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Evaluating the Cost-Effectiveness of Environmental Policies: Theoretical Aspirations and Lessons from European Practice for Global Governance

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Abstract

In Europe as in other industrialised countries, environmental policy faces the need to demonstrate that targets are achieved efficiently, and at the lowest possible cost. At the European level, the renewed interest in the cost-effective design and implementation of environmental policies is manifested e.g. in the impact assessments carried out for all major EU policy initiatives. However, although some European countries and the EU itself have moved ahead with such assessments in recent years, there is still a considerable gap between policy maker demand for economic assessments and the potential for actually delivering practical recommendations based on solid environmental-economic analysis. In particular, the ex-post evaluation of environmental policy performance remains a recent phenomenon and is not widely applied. At the European level, there is little experience with carrying out such assessments, and even less with using their results to feed back into policy making. In conducting such assessments, the main challenge encountered is to establish the causality between observed effects and influencing factors. Another main issue relates to the scale of the analysis – traditionally, CEAs have mainly been applied at the local level, in order to evaluate individual, well-defined measures. Moving up the scale of the analysis to assess the cost-effectiveness of strategies or policies at national, European or global level necessarily increases the uncertainty of relating observed impacts to a particular action.

This paper first provides an overview of legal requirements for ex-post CEA in European environmental policy. It then presents an overview of existing guidance documents and manuals for carrying out ex-post CEAs. The paper then gives a summary of the current practice in EU Member States with regard to ex-post CEA of environmental policies. Finally, the potential evaluation of cost-effectiveness of Environmental Policies at the global level is discussed.

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I Introduction[2]

Economic analysis for policy appraisal is generally interested in answering two questions: 'is a given policy objective worth achieving?' and 'if so, has the policy objective been achieved in the most cost-effective way?'. While the first question is addressed in a cost-benefit analysis (CBA), the second question can be answered with the help of a cost-effectiveness analysis (CEA).

Cost-benefit analysis (CBA) is carried out in order to compare the economic efficiency implications of alternative actions. The benefits from an action are contrasted with the associated costs (including the opportunity costs) within a common analytical framework. To allow comparison of these costs and benefits related to a wide range of scarce productive resources, measured in widely differing units, a common numeraire is employed: money. This is where most problems usually start for economic policy or project appraisal since some resources, especially environmental resources, are difficult to evaluate in money terms. Many of the goods and services provided by ecosystems, such as amenity, clean air, biodiversity sustenance, are not traded on a market, hence, no market price is available which reflects their economic value. Such prices need to be estimated instead through the use of valuation studies, for example eliciting people's willingness to pay for a particular environmental good. By comparing costs and benefits in monetary terms, a CBA provides an assessment of whether a policy option is worth implementing (that is whether the benefits outweigh the costs). The comparison can either be done by dividing benefits by costs (where a benefit-cost ratio larger than one means that the option is worth implementing), or by subtracting net costs from net benefits (where a positive sum indicates a beneficial option).

A cost-effectiveness analysis (CEA) seeks to find the best alternative activity, process, or intervention that minimises resource use to achieve a desired result. An ex-ante CEA is performed when the objectives of the public policy have been identified and an analyst or an agency has to find the least cost-option of achieving these objectives. An ex-post CEA addresses the question of how far objectives have been achieved, and at what cost. In either case, the cost-effectiveness of a policy option is calculated by dividing the annualised costs of the option by a quantified measure of the physical effect, such as animal or plant species recovered, tons of emissions of a given pollutant reduced, kilometres of river length restored, and so on. In this context, the effects of a policy can be both reduced pressures (for example, the least-cost option to reduce CO2-emissions), or avoided impacts (for example, the cheapest way to keep global warming below 2°), where the latter is usually more difficult to assess. Different options that achieve / have achieved the same effect are then compared based on their cost. CEA, therefore, does not ask, nor attempts to answer, the question whether the policy is justified, in the sense that its benefits to society will exceed its costs to society. CEA is sometimes used as a second-best option when a full-blown CBA would be desirable, but many effects cannot be captured in monetary form.

Cost-effectiveness analysis can be applied both as an ex-ante appraisal and as an ex-post evaluation tool. If applied ex-ante, a CEA will help to determine the most cost-effective way of achieving a given target, assisting policy makers to allocate resources and efficiently realise policy objectives.

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[2] This paper is based on research that was carried out by Ecologic, eftec and IVM in 2004 and early 2005 on behalf of the European Environment Agency. Some parts of this paper have not been updated since. It should be noted that the positions presented in this paper represent solely the views of the authors, and cannot be attributed to the EEA. The authors would like to thank the Members of the EEA national focal point network for their support and input to this paper. The authors would also like to thank Friedrich Hinterberger (SERI), Frans Oosterhuis (IVM), Hans Vos (EEA), and the late David Pearce for reviewing and commenting on the original research.

The focus of this paper is on ex-post CEAs. Where it is applied ex-post, a CEA may help to assess whether a policy measure has been effective in addressing the problem it was designed for, and at what cost. It can take the form of an ex-ante / ex-post comparison, assessing whether expected effects were realised in the projected cost; it can consist of a cross-country comparison (benchmarking), or, if ex-post CEAs are carried out repeatedly, it can determine whether efficiency has increased over time.

Although some European countries have moved ahead in this respect in the last years, ex-post evaluation of environmental policy performance remains a relatively recent phenomenon and is not widely applied. At the European level, there is little experience with carrying out such assessments, and even less with using their results to feed back into policy implementation. Whether at the European level or at the level of Member States, the problems encountered in ex-post assessments are similar. First, the main challenge is to establish the causality between observed effects and influencing factors, thereby disentangling the different effects of policies and relating them to individual policy measures, and separating out the influence of other factors. Second, a related problem is that of data gathering: unless specifically tailored monitoring requirements have been specified up front, it is often difficult to find the data that measures the impact a policy has had. For this reason, data gathering ex-post can easily become very costly and time-consuming. And third, another main issue relates to the scale of the analysis: traditionally, CEAs were mainly applied at the local level, in order to evaluate individual, well-defined measures. Upscaling the analysis to assess the cost-effectiveness of strategies or policies at the national, European or even to the global level necessarily increases the uncertainty of relating observed impacts to a particular action.

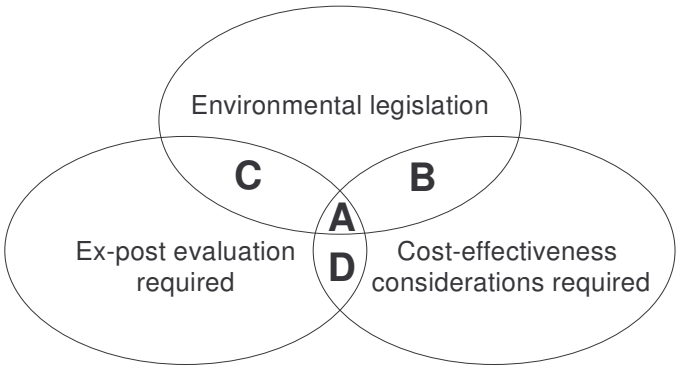
Next to these practical problems, there are also some theoretical issues that merit further discussion, but which are only touched upon in passing in the available literature. There is some discussion on which types of costs should be considered in a CEA, ranging from the purely financial private costs (investment and operational costs) of specific measures to general equilibrium-estimates of costs to the wider economy, including efficiency losses (foregone welfare). At least one guidance document argues that changes in producer and consumer surplus should be included, however none of the case studies identified actually calculated these cost components. Regarding the treatment of effectiveness, there is an interesting issue of whether measures of effectiveness should be discounted even though they are in non-monetary terms. Discounting of costs is a standard procedure in most CEAs, and is called for in all guidance documents. Regarding the temporal dimension of effectiveness, there is no guidance on whether some type of discounting should be applied as well. For example, in a comparison of two measures that achieve the same objective at the same cost, but where one takes two years to reach the objective, while for the other costs are stretched out over five years, the latter would appear more cost-effective. Other issues include the distinction between intermediate goals and final goals of a policy intervention, which are often confused. Thus, the effectiveness term in a cost-effectiveness analysis can either capture a pressure (tons of emissions reduced) or an impact (avoided damage or improvements in environmental quality). Which of the two is applicable depends on the original goal of the policy measure. In practice, most assessments tend to focus on pressures, since they are less challenging to measure and since the causality between measures and effects is easier to establish.

This paper is structured into seven sections. The next section provides an overview of legal requirements for ex-post CEA in European environmental policy. Section III summarises the state of the art with regard to available guidance documents and manuals on carrying out ex-post CEAs. Section IV presents selected case studies of applied ex-post CEA for environmental policy measures and section V provides an interpretation of the results at the European level. Section VI discusses briefly the results in relation to the potential relevance for the global level, while section VII concludes.

