

# The Role of Technologies in Carbon Management Strategies

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First National Conference on Carbon Sequestration  
Washington DC, May 15–17, 2001

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**We stand at the threshold to a new century**

**It marks a shift in energy technologies**

**New issues become the dominating factors**

- Global Environment**
- Global Market**
- Rapid Development of the Less Developed Countries**

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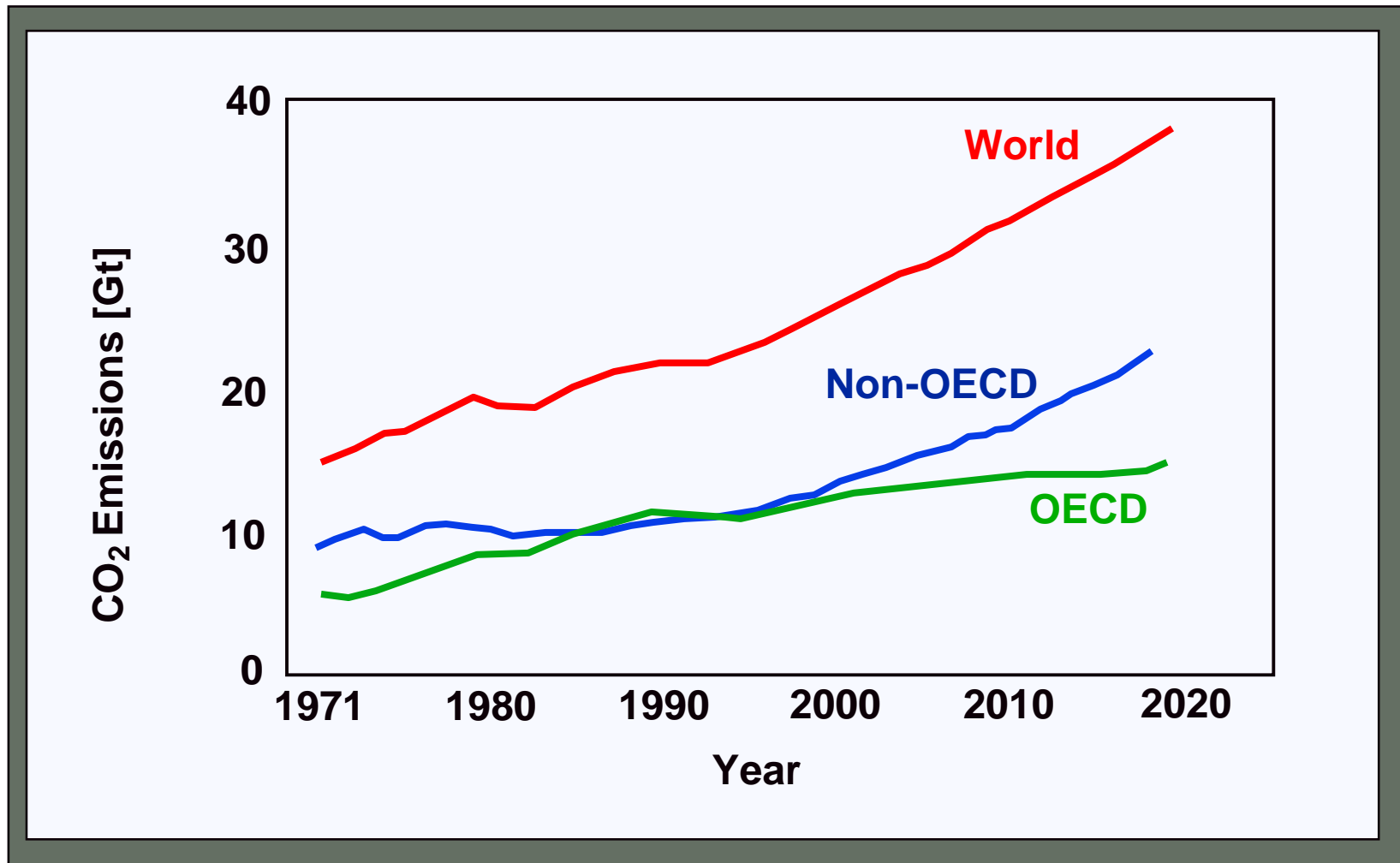
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# World Energy Related CO<sub>2</sub> Emission



