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## First International Conference on Industrial Gas Turbines

10-11 July 2003, Brussels

**“Energy Systems in transition -  
New roles and priorities for  
research and technology”**

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**Energy Production and Distribution Systems**

**European Commission  
Research Directorate General**





# INTRODUCTION

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- **Energy is basis for (sustainable) economic development**
  - **GDP increasing**
  - **Energy usage increasing more slowly**  
Energy intensity decreasing
- **Energy supply and use**
  - **Increasing socio-economic demand**
  - **More stringent environmental criteria**
- **Key word: Sustainability (Göteborg, Kyoto, Johannesburg)**
- **Industrial viewpoint:**
  - **Transition towards sustainability (Energy industry is capital-intensive)**





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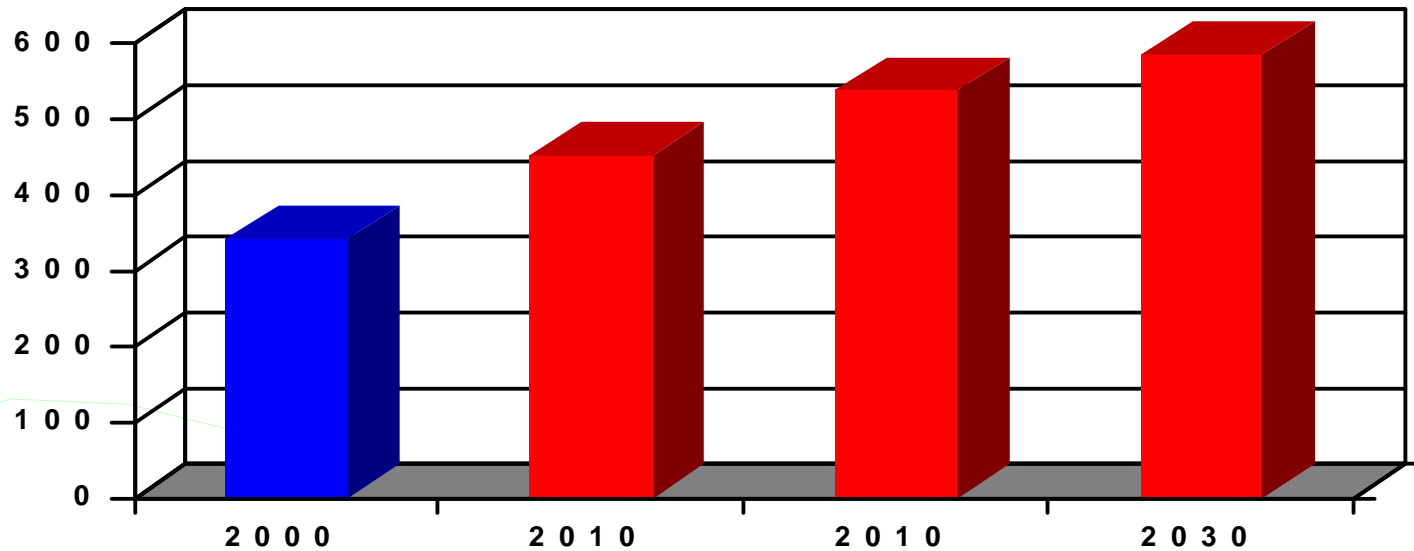
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# EU NATURAL GAS... BASIC FACTS

Projected demand  
Natural Gas (EU-15)

Source: EU Energy and Transports Trends to 2030  
(DG-TREN)

