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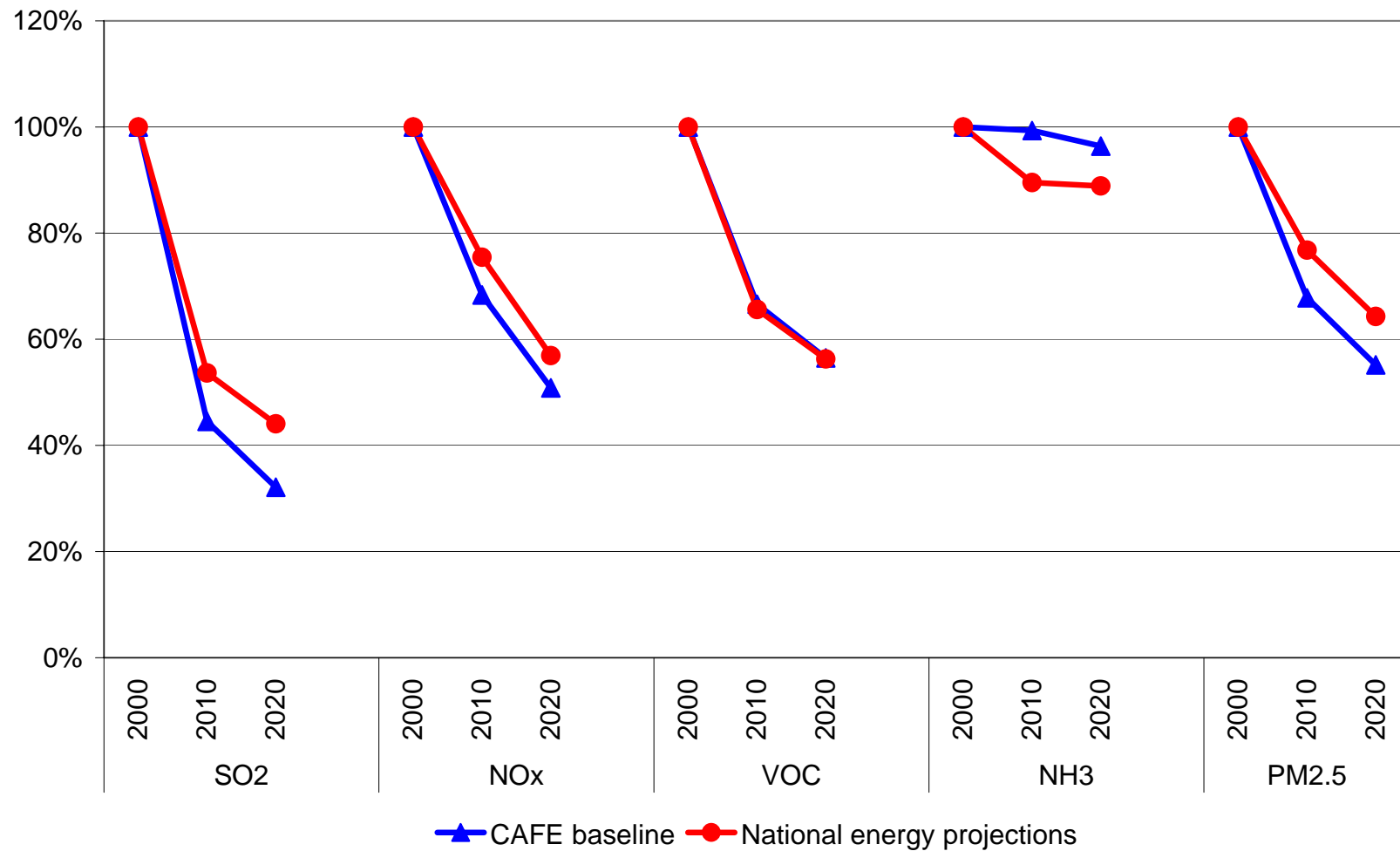
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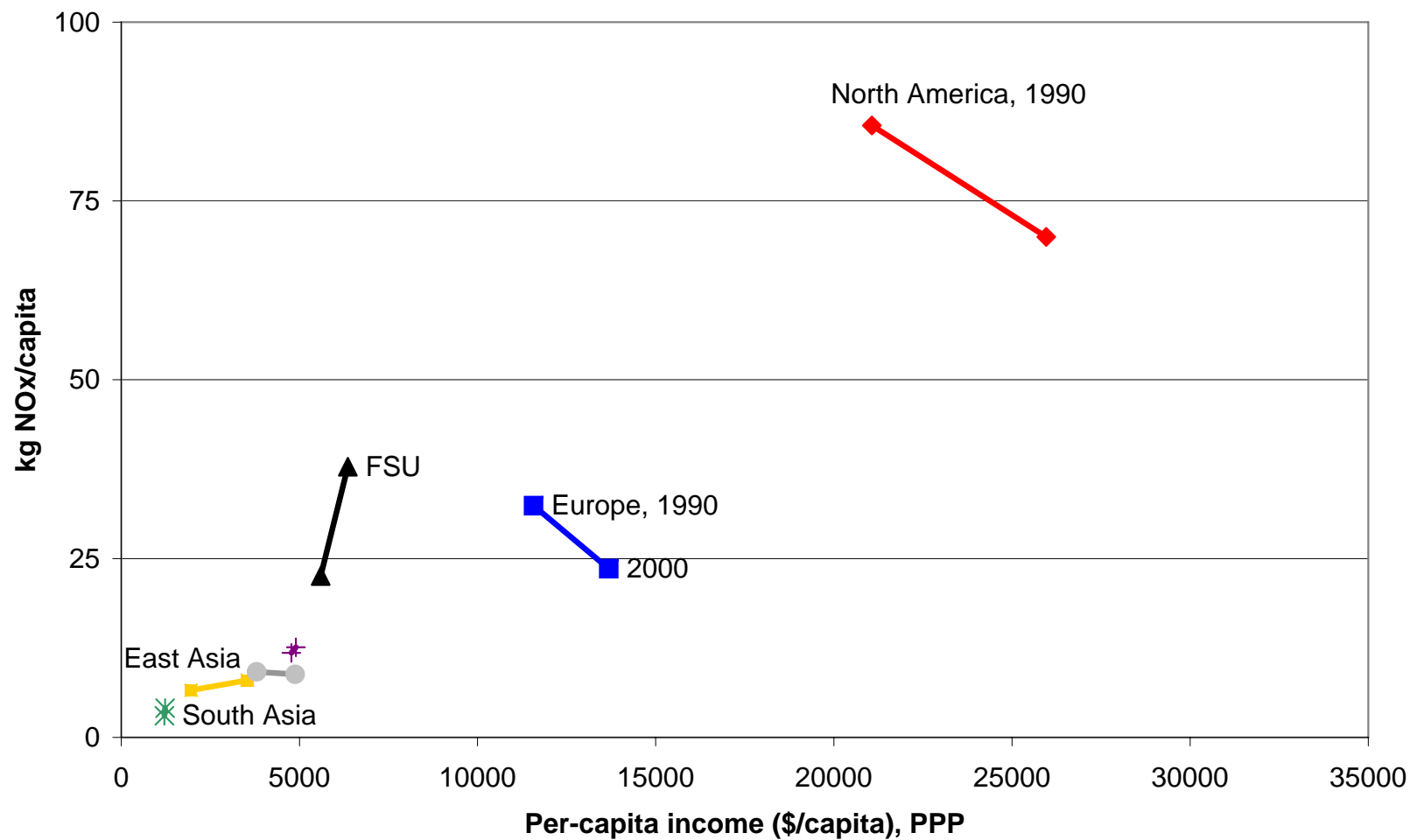
# **Projections of global emissions of air pollutants**

TFHT Workshop on Emission Inventories and Projections  
Beijing, October 18-20, 2006

# “Current legislation” projections of EU-25 emissions (CAFE and NEC analyses, EU-25, relative to the 2000 levels)



# Per-capita NO<sub>x</sub> emissions, 1990-2000



# Approach for emission projections

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- Using global version of the GAINS/RAINS model
- Emission projections based on
  - National projections of activity data
  - Local emission factors
  - Implementation of emission control measures
- Sources of activity data projections:
  - Europe: RAINS/GAINS Europe – national projections
  - Asia: RAINS Asia – national projections
  - Russia: National data
  - North America: National studies
  - Other continents: IPCC SRES B2 scenario

