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# Clean Air For Europe (CAFE) program

## *Objectives and Results*

4th JCAP Conference, Tokyo, 1-2 June, 2005

# Why CAFE programme?

- Robust association of health impacts from fine particulate matter available – no threshold
- Previously agreed legislation and UNECE Protocols extend to 2010 only
- Harmonized strategy for reducing air pollution
- Knowledge based approach
- European Union grew from 15 to 25 Member States

# Clean Air for Europe (CAFE) – *2001-2005*

**Objective:**

European Commission CAFE programme's goal is to develop a **long-term, strategic and integrated** policy to protect against the effects of air pollution on human health and the environment

**Priorities:**

Particulate matter and ozone

**Setup:**

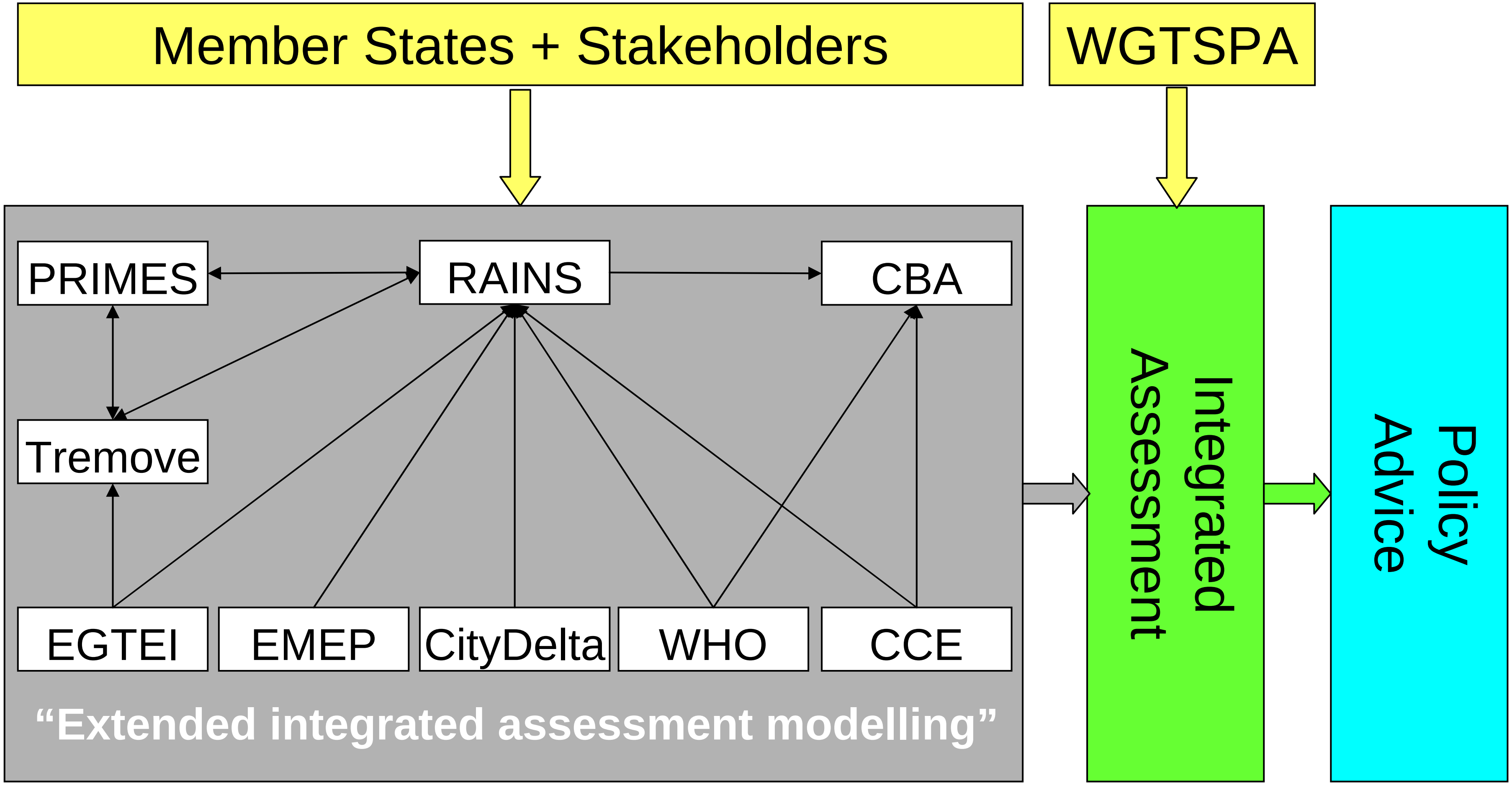
- CAFE secretariat
- CAFE Working Groups
- stakeholder consultations
- consultants

# Clean Air for Europe (CAFE) - *Coverage*

- **Geographical scope – 25 EU Member States**
- **Base year – 2000; Target year - 2020**
- **A multi-pollutant/multi-effect problem**

| | $SO_2$ | $NO_x$ | $NH_3$ | VOC | Primary PM |
|---|---|---|---|---|---|
| Acidification | √ | √ | √ | | |
| Eutrophication | | √ | √ | | |
| Ground-level ozone | | √ | | √ | |
| Health impacts | | | | | √ |
| *via sec. aerosols* | √ | √ | √ | √ | |

# Integrated assessment modelling in CAFE



# Models help to separate policy and technical questions

Decide ambition level - environmental objectives

Value the importance of uncertainties/risk

## Identify cost-effective and robust measures:

- Balance controls over different countries, sectors and pollutants
- Regional differences in Europe
- Side-effects of present policies
- Maximize synergism with other air quality problems
- Search for robust strategies

