THE PROBLEMS WITH SOCIAL COST-BENEFIT ANALYSIS: ECONOMICS, ETHICS AND POLITICS

By

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ABSTRACT

This thesis examines the problems with social cost-benefit analysis in three areas -- economics, ethics and politics -- and suggests how these problems might be addressed in government project review processes. Problems in economics are empirical, methodological or theoretical dilemmas that make a social cost-benefit analysis difficult to prepare and interpret. Problems in ethics stem from the value judgments implicit in a social cost-benefit analysis that may be in conflict with the ethical beliefs of some individuals in society. Problems in politics stem from the various powers of individuals in a political process and challenge the relevancy of analysis.

A literature survey, primarily of welfare economics but also of environmental ethics and political theory, is used to determine the various problems with social cost-benefit analysis, while a case study is used to illustrate how these problems are reflected in practice. Similarly, ideas for improvement are drawn from the literature of environmental impact assessment and these ideas are illustrated by applying them to the case study. The problems are discussed according to the stage of analysis at which they occur: problem definition, specification of objectives, selection of alternatives, prediction of consequences, and evaluation of alternatives. The case study is of the social cost-benefit analysis of B.C. Hydro's proposed Site C hydroelectric development and the associated project review process of the B.C. Utilities Commission Act.

Empirical problems in economics range from: defining "wicked problems"; measuring interpersonal utility; defining and measuring consequences; obtaining adequate data; and evaluating or recognizing intangibles. Methodological problems in economics include: predicting consequences; elements of bias in evaluation techniques; the neglect of non-users in evaluation techniques for non-market resources; option values for environmental resources; and evaluating irreversible project consequences. Theoretical problems in economics stem from: narrow
problem definitions and incomplete specification of alternatives which hinder achievement of optimal decisions; the theory of "second best"; the Scitovsky reversal paradox; the need for actual compensation to take place under certain situations; the use of willingness-to-pay or willingness-to-be-compensated measures of consumer surplus; the selection of a discount rate; and the effect of risk and uncertainty on evaluation.

Ethical problems in social cost-benefit analysis arise from: the existence of multiple and conflicting problem definitions and sets of alternatives; Arrow's Impossibility Theorem which precludes the specification of a social welfare function; value judgments made implicitly in the methods of inquiry in both economics and the science needed for impact prediction; the existence of non-utilitarian frameworks that conflict with the utilitarian emphasis of social cost-benefit analysis; the reductionist nature of valuing environmental resources; the judgments made about individual rights in the selection of willingness-to-pay and willingness-to-be-compensated measures; and the judgments made about future generations in the selection of a discount rate.

Political problems in social cost-benefit analysis are evident in: the hidden agendas and political goals of politicians, bureaucrats and interest groups; incentives to bias problem definition and alternative selection in order to justify a politically but not necessarily economically justified project; incentives to restrict the boundaries of analysis to provincial boundaries; and incentives to overstate benefits, understate costs and neglect qualitative project effects.

Some of the economic, ethical and political problems can be resolved by changing the way that government project review processes operate. Three broad changes are recommended: a two-tier review process which clearly separates evaluation from the preceding stages of analysis; an increased use of public and interdepartmental review in the early stages of analysis; and a flexible and experimental approach to evaluation.
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CHAPTER 1
INTRODUCTION

Social cost-benefit analysis (SCBA) is an economic tool used to help governments make decisions about major public projects. The goal of social cost-benefit analysis is simple, but its achievement difficult: to compare the benefits of a project to its costs. Environmentalists, politicians, bureaucrats and city planners have repeatedly attacked social cost-benefit analysis and economists, the supposed champions of SCBA. Environmentalists claim that SCBA cannot possibly reflect the values that people place on health, quality of life, aesthetic appreciation of wilderness, recreational opportunities and wildlife, to name but a few. Politicians and bureaucrats complain that SCBA, while useful in determining the economic effects of projects, is incapable of reflecting the political realities that pervade government decision-making. Planners think that it focuses too much on economic considerations and too little on broader social concerns. These groups are not alone in their criticism. Perhaps the strongest challenges to SCBA have come from economists themselves. Economists have attacked its ability to make decisions for the good of all society, as well as its ability to make good economic decisions.

