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Combined strategies to control climate change
and air pollution

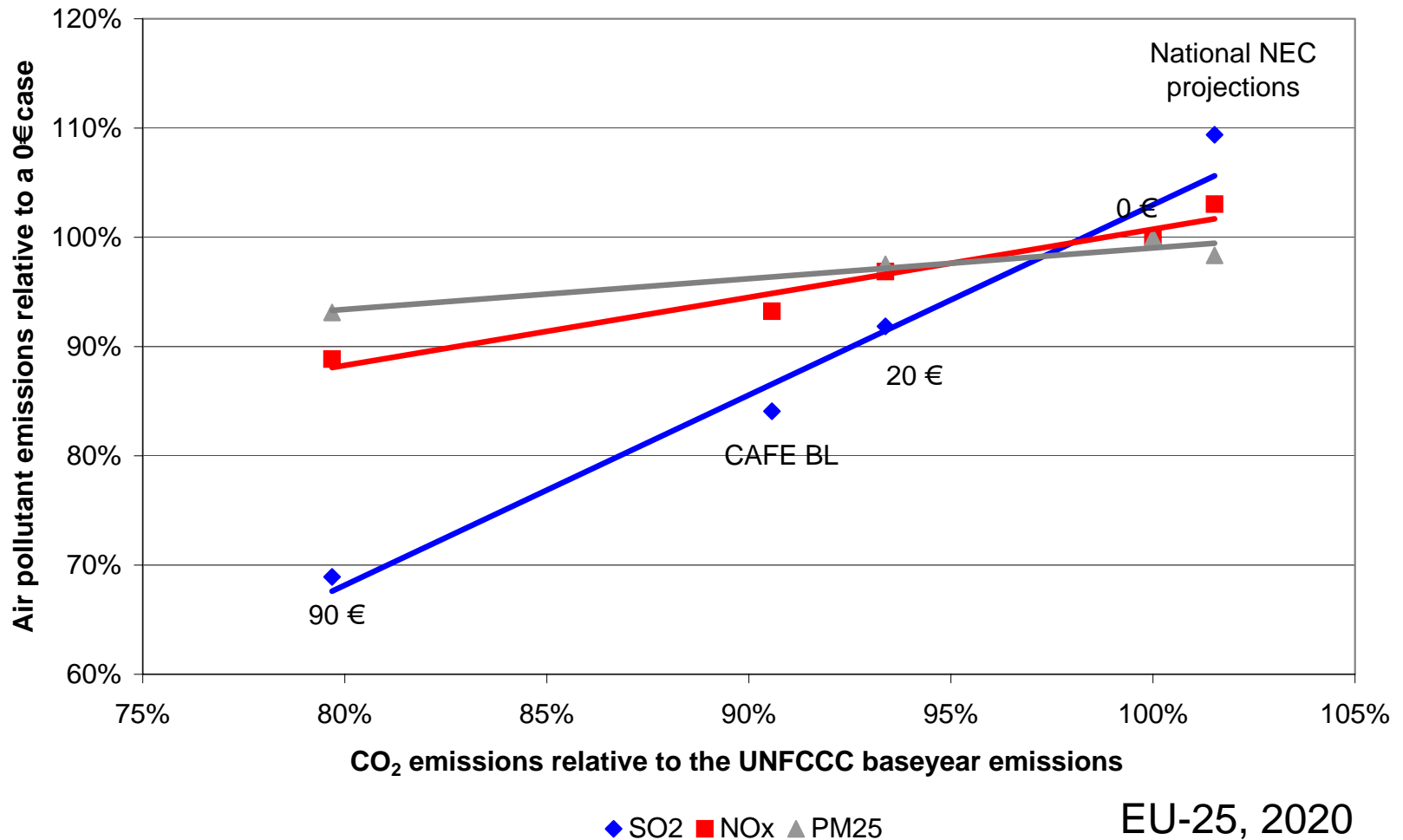
Some initial perspectives from
the GAINS model

Linkages between air pollution and climate: What can we quantify?