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IEA World Energy June 1999

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# Third Assessment Report (TAR) IPCC, February 2001

The report finds

**“new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.”**

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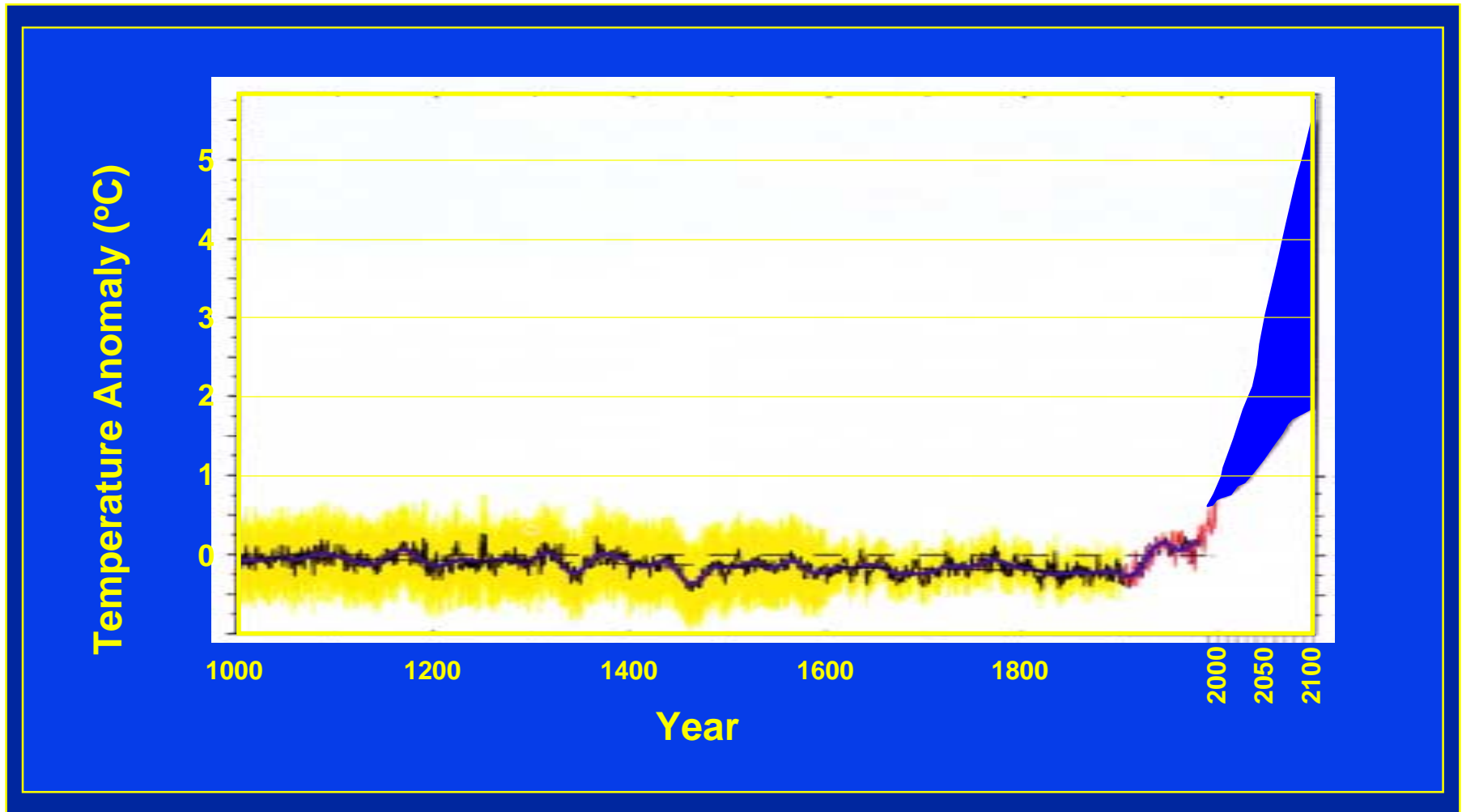
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# Mean Annual Temperature Variations Northern Hemisphere



