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Integrated Assessment of Air Pollution and Greenhouse Gases Mitigation in Europe

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Content



- European air pollution policy process – past and present
- Methodology of integrated assessment modeling
- Simulations for the revision of the NEC Directive
- Further steps – link to climate policies

Air pollution policy in Europe - past



- UN/ECE Convention on Long-range Transboundary Air Pollution (1979)
 - SO₂ protocols 1985, 1994
 - NO_x protocol 1988
 - VOC protocol 1991
 - Protocols on heavy metals and POPs 1998
 - Gothenburg Protocol (acid., eutroph. and ozone) 1999
- EU Legislation
 - Air Quality Directives (1980 - 1998)
 - Technology-related Directives (LCP, IPPC, solvents, Auto-Oil, etc.)
 - National Emission Ceilings Directive (2001)

Policy process - recent



- 2003: Clean Air For Europe (CAFE) Programme established
- 2005: EU Thematic Strategy on Air Pollution (TSAP) proposed
- 2007: Review of the NEC Directive based on targets from TSAP
- 2007: GHG reduction (burden sharing agreement)
- 2008: Review of the Gothenburg Protocol to CLRTAP

The RAINS multi-pollutant/multi-effect framework



	PM	SO ₂	NO _x	VOC	NH ₃
Health impacts:					
PM	✓	✓	✓	✓	✓
O₃			✓	✓	
Vegetation damage:					
O₃			✓	✓	
Acidification		✓	✓		✓
Eutrophication			✓		✓

Air pollution and greenhouse gases

Critical linkages



- Emission originate from the same sources
- Aerosols/small particles cause health impacts and influence radiative forcing
- Tropospheric ozone damages health and vegetation and causes radiative forcing

The RAINS multi-pollutant/multi-effect framework extended to GHGs (GAINS)



Economic synergies between emission controls

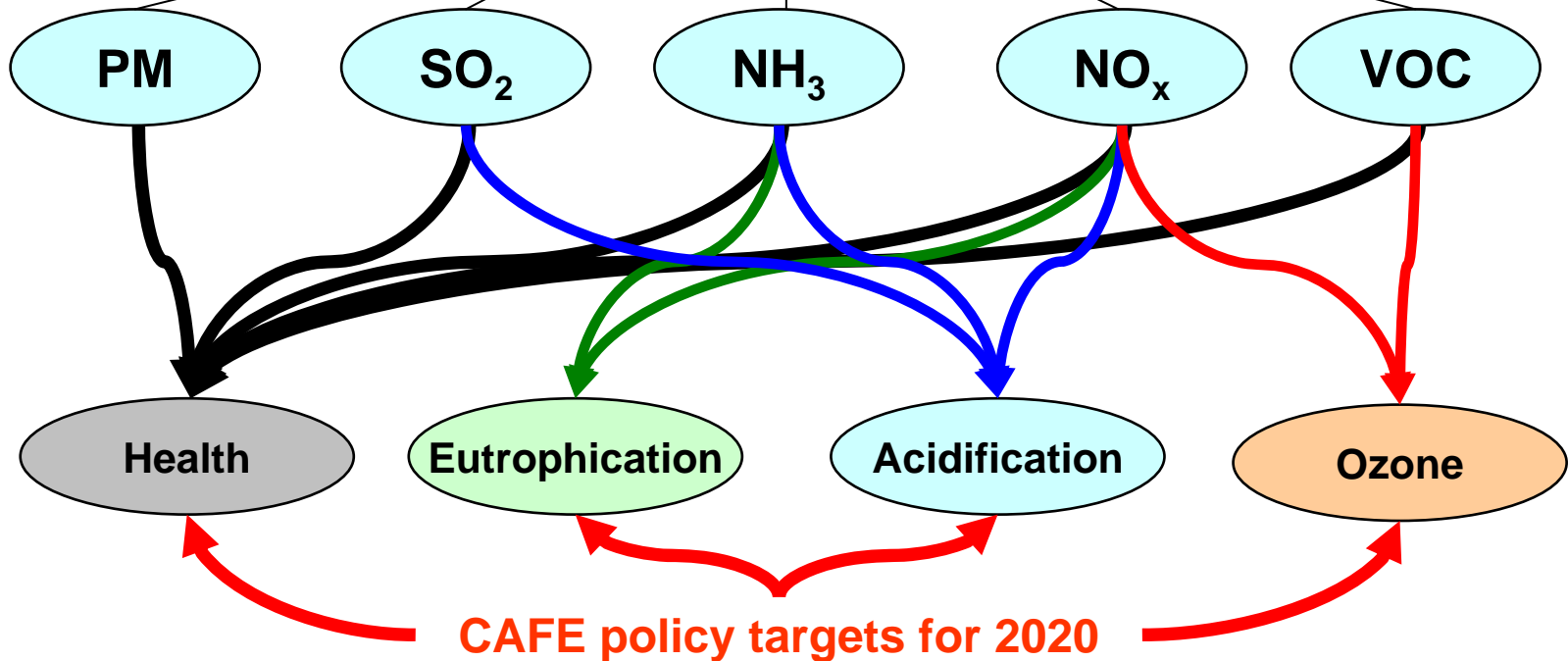
Multiple benefits

	PM	SO ₂	NO _x	VOC	NH ₃	CO ₂	CH ₄	N ₂ O	CFCs HFCs SF ₆
Health impacts:									
PM	✓	✓	✓	✓	✓				
O ₃			✓	✓			✓		
Vegetation damage:									
O ₃			✓	✓			✓		
Acidification		✓	✓		✓				
Eutrophication			✓		✓				
Radiative forcing:									
- direct						✓	✓	✓	✓
- via aerosols	✓	✓	✓	✓	✓				
- via OH			✓	✓			✓		

