Clean Air for Europe and Future Legislation on Air Quality in the EU

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The European Commission is expected to publish the Thematic Strategy on Air Quality in September 2005 (http://europa.eu.int/comm/environment/air/cafe/). This Thematic Strategy is based on the Community's Sixth Environmental Action Programme (EAP), which called for the development of a thematic strategy on air pollution with the objective to attain 'levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment'.

The Thematic Strategy will outline the expected development of air quality until 2020 under current legislation and will assess the environmental impacts on human health from exposure to particulate matter and ozone. The health effects are assessed based on the advise developed by the World Health Organization (WHO) within the EU funded project 'Systematic Review of Health Aspects of Air Pollution in Europe' (http://www.euro.who.int/air/activities/20030528_3). Some of the most important conclusions of WHO on PM from this project are the following:

- PM pollution at current levels has been linked to several severe health endpoints, including a marked reduction in life expectancy, mainly due to an increase in cardiopulmonary mortality and probably lung cancer.
- The evidence for a causal link between the exposure to PM and those effects has become stronger in the recent years.
- No no-effect threshold for the impact of PM on human health could be identified. A major reason for this observation is probably the wide range of individual susceptibilities in any larger population.
- Groups at risk include children, the elderly and individuals with underlying disease.
- Fine PM mass is (still) an appropriate indicator for assessing health effects, even though toxicology indicates importance of HM, OC, endotoxins and ultrafine particles (with an aerodynamic diameter less than 0.1µm).
- Coarse PM is linked to some morbidity endpoints, probably independent of fine PM.
- Further decrease in PM pollution exposure is likely to have considerable health benefits.

As part of CAFÉ, health impact assessments have been performed using the RAINS model (http://www.iiasa.ac.at/rains/index.html). Relative risks to assess mortality were taken upon advise by the World Health Organisation from a large US cohort study (ACS study), the exposure was estimated using the EMEP model (http://www.emep.int). It was estimated that some 3 million life years are being lost in about 288,000 premature deaths due to current PM exposure in EU25 for the base year 2000.

In addition, environmental effects on eutrophication and acidification were assessed. Despite marked anticipated reductions in emissions of the key pollutants (PM, SO_2, NOx, NH_3, NMVOC), significant negative impacts are expected even in 2020. Statistical losses of life expectancy due to PM exposure in Europe will still exceed five months on average across the population, amounting to an estimated 2 million life years lost in ca. 208,000 premature deaths annually.

Based on this assessment, the possibilities for further action to reduce emissions cost effectively will be analyzed. This is done by using integrated assessment models (the RAINS model developed by IIASA) and extensive cost benefit analyses (http://europa.eu.int/comm/environment/air/cafe/activities/cba.htm). These analyses already showed that the anticipated benefits of further reductions of PM pollution exceed the estimated costs significantly.

The Thematic Strategy itself is a communication, which will be presented to the European Council and the European Parliament. It does not contain any legislative proposals, but will most probably by accompanied by a proposal to revise the current air quality legislation. This proposal could combine the Air Quality Framework Directive (96/62/EC) and its first three daughter directives (1999/30/EC; 2000/69/EC and 2002/3/EC, regulating NOx, NO_2, SO_2, PM10, lead, CO, benzene and ozone) in on new directive.

It is anticipated that the current limit values remain in force, but will be supplemented by regulations on PM2.5. These regulations will be in the form of an exposure reduction requirement, which will be applicable to all Member States with the objective to reduce the exposure of the total (urban) population to fine PM. This new format of an air quality objective is expected to drive emission reductions not only in the most polluted areas but also in other areas. This approach reflects the fact that there is currently no well defined no-effects threshold for PM – as a consequence, health benefits can also be expected from pollution reductions in areas with average PM levels. Such an approach has also been demonstrated to be potentially more cost effective than a sole limit value approach.

It is also expected that the European Commission will propose new standards for cars ("EURO5") in the second half of 2005 and regulations for heavy duty vehicles ('EURO6') in 2006.

