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Scenarios and R&D priorities in the 7th Framework Programme

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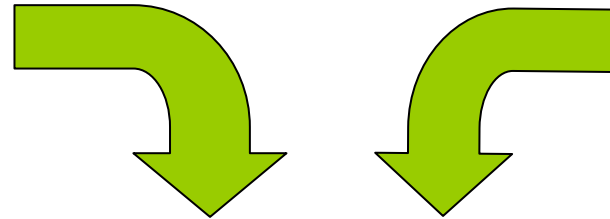
- European Union « Energy Package »
- Quantitative and qualitative tools
- EU scenarios up to 2030
- Energy technology scenario up to 2050
- Very long term (2100) energy issues
- EU energy R&D priorities (FP7)
- EU strategic energy technology plan (SET-Plan)
- Conclusions



INTEGRATING ENERGY & ENVIRONMENT

Energy Policy for Europe
(Strategic Energy Review)

Limiting Global Climate
Change to 2°C



STRATEGIC OBJECTIVE

A unilateral **EU** independent commitment of
at least **20%** GHG emission reduction by
2020, compared to 1990 levels
And a **30%** reduction if broader participation



Energy for a Changing World



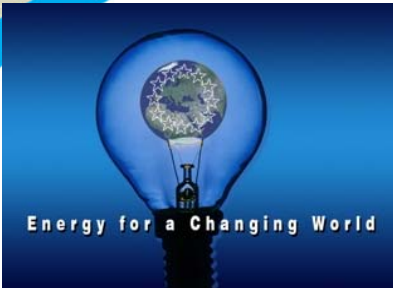
growth and jobs
working together for Europe's future



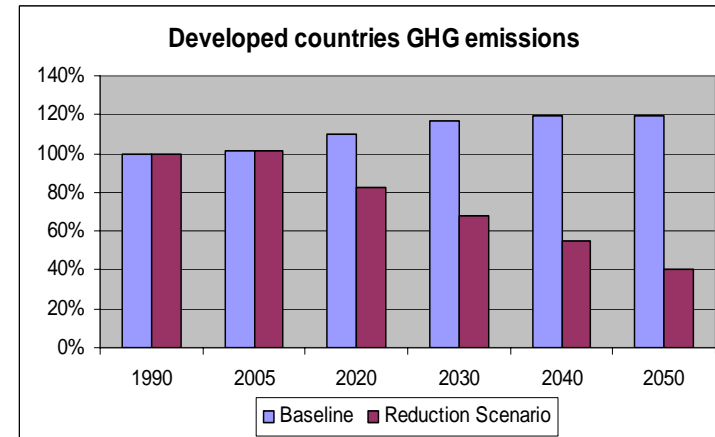
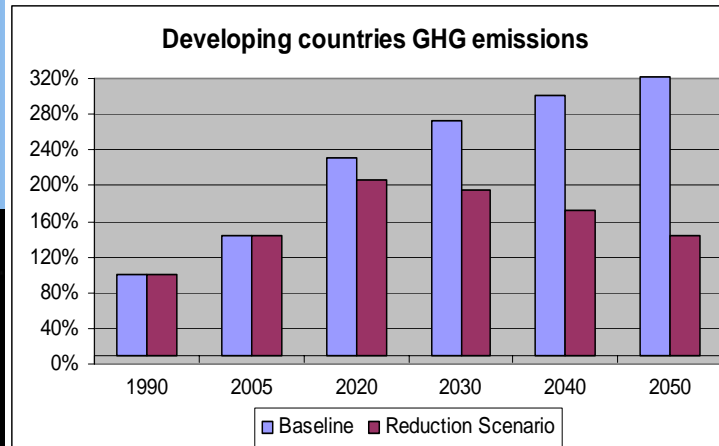
YOU CONTROL
CLIMATE CHANGE.



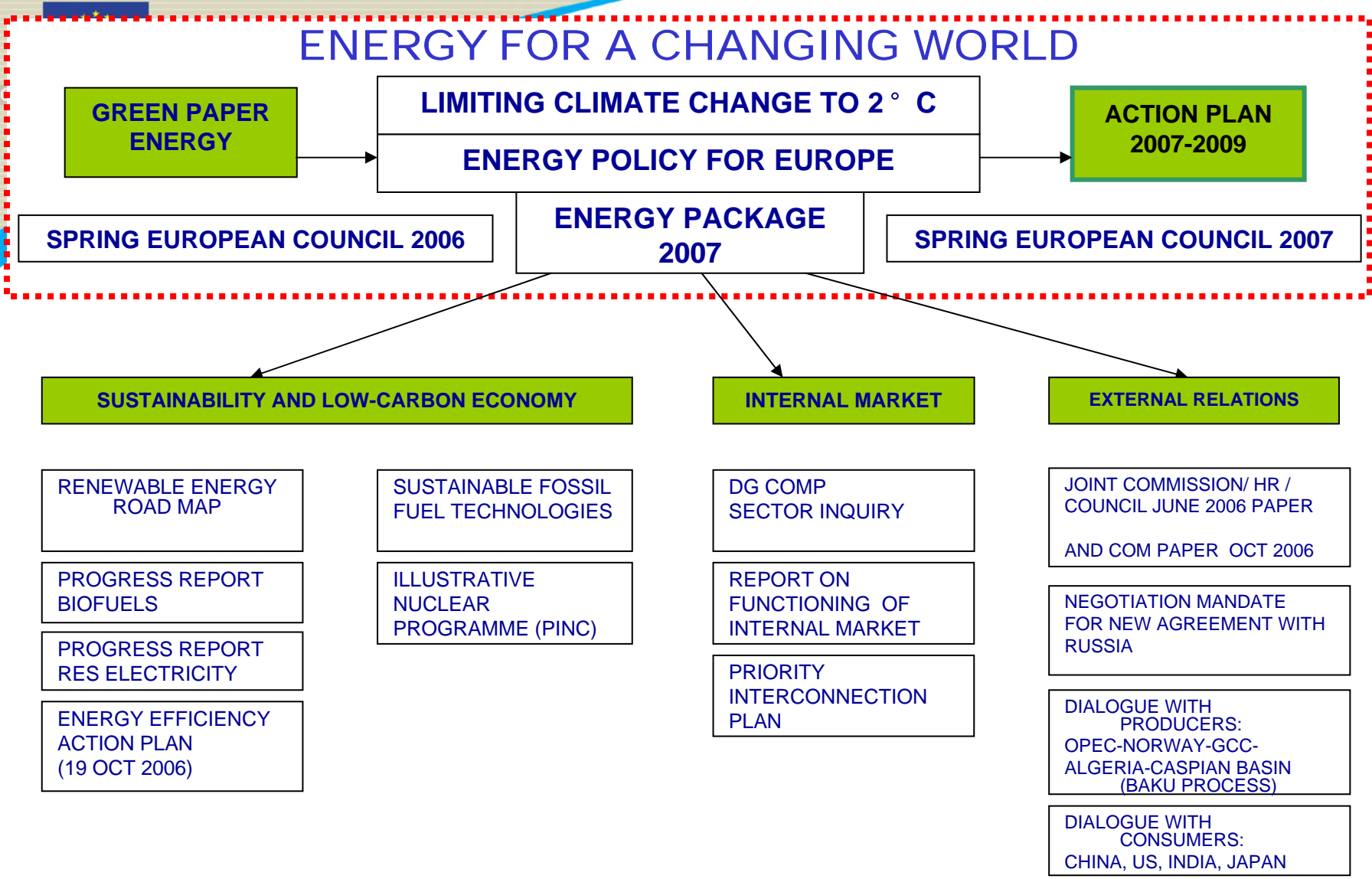
THE STRATEGIC OBJECTIVE



- At EU level at least **20%** GHG emission reduction by 2020, compared to 1990 levels
- For negotiations with developed countries: **30%** GHG emission reduction target by 2020, compared to 1990 levels
- Developing countries: Decoupling emissions and growth *asap*, absolute reductions after 2020
- Deforestation: halt within two decades and then reverse



