

GHG MITIGATION TARGET BY 2020: WHAT INTERNATIONAL COORDINATION?

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Environmental concerns for post-Kyoto

2

Great expectation for an international agreement at the upcoming Copenhagen Climate Change Conference...

- Increased scientific evidences in the past couple of years for the climate change debate
- The end of the two-year negotiation process set by the Bali conference in 2007
- No agreement currently in place, except for European Union
- Greener positions expressed by the new US administration

... But, the deal is far from being sealed.

- The US medium term commitments
- The fast growing transition countries commitments

So, one rule of the Copenhagen game seems to be:
« *what involvement is acceptable from others to define our own commitment level?* »

- ▶ EU is waiting for signs from other developed countries
- ▶ US is waiting for positive signs from China

⇒ The aim of this analysis is to **discuss the outcomes of different coordination schemes for intermediate mitigation targets**

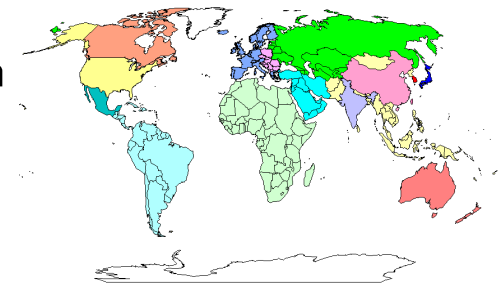
- ⇒ Through scenario analysis based on the ETSAP-TIAM model covering the period 2000-2050 and assesses for different scenarios:
 - ⇒ Evolution of primary energy consumption
 - ⇒ Regional emission levels
 - ⇒ Costs of the climate policy

Methods: the global ETSAP-TIAM

4

A technology-rich bottom-up energy system model

- The Reference Energy System (RES) concept
- A linear programming model
 - ▣ Minimisation of the total discounted energy system cost
 - ▣ Structure of the energy system
- A time horizon from 2000 to 2100
- A geographically integrated model
 - ▣ 15 world regions with OPEC and non-OPEC sub-division
 - ▣ Regions linked by energy, material, and emission permit trading variables
- An integrated Climate Module