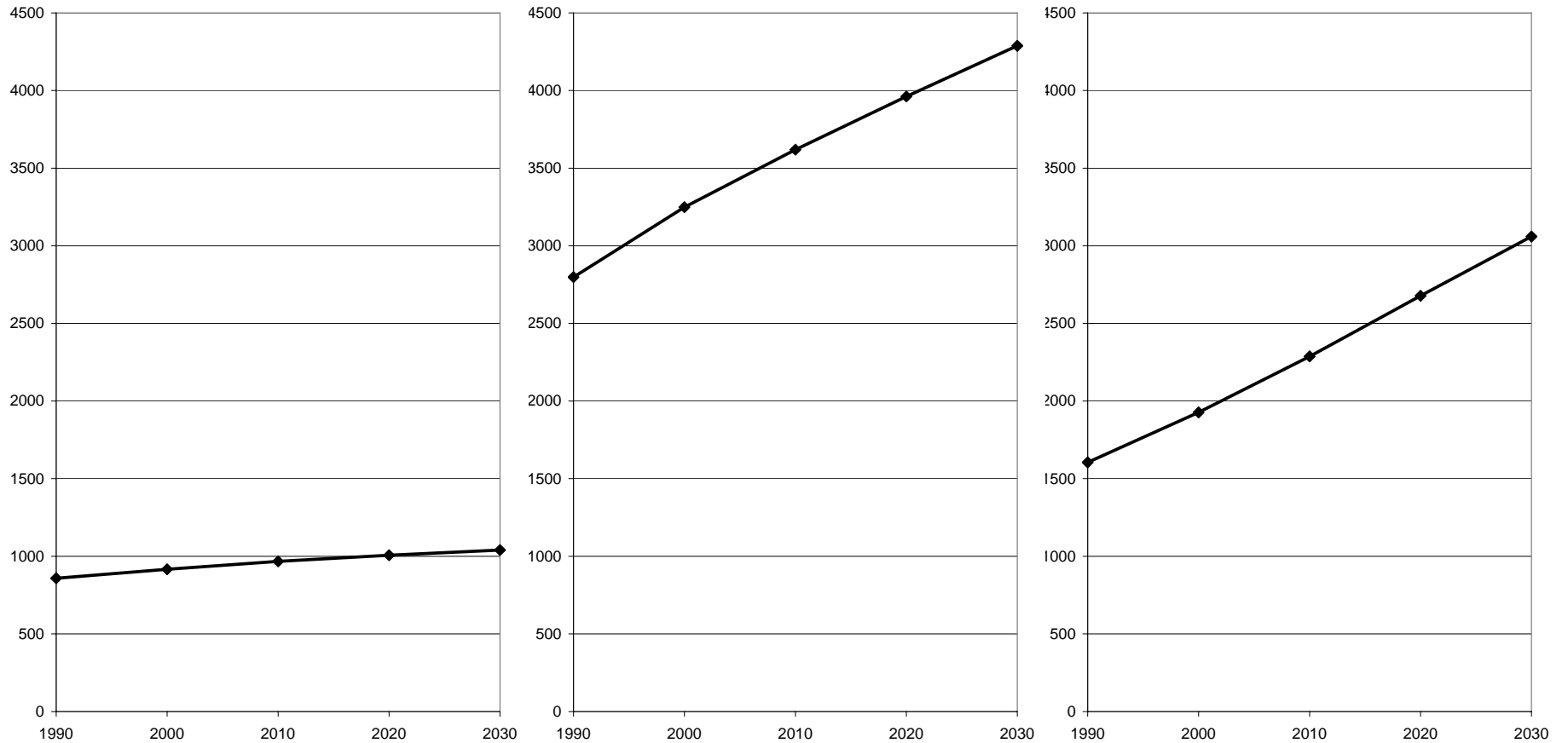
# Presentation of results

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- Driving forces
- Resulting emission projections
- Main uncertainties
  
- Three groups of countries:
  - OECD (Europe, North America, Japan, Australia)
  - Asia
  - Rest of world (Russia, Latin America, Africa)
  
- Graphs use same scale for all regions

# Driving forces for emissions: Population (Governmental and UN projections)



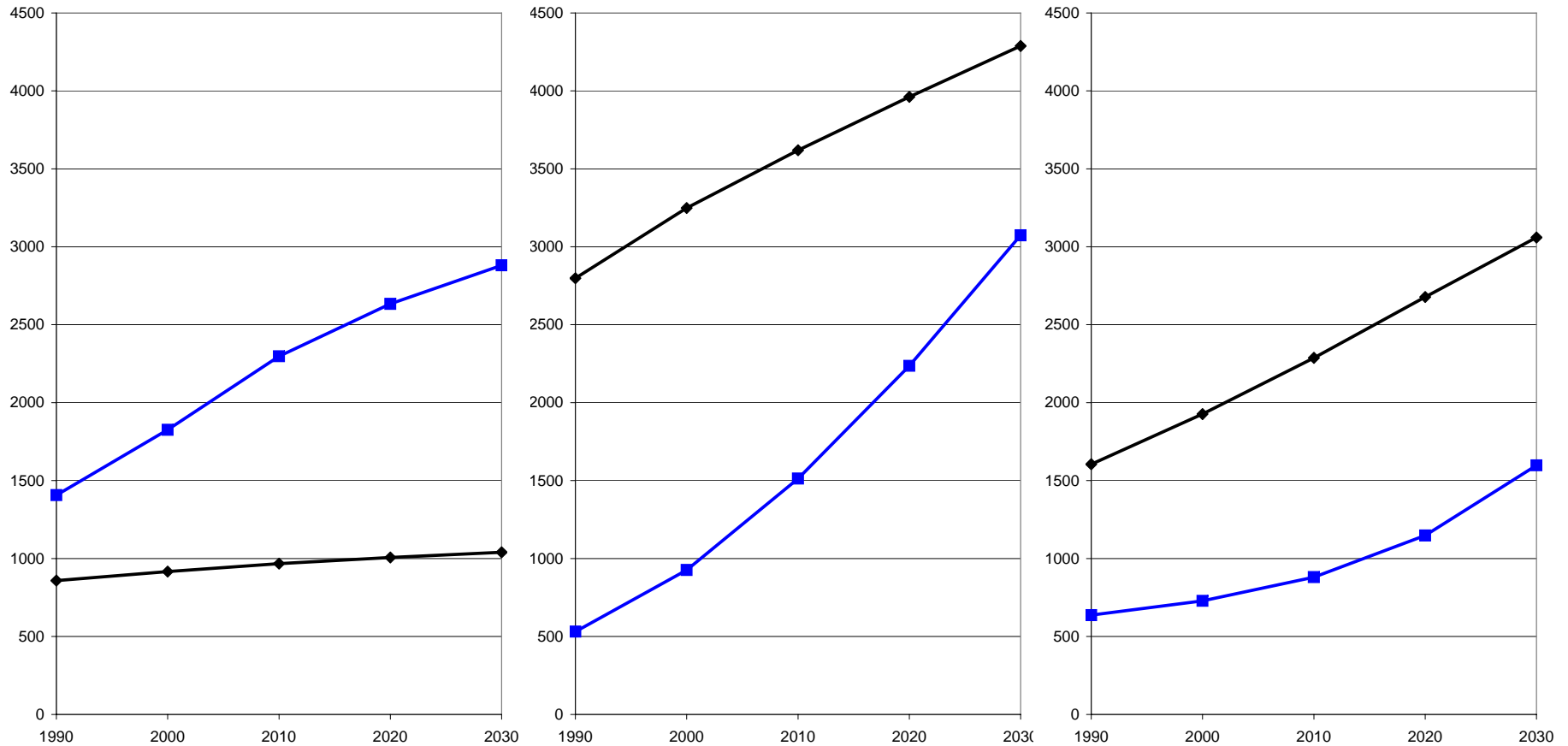
**OECD**

**Asia**

**Rest of world**

◆ Population (mio) ■ GDP in PPP, 10 bn \$/yr ▲ Energy use (100 PJ)

# Driving forces for emissions: Population, GDP (PPP) (Governmental projections)



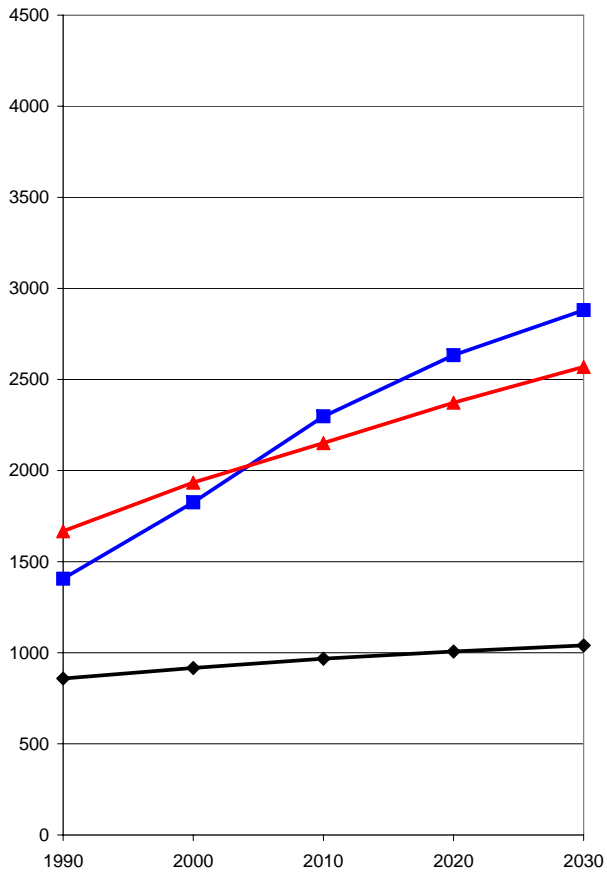
**OECD**

**Asia**

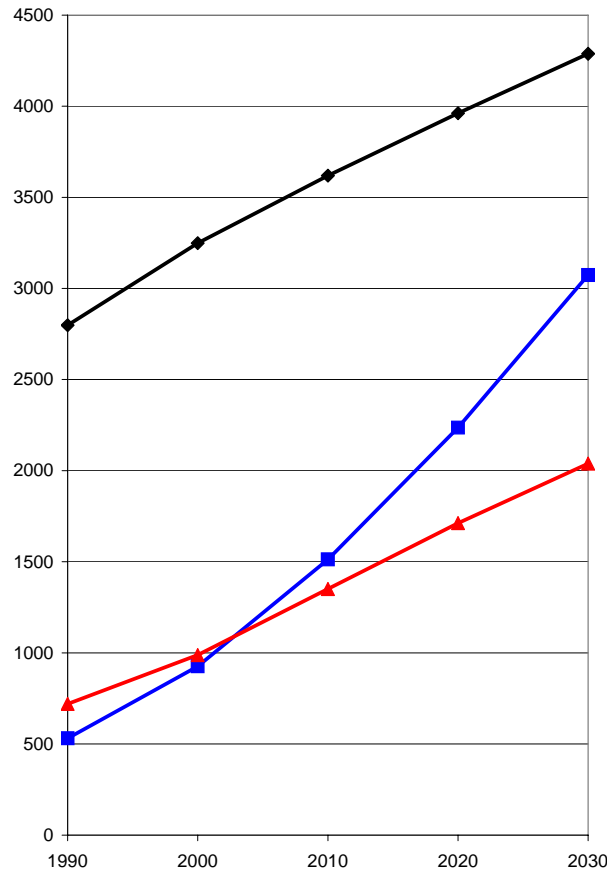
**Rest of world**

◆ Population (mio) 
 ■ GDP in PPP, 10 bn \$/yr 
 ▲ Energy use (100 PJ)