If social cost-benefit analysis is to continue as a tool for helping governments make decisions, its problems must be clearly articulated and solutions put forward. This thesis contributes to this goal by synthesizing the problems with SCBA in three areas — ethics, economics and politics — and suggesting how these problems might be remedied.

Problems in economics are empirical, methodological or theoretical dilemmas that make a social cost-benefit analysis difficult to prepare. Problems in ethics stem from the different value judgments implicit in a SCBA that may be in conflict with the ethical frameworks held by individuals in society. Problems in politics challenge analysts to make
a SCBA relevant to decision-makers and citizens affected by a project. Wherever possible, these problems will be illustrated in this thesis by a hypothetical project: a hydroelectric dam and generating station.

Chapter 2 traces the history of project evaluation from the emergence in the 1930s of cost-benefit analysis (CBA), that focussed on economic costs and benefits, to the development of social cost-benefit analysis in the late 1950s, that more explicitly recognized non-economic environmental and social impacts, and finally to the creation of environmental impact assessment in the 1970s and its effect on social cost-benefit analysis. Simultaneously, the discussion traces developments in the theory of welfare economics that underly the principles of social cost-benefit analysis and explores how these theoretical underpinnings were reflected in practice.

In Chapters 3 and 4, I describe the five tasks involved in a social cost-benefit analysis: the definition of a problem; the definition of goals and objectives; the identification of project alternatives; the identification of the consequences of each alternative; and the evaluation of consequences and alternatives, and the selection of an alternative (Lindblom, 1965; Bradley, 1973; Coleman, 1977; Hollick, 1981a). Chapter 3 both addresses the general problems encountered in the first four tasks and deals more specifically with problems in economic theory and methodology that affect those tasks. In particular, much of the discussion in Chapter 3 is devoted to the problems of specifying social goals and measuring goal achievement. Chapter 4 discusses the problems encountered in the economic evaluation of environmental resource impacts, such as transforming physical environmental impacts into economic costs and benefits, discounting impacts, and the ways that risk and uncertainty affect evaluation.

Chapter 5 then turns to the ethical problems and implications of social cost-benefit analysis. The value judgments implicit in traditional social cost-benefit analysis are
explored: whose preferences count and how are those preferences weighted. This chapter also discusses the utilitarian ethical framework underlying social cost–benefit analysis and the implication of the existence of non–utilitarian ethical systems on the validity or appropriateness of social cost–benefit analysis as a tool for making "wise" social decisions.

Chapter 6 describes a framework based on Allison (1971) that is used to explore the political forces affecting the use of social cost–benefit analysis. A general model is developed for project evaluation processes that describes the actors involved in a social cost–benefit analysis and their goals, their role in project evaluation, the nature and extent of their power to affect the process, and their access to the process. Based on this model, some hypotheses are proposed about the way politicians, bureaucrats, interest groups and the general public might view the usefulness of social cost–benefit analysis or attempt to manipulate its results.

In Chapter 7, I illustrate how the various economic, ethical and political problems are reflected in practice by describing the events surrounding the preparation of a social cost–benefit analysis for the proposed Site C hydroelectric development in northern British Columbia. The analysis illustrates: how individuals varied in their problem definitions, in the objectives they chose, in the selection of alternatives and identification of consequences, and in the use of evaluation methods, and how these differences resulted in competing versions of social cost–benefit analyses; how ethical problems were reflected or recognized; and how political factors affected the use of social cost–benefit analysis.

