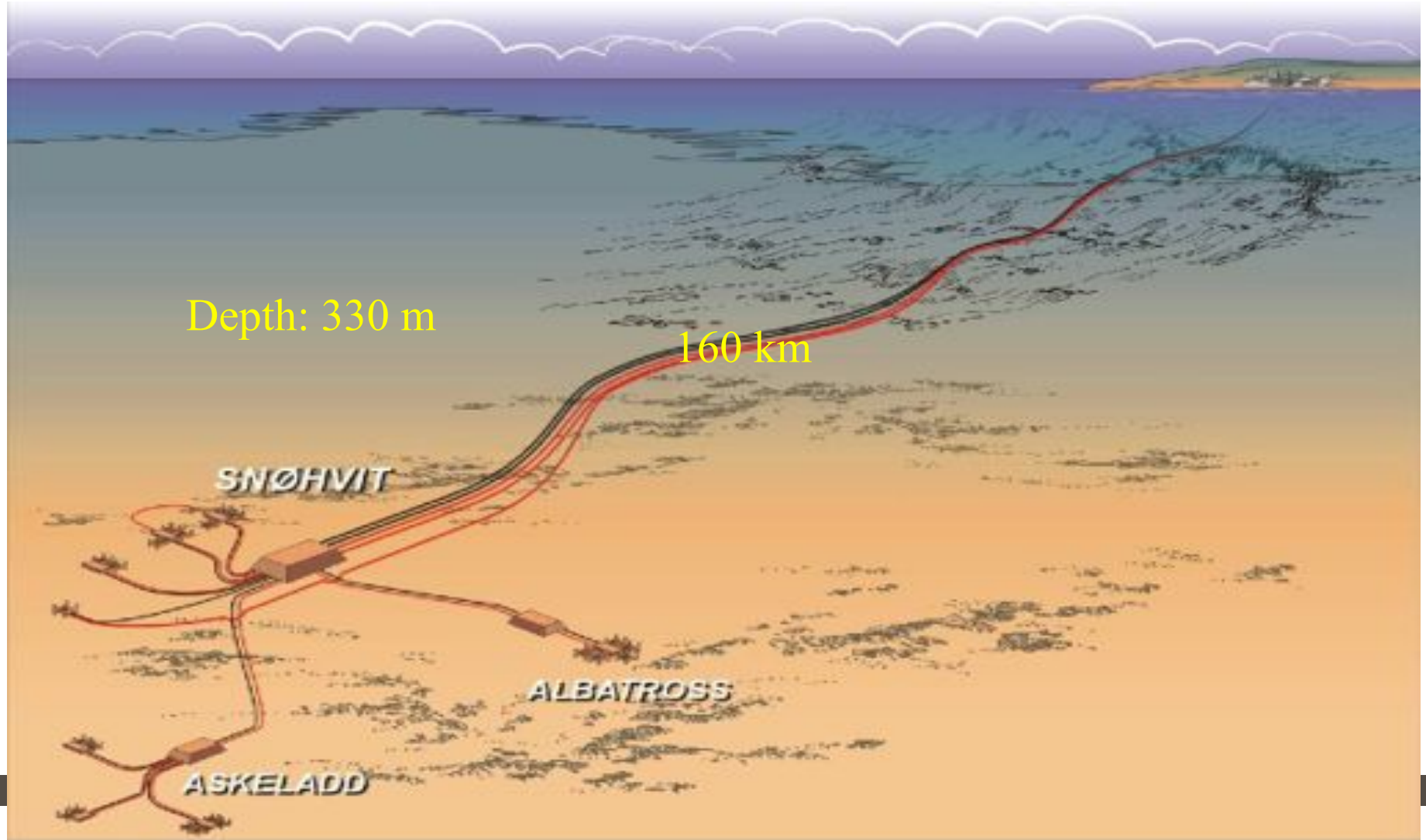
- **Stable & Condensed – 800-3000m depth**
- **Injective, Permeable & Capped Reservoir**