ENERGY FOR A CHANGING WORLD



THE R&D 7TH FRAMEWORK PROGRAMME → **STRATEGIC ENERGY TECHNOLOGY PLAN (2007)**



THE KEY DRIVERS 3x20% by 2020

**20% by 2020
EFFICIENCY**

By 2020 20% EU GHG

By 2020 20% RENEWABLES

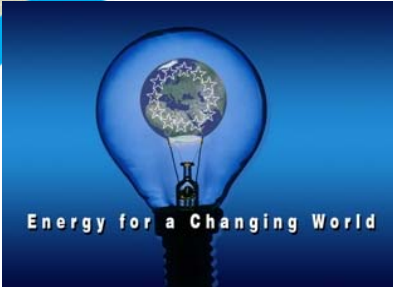
BIO-FUELS

**10 % 2020
binding**

E-ELECTRICITY

HEATING & COOLING

NATIONAL TARGETS and ACTION PLANS





Quantitative Tools

- **World energy model: POLES**
- **European energy model: PRIMES**
- **European general equilibrium model: GEM-E3**
- **European econometric model: NEMESIS**
- **World and European optimization model: MARKAL (ETSAP)**
- **Analytical framework for RES: SAFIRE / GREEN-X**
- **Back-casting approach: VLEEM**
- **External costs accounting system: EXTERNE**



Qualitative Tools

- **Delphi method for energy technologies (2030)**
- **Public opinion perception (Eurobarometer)**
- **Energy technology indicators**
- **Participatory methods**
- **Experts networks (e.g. HLG-competitiveness, Energy Environment, AGE)**



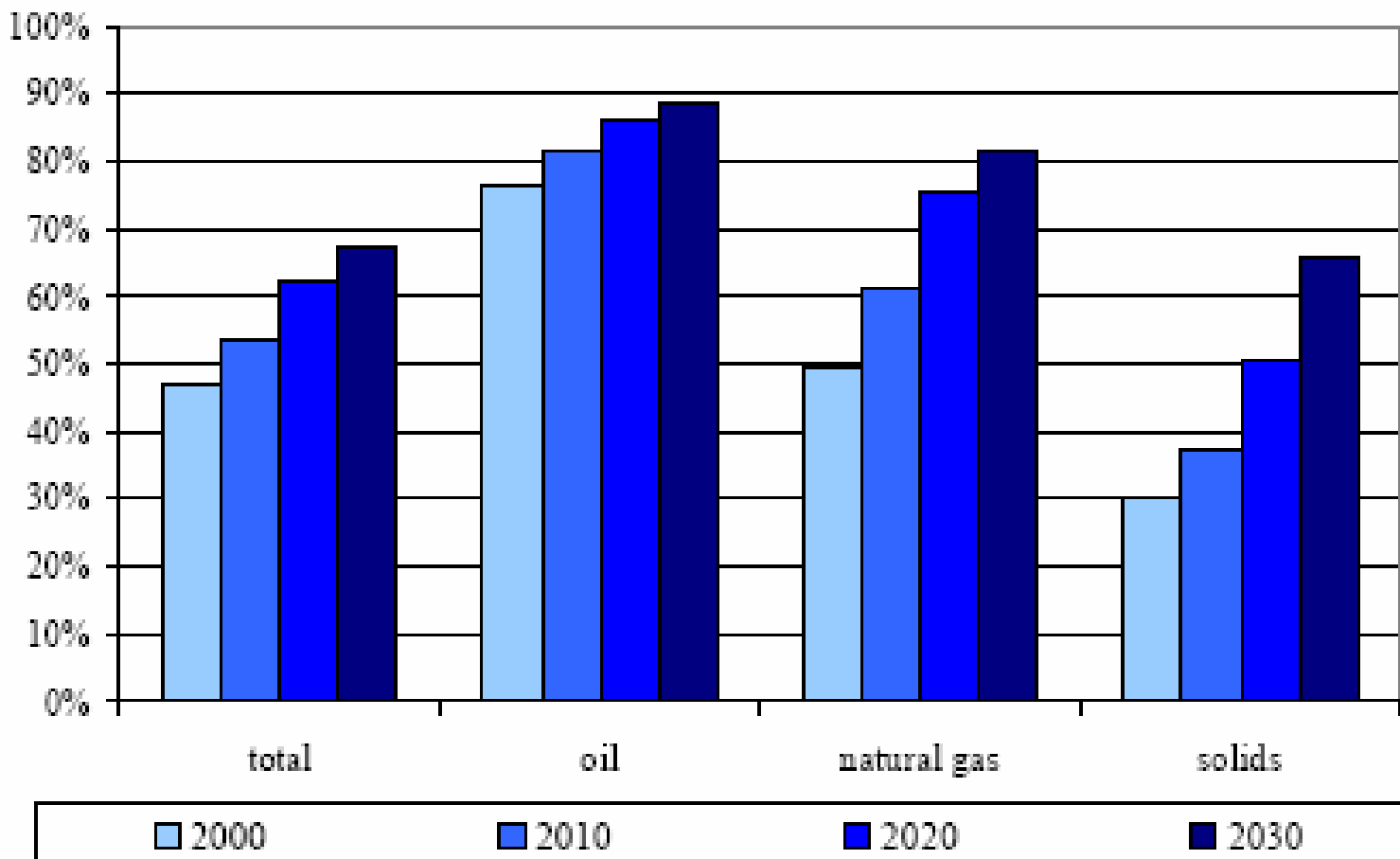
EU scenario up to 2030 Baseline

- Use of **electricity** grows twice faster than average. Over the next 30 years, 500-600 GW of new power plants - essentially gas fuelled - need to be built to reach a capacity almost double than today
- **Petroleum** becomes a product only for specific use in two sectors: transport and chemicals
- **Gas** becomes the strategic fuel: in 2030 the EU needs 50% more gas per year than today
- **Renewables** grow fast but do not exceed 9% of primary energy needs of the EU-25 in the baseline (today 6.5%). EU targets need strong policies
- Use of **solid** fuels is stable, but increases after 2020 as a result of nuclear decommissioning