Chapter 8 shifts the focus of the paper away from the problems with social cost–benefit analysis to suggestions for its reform and improvement. In Section 8.1, I categorize the problems with social cost–benefit analysis into five types -- empirical, methodological, theoretical, ethical and political -- and develop both general and specific suggestions for dealing with them. In Section 8.2, some of these suggestions are applied to
the Site C case study by developing a project review process that allows a more flexible use of social cost–benefit analysis. The result is a decreased emphasis on measures of net benefits and an increased emphasis on identifying and understanding the impacts of projects on the economy, on the environment, and on society. The reforms suggested here are only a beginning; their success must be tested and refined in practice.
Before proceeding with a detailed examination of social cost-benefit analysis, we must clearly define what it is. To do this, it is also necessary to examine what it has been. This chapter traces the history of social cost-benefit analysis and related theory in welfare economics, from the early 1900s to the present, to show how the theory developed and how it was reflected in practice. By doing so, I hope to clarify some of the confusion surrounding the definition of such terms as cost-benefit analysis, social cost-benefit analysis and environmental impact assessment, as well as dispell some frequent misunderstandings about the purpose and scope of social cost-benefit analysis. Table I summarizes the major ideas that will be developed in this chapter.

2.1 THE 1930s AND 1940s: COST-BENEFIT ANALYSIS

The use of cost-benefit analysis in government decision-making began with the development of project evaluation for water resource developments in the United States. Formal project evaluation techniques developed in the 1930s when the U.S. government began undertaking major water resource projects such as navigation and flood control. Such projects were undertaken as part of national policy rather than by individual states or by private business because of weak state efforts in flood control, the large scale of such projects, and a lack of private capital (Ehrhardt and Ehrhardt, 1980, p. 94).

Controversy over these large resource developments arose because many projects resulted in financial losses for government and created conflicts with downstream users (Rees, 1985). As a result, the government was increasingly faced with pressure to justify project developments and maximize its real returns on investment. The question arose:
# TABLE I

A HISTORY OF SOCIAL COST-BENEFIT ANALYSIS AND WELFARE ECONOMICS

<table>
<thead>
<tr>
<th>Date</th>
<th>Cost-Benefit Analysis</th>
<th>Welfare Economics</th>
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| 1930s | CBA - measured direct economic costs and benefits  
- focussed on economic welfare | - recognized that non-economic costs and benefits affected project evaluation  
- recognized economic welfare was part of social welfare |
| 1950s | CBA - measured direct and some indirect costs and benefits (externalities)  
- focussed on economic welfare | - evaluation techniques developed for limited range of externalities  
- recognized intangibles should be identified  
- understood value judgments required to include redistribution  
- identified distribution of economic welfare |
| 1960s | SCBA - measured direct and many indirect costs & benefits  
- recognized intangibles should be included  
- focussed on economic welfare | - developed theory for using multiple objectives  
- recognized option values |
| 1970s | SCBA - same as 1960s  
EIA - identified environmental and social impacts  
- stressed distribution of impacts, costs and benefits | - increased development of evaluation techniques for non-economic impacts |
| 1980s | SCBA - same as 1960s  
- intangibles treated inconsistently  
- focussed on economic welfare and its distribution | - further development of evaluation techniques |
"How was the public to judge whether a local water resources project benefitted the whole nation?" (Ehrhardt and Ehrhardt, 1980, p. 95). It no longer seemed acceptable to leave decisions about such major projects to the "political realm where logrolling and pork barrel politics often predominated the choice" (Ibid., p. 95).

This controversy led to the formal introduction of cost–benefit analysis for public sector project evaluation in the U.S. Flood Control Act of 1936. Cost–benefit analysis "gave politics a rationale similarly rigorous to that of profitability in business but which would also rate a project's worth according to the national welfare" (Ibid., p. 95). The Flood Control Act required that "benefits to whomsoever they accrue [be] in excess of estimated costs" (in Pearce, 1983, p. 14). This deceptively simple rule remains the basic premise of cost–benefit analysis today. It attempts to determine whether or not a public expenditure or public policy contributes to the national welfare: "cost benefit analysis purports to be a way of deciding what society prefers" (Dasgupta and Pearce, 1972, p. 19). Any project that contributes to national welfare is a benefit, while any effect that deters from it is a cost (Dasgupta and Pearce, 1972, p. 19; Downs and Larkey, 1986, p. 108).