# Statoil's CO<sub>2</sub> Storage Sites



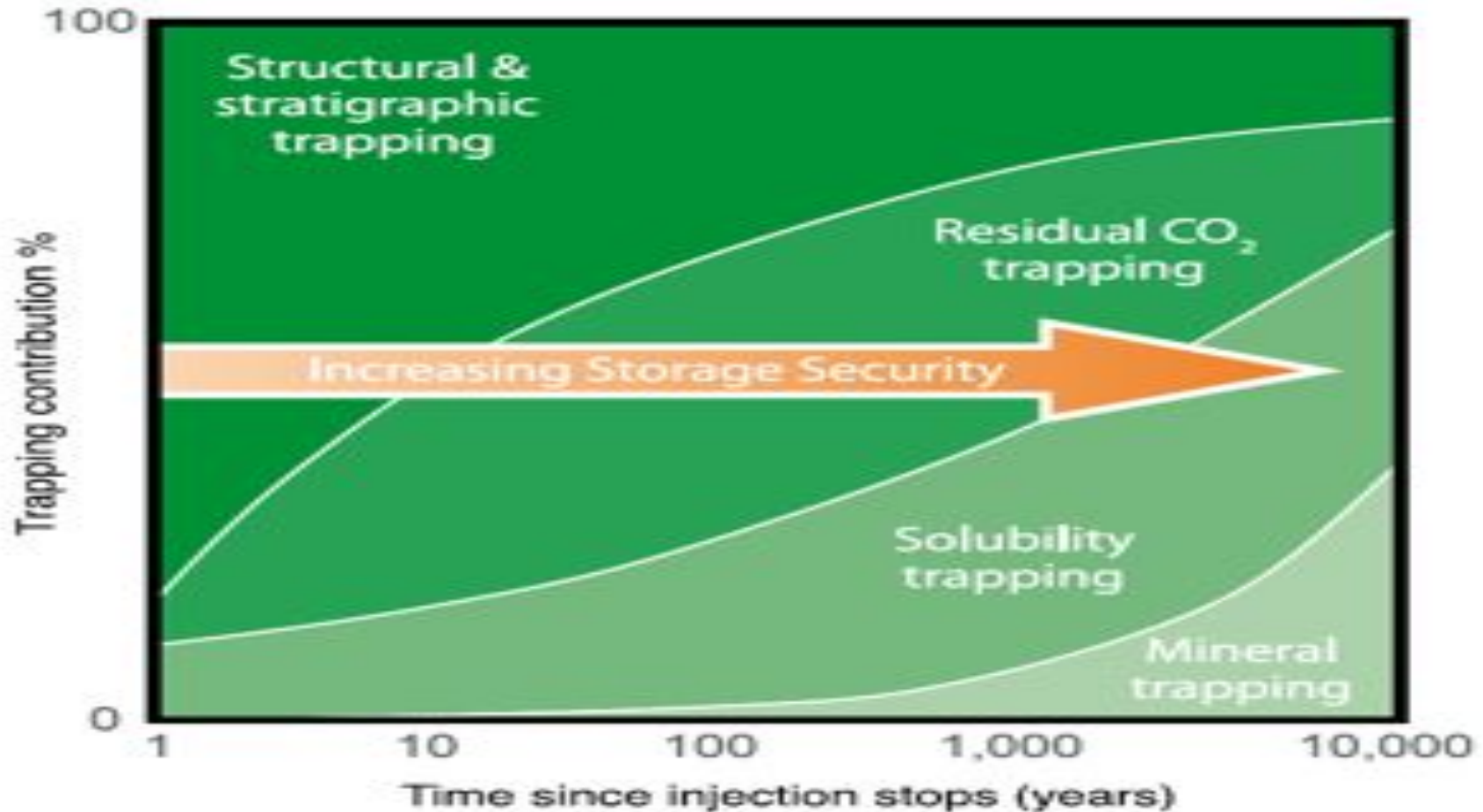
Dr. Ing. Tore A. Torp, CO<sub>2</sub> Storage Adviser