EU scenario up to 2030

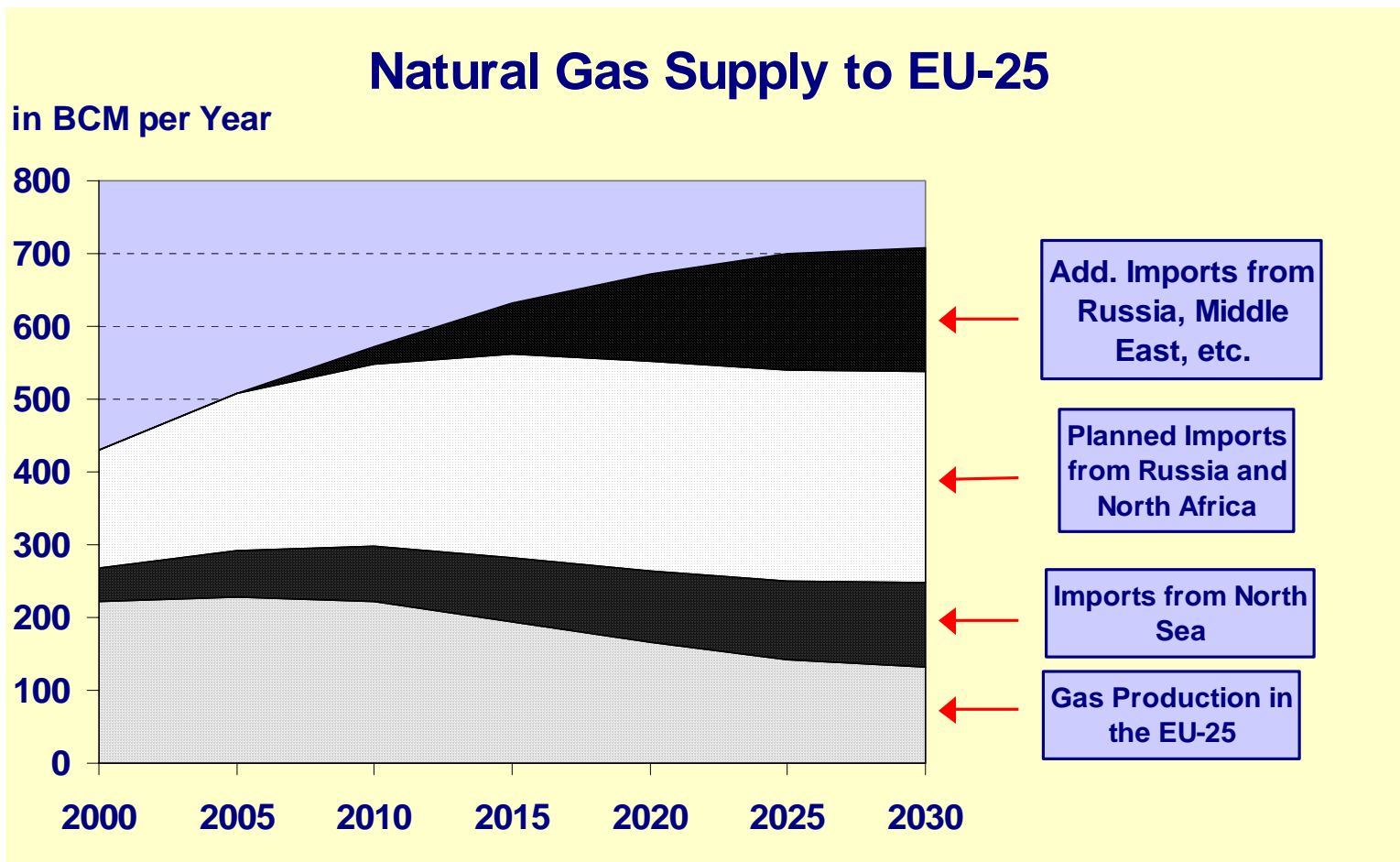
Energy imports





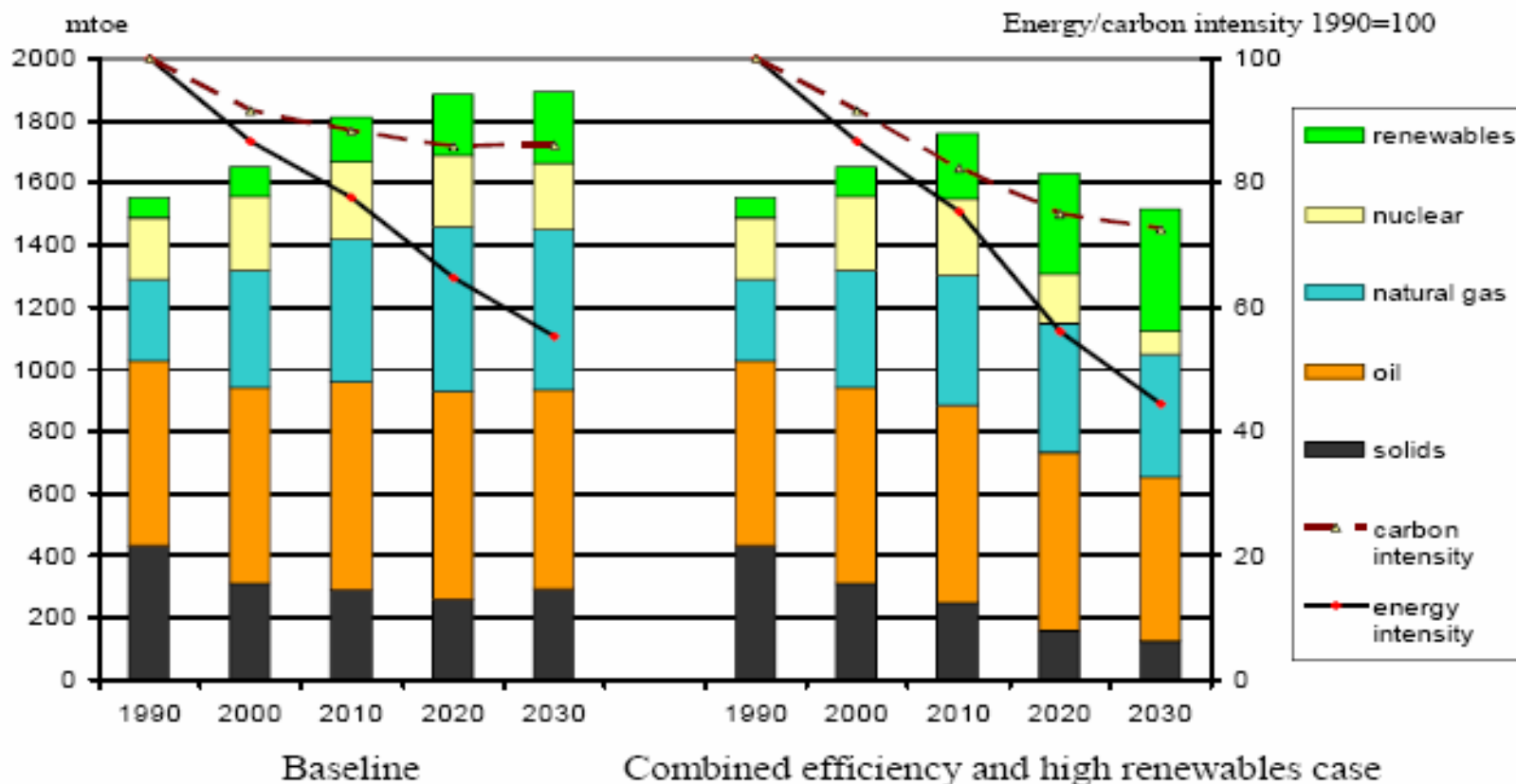
EU scenario up to 2030

Gas supply to the EU





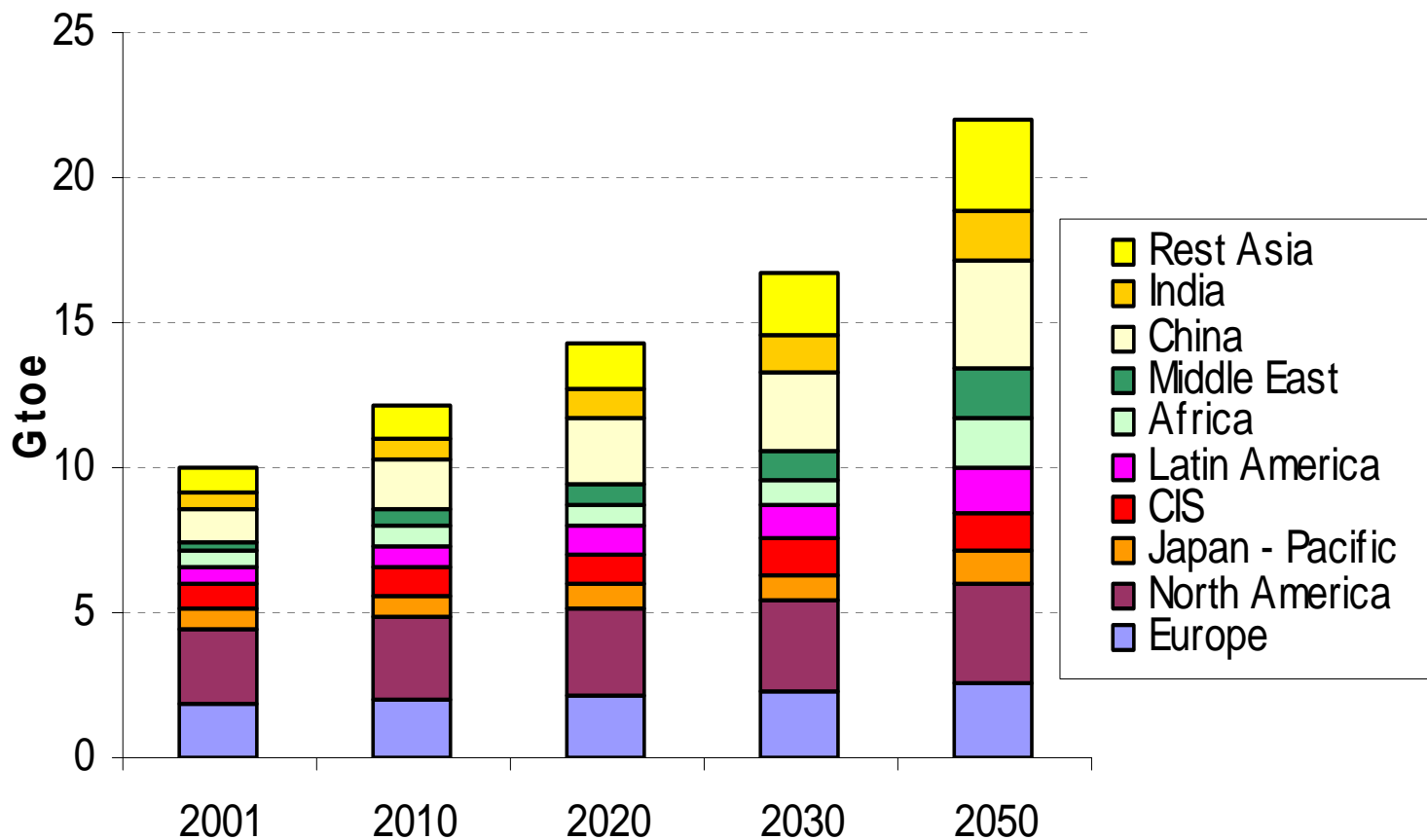
ALTERNATIVE SCENARIO to 2030 TPES by fuel + energy and carbon intensities: EU-25 -Combined efficiency and high renewables case vs Baseline



Source: NTUA



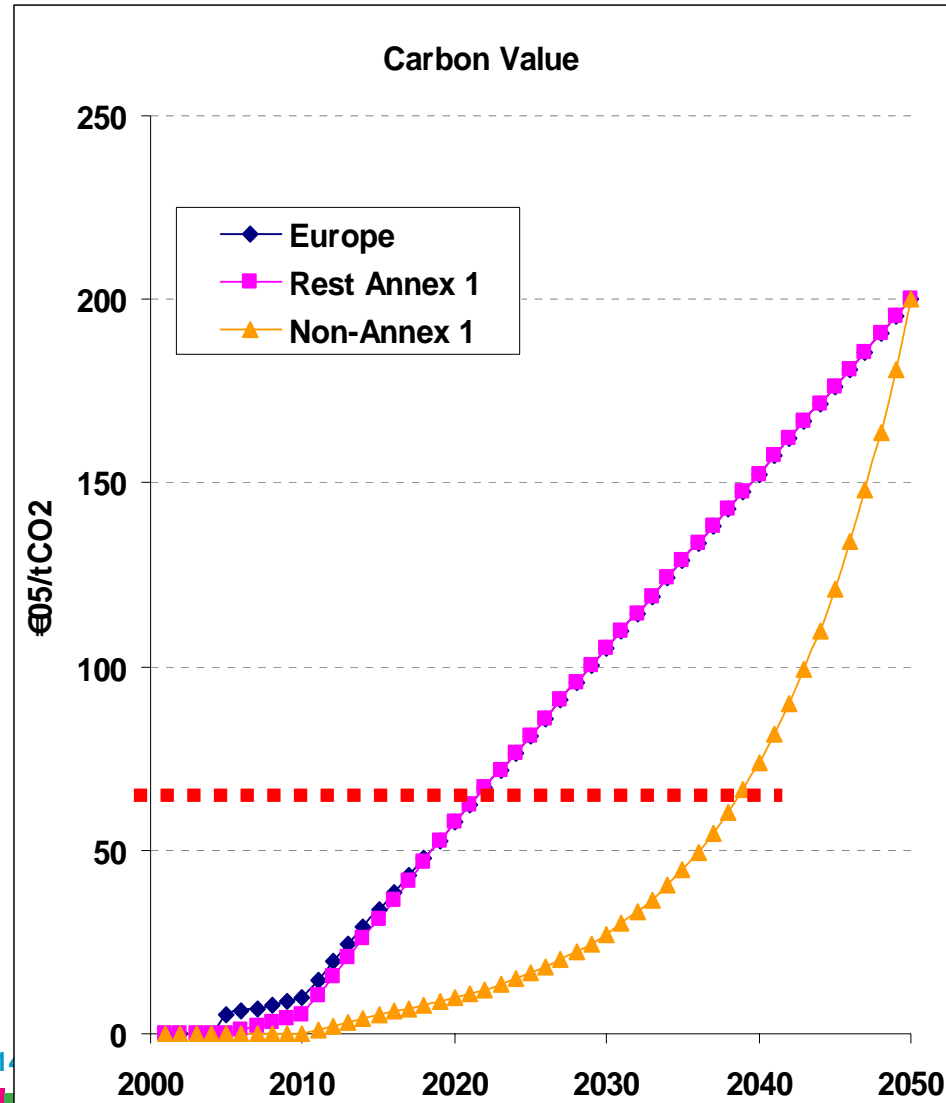
Scenario up to 2050 Global energy demand





Scenario up to 2050 Carbon Constraint Case