II Legal requirements for ex-post CEAs in EU environmental legislation

In 2001, the EEA noted that 'very few items of EU environmental legislation request information on policy effectiveness … even though some EU measures are very costly to implement and should be subject to some kind of cost-effectiveness scrutiny' (EEA, 2001, p. 14). This observation still seems to be valid, although a (small) number of recent Directives do include a requirement to perform an ex-post cost-effectiveness analysis.

This project identified eighteen legislative items that require some type of evaluation, and can be related to environmental policy. In figure 18.1 below, these items are visualised by grouping them in four categories. As the analysis shows, only a small subset (A) indeed meets all three requirements: (i) environmental legislation that (ii) mandates a cost-effectiveness analysis (iii) to be carried out ex-post. If any of these three criteria are relaxed, the scope of relevant items can be expanded.



This means that the eighteen general items covered in this project may be subdivided as follows:

A) Environmental legislation that requires an ex-post evaluation of cost-effectiveness, at least as one of several factors to be considered in a wider evaluation framework. The current study has identified four items in this category: Directives on cogeneration, bio-fuels, renewable energy and emission ceilings (see below).

B) Environmental legislation that requires an ex-ante evaluation / analysis of cost-effectiveness, or at least consideration of cost-effectiveness as one of several factors. In this category, six items have been identified. The cost-effectiveness requirements in this category may take different forms: for example, in the case of the Water Framework Directive (WFD), it is not so much the cost-effectiveness of the Directive as such that is considered, but rather the cost-effectiveness of combinations of measures mandated by the Directive. Several Directives (for example large combustion plants, ozone and benzene in ambient air) require that experiences with the implementation of the Directive be taken into account when deciding on the cost-effectiveness of stricter standards, thus connecting ex-post evaluation and ex-ante CEA.

C) Environmental legislation that requires an ex-post evaluation, but not (necessarily) the analysis of cost-effectiveness. Four items have been identified that fall into this category, including Directives on marine and air pollution. While none requires explicitly the consideration of cost-effectiveness, some items refer to the overall efficiency or the effectiveness of the regulations, implying at least a contributing function for cost-effectiveness.

D) Legislation and regulations requiring ex-post CEA that is not strictly environmental, but has a significant impact on the environment. This category comprises four items related to funding instruments of the Community regional policy (Cohesion Fund, Structural Funds, the Instrument for Structural Policies for Pre-Accession (ISPA) and the Financial Instrument for the Environment (LIFE)). It should be noted that this list is not exhaustive. Depending on which policies are

regarded as having a significant impact on the environment, more could be included in this category.

This also means that while there are several more Directives that involve effectiveness assessments in one way or another, the set of environmental Directives calling for an ex-post evaluation of cost-effectiveness is limited to four Directives:

- Directive 2001/77 (Electricity from renewable energy sources). Article 4.2 of the Directive demands that '[the] Commission shall, not later than 27 October 2005, present a well-documented report on experience gained with the application and coexistence of the different mechanisms [...]. The report shall assess the success, including cost-effectiveness, of the support systems [...] in promoting the consumption of electricity produced from renewable energy sources.' The reporting may include a proposal for a framework for Community activities with regard to support schemes for Community activities. This framework should 'promote the use of renewable energy sources in an effective way, and be simple and, at the same time, as efficient as possible, particularly in terms of cost'.
- Directive 2001/81 (National Emission Ceilings). Article 9.1 of the Directive demands that 'in 2004 and 2008, the Commission shall report to the European Parliament and the Council on progress on the implementation of the national emission ceilings', and on the extent to which the objectives of the Directive are likely to be met. The reports shall include 'an economic assessment, including cost-effectiveness, benefits, an assessment of marginal costs and benefits and the socioeconomic impact of the implementation of the national emission ceilings on particular Member States and sectors'.
- Directive 2003/30 (Promotion of bio-fuels and other renewable fuels). Article 4.2 of the Directive states that 'by 31 December 2006 at the latest, and every two years thereafter, the Commission shall draw up an evaluation report [...] on the progress made in the use of biofuels and other renewable fuels in the Member States.' The report shall assess 'the cost-effectiveness of the measures taken by Member States in order to promote the use of biofuels and other renewable fuels', as well as 'the economic aspects and the environmental impact of further increasing the share of biofuels and other renewable fuels'.
- Directive 2004/8 (Cogeneration). Article 7.3 of the Directive demands that the Commission should provide 'a well-documented analysis on experience gained with the application and coexistence of the different support mechanisms' in order to 'assess the success, including cost-effectiveness, of the support systems in promoting the use of high-efficiency cogeneration.'

By way of an example, the experiences with the ex-post cost-effectiveness analysis of the Directive 2000/81 on National Emission Ceilings and the Directive 2001/77 on Electricity from Renewable Energy Sources are described in boxes 1 and 2 below.

Box 1: Ex-post evaluation of the Directive on National Emission Ceilings

The Directive 2001/81/EC on National Emission Ceilings for certain pollutants (NEC Directive) is among those pieces of European environmental legislation that were researched extensively, including economic implications. A comprehensive Cost-Effectiveness-Analysis was conducted during the negotiation of the Directive (Amann et al. 1999), as well as an assessment of the expected benefits and a cost-benefit comparison (Holland and King 1999).

A first review of the implementation of the NEC Directive, including an assessment of it cost-effectiveness, was originally foreseen for 2004. This process was delayed, as it was integrated with the development of the Clean Air for Europe (CAFE) programme and the Thematic Strategy on Air Pollution. Under the CAFE programme, a set of service contracts were launched by the European Commission, aimed at assessing the expected impacts of the programme in various dimensions. This included the development of baseline scenarios for the CAFE programme, a cost-benefit analysis of the CAFE programme and an ex-post assessment of the effectiveness of European air quality policies. These studies all contributed to the Commission's impact assessment for the Thematic Strategy on Air Pollution (European Commission 2005a). The impact assessment, consequently, has been attested high scientific quality and academic rigour, and has been highlighted as a good example of a well-prepared impact assessment (see e.g. Skinner et al 2006). While these studies were not directly related to the review of the NEC Directive, a number of overlaps existed, especially with the ex-post assessment carried out by Milieu et al. (2004).

In addition, the Commission has launched a service contract in order to prepare the review of the NEC Directive and to evaluate the national programmes that were established by the Member States.[3] The project was commissioned to the British consultancy entec. Its final output consists of 12 sub-reports, which became available in May 2005. One of these, the "First Draft Review Report", provides a first draft to fulfil the reporting requirements of the Commission established under the NEC Directive, according to which the Commission must report on progress on the implementation of the national emission ceilings, including an assessment of cost-effectiveness.

However, despite the multitude of research contracts and assessments, and despite the wealth of information contained in the various reports, the actual output in terms of ex-post cost-effectiveness analysis is meagre.

- The project "Assessment of the Effectiveness of European Air Quality Policies and Measures" that was conducted by Milieu et al. in support of the CAFE programme conducted an exhaustive literature review of ex-post studies on air pollution abatement policies and their effectiveness. The finding was that ex-post analyses of air quality policies in Europe were generally scarce, and that "almost nothing could be found on cost-effectiveness of the EU policies." As a consequence, experiences in the US were also considered. In addition, a consultation exercise was carried out among European experts, in which some doubts were raised about the expected effectiveness of the NEC Directive. Others pointed out that it was too early to assess its effectiveness.
- The First Draft Review Report on the review of the NEC Directive that was produced by entec in May 2005 provides substantial detail on the impacts of the Directive, including detailed figures on the cost-effectiveness of possible measures. However, the document mainly summarises and updates results of the various ex-ante analyses that were carried out for the NEC Directive and the CAFE impact assessment. Consequently, the First Draft Review Report itself is more of an ex-ante analysis, describing expected impacts rather than observed ones.

[3] See http://ec.europa.eu/environment/air/necr.htm

Box 2: Ex-post evaluation of the Directive on Renewable Energy Sources

A second test case is provided by the Directive 2001/77/EC1 on the promotion of electricity produced from renewable energy sources in the internal electricity market (RES Directive), Article 4 of which stipulated that " not later than 27 October 2005, the Commission shall present a well documented report ... [that] shall assess the success, including cost effectiveness, of the support systems [for] ... electricity from renewable energy sources [established in the Member States]." In response to this obligation, the Commission produced a Communication (European Commission 2005b), accompanied by an impact assessment (European Commission 2005c). The publication of both documents was delayed by two months, allegedly because of concerns about competitiveness impacts. The economic information contained in these documents derived from a consultancy project carried out by PriceWaterhouseCoopers.[4]

Annex 3 of the Commission Communication presents an ex-post CEA of different support mechanisms in summarised form, differentiated for different types of RES. In the annex, cost ranges of generation costs are presented for different RES and for all EU Member States, as well as the incentives that producers face from support instruments (again presented as ranges). The effectiveness of support schemes for RES is presented as the degree to which the potential for RES has been exploited – or, more specifically, the change in the electricity generation potential (installed capacity) to the additional realisable potential. Both costs and effectiveness were calculated for the period 1998 – 2004. The analysis does not calculate cost-effectiveness ratios for different countries or instruments, but it does provide a graphical representation wherein the effectiveness is mapped against the costs.