- Linkages between emissions

Air pollutant emissions as a function of CO₂ mitigation

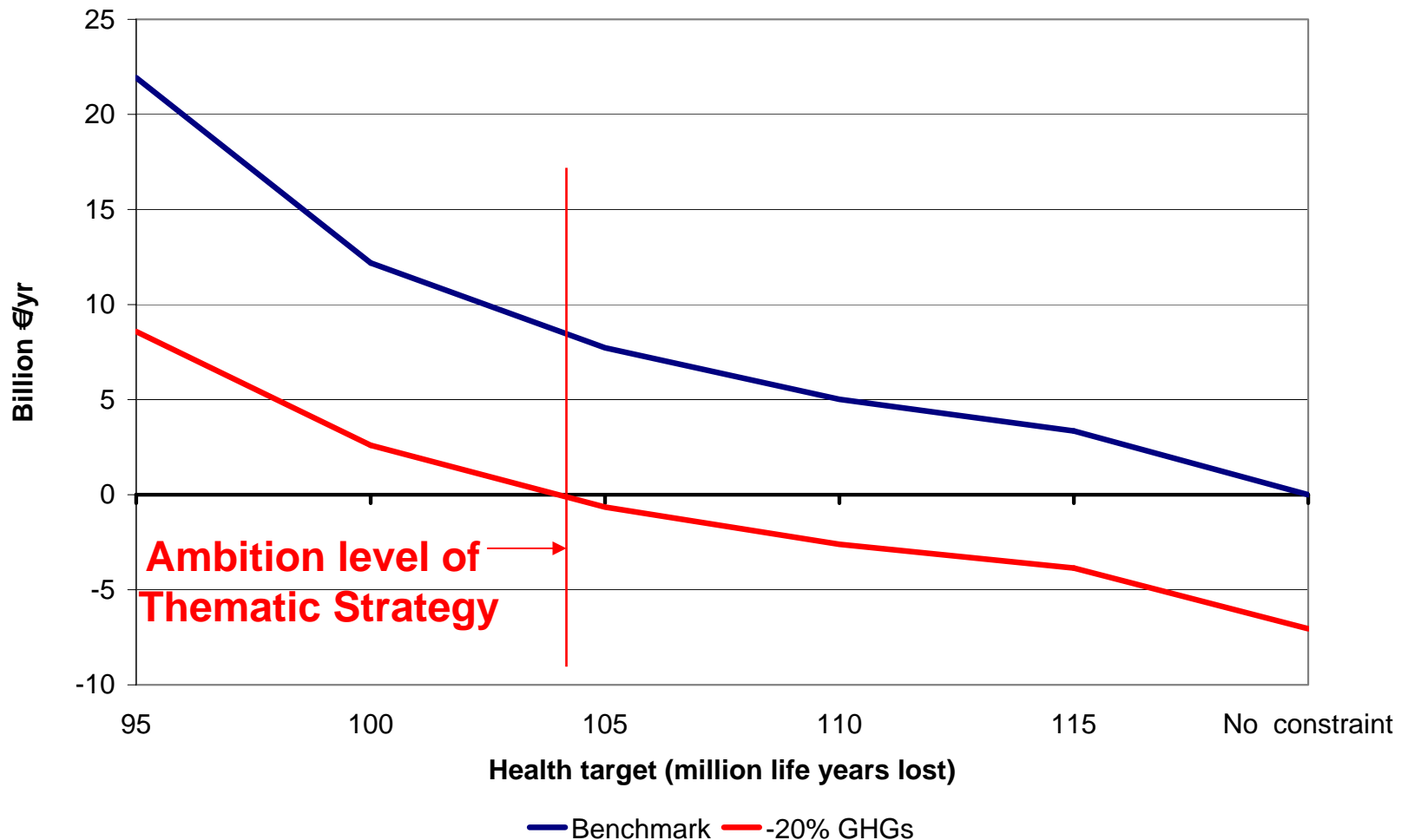


Linkages between air pollution and climate: What can we quantify?



- Linkages between emissions
- Linkages between emission control costs

Net costs for further air pollution control as a function of CO₂ mitigation



Linkages between air pollution and climate: What can we quantify?



- Linkages between emissions
- Linkages between emission control costs
- Linkages in the atmosphere

Radiative forcing by aerosols: past & future

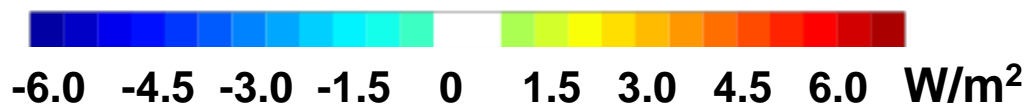
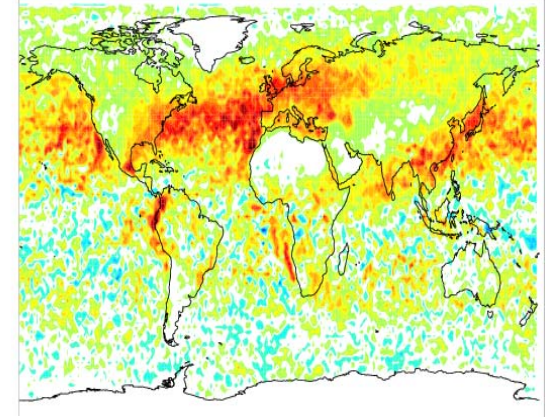
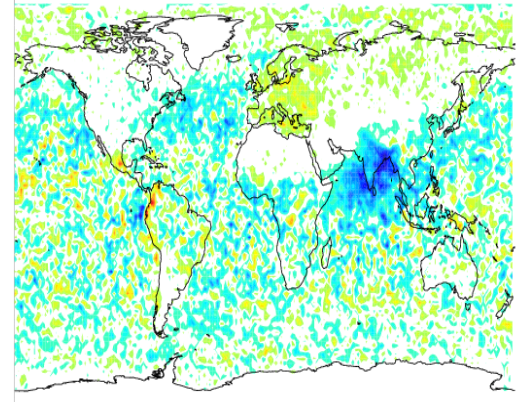
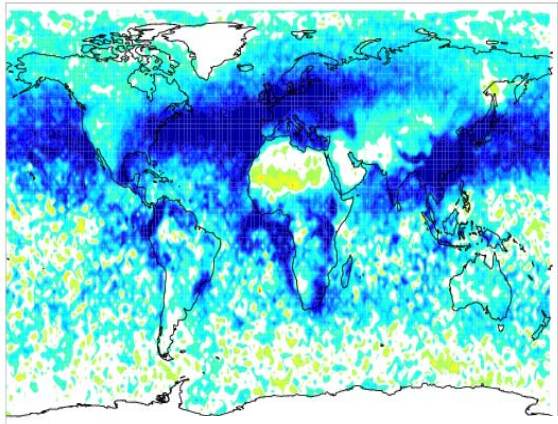
(direct & indirect effects)