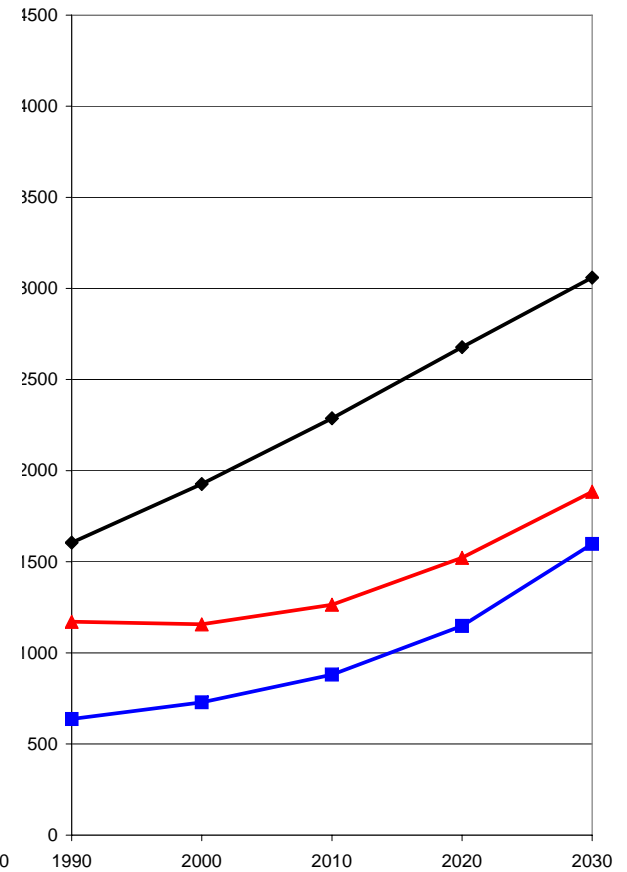
# Driving forces: Population, GDP (PPP) and energy demand



**OECD**



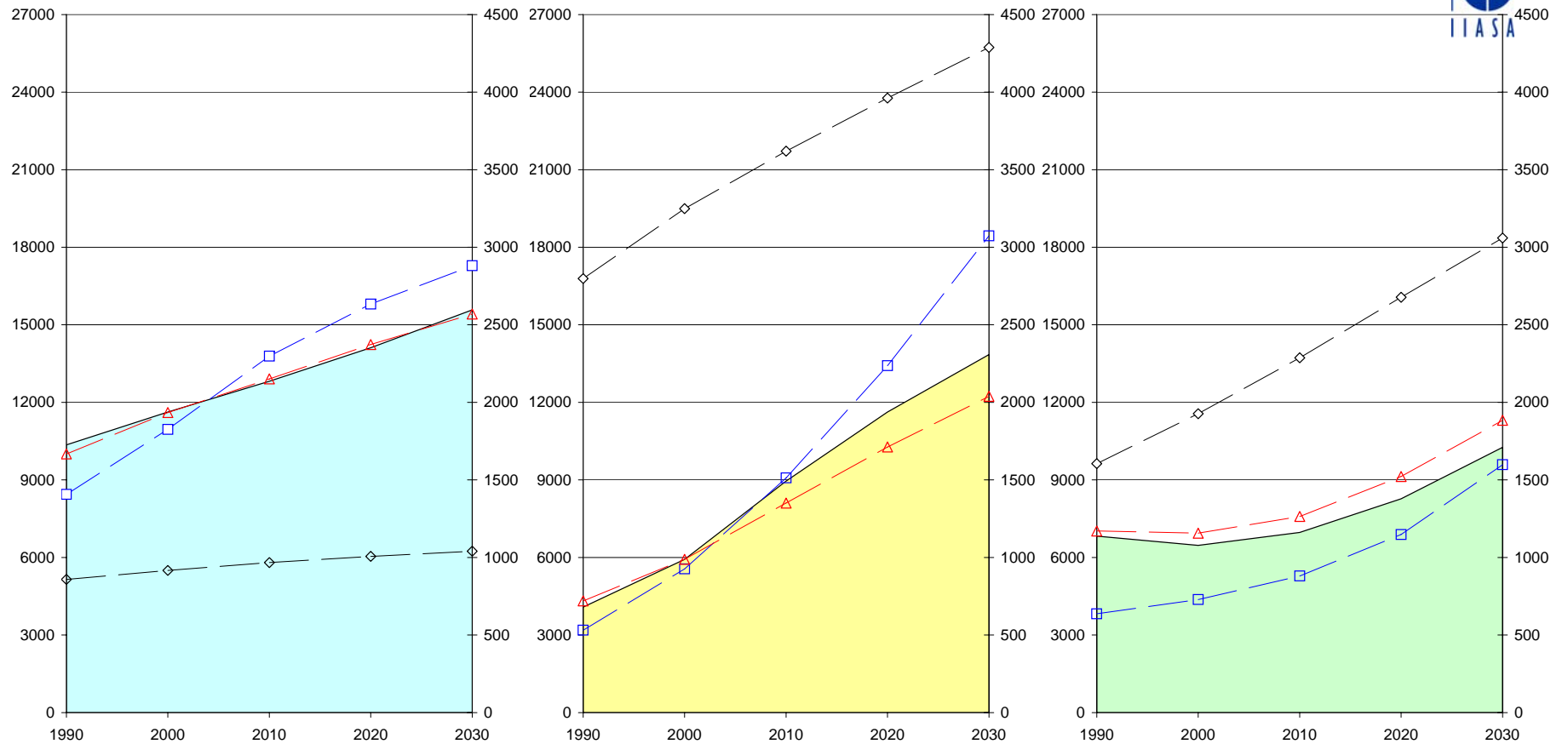
**Asia**



**Rest of world**

◆ Population (mio)    ■ GDP in PPP, 10 bn \$/yr    ▲ Energy use (100 PJ)

# Resulting projection of CO<sub>2</sub> emissions [Mt CO<sub>2</sub>]



**OECD**

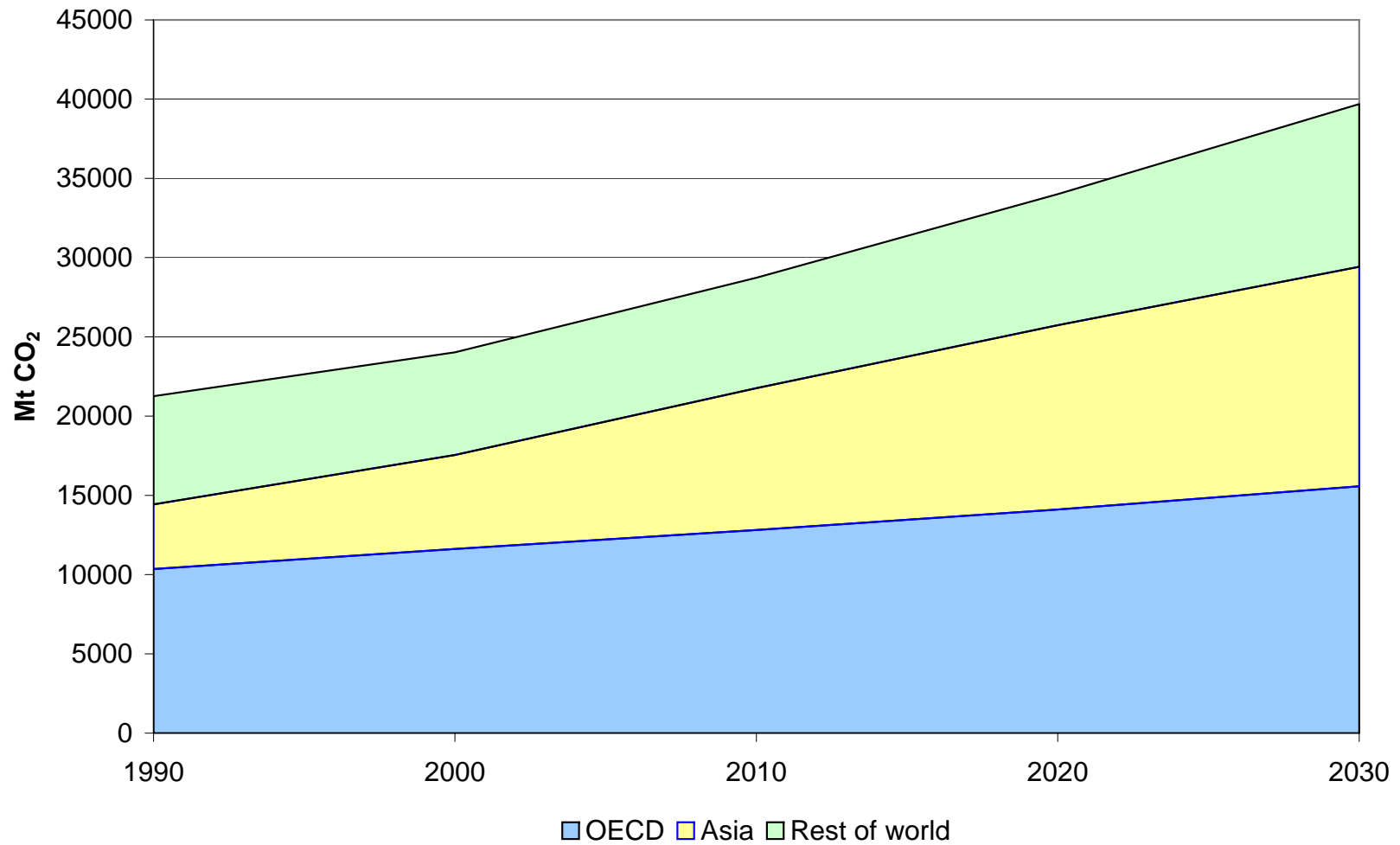
**Asia**

**Rest of world**

◆ Population (mio)    ■ GDP in PPP, 10 bn \$/yr    ▲ Energy use (100 PJ)