Multi-pollutant/multi-effect analysis for identifying cost-effective policy scenarios



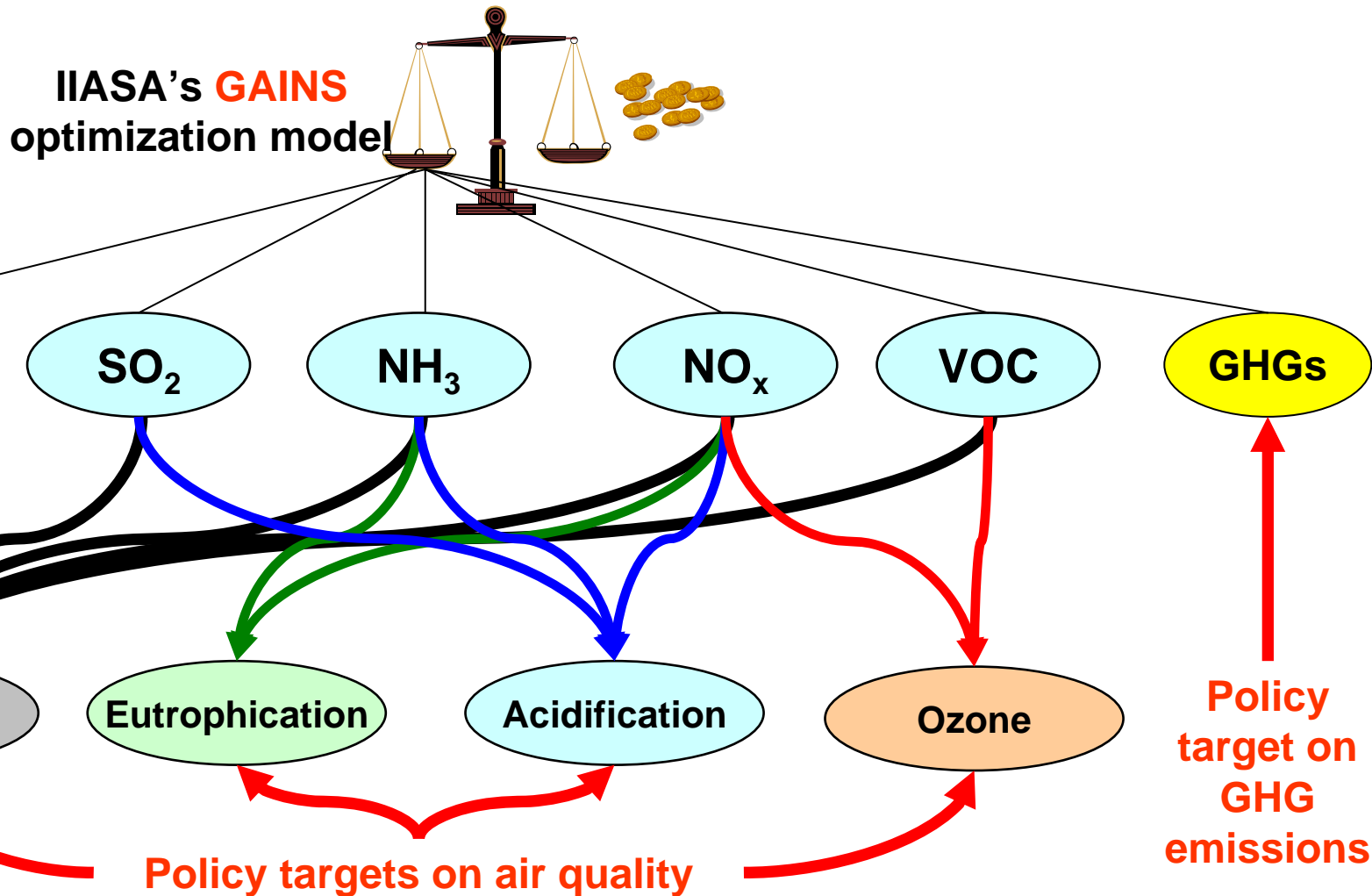
IIASA's RAINS
computer model



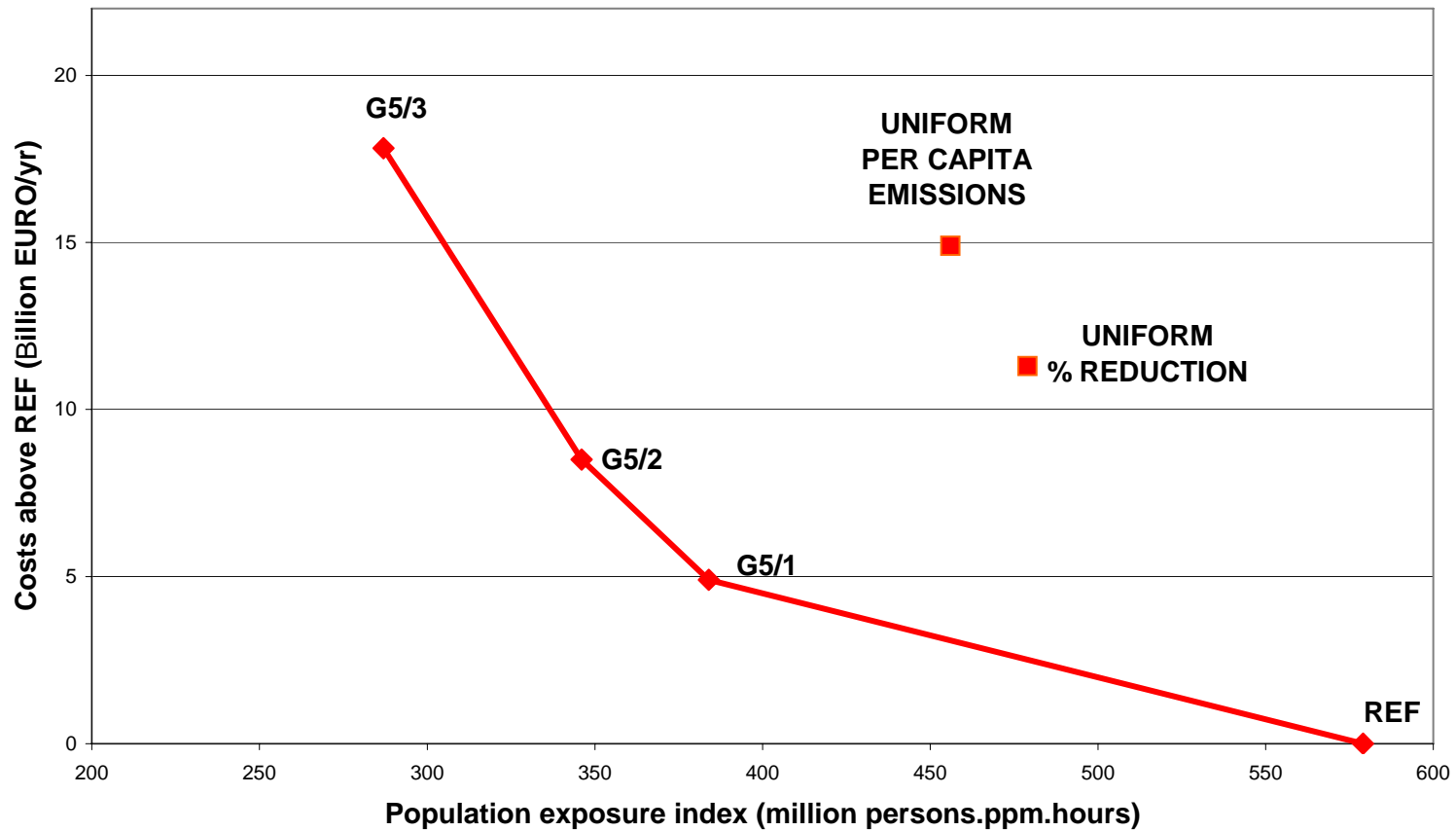
