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Recent model developments and scenario runs with the GAINS model

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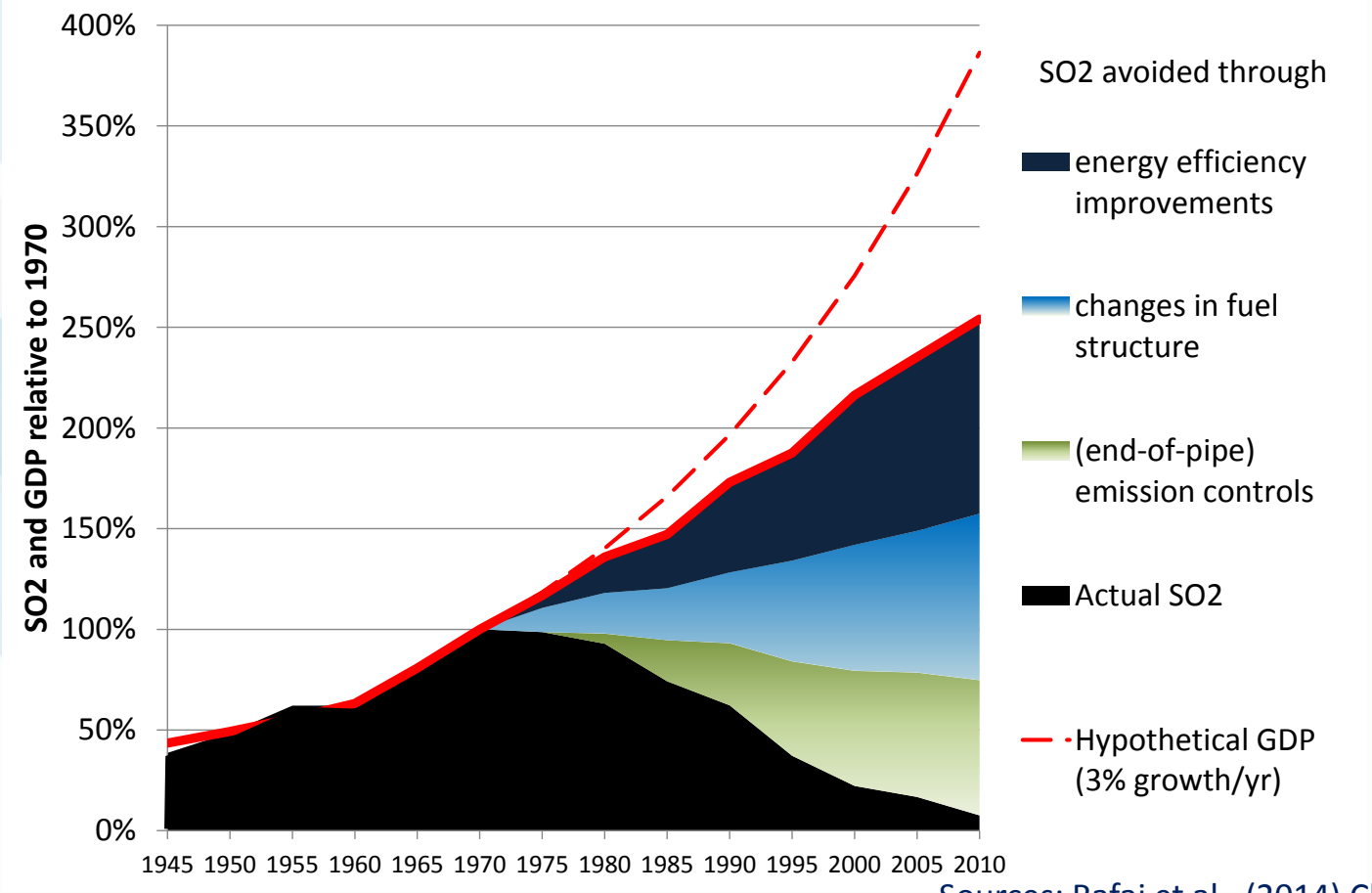
EMEP Centre for Integrated Assessment Modelling

Contents

- Avoided air pollution effects 1990-2010
- The role of EU-wide instruments for achieving the NECs
- Global-scale analyses

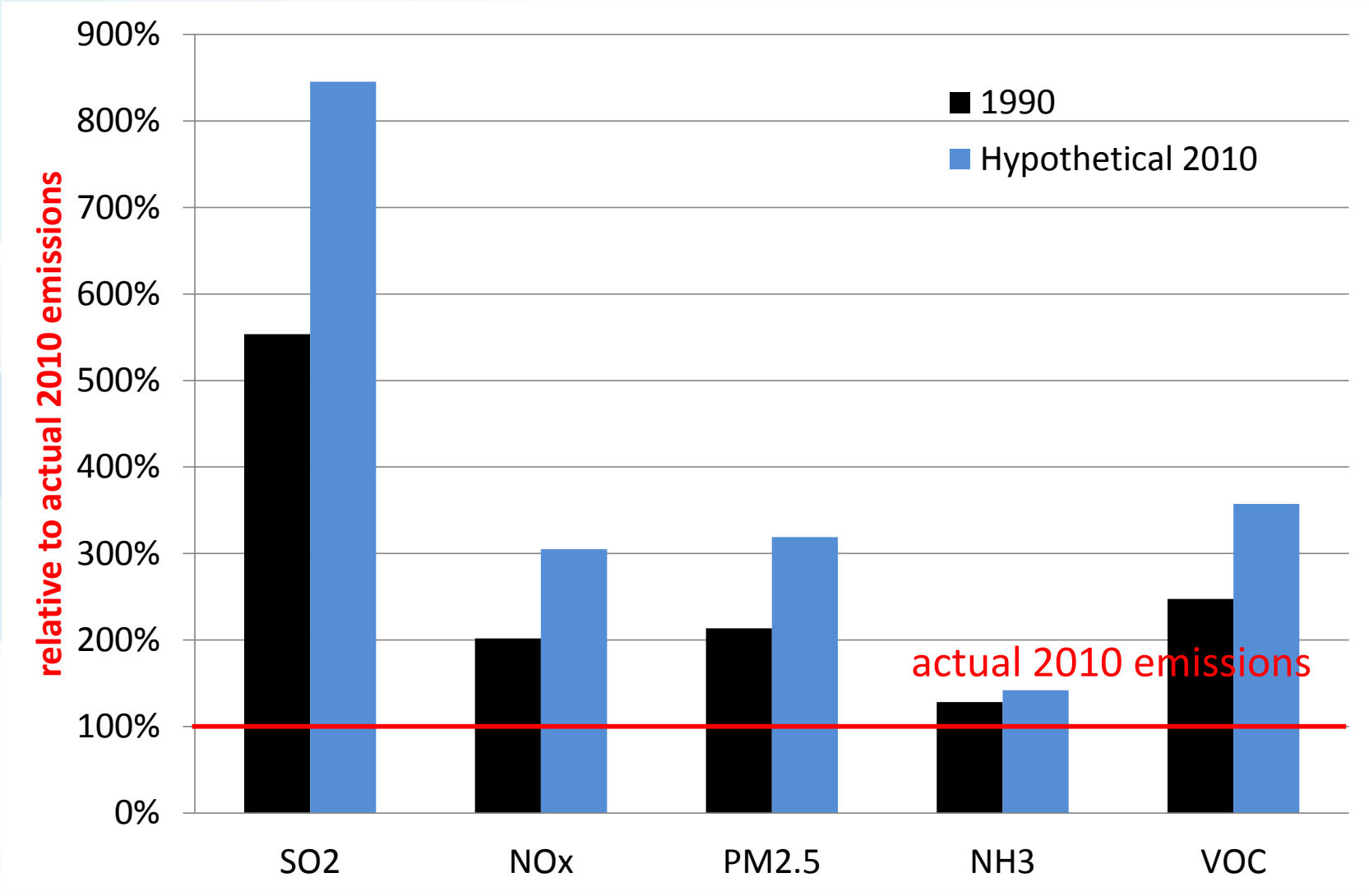
Policy action was an important driver for the past decline in emissions