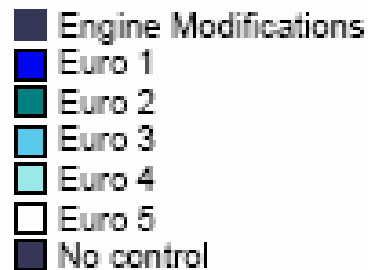
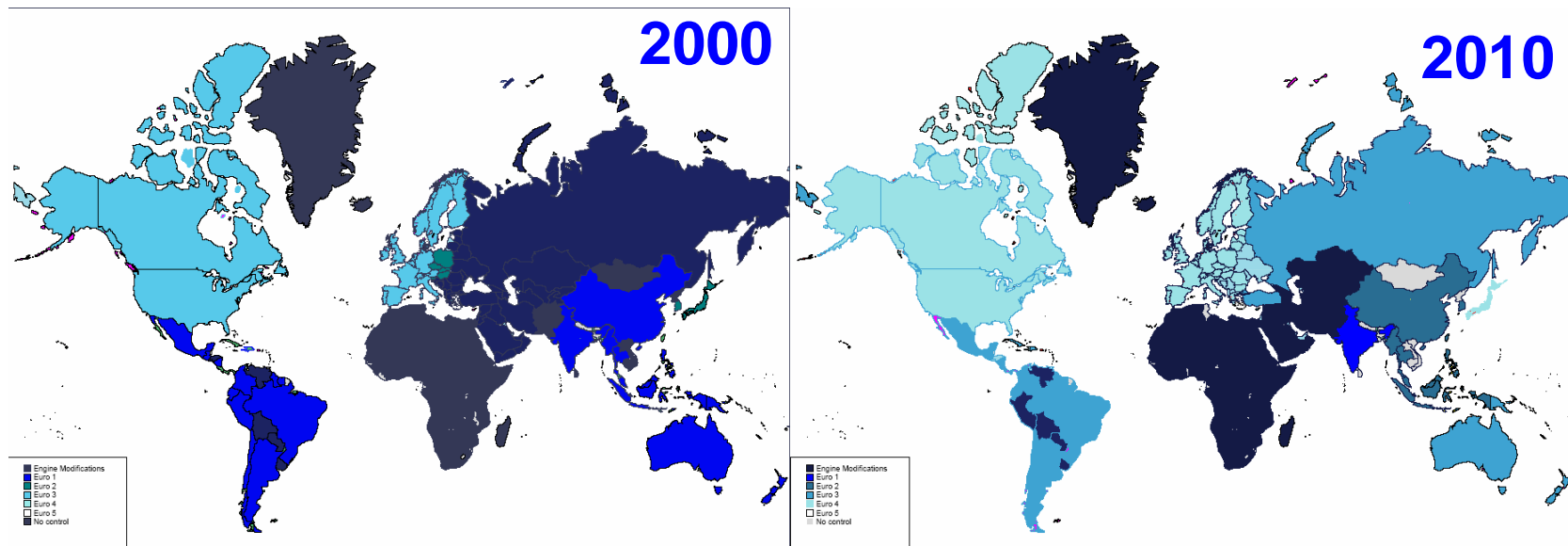
# Global CO<sub>2</sub> emissions

resulting from the collected national activity projections



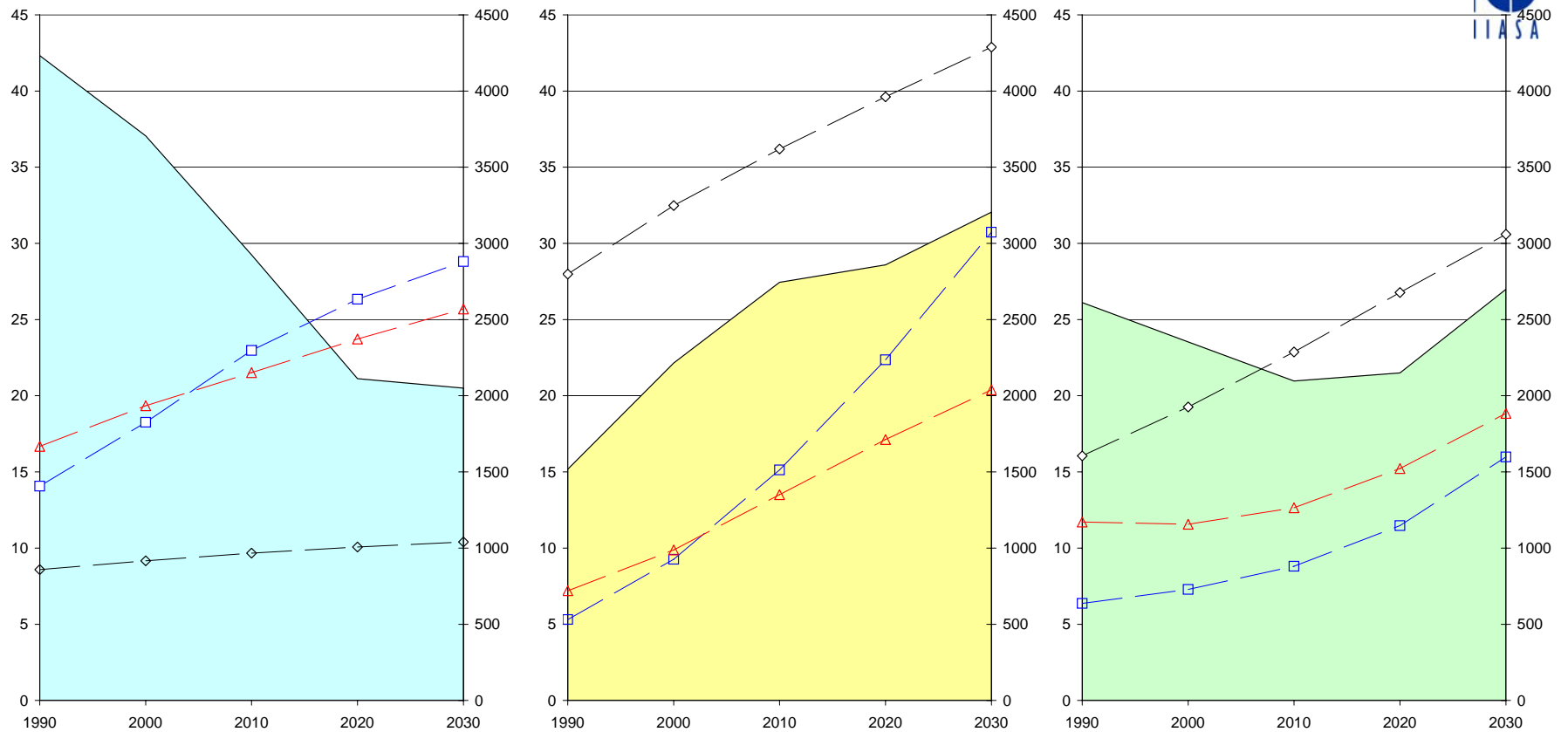
# Emission standards for gasoline vehicles

## Current legislation (as of early 2005)



Source: IIASA, Cofala *et al.*, 2005

# “Current legislation” projection of NO<sub>x</sub> emissions [Mt NO<sub>x</sub>]



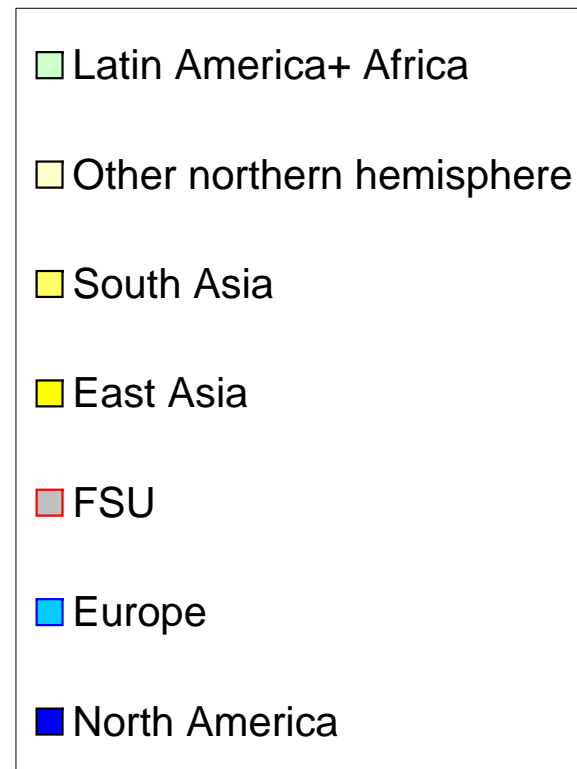
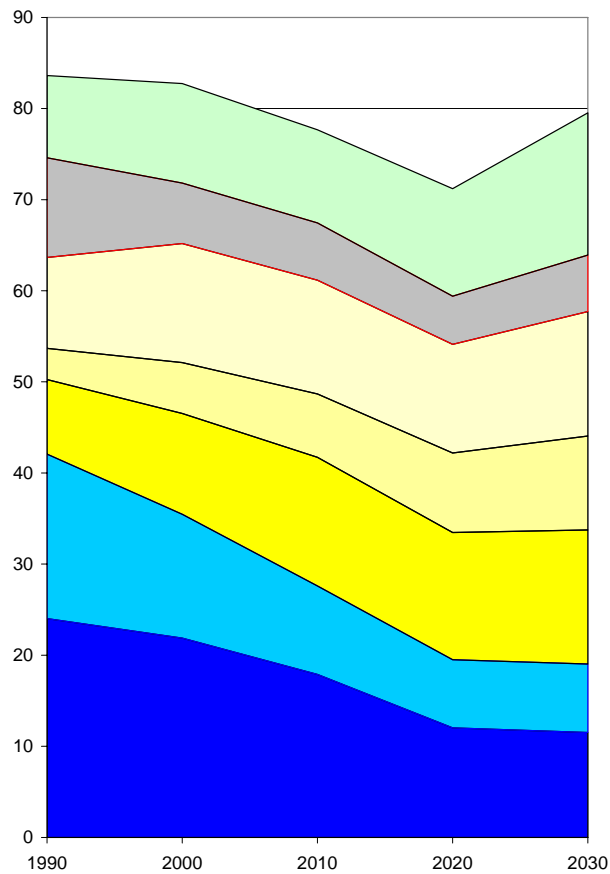
**OECD**