The **GAINS** approach

for identifying cost-effective emission control strategies

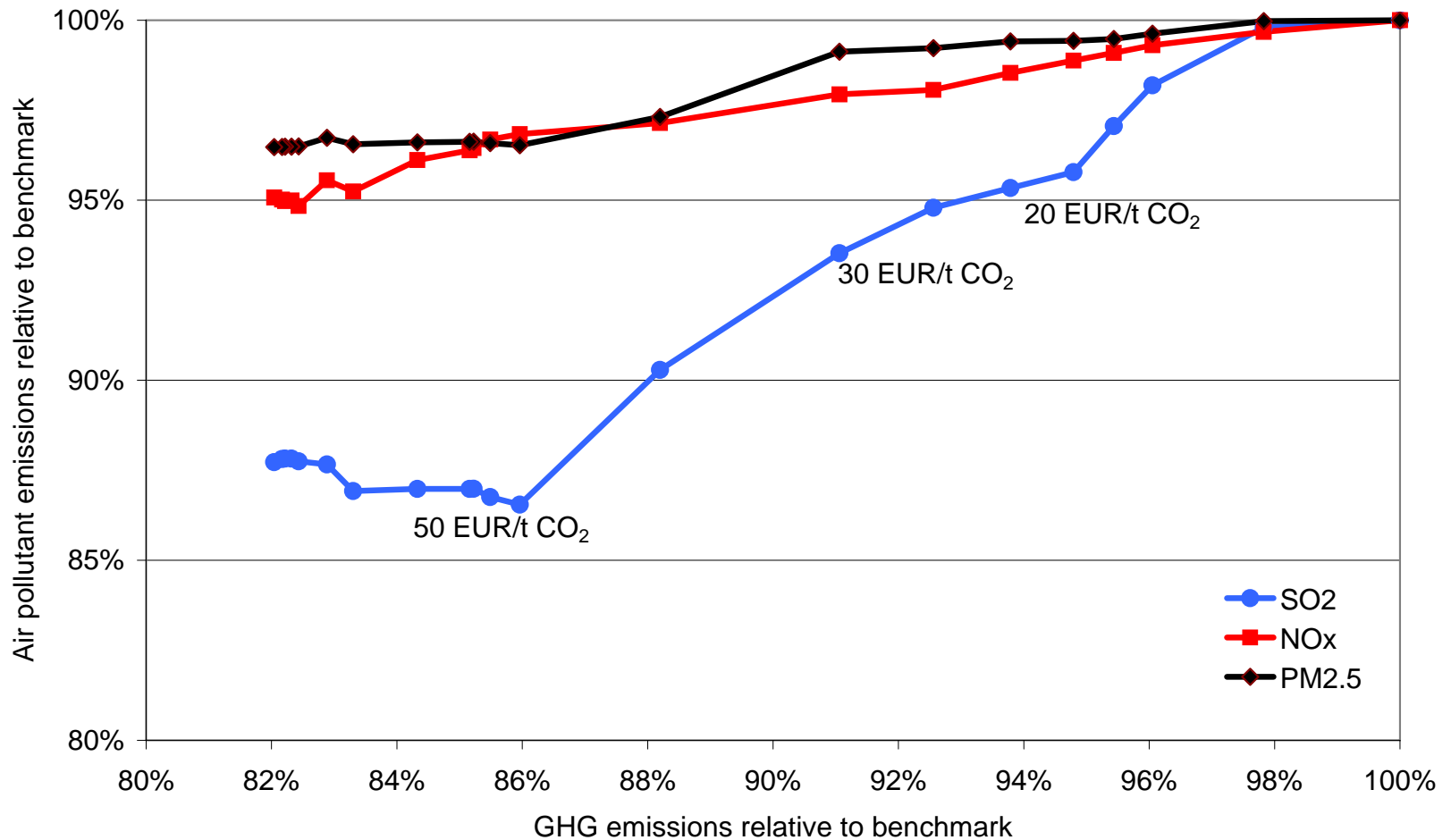
(**G**HG-**A**ir pollution **I**nteractions and **S**ynergies)