Radiative forcing from aerosols

1750 - 2000
- 1.95 W/m²

With current legislation
2000 - 2030
- 0.17 W/m²

With maximum
technical AP reductions
2000 - 2030 MFR
+ 1.12 W/m²



Radiative forcing from greenhouse gases

1750 - 2000
+ 2.60 W/m²

2000 - 2050 B1
+ 1.90 W/m²

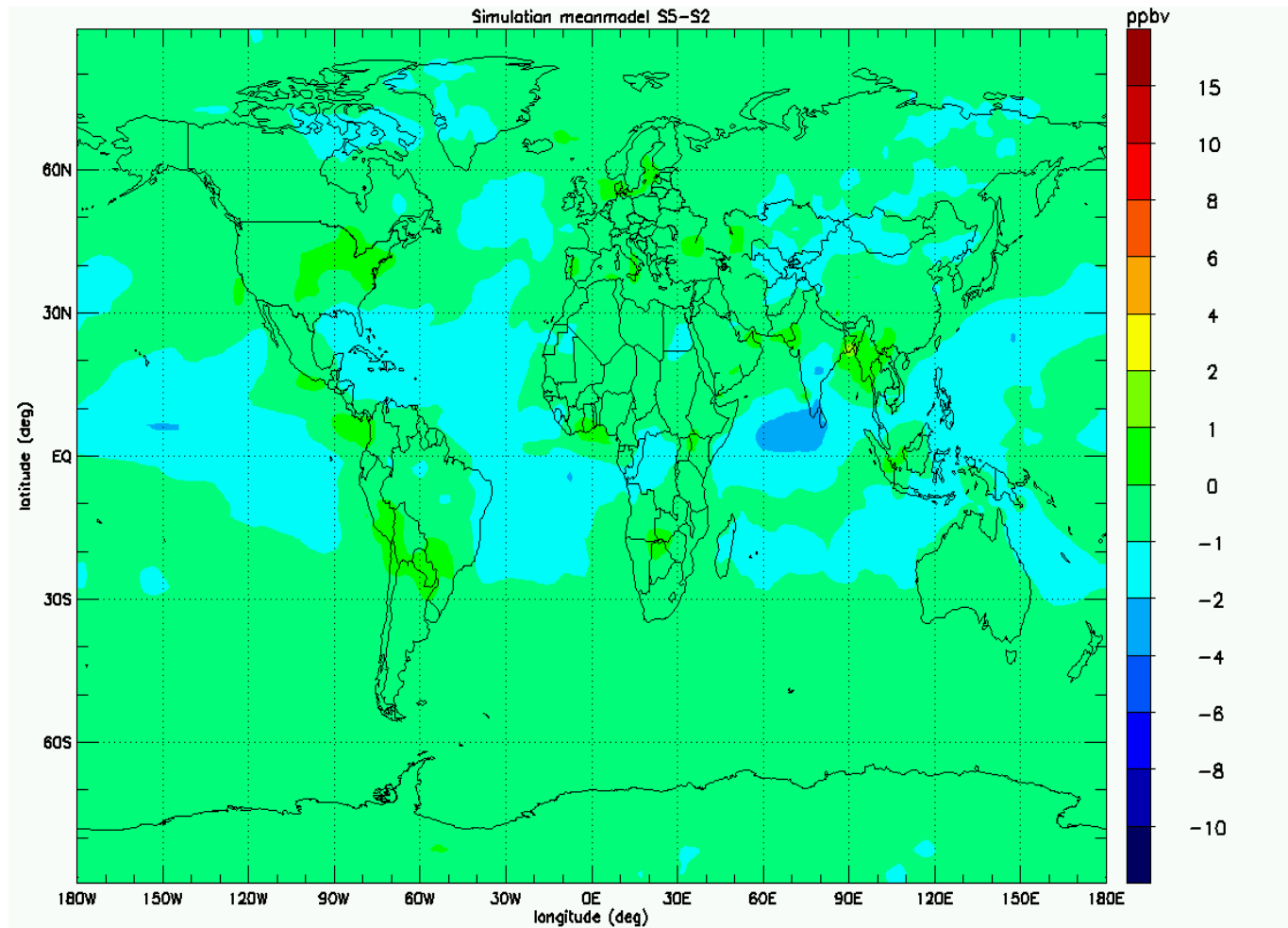
Linkages between air pollution and climate: What can we quantify?