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R.T. Watson COP6 November 2000

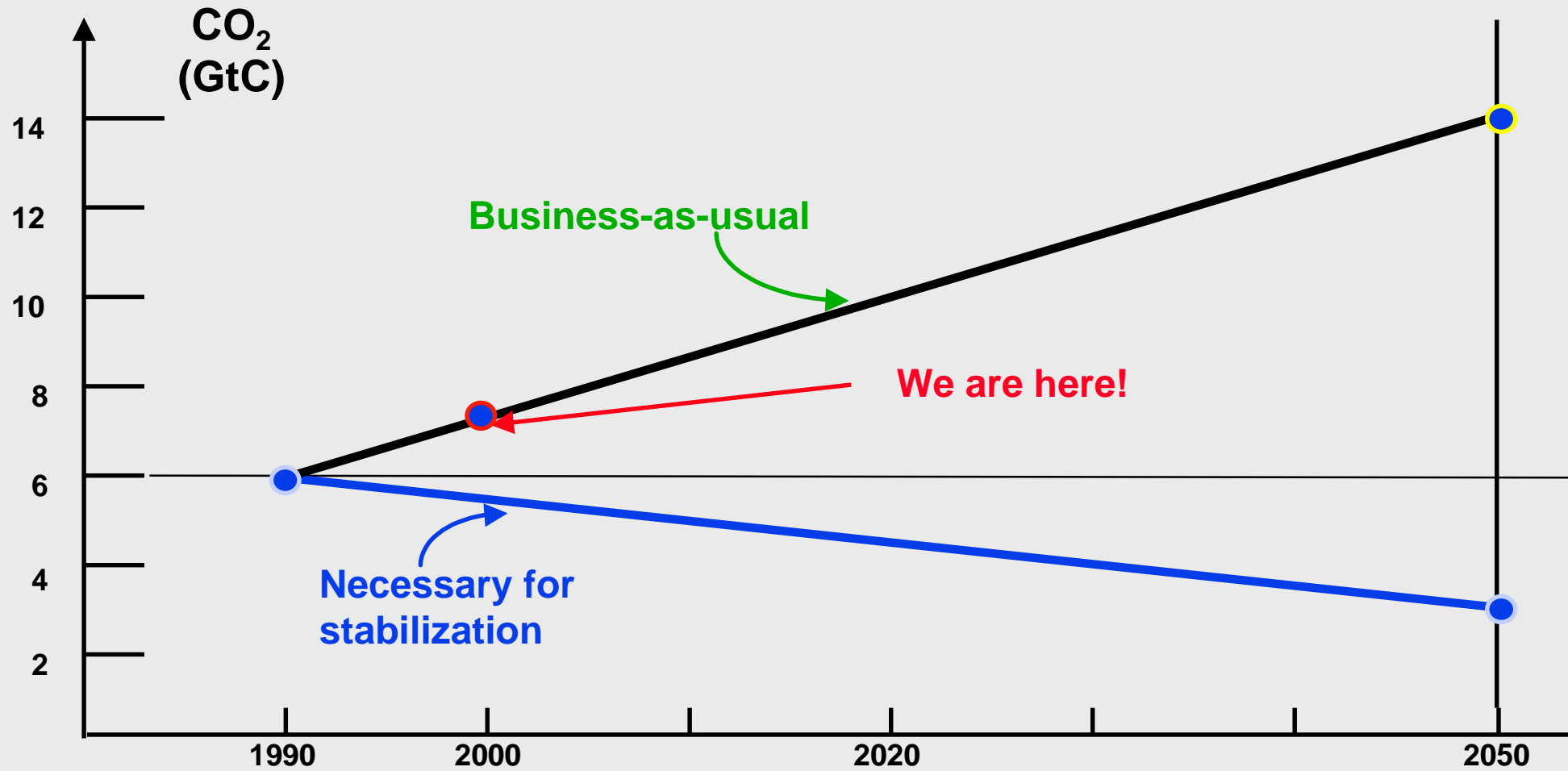
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# POLICY