# Snohvit 2008 – All subsea



Dr. Ing. Tore A. Torp, CO2 Storage Adviser

## CO<sub>2</sub> finnes "lagret" naturlig i undergrunnen.



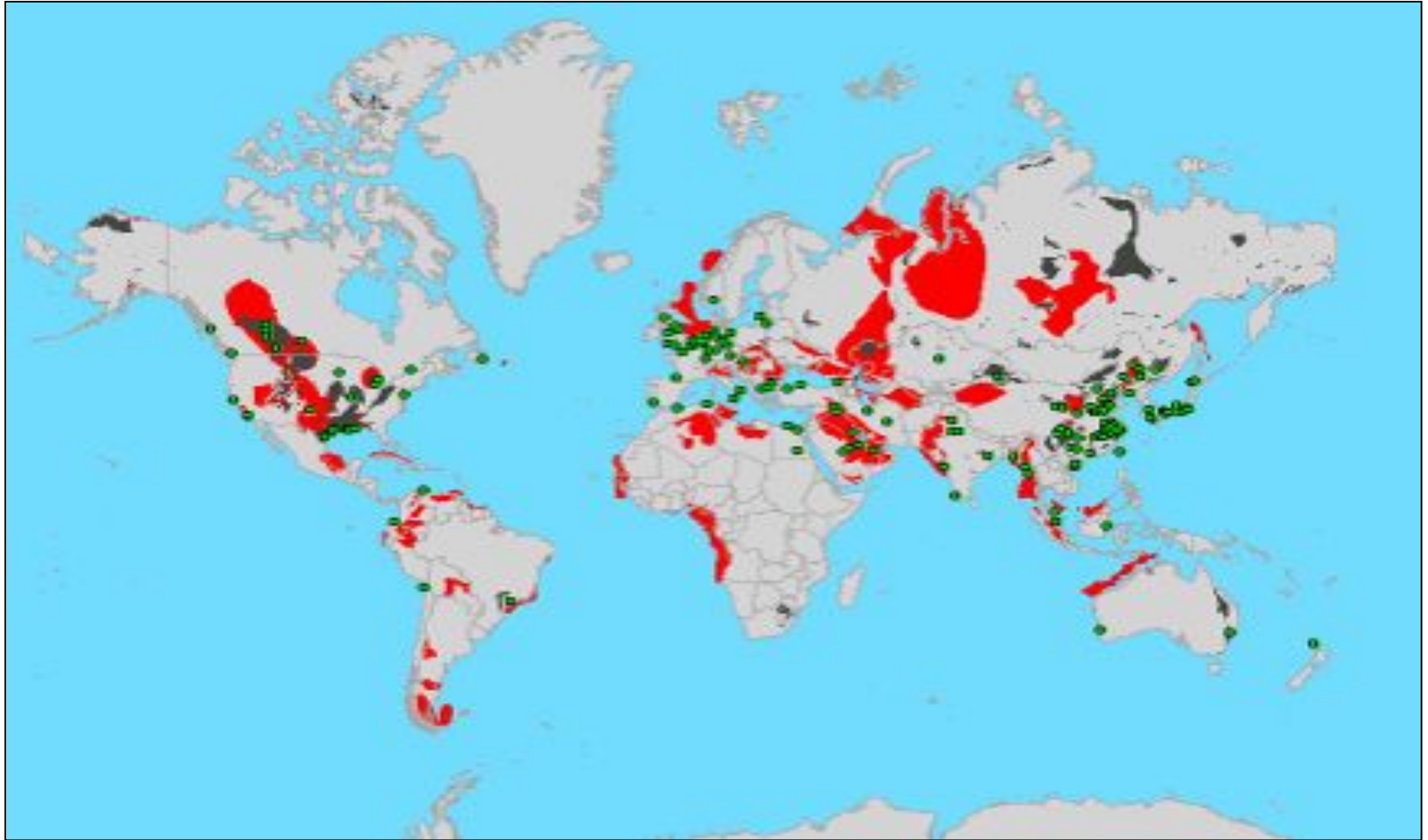
**Figure 5.9** Storage security depends on a combination of physical and geochemical trapping. Over time, the physical process of residual CO<sub>2</sub> trapping and geochemical processes of solubility trapping and mineral trapping increase.

# SAFETY STRATEGY

- **Prepare**
- **Monitor**
- **Remediate**



## Point sources of CO2 (green dots)



Courtesy of IEA Greenhouse Gas R&D Programme

Dr. Ing. Tore A. Torp, CO2 Storage Adviser



# Sedimentary basins of the world.

Onshore - Green. Offshore - Lavender.



Source: Schlumberger

Dr. Ing. Tore A. Torp, CO2 Storage Adviser