In parallel, expert groups will start the discussion on the revision of the Directive on national Emission Ceilings (NEC). This revision could lead to the establishment of ceilings for PM2.5. However, it is not expected that the European Commission will propose this directive before end of 2006.

9th ETH Conference on Combustion Generated nanoparticles

Clean Air for Europe and future Legislation on AQ in the EU

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Objectives of CAFE (Clean air for Europe)

Clean Air for Europe (CAFE) is a more-year programme carried by the European Commission

- to develop, collect and validate scientific information relating to the effects of air pollution, …, cost-effectiveness studies and integrated assessment modeling, leading to the development and updating of air quality objectives and indicators and identification of the measures required to reduce emissions;
- to support the implementation and review the effectiveness of existing legislation;
- to ensure that the sectoral measures that will be needed to achieve air quality objectives cost-effectively;

CAFE (Clean air for Europe)

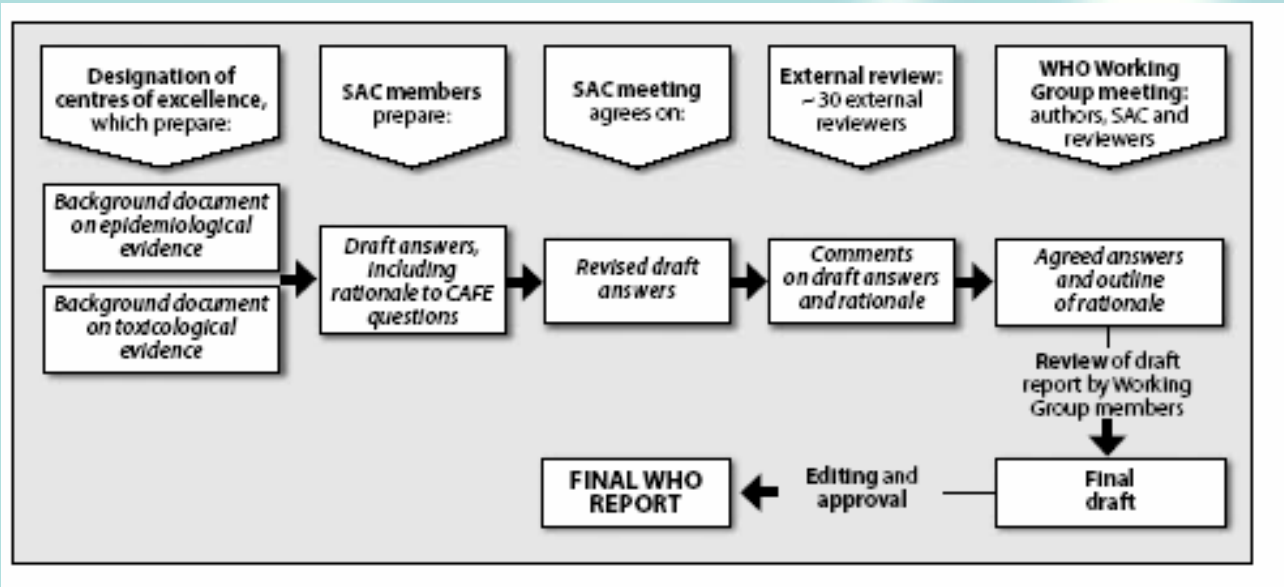
- to determine an overall, integrated strategy at regular intervals which defines appropriate air quality objectives for the future and cost-effective measures for meeting those objectives;
- to disseminate widely the technical and policy information arising from CAFÉ

Publication of the Communication by EC planned for September 2005

Will be most probably accompined by a proposal for a revision of the AQ Directives (FWD & DD 1-3)

WHO Systematic Review – approach

- The WHO review used predefined protocols to assess the evidence
- The review focused on policy relevant questions
- All together, about 80 leading scientists were invloved
- Several reports were published



WHO Systematic review of PM pollution

- PM pollution at current levels has been linked to several severe health endpoints, including a marked reduction in life expectancy
- No no-effect threshold could be identified
- Fine PM mass is (still) an appropriate indicator for assessing health effects, even though toxicology indicates importance of HM, OC, endotoxins and **UF particles**
- Coarse PM is linked to some morbidity endpoints, probably independent of fine PM
- Further decrease in PM pollution exposure is likely to have considerable health benefits

Consequences for CAFE

How to regulate a non-threshold pollutant most effectively???