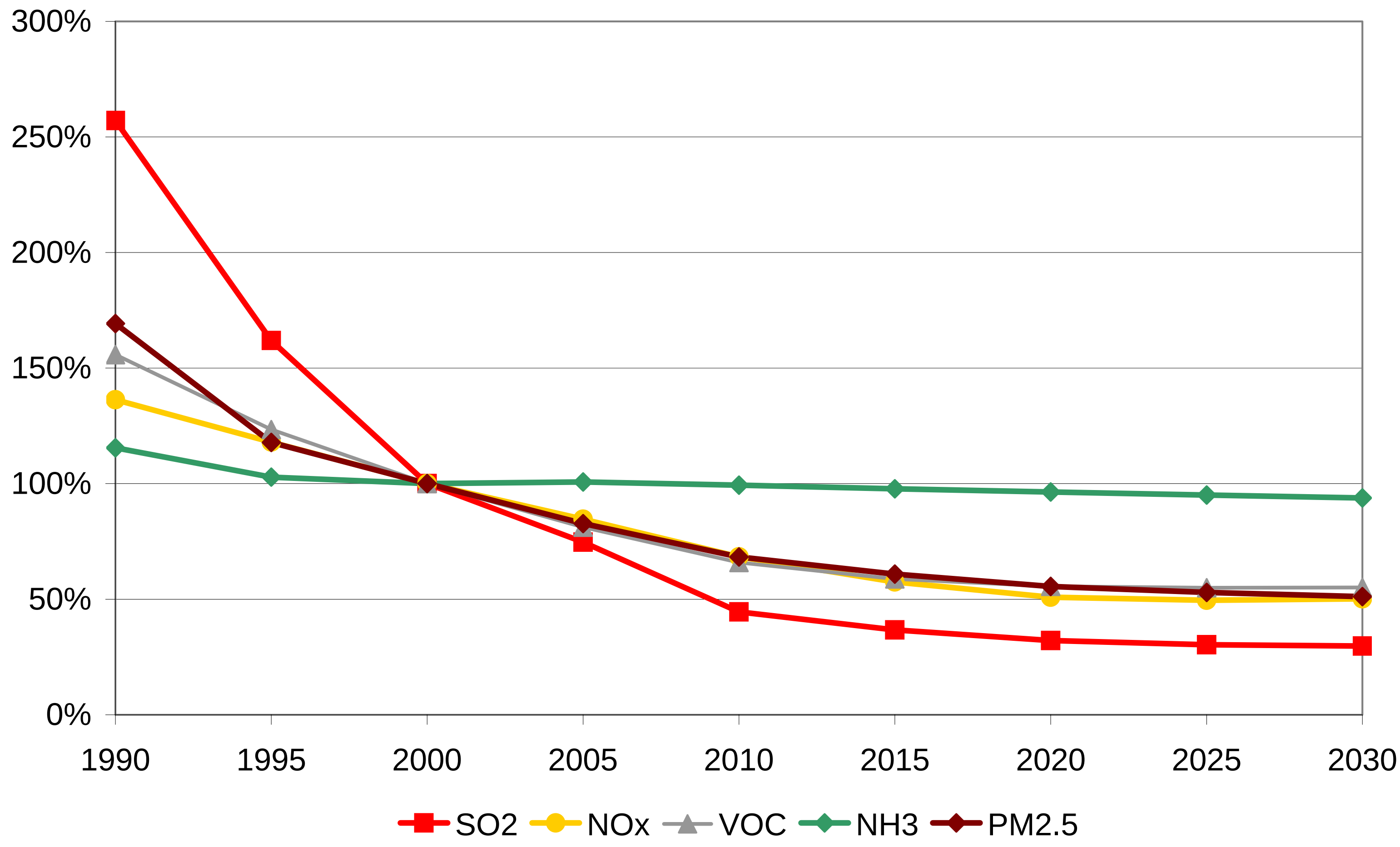
# Clean Air for Europe (CAFE) - *Approach*

- **Baseline scenario - Current legislation (CLE) case for 2020 “with climate measures”**
- **Scope for further measures – Maximum technicallay feasible reduction” (MTFR) case assumes maximum reductions also in non-EU countries and sea regions**
- **Identify cost-effective policy measures**