M T O E



Market share: 22%, increasing to 27%  
Strongest increase in power generation



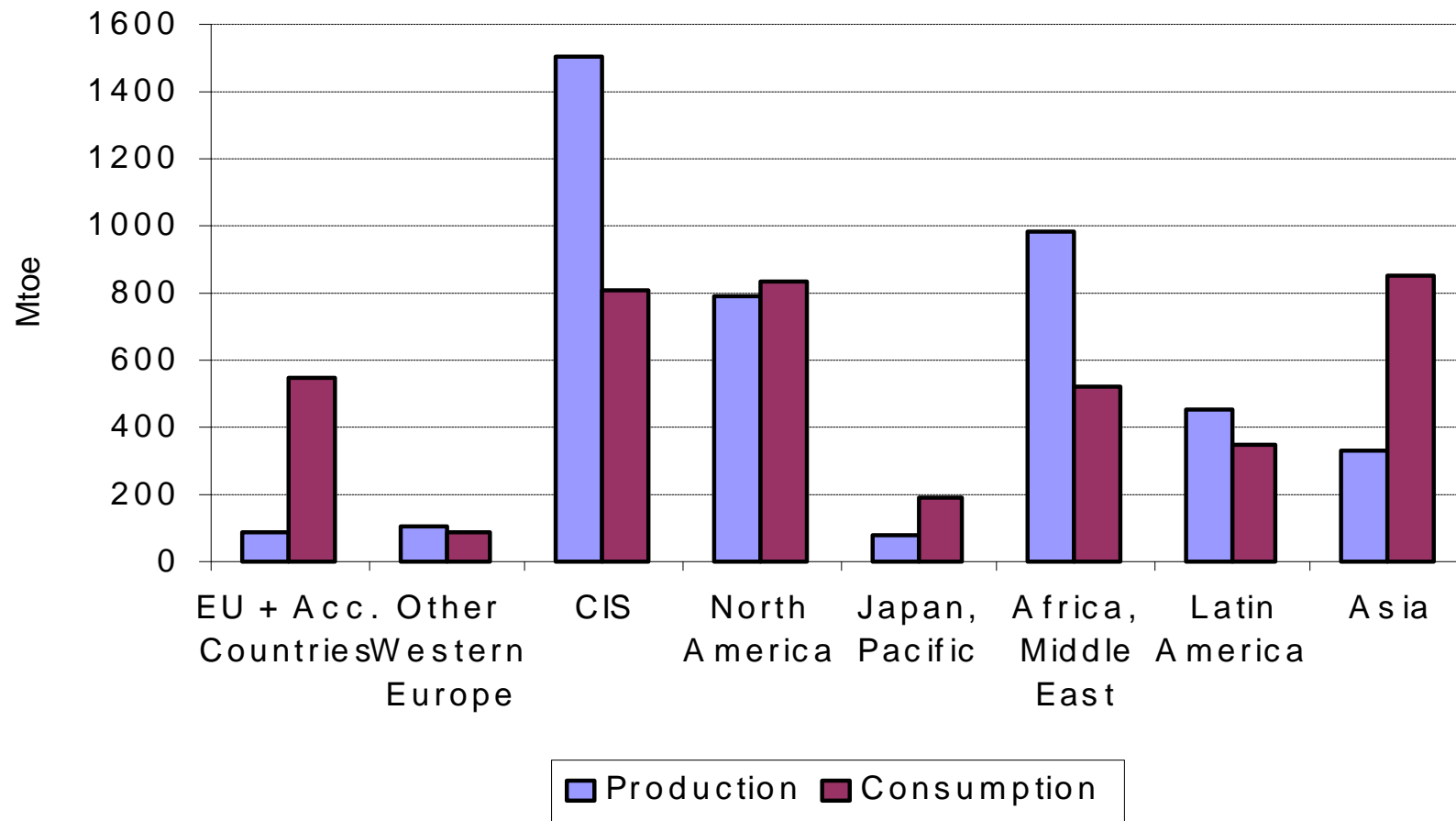


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# WORLD GAS PRODUCTION AND CONSUMPTION (2030)

(From World Energy Technology Outlook  
Reference Scenario 2030 - WETO 2003)





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# SHARE OF ELECTRICITY GENERATED FROM NATURAL GAS

(From World Energy Technology Outlook  
Reference Scenario 2030 - WETO 2003)

	1990	2000	2010	2020	2030
<b>European Union</b>	12%	22%	27%	29%	27%
<b>CIS, CEEC</b>	35%	30%	36%	44%	49%
<b>North America</b>	15%	14%	22%	24%	20%
<b>Japan, Pacific</b>	24%	31%	40%	37%	35%
<b>Africa, Middle East</b>	25%	34%	39%	47%	49%
<b>Latin America</b>	10%	15%	29%	38%	40%
<b>Asia</b>	5%	12%	13%	16%	17%
<b>World</b>	<b>18%</b>	<b>19%</b>	<b>25%</b>	<b>28%</b>	<b>28%</b>