Uniform or effect-based scenarios?



Air pollutant emissions as a function of GHG mitigation (EU-15)

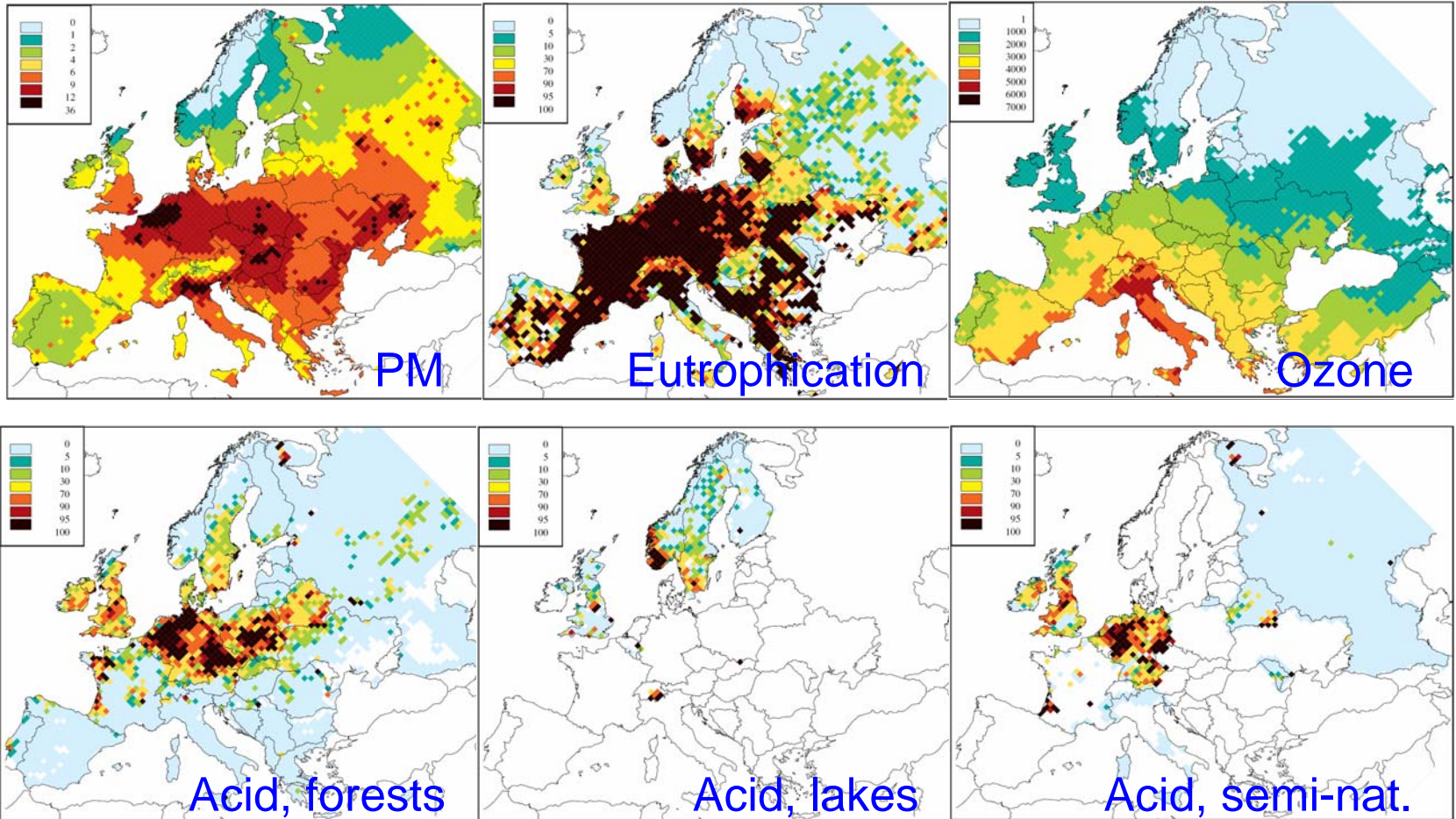


Targets from the EU Thematic Strategy on AP

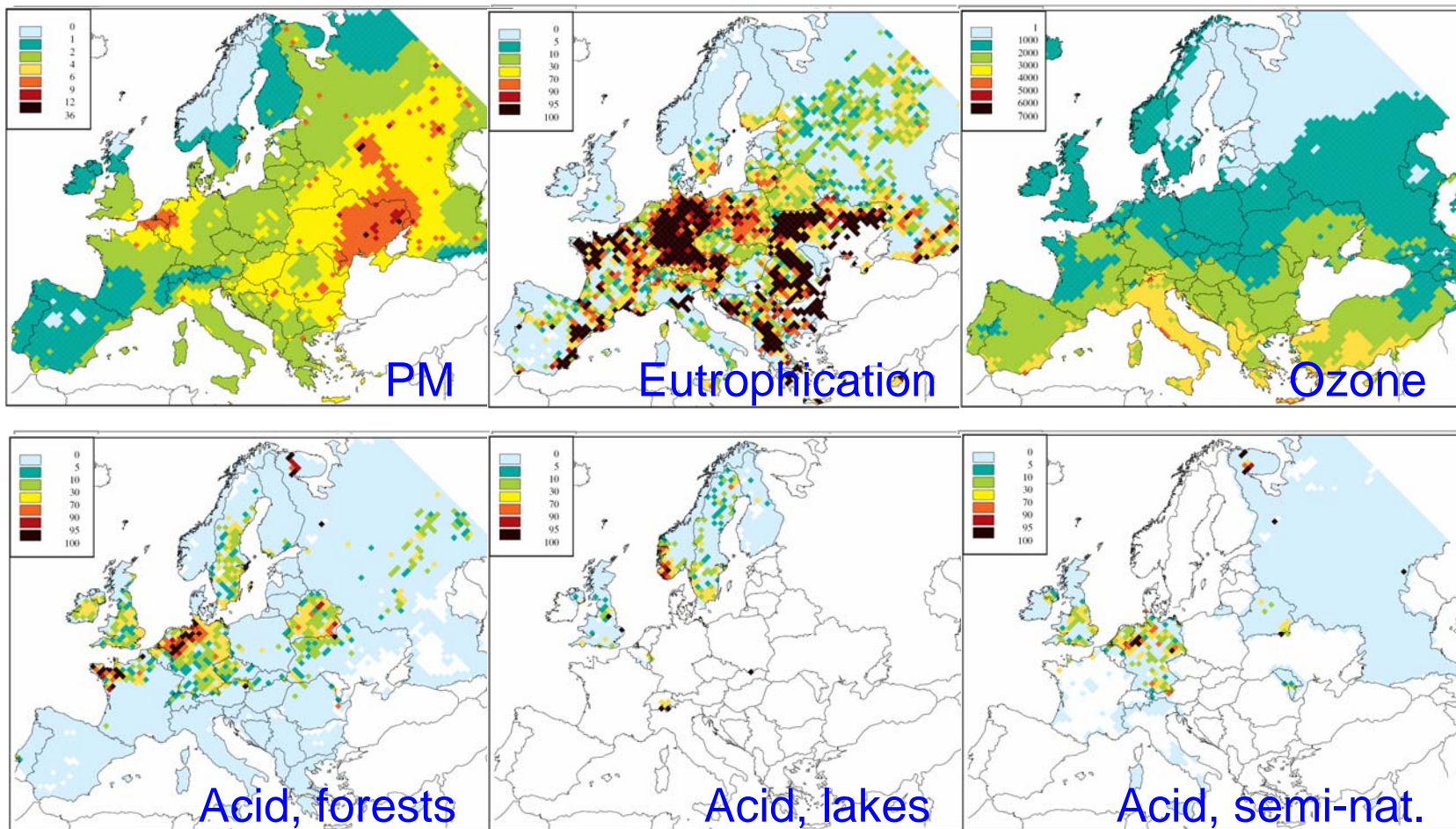


	Unit of the indicator	<i>Percentage improvement compared to the situation in 2000</i>
Life years lost from particulate matter (YOLLs)	Years of life lost	47 %
Area of forest ecosystems where acid deposition exceeds the critical loads for acidification	km ²	74 %
Area of freshwater ecosystems where acid deposition exceeds the critical loads for acidification	km ²	39 %
Ecosystems area where nitrogen deposition exceeds the critical loads for eutrophication	km ²	43 %
Premature mortality from ozone	Number of cases	10 %
Area of forest ecosystems where ozone concentrations exceed the critical levels for ozone ¹⁾	km ²	15 %