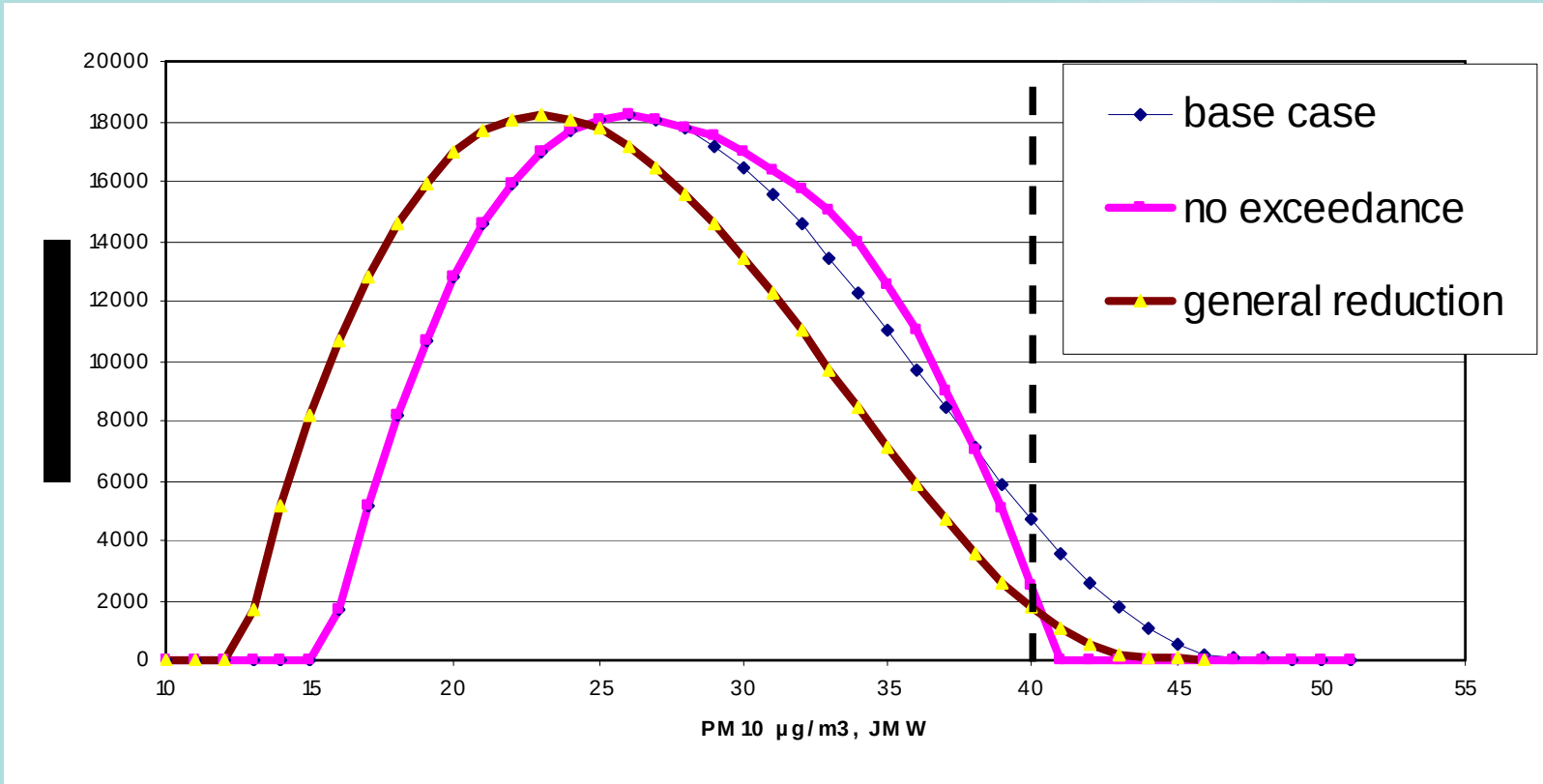
There are different tools available to further reduce PM:

- PM limit values (as those for PM10 in force)
- Source related regulations (stationary and mobile sources – EURO standards)
- Product regulations (e.g, S in fuels,...)

