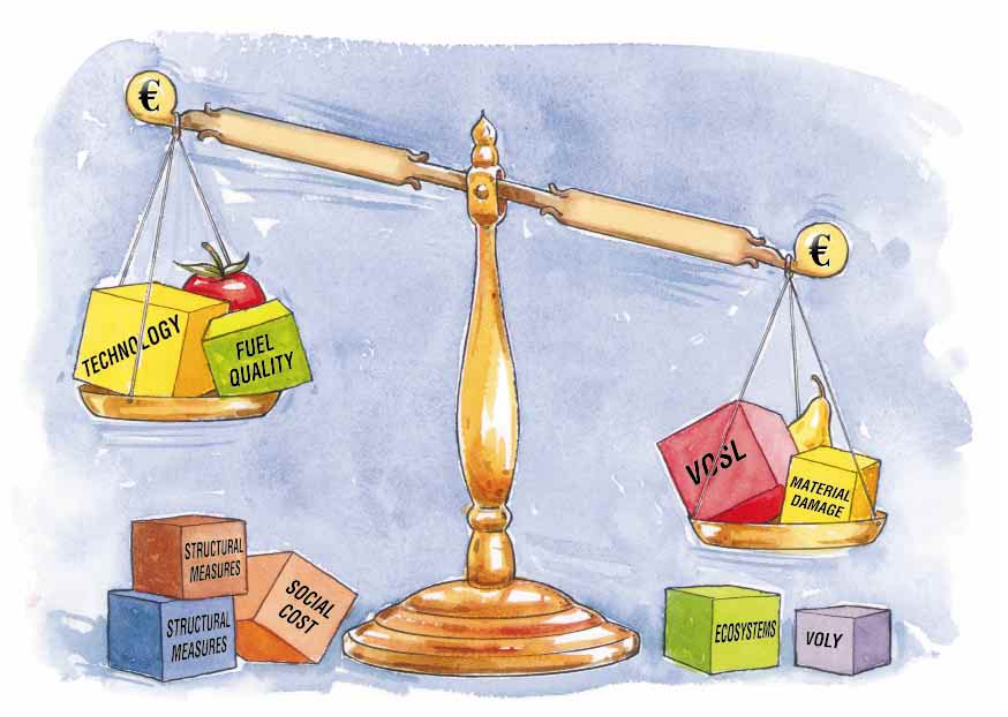
Assessing the monetary benefit of improving air quality

Can decision-makers trust these monetary benefit figures?



The European Commission and some Member States have recently carried out studies to estimate the monetary benefits of proposals to improve air quality and reduce adverse effects on the environment. Early studies suggested extremely high monetary benefits arising from relatively small changes to air quality, and this provoked considerable debate between those who wanted to believe such figures and those who felt the estimates were unrealistically high. It continues to be a difficult and sensitive debate but there has been a perceptible shift in opinion towards more modest benefit evaluations.

Typically monetary benefits from improving air quality can arise from:

- reduced adverse impacts on human health (short-term and long-term);
- reduced adverse impacts on crops and ecosystems;
- reduced material damage and soiling of buildings etc; and
- improved visibility (reduction of pollution-related haze).

A satisfactory monetary method for assessing benefits to ecosystems remains elusive and hence such benefits are 'left out' of the monetary evaluations. This is most regrettable from a scientific point of view but, politically, provides ready ammunition to those who wish to argue that the current monetary benefit evaluations are underestimates. Their omission has also been used by some as a reason to dismiss concerns that certain of the other benefits are overestimated.

CONCAWE notes this omission of ecosystem benefits in recent monetary evaluations but urges that economic methodologies are developed and applied in this difficult area, and that those other benefits which are currently evaluated should be assessed as accurately as possible. CONCAWE also urges that the various uncertainties are made transparent to the decision makers. This is particularly important when the aggregated monetary benefits evaluation covers a wide range of diverse adverse effects.

Recent reports by the Commission's cost/benefit consultancy (AEA Technology) have made good progress in this regard, including a ranking system which attempted to display the reliability of the monetary valuations applied to each of the effects. In addition, results were displayed with and without one of the large but highly uncertain benefits. However, still greater transparency is needed to ensure that the estimates of monetary benefit take full account, not only of the reliability of the monetary value placed on each benefit, but also of the probability that the pollutant actually causes the effect *and* that it does so at the ambient air concentrations in question. This article concentrates on these two areas of uncertainty, but it should not be forgotten that there are many other sources of error and uncertainty which could affect substantially the monetary evaluations. These include emission projections, modelling, exposure calculations, the number of people at risk, plant responses to drought which reduce ozone damage, significance of ecosystem damage, etc.