## The Problem



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# UN Climate Conferences

- 1992 Rio Brazil Emissions in 2000 at 1990 levels
- 1995 COP-1 Berlin Berlin Mandate
- 1996 COP-2 Geneva USA agrees to Limitations
- 1997 COP-3 Kyoto Kyoto Protocol, Legally Binding
- 1998 COP-4 Buenos Aires Buenos Aires Action Plan / Flop
- 1999 COP-5 Bonn Preparations for COP-6 / Flop
- 2000 COP-6 Den Hague Flexible Mechanisms / Flop

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# Kyoto

The Kyoto Protocol becomes international law if at least 55 countries, incorporating Annex I countries accounting for at least 55% of the total Annex I emissions verify it.

Annex I = countries affected by the Protocol = 40 industrialized countries

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# The Technological Options for Reducing Greenhouse Gas Emissions

- **Minimize Emissions**

  - Conservation

  - Better Efficiency

  - Less Polluting Fuels

  - Recycling

  - .....

- **Zero Emission Technologies**

  - Nuclear Energy

  - Solar Energy

  - Wind Energy

  - Hydro Energy

  - .....

- **Greenhouse Gas Control**

  - Capture

  - Disposal

  - Recycling

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# Fossil Fuels will be used throughout the 21st Century

- Fossil fuels will remain an important energy source
- Fossil Fuels sustain 80% of the world's energy today
- Ways will have to be found to utilize Fossil Fuels in an environmentally friendly and sustainable manner

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# NUCLEAR POWER PLANTS WORLDWIDE 1997

( IN OPERATION, UNDER CONSTRUCTION, PLANNED)



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# New Technologies and New Energy Carriers

- Renewable Power
- Distributed Power
- Hydrogen and Methanol
- Fuel Cells
- Microturbines
- GHG Control Technologies

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# Renewable Energies for Electricity Generation

Installed Capacity [GW]

Solar Energy (PV)

1

Wind

20

Hydro

(700)

Biomass

10

Geothermal

7

Ocean

0.3

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38 GW  $\hat{=}$  1% of total world capacity