Application of

- **„Effect-based“ approach – reduce overall effects at minimal costs -> requires a quanitifcation of effetcs**

One LV for EU25?



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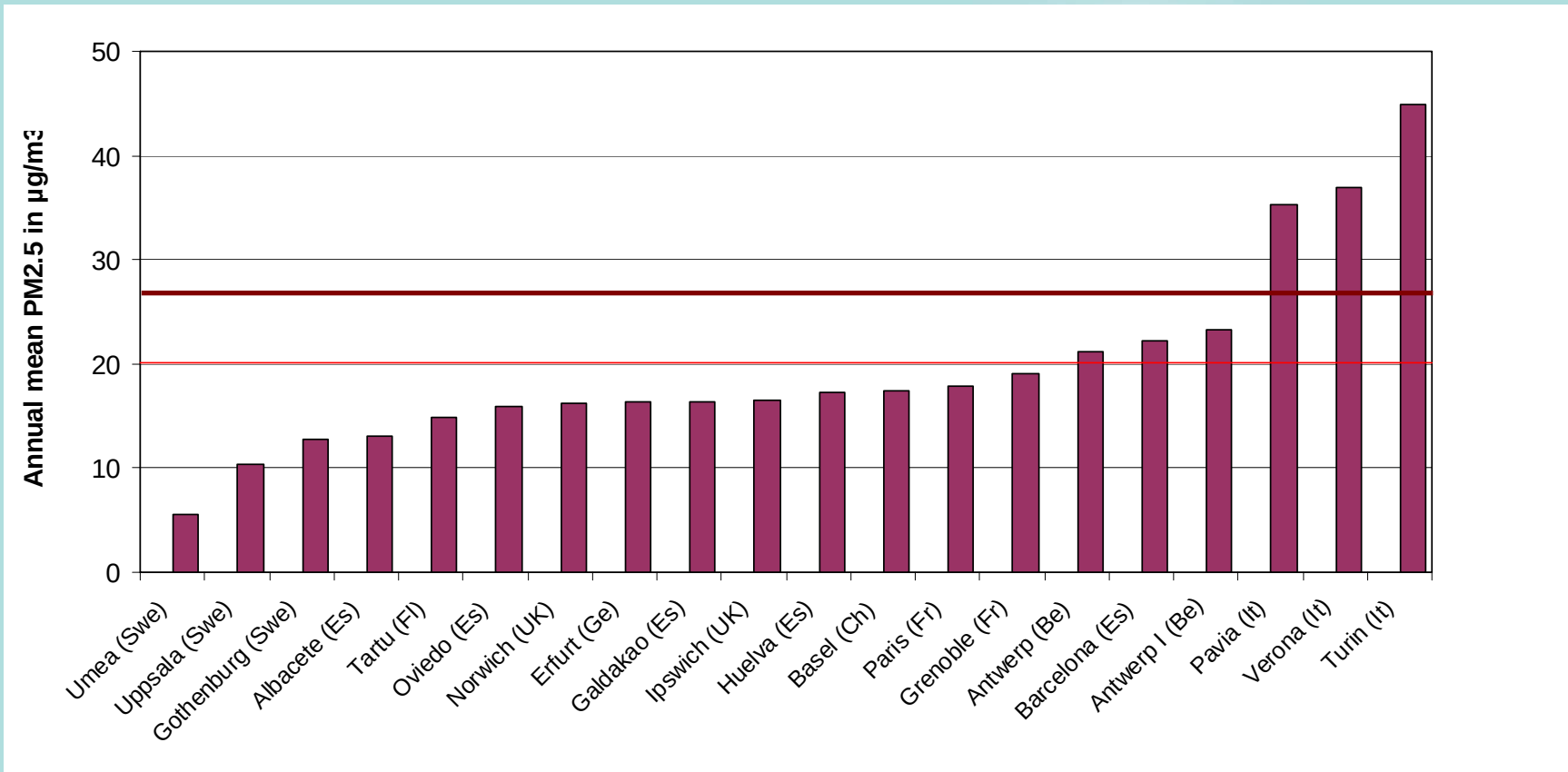
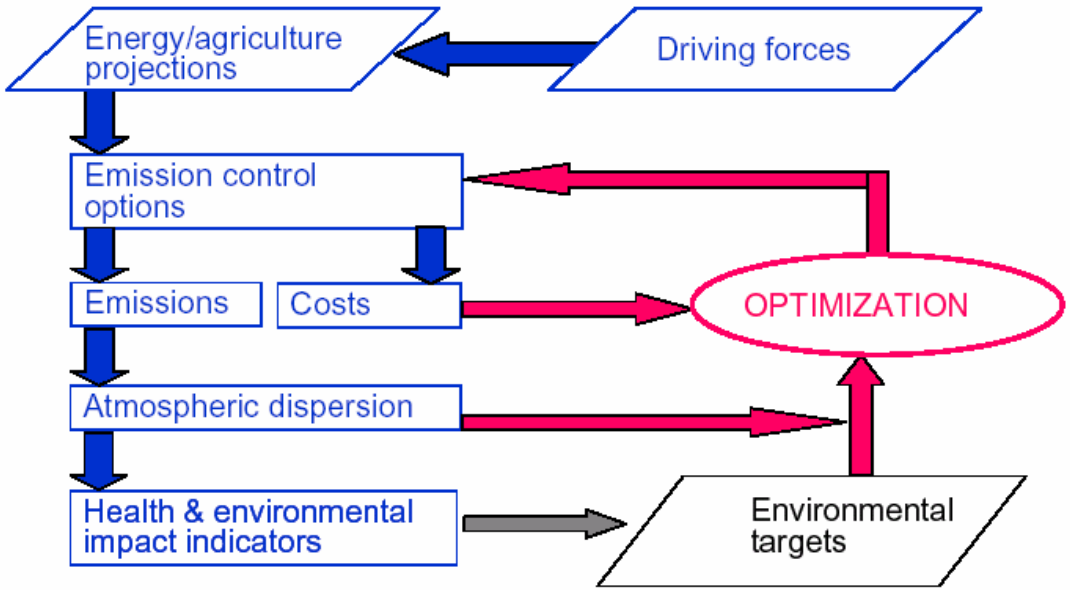