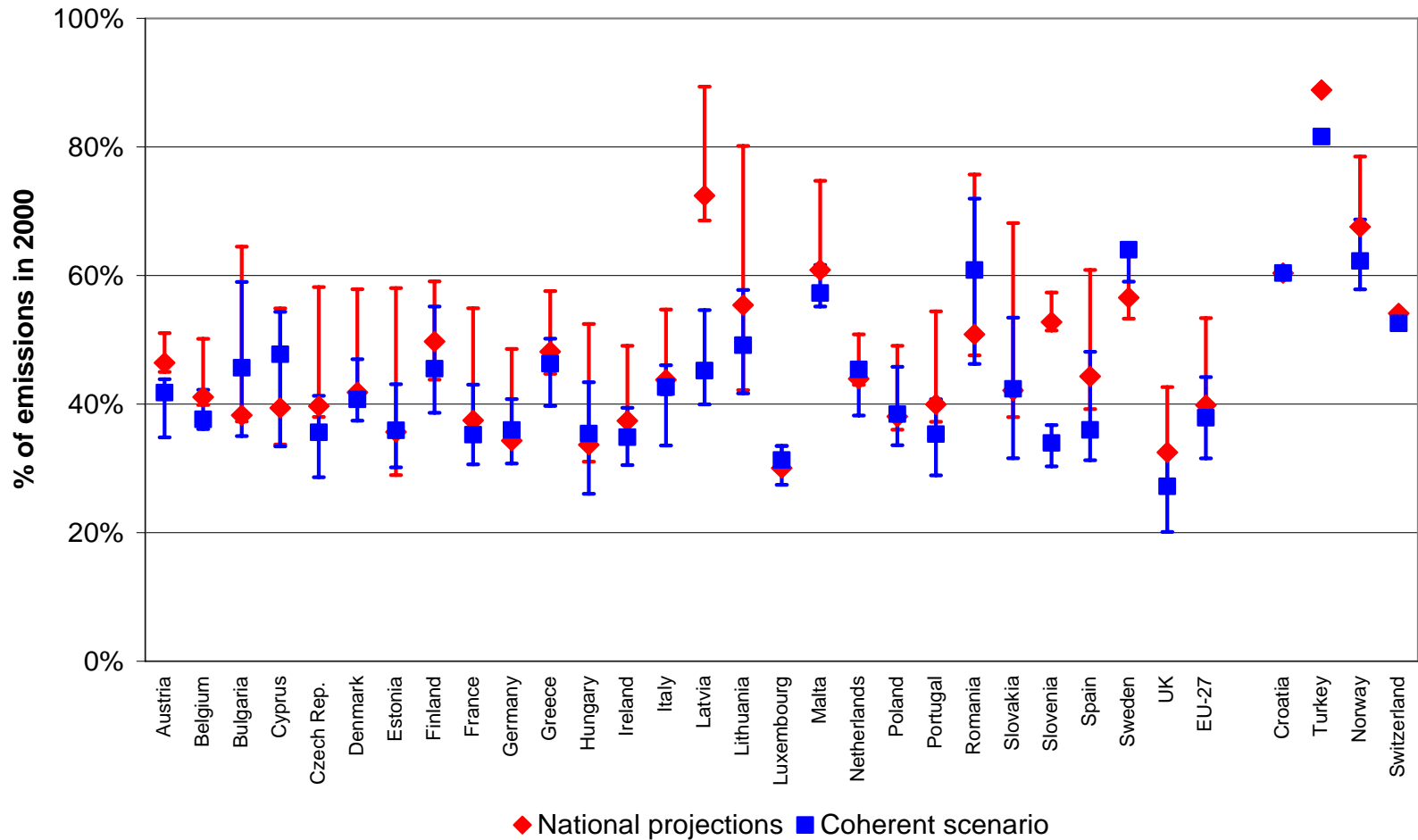
Air pollution effects in 2000



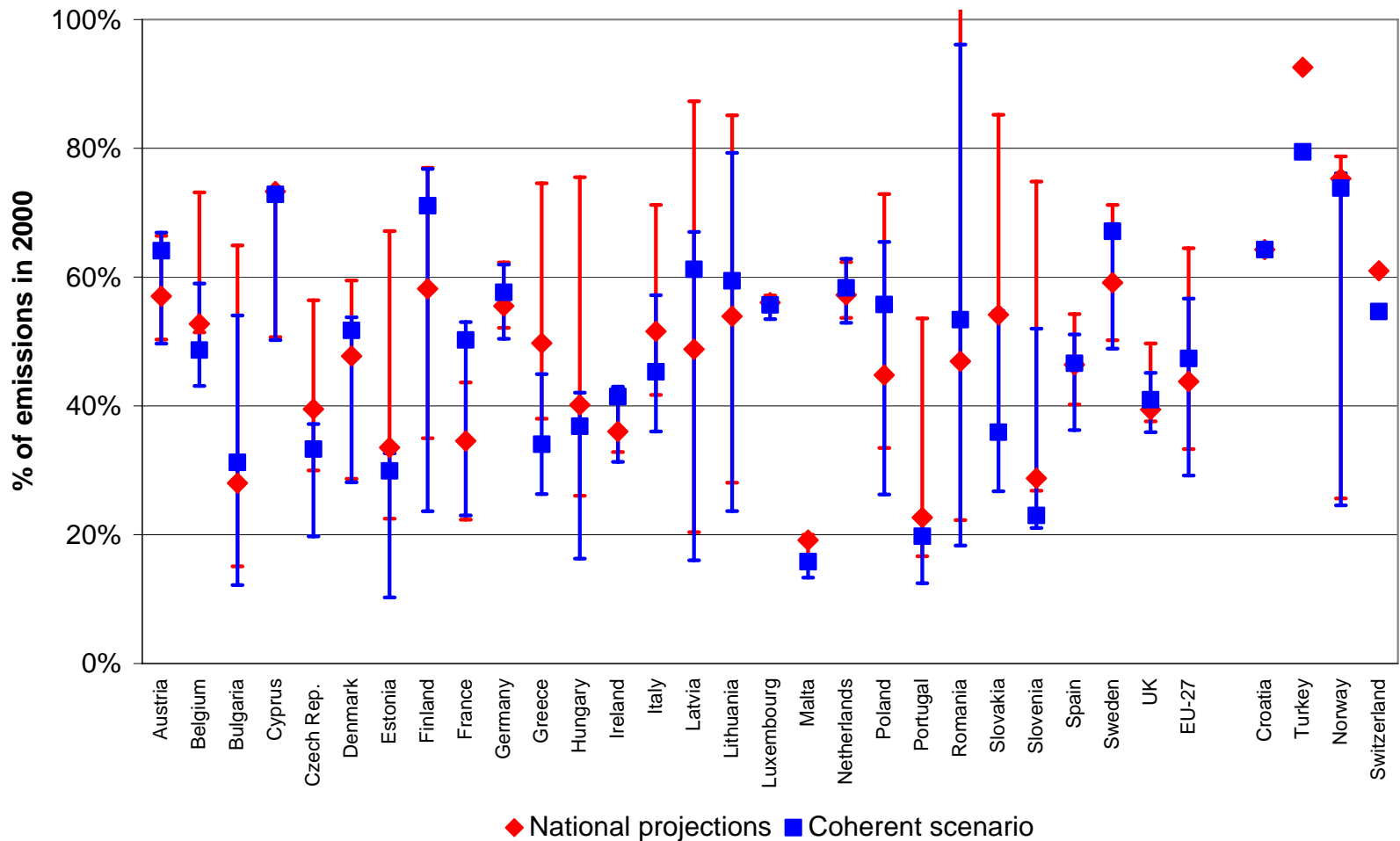