- Linkages between emissions
- Linkages between emission control costs
- Linkages in the atmosphere
- Linkages between impacts

Ozone changes between 1990s and 2020s climates, for constant 2030 emissions

Sources: Dentener et al. EST 2006; Stevenson et al. JGR, 2005



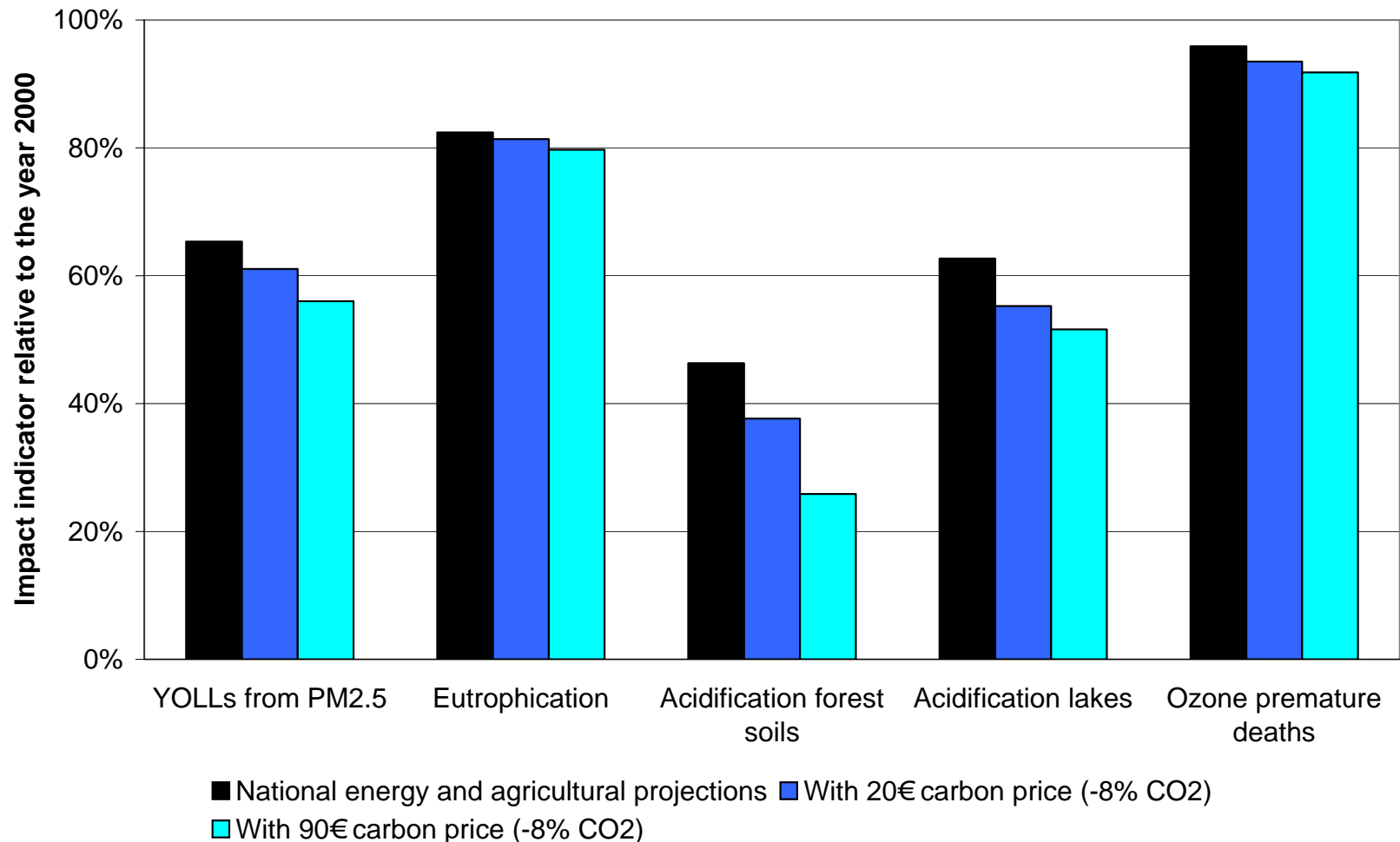
If AP and CC strategies are designed and analyzed separately ...



- Incomplete assessment of benefits (co-benefits ignored)