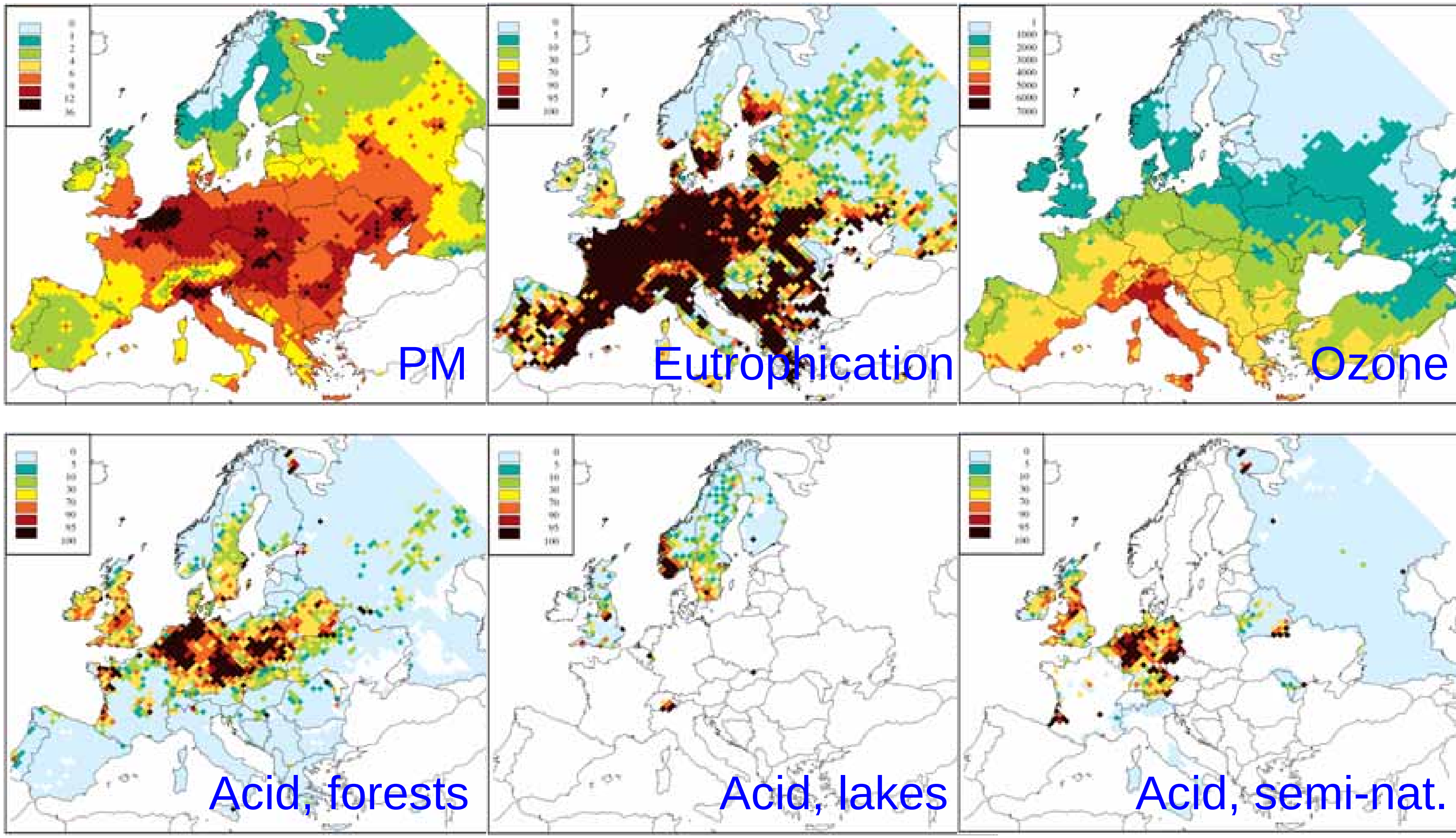
# Long-term trends of EU-25 emissions

CAFE "Climate policy" projection, relative to year 2000 [= 100%]