**Asia**

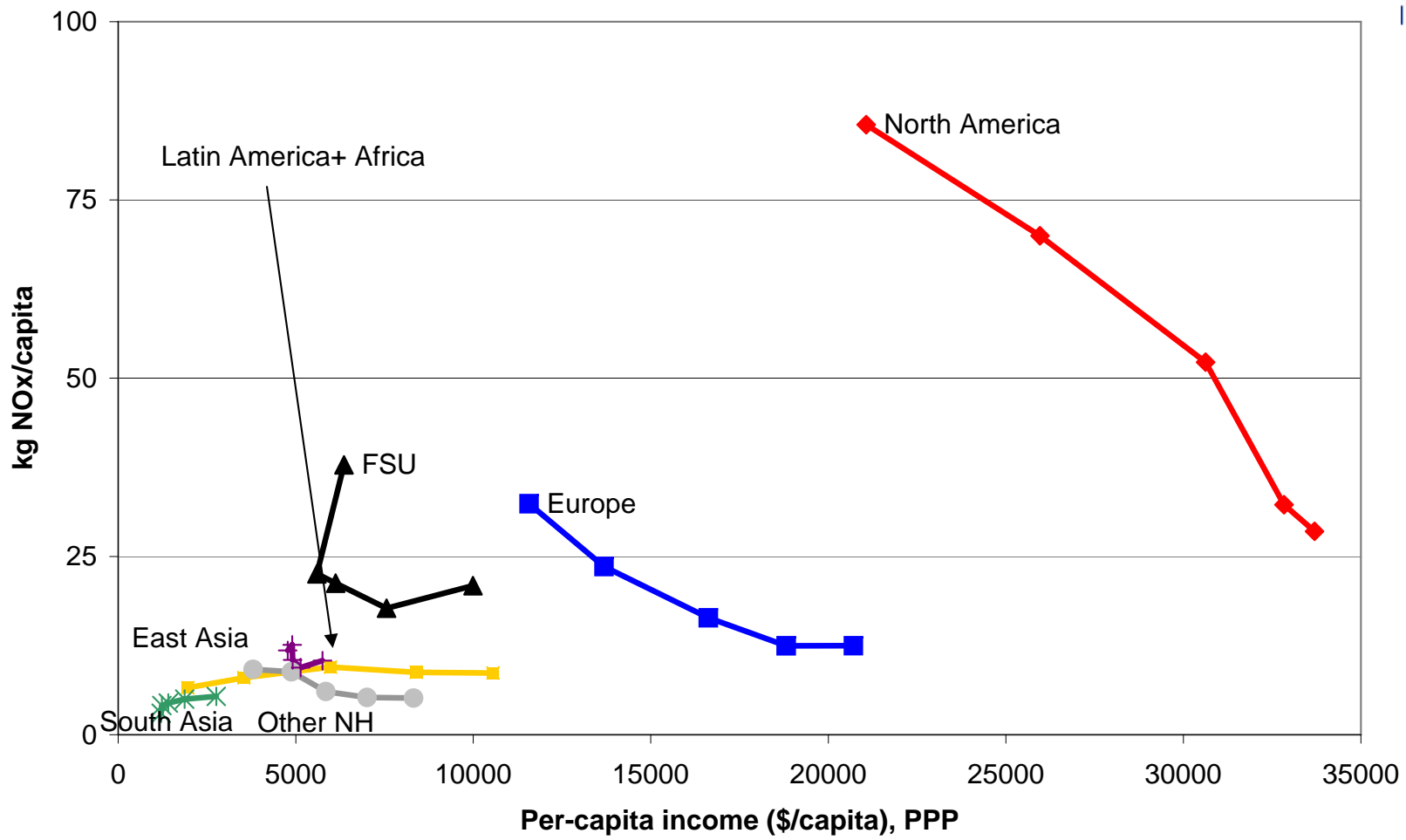
**Rest of world**

◆ Population (mio)    ■ GDP in PPP, 10 bn \$/yr    ▲ Energy use (100 PJ)

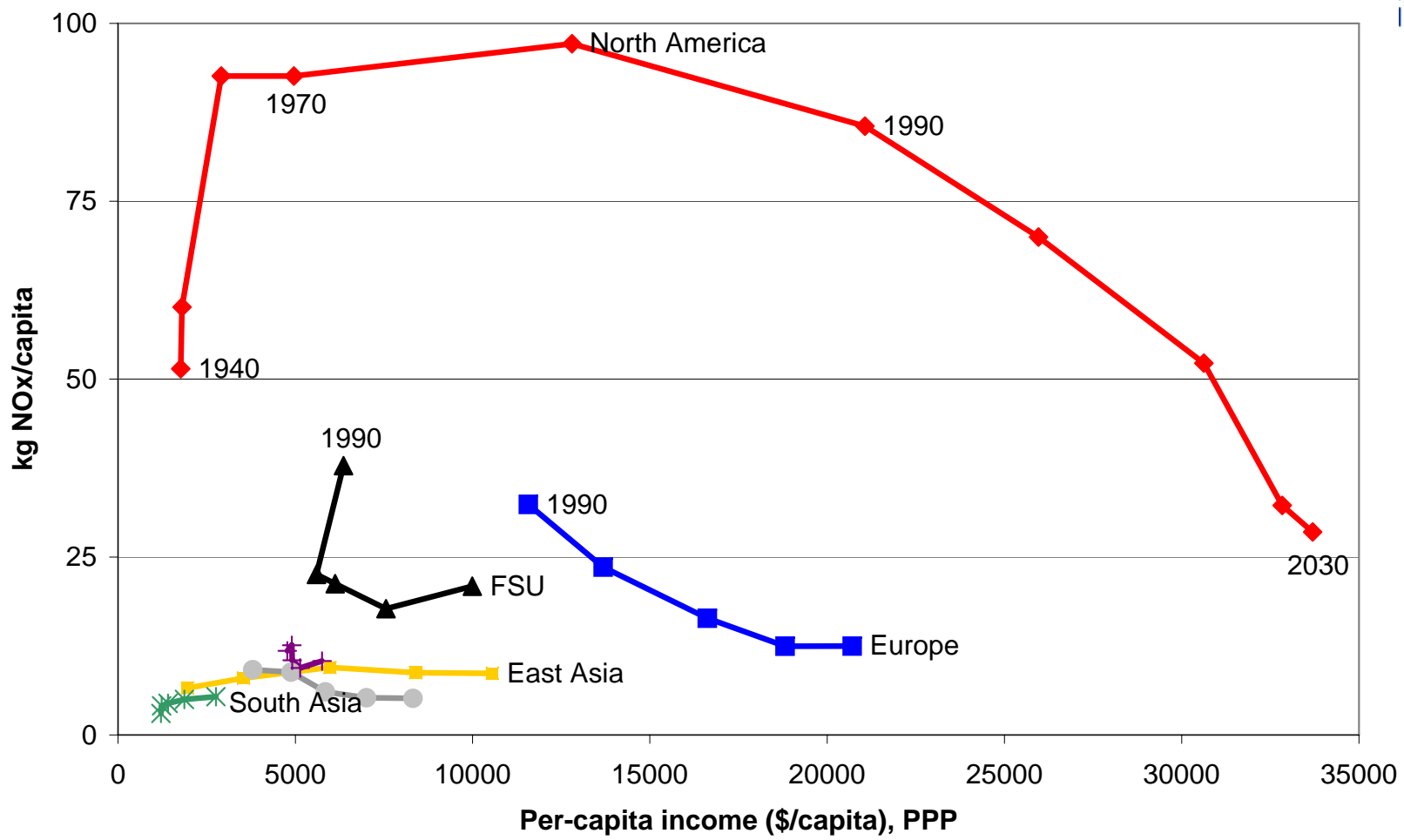
# Global NO<sub>x</sub> emissions by world region [Mt NO<sub>x</sub>]



