Appendix C
Response to NTDG-commissioned review of Project socioeconomic modelling

Response to “Technical Comments on the ‘Socio-economic Assessment’ undertaken by Hunter Water Corporation and Aurecon for the Tillegra Dam Planning and Environmental Assessment Report by Dr Geoff Wells, November 2009 – A comment on the appropriateness of Cost-Effective Analysis”

Hunter Water Corporation

1. Introduction

Wells’s (2009) submission to on the Hunter Water Corporation’s (2009) Environmental Assessment Report for Tillegra Dam claims that environmental assessment based cost-effectiveness analysis (CEA) is not appropriate to the decision, not supported by international practice or relevant Australian guidelines. Wells argues that a cost- benefit analysis (CBA) is essential.

Hunter Water contends that, when the basic theoretical applications for CEA and CBA are considered, there is a case for preferring CEA in this case.

CBA is an analysis tool for optimising investment decisions to ensure that only candidate projects with the best economic return are selected. It assesses the net benefits of competing projects over time to select the project with the best returns to society. In this case, competing projects may be in different geographical areas, provide quite different benefits (for example, ranging from electric power to transport infrastructure) and provide these benefits to quite different communities or sectors of the community.

CEA and least-cost analysis address a different decision need, where the objective of the investment is to deliver a pre-determined, specific outcome or benefit, rather than necessarily maximize net benefits.

Although not always so, this objective usually relates to benefits for a specific community, region or environment. Hunter Water’s specific application of the CEA approach is sometimes referred to in the literature as least-cost analysis. For this paper, we refer to this approach as CEA, which is commonly accepted in much of the literature.

Hunter Water’s investment objective is to meet the forecast demand for water in the lower Hunter region rather than to find which regional developments, water-related or otherwise, maximise investment returns to society. Hunter Water’s decision requirement, therefore, is to find the most cost-effective or least-cost project, or mix of projects, from a suite of alternative investments to achieve this purpose. In this context, CEA is an appropriate project decision tool for selecting projects that deliver outputs that will meet the forecast water demand.

Wells claims that “CEA is entirely unsuited to such a wide-ranging analysis” and that Hunter Water’s analysis “uses CEA in a context and on a scale for which it is not designed”. He argues that use of CEA for assessment of projects is not consistent with international best practice and refers to recognised international project evaluation guidelines such as those produced by the Asian Development Bank. Contrary to this assertion, applications of CEA to similar wide-scale issues to that faced by Hunter Water can be found in the guidelines that Wells claims recommend against the use of CEA.

2. Project analysis tools – which one, when?

There are two basic types of project analysis – investment analysis and cost-effectiveness analysis and they have application in quite different circumstances.

Investment analysis is used when the analyst is considering an investment now that will result in a stream of increased and varying outputs (benefits) over a number of years. Investment analysis enables the analyst to see if the stream of variable, year-to-year benefits covers operating costs and justifies the capital costs of the planned investments. In short, investment analysis is used to see if the investment is justified in economic terms by the resultant increase in economic activity and other quantifiable benefits.

Investment analysis is undertaken by CBA. The traditional criteria for investment analysis or CBA are benefit-cost ratio, net present value and internal rate of return. Each of these criteria has certain advantages and disadvantages in use and peculiarities in way they treat investment scale, rate of investment and investment timing and these factors need to be recognised by analysts.

Some well-known water examples of CBA are examining the merits of building dams at various locations to increase economic activity and output through irrigation and/or the production of hydro-electric power. CBA enables the analyst to rank alternative dam proposals by taking account of the likely increases in production from each and the investment cost. It also enables central government agencies to assess whether this is a better investment than, say, transport projects competing for limited investment funding.

CEA is used in project appraisal to assess public sector capital expenditure in projects where the decision is not simply about justifying the project on the grounds of economic benefits exceeding economic costs. In these instances, other criteria have established the need to address a particular issue.

