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INDEPENDENT COMPETITION AND REGULATORY COMMISSION

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Standing Committee on Climate Change, Environment and Water

Inquiry into
ACT Greenhouse Gas Reduction Targets

Submission:
Cost Effectiveness Analysis

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Level 2, 12 Moore St Canberra City ACT - GPO Box 296 Canberra City ACT 2601 - Phone 02 6205 0799 - Fax 02 6207 5887 -
www.icrc.act.gov.au
ABN: 88 647 913 351

Cost Effectiveness Analysis (CEA) for Environmental Enhancing Projects

Introduction

In October 2009, the Standing Committee on Climate Change, Environment and Water released a draft report on its inquiry into ACT Greenhouse Gas Reduction Targets. The Independent Competition and Regulatory Commission (ICRC) made a submission to this inquiry and, as part of that submission, recommended that the Standing Committee consider the adoption of a formal review process of all programs that might be introduced as part of the Government's response to the meeting of agreed greenhouse gas (GHG) reduction targets.

In its draft Report, the Standing Committee recommended that:

> the Government undertake social environmental and economic impact analysis of all policies and programs introduced to implement legislated targets and that this analysis be publicly available (Recommendation 9).

In its response to the Draft Report, the Government advised that it agreed in principle with the recommendation and that

> The ACT Government will establish a new role for the ICRC in providing independent advice on the robustness of the analyses (statement by Minister Corbell to Legislative Assembly, 17 November, 2009).

The Standing Committee has now asked the Commission to expand upon its earlier proposal and to provide further detail on the appropriate methodology to use in undertaking this analysis. This paper expands upon the earlier recommendation from the Commission that a form of cost/benefit analysis (CBA) methodology be used for the purposes of these evaluations of various policy and program options. However, in recognition that many of the 'costs' and 'benefits' may not be readily expressed in dollar terms, the form of analysis and assessment that is proposed and discussed further below is cost effectiveness analysis (CEA).

Outline of Cost Effectiveness Analysis

A cost effectiveness analysis approach to assessing a range of program options designed to meet some overall policy objective is a widely recognised and applied methodology within the public sector across both Commonwealth and State/Territory jurisdictions. This assessment framework and methodology has largely grown out of the more commonly known cost benefit analysis that has been widely used within the public sector when considering a range of possible options to meet some particular objective. The Australian Government, through the Department of Finance and Deregulation has produced a number of guidelines on CBA and these form the standard 'texts' that are used within the Australian public sector when undertaking this form of analysis.[1] Given the close parallels between CEA

[1] See http://www.finance.gov.au/obpr/about/

and CBA, the following outline of CEA draws heavily from the Department of Finance and Regulation's publication, *Handbook of Cost Benefit Analysis.*[2]

CEA provides for a systematic evaluation of the costs and benefits that are associated with a particular policy or program. CEA allows for the stand-alone analysis of a single policy option focussing on whether there are net economic benefits from adopting the policy. CEA analysis allows consideration of not just the immediate impacts of the policy or program, but also the impact over time. This is particularly useful when a program or policy might have some initial costs and the benefits are not evident until some point in the future. Similarly some program options can have early beneficial impacts, but may involve higher costs at some time in the future. A CEA approach provides a mechanism whereby these types of issues can be addressed in a systematic way that allows for a comparison to be made between the various options available to governments.

The objective of CEA is to identify those projects that generate positive net economic benefits to society taking into all quantifiable and non-quantifiable effects including environmental and social impacts. While the standard approach is to identify the net economic impact of a stand-alone program, it is usually used in the context of evaluating the relative performance merits of more than one prospective policy or program designed to achieve some particular policy objective. Additionally, the implementing the CEA framework allows for the identification of the least-cost in economic terms or efficient means of achieving a goal.