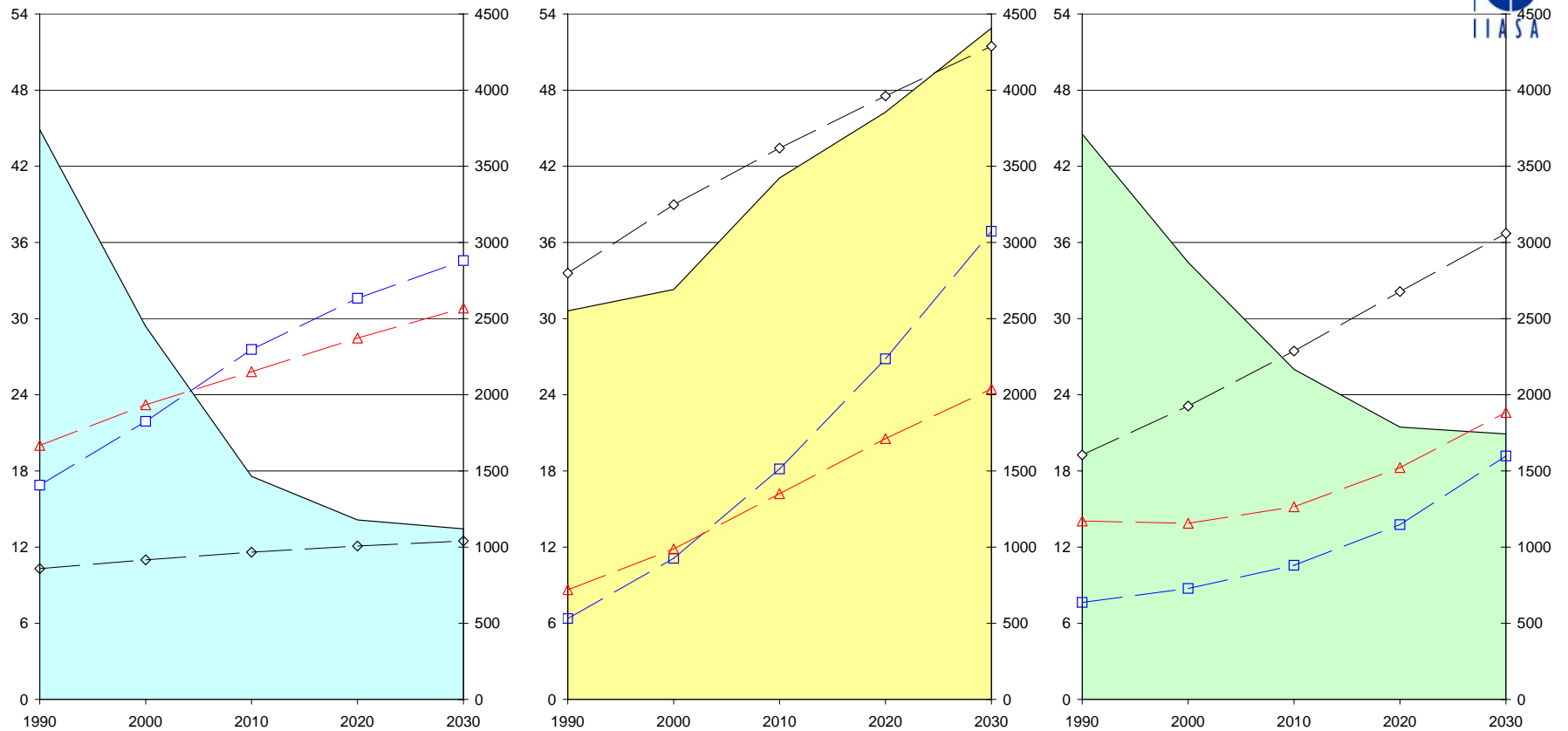
# Per-capita NO<sub>x</sub> emissions, 1990-2030



# Per-capita NO<sub>x</sub> emissions, 1940-2030



# "Current legislation" projection of SO<sub>2</sub> emissions [Mt SO<sub>2</sub>]



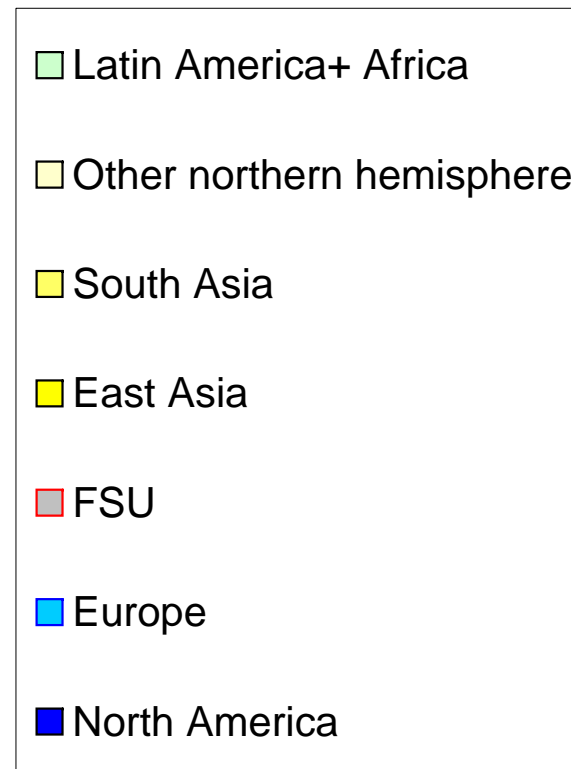
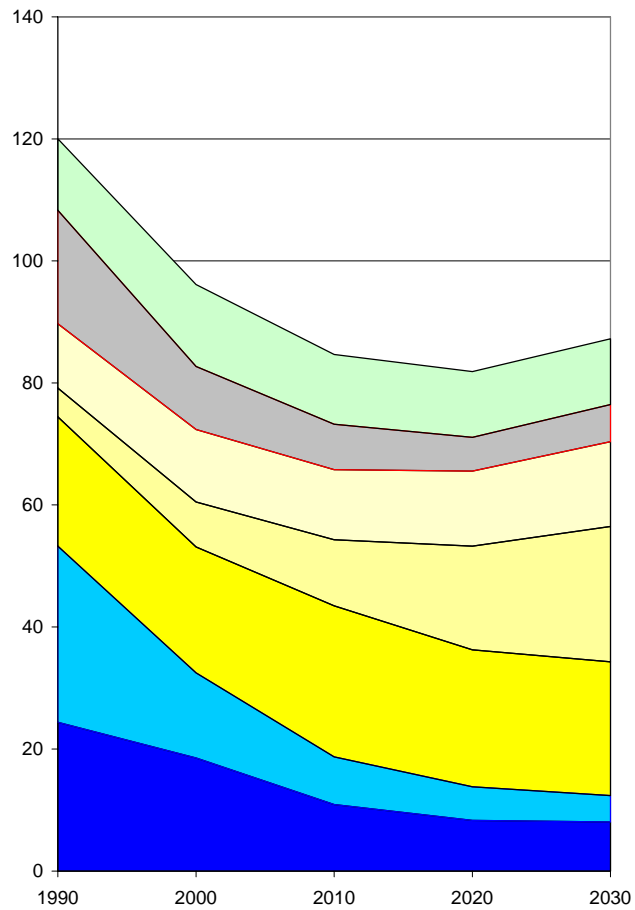
**OECD**

**Asia**

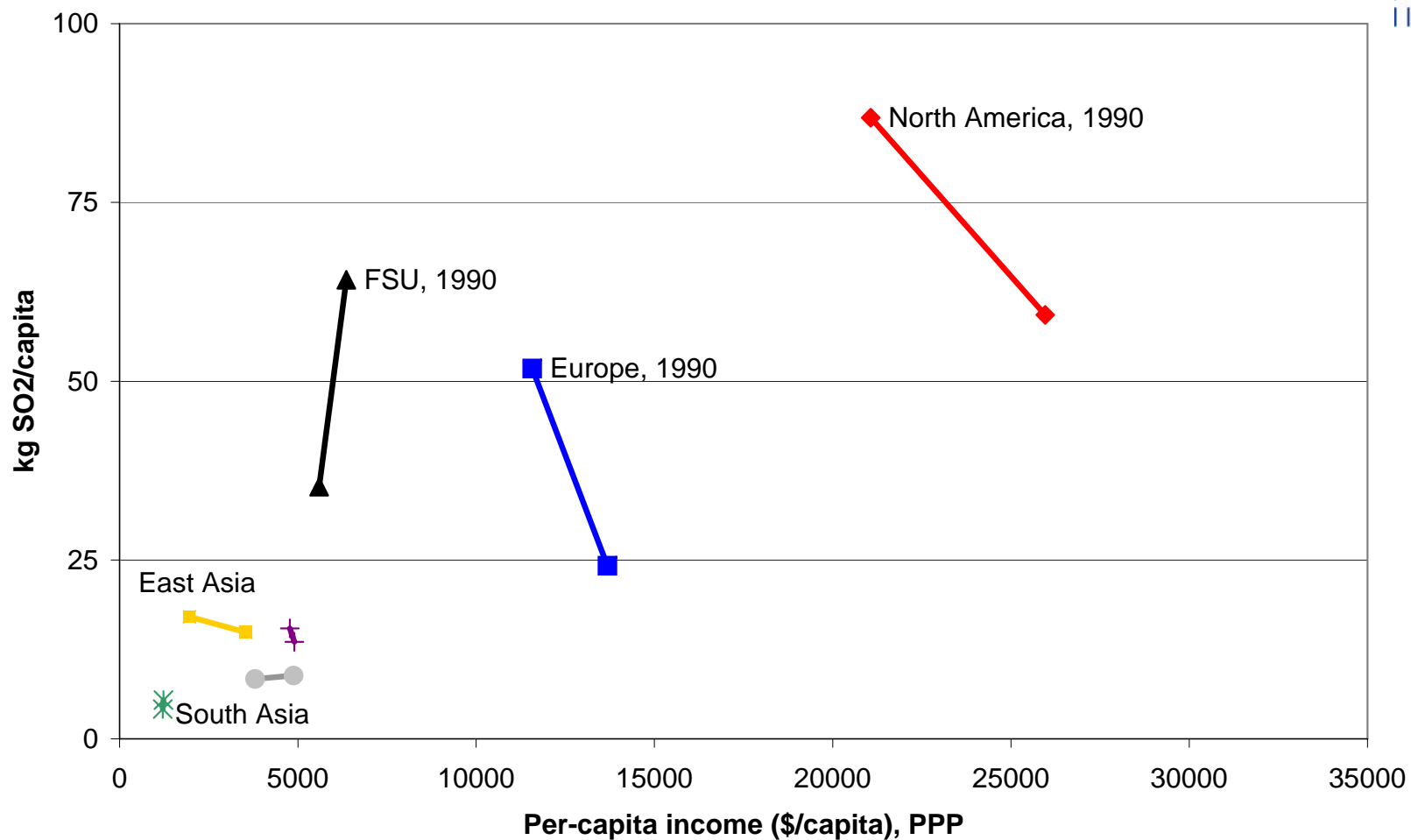
**Rest of world**

◆ Population (mio)    ■ GDP in PPP, 10 bn \$/yr    ▲ Energy use (100 PJ)