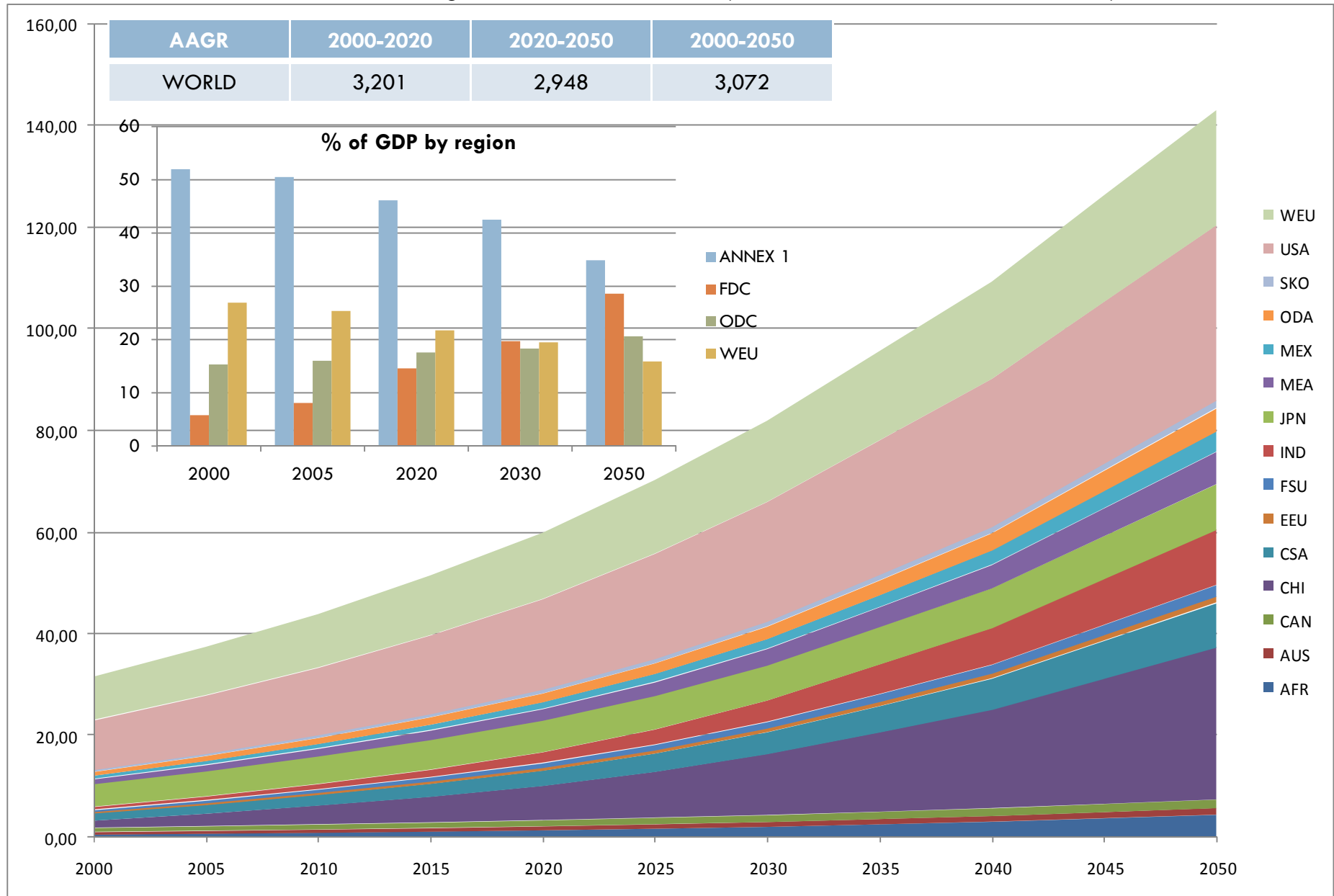


The general assumptions

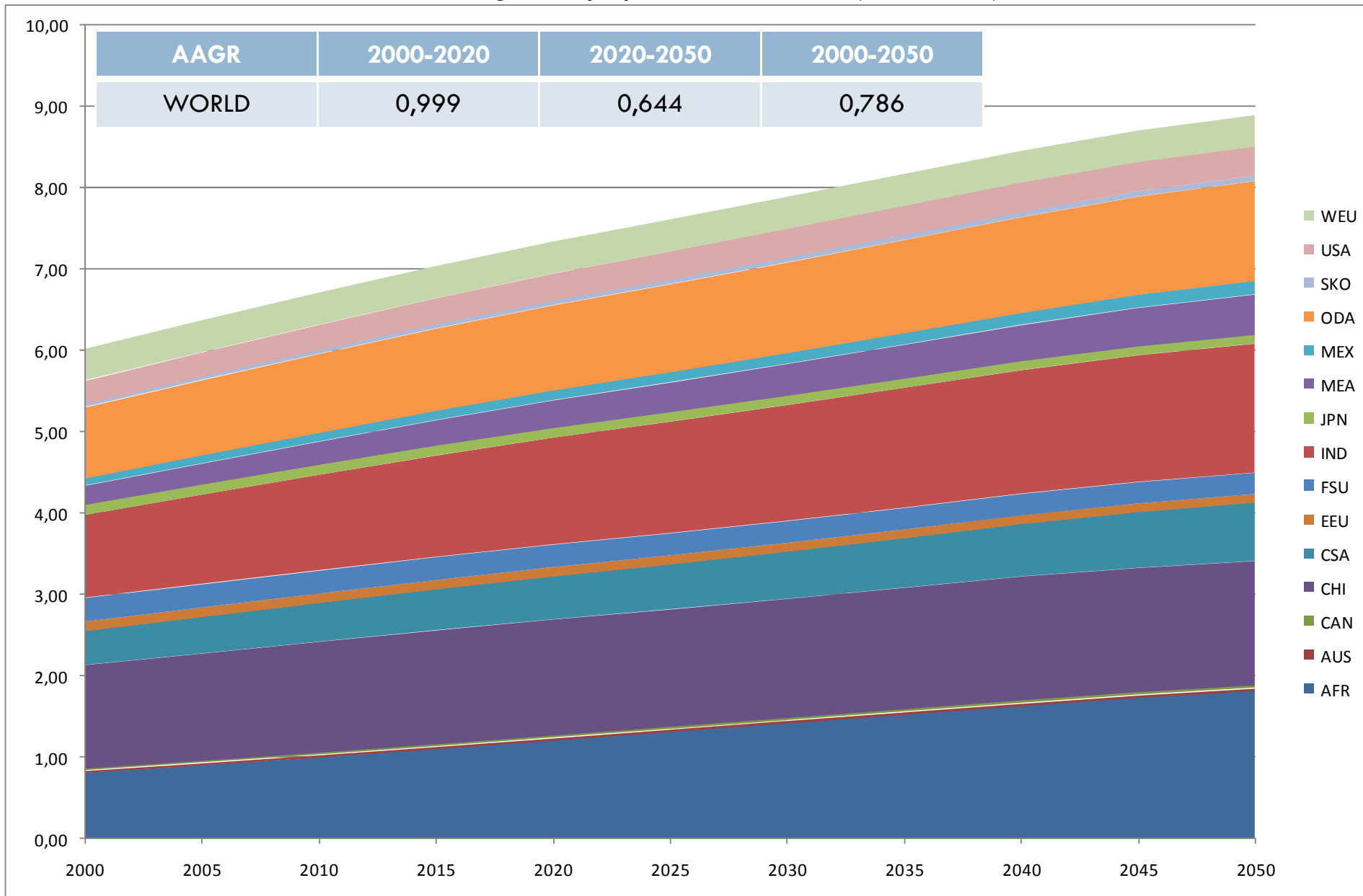
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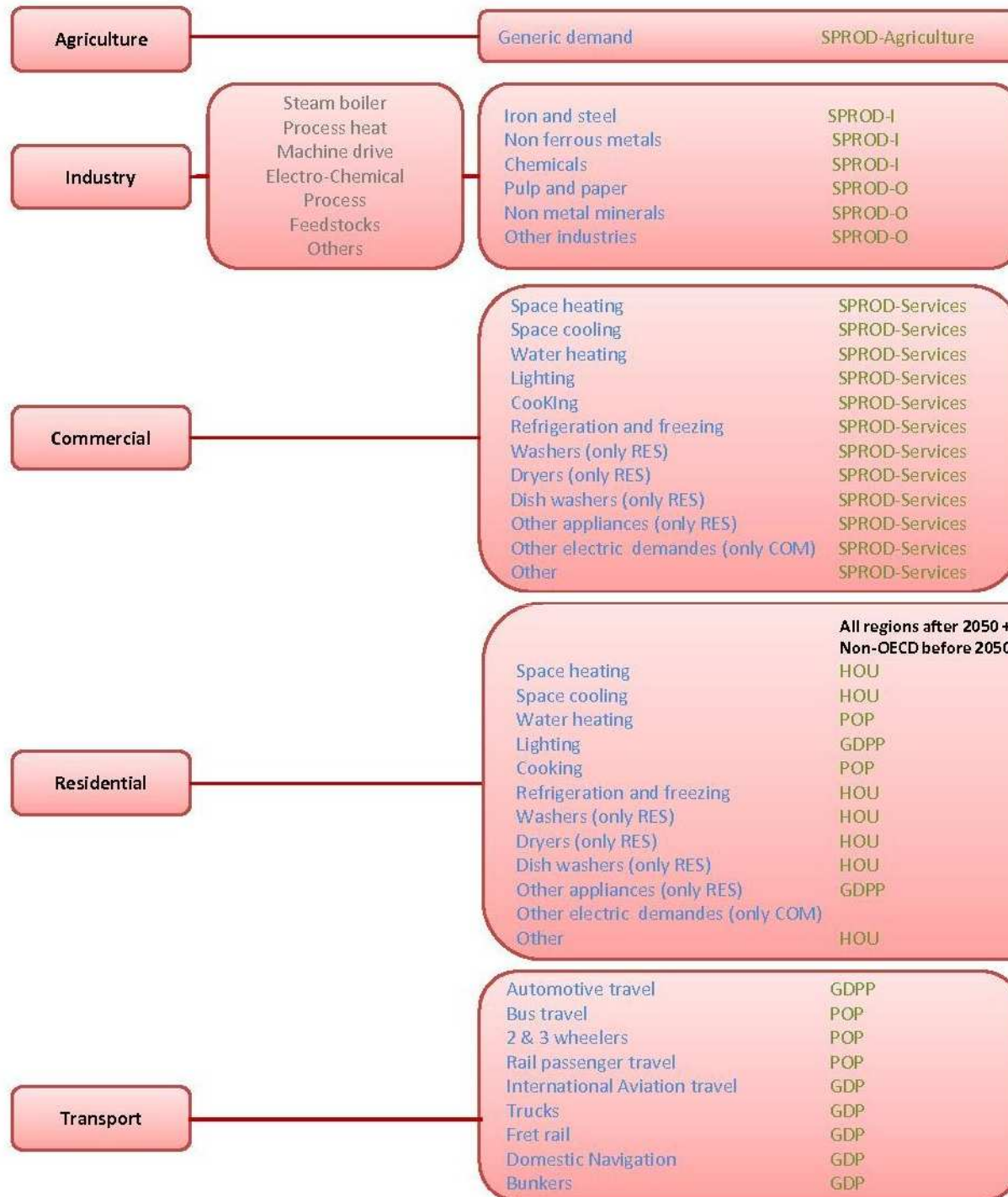
- Main socio-economic drivers: Energy consumption based on external projections of:
 - ▣ The growth of regional GDP
 - ▣ The growth of population
 - ▣ The volume of various economic sectors
- Fossil fuel import prices
- World scenario:
 - ▣ World Energy Outlook
 - ▣ DGEMP (General Directorate for Energy and Raw Materials)
 - ▣ International Energy Agency
 - ▣ Department Of Energy
 - ▣ ...

Evolution of regional GDP in TIAM (in trillion current 2000 USD)



Evolution of regional population in TIAM (in billions)