CEA is usually associated with a monetised (dollar valued) accounting of the costs and benefits. By expressing these impacts in dollar value terms, it is relatively straight forward for policy makers to compare the overall benefit cost outcome from a CEA exercise. There has thus been some concern that perhaps a CEA approach would not be as relevant to the assessment of projects where the costs or benefits might be less able to be quantified in dollar value terms. Policy programs linked to environmental issues is one area where this concern has been expressed. However, it has become more generally accepted that even where it is not possible to quantify in money value terms all the impacts, it is still possible to use a CEA approach, as the CEA provides a framework and discipline that helps to ensure that comparisons made between alternative policies and programs can be undertaken with some degree of confidence that a 'like on like' comparison is being made.

Triple bottom line reporting has been noted as being a form of 'accounting' which seeks to address valuation issues and therefore a possible mechanism for use in evaluating policy and program options. In the ACT, departments and agencies are currently trialing triple bottom line reporting.[3] Under the Chief Minister's Annual Report directions, government departments will in future be required to report on a range of matters relating to social equity and environmental impacts of ACT Government operations in addition to the financial effectiveness and efficiency of departmental activities. Triple bottom line reporting seeks to expand the coverage of reporting to assist all stakeholders in assessing the overall

[2] Commonwealth of Australia, Department of Finance and Regulation, *Handbook of Cost Benefit Analysis,* January, 2006

[3] See ACT Chief Minister's Department*, Pilot Triple Bottom Line, Annual Report 2008-09*

effectiveness of a particular policy program or agency's activities in the context of outcomes in the most recent period or over some past period.

Similar to CEA, triple bottom line reporting seeks to consider a wider range of issues other than simply the 'financial' outcomes or those that can be readily valued in dollar terms. However, what triple bottom line reporting does not do which CEA does, is to provide an analytical framework within which policy and program options can be considered over their projected life (or at least over an extended future period) and which seeks to look beyond an historical representation of the outcomes in a particular period (such as a financial year) as is the approach used by triple bottom line accounting. Furthermore, CEA uses a 'discounting' process whereby the values (in monetary or other terms) of future costs of benefits are brought back to a current day value, thereby allowing stakeholders to assess what are optimal policy or program choices against which final decisions on these choices can be made. Nevertheless, the discipline of triple bottom line reporting is valuable in a CEA context as it requires departments and agencies to consider policies and programs in terms other than simply financial costs or outcomes, and thus helps to provide the raw data and assessment perspective on policy options and programs that can be used in CEA analysis.

Commission Proposal

In its June 2009 submission to the Standing Committee, the Commission presented a very high level summary of the evaluation methodology that should be applied when considering policy and program options to achieve GHG savings. This is reproduced as Figure 1 below.[4]

Figure 1. Suggested Cost/Efficiency Evaluation Methodology

1. Determine efficiency of proposed GHG reduction program
    a. Estimate GHG savings
    b. Estimate cost to achieve GHG savings
    c. Determine efficiency factor as measured in either:
        i. Dollars per unit of GHG abated or
        ii. Units of GHG abated per dollar
2. Benchmark against alternative programs
    a. Comparison by:
        i. Efficiency factor
        ii. Total GHG abated
3. Determine social benefits
    a. Determine who can take advantage of the program (i.e., beneficiaries)
    b. Determine how program is funded
    c. Evaluate potential increase in social (CSO) obligations

[4] While the original submission presented this table as the framework for cost benefit analysis, the same outline equally applies to cost effectiveness evaluations discussed in this paper.

The following steps outline in more detail the process that should be used under a CEA, and in so doing address issues such as the range of benefits or costs that should be included in the analysis, a matter that has been raised by the Standing Committee in its response to the Commission's submission.[5]

Identify the policy/program options

A clear definition and specification of the policy/program options available needs to be agreed. Without clarity at this point, the costs and benefit identification process that follows and the valuation of both direct and indirect effects becomes confused. One option that should apply for each assessment is the 'do nothing' option, as this provides the base case against which other options can be considered.

Whose costs and benefits count

It would be normal from an ACT Government perspective that the interests of the ACT and the ACT population are the main focus. However, with GHG matters (and wider environmental issues which also would be relevant for this form of analysis), there is a need to consider the wider environmental impact. For example, should the interests of Queanbeyan residents and the surrounding rural areas be considered? Should possible reductions in GHG in the ACT which are linked to increased GHG emissions elsewhere in Australia be considered? What consideration should be given to downstream impacts on the Murray Darling Basin should the option involve abstraction of water for consumptive purposes in the ACT or changes in the treatment of sewerage and waste water in the ACT?