Air pollution effects for TSAP targets 2020



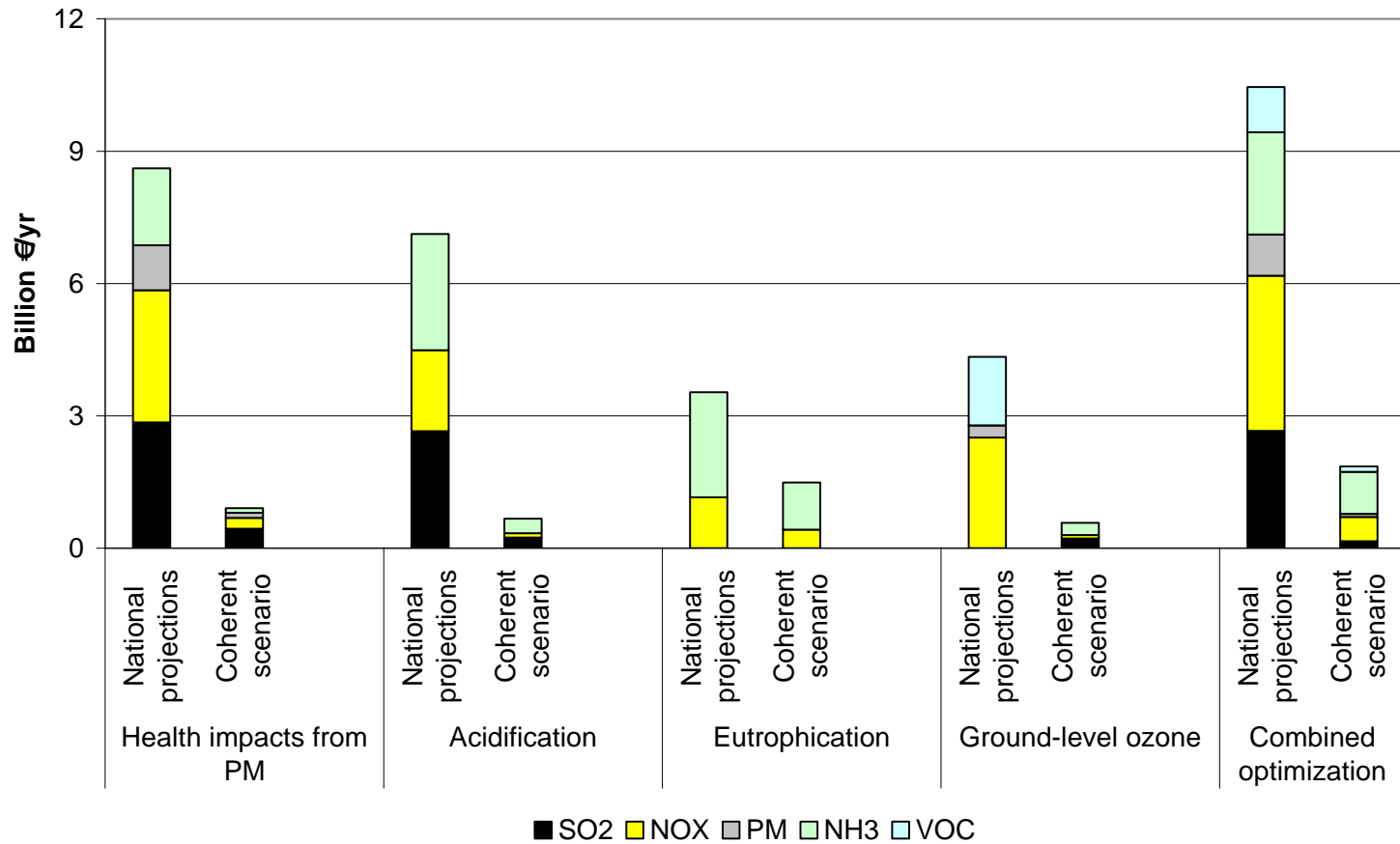
Optimized NO_x emissions - reduction from 2000