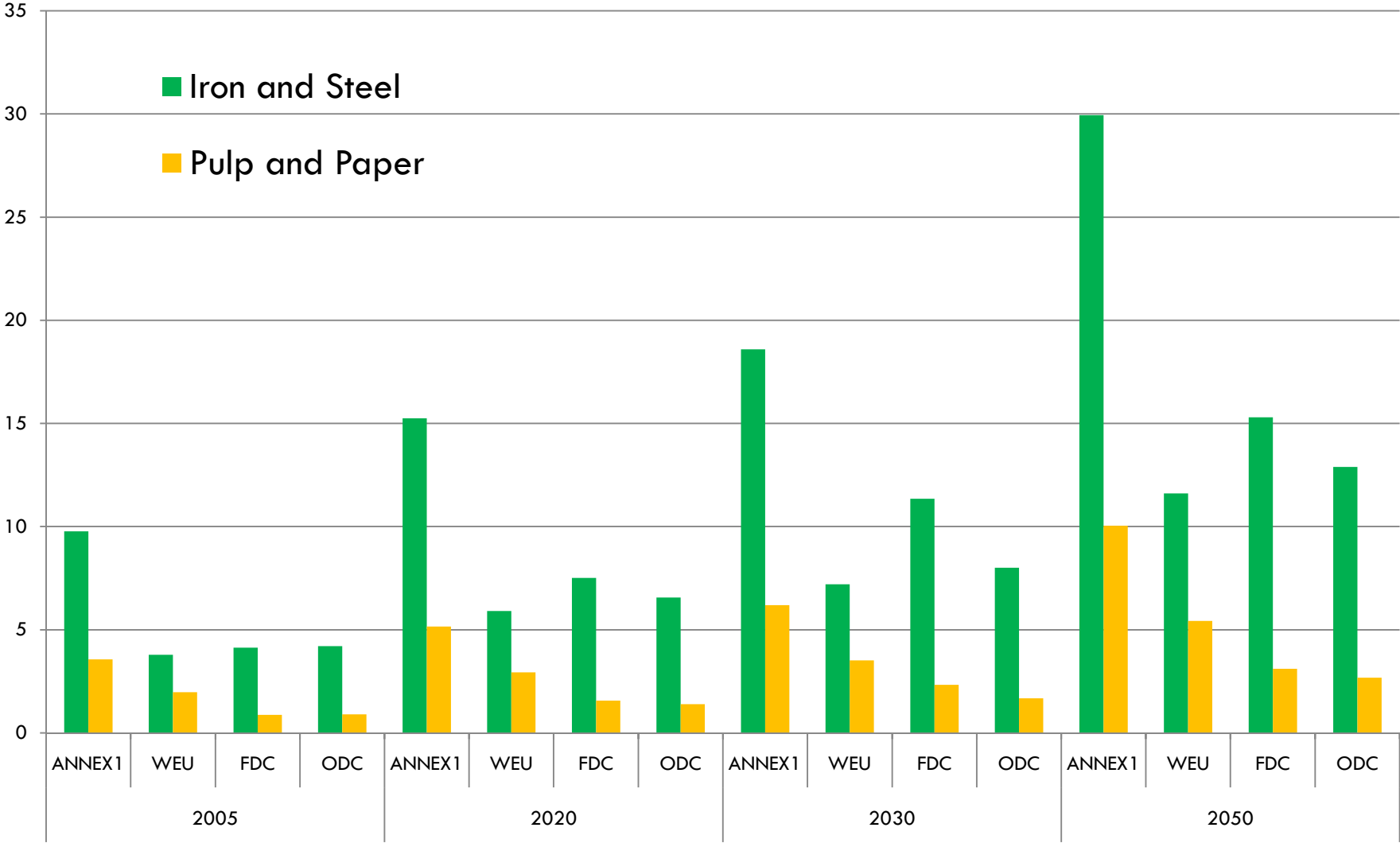


End-use sectors : Demands for energy services and drivers

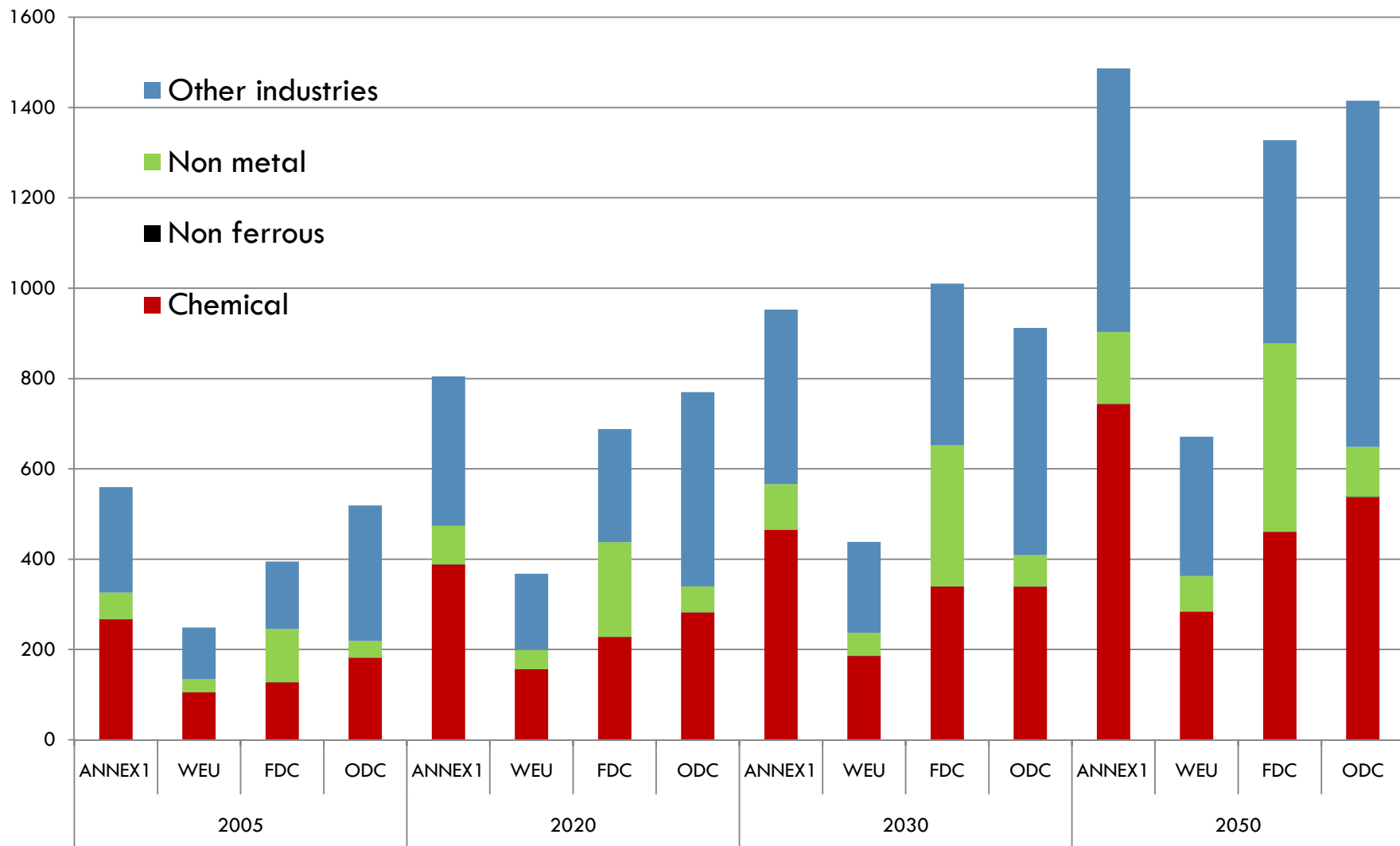
Demands for energy services
Drivers

HOU : Households
GDP: Gross domestic product
POP: Population
GDPP: GDP per capita
SPROD-X: Production of sector X related to GDP

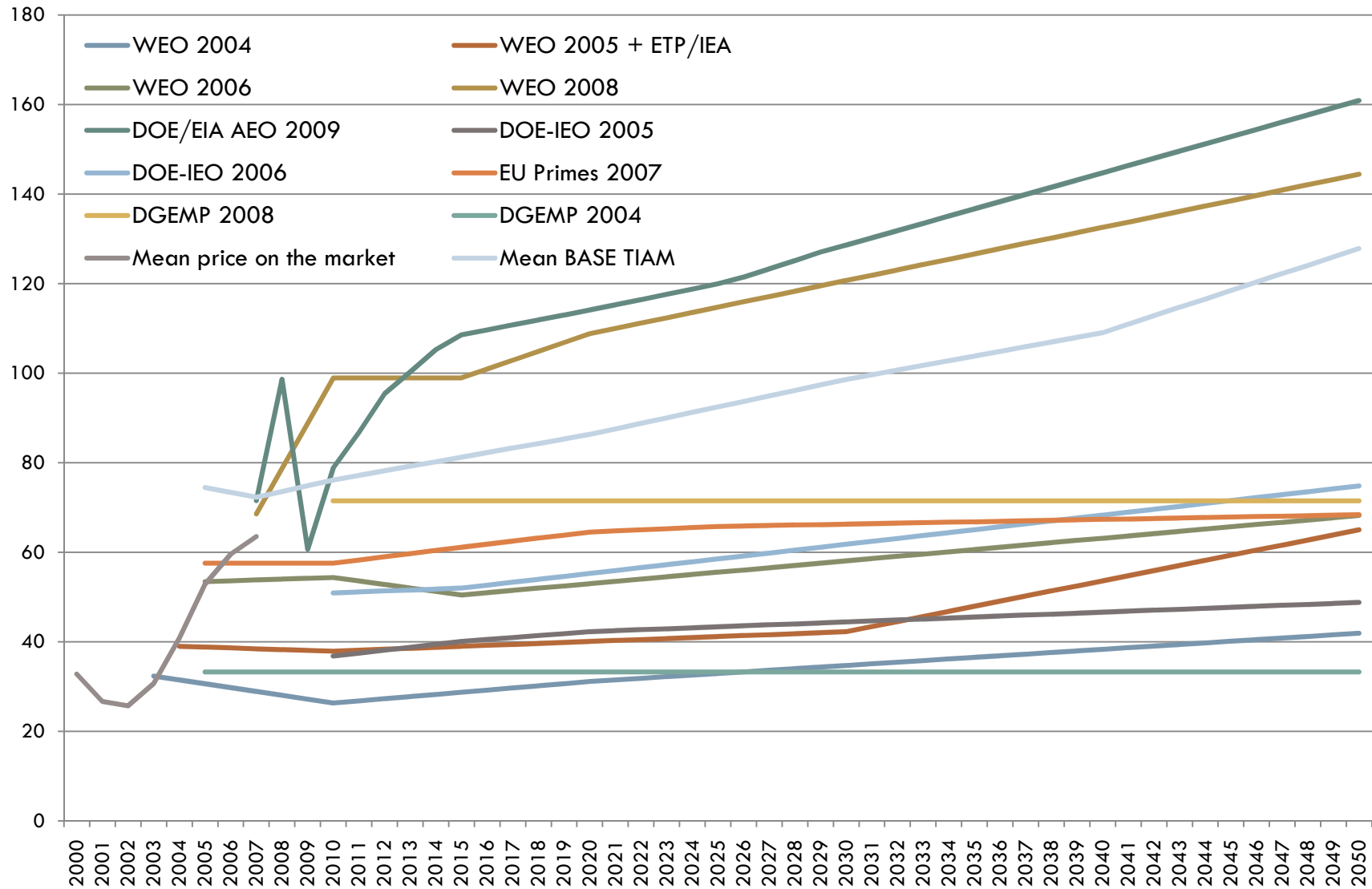
Regional demand of useful energy service by sector (Mt)