Identify and list the impacts and select the measurement indicators

There will be a wide range of impacts, both benefits and costs that can be identified with any policy/program option. The objective here should be to assemble a comprehensive listing that will then inform the following stages of the analysis. Essentially for each impact, the incremental effect by comparison to the base case is what the analysis is seeking to measure and compare across options. Provided the base case is also included, then the analysis should automatically compare this incremental effect.

Costs and benefits extend beyond what are generally referred to as direct effects. There are indirect effects that need to be considered and at least included in the listing of impacts. For example, it is relatively simple to list as a benefit any incremental employment effects that may result from a policy/program option. However, it also needs to be recognised that the indirect effect of the creation of additional employment opportunities could be the transfer of employees from one sector to another with consequential losses to that sector which does not have sufficient access to staff (particularly in circumstances of low unemployment rates within the Territory) or where the sector losing staff is required to increase its wage and salary payments in order to try to retain staff.

Similarly, where there is excess capacity in the economy (i.e., high unemployment), the creation of additional jobs in one area as a direct result of the policy or program option may

[5] Based on a list presented in Boardman, E.A., Greenberg, D.H., Vining, A.R. and Weimer, D.L. (2006) *Cost-Benefit Analysis: Concepts and Practice*, 3rd edition.

create additional job opportunities in other areas as part of any stimulus that is created within the economy. Consideration will need to be given however to the possibility of crowding out effects which may mean that there is little additional activity occurring within the economy as a result of the policy/program option under consideration.

These spillover type effects can be both positive and negative. For example, it is generally acknowledged that some form of 'carbon pricing' would be highly beneficial in terms of sending a price signal both to encourage greater conservation of existing energy resources, and in encouraging alternative less GHG emission producing forms of energy generation and supply. It is also acknowledged that there is a direct effect on lower income households of significant increases in energy costs, and potential adverse follow on cost effects to energy intensive industries particularly when they are in direct competition with international suppliers who perhaps do not have to pay for their carbon emissions.

The impact of these energy price increase effects can be spread across the wider community by way of government subsidies and the like to help to dissipate the overall cost burden, and thus there are appropriate policy initiatives that can be taken to lessen any adverse effect on any one sector or group within the economy (although this should also be seen as being a cost that the community has to be prepared to pay, and thus needs to be recognised in the CEA). It would be inappropriate however simply to leave these types of costs and benefits out of any CEA assessment as they need to be recognised when assessing the relevant costs and benefits of one option against another.

Thus, in the process of identifying the various positive and negative impacts, it is important that the assessment extends beyond the direct impacts, and those impacts that affect the economy as a whole, and also consider the indirect and spillover effects, and the impacts that apply to certain sectors or sections of the economy and perhaps not to all parts of the economy. The inclusion of the social and welfare impacts will be of particular importance and can be easily omitted when the focus in the policy/program initiative is upon wider Territory or national objectives.

Desirably all impacts would be valued in monetised terms. However, this is not always possible. Thus it may be necessary to assign some form of quantification to non-monetised impacts (for example, tonnes of GHG, employment gains/losses). The choices that will be made will depend on data availability. However, there needs to be a consistent approach adopted across the various options under consideration. This issue is discussed further below.

Impacts over time

CEA is not dependent on a single year's impact assessment. Rather it is designed to consider the impact of a policy/program over the lifetime of that initiative, and thereby allow an informed choice to be made by governments as to the best available option to meet some overall objective. To achieve this time dimension in the analysis, it is necessary to identify and quantify the impacts over the life of the policy/program. It is normally assumed that this time projection be no more than 20 years. However, for policy/programs that involve environmental issues, particularly where there are potentially long lead times or ongoing

impacts of a significant dimension, it is appropriate to project out much longer than 20 years. This issue is discussed further below.