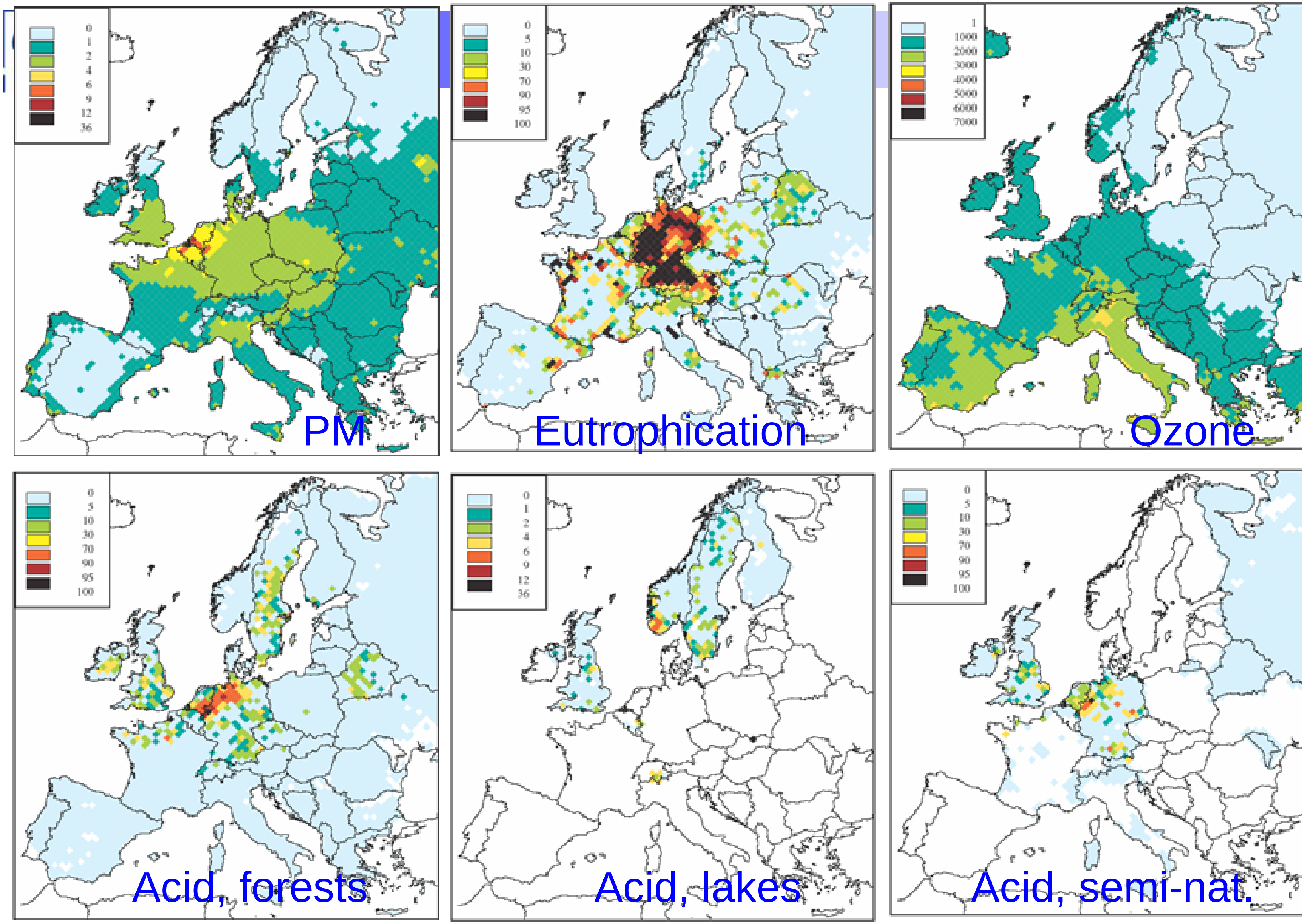
IIASA



# Effects estimated for 2000

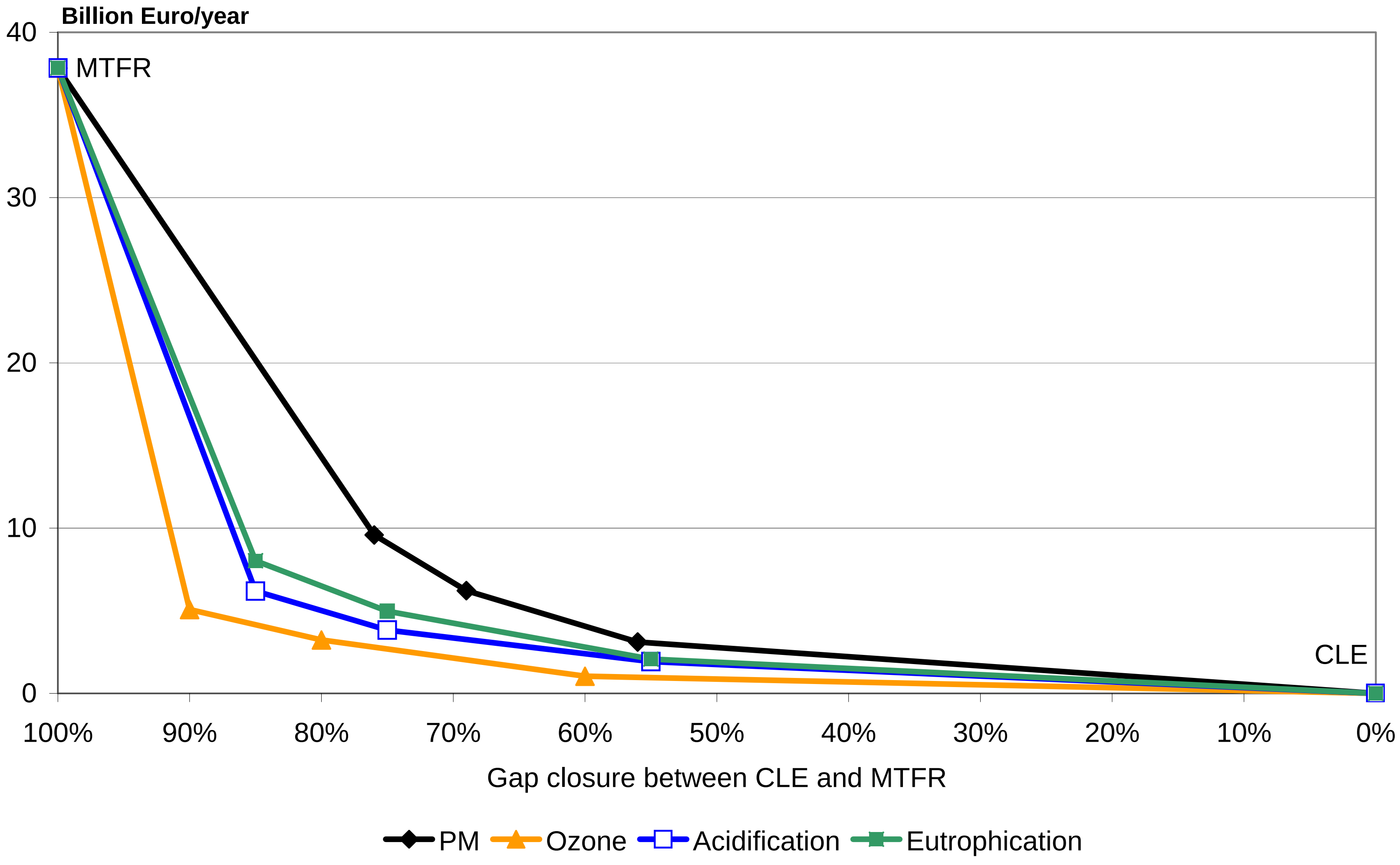


# Effects estimated for 2020 - MTFR



# Costs for reducing the four effects

## between CLE and MTFR




*) excluding costs for road sources

# Three concepts for interim targets

for PM2.5

1. **Uniform limit value on air quality:**
   **Bring down PM2.5 everywhere below an AQ limit value**

2. **Gap closure:**
   **Reduce PM2.5 levels everywhere by same percentage**

3. **Reduce total European PM2.5 exposure/health impacts at least cost – irrespective of location**