Not only does the analysis provide an example of a genuine cost-effectiveness analysis, it also provides a substantial amount of information in an accessible way. The analysis offers both a cross-country comparison and a comparison across different types of support instruments. It also presents different types of costs – generation costs (which are costs to the producers) as well as support levels for RES (which are costs to the electricity consumers or taxpayers).

In several instances, the analysis looks beyond the prima facie information contained in the numbers and graphs, and discusses the underlying trends and situations in the country (e.g. the fact that a low level of support can have quite different implications in a country where a mature market for renewable energies already exists, compared to one where renewable energies have not taken off). Likewise, the analysis also touches upon instances where cost-effectiveness as the sole decision risks taking too narrow a view – e.g. in the case of biofuels, where impacts on rural development may give rise to co-benefits that are not reflected in the cost-effectiveness analysis, or in the case of environmental co-benefits of agricultural biogas. On an aggregate level, the effectiveness of different support schemes in different countries is also compared across different types of renewable energy sources (e.g. wind and biomass). This is mainly done in a verbal-descriptive way.

A further question is how the evaluation of cost-effectiveness should be conducted. For the four Directives that require an ex-post CEA, neither guidelines nor standards are provided regarding the content or the methodology to be applied. For some of the other Directives and regulations, more guidance exists. The guidance is most developed in the case of the Water Framework Directive, Article 11 / Annex III of which requires an ex-ante appraisal of the most cost-effective combination of measures to achieve good ecological status. To support the selection of measures, the European working group WATECO (established under the WFD Common Implementation Strategy) has produced an extensive guidance document.

In addition, some Member States have come up with handbooks and guidance documents for the national implementation. For example, considerable experience with such assessments exists in the

[4] PriceWaterhouseCoopers (2005): Contribution study to the impact analyses on social and economic aspects of RES-E", contract TREN/A1/17-2003, August 2005

Netherlands and the United Kingdom, where requirements are in place to evaluate policies and their impacts, including their (cost-) effectiveness.

- In the Netherlands, Article 20 of the Government Accounts Act (Comptabiliteitswet) states that Ministers shall be responsible for the effectiveness and efficiency of the policy underlying their budgets. This includes conducting regular audits of the effectiveness and efficiency of the policy, and reporting back to the Ministry of Finance. Guidance for this requirement is presented inter alia in the draft "guidance for ex post evaluation research" (Concept wegwijzer evaluatieonderzoek ex-post, VROM (2003)).
- For the UK, the Green Book on appraisal and evaluation in central government (HM Treasury 2003) states that "all new policies, programmes and projects, whether revenue, capital or regulatory, should be subject to comprehensive but proportionate assessment, wherever it is practicable, so as best to promote the public interest." In this context, the Green Book mentions cost-effectiveness analysis as one possible assessment method.

III Guidance documents

There are a large number of textbooks on the use of economic appraisal, most of which focus on cost-benefit analysis but also sometimes cover cost-effectiveness analysis. This abundance in the domain of academic publications does not seem to be reflected in the publication of practical guidelines. In addition, cost-effectiveness analysis is dealt with to a greater extent in the health sector than in the environmental sector. Textbooks on cost-benefit analysis in the environmental sector typically only mention cost-effectiveness in passing.

For the selection of the guidance documents covered in this study, emphasis was placed on providing a range of the best examples, in order to make an overall assessment of the state of play. For selecting guidance documents, four selection criteria were employed:

- the guidance was up-to-date (thus only the latest Government guidance from one issuing body is presented);
- the guidance is focused on the analysis of environmental policies (or explicitly mentions them as one of a number of policies to be assessed);
- the guidance is issued by or directed at EU Member States (except where other country-level guidance offers additional insights, as is the case with the USA); and
- public sector guidance is preferred.

Forty-four potential guidance documents, mostly guidelines from various national and international public sector bodies, but also academic papers and books, were identified during the course of this project, of which twenty-four were deemed to be relevant for the purposes of this study. The relevant guidance documents are summarised in table 18.1 below (a bracketed '(X)' in the ex post or ex ante column indicates that the document is relevant, but does not explicitly address ex post/ex ante evaluation; a question mark indicates that we were informed of the document's existence, but were either unable to obtain a copy).

No.	Title	Policy Area	Country	Author/client	Type of analysis	Ex post	Ex ante	Summary
G2	*CEA and Developing a Methodology for Assessing Disproportionate Costs* (2004)	WFD	UK	Risk and Policy Analysts Ltd /DEFRA and UK Environment Agency	CEA & CBA		X	X
G3	*Guidelines for Defining and Documenting Data on Costs of Possible Environmental Protection Measures* (1999)	Environment general	EU	European Environment Agency / no client	Neither			X
G8	*The Green Book: Appraisal and Evaluation in Central Government* (2003)	General	UK	UK Treasury / no client	CBA & CEA	X	X	X
G9	*Guidelines for Preparing Economic Analyses* (2000)	Environment general	USA	US Environment Protection Agency / no client	CBA & CEA	(X)	X	X
G12	*Basic Principles for Selecting the most Cost-Effective Combinations of Measures as Described in Article 11 of the Water Framework Directive HANDBOOK* (2004)	WFD	Germany	Ecologic / German Federal Environment Agency	CEA		X	X
G14	*Economics and the Environment: the Implementation Challenge of the Water Framework Directive, Guidance Document* (2003)	WFD	EU	WATECO / no client	CEA		X	X
G18	*What Constitutes a Good Agri-Environmental Policy Evaluation?* (2004)	Agriculture	OECD	Pearce, David / no client	CEA & CBA	(X)	(X)	X
G20	*Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* (1992)	General	USA	US Office of Management and Budget / no client	CBA & CEA		X	X
G21	*Guidelines for the Economic Analysis of Projects* (1997)	Development projects	Asian countries	Asian Development Bank / no client	CBA & CEA		X	X
G22	*Opportunities Envelope Guidelines for Proposals* (2004)	Climate Change	Canada	Government of Canada / no client	CEA		X	X
G24	*PEEM Guidelines 3 - Guidelines for cost-effectiveness analysis of vector control.* (1993)	Vector-borne diseases	Inter-national	Panel of Experts on Environmental Management for Vector Control (PEEM), WHO / no client	CEA	X	X	X
G25	*Review of Technical Guidance on Environmental Appraisal* (1999)	Environment general	UK	eftec / former UK DETR	CBA & CEA	X	X	X
G27	*Guide to Cost-Benefit Analysis of Investment Projects*	General	EU	Evaluation Unit, DG Regional Policy, EC / no client	CBA & CEA		X	
G29	*Cost-Effectiveness Analysis a Tool for UNESCO*	General	Inter-national	SPM consultants / UNESCO	CEA	X	X	X
G30	*DTLR Multi-Criteria Analysis Manual*	General	UK	former UK DETR/ no client	CBA, CEA &		X	

No.	Title	Policy Area	Country	Author/client	Type of analysis	Ex post	Ex ante	Summary
					MCA			
G32	*Making Choices in Health: WHO Guide to Cost Effectiveness Analysis*	Health	Inter-national	World Health Organisation / no client	CEA		X	
G33	*A Handbook for Impact Assessment in the Commission: How to do an Impact Assessment*	General	EU	Strategic Planning and Programming unit, Secretariat-General, EC / no client	CBA, CEA & MCA	(X)	X	
G34	*Samfundsøkonomisk vurdering af miljøprojekter.*	Environment general	Denmark	Danish National Environmental Research Institute / no client	?	?	?	
G35	*Kosten en baten in het milieubeleid, definities en berekeningsmethoden*	Environment general	NL	Dutch Ministry for Spatial Planning, Housing and the Environment (VROM) / no client	?	?	?	
G36	*Evaluating EU Activities*	General	EU	European Commission DG Budget / no client	CBA & CEA	X	X	
G37	*A Framework for Evaluating Environmental Policy Instruments*	Environment general	Finland	Mickwitz, Per / no client	CBA & CEA	X	X	
G38	*Kosteneffectiviteit natuurbeleid: Methodiekontwikkeling*	Environment general	NL	Rijksinstitut voor Volksgezondheid en Milieu (RIVM) / no client	CEA	X		
G39	*Evaluating EU expenditure programmes: A guide: ex post and intermediate evaluation*	General	EU	European Commission DG Budget / no client	CBA & CEA	X		
G40	*Ex-ante Evaluation: a Practical Guide for Preparing Proposals for Expenditure Programmes*	General	EU	European Commission DG Budget / no client	CBA & CEA		X	X
G43	*Ympäristöpolitiikan Taloudellisten Vaikutusten Arviointi (Economic Assessment of Environmental Policy)*	Environment general	Finland	Porvari, M. and Hildén, M. (Finnish Environment Institute) / no client	?	?	?	
G44	*Wegwijzer Evaluatieonderzoek ex post (2003)*	General	NL	Dutch Ministry for Spatial Planning, Housing and the Environment (VROM) / no client	Neither	X		X