Projecting impacts out over many years adds a degree of uncertainty to the analysis. However, the strength of the methodology is that it allows for multiple assessments to be undertaken, thereby permitting different assumptions regarding longer term impacts to be subject to sensitivity testing. Fundamental to the process should be transparency in the assumptions that have been made so as to inform the users of the analysis of the extent to which the results can be subject to possible variation under different assumptions and the significance of any changes in these assumptions to the final CEA assessment.

It should not be assumed that benefits or costs will necessarily be the same year after year. For example, there may be significant costs that occur early in the life of the program and possibly at some later stage. Benefits may not occur immediately but may increase over time. Thus, there needs to be a careful consideration of all these impacts over time and at least some form of recognition of what these might be in current value terms.

Discounting future costs and benefits

Because costs and benefits occur at different points of time, possibly over many years, it is important to express them in present value terms to enable a meaningful comparison of the options under consideration. Effectively this recognises that a dollar received today if it as invested at say 7% interest, would be worth $1.07 in 12 months time, and a dollar received in 12 months time is only worth 93 cents today. Future benefits and costs therefore need to be discounted back to the present day's values if any meaningful comparison is to be made between competing policies/programs. This allows for a balanced consideration of options which may have different timings for costs and benefits to occur. Thus policies/programs which may at first glance appear to be comparable simply in terms of adding up the costs and benefits over time and finding that these are the same, will be differentiated on the basis of the timing for when these costs and benefits might occur.

The issue of choosing the right discount rate and its application is discussed further below.

Computing the net present value for each option

CEA analysis relies upon the determination of the net economic benefit (NEB) which is the difference between the present value of benefits and the present value of costs. Effectively this is presented as

NEB = PV(B)-PV(C)
where PV(B) and PV(C) is present value benefits and present value costs respectively.

Where not all the benefits or costs can be presented in monetised terms, it may be necessary to assess the NEB in some other way.[6] However, to the extent possible the

[6] For example, assessing the net cost effectiveness the building of different court house designs in Queensland in the 1980s required the use of proxy estimates of the value to witnesses of having separate waiting areas away from the general public areas where the family of the accused might have been present (a preference ranking system was used). Similarly, the net economic benefit assessment of the Enlarged Cotter Dam development in the ACT has required the development of estimates of what ACT residents might be prepared

present dollar value of the benefits over the costs should be calculated. To the extent that there are other benefits or costs that cannot be presented in dollar terms, these should be specified in the results of the analysis to allow consideration of these as part of the comparison of outcomes for the various policy/program options under consideration. For example, when CEA is applied to health regulations it is common to determine a measure of the value per statistical life saved recognising that the analysis cannot place an explicit value on a human life but can implicitly determine the value.

Sensitivity analysis

An integral part of a CEA should be the undertaking of sensitivity tests around the assumed benefits and costs that have been incorporated into the calculation of the NEB outcome. Sensitivity analysis will help in determining those assumptions and values that have been included in the NEB calculation that are having the greatest impact upon the final results, and thereby allow the consideration of the policy/program options in a manner that recognises the data limitations.

Desirably, sensitivity analysis should be undertaken in a systematic and consistent manner across the range of options under consideration. It should test worst case outcomes along with best case outcomes. This will allow consideration of the most pessimistic together with the most optimistic results, and inform the decision making process which will ultimately involve a degree of judgement as to what option is preferred.

Partial sensitivity analysis whereby one assumption is changed across all options and the impact on the final outcome noted, is another form of sensitivity testing. Clearly the number of sensitivity runs that need to be made will depend on the reliability of the data that has been used in the CEA assessment process. It should be readily apparent to the users of the analysis just what sensitivity analysis should be undertaken, and for transparency purposes this should be clearly stated to allow informed decision making.

Monte Carlos sensitivity analysis is also a possible option. This form of sensitivity testing draws out a number of key assumptions or parameter values from the probability distribution of the analysis, and allows the user to form a view as to just how robust the conclusions from the CEA might be to changes in the assumptions that are made.

Access to desk computers allows greater opportunity for sensitivity testing of NEB results, and thus enhances the ability of the policy/program maker to reach an informed and desirably optimal policy/program choice.