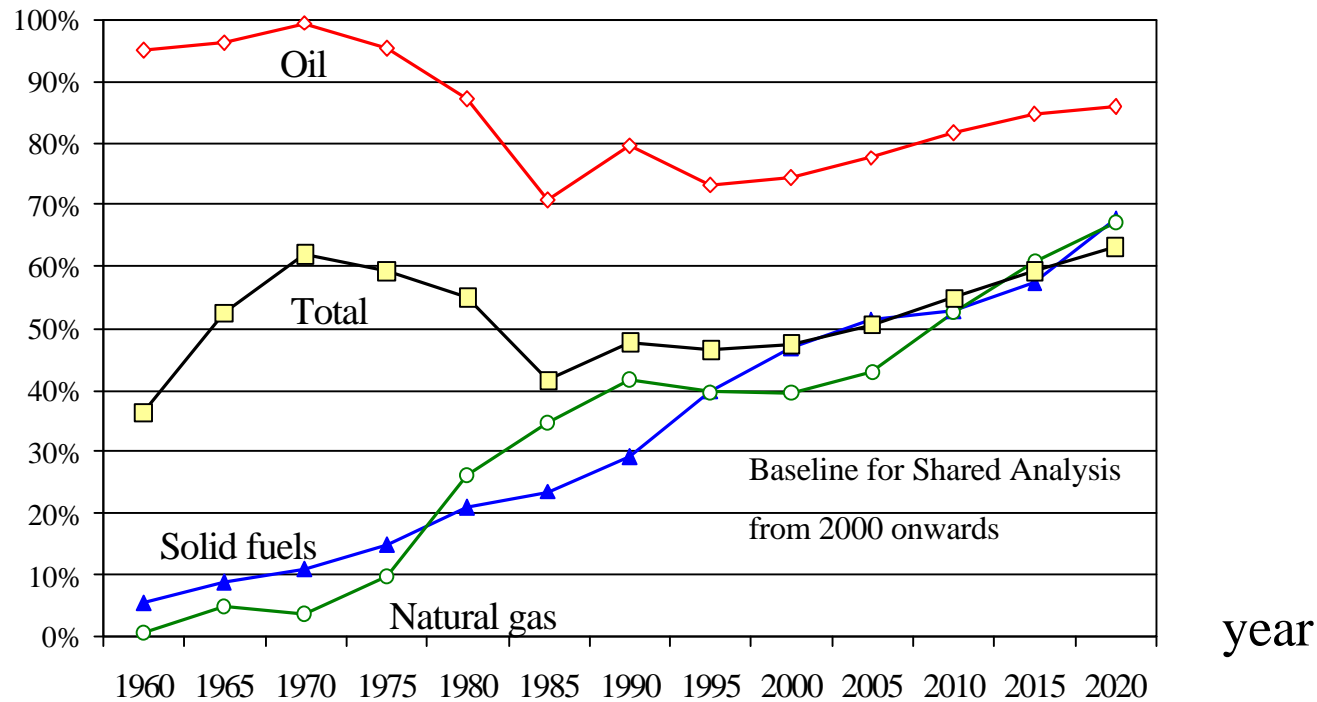
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Green Paper: „Towards a European Strategy for the Security of  
Energy Supply“ European Commission, (2001)

# ENERGY SELF SUFFICIENCY IS DIFFICULT TO ACHIEVE

## EU – import share (%)



- *major player on the world market (~15% of energy consumption)*
- *no clout in world energy pricing*
- *unsatisfactory policy for preventing supply crises*





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# ENERGY OUTLOOK

(From World Energy Technology Outlook  
Reference Scenario 2030 - WETO 2003)

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- World energy system still relying by 90% on fossil fuels by 2030
- World CO<sub>2</sub> emissions to grow more rapidly than energy demand (2.1% p.a.)
- Oil to increase by 65% over 2003-2030, gas and coal to double over the period
- Electricity demand to increase by 3% p.a., much relying on coal and gas