Impact indicators for different GHG projections

EU-25, current legislation baseline 2020



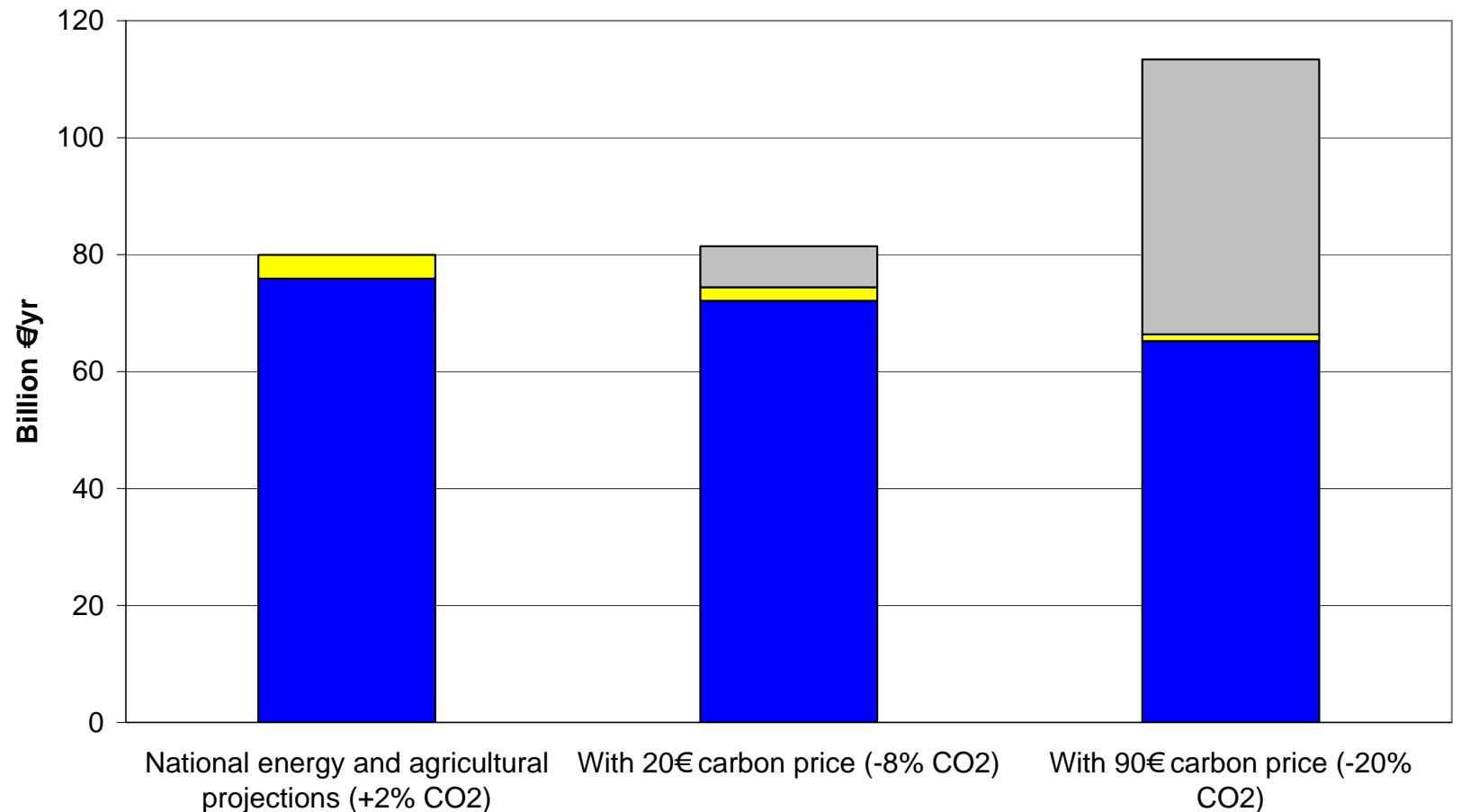
If AP and CC strategies are designed and analyzed separately ...



- Incomplete assessment of benefits (co-benefits ignored)
- Double-counting of costs

Costs for AP and GHG mitigation in 2020

EU-25, preliminary GAINS estimates



■ Costs for current legislation on air pollution ■ Additional costs for TSAP ■ Additional costs for the CO2 reduction