Ranking the policy/program options

The ranking of policy/program options would normally be undertaken on the basis of the option with the largest NEB. However, because of the possibility that some of the costs or benefits may not be capable of being expressed in monetised form, the ranking of options may have to involve both an assessment of the ranking of the NEB outcomes and a comparison of the other non monetised costs and benefits.

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to pay to avoid the cost of different levels of water restrictions in the Territory (in this instance a 'willingness to pay' approach was used to derive a monetised value).

The objective will be to make this process as transparent as possible so that an informed decision can be made on the full range of information and data that has been collected and incorporated into the CEA. In considering the outcomes and making a decision on the ranking, account should be taken of the findings from the sensitivity analysis, and consideration also given to the timing of the costs and the benefits (although these factors will have been built into the CEA itself). The CEA becomes a tool that helps in making a final decision. However, it is recognised that in making that decision, there may be reasons for selecting an option that does not of itself have the largest calculated NEB. The purpose of the CEA is to place a discipline over the process of making a choice from the available options and to assist in the consideration of the various factors in favour of or against the options that are available.

Overview

This outline of the CEA presented essentially encompasses the three main points identified in Figure 1 above. That is, there is

- a clear specification of the options, the impacts both in terms of benefits and costs, and a valuation of these impacts;
- consideration of the timing of when these costs and benefits might occur, and
- a comparison of the likely outcomes taking into account not only the direct targeted outcomes (be it in terms of total GHG abated or some other targeted objective) but also the wider social impacts including who bears the cost and how any disadvantaged groups may be assisted in this process if appropriate.

The above presentation of the CEA basic principles covers a number of issues which will need further elaboration and explanation. However, it is not intended that this paper provide a full text on CEA analysis. Rather it is intended that sufficient information be provided to allow consideration of the use of this technique, and then to allow the relevant agency to development further how this methodology might be applied in the context of the ACT's application of its greenhouse gas reduction program.

However, there are some issues that deserve further comment. In the following sections, this paper touches upon two important issues in more detail, namely the **valuation** issue, and the **discount rate** and **period**.

Discounting

Dealing first with the discount rate, it is generally accepted that one dollar today is not the same as one dollar one year from now. Discounting refers to the mathematical process of translating future values into current dollars.

Discounting is used in CEA to compare costs and benefits over time. All costs and benefits are "brought back" to the starting time. The intuitive way of understanding discounting is to start with the example of investing money into an interest bearing account. Suppose one put $100 into an account that earns interest at the rate of r. Note that r will become the discount rate. At the end of 1 year the investor has $100 plus the earned interest of $100×r

or $100×(1+r). If the investor reinvests this amount for another year they have $100×$(1+r)^2$. The general result is after t years the investor has $100×$(1+r)^t$. Thus if $100 is worth $100×$(1+r)^t$ in t years then $100 in t years is worth $100/$(1+r)^t$ today. To return future cash flows to dollars today, divide by $(1+r)^t$.

The impact of discounting is shown in Table 1, which gives the present value of one dollar of costs or benefits occurring from 10 to 50 years after the start of a project at various discount rates.

Table 1: Present value of one dollar of future costs or benefits

	Discount Rate				
Years	1%	3%	5%	10%	15%
10	$0.905287	$0.744094	$0.613913	$0.385543	$0.247185
20	$0.819544	$0.553676	$0.376889	$0.148644	$0.0611
30	$0.741923	$0.411987	$0.231377	$0.057309	$0.015103
40	$0.671653	$0.306557	$0.142046	$0.022095	$0.003733
50	$0.608039	$0.228107	$0.087204	$0.008519	$0.000923

At the discount rate of 10%, one dollar in year 30 looses 95% of its value through discounting, whereas one dollar in year 50 has a present value close to zero at this discount rate. Due to discounting, future environmental costs and benefits have a small impact on NEBs. This is advantageous to projects with long-term environmental costs. However, for projects which have long term environmental benefits, it can mean that these benefits rapidly lose value over time in a CEA unless consideration is given to the discount rate used. As can be seen from Table 1 the choice of the discount rate can drive the analysis. One dollar in 50 years from now is worth 60 cents at a 1% discount rate but is only worth less than one-thousandth of a cent if a 15% discount rate is chosen.