Decoupling between GDP and SO_2 emissions in Western Europe

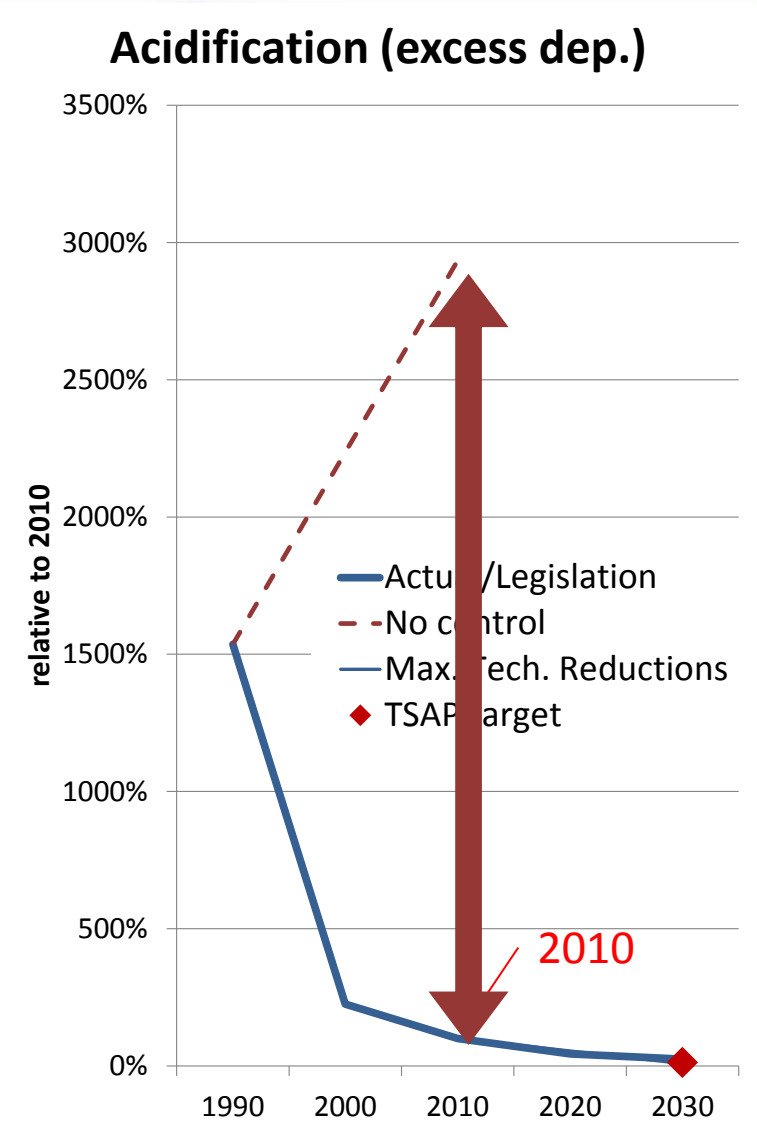


Sources: Rafaj et al., (2014) Clim.Change 24(3)477-504
(2014) Sc.Tot. Env. 414

Hypothetical emissions in 2010 (EU-28)



Air pollution impacts 1990-2010-2030 (EU28)