# Conclusions

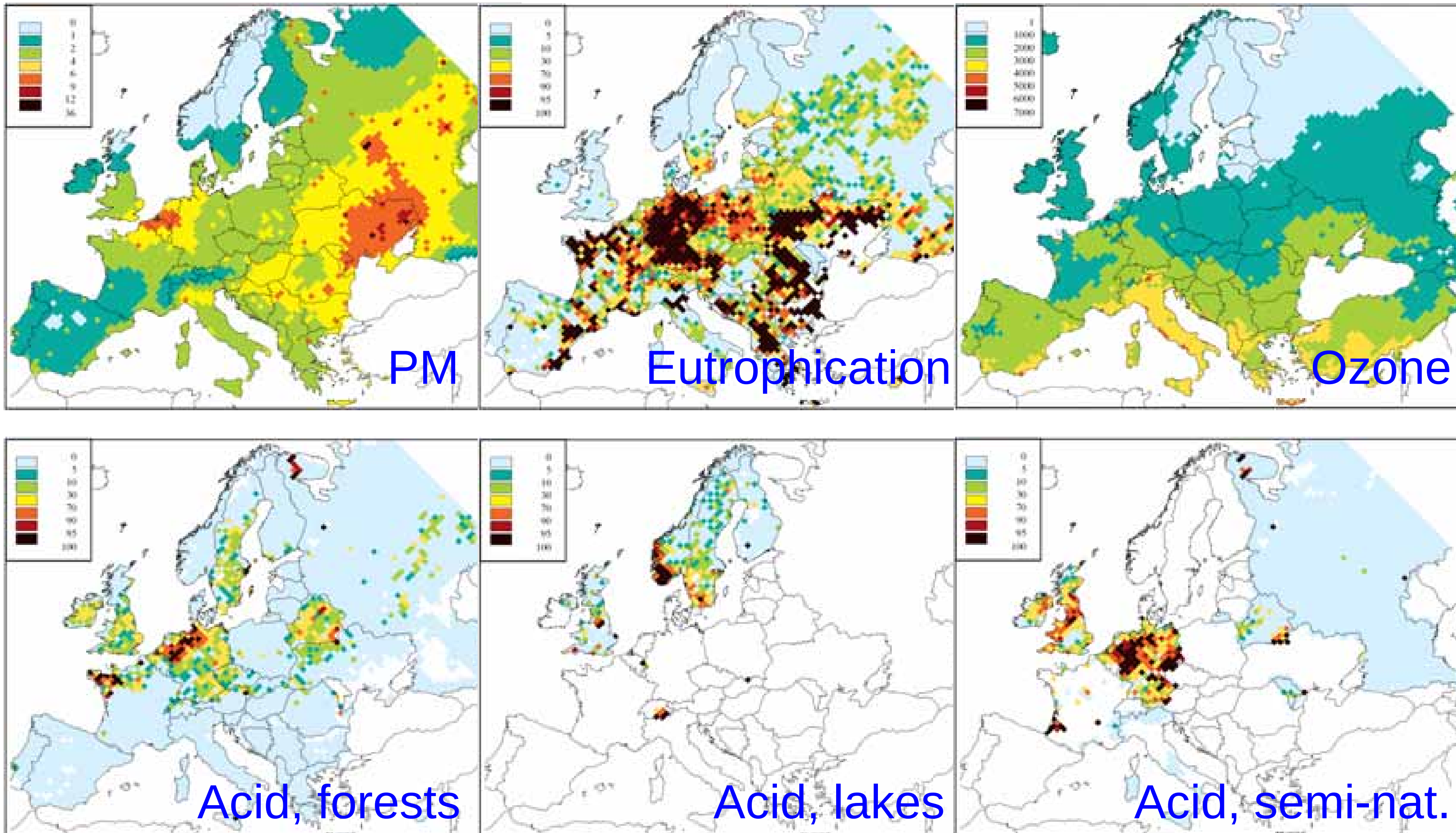
## on target setting approaches

- **Limit value approach:**
  - **Highly sensitive towards understanding of and weight given to worst polluted site**
  - **Economically inefficient**
  - **Distribution of costs and benefits across MS very uneven**
- **Gap closure approach:**
  - **More robust towards model uncertainties (biases cancel out)**
  - **(Arbitrary) cut-off for less polluted sites can increase equity and efficiency**
- **Europe-wide target approach:**
  - **Sensitive towards model quality for typical and medium-cost situations, less influenced by extreme cases**
  - **Per definition most efficient**
  - **Also superior for many equity criteria**