Regional demand of useful energy service by sector (PJ)



Price of crude oil (\$2005/bbl)



Scenario specification

12

Seven scenarios will be analysed:

- (1) World reference scenario without any explicit policy measures concerning CO₂ mitigation
- (2) Europe scenarios with a CO₂ emission reduction commitment of :
 - (a) 20% by 2020 (60% by 2050) compared to 1990' level for European countries;
 - (b) 30% by 2020 (80% by 2050) compared to 1990' level for European countries;
- (3) Developed countries scenarios :
 - (a) with a CO₂ emission reduction commitment of 20% by 2020 (60% by 2050) compared to 1990' level for European countries, USA, Japan, Canada, Australia;
 - (b) with a CO₂ emission reduction commitment of 30% by 2020 (80% by 2050) compared to 1990' level for European countries, USA, Japan, Canada, Australia;
- (4) Developed countries-China-India scenarios:
 - (a) with a CO₂ emission reduction commitment of 30% by 2020 (80% by 2050) compared to 1990' level for European countries, USA, Japan, Canada, Australia and a CO₂ emission reduction commitment of 10% to 2020 (20% by 2050) compared to 1990' level for India and China;
 - (b) with a CO₂ emission reduction commitment of 30% by 2020 (80% by 2050) compared to 1990' level for European countries, USA, Japan, Canada, Australia and a CO₂ emission reduction commitment of 20% to 2020 (40% by 2050) compared to 1990' level for India and China.

Results

13

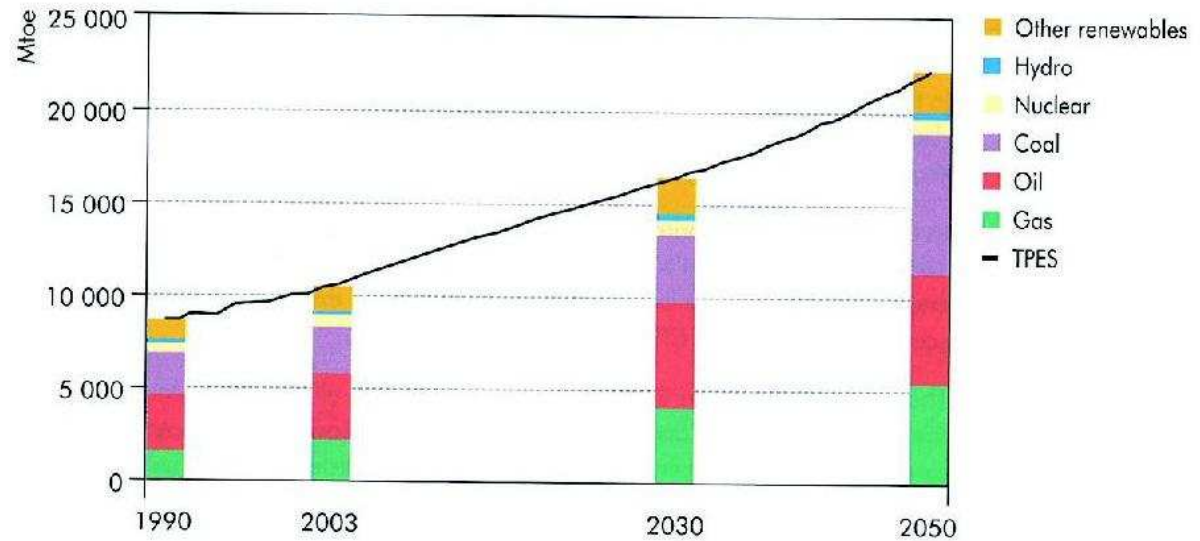
The focus is on the effects on :

- CO2 emission
- Total costs
- Carbon prices
- Total energy consumption

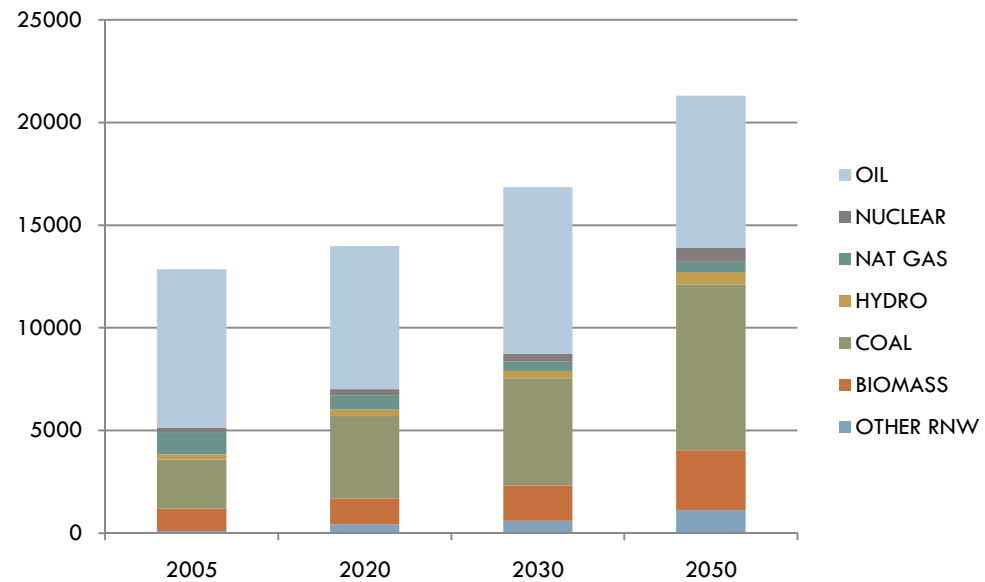
...associated with the different GHG reduction targets for developed countries with or without a climate constraint for China and India

THE REFERENCE SCENARIO

World total primary energy supply (TPES) by fuel in the ETP 2006 Baseline Scenario



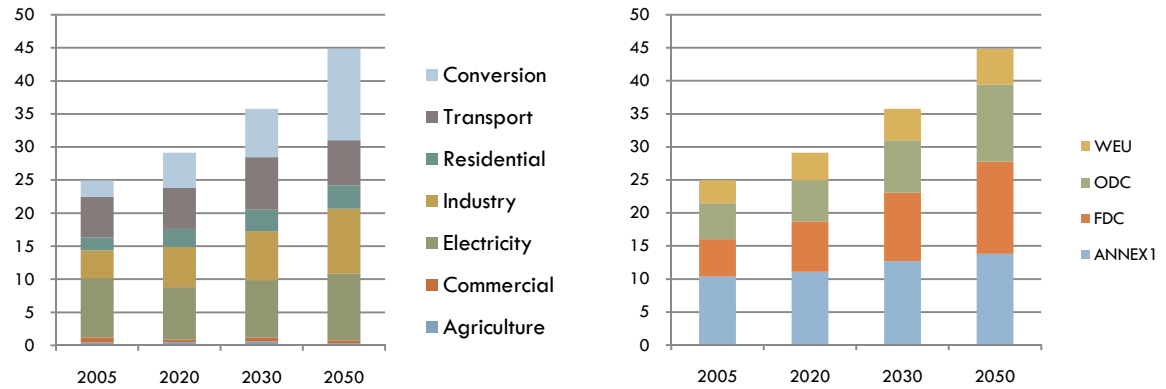
World total primary energy supply (TPES) by fuel in the TIAM Baseline Scenario (Mtoe)