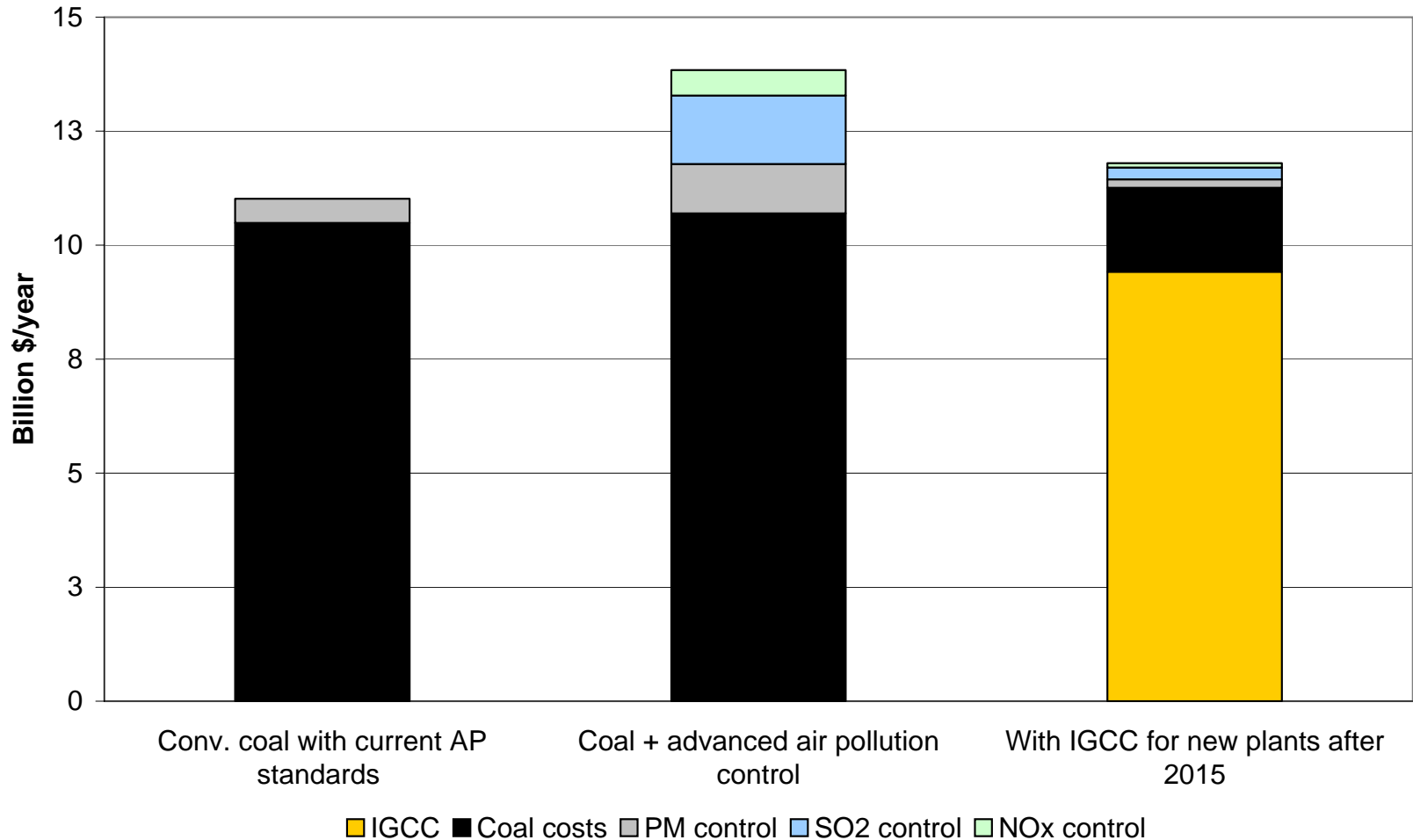
If AP and CC strategies are designed and analyzed separately ...



- Incomplete assessment of benefits (co-benefits ignored)
- Double-counting of costs
- Overlooking the "2nd best" options

Costs of electricity generation

Andhra Pradesh, 2020



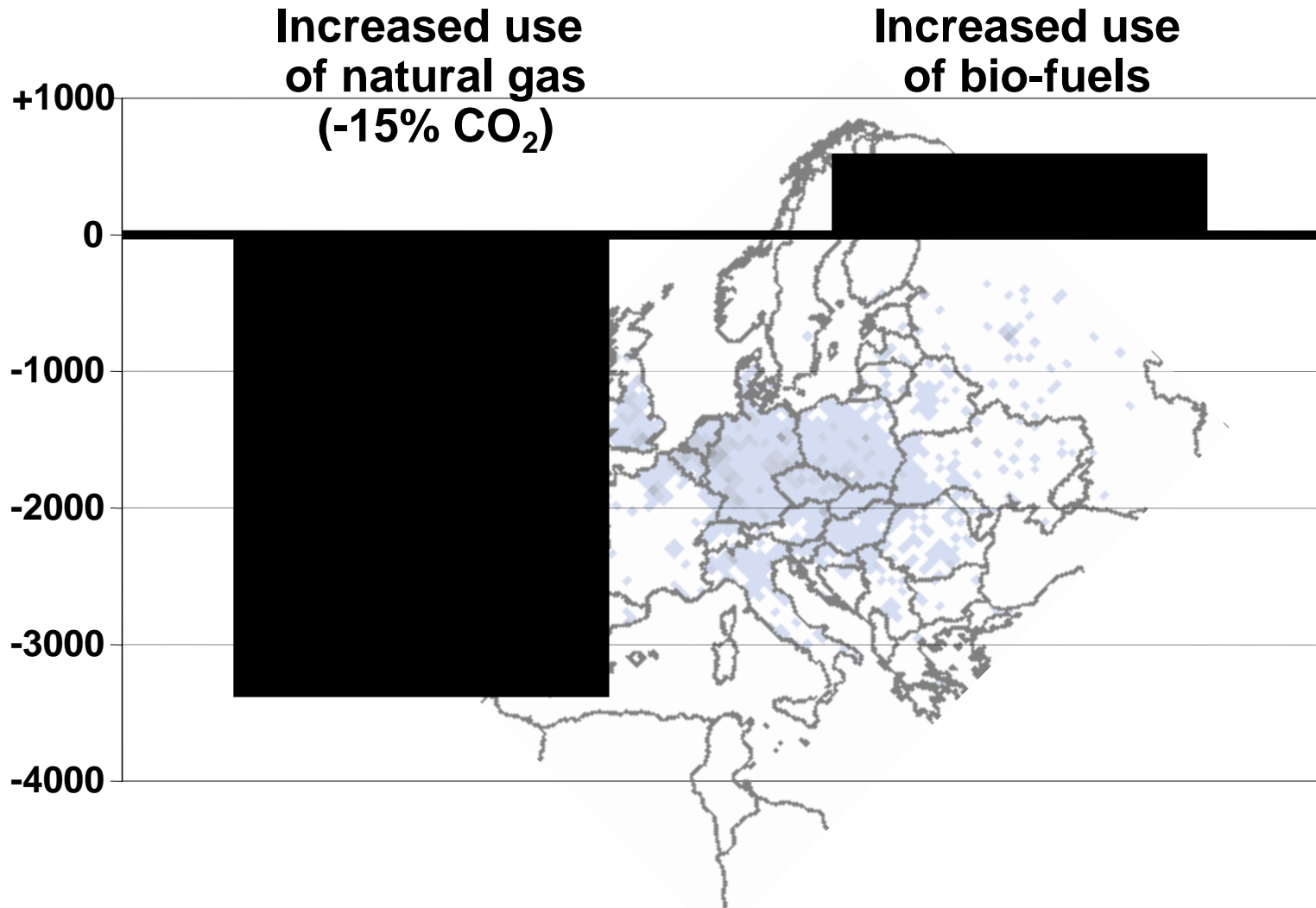
If AP and CC strategies are designed and analyzed separately ...