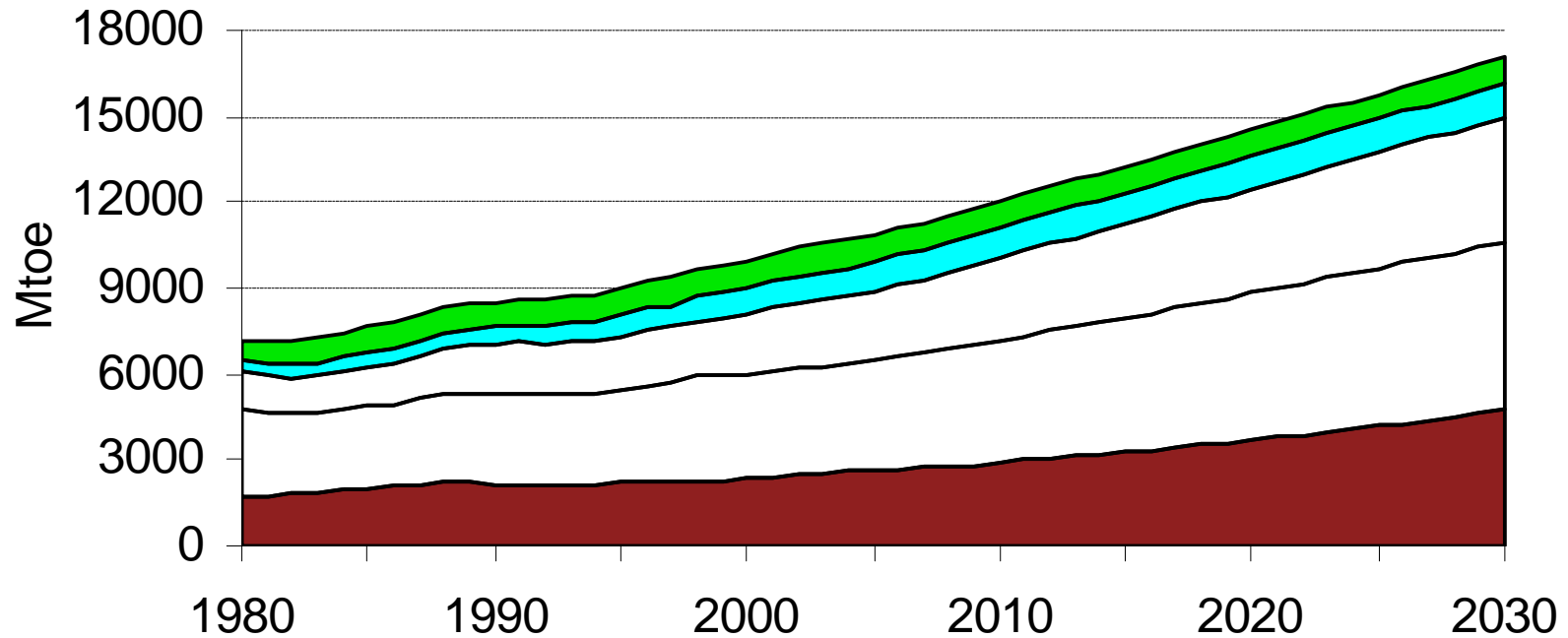
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# ENERGY OUTLOOK

(From World Energy Technology  
Outlook Reference Scenario 2030 -  
WETO 2003)

## World Energy Consumption



■ Coal, lignite

□ Oil

□ Natural gas

■ Prim. Electricity

■ Wood and wastes







# ENERGY POLICY RESPONSE (1/3)

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- **To curb some of the trends policies required**
- **Climate Change - EU ratified Kyoto**
  - GHGs - 8% over 2008 - 12 compared to 1990
  - Burden sharing agreement
  - On track so far
  - But final target may be missed
    - ECCP to identified cheapest routes
    - ETAP (in preparation) for specific action
- **Security of supply - Green Paper issued**
  - Rising import dependency
  - Diversification is key
  - No option to be ruled out
  - Need to act on orienting demand





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# ENERGY POLICY RESPONSE (2/3)

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## → RES

- Directives to go from 6% to 12%(14% to 22% for electricity) in 2010
- White Paper on European Transport Policy (20% substitution of diesel and gasoline by alternative fuels by 2020)
- Communication to promote alternative fuels (H<sub>2</sub>= 5% of road transport by 2020)
- Proposal for a directive on biofuels
  - 2% in 2005
  - 5,75% in 2010

## → Energy Efficiency

- Commission communication
  - + 18% from 1995 to 2010
  - Equivalent to 160M tonnes of oil equivalent
- Proposal for directives on CHP, buildings, energy efficiency





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# ENERGY POLICY RESPONSE (3/3)

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## → Liberalisation

- Essential framework (Amended directive for Internal Markets for Electricity and Gas)
- Market forces
- Stressed at Barcelona Summit 2002
- Can have adverse effects
  - Notably on R&D spending, hampering long-term solutions

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# ENVIRONMENT POLICY CONTEXT

## Climate change

- **Johannesburg World Summit on Sustainable Development, with Russian announcement that they would ratify Kyoto.**
- **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.**
- **EU on good track so far, but still uncertain whether the -8% will be achieved domestically or through flexible mechanisms.**
- **Proposal for an EU Greenhouse Gas Trading Directive and registries.**
- **Proposal for a “linking” directive transferring CDM and JI credits into the EU GHG trading directive.**
- **European Climate Change Programme to identify most promising and cost-effective routes.**