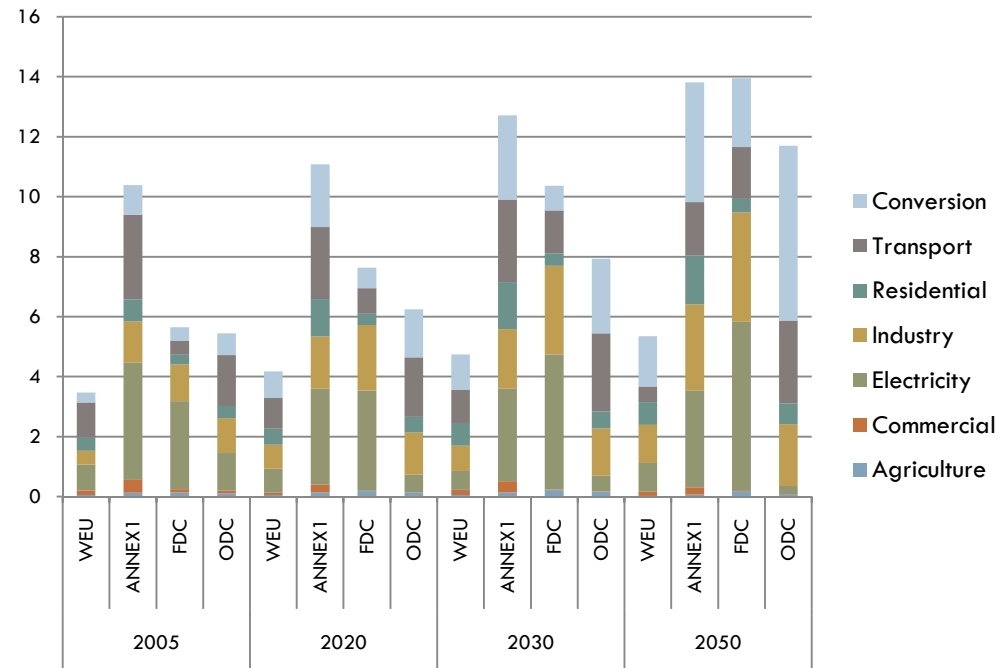
World CO2 emission by sector and by region in the ETP 2006 Baseline Scenario (Gt)

CO2 emissions (Gt)	2003	2050
OECD	12,969	21,949
Transition economies	2,543	3,953
Developing countries	9,02	32,12
World	24,532	58,022

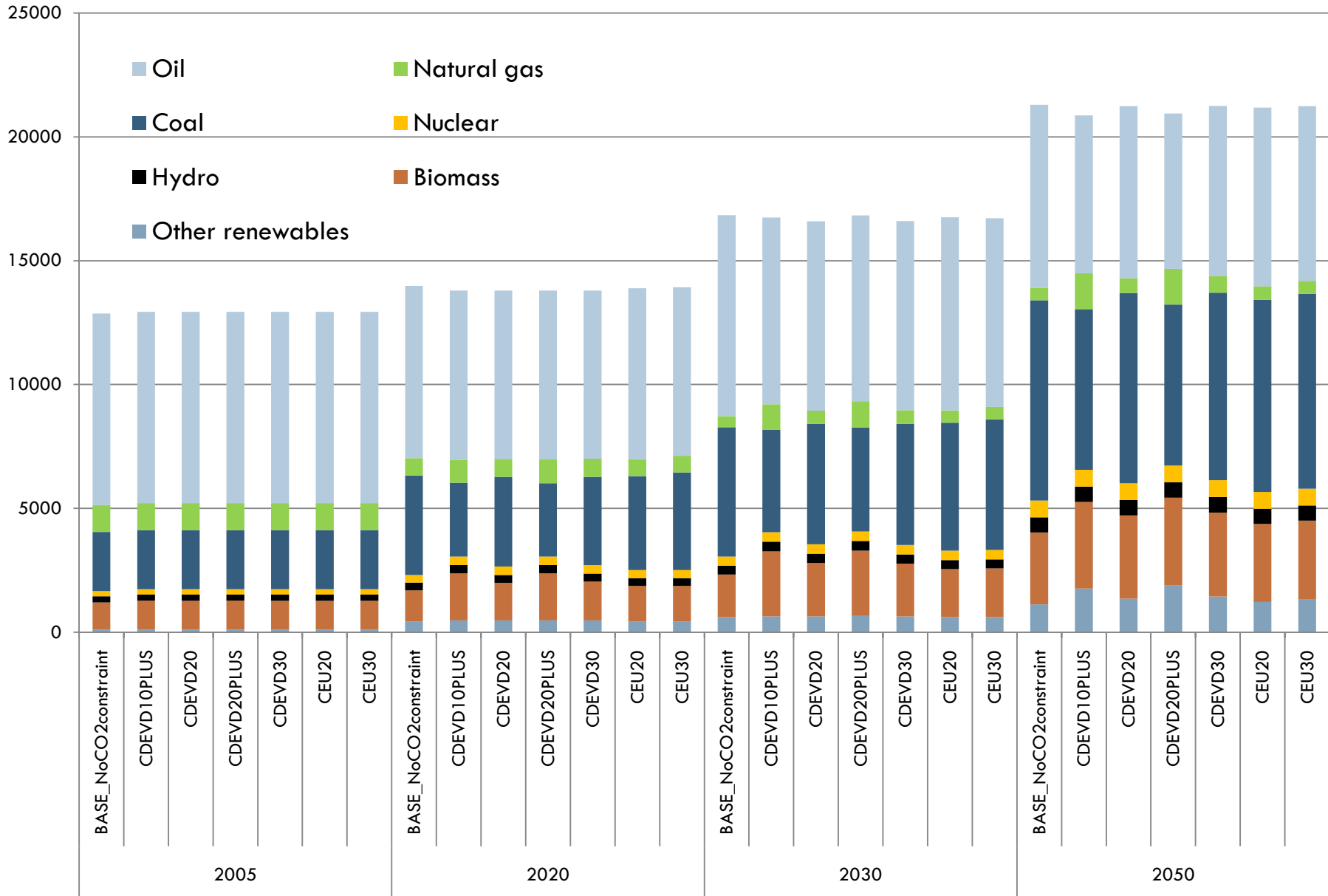
World CO2 emission by sector and by region in the TIAM Baseline Scenario (Gt)



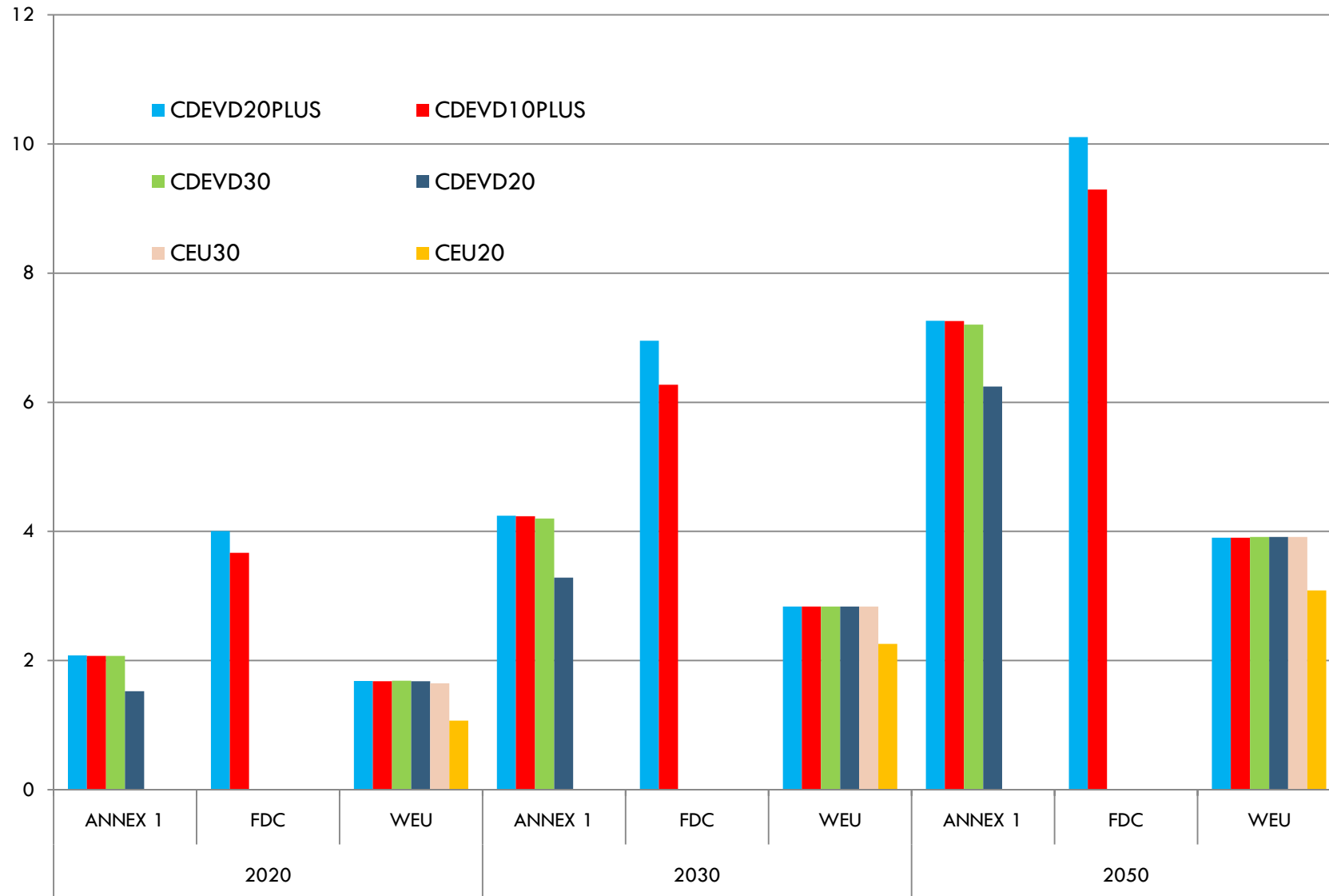
Regional CO2 emission by sector in the TIAM Baseline Scenario (Gt)