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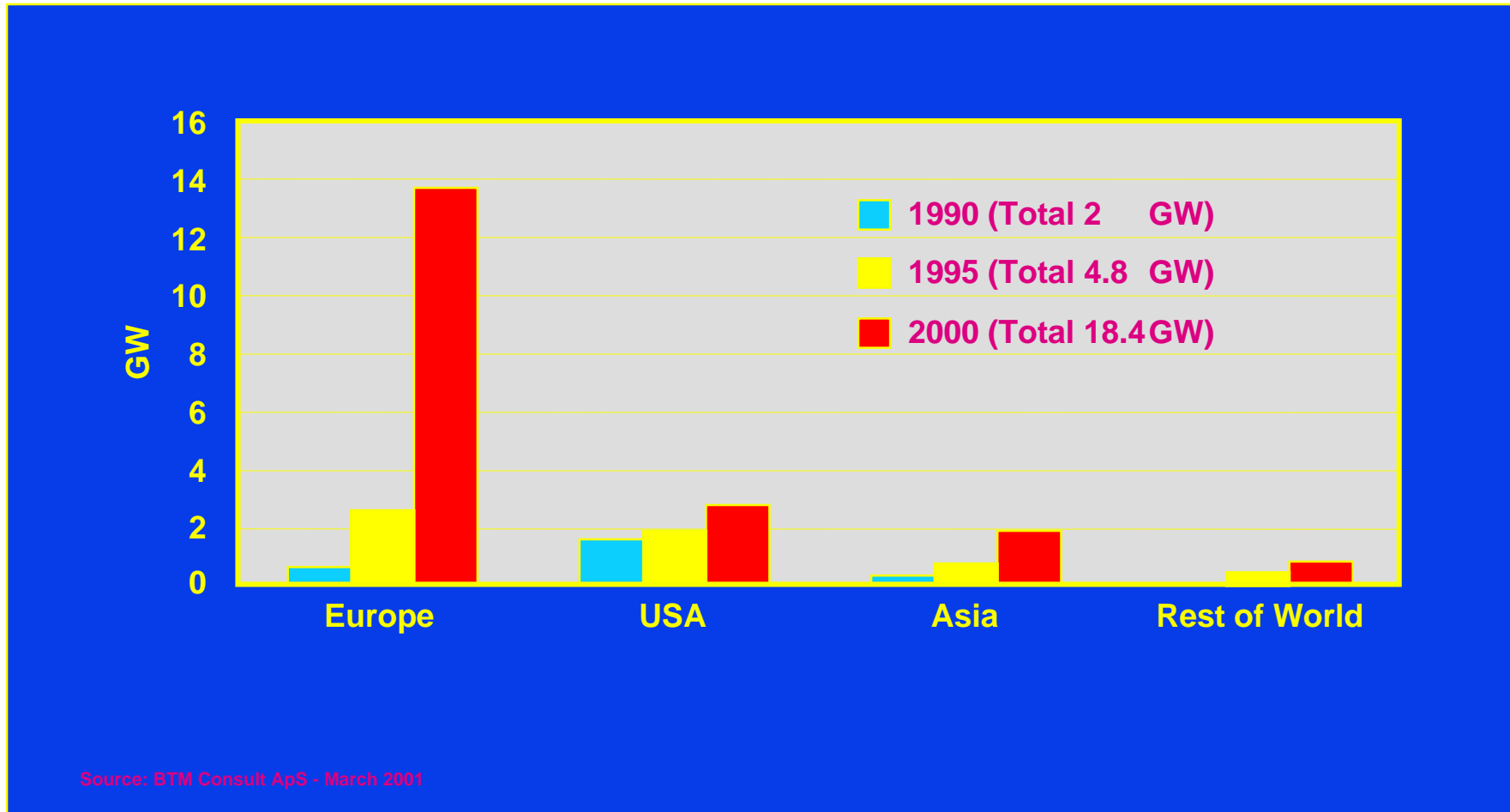
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# Global Wind Power Status Today

Installed Power by end of 1990,1995 & 2000



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International Wind Energy Development March 2001

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# What is Windformer?

- Based on ABB Powerformer™ high voltage generator
- DC transmission. Variable speed
- No gearbox, no transformer
- Highly suitable for offshore and coastal windfarms



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# CO<sub>2</sub> Recovery from Flue Gas