Of the fifteen guidelines summarised, there are:

- Three documents dealing with cost-effectiveness analysis for implementing the Water Framework Directive (RPA 2004, Ecologic 2004, Wateco 2003);
- Six government or international body-issued guidance documents for the public sector in general (HM Treasury 2003, OMB 1992, PEEM and WHO 1993, UNESCO 1997, DG Budget 2001, VROM 2003);
- Two government-issued guidance documents for evaluation of environmental policies (EPA 2000, eftec 1999);
- Two guidelines on using cost-effectiveness for project appraisal (ADB 1997, Government of Canada 2004);
- One document primarily concerned with data collection and management as a prerequisite for cost-effectiveness analysis (EEA 1999); and
- One academic background paper on cost-effectiveness analysis of agri-environment schemes (Pearce 2004).

The guidance documents and manuals identified in the study vary substantially in the level of detail they provide about how to undertake cost-effectiveness analysis, especially with regards to technical issues such as discounting, distributional impacts, effects on competitiveness, and so on. However, the basic descriptions of the core stages of the cost-effectiveness analysis differ only a little.

As discussed in greater detail in the next section, the overall picture that emerges is that many useful elements are present in the different documents, which together provide good insights on how to conduct an ex-post cost-effectiveness analysis. However, there is not one single document that would combine all of these elements into one volume.

This section ends with a few observations regarding the distribution and the focus of the respective documents. First, there is a bias in the guidance towards ex-ante analysis. There are, however, some guidelines that provide insight in the processes and techniques of ex-post evaluation, including ex-post CEA. These are the Commission's Guide on Evaluating EU Expenditure Programmes (DG Budget 1997), and Evaluating EU Activities: A practical guide for the Commission Services (DG Budget 2004); the Dutch Wegwijzer Evaluatieonderzoek ex post (VROM 2003), and the HM Treasury Green Book: Appraisal and Evaluation in Central Government (HM Treasury 2003). While these documents give insights on ex-post evaluation in general, the treatment of cost-effectiveness analysis in these documents is rather superficial. Thus, HM Treasury Green Book (HM Treasury 2003) mentions cost-effectiveness on three occasions only (p. 4, 37, 38) and defines CEA in one short sentence only (p. 4). Annex E of the EU guide on evaluating EU Activities (DG Budget 2004) lists several evaluation techniques including CBA and MCA, however CEA is not included in this annex (p. 89, 90), but is only briefly defined in the glossary (p. 103). The Commission's Guide on Evaluating EU Expenditure Programmes (DG Budget 1997) provides comprehensive guidance on how to frame, set up and conduct an ex-post evaluation, for example in terms of establishing causality between measures and outcomes, and singling out the effects of a particular policy measure. Cost-effectiveness analysis is briefly discussed and compared to other evaluation tools (p. 58), but on a rather abstract level. The Dutch Wegwijzer Evaluatieonderzoek ex post (VROM 2003) discusses the distinction between efficiency, effectiveness and cost-effectiveness in some detail, but does not provide guidance on which costs to consider or how to measure them.

- In many cases, guidance documents will generally be written with ex-ante analysis in mind, treating ex-post analysis as a special case, and in far less detail (see, for example, HM Treasury Green Book (HM Treasury 2003) or the Handbook for Impact Assessment in the European Commission (undated) as well as the DETR Review of Technical Guidance on Environmental

Appraisal (eftec 1999)). As also documented in the survey of legal requirements, there are more cases where undertaking an ex-ante analysis is a legal obligation. Where organisations are not legally required to perform ex-post analysis, the need for guidance will be less pressing and the focus of the guidance less clear-cut. In terms of spatial distribution of national-level guidance documents, good examples can be found in three countries in particular: the UK (RPA 2004, HM Treasury 2003, eftec 1999), the US (EPA 2000, OMB 1992) and the Netherlands (VROM 2000, RIVM undated, VROM 2003). Fourth, the documents relating to the Water Framework Directive (RPA 2004, Ecologic 2004, Wateco 2003) contain a large amount of WFD-specific supplementary details and are of limited value as general guidance documents. Also, in line with the requirements for CEA established by the WFD, they focus on ex-ante analysis only.

- A further observation would be that the general guidance documents issued by governments or their agencies or international bodies are for the most part not specifically related to the analysis of environmental policy, but have a much broader scope. In this way, for example HM Treasury Green Book (HM Treasury 2003), the Guide to Cost-Benefit Analysis of Investment Projects issued by the European Commission, DG Regional Policy (undated) or the Dutch guidance on ex-post policy evaluation (VROM 2003) do provide general guidelines for assessing the cost-effectiveness of policies, but pay less attention to the specific needs of evaluating environmental policies, such as the valuation of environmental goods and services, or the incorporation of long-term effects and irreversible damages. The HM Treasury Green Book provides examples of data sources for a range of impacts, including environmental impacts, with an entire annex devoted to the valuation of non-market goods. However, this type of data is more commonly used in a CBA than a CEA.
- Another remark may relate to the UNESCO (1997) guidance document on the potential role of CEA within UNESCO. The authors make the observation that making CEA a permanent feature and an accepted tool within the organisation it will be necessary to modify the culture of the organisation, ‘which is very sceptical of what is seen as limited "economistic" methods’. The paper makes the case for introducing incentives to ensure that this evaluation tool is streamlined within the activities of UNESCO.
- At the same time, several guidance documents focus specifically on the evaluation of environmental policy, including for example the OECD guide on evaluating economic instruments for environmental policy (OECD 1997), the US EPA guidelines for preparing economic analyses (EPA 2000, ex-ante only), the eftec / DETR study on Review of Technical Guidance on Environmental Appraisal (eftec 1999), the Danish Economic assessment of environmental projects (Samfundsøkonomisk vurdering af miljøprojekter, NERI 2000) or the Dutch guidance on costs and benefits in environmental policy (Kosten en baten in het milieubeleid, VROM 2000).
- An explicit distinction between financial and economic costs is made in most of the guidance documents. The documents use different terms to make this distinction, and sometimes the same terms are used to mean different things. In some cases, the terms ‘direct’ and ‘indirect’ costs are used instead of ‘financial’ and ‘economic’, in other cases ‘social welfare losses’ are used to mean economic costs. The US EPA guidelines (EPA 2000) are the most detailed in this respect, differentiating between compliance costs, government regulatory costs, social welfare losses, transitional costs, and indirect costs. However, environmental costs are not always explicitly mentioned. The focus of some of the guidelines is on the social costs of the options assessed, while others are more interested in the costs to industry of proposed environmental regulation.
- A further remark is that at least one of the documents (HM Treasury Green Book (HM Treasury 2003)) recommends cost-benefit analysis over cost-effectiveness analysis. A similar tendency to regard CEA as a simpler but inferior alternative to a CBA can also be discerned in the UK Water Framework Directive Guidance (RPA 2004). Other documents note that cost-effectiveness

analysis should be performed when there are substantial doubts about the theoretical basis of the monetisation of benefits, or if environmental targets are set politically without a cost-benefit analysis.

- Finally, some of the guidelines (RPA 2004, HM Treasury 2003, VROM 2003) point out that performing the cost-effectiveness analysis or the evaluation itself can be a significant drain on resources, and the effort put into the analysis should be commensurate with the proposed program or policy.

IV Case studies of applied ex-post cost-effectiveness analyses

This section reviews applications of cost-effectiveness analysis in the evaluation of environmental policies, with a strong focus on European studies and on ex-post analyses. To this end, more than seventy potential case studies were identified, out of which eighteen passed the selection criteria and were thus summarised and treated in greater detail. The project did not attempt to give a comprehensive overview of ex-post CEA in Europe, due to language limitations an emphasis was placed on studies that are published in English, French, German or Dutch. To identify a broad scope of potential studies, consultations were carried out with some national authorities as well as with the EEA's network of national focal points. Table 18.2 presents a selection of the total case studies, listing only those that were pre-selected for further analysis.