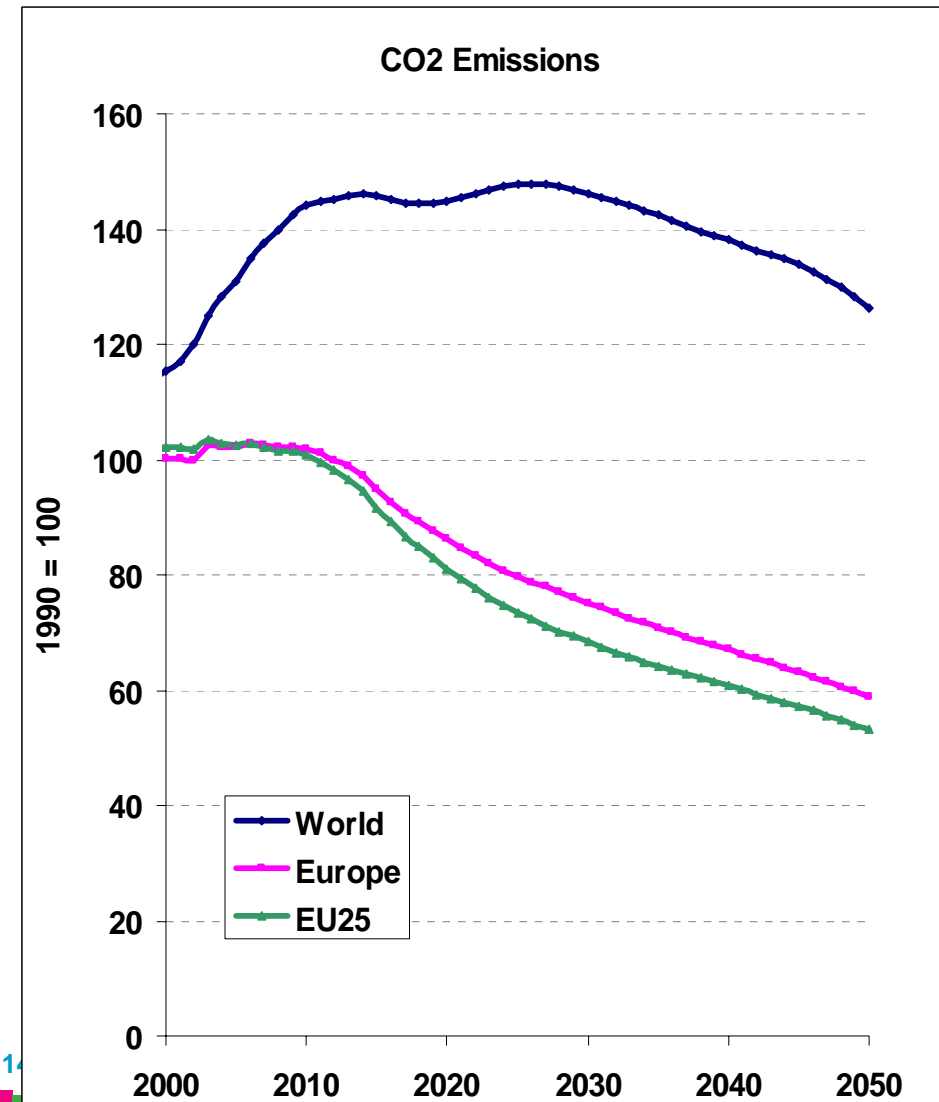
- The CCC recognises that Annex 1 countries, while having a greater historic responsibility, also have more capacities to act rapidly in order to reduce emissions
- It has thus been supposed that, in Annex 1 countries, “early action” is taken, with rapidly (and linearly) increasing Carbon Values, up to 200 €/tCO₂ in 2050
- While more delay is given to Non-Annex 1 countries, with a Carbon Value that catches up with that of Annex 1 only in 2050