SHADY POINT,  
OKLAHOMA, USA

Kerr-McGee/  
ABB Global Lummus  
Carbon Dioxide  
Recovery Technology



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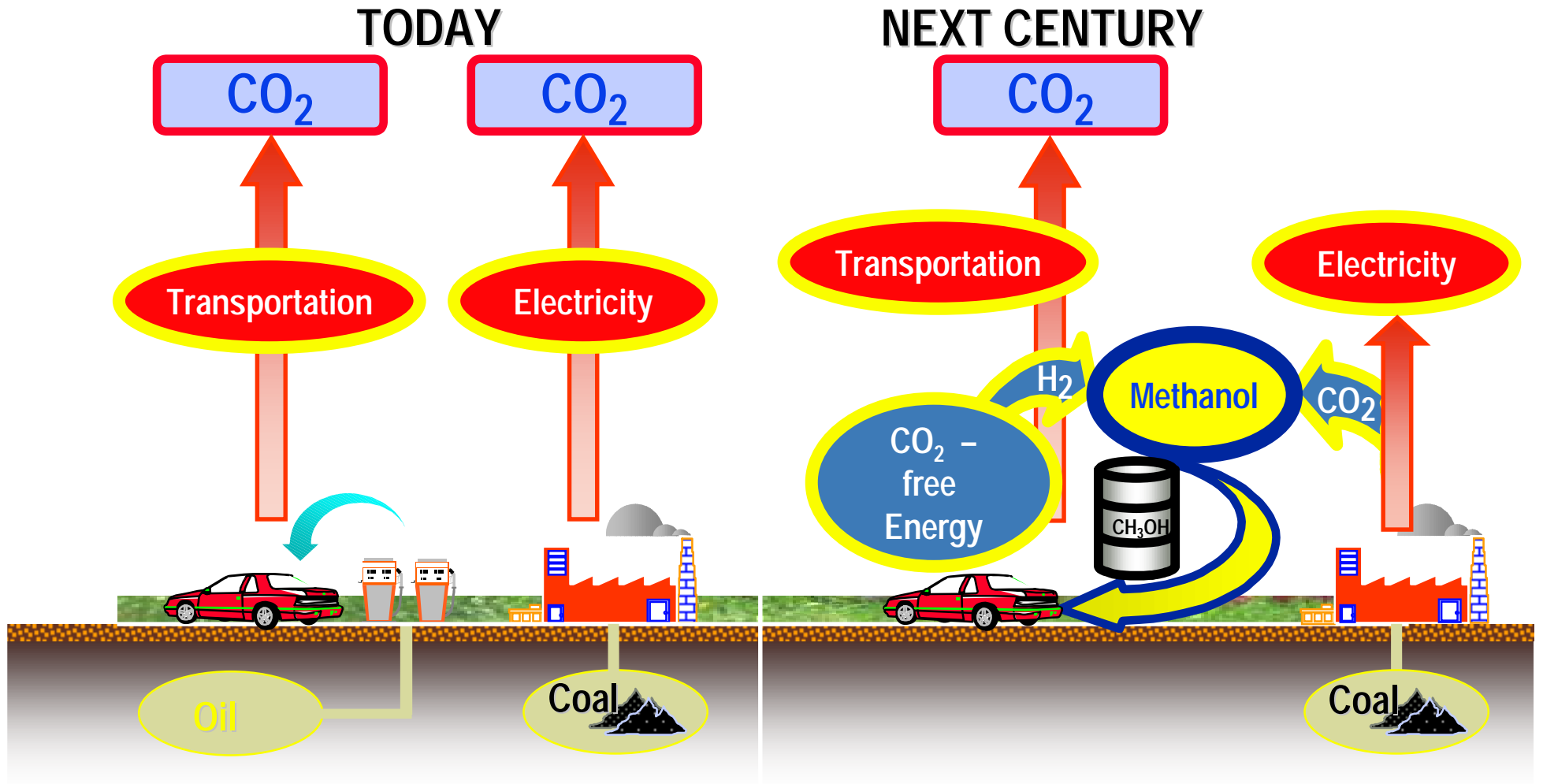
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# Recycling of GHGs