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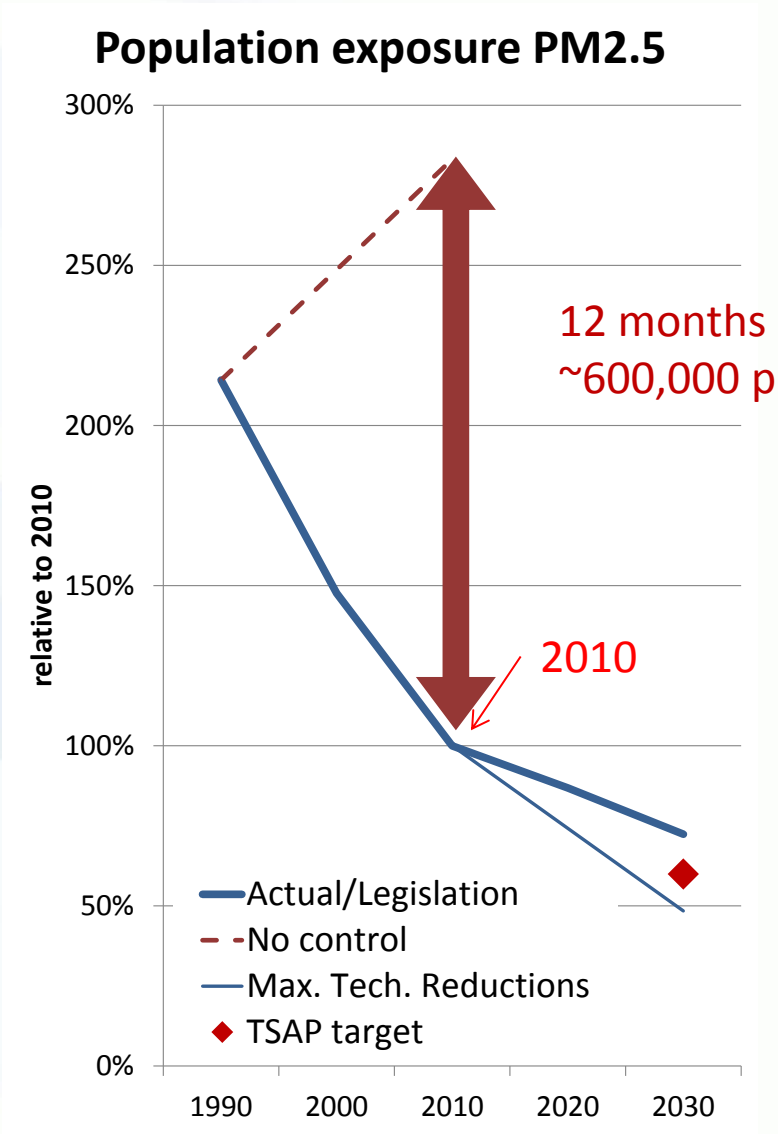