Scenario up to 2050 CCC - CO₂ emissions

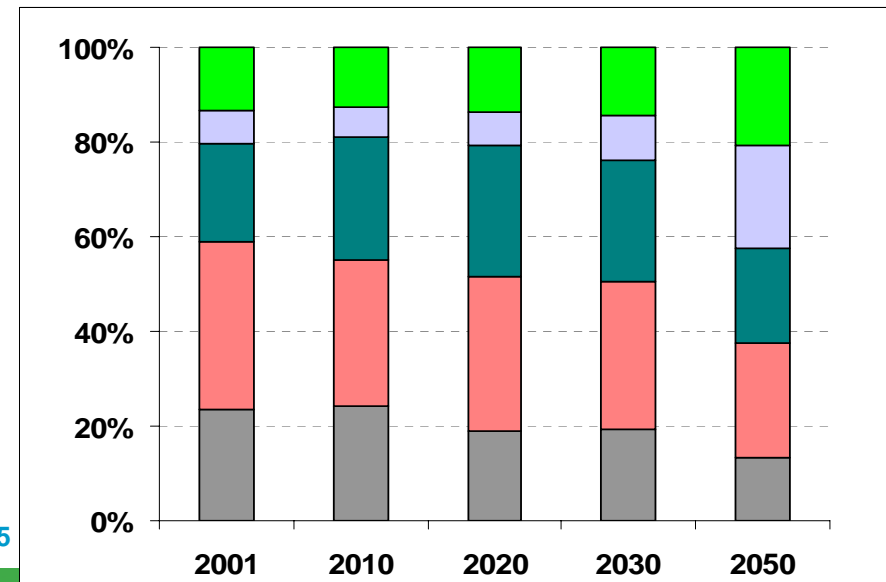
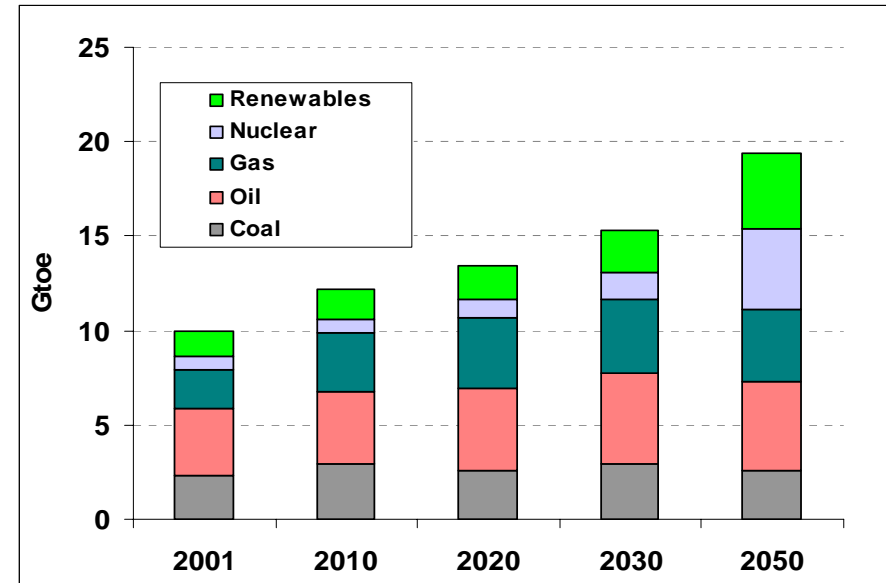
- Total emissions are almost stabilised between 2015 and 2030 and decrease to a 2050 level of +25% compared to 1990
- This two-stages process corresponds to the crossing of a 25 €/tCO₂ threshold:
 - just before 2015 for Annex 1
 - and 2030 for Non-Annex 1
- For EU25, emissions are reduced by a Factor of 2 in 2050 from 1990 level, i.e. reductions represent 10% of 1990 level every decade after 2020





Scenario up to 2050 CCC – World energy consumption

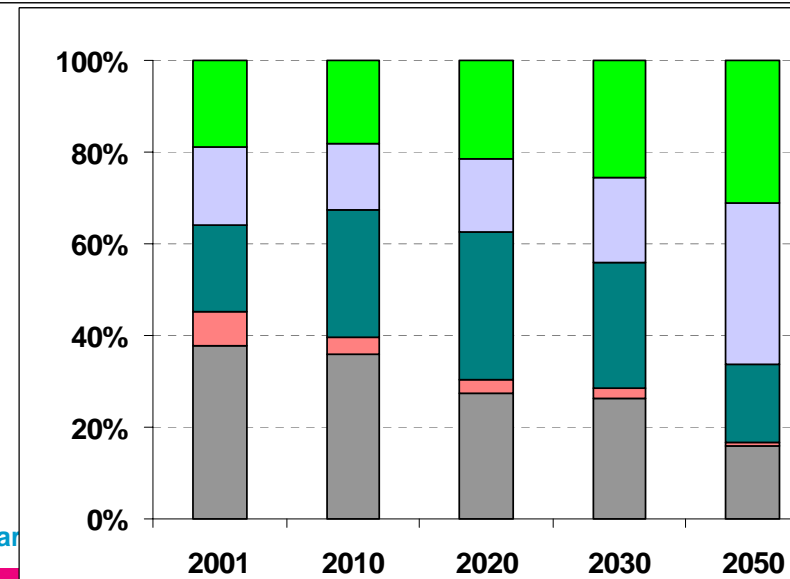
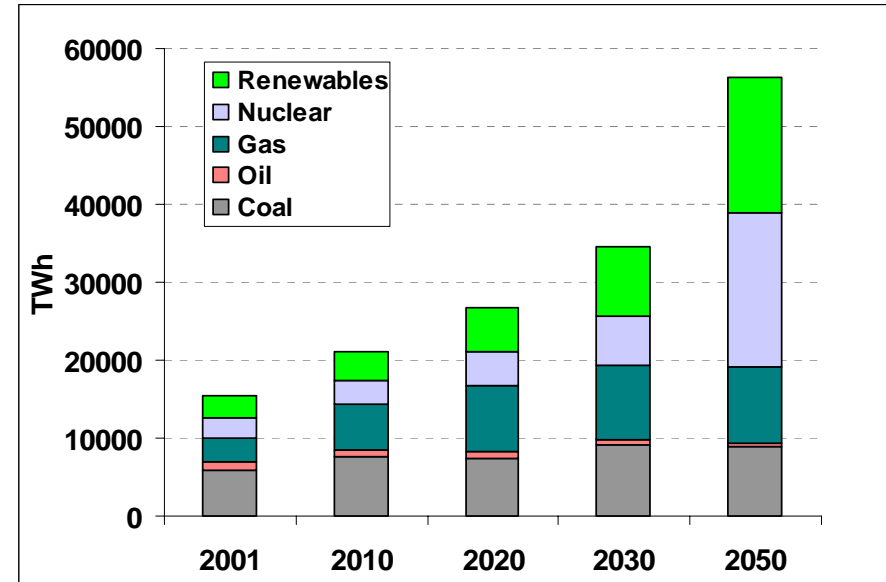
- World 2050 primary energy consumption decreases from 22 Gtoe in the REF to 19 Gtoe
- Due to early action in Annex 1, the primary fuel mix changes quite rapidly after 2010
- The structure of world primary fuel-mix is significantly altered in 2050, with Renewables and Nuclear each representing more than 20 % of primary energy