The following text describes in further detail the monetary evaluation of benefits to human health, as it is these effects that are given the highest priority for abatement across the range of stakeholders.

Human health effects are classified as either 'acute' (effects arising from short-term exposure), or 'chronic' (effects arising from longer-term exposure). Such effects have been identified through controlled exposure experiments or are suggested through statistical associations identified in epidemiology studies. The effects range from small changes to lung function (ozone), hospital admissions and even mortality (both suggested for SO_2, PM and ozone). In general, uncertainty as to whether an effect is actually caused by a pollutant is greatest for chronic effects, typically for those effects suggested by statistical associations in epidemiology studies. Effects observed in controlled experiments of short-term exposure are more reliable (and can differ from those determined in epidemiology studies).

So far, the most dominant of the monetary human health benefit figures come from reducing the risk of mortality, in particular that associated with exposure to secondary particulate matter. The statistical association between mortality and particles is open to considerable speculation, and most significantly, key scientists believe that secondary particles are not likely to cause such effects. Nevertheless these figures have been included as if exposure to secondary particles is causally linked to mortality. Notwithstanding this uncertainty a high monetary value is then placed on reducing the risk of mortality.

In recent studies two methods have been applied to mortality risks:

- the traditional 'value of statistical life' (VOSL) method; and
- the newer 'value of life years lost' approach (VOLY).

Economists have developed the VOSL approach over the last 25 years for use in public decision making. VOSL estimates use various sources of information to determine the general public's 'willingness to pay' to reduce the risk of mortality. Typically, VOSL numbers are in the range of 2–5 million Euros which means that the benefit of reducing the risk of a single pollution-related

death across the whole of the EU-15 is assigned a monetary benefit of 2–5 million Euros.

What remains highly questionable is whether these estimates of VOSL should be applied to risks such as those posed by air pollution. It is generally believed that deaths associated with air pollution would occur mainly in the elderly with advanced lung or heart disease and that such deaths may be brought forward only by weeks or months, but not years (though the reduction of life expectancy is not known precisely). In addition, air pollution acts as an aggravating, rather than a causal, factor and this has implications when judging the importance of effects.

Most VOSL studies are based on information derived from average healthy and happy populations. However, at the individual level, a poor quality of life may lead to a low 'willingness to pay' to prolong life. It can thus be concluded that, if a particular mortality risk is primarily associated with a group of individuals already suffering a degraded quality of life, then standard estimates of VOSL may be inappropriate. Most experts now conclude that the VOSL method is more suitable for use in connection with indiscriminate risks to the whole population, e.g. the risk of death in a traffic accident, than with risks that tend to affect a specific subset of the population, such as is considered to be the case for air pollution.

Recent work on the VOLY approach recognizes this issue and is based upon the concept that when mortality risk is reduced, death is not avoided but its expected time of arrival is delayed and life expectancy increased. Evaluations based on assessing life extension have yielded valuations of as low as 0.06 million Euros per life year. The methodology developed in a recent UK Department of Health report[1] suggests a range of GBP 32 000 (EUR 48 000) to GBP 110 000 (EUR 165 000) for avoiding one premature mortality by one year. This is in sharp contrast to the value of 2–5 million Euros used in other estimates and brings into question the economic merits of proceeding with a number of present air quality initiatives. Whatever the monetary value assigned, the VOLY-based monetary evaluation generally produces much lower monetary benefits than evaluations using the VOSL approach.

There are a number of other issues of concern. For instance, emission control costs are derived on a quite different basis from monetary benefit estimates. Recent estimates of costs are based on actual expenditure on emission control technologies. However, monetary benefit figures are based on a 'willingness to pay' approach. Is it really justified to compare these two sets of figures? Is the comparison between monetary benefits and costs not like comparing apples with pears?

In conclusion, there are many questions still unanswered concerning the valuation of benefits arising from improving air quality, and there is an urgent need for additional studies in this important area of public policy. The wide range of uncertainties affecting the outcome of such studies are of particular concern and lead us to conclude that the results from such studies are unreliable in their aggregated form.

Other questions surround the responsibility which society in general, and Government in particular, has for the wise and cost-effective use of finite resources. For instance, is the reduction in risk resulting from the allocation of scarce resources to reduce emissions of a particular air pollutant worth more than the societal benefit which would be derived if those resources were utilized elsewhere? In particular, are there other more cost-effective ways of improving the health and well-being of the general population rather than by reducing air pollution?

[1] Economic Appraisal of the Health Effects of Air Pollution