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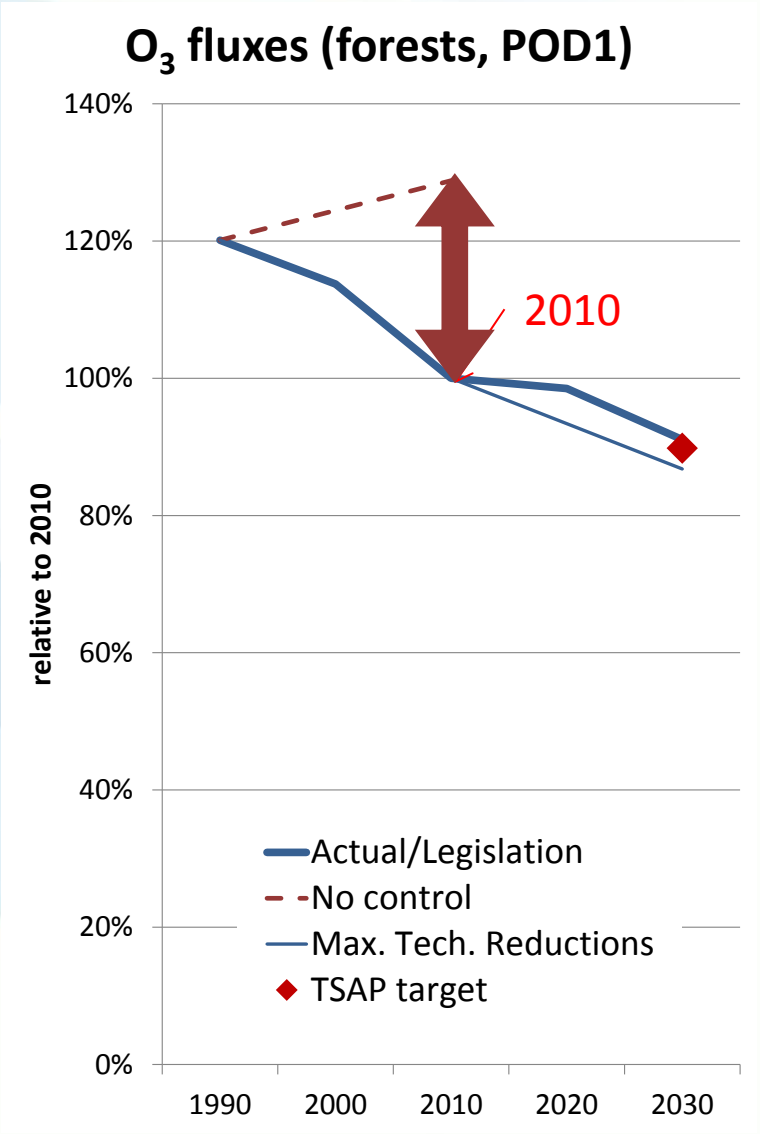
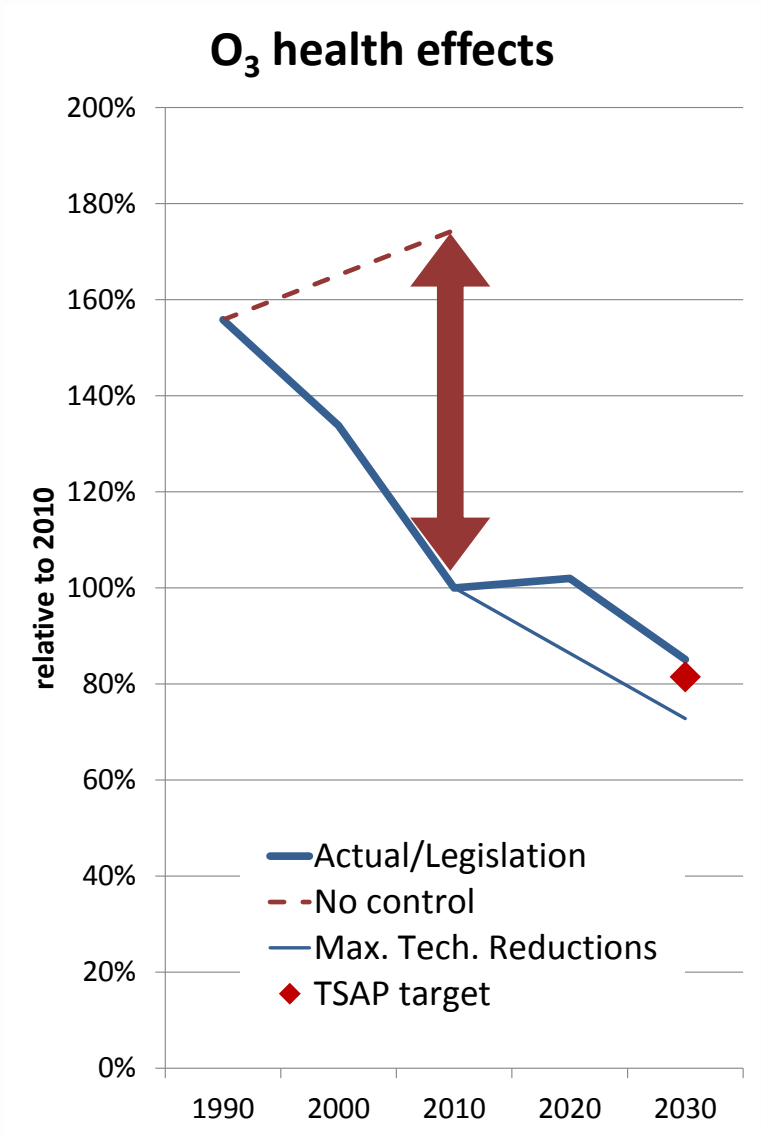
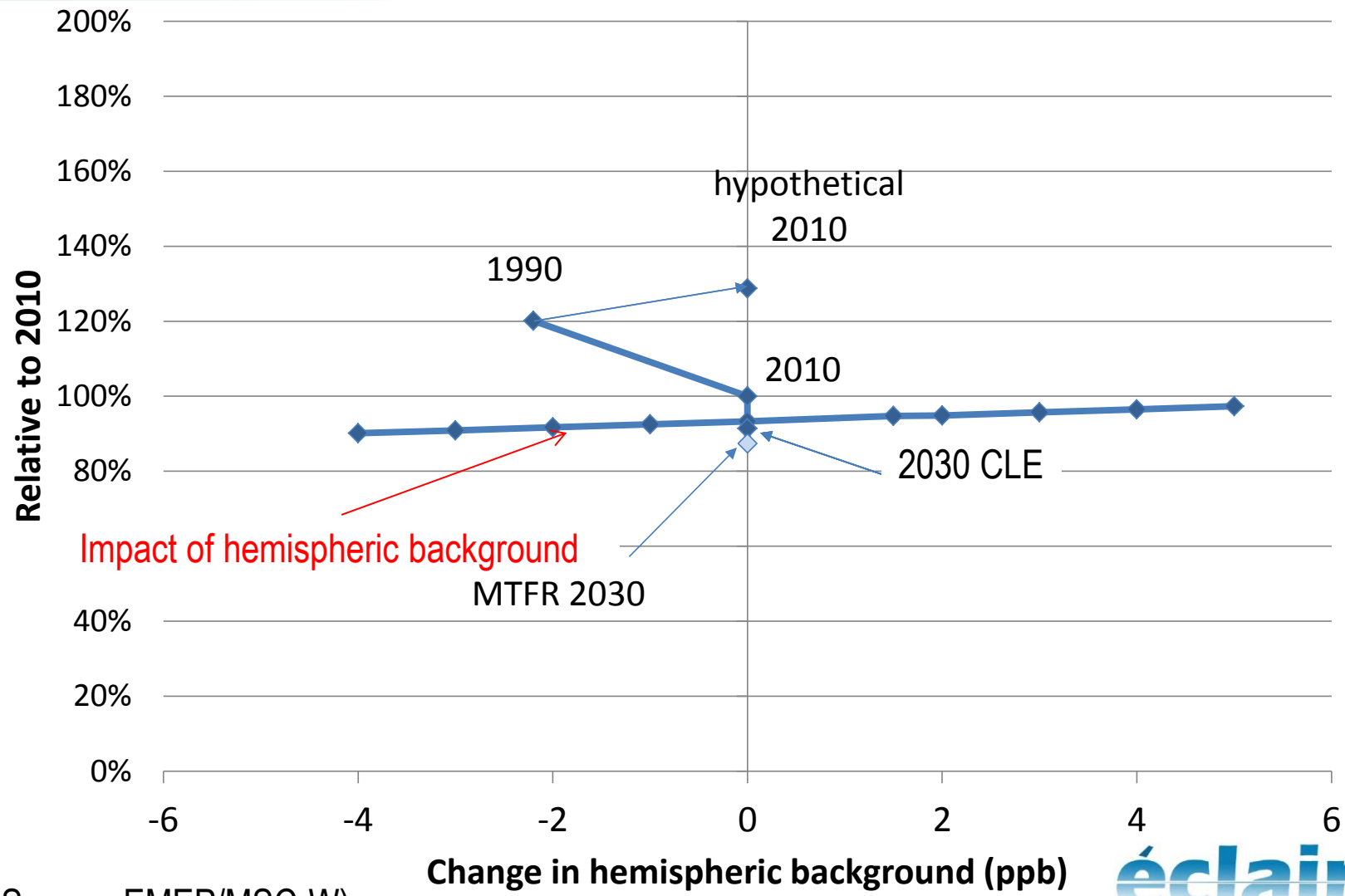