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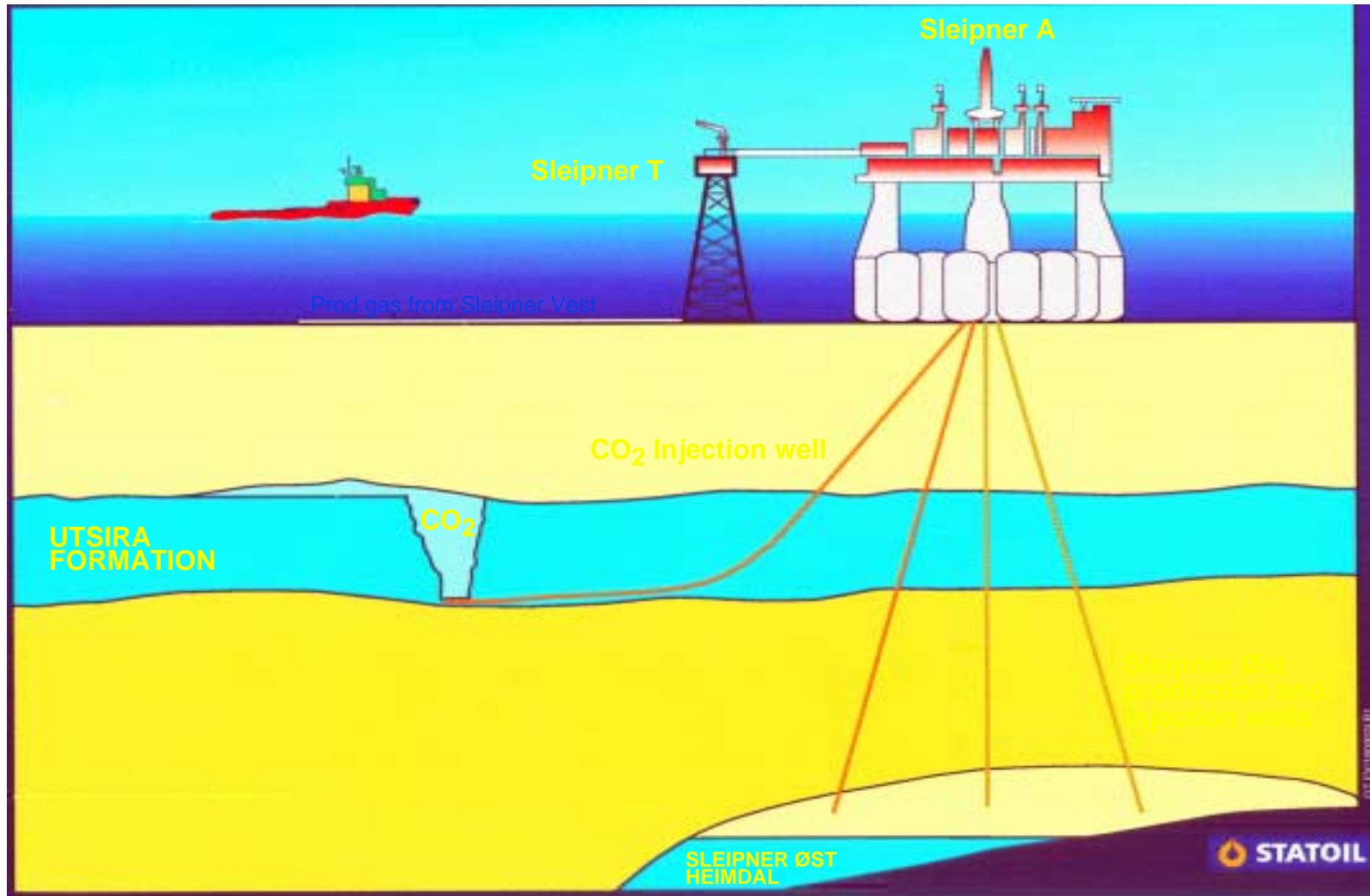
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# CO<sub>2</sub> Sequestration in the North Sea