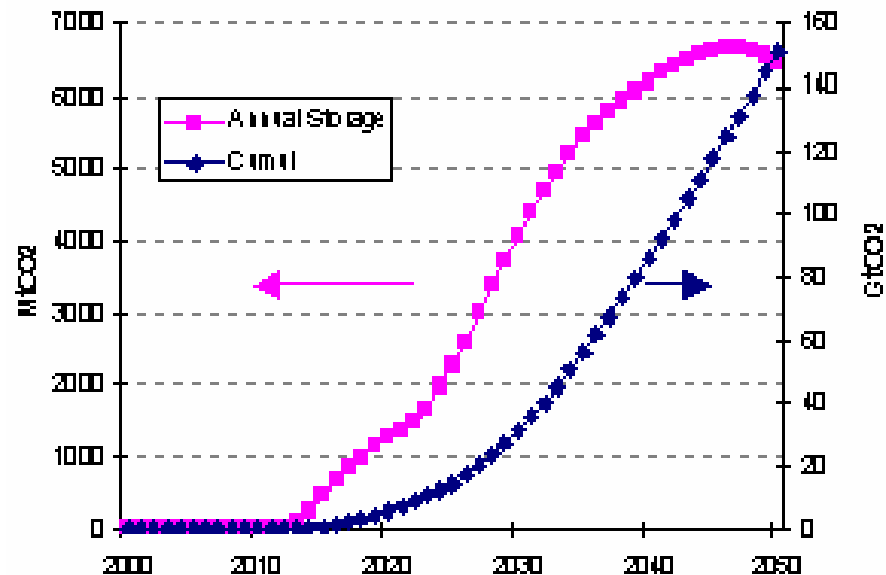
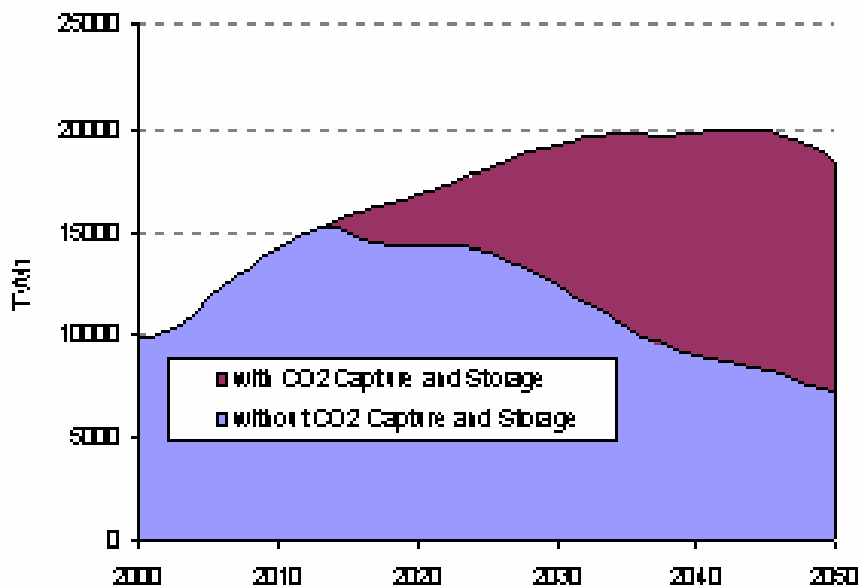
Scenario up to 2050 CCC - World electricity

- Total electricity consumption is only 10 % down from the Reference as this increasingly low carbon energy-carrier substitutes to others
- In 2050, renewable sources represent 30 % of total production and nuclear electricity nearly 40 %, as its revival is relatively quick in Annex 1 countries