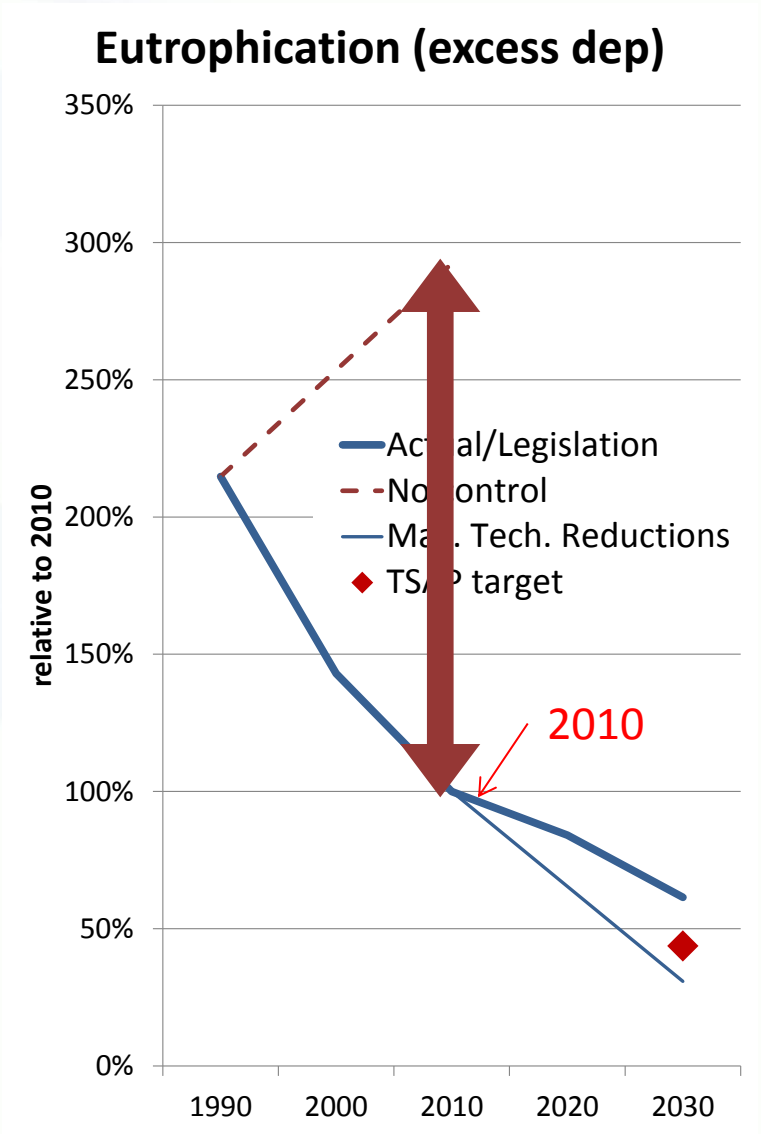


Impact of European emissions and hemispheric background on ozone fluxes (POD1) in Europe



(Source: EMEP/MSC-W)

Air pollution impacts 1990-2010-2030 (EU28)



Conclusions (1)

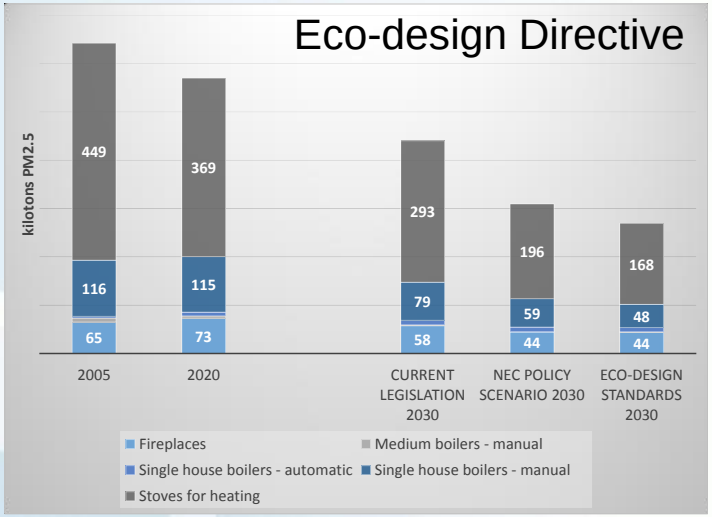
Model estimates suggest that policy interventions (among other factors) have avoided dramatic further increases in air pollution impacts in Europe.

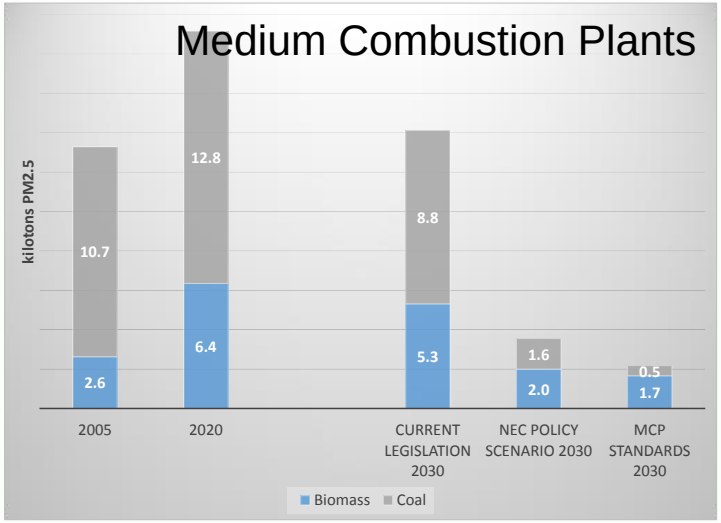
In absence of policies, in 2010 in the EU-28:

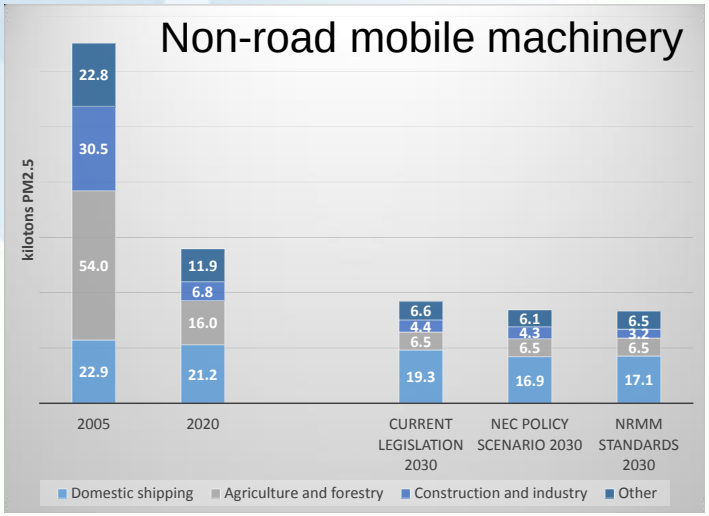
- acidification would have been 30 times more severe,
- health impacts from PM ~3 times higher,
- eutrophication 3 times higher,
- health impacts from O_3 70% higher, and
- vegetation damage from O_3 30% higher.