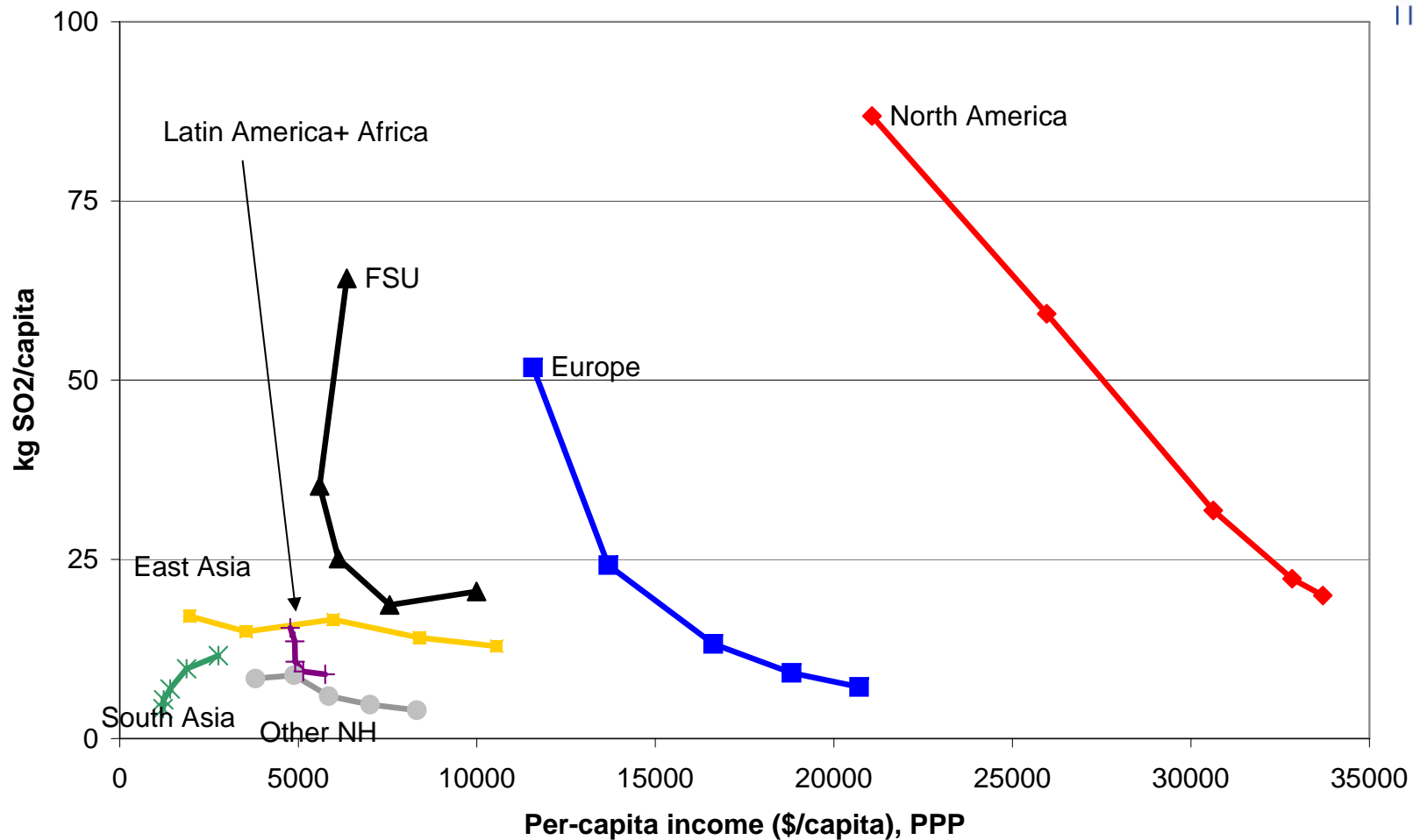
# Global SO<sub>2</sub> emissions by world region [Mt SO<sub>2</sub>]



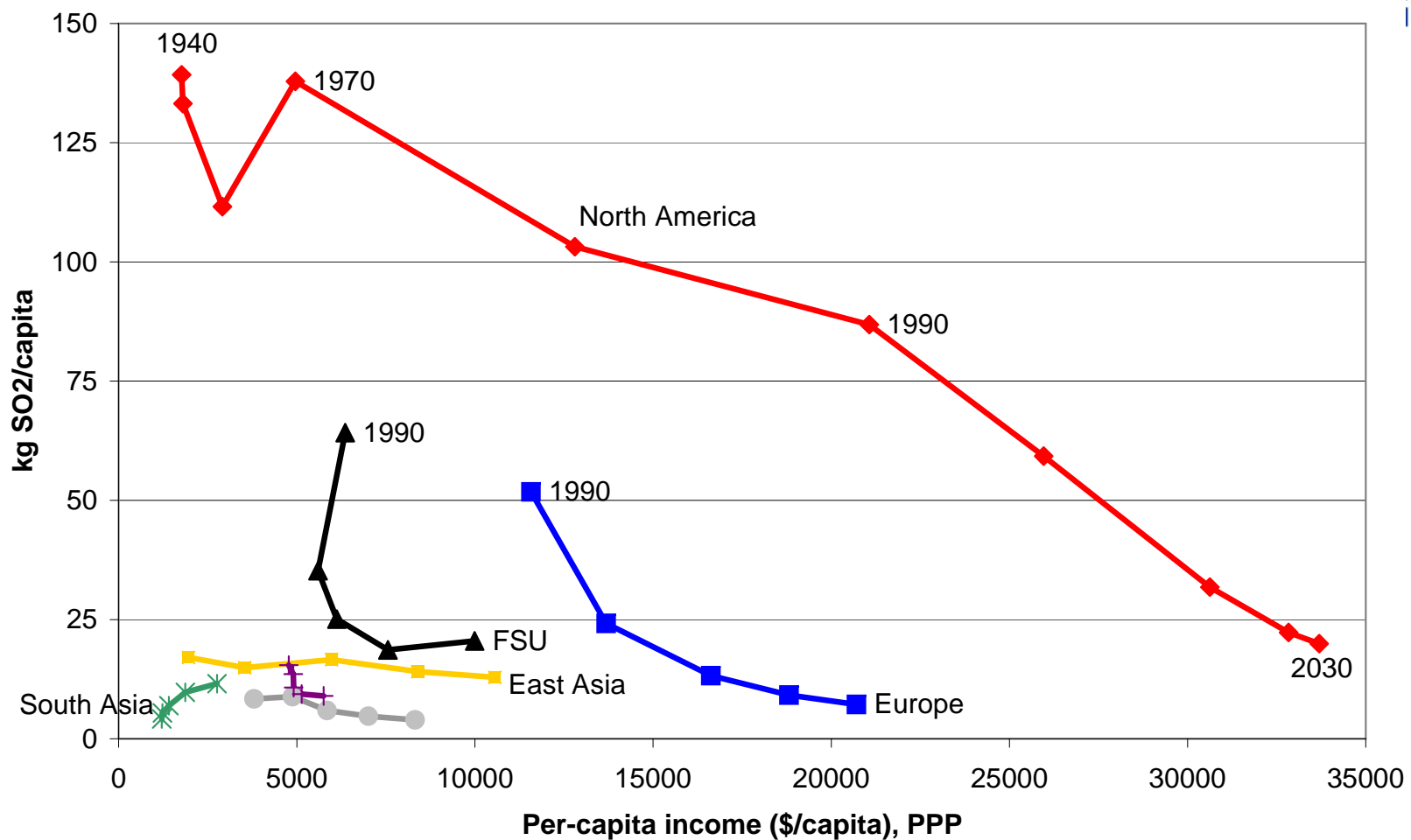
# Per-capita SO<sub>2</sub> emissions, 1990-2000



# Projections of per-capita SO<sub>2</sub> emissions, 1990-2030



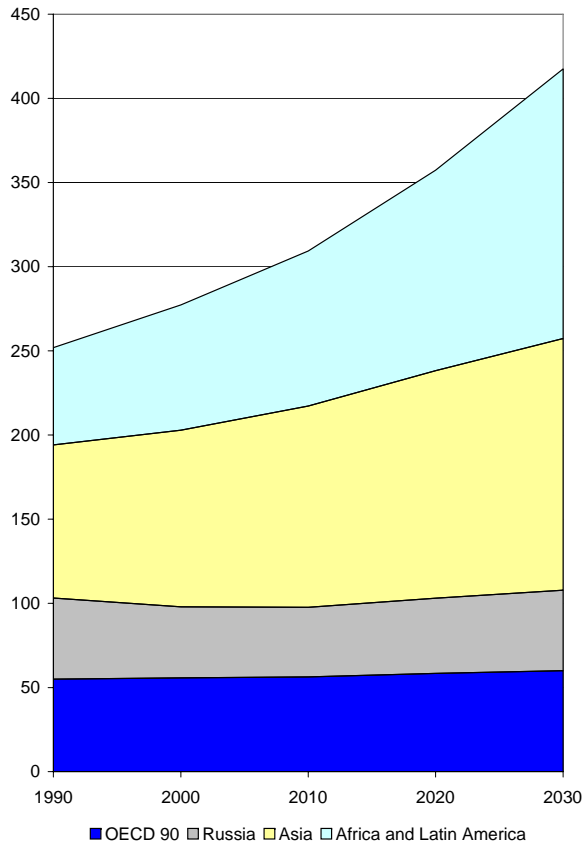
# Per-capita SO<sub>2</sub> emissions, 1940-2030



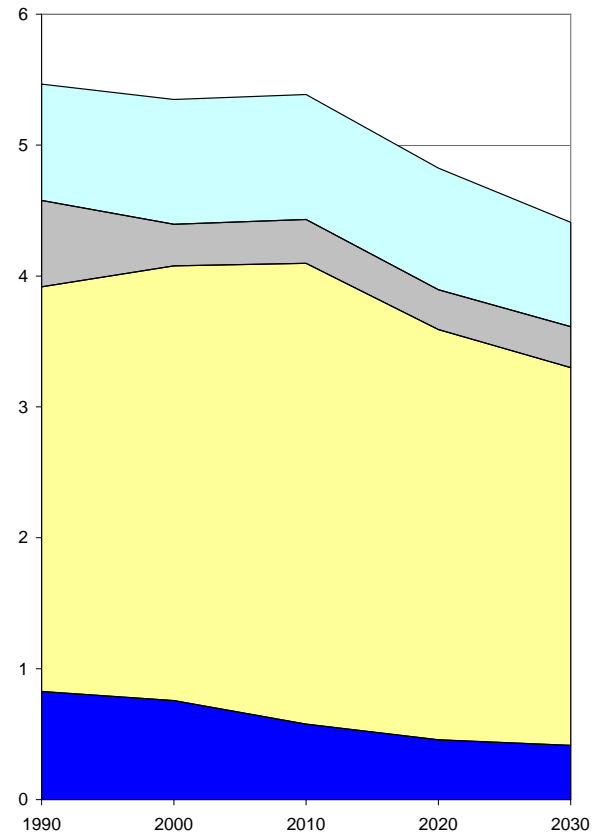
# Projections of CH<sub>4</sub> and BC emissions [Mt]