However, the interpretation of cost–benefit analysis today differs considerably from that which was common in the 1930s. The practice of cost–benefit analysis in the 1930s and the 1940s did not incorporate much of the theory of welfare economics (Dasgupta and Pearce, 1972, p. 12; Pearce, 1983, pp. 14–5). During the 1930s, interpretation of the Flood Control Act developed in two ways. First, costs and benefits were defined as direct economic costs and benefits (Pearce, 1983, p. 15; Rees, 1985, p. 306). Relatively little attention was given to the environmental and social impacts of projects. Second, practical applications of cost–benefit analysis developed an economic–efficiency perspective; the welfare of the nation was interpreted narrowly as economic welfare (see, e.g. Little, 1957,
p., 77; Dasgupta and Pearce, 1972, p. 12). Other social goals such as income redistribution or environmental quality did not enter the cost–benefit equation.

In contrast to the practitioners of cost–benefit analysis, welfare economists of the early 1900s recognized that projects could result in non–economic costs and benefits that had an effect on economic welfare (Pigou, 1912, 1920). Pigou stated that

smoke in large towns inflicts a heavy uncharged loss on the community in respect of health, of injury to buildings and vegetables, of expenses of washing clothes and cleaning rooms, of expenses for the provision of extra artificial light, and in many other ways (1912, p. 159).

Welfare economists were also modest about their ability to measure social welfare. Pigou (1912, p. 3) recognized that economic welfare is but one part of total social welfare, and that any "rigid inference from effects on economic welfare to effects on total welfare is out of the question" (p. 11). Instead, welfare economists relied upon an assumption that an increase in economic welfare would probably increase total welfare.

2.2 THE 1950s: SOCIAL COST–BENEFIT ANALYSIS

By the 1950s, cost–benefit analysis had begun to receive more widespread application in government decision–making. It became evident to its practitioners that standard procedures were needed for conducting cost–benefit analysis (Dasgupta and Pearce, 1972). Two U.S. documents released in the early 1950s, the Green Book (Subcommittee on Benefits and Costs, 1950) and a Budget Circular (U.S. Government, 1952), began to merge the practice of cost–benefit analysis with the theory of welfare economics (Dasgupta and Pearce, 1972, p. 12). While these early documents continued to focus on economic welfare and economic analyses (Subcommittee on Benefits and Costs, 1950, pp. 2–3), they recognized that non–market effects, such as loss of life or provision of recreation, should be expressed in monetary terms, and intangible effects "should be considered and described in such a way that their importance and influence on project formulation and selection can be clearly
indicated" (Ibid, p. 7). However, the detailed guidelines in the Green Book do not give equal attention to non-market costs and benefits; the emphasis is on intangible benefits (pp. 26–7) but financial costs (p. 36).

In the late 1950s three seminal articles, by Eckstein (1958), McKeen (1958) and Krutilla and Eckstein (1958), outlined clearer links between cost-benefit analysis and welfare economics. These works stressed that governments could have a range of socio-economic and political objectives in addition to economic efficiency. Social welfare was, therefore, not necessarily synonymous with economic welfare (e.g., Little, 1957). There was also a clearer conceptual basis for supplementing economic costs and benefits with a notion of externalities -- costs and benefits not reflected in market transactions but which "alter the physical production possibilities of other producers or the satisfactions that consumers can get from given resources" (McKeen, 1958, p. 136). A cost-benefit analysis should therefore identify the social costs and benefits of projects, which includes both the traditional market effects of projects and the frequently neglected externalities. The term social cost-benefit analysis (SCBA) is sometimes used instead of cost-benefit analysis (CBA) to differentiate between public and private sector project evaluation and to stress that social rather than just financial costs and benefits are to be included.