- Incomplete assessment of benefits (co-benefits ignored)
- Double-counting of costs
- Overlooking the “2nd best” options
- Running into trade-offs (diesel, bio-fuels)

Differences in premature deaths

attributable to PM2.5, compared to baseline (cases/year)

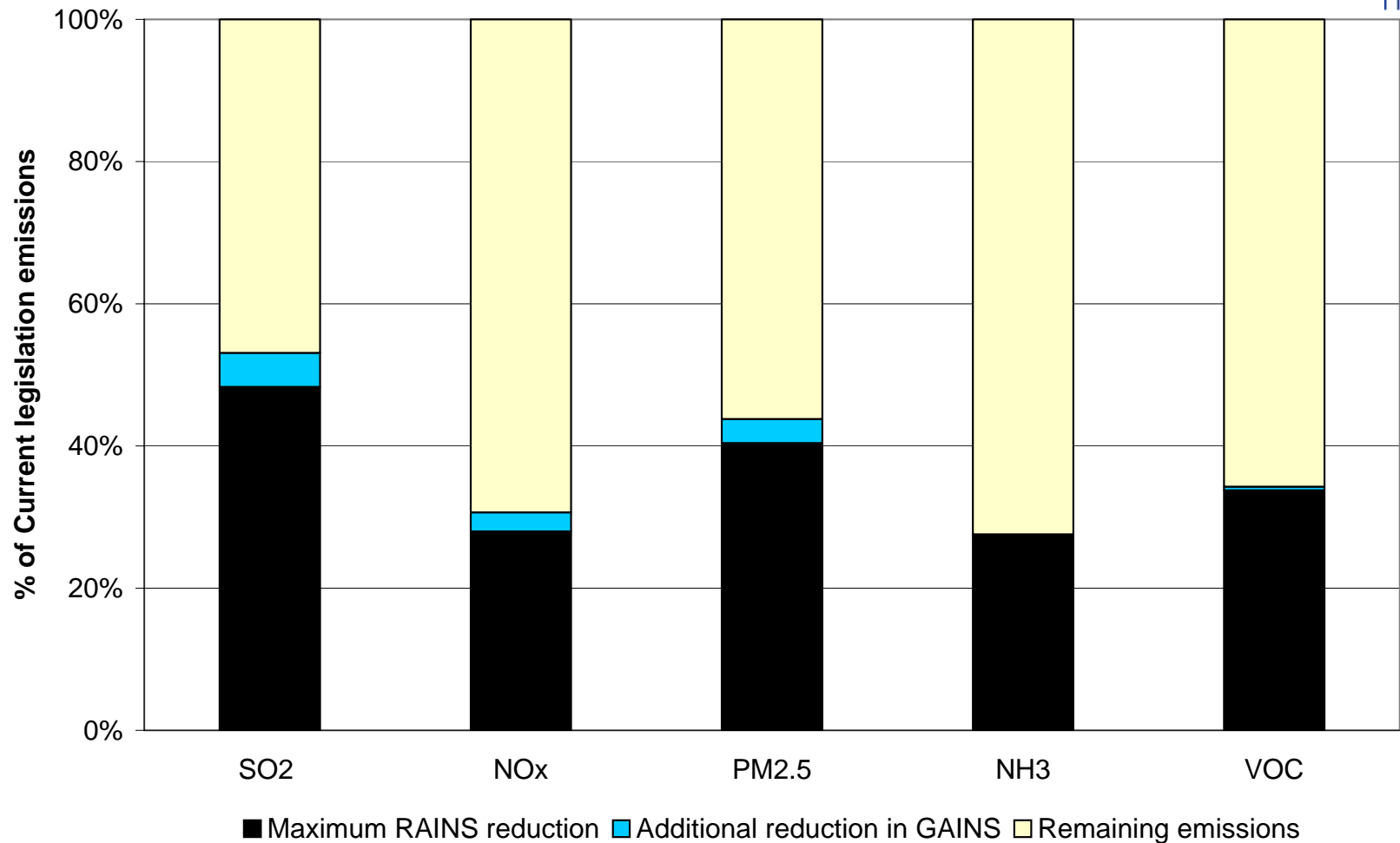


If AP and CC strategies are designed and analyzed separately ...