Model studies suggest a strong influence of hemispheric background on ozone impacts, especially for fluxes

The role of EU-wide instruments for achieving the NEC targets



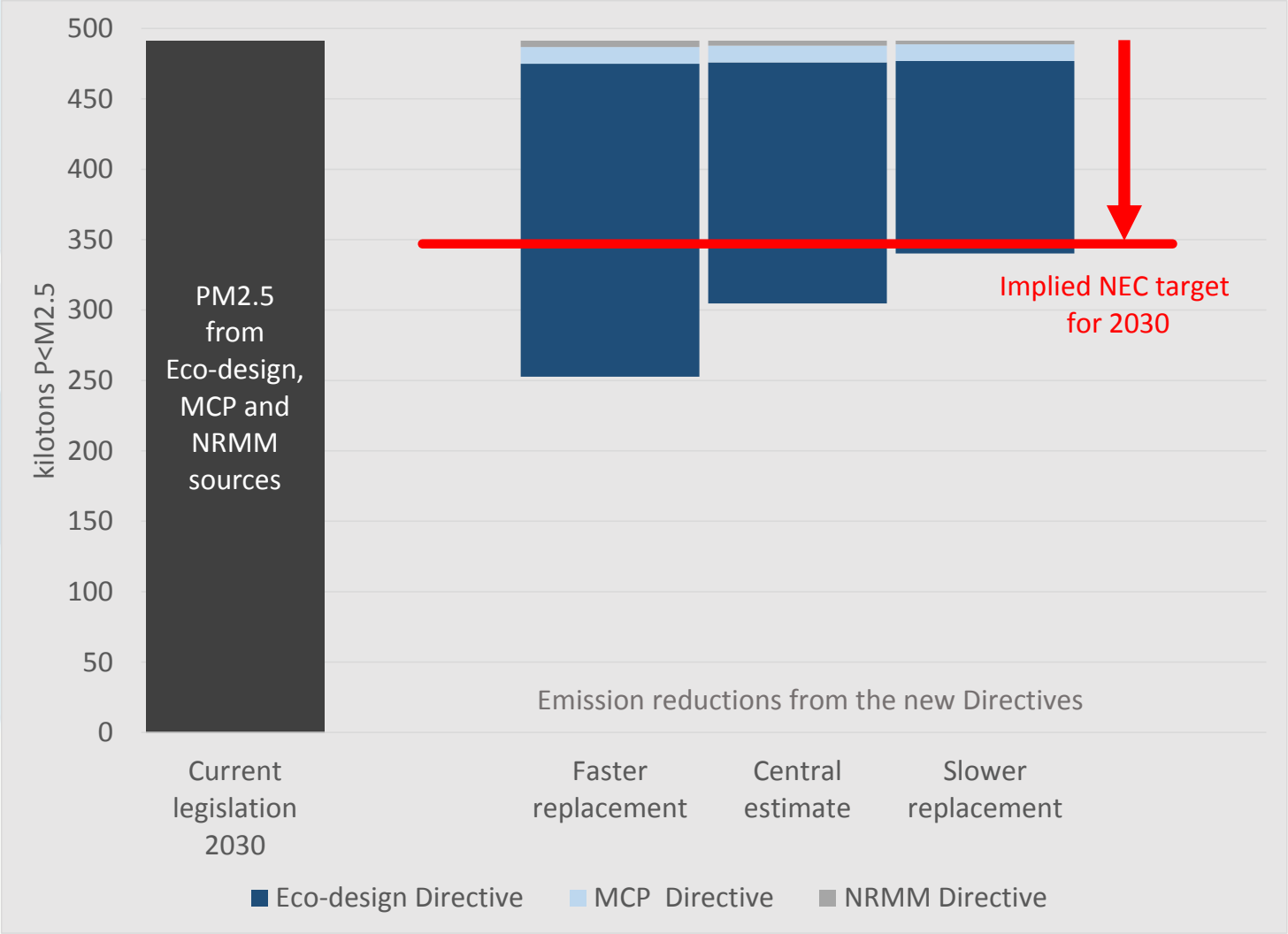




New analysis for COM

The three new Directives exceed the emission reductions implied by the NEC proposals for the respective sources

The turnover rate of equipment is critical; accelerated turnover offers large potentials

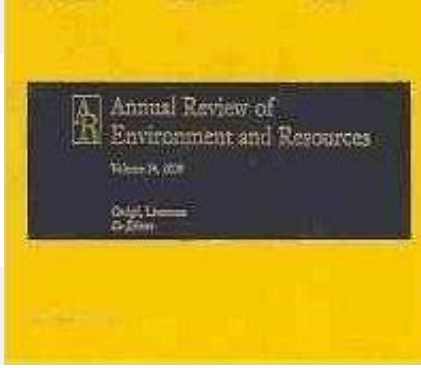


Policy decisions will determine future air pollutant emissions in Asia

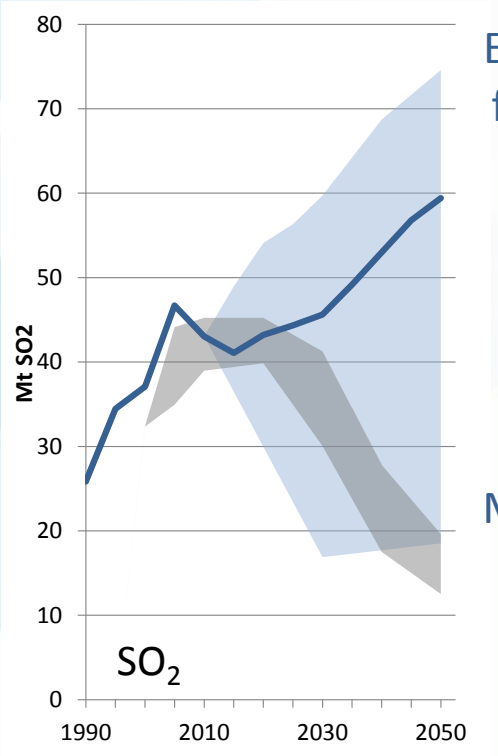
Regional and Global Emissions of Air Pollutants: Recent Trends and Future Scenarios

Markus Amann, Zbigniew Klimont, and Fabian Wagner

Ann.Rev.Env.Res. 38(1)