No.	Author	Year	Title	Country	Policy area	Timing	Summary
CS1	NERA	2002	Fleetwide emissions and cost-effectiveness of the consent decree pull-ahead requirements for heavy-duty diesel engines	USA	Air quality	ex ante	
CS2	Wright et al.	2001	The cost-effectiveness of reductions in dioxin emissions to air from selected sources	New Zealand	Air quality	ex ante	
CS8	Standard & Poor's DRI	1999	Auto-Oil II Cost-Effectiveness Study	FI, F, D, EL, IRL, I, NL, E, UK	Air quality	ex post	
CS11	IVM	2000	Cost-effectiveness of Dutch water policies	NL	Water	ex ante	X
CS12	RIVM	2000	Cost effectiveness of environmental measures	NL	Acidificatio n	ex ante	X
CS13	RIVM	2004	Environmental costs of energy measures 1990-2010	NL	Energy, Climate	ex ante / ex post	X
CS15	RIVM	2003	Evaluation of the Implementation memorandum for emission ceilings, acidification and large-scale air pollution 2003	NL	Air quality	ex ante	X
CS19	CE Delft	2001	Treatment of plastic packaging waste from households	NL	Waste	ex-ante	
CS20	CE Delft	2000	Accelerated introduction of cleaner petrol and diesel engines in the Netherlands	NL	Air quality	ex-ante	

No.	Author	Year	Title	Country	Policy area	Timing	Summary
CS26	Resources for the Future	1999	The Enhanced I/M Program in Arizona: Costs, Effectiveness, and a Comparison with Pre-regulatory Estimates	USA	Air quality	ex post	X
CS30	Harvard School of Public Health	2000	Are the Costs of Proposed Environmental Regulations Overestimated? Evidence from the CFC phaseout	USA	Ozone	ex post	X
CS31	Swedish University of Agricultural Sciences	2000	Cost efficient reductions of stochastic nutrient loads to the Baltic Sea	Baltic Sea countries	Water	ex ante	
CS47	Macaulay Land Use Research Institute	2002	The cost-effectiveness of biodiversity management: a comparison of farm types in extensively farmed areas of Scotland	UK	Biodiversity	ex post	X
CS49	Beamount, N. and Tinch, R.	2003	Cost Effective Reduction of Copper Pollution in the Humber Estuary	UK	Water	ex post	X
CS51	IIASA	1999	Economic Evaluation of a Directive on National Emission Ceilings for Certain Atmospheric Pollutants. Part A Cost-Effectiveness Analysis	EU	Air quality	ex ante	X
CS52	VTT	1999	Integrated cost-effectiveness analysis of greenhouse gas emission abatement: the case of Finland	FI	Climate change	ex ante	X
CS53	AEA Technology	1998	Options to Reduce Nitrous Oxide Emissions	EU	Climate change	ex post	X
CS54	AEA Technology	1998	Options to Reduce Methane Emissions	EU	Climate change	ex ante	
CS56	WRc	Unknown	Examination of Existing Policy Options ... to Implement Directive 76/464/EEC	EU	Water	ex post	
CS57	eftec	2001	The potential cost and effectiveness of voluntary measures in reducing the environmental impact of pesticides	UK	Agriculture	ex ante	
CS63	Entec	2004	Review of the Large Combustion Plant Directive	EU	Air quality	ex ante	
CS69	Tyndall Centre	2004	Ex post evaluations of CO2-based taxes: a survey	DK, FI, D, NL, NO, S, UK	Climate change	ex post	X
CS70	DMU	2004	Effectiveness of waste water	DK, NL, F,	Water	ex post	X

No.	Author	Year	Title	Country	Policy area	Timing	Summary
			policies in selected countries – an EEA pilot study	E, PL, EE			
CS71	European Topic Centre on Waste & Material Flows	2004	Analysis of effectiveness of implementing packaging waste management systems	AT, DK, IRL, I, UK	Waste	ex post	X
CS73	SPRU	2000	The Large Combustion Plant Directive (88/609/EEC): An Effective Instrument For Pollution Abatement? (IMPOL)	F, D, NL, UK	Air quality	ex post	X
CS74	CERNA	2000	The Implementation of the Municipal Waste Incineration Directives (IMPOL)	F, D, NL, UK	Air quality	ex post	X
CS75	SPRU	2000	The Implementation of EMAS in Europe: a case of competition between standards for environmental management systems (IMPOL)	F, D, NL, UK	Population & Economy	ex post	X
CS86	RIVM	2004	Evaluation of the Dutch Manure and Fertiliser Policy, 1998-2002	NL	Agriculture	ex post	X

It emerged that the practical experience with ex-post cost-effectiveness evaluations is unevenly distributed in Europe, with much evidence coming from the Netherlands and the UK. The finding that these countries have a long tradition for such assessments is in line with the results of a 1998 study for the European Commission, which surveyed the use of economic evaluation methods for environmental policies in several European countries (Virani 1998).

In general, there is a limited awareness of the precise concept of cost-effectiveness, both by consultants conducting the analyses and by the officials administrating them. Reports promising discussions of cost-effectiveness sometimes turn out instead to be cost-benefit analyses (for example Entec 2000) discussions on whether static or dynamic efficiency are being achieved (especially with respect to market-based instruments) (for example Agnolucci 2004), or aggregations of cost estimates unrelated to the outcomes achieved (case studies not summarised). Few studies were strict methodical cost-effectiveness analyses of the type outlined in guidance documents (the most complete example of which was the US EPA guidance, EPA (2000)). Where cost-effectiveness ratios are actually calculated, they are sometimes not clearly defined (for example, in the IMPOL studies Eames (2000) and CERNA (2000)).

- As stated in EEA (2001) and by Agnolucci (2004), environmental effect and environmental effectiveness should be treated as distinct concepts. The former is the physical outcome of the intervention, while the latter is a measure of this effect in comparison with what was expected or with what other interventions have achieved. This distinction is not made in all case studies. Many of the aspects of cost-effectiveness analysis recommended by guidance documents are not carried out in practice in the studies, presumably because of the difficulties of reconciling theoretical

correctness with time, data, resource and skill constraints.[5] For example, none of the studies reviewed included lost consumer or producer surplus in their costs, as recommended by the US EPA guidelines (EPA 2000). Furthermore, discounting, although recommended in almost all guidance documents, was not applied in most studies. This was particularly noticeable in Lehtilä and Tuhkanen (1999), which discussed greenhouse gas abatement costs in Finland far into the future without the use of discounting. As one exception, a study on energy measures in the Netherlands (Boonekamp et al. 2004) not only applied discounting, but also investigated the impact of choosing a social or a private interest rate.

- With regard to the choice of a baseline or reference scenario, business-as-usual baselines representing 'the world without the intervention' are found less often than baselines, which use a single year as a reference point. The latter implies that without the intervention, environmental outcomes would have stayed constant at the level of the base year. This can lead to a large underestimation of the actual effect that an intervention has had.
- Some of the studies reviewed discussed the marginal abatement costs of emission reductions. However, it should be remembered that marginal abatement cost is only a proxy for cost-effectiveness, and becomes a less accurate proxy the more marginal abatement costs vary for different emission levels. This is because the cost-effectiveness ratio should use the total cost of a measure,[6] whereas the marginal abatement cost is the cost per unit reduction at a particular stage of abatement, and ignores the fact that costs at an earlier stage may very well have been lower.[7] Therefore, the marginal abatement cost is only an exact measure of cost-effectiveness if marginal abatement cost is constant across all emission levels, which would be a brave assumption.
- The most widely used sources of information were surveys of regulated business units (Resources for the Future 1999, Wynn 2002, AEA Technology 1998, Eames 2000, Entec 2000), academic studies (RIVM 2000, Hammitt 2000, Wynn 2002, Amann et al. 1999, Lehtilä and Tuhkanen 1999, Entec 2000), firms' environmental reports (RIVM 2000, Beamount and Tinch 2003, Entec 2000), official national statistics (Amann et al. 1999, Lehtilä and Tuhkanen 1999), data transmitted to the regulatory agency as part of the regulatory obligation (Resources for the Future 1999, Beamount and Tinch 2003, Andersen 2004, ETC/WMF 2004), including data submitted to international bodies such as the IPCC or CORINAIR database (Lehtilä and Tuhkanen 1999, AEA Technology 1998). The latter included three studies where data was supposed to be reported to Eurostat or other (Andersen 2004, ETC/WMF 2004, Eames 2000). Strikingly, some of these studies were conducted in those cases where there least data was available. Other sources were realised using market prices from trade journals and newspapers (Hammitt 2000), consultation with technical experts (Hammitt 2000, Entec 2000), and government information on subsidy amounts (Wynn 2002).
- Some case studies addressed lack of data as a restriction for the analysis. One case study (AEA Technology 1998) noted that commercial sensitivity restricted the availability of data; another (Agnolucci 2004) noted that a lack of data on the marginal costs of abating carbon dioxide make attempts to perform CEA problematic. Other problems with data sourcing were noted in Andersen (2004), namely insufficient data provided by Eurostat, and ETC/WMF (2004), which found that it

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[5] Unfortunately, few of the studies are transparent about which aspects were omitted out and why, which difficulties and constraints were encountered, and how they were addressed.