Reduction of general exposure

Use of integrated assessment modelling (IAM)

- Construct business as usual scenario (‚baseline scenario‘)
- Assess impact of BAU on environmental/**health** objectives
- Investigate costs and effects of additional control options
- Optimisation mode: „maximum effects for minimum costs“



TF on Health (WHO) recommendations for integrated assessment modelling:

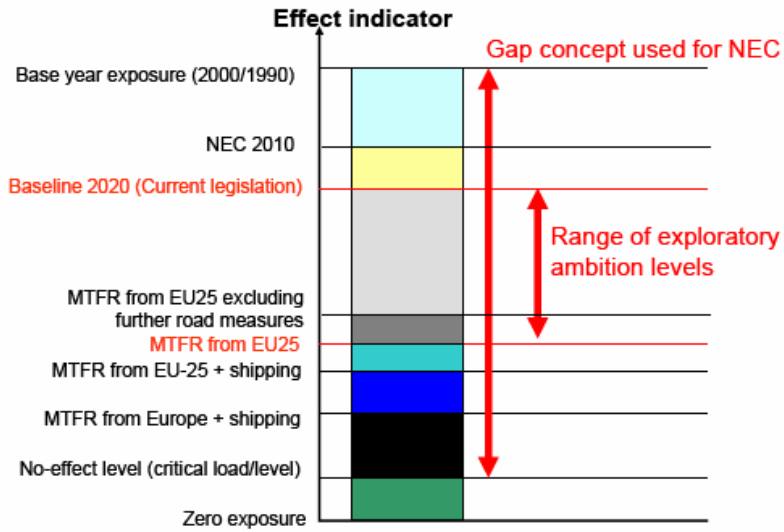
- Reduction of life expectancy as health endpoint
- Use of PM2.5 as indicator for PM related health effects
- RR from extended ACS (JAMA: Pope, 2002) (there is no large European cohort study available on fine PM)
- Linear concentration-response function
- No counterfactual level, but only anthropogenic fraction