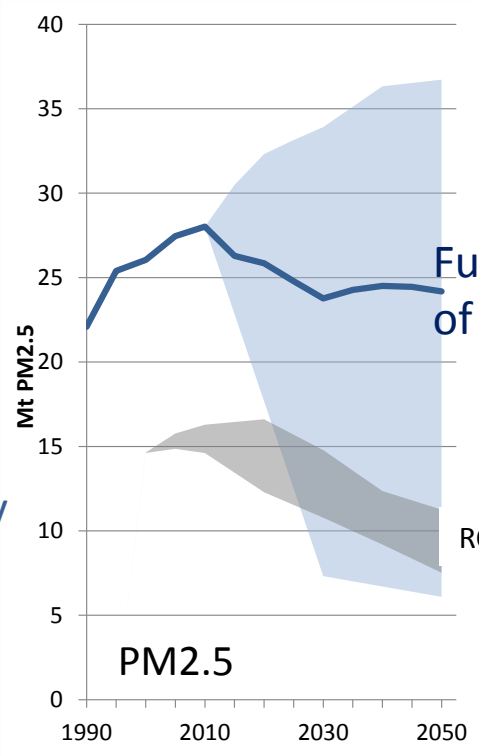


Range of future SO_2 and PM emissions in Asia: GAINS vs RCP scenarios



Emission controls frozen as of 2010

Maximum technically feasible reductions



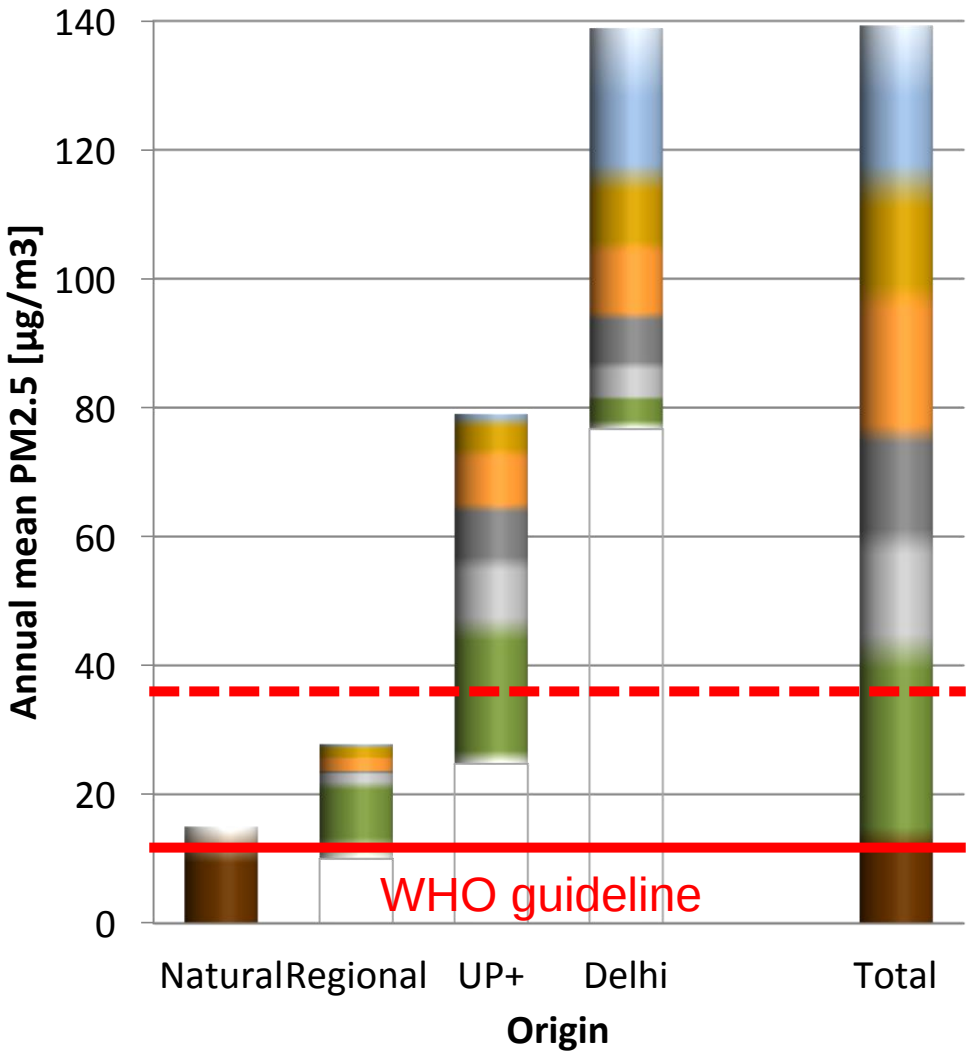
Full implementation of current legislation

RCP: BC+OC only

Range spanned by different RCP climate scenarios

Sources of ambient PM2.5 in Delhi

Initial GAINS estimates



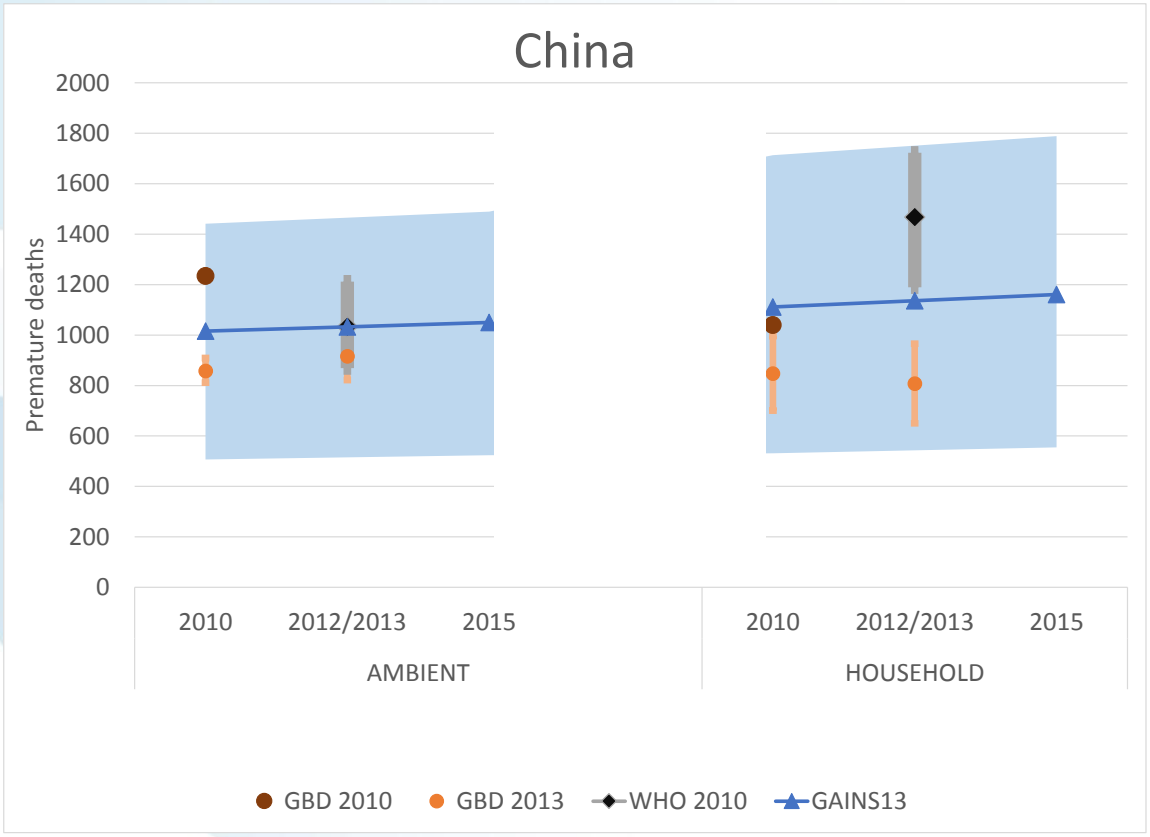
- Mobile sources (diesel soot and non-exhaust)
- Waste burning (residential and agricultural)
- Cookstoves
- Small industries
- High level sources (Power & industry)
- Secondary PM: Agricultural NH3 with SO2
- Natural sources (soil dust, etc.)