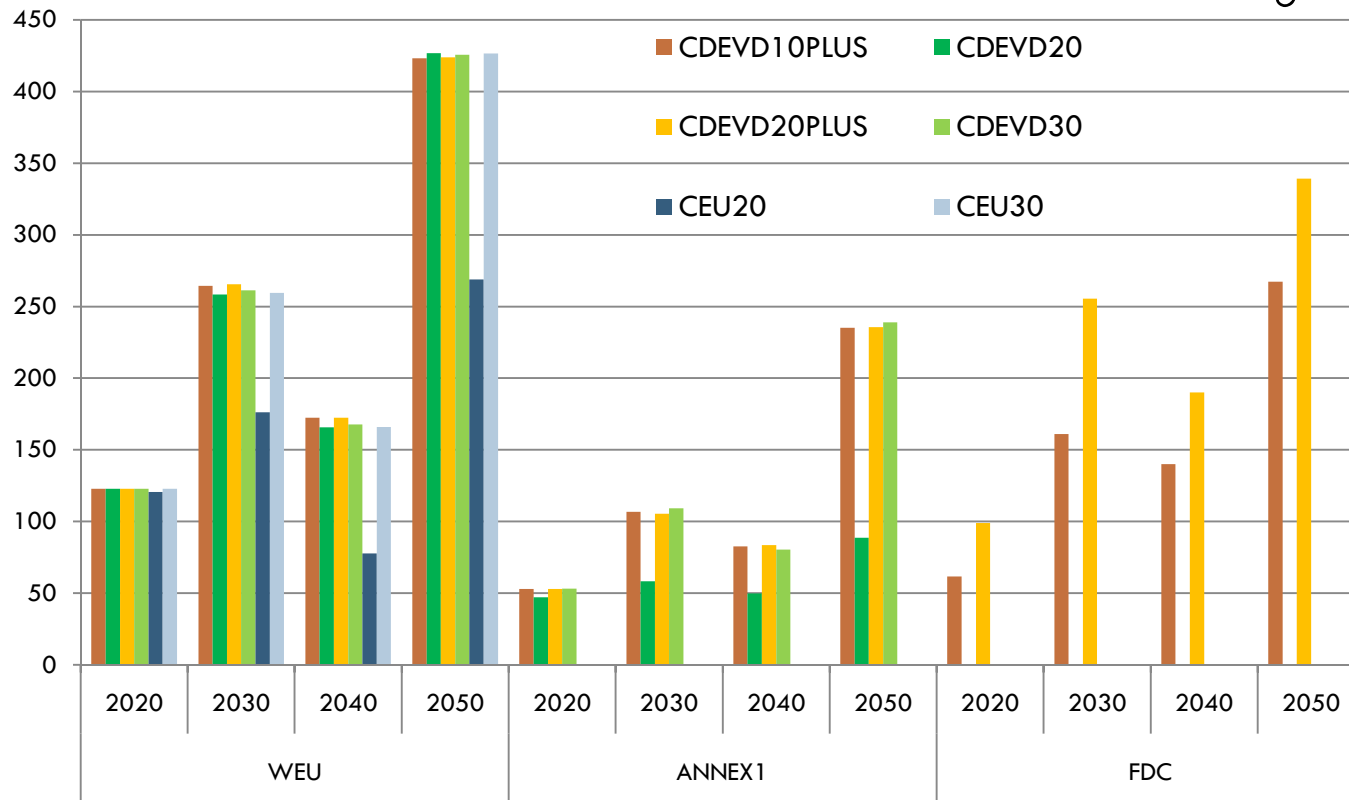
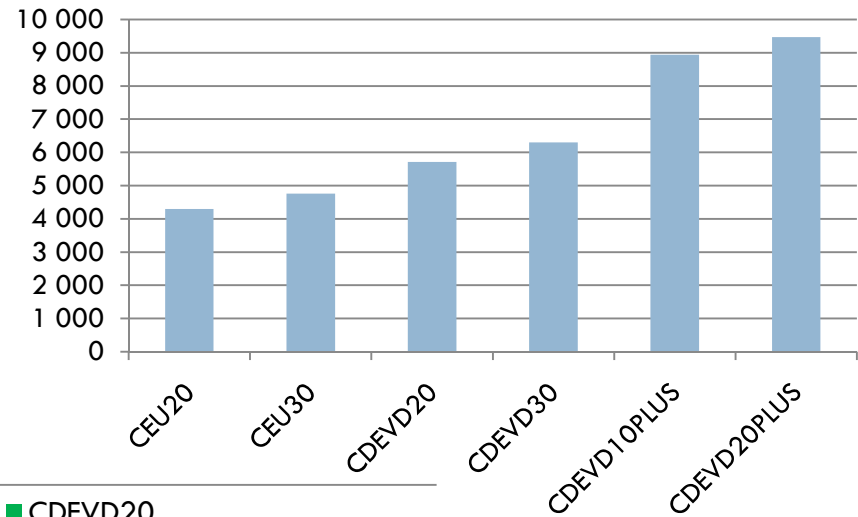
World TPES by fuel in the TIAM Scenarios (Mtoe)



Total net CO₂ sequestration (Gt CO₂)