Thus, selecting the right discount rate to apply in CEA exercises can be crucial in determining whether a particular policy option has a net public benefit. For CEA evaluation of policy programs having environmental impacts, the discounting of future costs and benefits is the most controversial element. High discount rates are often blamed for the low feasibility of environmentally sound projects. As shown above, high discount rates effectively reduce future benefits to near zero values over a relatively short period of time. The costs and benefits of a policy, particularly those involving environmental effects, will often stretch across many years, and to allow for a comprehensive accounting of the costs and benefits there needs to be the ability to compare impact across all these years. Thus the discounting approach that is adopted has a significant effect on decisions involving programs or policies which have long tailed effects or impacts. Therefore careful consideration needs to be given to both the discount rate that is applied and the period over which the CEA is undertaken.

So what discount rate should be chosen? The appropriate choice would appear to be a market interest rate. The problem is that there are multiple market interest rates such as government bond rates, corporate bond rates and other cost of capital measures. The Productivity Commission recently released a report on determining the discount rate to be

used in CBA/CEA.[7] The conclusion reached in this report was to use a market based rate, 8% currently, but to do sensitivity analysis around this value.

The other element in this calculation is the period of time over which the CEA is undertaken. For projects which involve a lengthy period of time before benefits are realised, the use of a time period that is relatively short will bias the results towards the costs rather than the benefits which may not have been achieved prior to the end of the assessment period. At the same time, where there are longer term costs, but short term benefits, adoption of a short period for the CEA will bias the results towards the benefits and potentially omit any consideration of the longer term costs.

For CEA projects involving environmental programs or policies, it would be desirable to adopt an assessment period as long as possible given the data availability.

Valuation of environmental impacts

Similar to other resources, the use of environmental resources should be accounted for in any CEA assessment of policy or program options. Environmental effects should desirably be estimated both within the ACT and externally. For example, water with high salt content discharged from water treatment may have limited effects in the Territory but will have consequences downstream in NSW and potentially South Australia.

The collection of reliable information about environmental effects may be time-consuming and costly. Environmental impacts should be estimated first in physical terms, for example, the percentage increase of emissions of gases, area of land lost due to erosion, and temperature increase in degrees Celsius. In the next step these effects need to be monetised where ever possible, that is given a monetary value. Environmental effects are often external effects, which by definition do not come into a purely financial CBA form of analysis. However, in projects aimed at environmental protection or improvement, financial and ecological variables may be related. Environmental amenities, such as clean air cannot be traded because property rights have not been assigned to someone. Thus, there is no direct price indicator for their value to society. **However, economists have developed models or tools to value the environment and these environmental effects.**

To understand the principle underlying these valuation methods, consider the question of how to value clean air. Assume that polluted air creates cost elsewhere such as higher medical costs. The value of the ecological effort (cleaner air) may be estimated by investigating the effects on asthma sufferers, thus indirectly measuring one component of the total external effect.

A basic principle of valuation techniques is that environmental effects that do not have market value or have an artificially low market value, should be linked to markets, where prices are available. This is the fundamental premise behind an emissions trading scheme where a market price for carbon emissions is determined by linking the creation of carbon

[7] Harrison, M. 2010, *Valuing the future: the social discount rate in cost-benefit analysis*, Visiting Researcher Paper, Productivity Commission, Canberra.

emissions to a market for the trade in these emissions and emission reduction activities that is established under legislation.

In a standard market, the value of a productive natural resource (such as clean water for example), may be associated with the value of the final output. Given that these final output values are well determined they can be used as a proxy or **revealed preference valuation** for environmental effects. Changes in environmental quality may cause damage to physical assets, such as houses, buildings, or cars. The value of environmental changes may be estimated by investigating the costs of replacing lost assets or relocating these assets that have been damaged by the change in environmental quality[8]. Alternatively, values can be determined by estimating the costs of preventing any damage. The revealed preference technique relates to environmental quality changes to existing markets for commercial products.