It is important to understand what welfare economists were saying about social welfare and externalities at the end of the 1950s. Krutilla and Eckstein (1958) and McKeen (1958) recognized that when distributional effects were considered to be important, the results of a social cost-benefit analysis could not be the final word on a project's desirability -- the analysis could only comment objectively on the efficiency aspects. Economists could trace the distributional consequences of a project by identifying economic efficiency costs and benefits received by various regions, income groups or other categories. Within this economic efficiency perspective, economists defined a wide variety of
externalities related to water resource developments that could affect economic efficiency, such as pollution, changes in agricultural productivity, in scenic resources and in recreational resources (McKean, 1958, pp. 135–6). McKean also recommended that when intangibles could not be quantified and when uncertainty was present, the analysis should include separate exhibits on these aspects for the consideration of the decision-maker.

Social cost–benefit analysis began to be used in Canada in the late 1950s and early 1960s, largely in the area of flood control. The Resources for Tomorrow conference held in Montreal in 1961 resulted in a Guide to Benefit–Cost Analysis subsequently published by the Canadian government in 1965 (Sewell et al., 1965). The Guide described cost–benefit analysis from an economic efficiency perspective, mentioning neither the possibility of incorporating other objectives nor the possibility of identifying the regional distribution of efficiency costs and benefits. The Guide did stress the identification of social costs and benefits, including external effects such as changes in scenic resources, the benefit of preserving land in its natural state, the loss of a sport fishery, pollution, and the destruction of wildlife habitat (pp. 6, 10). Moreover, the Guide recommended a progressive approach for dealing with externalities that were difficult to quantify. By producing a qualitative statement of effects, unquantified externalities could be thought of as

... preponderantly positive or negative factors. Thus, the analyst is forced to regard the benefit–cost ratios of tangibles ... to be modified by the value of intangibles. ... Treated in this way they can, at times, tip the balance away from one alternative and result in the selection of another (p. 6).

By the beginning of the 1960s, social cost–benefit analysis represented a technique for evaluating projects in terms of their contribution to economic welfare and provided a framework for incorporating externalities, both quantitative and qualitative, and for identifying the distribution of efficiency gains and losses whether by region or by income
2.3 THE 1960s: SOCIAL WELFARE VS. ECONOMIC WELFARE

During the 1960s, a debate emerged about the proper role of economic analysis in government decision-making. While many economists chose to focus on the economic efficiency of projects, because other social objectives required political input, some economists (Marglin, 1967) and city planners (Lichfield, 1966a, 1966b, 1966c; and Hill, 1967) attempted to more explicitly incorporate multiple objectives in the cost–benefit framework. Yet other economists (e.g., Lipsey and Lancaster, 1957) questioned their ability to make any statement at all about the economic efficiency of projects because the assumptions underlying welfare economics appeared to be invalid (see Chapters 3 and 4 for a detailed discussion).

Marglin (1967) identified social objectives such as income redistribution, employment and national self-sufficiency and specified how costs and benefits were to be defined for each of these objectives within a social cost–benefit framework. This work was further developed in a collaborative effort by Dasgupta, Sen and Marglin in 1972 for the United Nations (Dasgupta et al., 1972). At about the same time as Marglin's earlier work, the Planning Balance Sheet (PBS) was developed in England by Nathaniel Lichfield (1966c, 1969), also in response to SCBA's frequent neglect (in practice, not in theory) of objectives other than economic efficiency. Lichfield was primarily concerned with promoting the use of both economic efficiency and income redistribution as separate components of social welfare, leaving the task of weighting the relative importance of these objectives to decision-makers. Lichfield also stressed the importance of identifying externalities that could not be quantitatively evaluated. The Planning Balance Sheet was not a new technique but rather a more explicit statement of one possible formulation of social cost–benefit analysis with income redistribution as an objective, and a restatement of the proper way to
conduct analysis when intangible effects were present (Lichfield et al., 1975, p. 78).