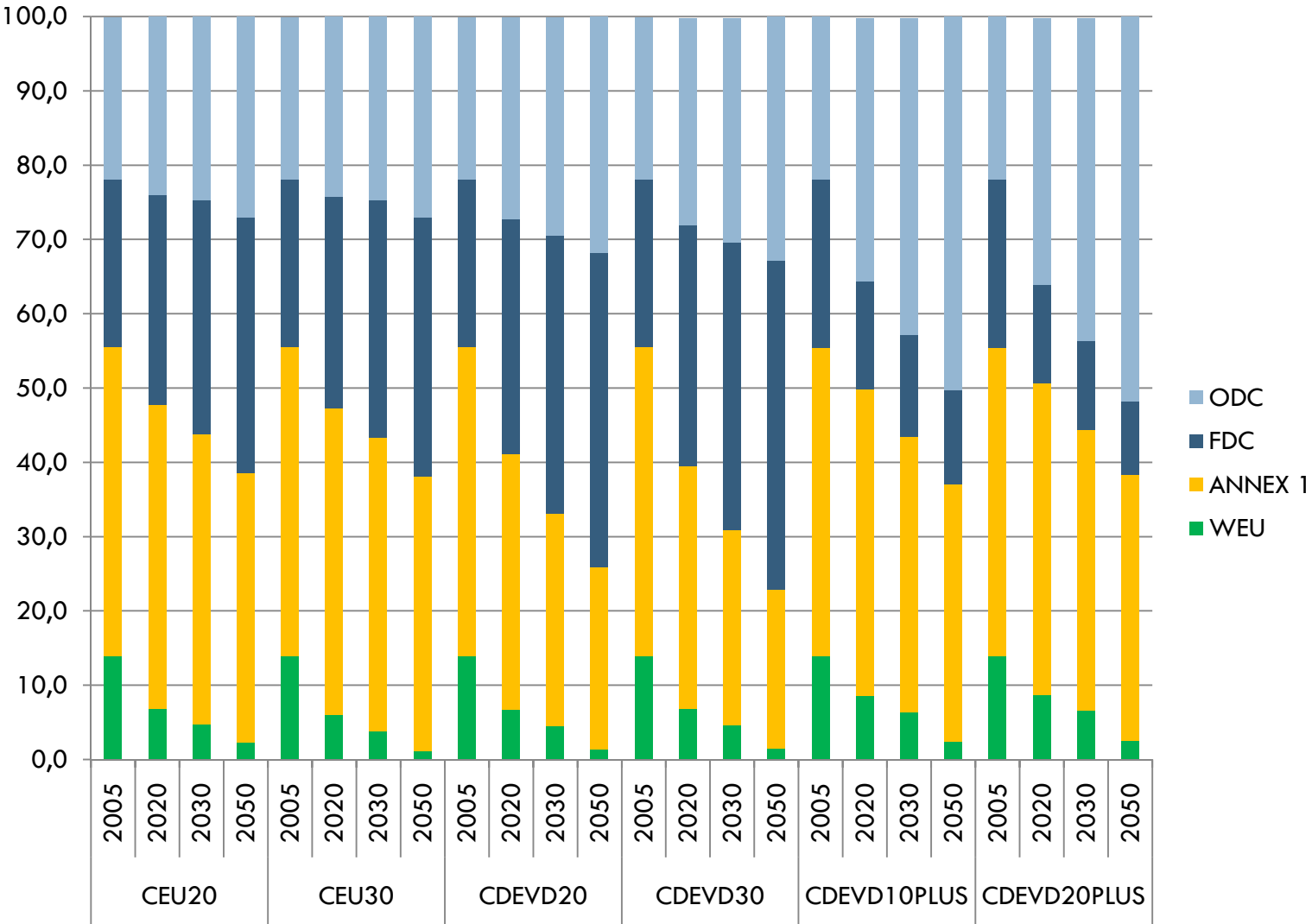


**Total discounted cost (2005 billion US\$)
by scenario**

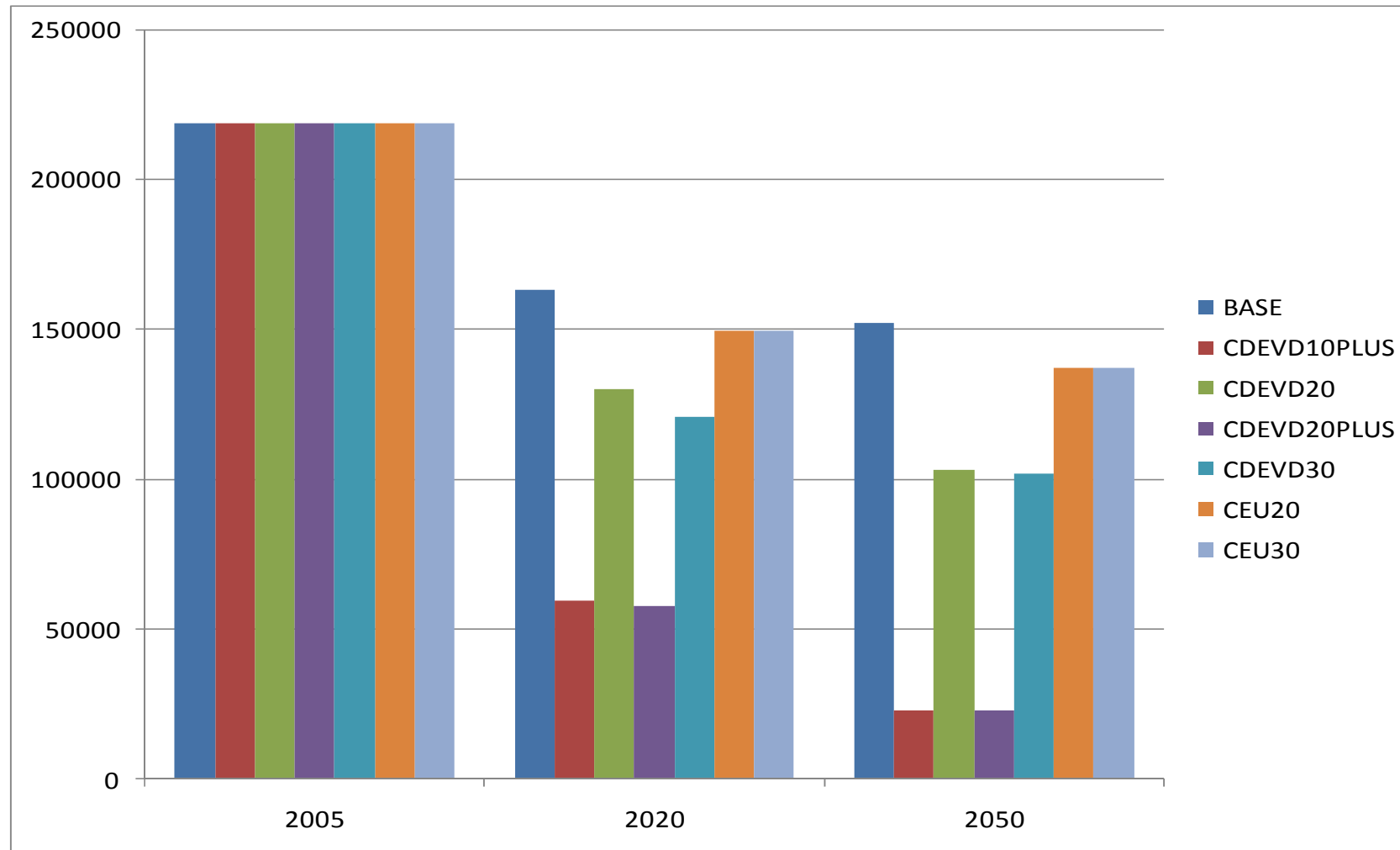


**Carbon cost
(2005 US\$/t) by
scenario and by
region
(Ponderated by
total carbon
emission)**

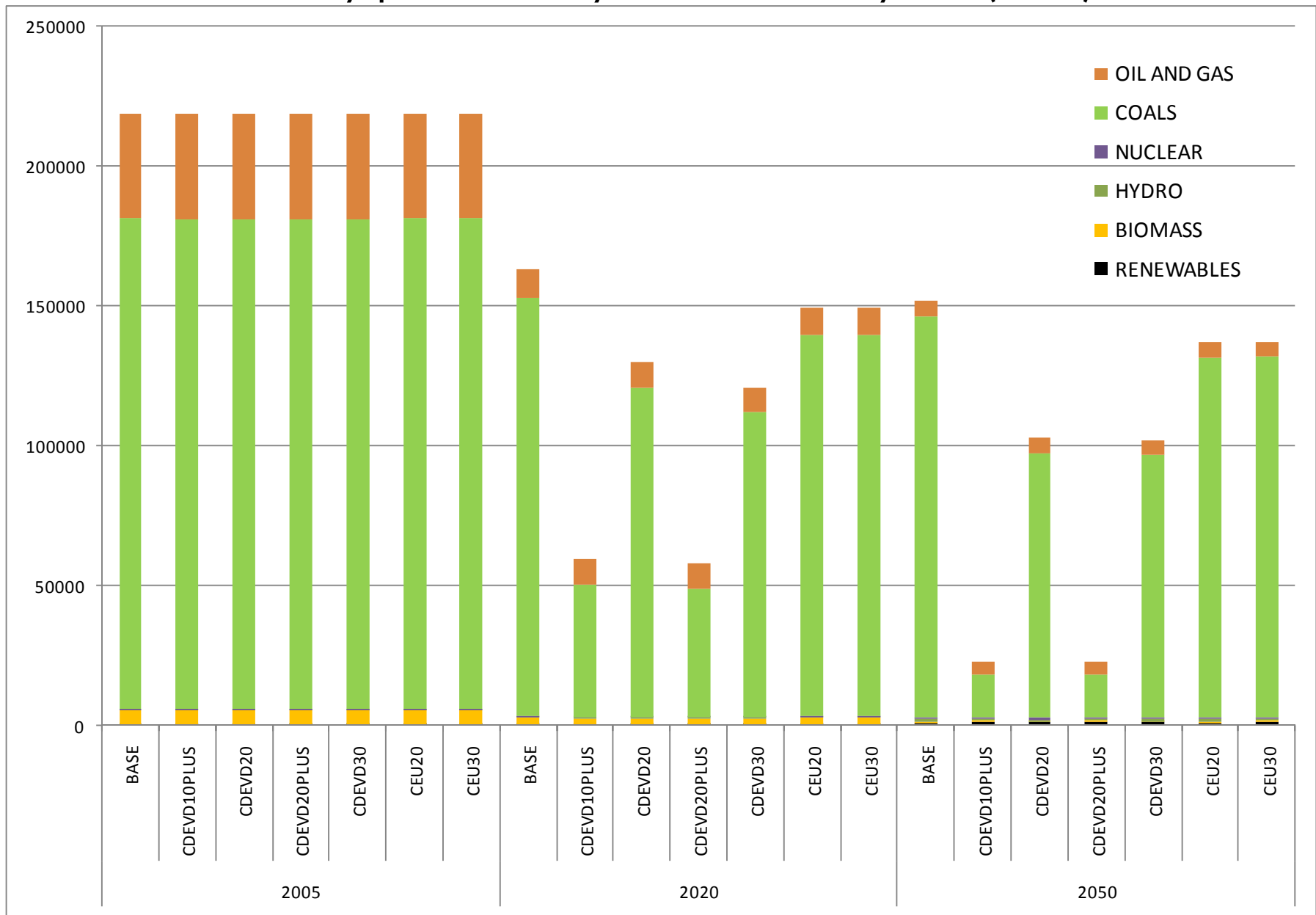
Distribution of CO₂ emissions by region (%)