Optimized PM2.5 emissions – reduction from 2000

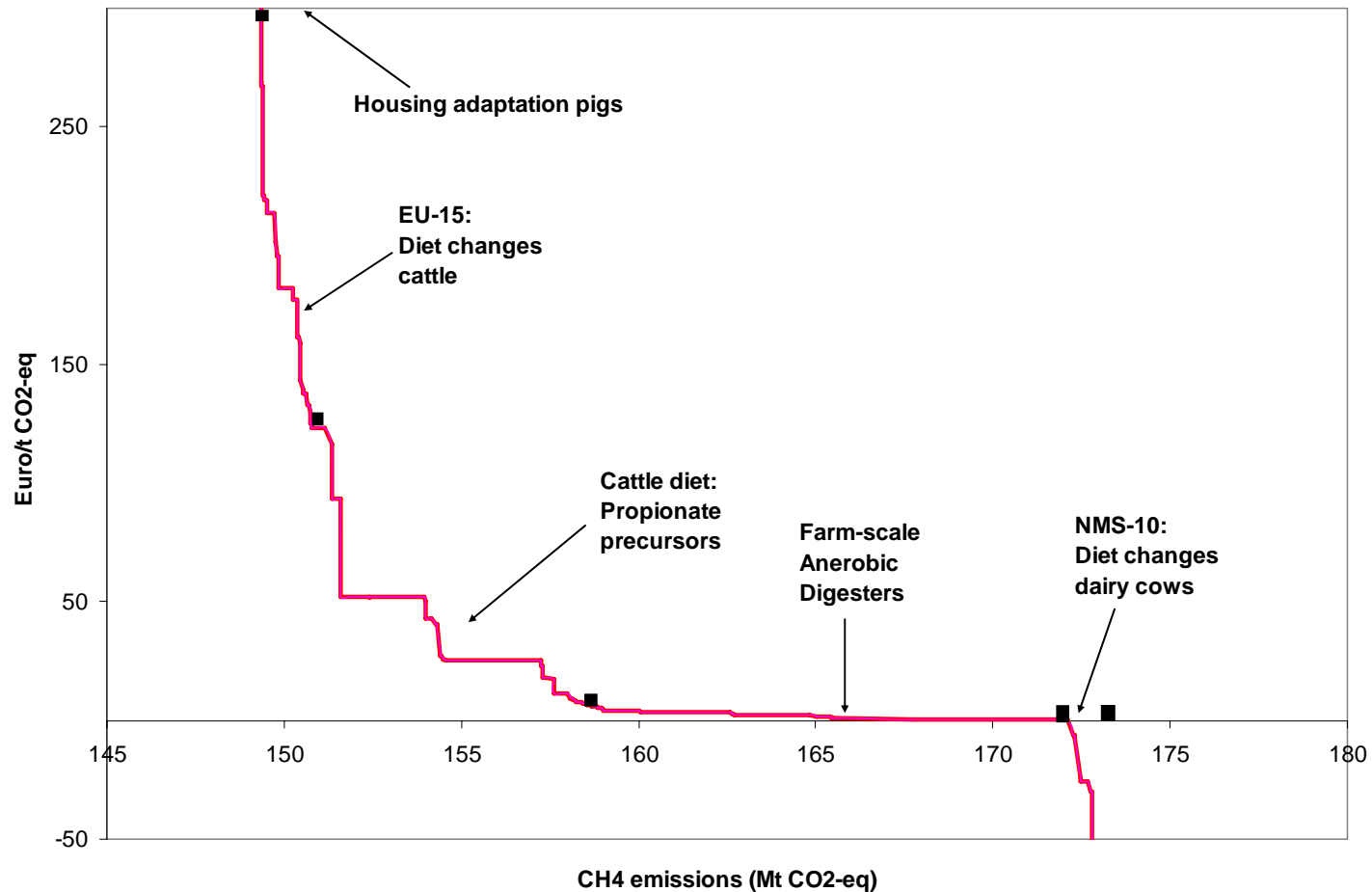


Costs of achieving environmental objectives



Scope for further CH₄ reductions from agriculture

GAINS cost curve – an example



Conclusions



Integrated assessment models:

- Enable designing air pollution control policies and explore linkages with mitigation of greenhouse gases
- Help to explore a wide range scenarios and targets
- Assess co-benefits and synergies of combined policies and look for cost-optimal solutions
- Are widely used in all-European context
- Are also useful for national analysis (RAINS Netherlands, RAINS Italy)
- Work on integrated assessment framework for Poland needed

More information:

www.iiasa.ac.at/rains