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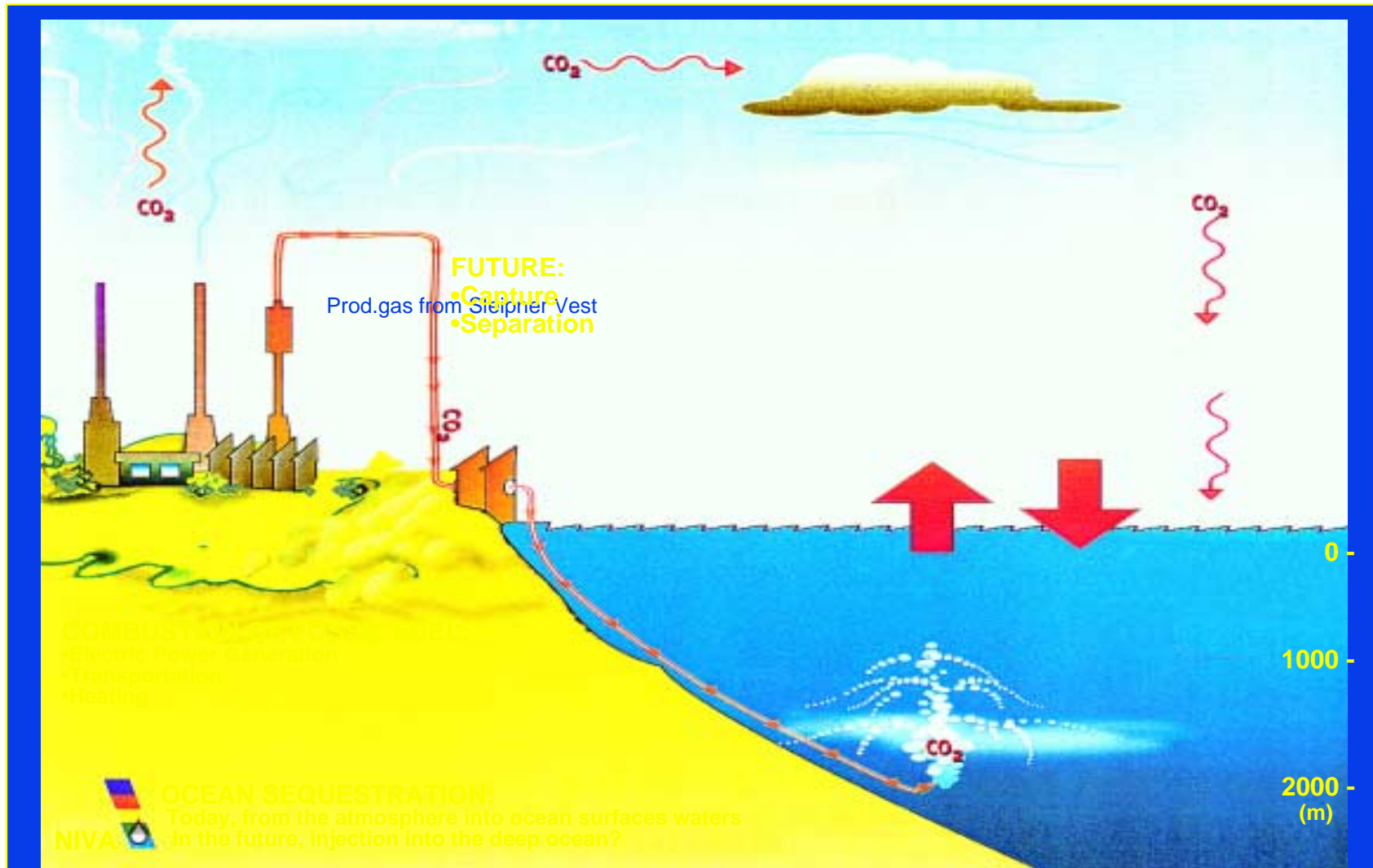
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# OCEAN SEQUESTRATION OF INDUSTRIAL CO<sub>2</sub>



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# Outlook

## The next 20 years

- Global CO<sub>2</sub> Emissions will increase by 60%
- Global limits on CO<sub>2</sub> Emissions will influence power technology development
- Fossil fuels will remain the most important energy source
- Renewables will increase at double-digit rates
- The importance of Hydrogen and Methanol as environmentally friendly fuels for combustion and fuel cells will increase
- Impact Assessment of Energy Systems

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# *CARPE KYOTEM*

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