[6] Note that total costs here refer only to the additional costs associated with the measure itself, and not the total costs of achieving the environmental outcome.

[7] A more formal mathematical explanation would describe this by showing that the total cost of emissions reductions is the integral of the marginal abatement cost between two different emissions levels.

takes a long time for data to become publicly available. However, none of the studies explicitly discussed the cost of conducting the analysis itself, or of the data gathering in particular.

- Methodological considerations, such as the treatment of confounding factors and sensitivity testing, are variably applied and are sometimes buried in the text rather than explicitly introduced as important parts of the cost-effectiveness analysis. RIVM (2000) is a notable exception in this regard, providing a comprehensive set of sensitivity tests that control for variations in the interest rate, depreciation period applied, indirect costs, effect of interactions between measures, timing of different measures and the impacts of relative price changes. Other case studies reflect uncertainty by using different weightings for different parts of environmental effectiveness (Resources for the Future 1999), different assumptions about baselines (Hammitt 2000), different lifetimes for abatement measures (Beamount and Tinch 2003), to wider influences like reform of the Common Agricultural Policy (Amann et al. 1999) and economic growth (Lehtilä and Tuhkanen 1999).

V Interpretation of the results at the European level

The current paper and underlying research addressed the extent to which cost-effective considerations are taken up in the evaluation of environmental policy in Europe, and where they are, whether the analysis is consistent with existing guidelines. In other words, is the current practice of ex-post cost-effectiveness analysis making best use of available advice to quantify the effectiveness of policies and relate it to the costs encountered?

For environmental policy at the Community level, systematic ex-post assessment of cost-effectiveness is a fairly recent phenomenon. Of the total environmental acquis, only four Directives explicitly mandate that an ex-post assessment of cost-effectiveness be carried out. The experience with the assessments carried out so far in response to the reporting obligations is mixed (see boxes 1 and 2). However, several ex-post cost-effectiveness assessments have been carried out to assess the performance of other earlier Directives and Community programmes, even though the Directives and regulations themselves do not mandate such assessments. This includes assessments of the EU Urban Waste Water Treatment Directive (Andersen 2004), the Directive on packaging and packaging waste (ETC/WMF 2004), the Large Combustion Plant Directive (CERNA 2000) or the EMAS regulation (Entec 2000). Likewise, there are a few examples where the implementation of European regulations at the Member State level has been analysed in a CEA (for example, RIVM (2003) for the National Emissions Ceiling Directive in the Netherlands).

From the analysis of ex-post CEAs surveyed in this study, it has emerged that the scope, level of detail and methodological focus of ex-post CEAs differ substantially. As of yet, it is not possible to identify one ‘common approach’ to ex-post CEA that has been applied in different countries, or to different policy questions. On the contrary, a certain tendency of reinventing the wheel can be discerned, for example in the case of the Water Framework Directive, where different Member States have commissioned guidelines and handbooks in addition to the guidance prepared on the European level. This is not necessarily a negative development, as different approaches to implementing one and the same Directive may be warranted by different conditions in the Member States (for example in terms of available data, complexity of the decision situations, available human resources and so on). Yet it means that much scope remains for policy learning and mutual exchange.

The actual implementation of the CEAs documented in this project differs from the theoretical ideal of a CEA, more so in some cases than in others. The real-life practice combines several different approaches, all of which include assessments of costs and outcomes of some sort, but which do not always closely resemble the textbook ideal of a CEA. Such changes are not always due to a lack of understanding, but are often necessitated by data gaps or by time and capacity constraints. To deal with these, authors will often take methodological shortcuts. For instance, a US study on the cost of CFC phase-out (Hammitt 2000) uses marginal abatement cost as a proxy for cost-effectiveness, an

EEA study on packaging waste (ETC/WMF 2004) uses budgeted government expenditure as a proxy for costs, and the cross-country study (CERNA 2000) on the implementation of the municipal waste incineration directives uses data from two German Länder as representative of the whole of Germany. Three studies (Agnolucci 2004, Andersen 2004 and ETC/WMF 2004) explicitly note that the lack of data makes analysis difficult, but derive their conclusions on the limited database available. Some studies will omit certain parts of the analysis and certain types of impacts, or treat them in a qualitative way. Thus, many studies do not address impacts to the national economy, such as increased expenditure, job creation and so on. (This omission is explicitly noted in a study on copper pollution in the Humber estuary (Beamount and Tinch 2003), but also applies to other studies). Other studies do not address secondary environmental impacts of abatement technologies used, or describe them only in qualitative terms (for example, Entec (2000) for the case of the EMAS scheme). In some cases, cost estimates are sometimes taken over from previous studies, even though these may not be recent ones (for example, Beck et al. 2004, Amann et al. 1999).

Confounding factors and parameters, such as economic growth, technological change, policy developments, the interactions and interdependencies between measures, the presence of side-effects, or the difficulty of relating measures to outcomes, are discussed in many studies. Most studies would either mention them, but not incorporate them into the subsequent analysis (Beck et al. 2004, Hammitt 2000, Andersen 2004, ETC/WMF 2004), or are treated in the sensitivity analysis only (RIVM 2000, Amann et al. 1999). For presenting results, a particular shortcut was applied in the IMPOL study on the large combustion plant Directive (Eames 2000), which described the cost-effectiveness of the compared options only in qualitative terms as low, medium or high.

The variety of methodological shortcuts employed means that only a minority of case studies has actually applied the different parts of a CEA that are described in guidance documents. Thus, for example, a third of the summarised case studies do not consider sensitivity testing of any sort. While some others employ sensitivity testing or at least some type of plausibility check (for instance by comparing results with other studies), only two provide an elaborated sensitivity analysis (RIVM 2000, Amann et al. 1999). In two studies, a reduced form of sensitivity analysis is applied by using different baselines (Hammitt 2000, Lehtilä and Tuhkanen 1999). Only four studies (RIVM 2000, Beamount and Tinch 2003, Amann et al. 1999, AEA Technology 1998) apply discounting and discuss the effect that the choice of discount rate has on the results, while other studies skip this part altogether. Also, only four studies (RIVM 2000, Amann et al. 1999, Lehtilä and Tuhkanen 1999, AEA Technology 1998) made use of models to estimate the cost-effectiveness of policies. While many studies simply applied the status quo (or the situation in a given year) as the baseline for the analysis, one study (Andersen 2004) did not specify a baseline for the analysis, making interpretation of the findings rather difficult. And in addition, none of the studies provided a monetary valuation of environmentally beneficial side-effects, as suggested, for example, by the WFD-related guidance document (RPA 2004).

The majority of these simplifications, shortcuts and omissions can be related to a lack of data, or respectively to a lack of resources for gathering the necessary data. While the reviewed case studies are not very transparent about the cost of conducting the analysis and of gathering the data, some of the guidance documents contain insights on this point. The particular difficulties of gathering ex-post data on costs and effectiveness are discussed, for instance, in VROM (2003) and UNESCO (1997), both of which note that data gathering ex-post can be more tedious than for ex-ante analysis. For example, the UNESCO guidance on CEA (1997) notes that ‘systematic C-E analysis presumes the existence of clear objectives, cost data and results indicators. Many times, however, organisations request ex-post evaluations of the effectiveness of interventions that were never designed with any of these aspects in mind.’ Consequently, all these steps that should have been taken up front have to be repeated ex-post.

When comparing different ex-post CEAs, it has to be considered that not all policy initiatives are equally suited for an ex-post evaluation by means of a CEA. Two main conditions would appear most relevant for a successful ex-post CEA (see also VROM 2003). First, the objectives of the policy intervention have to be clearly identified and defined, ideally connected with a quantified target and a clear baseline. And second, the policy should be connected to a fixed time period, identifying when policy targets should be achieved.

This diversity in terms of depth and detail also can also be related to the guidelines used. None of the guidance reviewed for this study is an 'uncluttered', easily digestible general guidance document for performing CEA with respect to environmental policies. They are either a little too comprehensive, for example the US EPA's Guidelines for Preparing Economic Analyses, or too general for non-economists, for example the UK Treasury Green Book, or too specifically focused on one policy area, for example the Water Framework Directive documents. Also, while most guidelines for ex-post cost-effectiveness analyses strive to be theoretically comprehensive, which, by itself, is positive, they also need to take into account the likelihood of data gaps and other practical difficulties in conducting analysis, and make practical recommendations for dealing with these limitations.