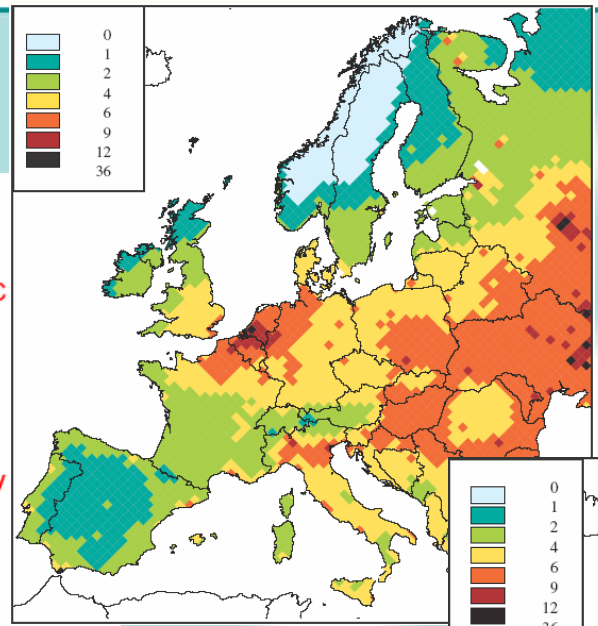
Reduction of general exposure

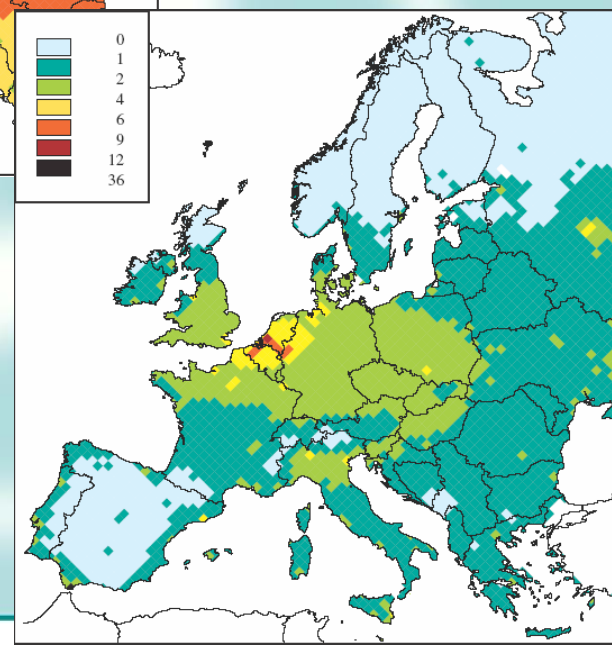
Goal of the optimization

- For a given set of environmental targets (e.g., maximum reduction in concentration or effects) find the least-cost set of measures
- Some sources are more strongly linked than others via the atmosphere to 'sensitive' receptors, i.e. a densely populated area (as indicated by the source-receptor relationships)
- Some sources are cheaper to control than others (as indicated by the cost curves)