- Incomplete assessment of benefits (co-benefits ignored)
- Double-counting of costs
- Overlooking the “2nd best” options
- Running into trade-offs (diesel, bio-fuels, aerosols)
- Incomplete assessment of mitigation potential

Further reduction potential offered by the GAINS approach (EU-25, 2020)



If independent AP and CC strategies are analyzed together ...



- + Correct assessment of costs
- + Correct assessment of benefits
- ± Discovery of trade-offs, **but no prevention**
- **Overlooking the 2nd best options**

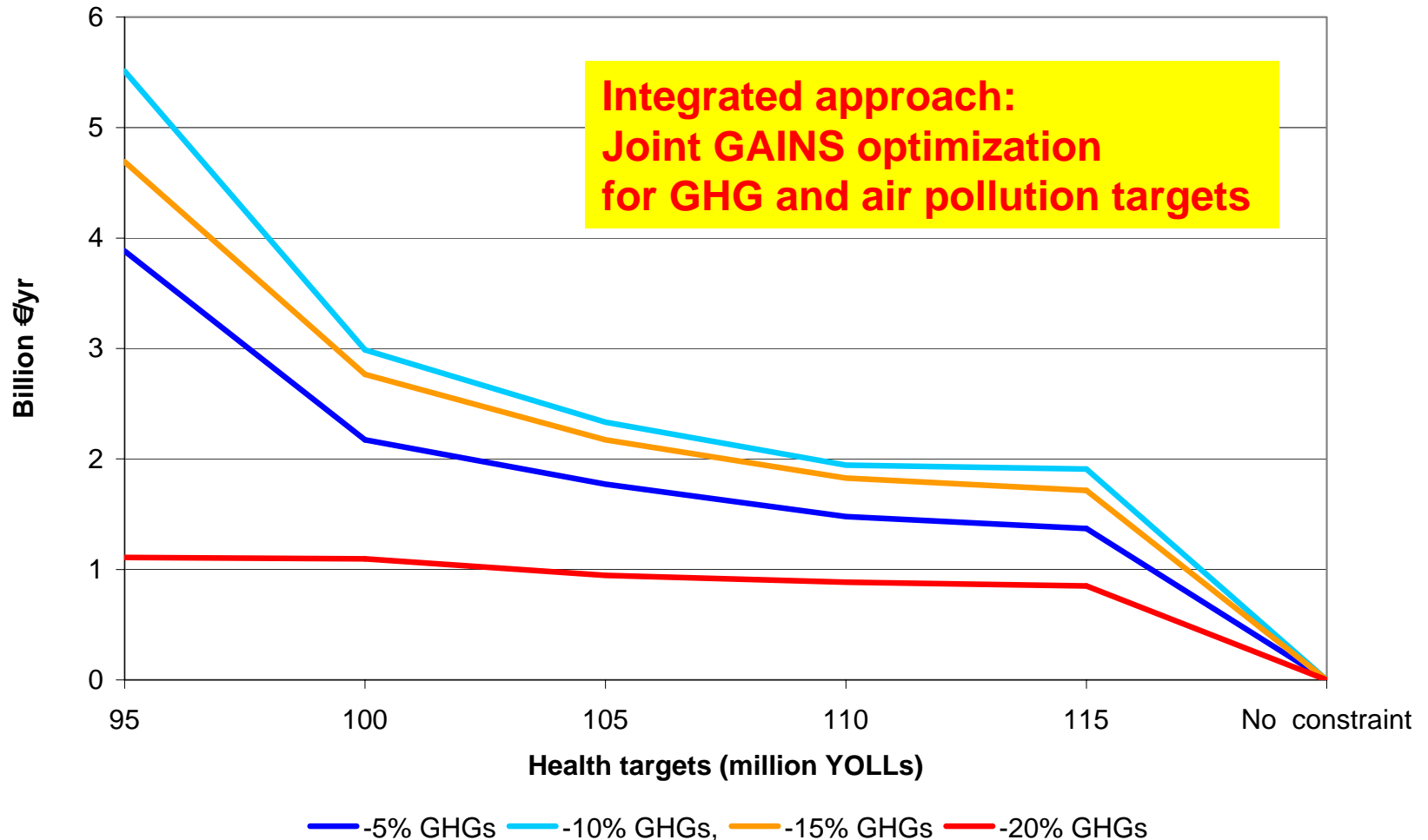
If AP and CC strategies are designed together ...



- + Correct assessment of costs
- + Correct assessment of benefits
- + Discovery and prevention of trade-offs
- + Increased cost-effectiveness by utilizing the 2nd best options

Cost savings from an integrated approach

Provisional GAINS estimates, EU-25, 2020



If AP and CC strategies are designed together ...



- + Correct assessment of costs
- + Correct assessment of benefits
- + Discovery and prevention of trade-offs
- + Increased cost-effectiveness by utilizing the 2nd best options
- But: increased analytical and institutional complexity

Conclusions



- Separate design and analysis of AP and GHG mitigation strategies is likely to result in inefficient solutions
- Combined analysis of separate strategies:
Correct accounting, but possibly inefficient allocation
- Combined analysis and joint strategies:
Efficient allocation, but institutional and analytical complexities