

Benefits Analysis and CBA in the EC4MACS Project



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Objectives of the benefits analysis

- Quantify a greater range of impacts than the indicators used by GAINS:
 - Health – morbidity as well as mortality
 - Crops – yield losses
 - Materials – damage to buildings
- Monetise impacts
- Compare costs and benefits accounting for uncertainties



History of the benefits assessment in the EC4MACS context

- ExternE Project series, 1991 – present
- Debate on CBA methods in context of CLRTAP (early 1990s)
- Acidification Strategy (1996)
- Ozone Directive (1998)
- Gothenburg Protocol (1999)
- National Emission Ceilings Directive (1999)
- CAFE/Thematic Strategy (2002-6)



Approach

Effects:
Health
Crops
Materials

Ecosystems
Climate

Scales:
Urban to hemispheric



Identify sources and quantify emissions of NOx and VOCs



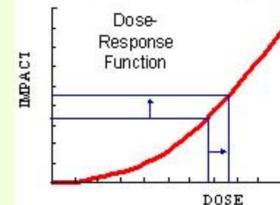
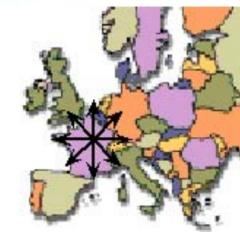
Calculate dispersion of precursors and ozone concentrations across Europe



Apply exposure-response functions to estimate yield loss



Value yield loss using world market prices



Developments since CAFE

- Development of the ALPHA2 model for impact and benefit assessment
 - revision of the model structure, training more people to use it within the research group
 - updating population data, etc.
- Consideration of recent research:
 - health impact assessment
 - health impact valuation, particularly mortality
 - ecosystem valuation
 - impacts to cultural heritage
 - secondary organic aerosols



Health impact assessment

- Effects of chronic exposure to $PM_{2.5}$ on mortality
 - Recent reviews show a move to recommendation of higher risk factors
 - UK – 1% change in mortality per $10\mu g/m^3$ $PM_{2.5}$ increased to 6% as core estimate
 - USEPA – mean of expert panel ~10%
 - Need for reconsideration of risk factor by WHO?
 - Role of the 4% risk factor used in CAFE for sensitivity analysis?
 - Best estimate?



Mortality valuation

	VSL	VOLY	Comment
NEEDS		€40,000	Direct
NewExt	€1.02 million	€54,000	Median, 5:1000 risk
NewExt	€2.08 million	€125,000	Mean, 5:1000 risk



Mortality valuation

- Reasons for preferring NEEDS €40k VOLY:
 - Larger sample
 - More countries involved
 - Direct valuation of loss of life expectancy
- Problems with adoption of NEEDS value
 - Yet to be formally peer reviewed
 - Preference by some (e.g. USEPA) for VSL



Mortality valuation

- Options
 - Use NEEDS, or
 - Stick with CAFE, or
 - Use NEEDS and VSL as alternatives, or
 - Add NEEDS estimate as an additional sensitivity case to the 4 CAFE cases
 - Switch point analysis
 - how large does valuation need to be for benefits > costs?
 - how does this compare with available estimates?



Developments regarding valuation of damage to ecosystems

- Swedish Östads forest analysis of ozone impacts
 - €316million/year timber loss (Europe)
 - Problems:
 - Loss of other forest value?
 - Forest management?
- NEEDS repair cost approach for ecosystem valuation



Materials damage

- ICP Materials focus on cultural heritage
 - Advances have been made but there remain problems for our analysis:
 - Concepts of permanence
 - Need for full European stock at risk
 - High level of detail of stock at risk
 - Specific materials
 - Type of object or monument
 - Lack of adequate valuation data

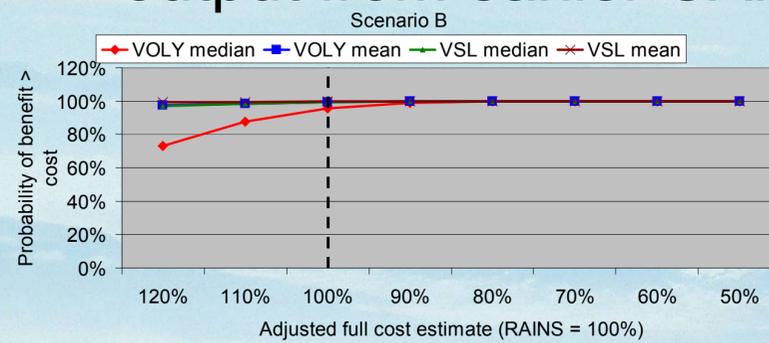


Uncertainty analysis

- Address uncertainty by consideration of:
 - Statistical error
 - Sensitivity to methodological assumptions
 - Inherent (unquantified) bias in the analysis
- Challenge – how do you bring all uncertainties together to give guidance to policy makers?

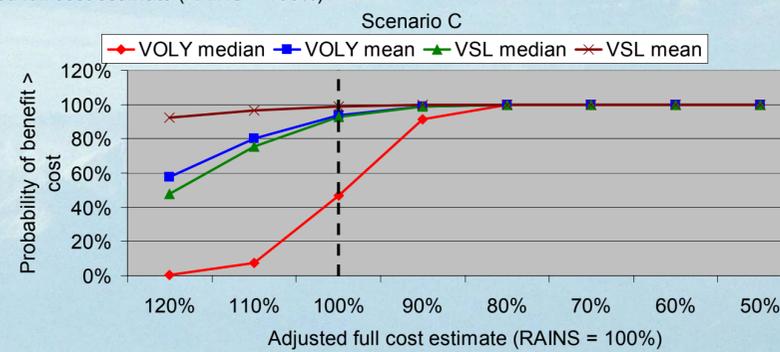


Illustration of uncertainty analysis output from earlier CAFE work



How useful and well understood is this presentation of uncertainty?

Are there better options?



Inherent bias

- Examples:
 - Failure to monetise ecological impacts
 - Failure to quantify impacts to cultural heritage
 - Failure to quantify some possible health impacts because of a lack of data



Bringing ecosystem effects closer to the CBA

- Critical loads mapping highlights the extent of areas at risk
- But it remains hard for the non-expert to visualise that risk



Bringing ecosystem effects closer to the CBA



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Making the ALPHA2 model available more widely

- Problem – not a self standing model
 - E.g. Pollutant concentration data
- Solution
 - Generation of estimates of damage per tonne emission (national averages)
 - Production of simple models where users can adjust inputs (e.g. MethodEx toolbox) to generate their own damage per tonne estimates



Conclusions

- Overall structure of the benefits analysis and CBA is little changed to that used in CAFE
- Key developments have been highlighted
- Your thoughts on these, or on other issues, will be welcome!