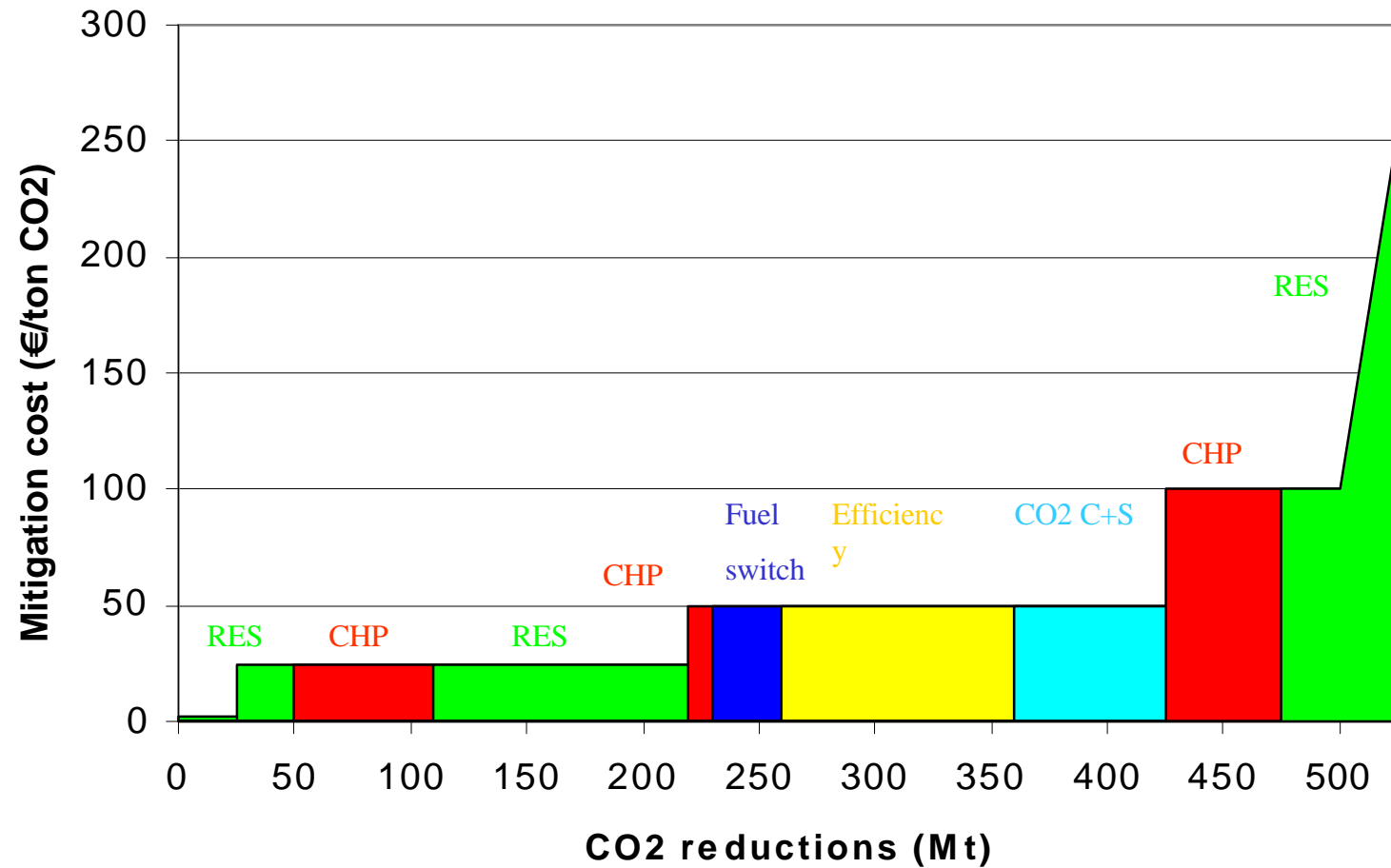


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# ENVIRONMENT POLICY CONTEXT

Cost-effectiveness (ECCP)





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# ENVIRONMENT 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**
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- **In economies in transition, even if the per capita emissions are still low, total emissions will become more and more significant.**