Shortly after Lichfield's work on the Planning Balance Sheet, Morris Hill developed the Goals Achievement Matrix (GAM) which he touted as a more "rational" method of evaluation than either PBS or SCBA (Hill, 1967, 1973). In the Goals Achievement Matrix, cost and benefits are calculated according to community objectives, which need not include either economic efficiency or income redistribution. Hill claimed that the Goals Achievement Matrix is more rational than the Planning Balance Sheet or social cost–benefit analysis because it does not presume that efficiency and distribution are the sole objectives of a community; in effect, Hill said that cost–benefit analysis could be based on any conception of social welfare. Welfare economists had been saying that for quite some time, and the work by Marglin (1967) and Dasgupta, Sen and Marglin (1972) gave practitioners or SCBA better guidelines for proceeding with this type of multi-objective analysis. Nevertheless, Hill's work did help translate the concepts of cost–benefit analysis into the field of community and regional planning.

The two developments in the theory of welfare economics -- the definition of social costs and benefits, including externalities, and the recognition of multiple objectives -- were slow to be adopted in practice. Practical applications of SCBA continued in many cases to be concerned only with economic welfare and gave little attention to environmental and social externalities that might affect economic welfare. In the 1970s the environmental and social impacts of projects began to receive more widespread attention in both the United States and Canada. Several factors contributed to this new focus: the increased scale and variety of government projects drew attention to major environmental and social consequences (Rees, 1985; O'Riordan and Sewell, 1981); increased protest by environmental lobby groups made environmental quality objectives and social objectives more politically salient (Rees, 1985; O'Riordan and Sewell, 1981); and high levels of
economic growth in the 1970s and consequent expectations of sustained long-term growth made environmental and social goals more affordable (Schramm, 1973; Rees, 1985).

When environmental and social impacts were included in a SCBA, some critics doubted the ability of economists to properly evaluate them because value was measured in dollars. For some reason, dollars were perceived to be inappropriate measures for valuing non-economic impacts (Pearce, 1983, pp. 18-9) (see Chapter 4.1 for a detailed discussion of methodological problems in evaluation). This is the dilemma of social cost-benefit analysis:

> It is precisely because cost-benefit analysts have either ignored these problems, or because they have made bold attempts to value such gains and losses (and boldness is not necessarily a virtue here), that many people have become disenchanted with the procedure. To omit certain gains and losses is to fail to meet the all-encompassing definition of social costs and benefits. To include them is to stand charged with "arbitrariness" or valuing that which cannot be valued (Dasgupta and Pearce, 1972, p. 14).

During the 1970s, critics also stressed the pervasiveness of value judgments in social cost-benefit analysis (see, e.g., Nash et al., 1975). Soon social cost-benefit analysis was perceived to be not sufficiently "objective" (see Chapter 5 for a detailed discussion).

2.4 THE 1970s: ENVIRONMENTAL IMPACT ASSESSMENT

As a result of these forces, the early 1970s saw the development of something called environmental impact assessment (EIA) which stressed the analysis of environmental and social impacts. This development was partly in response to the past failure of economists to incorporate environmental and social impacts in their analyses. As Dasgupta and Pearce noted in 1972, "there is also frequently little or no relationship between practical applications [of SCBA] and the welfare theory which, one supposes, should underlie the practice" (1972, p. 14). It would appear that the concepts of social cost-benefit analysis had not been widely adopted in practice despite the advances made in identifying and
evaluating environmental and social impacts.

In 1969 the U.S. government enacted the *National Environmental Policy Act (NEPA)* (PL 91-190, S.1075) and environmental impact assessment came to be regarded as something distinct from SCBA. The purpose of the *NEPA* was, in part, to "insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking" (s. 102A) and "insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations" (s. 102B).

The *NEPA* required government agencies to consider the environmental consequences of major public projects and policies and produce an Environmental Impact Statement (EIS). This EIS would include a report on:

(i) the environmental impact of the proposed action,
(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
(iii) alternatives to the proposed action,
(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
(v) any irreversible and irreplaceable commitments of resources which would be involved in the proposed action should it be implemented (s. 102C).

The effectiveness of the *NEPA* has been criticized because environmental impact statements developed largely as *inventories* of physical effects rather than as *evaluations* of effects (Rees, 1985). The results was "a new procedure which had to be undertaken before formal decisions were made, [but] did not significantly alter the decision system per se" (Rees, 1985, p. 326).