The literature cites CEA as an appropriate economic analysis tool where:

- The objective for considering a project is predetermined, usually through non-economic decision criteria
- The objective is unique to a specific location and cannot be addressed by investment elsewhere
- The objective, or benefits, can be provided by a number of mutually exclusive projects[1]
- Each mutually exclusive project option has the capacity to provide most of the target benefits, and
- Project outputs are not traded in competitive markets and/or it is difficult to monetise the value of the outputs.

In CEA, the analyst is looking at how to achieve a predetermined outcome for the least cost. Thus it differs in intent from investment analysis because it starts with a presumption that the outcome is needed by society. Such pre-determined outcomes are often set using non-economic decision criteria. Nevertheless, as there may be various mutually exclusive investment options that can deliver the set outcome, society needs to ensure that this is achieved with the most efficient investment option.

Common water industry examples are wastewater treatment investments to meet regulated or otherwise defined standards for wastewater discharge to the environment. In such a case, various treatment plant options are examined to find the most cost-effective way of achieving the set environmental standards (where these standards are seen as the "benefits" to the community).

On the water side, CEA can be used to rank suites of demand management and supply augmentation options to ensure urban water demand and supply is balanced over the long term. In this case, the conceptual "benefit" is keeping demand and supply in balance through mixes of demand management and/or supply augmentation options. CEA enables the analyst to find which mix of demand and/or supply measures achieves the demand/supply balance at least cost.

3. The primacy CBA

Wells states that CBA is used by governments around the world to decide upon and choose between investments, programs and projects. In this regard, Wells asserts that CBA has primacy as the analytical tool for infrastructure projects.

While CBA does have primacy in public infrastructure analyses, understanding the context for this preference for CBA is important.

CBA's primacy comes mainly from the fact that there are many projects that will provide benefits to society competing for limited public (budget sector) capital. Because of the limited capital, not all projects can proceed at once, resulting in a need to

[1] CEA can be used to analyse physical infrastructure proposals and policies. We have used the term "project" in this paper because the paper is primarily concerned with the application of the approach to assessing a range of alternative project options to meet forecast water demand for the lower Hunter.

prioritise (rank) investment for budget sector capital. Also, among the projects competing for this limited government funding, there may be some for which the benefits to society may not justify investment at this time.

In most cases, these competing projects have directly quantifiable benefits, often in the form of output sold in relatively competitive markets. For example, projects to construct dams to supply irrigation water or hydro-electric power will generate higher levels of agricultural output and greater electricity for sale. These will compete with similar proposals elsewhere in the economy and therefore need to be compared with these similar projects, and other potential investments that could deliver quite different, but greater, benefits to society.

Thus, one of the main reasons for the primacy of CBA is that it enables comparison of projects that deliver quite different outputs and objectives. It enables Governments to compare investments in roads with investments in public transport or power generation. In this context, CBA is addressing questions like "is building a hydro electric project and location A better than at location B and better than building a road project at location C?"

Most infrastructure projects have directly quantifiable benefits, so governments therefore rightly insist on using CBA to get the broadest ranking of all their investment options. Thus most projects considered by governments for investment funding appropriately are subjected to CBA.

CBA's primacy in international guidelines stems from the fact that most international guidelines originate from the major development finance banks – the Asian Development Bank (ADB) and the World Bank. These organisations are similarly faced with a need to rank and prioritise the allocation of limited development funds over a wide range of projects with vastly different benefits and costs and in many different parts of the world. CBA provides an essential means of ranking projects for funding in this context so it is not difficult to understand the primacy of CBA in development funding assessments.

In international appraisals conducted for development agencies, cost effectiveness analyses often sit within a larger analytical framework examining system expansion to meet supply objectives or to balance supply and demand. For example, cost effectiveness analyses can form part of integrated water resource plans and electricity master plans. In these instances, it can be argued that it is actually CEA that has primacy over CBA, the latter being completed as confirmation of the CEA-determined outcome.

However, in some cases, governments and decision makers are faced with addressing investment decisions where the benefits are not defined as productive outputs. Governments therefore need to assess this generally smaller set of projects that produce indirect benefits. These projects have objectives or benefits such as environmental protection and restoration and meeting communities' needs for services that support population growth.