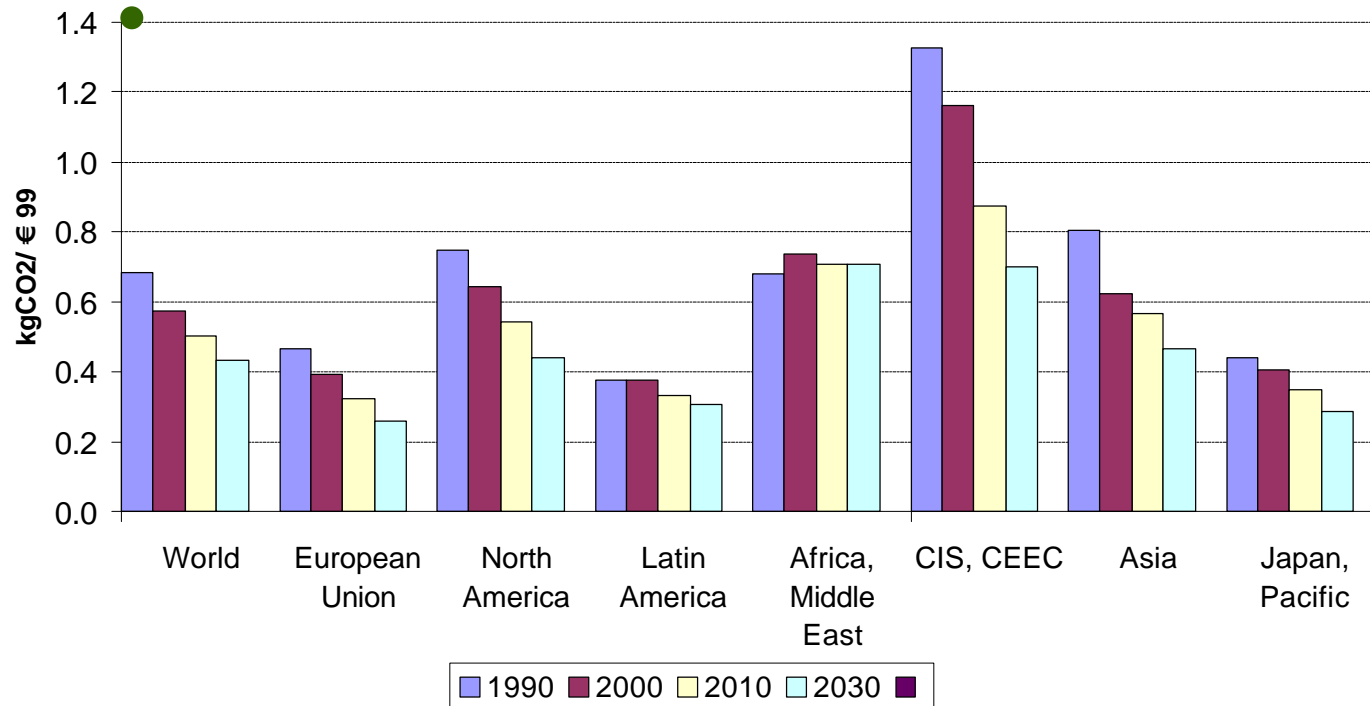


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# ENVIRONMENT POLICY CONTEXT