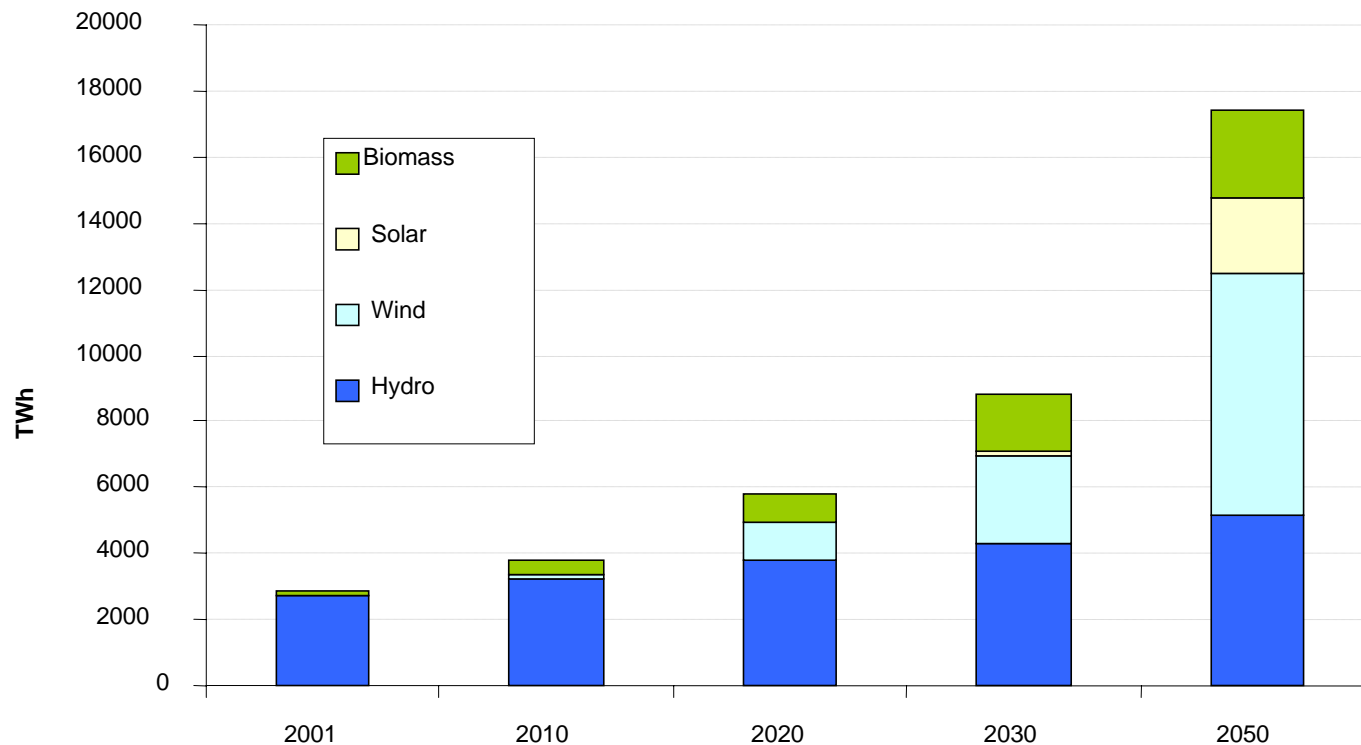


Scenario up to 2050 CCC – Development of CCS



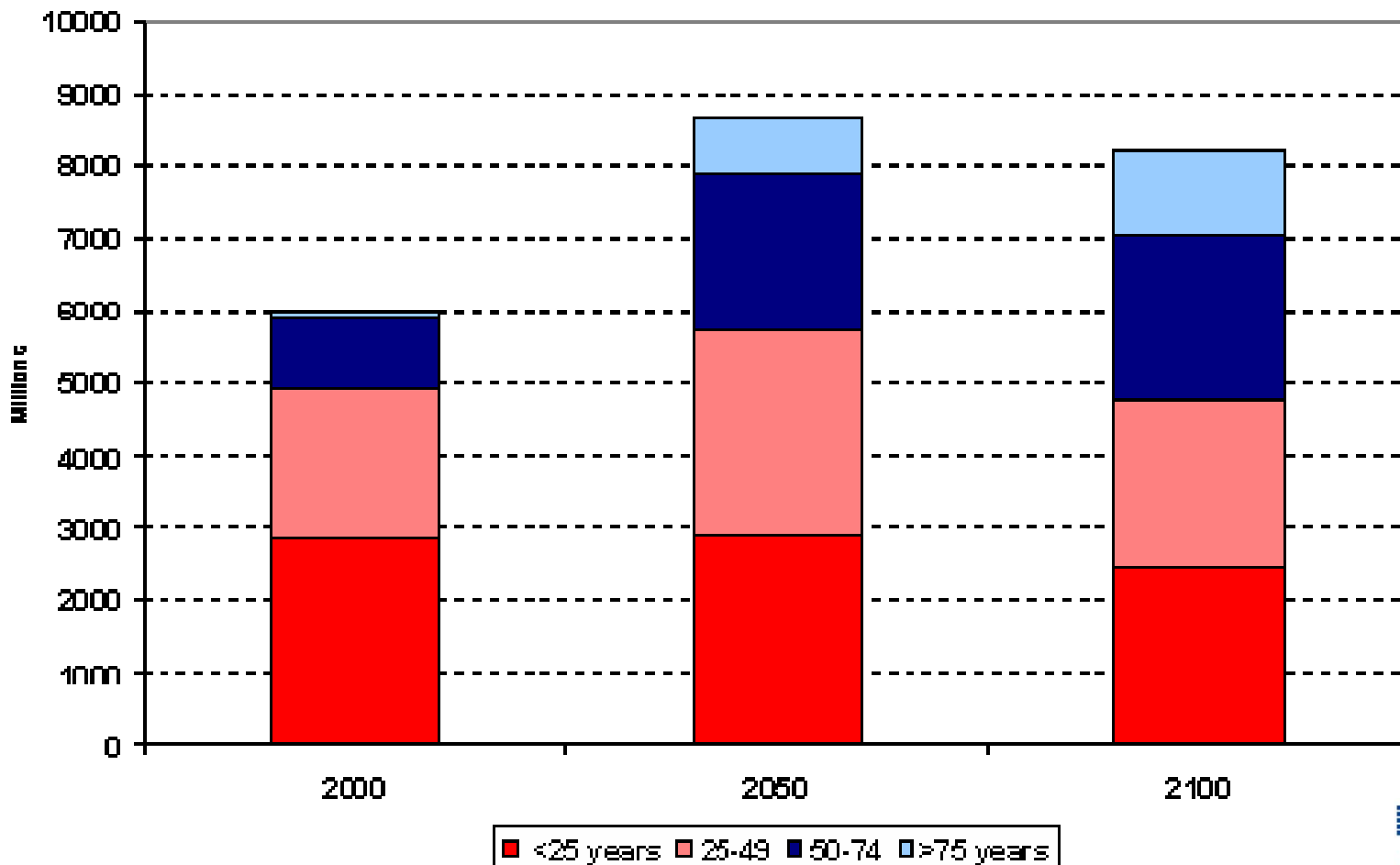


Scenario up to 2050 CCC – Development of RES



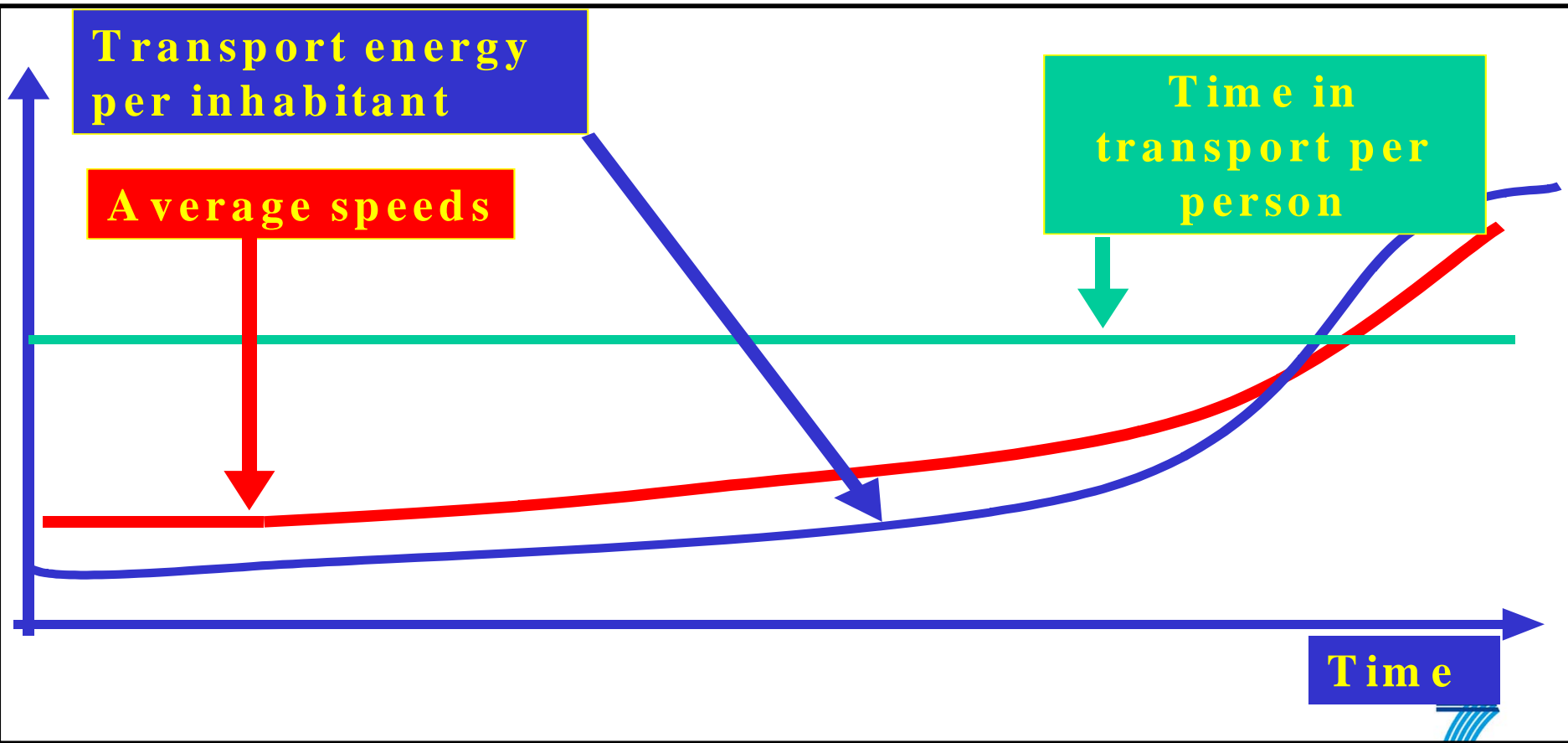


Very long-term issues Ageing population



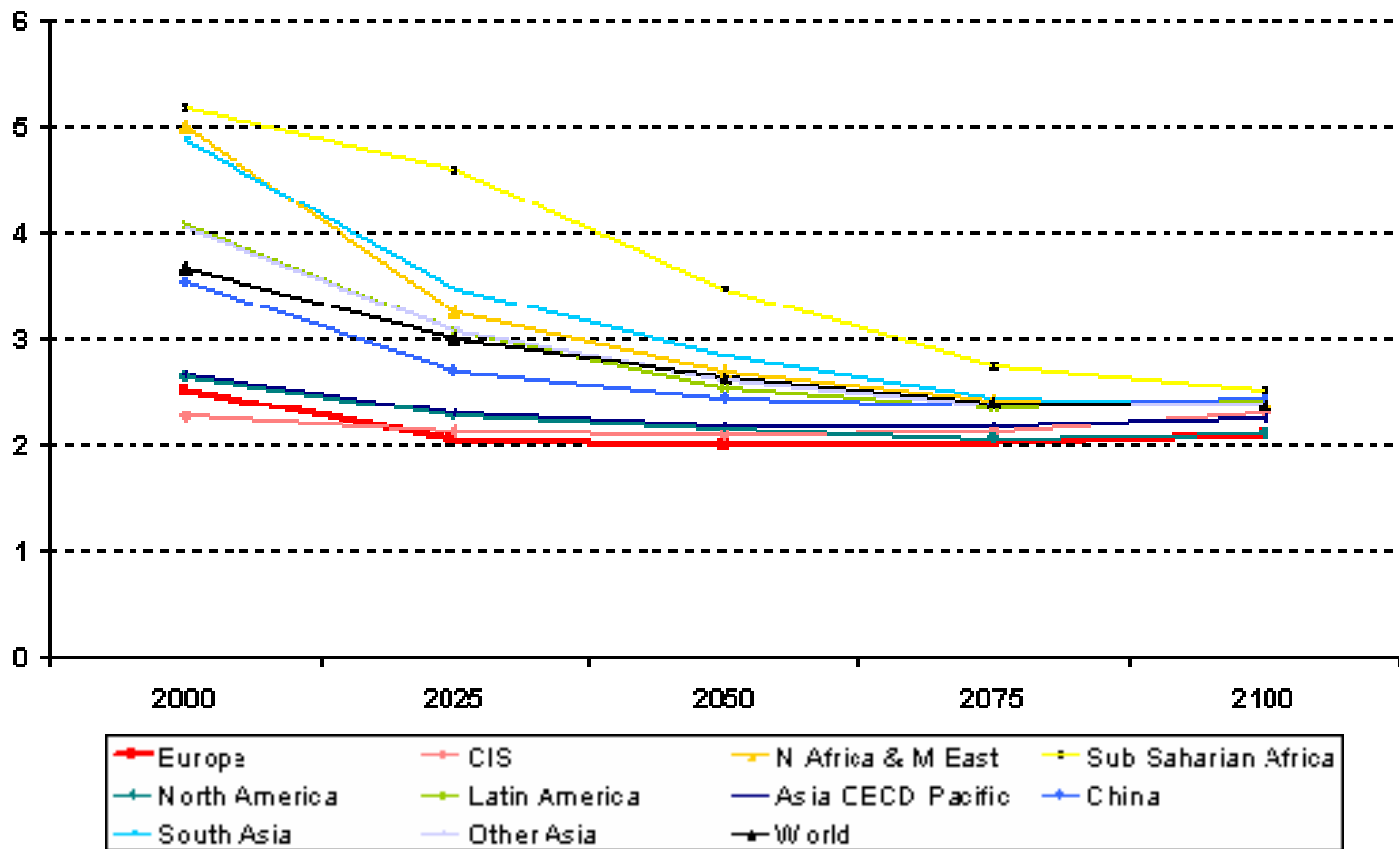


Very long-term issues Transport





Very long-term energy Persons per household





EU Energy R&D priorities FP7 Practical aspects

- **In total, EU energy research, demonstration and dissemination account for ~€ 1 billion per year relatively well shared between nuclear and non nuclear energy research**
- **The first calls (Non-Nuclear) (FP7-ENERGY-2007-1-RTD and FP7-ENERGY-2007-2-TREN) have been published the 22 December 2006 and the deadline is the 3 May 2007 (about 280M€)**



EU Energy R&D priorities Energy Theme

Hydrogen and fuel cells

**CO2 capture and storage
technologies for zero
emission power generation**

**Renewable
electricity
generation**

**Clean coal
technologies**

**Renewable
fuel production**

**Smart energy
networks**

**Renewables
for heating and cooling**

**Energy savings
and energy efficiency**

Knowledge for energy policy making



EU Energy R&D priorities

Euratom: Nuclear energy

- **Fission**

- Management of radioactive waste
- Reactor systems
- Radiation protection
- Support for and access to research infrastructures
- Human resources and training including mobility

- **Fusion**

- The realisation of ITER
- R&D in preparation of ITER operation
- Technology activities in preparation of DEMO
- R&D activities for the longer term
- Human resources, education and training
- Infrastructures
- Responding to emerging and unforeseen policy needs



EU Strategic Energy Technology SET-Plan

- **'Business as usual' is not an option**
 - Current trends and their projections show that we are not doing enough, by 2030
 - CO2 – 5% increase in the EU and 55% globally
 - SES – from 50% to 65% dependence
- **Structural weaknesses in the energy innovation system**
 - Long lead times
 - Locked-in infrastructure investment
 - Market failure ('Stern Report')
 - Dominant actors and network connection challenges
 - Scattered and un-coordinated market incentives (e.g. innovation programmes)
 - Reduction of Energy research funds (OCDE Report – «halved since the 80's»)
 - Scattered, fragmented and sub-critical capacities
 - Strong international competition and weak cooperation



EU Strategic Energy Technology SET-Plan

- **Essence of SET-Plan: matching technologies with instruments and proposing the optimal scale – «*different horses for different courses*»**
- **Reinforced and more coherent institutional framework**
- **Starting point: a shared vision**