On this point, the available guidance documents are mostly confined to a more or less concise technical description of cost-effectiveness analysis and its strengths and weaknesses. However, they give much less guidance at all on how to deal with real-life difficulties, for example, by specifying which methodological shortcuts can be advisable or at least justifiable. The exceptions to this are the guidelines aimed at the WFD (RPA 2004, Ecologic 2004 and Wateco 2003), which are already embedded in a specific regulatory context, the section on communicating assumptions and methods in EPA (2000), the Dutch guidance on ex-post evaluation VROM (2003), and the outlining of issues surrounding the practicalities of data reporting in EEA (1999). For instance, the WFD-related guidance RPA (2004) argues for a tiered approach in determining the level of detail of the analysis. Thus, it is suggested that the analysis can be limited if there is widespread agreement among stakeholders on the measures to be implemented, if different alternatives differ strongly in the results that they deliver, or if either of the alternatives delivers significant additional benefits. Likewise, the US EPA guidelines for preparing economic analyses (EPA 2000) recognise that some impacts may escape quantification, and provide brief guidance on which of the markets affected by a measure can be left out of the analysis. The Dutch guidance on ex-post evaluation (VROM 2003), by contrast, pays ample attention to the everyday problems encountered by policy makers, including scarce resources, lack of time, political pressures and so on. However, the document only describes evaluation in general and provides no information on how these findings relate to conducting a CEA.

Practical limitations of CEAs and ways of overcoming them are also sometimes touched upon in discussions on dealing with risk and uncertainty, but it is not explained how this can be related back to carrying out the assessment (see for instance the US EPA guidelines for preparing economic analyses (EPA 2000) or the European Commission handbook for impact assessments (undated)).

The emerging picture is thus that there is a considerable amount of guidance on Cost-Effectiveness Analysis, which sheds little light on ex-post CEA, and that there is sufficient guidance on the practical aspects of ex-post policy evaluation, which does however say little about cost-effectiveness and the way it can be assessed. That is to say: the knowledge of how to conduct an ex-post evaluation of cost-effectiveness is available, but it needs to be combined from different sources. There is as yet not one single document that provides all the relevant guidance in a consistent way.

As noted above, ex-ante CEAs are relatively more abundant than assessments carried out ex-post, a fact that is also reflected in the focus of most guidance documents. Since this project focused on ex-post analyses, it was considered (i) whether ex-post assessments would deliver results that are markedly different from ex-ante CEAs, and (ii) whether experiences with ex-ante CEAs could be inferred to the practices of ex-post CEAs. Regarding the first point, there are few cases where the

results of an ex-post CEA were directly compared to an ex-ante analysis previously conducted for the same policy measure. The assessment by Resources for the Future of the enhanced inspection and maintenance programme in Arizona (Resources for the Future 1999) is one of the rare examples of such comparisons, concluding that the ex-ante estimates of the costs of achieving the forecasted emission reductions were underestimated. Another assessment by James Hammitt (Hammitt 2000) of the cost of CFC phase-out found mixed evidence: while some ex-ante assessments substantially overestimated the marginal costs of limiting CFC consumption, others modestly underestimated this cost.[8] For the second point, the small amount of studies comparing directly the results of ex-ante and ex-post analysis prevents us from inferring specific conclusions regarding the relationship between ex-ante and ex-post CEAs. What can be said, however, is that an ex-post CEA will be much easier to perform in cases where an ex-ante assessment has been carried out. Certain points that are crucial for a successful ex-post CEA will have been clarified in cases where an ex-ante assessment has been carried out. This includes clearly defined and quantified targets for a policy intervention, a baseline scenario, and a timetable for achieving the targets. Carrying out an ex-ante assessment presents an opportunity to formulate at an early stage the questions that should later be addressed in the ex-post CEA. This means that monitoring and reporting requirements can be designed accordingly, meeting the data needs of an ex-post CEA.

VI Discussion of the relevance of these results for the global level

The economic dimension of environmental policies at the global level is of increasing relevance for the acceptability of such policies. One reason for this is the conflict between economic development and the cost of environmental regulations, and its (alleged) negative impacts on economic development and competitiveness. Such concerns, while also common in industrialised countries at the local level, are of even greater relevance for environmental policies at the national level. At the same time, there is also a growing awareness that a number of environmental issues can only be addressed with global-level agreements. Supporting this, the precautionary principle has gained in relevance, leading to the discussion of potential policy action also in cases where the extent and distribution of negative impacts is uncertain.

At the same time, the potential importance of economic evaluation is significantly different when such assessments are conducted at a more aggregated level: the assessments at local level (project-based), national level (concerning policies/strategies) and regional level (usually referring to a specific common legislative framework as discussed above) are based on a strong legislative and institutional framework. At the global level, however, intuitional arrangements are much weaker, thus increasing uncertainties about whether and how a possible agreement will be implemented by the participating countries. In addition, while the use of economic evaluation for policy support is increasing in a number of countries (e.g. in OECD-countries, but to a varied level among the different countries), most other countries around the globe currently do not fulfil the institutional, capacity and data/information requirements to conduct systematic policy evaluations.

Also, the fact that international environmental policies are developed and implemented in a much weaker institutional and legislative framework means that there is much less control of how policies are actually implemented, and hence much less use for, and interest in, policy evaluation (be it

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[8] A 1999 study published by the Stockholm Environment Institute, "Costs and Strategies presented by Industry during the Negotiations of Environmental Regulations" (SEI 1999), was not considered in detail in this project: while the study did compare ex-ante and ex-post estimates of costs, it did not relate to these to the effectiveness or measures or compare their cost-effectiveness.

economic or otherwise). In contrast to national or European-level policy evaluations, where there is one central institution that oversees the implementation process (i.e. the European Commission or the budget offices / treasuries in the Member States), there is no such institution in international environmental governance. Where international environmental agreements / conventions establish a secretariat, it would often lack the capacity and the political power and necessary independence to conduct an evaluation.

An additional effect to be considered is that due to the weak institutional and legislative arrangements at the global level, issues regarding the spatial distribution of a policy's compliance costs and their social and competitiveness impacts on countries with different development levels are of particular concern. Therefore, global-level negotiations on common policy action are strongly linked to national political priorities, leaving limited space for considering overall economic evaluation results.

Therefore, it is inappropriate to infer lessons learned with the use of cost-effectiveness analysis from the European to the global level. At the same time, specific elements of the analysis above can provide insights also for considerations of global and regional level policy alternatives and their effects:

- Insights on theoretical questions regarding CEA can be drawn based on the European experiences. This concerns e.g. the question of what types of costs should be included in a CEA and how they should be estimated: purely financial private costs of specific measures vs. general equilibrium of costs to the wider economy, including efficiency losses (forgone welfare). The relevant existing guidance documents can be helpful (especially with regard to technical issues such as discounting, assessing distributional impacts and effects on competitiveness etc.), while the "Impact Assessment" (IA) requirements and methodologies in Europe will over time provide more practical experiences based on this evaluation tool. At the same time, the spatial disparity of costs at the global level needs particular attention when considering the European experiences. This should also be reflected in the development and refinement of tools such as equity weighting, whereby costs are counted differently depending on the income level of the countries / individuals that have to bear the costs;
- An interesting field for knowledge transfer is the fact that global agreements have a strong element of flexibility on how a specific target is implemented regionally/locally. For example, within the Kyoto protocol, different counties/regions can choose their own instruments for reducing CO_2 emissions. Here, CEA of the European climate change policies and more specifically the European emission trading scheme (and its national implementation) can provide valuable insights also for the further development of the global agreements (Kyoto II). The model of decentralization in the EU trading scheme offers experiences with emissions trading regimes across multiple jurisdictions and new evidence on how different approaches to enforcement and monitoring, allocation, and even effort and stringency can be encompassed in a single trading program;
- On the issue of ex-ante and ex-post CEA in form of an ex-ante / ex-post comparison, (assessing whether expected effects were realised in the projected cost including a potential a cross-country comparison), even if so far experience with carrying out such assessments is limited even in Europe, the discussion of the main difficulties faced as well as what elements an ex-ante evaluation needs to comprise in order to enable ex-post evaluations (e.g. clearly defined and quantified targets for a policy intervention, a baseline scenario, a timetable for achieving the targets etc., leading an appropriate design of monitoring and reporting requirements) can be of relevance while considering global agreements and their regional implementation.

Overall, the issue of environmental policy decisions at the global level being taken based on political strategies remains; so, even if increased information from CEA approaches can obtained, the feedback into policy implementation remains a major issue.