# Targets selected for the optimization

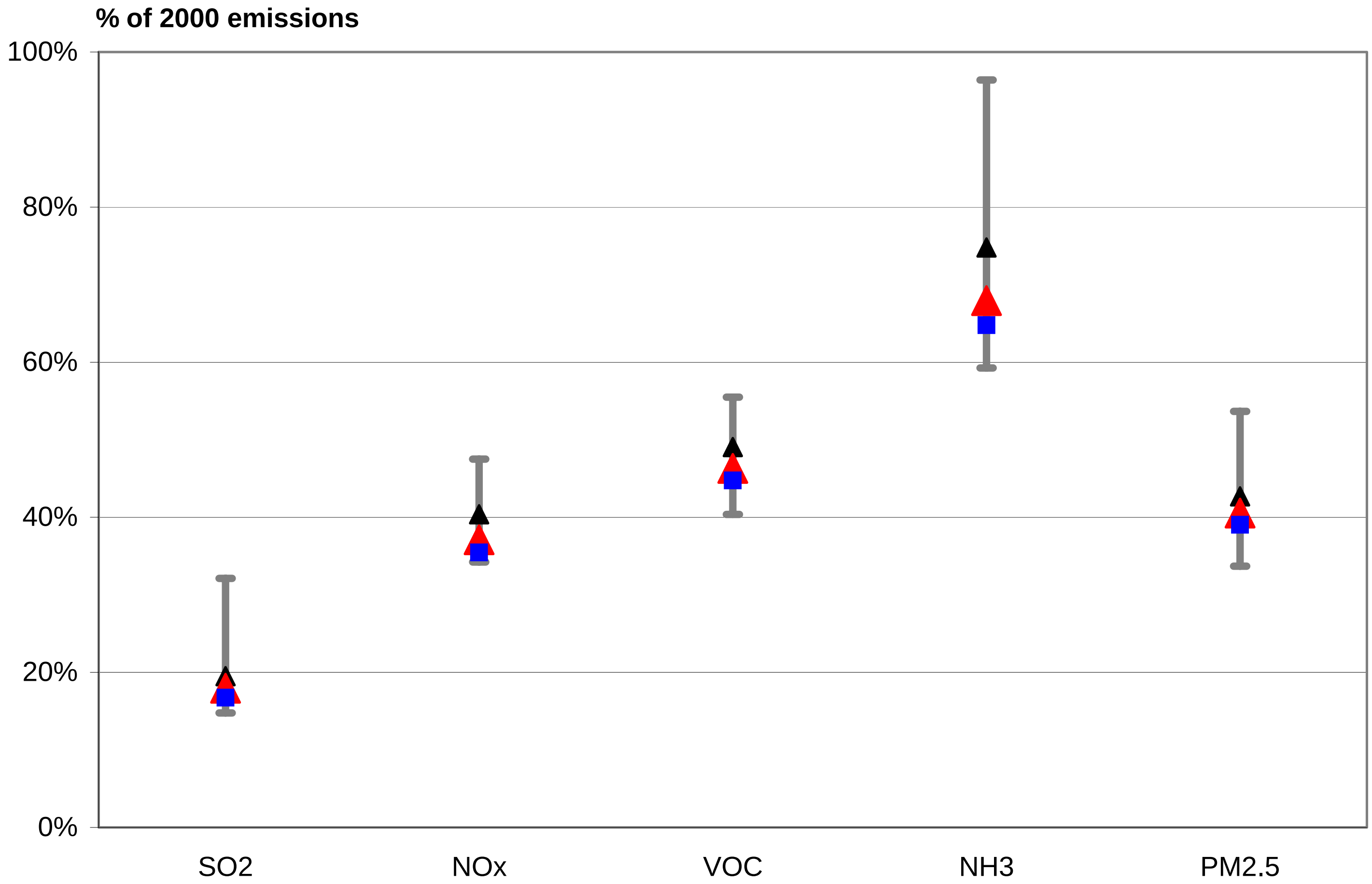
| | Ambition level | | | | |
|---|---|---|---|---|---|
| | **CLE** | **Low** | **Medium** | **High** | **MTFR** |
| **Years of life lost due to PM2.5** (EU-wide, million YOLLs) | **137** | **110** | **104** | **101** | **96** |
| **Acidification** (country-wise gap closure on cumulative excess deposition) | **0%** | **55%** | **75%** | **85%** | **100%** |
| **Eutrophication** (country-wise gap closure on cumulative excess deposition) | **0%** | **55%** | **75%** | **85%** | **100%** |
| **Ozone** (country-wise gap closure on SOMO35) | **0%** | **60%** | **80%** | **90%** | **100%** |