- Scenarios and Projections (source : WETO 2003)
- Carbon intensity of GDP





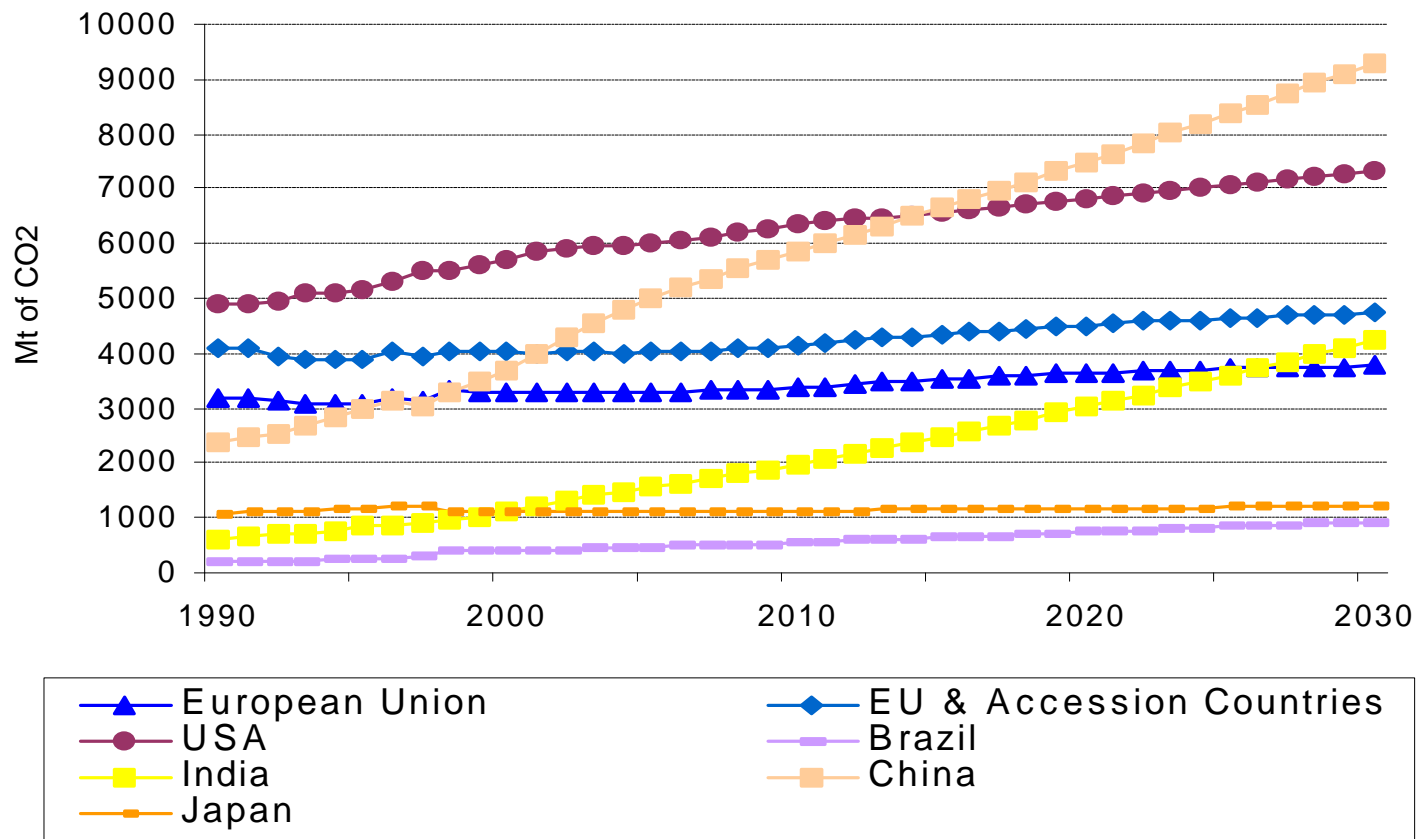
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# ENERGY OUTLOOK

(From World Energy Technology  
Outlook Reference Scenario 2030 -  
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## World Energy Related CO<sub>2</sub> Emissions