- **Ambitious objectives but realistic resources**
- **Strategic element: identifying technologies for which the EU needs result oriented action**
- **Result oriented actions: coalitions or partnerships; precise and measurable objectives; risk sharing; leveraging resources (new investment)**
- **Synergies with international partners**



EU Strategic Energy Technology SET-Plan

Priorities of such targeted actions could e.g. include:

- More **energy efficient** buildings, appliances, equipment, industrial processes and transport systems
- Developing biofuels, in particular **second generation biofuels**, to become fully competitive alternatives to hydrocarbons
- Getting large scale **offshore wind** competitive within the short term and paving the way towards a competitive European offshore super-grid
- Getting **photovoltaic** electricity competitive to harness solar energy
- Using fuel cell and **hydrogen** technologies to exploit their benefits in decentralised generation and transport
- **Sustainable coal and gas technologies**, particularly carbon capture and storage
- The EU should maintain its technological lead in **fourth generation fission nuclear reactors and future fusion technology** to boost the competitiveness, safety and security of nuclear electricity, as well as reduce the level of waste



- **Consultation phase (Spring 2007)**
 - Public consultation through the web
 - Consultation with experts groups – Hearings with Technology Platforms, and specific workshops
- **Analysis (Spring and Summer 2007)**
 - Technology and capacities map
 - SWOT analysis of the energy innovation system
 - Criteria to define the optimal type and level of action
 - Impact assessment



Drafting SET-Plan (Autumn 2007)

- **Possible elements for developing SET-Plan:**
 - A European vision
 - Specific result-oriented actions and generic actions
 - Strengthened and more coherent institutional framework
 - Financing and investing
 - International cooperation
 - Monitoring and review system for SET-Plan
- **SET-Plan Communication (November 2007)**
- **Endorsement by the European Council (Spring 2008)**
- **Implementation (2008-onwards)**



Conclusions

- **Doubling of energy demand and greenhouse gas emissions by 2030**
- **Fossil fuels \cong 80-90 % of supply in the next 25 years**
- **Rising prices of oil and gas**
- **Questions about nuclear for both the short (fission) and long-term (fusion)**
- **Role of sustainable coal (« clean » and CCS)**
- **Modesty and ambition on renewables**
- **More and more electricity**
- **Energy technology and energy efficiency: vital role to play (SET-Plan)**



Thank you for
your attention
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