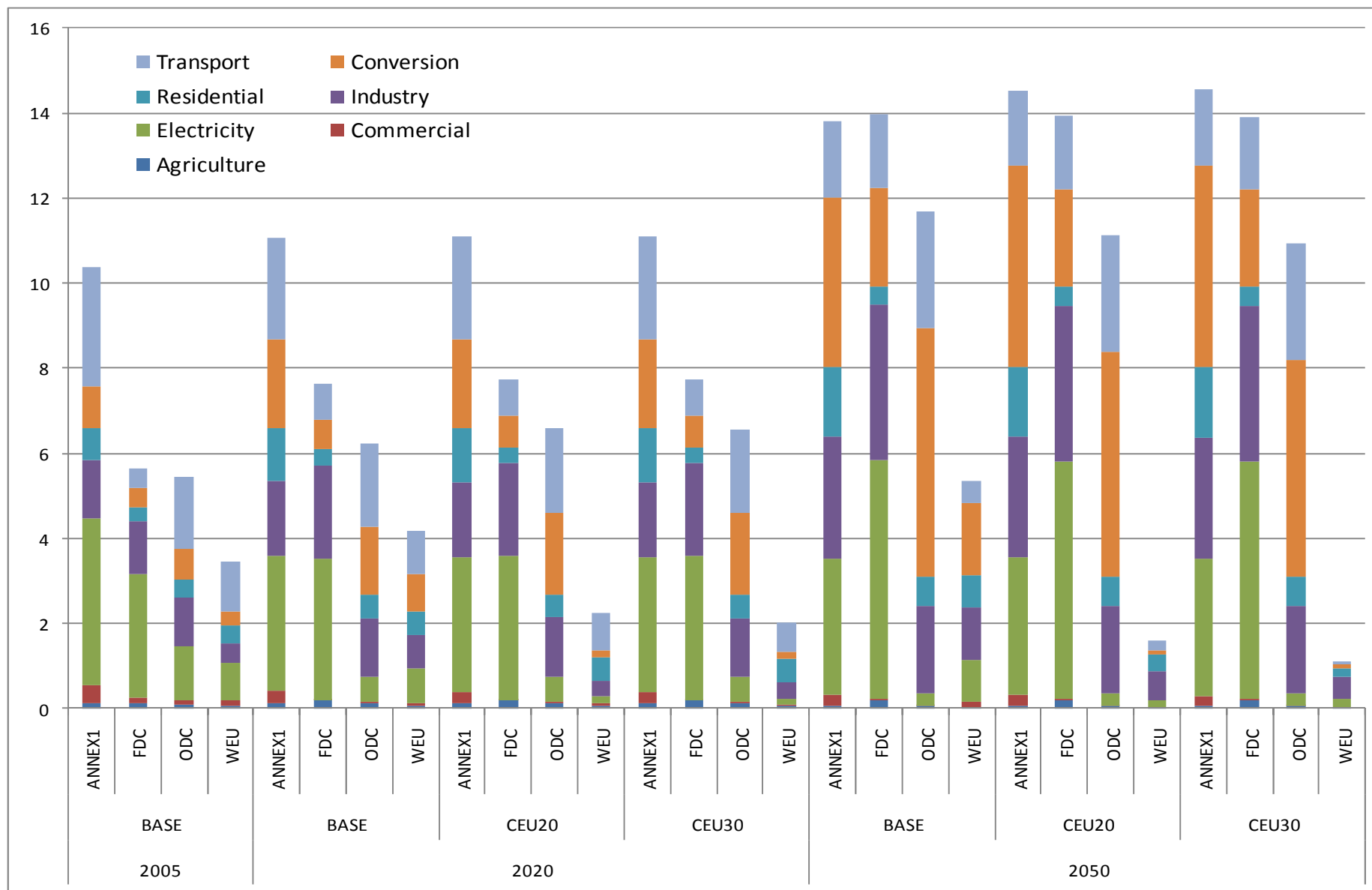
World electricity production by scenario (mtoe)



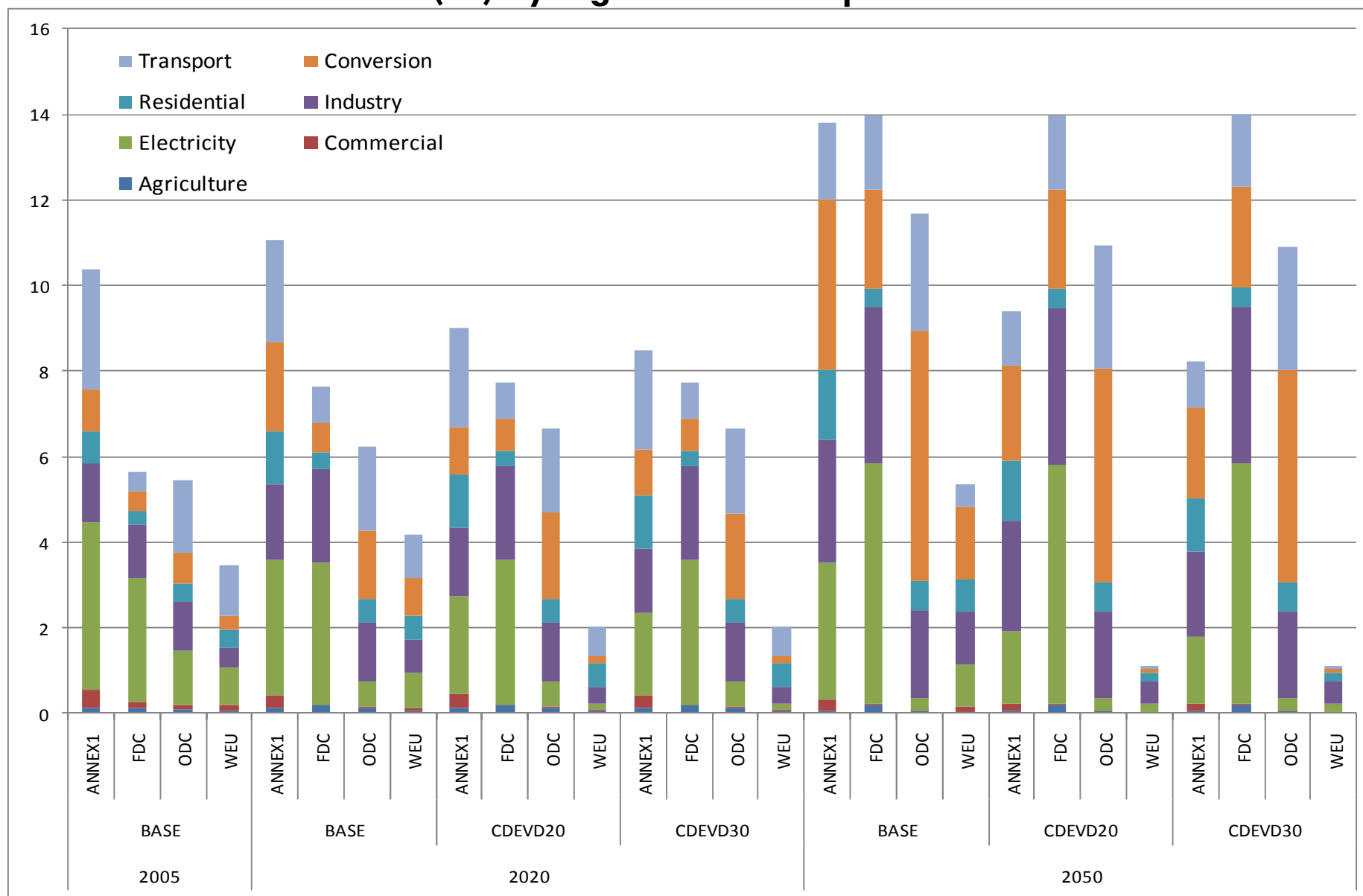
World electricity production by scenario and by fuel (mtoe)



Carbon emissions (Gt) by region for EU scenarios



Carbon emissions (Gt) by region for developed countries scenarios



Carbon emissions (Gt) by region for developing countries scenarios