These objectives are generally framed in other than economic terms such as environmental targets or service levels to be achieved. The decisions setting these objectives are usually made on technical grounds or on the basis of established or assumed community preferences.

In these cases, there may still be a number of mutually exclusive, competing ways of achieving these objectives. Thus, choices still need to be made between the different means of achieving the same objective or benefit. Economic analysis is again used to choose the means of delivering this desired benefit using the least resources. This is the role of CEA.

CEA involves comparing the costs of various feasible options to meet the predefined objective. It aims to find the option that satisfies this objective at lowest cost.

Unlike CBA, CEA is not used to compare projects with different objectives. Where CEA is used, the objective or outcome of all competing projects or policies must be the same or similar. In the case of the analysis which led to the Tillegra Dam decision, a range of options was considered to achieve the single objective of balancing the long-term demand for, and supply of, potable water to the growing population of the lower Hunter region.

CEA therefore is about ranking alternative ways or projects that will deliver essentially the same output. Because the output and benefits are the same, it is not necessary to separately consider the benefits of each project - each project has been framed to achieve that outcome. It is only necessary to compare costs and select the project with the lowest present value cost.

4. Selecting the most appropriate approach

The very first step in any project assessment is understanding the project need and objectives. Part of this step is assessing whether a CBA is needed and appropriate or CEA is the best approach for the issue.

The fundamental issue Hunter Water has sought to address is how to meet forecast water demand for the lower Hunter region, given a range of possible climatic influences on its current water sources. This is an objective that is unique to the Hunter region and one that cannot be addressed by investments elsewhere.

Urban water demand is product of both residential water demand and the demands for the non-residential sector. Only the supply to the non-residential sector can be considered to be an input to products and services sold in a competitive environment. For Hunter Water, the non-residential demand makes up only around 30 per cent of total annual demand. The remaining 70 per cent meets the water demands of households, where water is not an input to the production of goods and services sold in a competitive market.

This mix non-market and market output makes it difficult to attribute consistent values and economic benefits to both current and future demands across both the residential and no-residential sectors.

Future water demand is largely a function of autonomous urban population expansion and, as such, population growth pre-determines a need for a solution that will ensure the future demands are met – either through demand or supply management measures.

Autonomous population growth and the essential nature of water services to the community define a water demand forecast that then can be tested against the supply reliability of existing sources. Where the demand forecast cannot be met reliably by existing sources, a need to address the forecast demand-supply imbalance is established.[2]

In this situation, the economic analysis question is not one of attributing a value or benefit to the water use resulting from the autonomous population growth but rather one of finding the least-cost way of meeting the forecast demand.

Overall, CEA appears the preferable approach when considered in the light of the criteria outlined in section 2.

The objective relates to the need to meet a demand and supply imbalance determined on the basis of non-economic criteria relating to current water source yields and population growth projections. The issue is unique to the Hunter region and cannot be addressed by investments elsewhere.

The objective can be satisfied by selecting from a range of largely mutually exclusive projects and strategies, where each has the capacity to capture the target benefits. Finally, much of the project output is not sold in a competitive market place or does not form an input to products sold in competitive markets, making it difficult to reliably monetise the benefits.

5. Consistency with best practice and guidelines

Throughout the paper, Wells asserts that use of CEA in the context of the Tillegra Dam assessment is inconsistent with New South Wales Treasury (NSW Treasury) and Australian Government guidelines and international best practice. This assertion is made on the basis of the general primacy of CBA in these documents. Hunter Water's application of CEA to this project appraisal was made after careful consideration of the fundamental objective as outlined in sections 2 and 4 above.

[2] This process is outlined more fully by Berghout (2009).

A review of the relevant guidelines does not support Wells’s view and indicates that CEA is quite appropriate to the Tillegra analysis.

Australian Government guidelines recognise that cost-effectiveness analysis is a widely-used alternative to CBA. CEA is considered appropriate for comparing alternatives on the ratio of their costs to provide a single quantified, but not monetised, effectiveness measure. The guidelines further note CEA is reasonable to use if the effectiveness measure captures most of the benefits.