VII Conclusions

When summarising the results of the research, it should be reiterated that the findings presented here have to be considered as work in progress. Preliminary though they may be, the results of this project regarding the European level shed some light on the trend in European environmental policy towards more and better assessment of the impacts of policies, both ex-post and ex-ante. At the same time, policy evaluation is clearly not a goal in and of itself, but has to serve a specific purpose. Considering the time and resources that flow into evaluation exercises like an ex-post cost-effectiveness analysis, it is clear that the expenses will be justified only if the results of the analysis have a practical impact on policy making. Thus, the evaluation of policies becomes a useful tool once the results feed back into the policy process: be it for the further implementation of the same policy, or for future policy initiatives in a related field.

One of the main processes where cost-effectiveness considerations may play a role is the (Sustainability) Impact Assessment - (S)IA. At its Gothenburg summit in 2001, the European Council decided that an ex-ante sustainability impact assessment should be carried out for all major policy proposals, thereby establishing these assessments as a cornerstone for the coherent implementation of the EU Sustainable Development Strategy. With its communication (COM 2002/276), the European Commission developed a highly comprehensive approach to impact assessment. One motive behind the current initiatives in the EU is the establishment of more efficient and 'leaner' decision-making procedures.

- The relation between impact assessments (such as (S)IAs) and ex-post assessments (including cost-effectiveness analyses) is ambivalent. Different types of interactions can be conceived of. For example, ex-post assessments can be used to follow up on ex-ante appraisals, and to put their role into perspective. Ex-post appraisals can be employed to assess whether the predicted costs or the expected impacts have actually been incurred, or to reveal where they have been clearly under- or overstated. In the medium term, this information can be used to improve the quality of ex-ante appraisals, by revealing the crucial influence of particular assumptions or methodological choices. At the same time, the comparison with ex-post analyses could also help to better define the role of impact assessments in the policy making process, showing their usefulness and their limitations. Also, if it is clear from the outset that an (S)IA will be re-evaluated at a later stage, this could give an extra incentive to carry out the assessments more thoroughly, eliminating the likelihood that (S)IAs are drawn up before a decision is taken, but never re-considered afterwards. It is also possible that the existence of ex-post evaluation and monitoring requirements will reduce the burden placed on ex-ante appraisals. Where it is clear from the outset that the performance and the cost-effectiveness of a policy will be re-evaluated during the implementation, the requirements for an ex-ante assessment of all expected impacts may become less strict.
- Meanwhile, strengthening the link between ex-ante and ex-post assessments can also make both more effective: in this sense, the ex-ante impact assessment should comprise a list of issues that should later be addressed through an ex-post assessment, including the cost-effectiveness of measures taken. This is of particular relevance for the data collection – a recurring problem for an ex-post analysis is that necessary data on impacts and expenditure is not available. An ex-ante appraisal would be well suited to identify the data needs that have to be collected during the implementation phase, as many of the questions later to be answered through the ex-post assessment will also be raised during the ex-ante appraisal. Such an initiative should consider the 'Monitoring and Evaluation' requirement of (S)IAs as formulated in the guidance documents for Commission impact assessment (European Commission 2002, European Commission undated). A review conducted by the Institute for European Environmental Policy (IEEP 2004) concludes that 'Almost all IAs make some reference to monitoring procedures [...]. However, few specifically address the question of what specific data is required to assess the impact of measures.' Thus,

(S)IAs could not only be used to already identify data needs, but ex post CEAs could also reinforce the monitoring and evaluation as required by (S)IAs.

- Better integration of ex-ante appraisal and ex-post evaluation will also mean that the ex-ante assessment may take on a different form and focus. It would be expected that the assessment could become more action-oriented, identifying weak points and bottlenecks that are crucial for the implementation, and thereby also setting the focus for an ex-post analysis. In other words, the assessment would be less of a conclusive judgement on which option is or is not worth pursuing, but would rather specify the conditions under which an option is preferable.

However, if a stronger integration between ex-ante appraisal and ex-post evaluation is pursued, two main caveats should be considered. First, there is the issue of uncertainty. Both ex-ante and ex-post assessment have to deal with uncertainty to a degree, where the former has the problem of predicting realistic impacts, the latter has the problem of relating the observed impacts to individual measures and initiatives. In this sense, both are limited, and it is not necessarily possible to prove the ex-ante appraisal wrong with the benefit of hindsight. And second, scaling and agency need to be considered. Whereas the sustainability impact assessments are carried out on the EU level and by the Commission, ex-post assessments for many Directives would be carried out on Member State level, and by national administration officials. This means that the scale of the analysis will be different, affecting also the level of detail at which information is obtained; and this means that the questions initially identified by the Commission may not be equally applicable to all Member States.

The main findings of this work – a diversity of approaches followed in real-life CEAs, and a lack of guidance targeted specifically at ex-post CEA – are clearly relevant for the implementation and evaluation of those Directives that require an ex-post evaluation, including cost-effectiveness aspects. For the four Directives identified in section I, the first round of evaluation is either underway or imminent, highlighting the need for specific guidance and good-practice examples of ex-post CEAs. At the same time, the findings of this project are also relevant for the implementation of other Directives identified in this study, which either provide for an ex-ante cost-effectiveness analysis or which require ex-post reporting of effectiveness in a broader sense. In both these cases, findings related to the methodology and practice of ex-post CEAs, including specific guidance, can provide important inputs. Two possible applications are outlined below.

I. In policy areas where an ex-ante CEA is required: To support the learning from policy implementation, it seems advisable to re-consider the results of such an ex-ante analysis during, and after the implementation, in order to see if the ex-ante analysis succeeded in assessing expected impacts, and if the judgement made regarding the most cost-effective solution was indeed correct. Such knowledge can be a valuable input for the further implementation process, or for other subsequent policy initiatives in the same field. The Water Framework Directive provides an example of this. The WFD requires programmes of measures to be drawn up in order to reach good ecological status in all water bodies by 2015. The selection and combination of measures shall be guided inter alia by cost-effectiveness considerations. It is foreseen that the programme of measures will be adapted and revised at six-year intervals, repeating the cost-effectiveness analysis for the selection of potential measures. Although there is no formal requirement to do so, it seems highly advisable to base the selection of measures after 2015 on an assessment of how far the judgements made in the first planning cycle regarding the cost-effectiveness of measures were indeed correct. To this end, an ex-post analysis would be necessary to assess the extent to which the planned objectives have actually been reached, and if not, then why not. Similar arguments can be made for other Directives that are implemented over a longer time period and with more than one implementation and reporting cycle.

II. The second possible application concerns those Directives that mandate an ex-post evaluation of the policies' performance or effectiveness, but do not explicitly require a cost-effectiveness analysis. However, even a loose evaluation that does not qualify as a CEA in the proper sense will often involve a qualitative description of cost-effectiveness, or an unrelated juxtaposition of information on costs and on effects. With some guidance and better data, such assessments could be developed further towards a CEA. Here, it needs to be assessed whether the evaluation would benefit from giving a greater weight to cost-effectiveness considerations, in order to make it more stringent and more coherent.

Regarding the actual ex-post assessments that will eventually be carried out – be they fully fledged ex-post CEAs or other types of evaluations involving cost-effectiveness – it should be considered that this study only provides a first scoping of the available evidence. As many of the Directives requiring an ex-post evaluation of (cost-)effectiveness are still in their first reporting period, the number of ex-post evaluations carried out both at the EU and the Member State level will increase in the near future. This raises the question of how the assessments themselves will be assessed: what constitutes a successful assessment, and how can the value of an assessment for subsequent policy making be assessed? In this context, it also needs to be established which institutions will be responsible for reviewing assessments, and how the results of assessments will flow back into the policy making process.

As previously mentioned, there are notable differences between individual Member States when it comes to evaluating the (cost-)effectiveness of environmental and other policies. Judging by the number of case studies and guidance documents surveyed in this study, systematic and institutionalised procedures for evaluation and appraisal would appear to be furthest developed in the UK and in the Netherlands, supported by cross-cutting requirements to evaluate the performance and cost-effectiveness of major policy initiatives. This observation is also supported by Virani (1998), who surveyed the use of economic evaluation methods for environmental policies in several European countries. For those European Directives that require Member States to report on cost-effectiveness, it can be expected that the capacity and experience built up will also be reflected in the quality of the assessments (for example, Directive 2000/60 (WFD), Directive 2002/30 (noise-related operating restrictions at Community airports) and Directive 2004/8 (Cogeneration)).

While the main focus of the research was targeted towards the European level, the short discussion of the global level showed that the underlying situation is by far more complex when one moves up to the global scale. Even if an application of the work done in Europe is not of direct relevance, it can provide some insights on how to support policy decision making and evaluate implementation at the global level through economic evaluation. Finally, the insights gained can be of direct use for other regions and countries around the globe.

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