# Targets for 2020, medium ambition



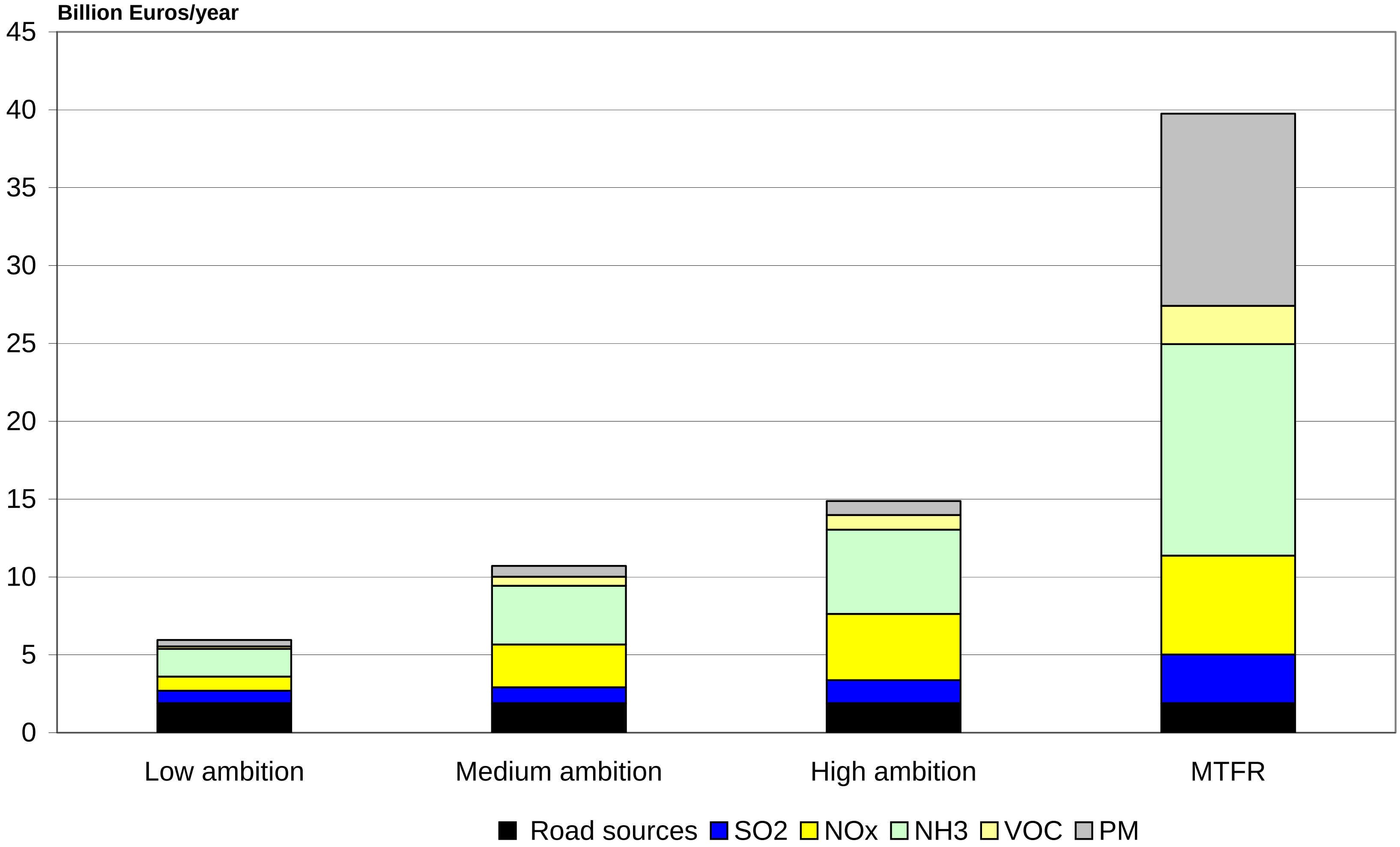
# Optimized emission reductions for EU-25