The effectiveness measure used in the assessment of Tillegra Dam and its alternatives is the capacity to balance the long-term supply and demand of potable water in the lower Hunter region. Balancing supply and demand fits the requirement of being a single, but not monetised, effectiveness measure.

Given that achieving this balance in supply and demand is the principal and major benefit of all the alternatives considered in analysis, it can reasonably be argued that use of CEA for the Tillegra Dam assessment is consistent with the application outlined in the Australian Government guidelines.

The NSW Treasury guidelines state that CEA is used to compare the costs of different project options with the same or similar outputs. The guidelines further say that CEA is applicable to a wide range of public sector agencies with strong community or social welfare objectives. The balancing of water demand and supply to meet projected population growth fits well within the definition of a community objective. Urban community growth and public health are strongly linked to availability of potable water supply.

Like the Australian Government guidelines, the NSW Treasury guidelines state the CEA is used where major benefits cannot be valued in money terms. Instead the guidelines say “the costs involved in achieving some desired effect or output are compared” through CEA. Again, the “desired effect or output” in this case is balancing potable water demand and supply into the future. The analysis undertaken compared the costs of achieving the balance using a number of alternative projects and Tillegra Dam was found to be the least-cost option.

Wells also implies that, in international practice, CEA is used under two conditions. These are to find the least-cost method to deliver a given environmental improvement and to identify a project that will achieve the greatest social benefit for a limited budget allocated to environmental improvement. Wells extends this argument to suggest that CEA is unsuited to a wide-ranging analysis of the type carried out for considering options to balance potable water demand and supply in the lower Hunter.

While the first of Wells’s examples is perhaps the best-known application of CEA, and one that has been used for many years, these examples are not the only uses of CEA in international practice.

The Asian Development Bank guidelines illustrate the use of least-cost analysis for selecting the lowest cost ways of increasing water supply to meet forecast demand and for comparison of options such as geothermal power and coal-fired power to meet an anticipated demand for electricity. The former is a close parallel with the approach adopted by Hunter Water in this instance.

These wider cost effective analyses can be used on their own where there is a predetermined objective for a particular location (such as the need to service a growing population with an essential supply like potable water) or as an input to CBA, where the least cost project becomes the candidate project for competing public sector investment funds. This latter application may be the case for electricity supply options, where alternatives exist to generate power outside a particular location.

6. Conclusion

Wells’s critique of Hunter Water’s economic assessment relies heavily on a very general view that CBA is required for all economic appraisals. Closer review of the literature suggests that this general observation cannot be extended to every particular circumstance.

The literature and various guidelines show that where specific, non-monetised, benefits

– such as matching forecast urban water demand and supply - can be achieved through a number of mutually exclusive options or projects, CEA is an acceptable approach for ranking the available options. This is precisely the application of CEA in the Environmental Assessment Report.

Hunter Water has demonstrated that the water yield from its existing sources is insufficient to meet the levels of drought security offered by other major Australian cities and to meet the population growth projected by the New South Wales Department of Planning over the next thirty years.

In this context, Hunter Water is faced with a predefined objective of balancing current and projected water supply and demand. The relevant economic analysis in this context is CEA, which has been used to develop the lowest cost approach to matching forecast demand and supply over the next fifty years.

References

Asian Development Bank, Economics and Development Resource Center, 1998, **Guidelines for Economic Analysis of Water Supply Projects**, Manila, March

Asian Development Bank, Economics and Development Resource Center, 1999, **Handbook for the Economic Analysis of Projects,** Manila, January

Australian Government, 2007, **Best practice Regulation Handbook**, Canberra, August

Berghout B. 2009, "*HWC technical review of An independent review of supply-demand planning in the Lower Hunter and the need for Tillegra Dam", Oct* (unpub comment response to Environmental Assessment Report submissions)

New South Wales Treasury, 2007, **NSW Government Guidelines for Economic Appraisal**, Sydney, July

Wells G. 2009, "*Technical Comments on the 'Socio-economic Assessment' undertaken by Hunter Water Corporation and Aurecon for the Tillegra Dam Planning and Environmental Assessment Report: Prepared for the No Tillegra Dam Group"*, November