If such markets do not exist, a hypothetical market may be created by asking individuals how they value environmental services. This is the **contingent valuation method**. In surveys, people may express their willingness-to-pay for being protected against environmental degradation, for clean water, nature and so on[9]. Their answers are contingent to the hypothetical market that has been described to them. Alternatively, they may express their willingness-to-accept financial compensation for being exposed to environmental decay.

The value of a loss in environmental quality can be expressed in terms of foregone income. Changes in environmental quality may affect human health and subsequently human productivity. The **loss of earnings approach** (also known as human capital or foregone earnings approach) estimates environmental value by calculating the loss of income and costs of medical treatment that may be attributed to environmental problems[10].

Often it is not possible to make an assessment of the value of the environment because we have limited knowledge; however, the loss of any environmental amenities or environmental damage should be included in a CEA. Thus the use of a CEA approach to assess alternative policies or programs will require consideration of the best valuation options available and the consistent application of these valuation methods in the assessment being undertaken.

[8] An example of this approach in the ACT is the advice given by the Commission in its October 2003 report on the *Water Abstraction Charge* in which the per kilolitre cost of environmental repair work on the Murray Darling Basin system (obtained from the Murray Darling Basin Commission) was used as a proxy for the cost of the environmental impact of the ACT's abstraction of water from the Basin for consumptive purposes.

[9] This is the approach used by ACTEW in its net economic benefit analysis of water security supply options for the ACT leading up to the decision to proceed with the enhanced Cotter dam, Murrumbidgee to Googong, and Tantangara transfer options

[10] This approach has been used in a number of the studies undertaken over recent years in relation to the impact of cigarette smoking on the Australian economy

Measurement issues and decision rules

The NEB of a project or policy is the present value of estimated benefits minus costs (NEB = PV(B)-PV(C)). In mathematical terms, it is expressed as:

$$PV(B) = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t}$$

$$PV(C) = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

$$NEB = PV(B) - PV(C) = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t}$$

Where B_t is the benefit in year t, C_t is the cost in year t, and r is the discount rate. Notice that annual net economic benefit can be determined and then the net present value operation applied to determine NEB.

The benefit-cost ratio (BCR) of a program or policy is the present value of the estimated benefits divided by the present value of the estimated costs. In mathematical terms, it is expressed as:

$$BCR = PV(B) / PV(C) = \sum_{t=1}^{n} B_t / (1+r)^t \Big/ \sum_{t=1}^{n} C_t / (1+r)^t$$

Under the NEB approach, a project is considered economically sound if the NEB is positive. However, if there are several projects competing for scarce funds, projects can be ranked by their relative BCR and the project with the highest BCR should be given first preference.

Conclusions

In this paper, a brief summary of the CEA approach to evaluating competing policy or program options is discussed, and some observations made concerning key issues associated with the discounting approach that should be applied, and the valuation of costs and benefits, particularly when these costs and benefits are not normally presented in monetised terms.

The application of this assessment methodology will bring to light a number of further practical issues that will need to be addressed and resolved particularly when reviewing environmental programs or policies. The advantage of the proposed methodology is that it provides a framework within which a rigorous and consistent approach can be used to inform decision makers on the best available option to adopt given the information on costs and benefits that is available.

The information that will be relevant will go beyond a simple accounting of the immediate effects of a policy or program to include coverage of the indirect and spillover effects that occur as a consequence of government intervention in the market. While CEA analysis has been widely used within the public sector to evaluate regulatory programs and major infrastructure investment decisions, its application to wider policy and program decision making is both practical and desirable when seeking to determine how best to achieve relevant environmental aims and objectives that are set by governments.

The adoption of a CEA approach to the assessment of environmental and GHG reduction policies and programs in the ACT will greatly enhance the ability of the ACT to maximise the benefits that can be achieved while minimising the cost to the ACT economy and to ACT residents. Ultimately some form of comparative analysis is needed if decisions taken by government within the ACT are to be both effective and efficient. CEA provides the framework and methodology whereby appropriate assessments can be made that will inform decision makers and ultimately be to the benefit of the ACT community.

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Independent Competition and Regulatory Commission
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