## of the D23 scenarios [2000=100%]

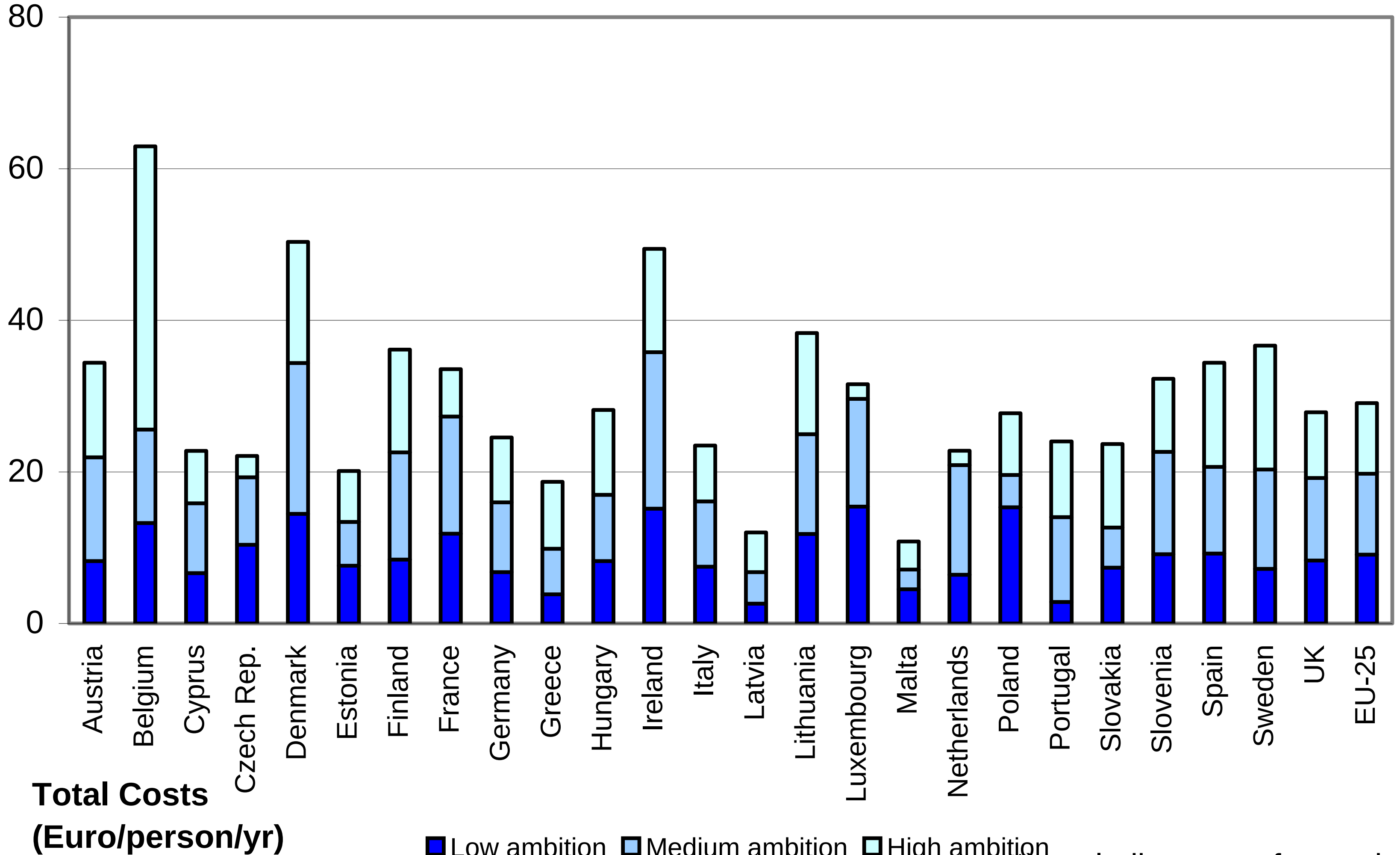



Gray range: CLE to MTFR ▲ Low ambition ▲ Medium ambition ■ High ambition

# Costs per pollutant for EU-25
## on top of CLE



# Distribution of costs
## [€/person/year]

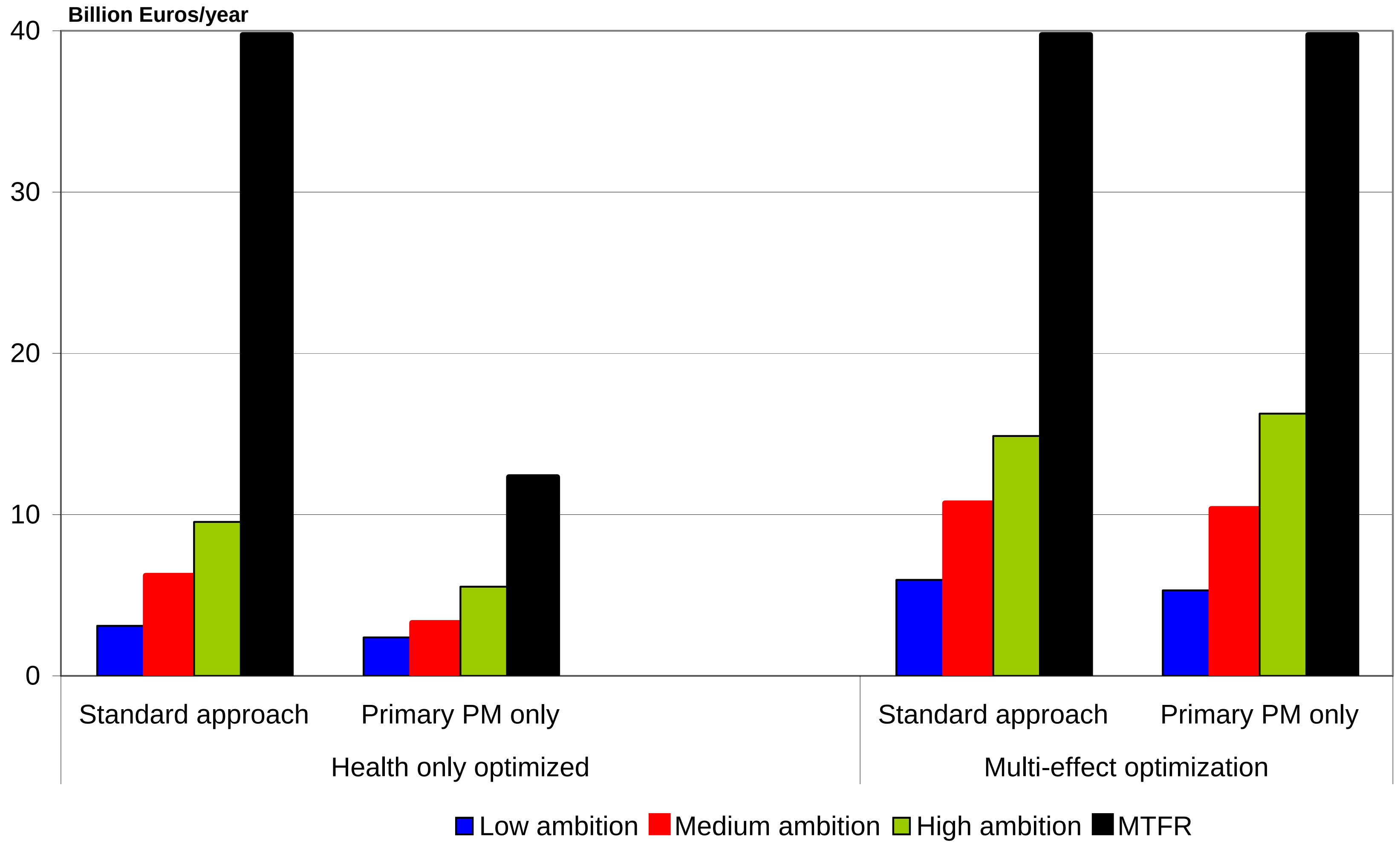



*) excluding costs for road sources

# Sensitivity analyses

1. How would measures for ships change the outcomes?
2. Are emission reductions in the joint optimization driven by health or ecosystems targets?
3. How would alternative health impact theories change the results?
4. How would national energy and agricultural projections change the optimization outcome?

# Sensitivity analysis 3:
## Control costs for alternative impact theories



# Conclusions

- **Three cases calculated for three ambition levels: costs of 6, 11 and 15 billion €/year**
- **For targets on PM, eutrophication, acidification and ozone**
- **Resulting emission reductions are cost-effective and have equitable distributions of costs and physical benefits**
- **Findings from sensitivity analyses:**
  - Control of ship emissions decrease overall costs
  - Optimization driven by health <u>and</u> ecosystems targets
  - Multi-effect optimization increases robustness against uncertainties in health impact mechanisms
  - Robustness against national energy projections needs further attention (and more robust national projections!)

# Atmospheric Pollution and Economic Development Programme at IIASA

www.iiasa.ac.at/rains

# Effects in 2000 and for CAFE medium ambition 2020