**CH<sub>4</sub>**



**Black carbon**



■ OECD 90 
 ■ Asia 
 ■ Former Soviet Union 
 ■ Africa and Latin America

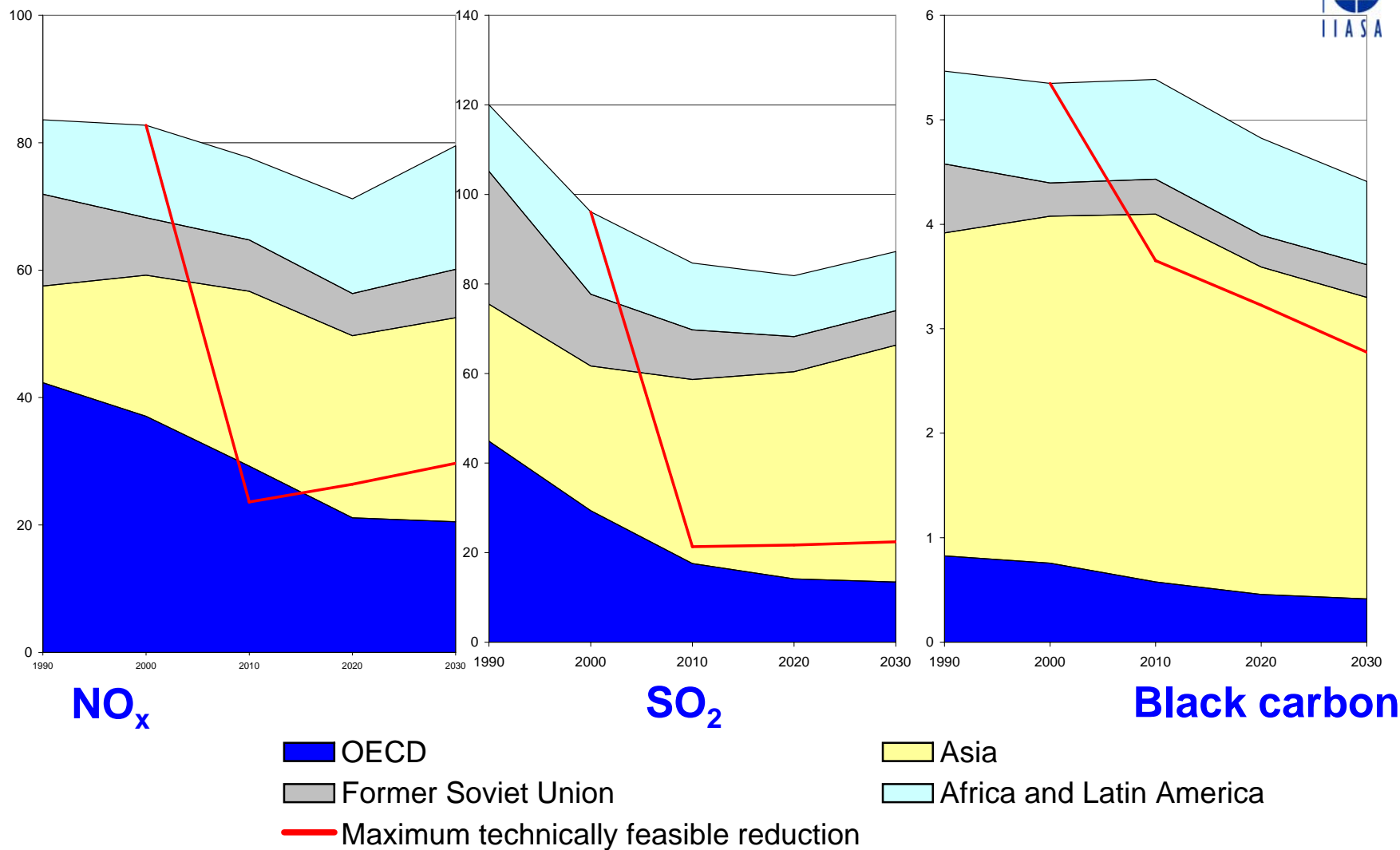
# Key uncertainties in emission projections

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- Enforcement of existing legislation
- Economic projections
- Further tightening of air quality legislation

# Potential for further emission controls from existing end-of-pipe technologies [Mt]



# Key uncertainties in emission projections

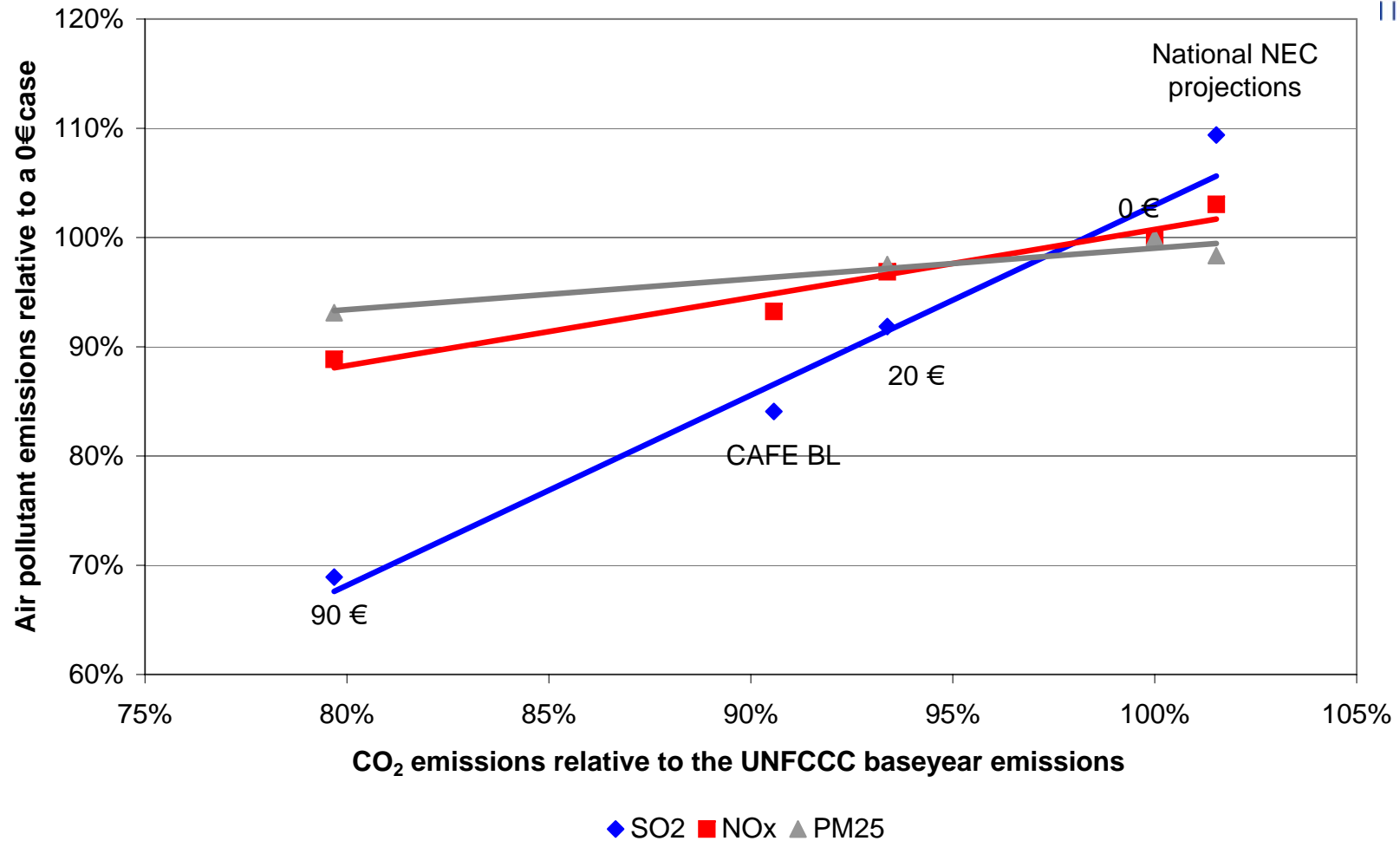
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- Enforcement of existing legislation
- Economic projections
- Further tightening of air quality legislation
- Future policies on CO<sub>2</sub> mitigation

# Air pollutant emissions as a function of CO<sub>2</sub> mitigation

## GAINS estimates for EU-25, 2020



# Summary

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For current expectations on economic development and legislation ...

- *Per-capita* emissions of  $\text{NO}_x$ ,  $\text{SO}_2$ , PM:
  - In OECD ... declining
  - In developing countries ... ~ stabilizing, at a low level!
- *Total* emissions up to 2030:
  - In OECD ... declining
  - In developing countries: increasing
  - Globally:
    - $\text{NO}_x$  ... stabilizing
    - $\text{SO}_2$ , PM ... declining
    - But  $\text{CO}_2$ ,  $\text{CH}_4$  ... increasing

# Conclusions

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- Despite (because?) of high pollution concentration levels (e.g., in urban areas), developing countries are not likely to repeat high *per-capita* levels of air pollutant emissions that have occurred in OECD countries.
- But no trend reversal for GHG emissions in sight
- Key uncertainties:
  - Enforcement of legislation
  - Further measures
  - Future climate policies