Kiesewettter et al., in prep

Global health impact assessment (HIA)

- The global HIA method of WHO and Global Burden of Disease projects have been implemented in GAINS
- Main differences to the HRAPIE/WHO-Euro method:
  - Non-linear Exposure-Response (IER) functions
  - Cause-specific (IHD, COPD, stroke, lung cancer, ALRI)
  - Including natural background
- Inclusion of indoor pollution from household sources
- 'Population-attributable fraction' to scale pollution estimates with total deaths

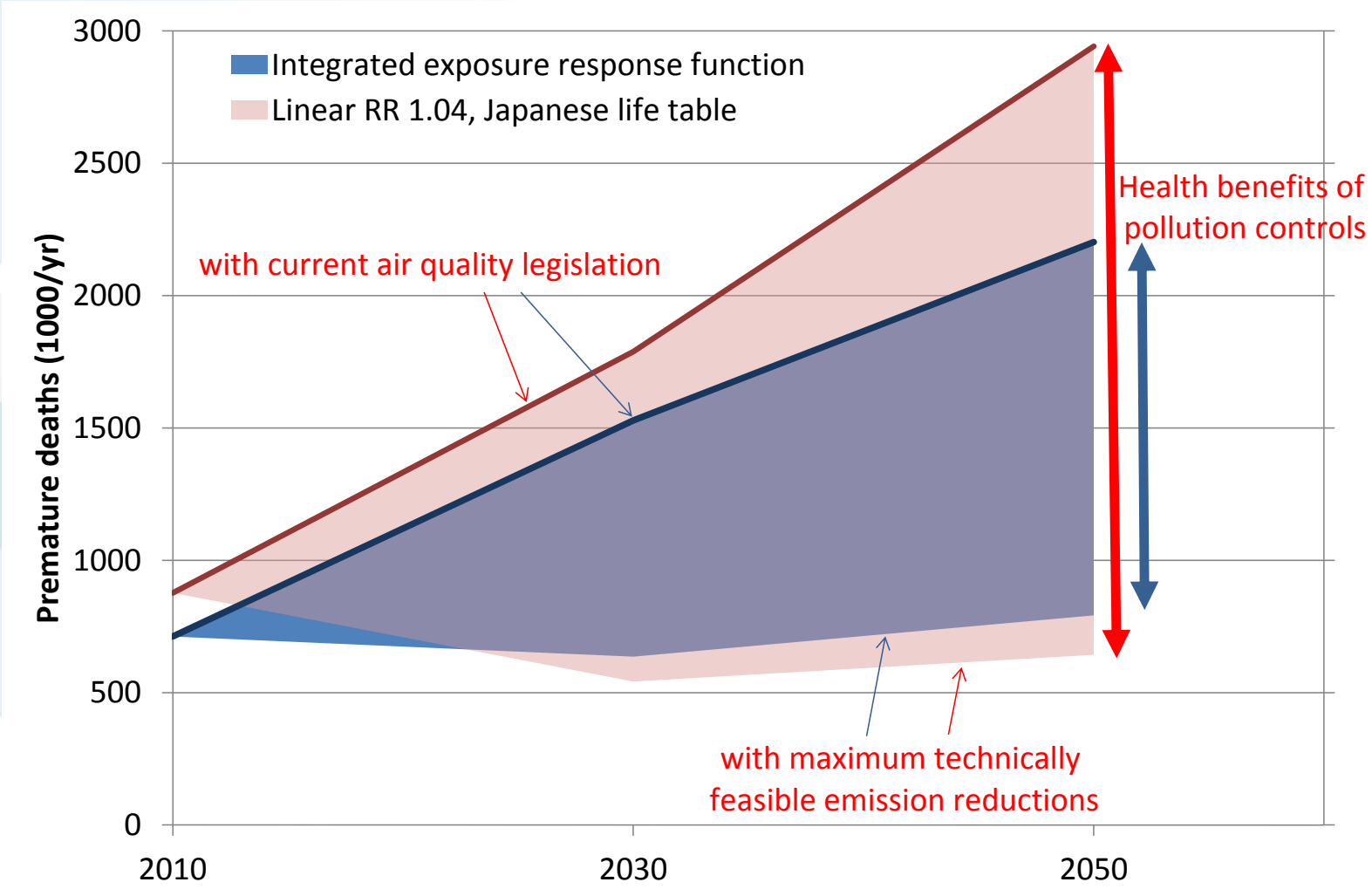
Comparison with other estimates



GAINS estimates:

- Population exposure: EMEP/GAINS
- UN population statistics
- IEA data on household energy use

The non-linear IER function suggests declining benefits from reducing high pollution



Conclusions (2)

- The GAINS source apportionment methodology reveals the important contributions to population exposure from a wide range of economic sectors; important opportunities for multiple co-benefits with SDG targets
- The prevailing health impacts assessment methodologies for global analyses for ambient and household pollution (WHO/GBD) have been implemented in GAINS
- Population ageing will counteract the impacts of planned emission control measures