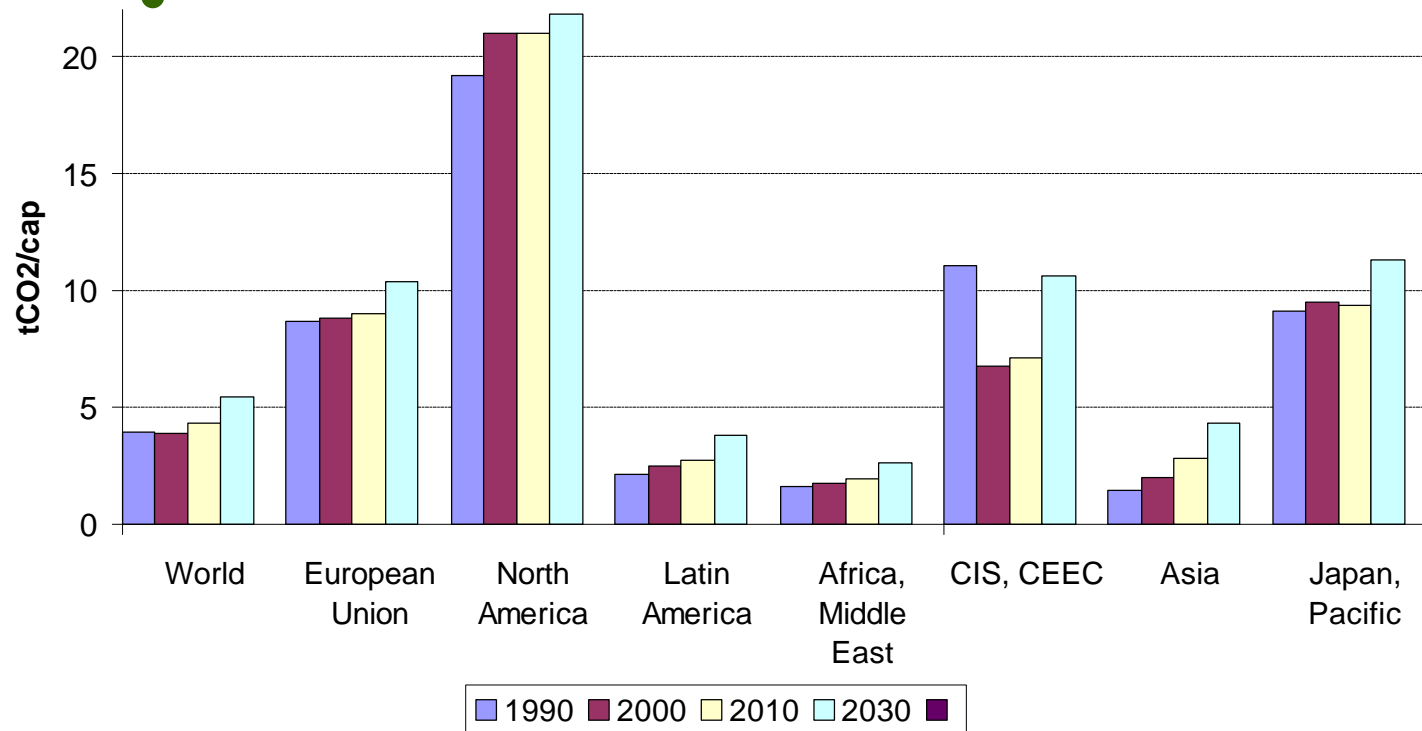


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# ENVIRONMENT POLICY CONTEXT

- Scenarios and Projections (source : WETO)
- CO<sub>2</sub> emissions per capita





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# RESEARCH POLICY (1/3)

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## → Analysis

- **Fragmentation of programmes and activities**  
**ERA. Lisbon, 2001**
- **Promising technologies not getting through fast enough into markets**  
**New patent policy**
- **Not enough RTD investment as fraction of GDP: EU 1.9%; US 2.6%; Japan 2.9 %,**  
**3% investment target; Barcelona 2002**





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# RESEARCH POLICY (2/3)

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## → ERA

- Avoid fragmentation and duplication
- Increase co-ordination of policies, programmes and activities (open method)
- Structuring and integrating EU research
- Framework Programme: Main instrument for ERA





# RESEARCH POLICY (3/3)

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## → Barcelona European Council - March 2002

Overall spending on R&D should be increased with the aim of approaching 3% of GDP by 2010; two-thirds of this new investment should come from the private sector

## → Action Plan (2003)

European open co-ordination process: coherence of Member states policies and actions

Technology Platforms: stakeholder vision, common strategic research agenda and deployment strategy

Enabling all regions to benefit from investment in research

Designing a coherent mix of policy instruments: a favourable set of framework conditions

Improving support to research and innovation: attract best human resources, enhance links public and private research, optimise mix of public financing instruments

Re-directing public spending towards research and innovation





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# TOWARDS A SUSTAINABLE ENERGY SUPPLY

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## Drivers

- **Kyoto: Reduction of EU Green House Gases by 8% in 2008- 2012 c.f. 1990 levels, and much stronger GHG reductions beyond the Kyoto deadlines;**
- **Pollution abatement;**
- **Security of supply.**

## Short and medium term

- **Fossil fuels still have many years to go (CO2 sequestration);**
- **RES need support for market penetration (Demonstration projects)**
- **RUE and non technical measures to save energy.**

## Long term objectives

- **An EU energy supply based much more on renewable energies and fuel cells with hydrogen and electricity as prominent energy carriers, in 20-30 years.**





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# SUSTAINABLE ENERGY SYSTEMS IN FP6

Part of Sustainable Development,  
Global Change and Ecosystems (1/2)

- **Together with sustainable transport and environment**
- **Short term actions (405 M€)**
  - **Clean energy, in particular RES and their integration, including storage, distribution and use**
  - **Energy savings and efficiency, especially in buildings**
  - **Alternative motor fuels**





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# SUSTAINABLE ENERGY SYSTEMS IN FP6

Part of Sustainable Development,  
Global Change and Ecosystems (2/2)

- **Long term actions (405 M€)**
  - Fuel cells, including their applications
  - New technologies for energy carriers, in particular H<sub>2</sub>
  - New and advanced concepts in renewable energy technologies
  - Capture and sequestration of CO<sub>2</sub> associated with cleaner fossil fuel plants





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# RESEARCH FOR ENERGY UNDER THE EURATOM TREATY

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## Nuclear Fission (190 M€)

Waste management research needed

RTD on new generation of reactors for post 2020

## Nuclear Fusion (750 M€)

The next step: from JET to ITER







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# CONCLUSIONS

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## Energy needed for development

Facing new challenges

Must be sustainable

Must ensure smooth transition to sustainability

## Research

Insufficient, fragmented, not delivering

Solution is ERA and increase public and private investment

## Energy Research

Required to help deliver the smooth transition to sustainability