Consequences for CAFE

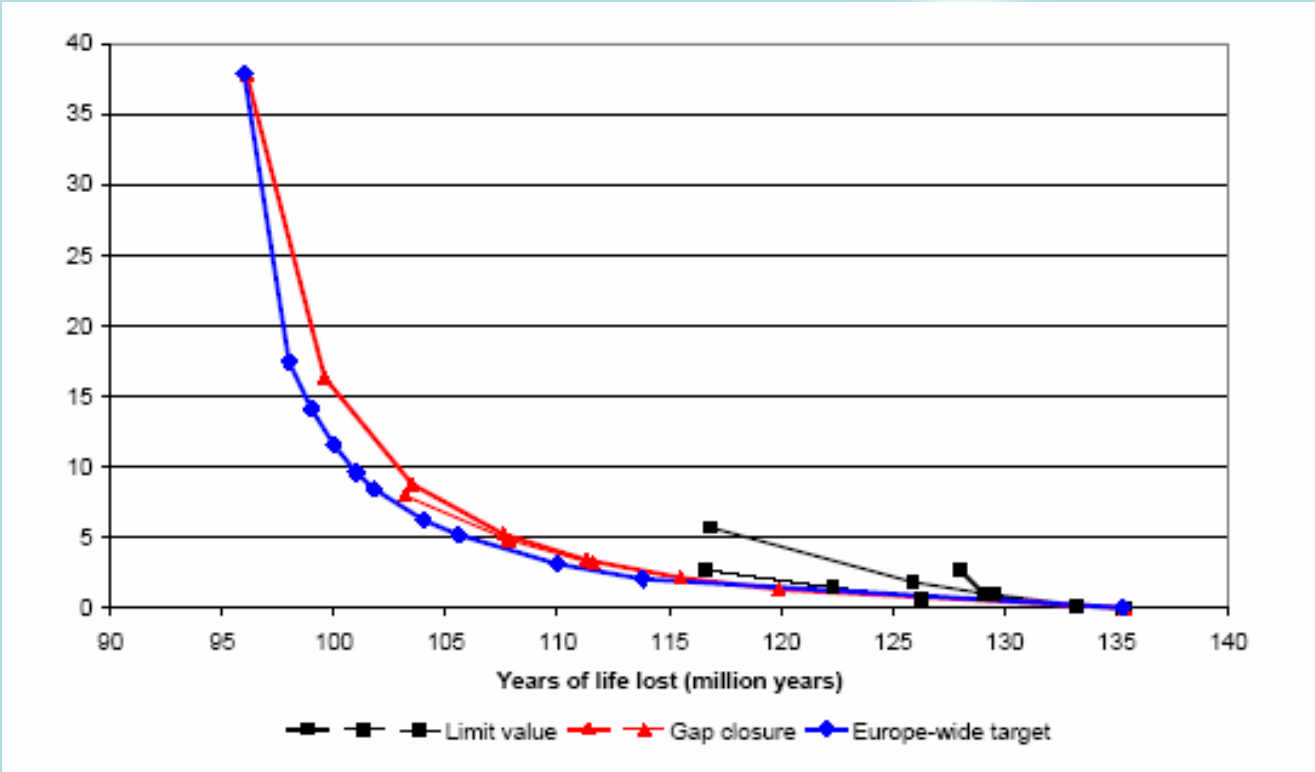






Effectiveness of different scenarios

Comparison of cost-effectiveness of different scenarios

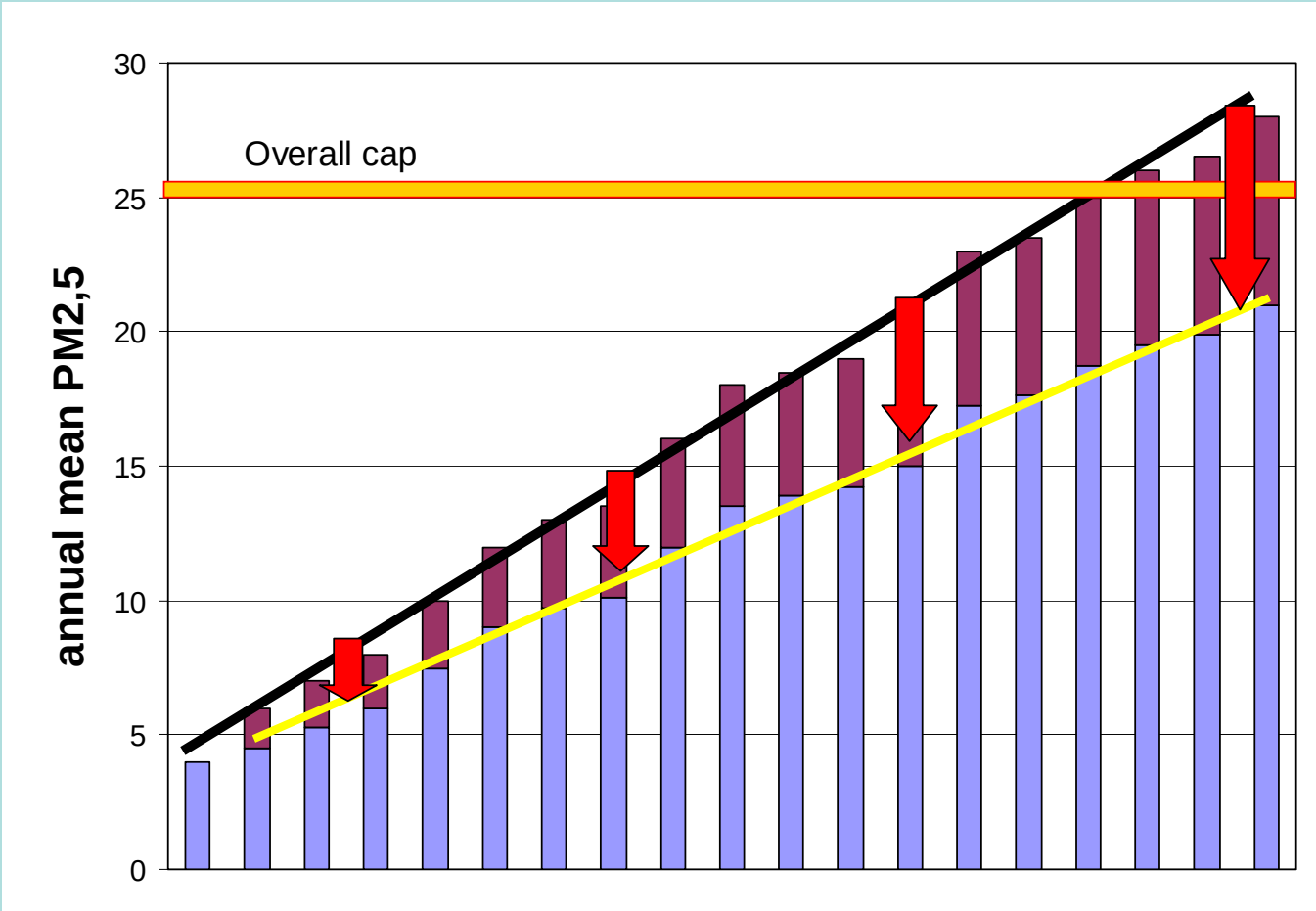


Effectiveness of different scenarios

Comparison of cost-effectiveness of different scenarios

From To	Baseline Low	Low Medium	Medium High	High MTFR
Total costs	5.9	10.7	14.9	39.7
Total benefits	34.1	42.1	46.1	52.8
Net benefits	28.2	31.4	31.2	13.1
Benefit/cost ratio	5.8	3.9	3.1	1.3
Incremental costs	5.9	4.8	4.2	24.8
Incremental benefits	34.1	8.0	4.0	6.7
Net benefits	28.2	3.2	-0.2	-18.1
Benefit/cost ratio	5.8	1.7	1.0	0.3

Exposure (urban background) reduction & overall cap



Conclusions

- Current European PM levels are likely to cause significant health impact
- Effective, science based abatement strategies require extensive information of effects; WHO provides this information on health effects
- IAM and CBA allow for a quantification of effects, benefits and costs; also other considerations are relevant like equity

Conclusions

- LVs alone are usually not cost effective
- A suite of tools and measures will be necessary to reduce health impacts of AP, including:
  - Source-based measures (EURO standards)
  - Emission ceilings for precursors of PM and prim. PM
  - Exposure reduction (taking urban background as proxy)
  - LVs

CAFE homepage:

http://europa.eu.int/comm/environment/air/cafe/index.htm

WHO review:

http://www.euro.who.int/air