As environmental impact assessment developed in the U.S. and Canada during the 1970s and 1980s it began to have a wider definition. There was an increasing emphasis on the integration of economic, environmental and social impact identification and, to a
lesser extent, evaluation. While some definitions of environmental impact assessment restrict it to impact *identification*, others have made claims that it is "a process designed to select alternatives, devise policies or suggest mitigation measures that *maximize social welfare*" [emphasis added] (Hyman et al., 1980, p. 210).

2.5 THE 1980s: THE INTEGRATION OF SCBA AND EIA

In practice, social cost–benefit analysis and environmental impact assessment are not the same. Environmental and social impact assessment deals with impact identification, while social cost–benefit analysis deals with impact evaluation. But they are similar in their underlying framework; both are rooted in the rational comprehensive model of decision–making (Hollick, 1981a; Wierzbicki, 1983). SCBA and EIA are *rational* because they follow a systematic and logical procedure, and *comprehensive* because they require the consideration of all alternatives and consequences (Hollick, 1981a, p. 81). There are five basic components of a rational decision model (see, e.g., Bradley, 1973, p. 290; Coleman, 1977, p. 37; Cyert et al., 1956; Hollick, 1981a, p. 81; Lindblom, 1965, pp. 137–8);

1. the recognition of a problem;
2. the definition of goals and objectives;
3. the identification of all feasible alternatives to achieve the goals;
4. the identification of all consequences of each alternative; and
5. the evaluation of the consequences and the selection of that alternative most conducive to the pre–selected goals.

Both social cost–benefit analysis and environmental impact assessment follow the first four steps, but SCBA proceeds to the fifth, as well. Social cost–benefit analysis is often associated only with this final task of evaluation, but it is not concerned solely with it:

... social benefit–cost analysis is not a technique but an
approach. It provides a rational framework for project choice using national objectives and values (Dasgupta, Sen and Marglin, 1972, p. 14).

McKean (1958) recognized early in the development of social cost–benefit analysis that the definition of the problem, objectives, and alternatives was an important component of cost–benefit analysis. However, these tasks are given little if any attention in SCBA guidelines or in the theory of welfare economics; instead, the literature deals primarily with the concepts and tools of evaluation. There are two possible explanations for this emphasis on evaluation. Firstly, the contribution that economists can make to cost–benefit analysis is in the identification of economic impacts and in the evaluation of all types of impacts, whether economic, environmental or social. The definition of goals, objectives and alternatives, and the identification of environmental and social impacts is a multi-disciplinary and political process in which economists have no particular expertise. Secondly, cost–benefit analysis was initially developed for project justification by government budget authorities, and not for project planning by the government agencies in charge of selecting and implementing projects (see Marglin, 1967, p. 18; Downs and Larkey, 1985, p. 114). As a result, economic aspects were paramount.

In contrast, the literature of environmental impact assessment is more closely associated with project planning, giving more attention to problem formulation, the definition of goals, objectives and alternatives, and the prediction of environmental and social impacts. EIA also addresses how information can be gathered, how institutional structures for conducting analyses can be designed and how project impacts can be managed. Little attention is given to specific evaluation techniques.

The literatures of social cost–benefit analysis and environmental impact assessment have diverged, but they are also complementary. The economic literature focusses on evaluation techniques while the impact assessment literature has more to say about general
processes for conducting impact assessments and managing project impacts. Increasingly, environmental impact assessment has paid more attention to linking the project-specific focus of SCBA and EIA to broader planning concepts by encouraging the development and coordination of regional resource policies, goals and priorities (see, for example, Cornford et al., undated; Marshall et al., 1985; Sadler, undated; O'Riordan and Sewell 1981). While this thesis will now turn to an analysis of social cost–benefit analysis, we will return to the literature of impact assessment in the design of administrative procedures for social cost–benefit analysis in the concluding chapter.
CHAPTER 3
PROBLEMS, OBJECTIVES, ALTERNATIVES AND CONSEQUENCES
IN SOCIAL COST–BENEFIT ANALYSIS

The previous chapter identified the five basic tasks involved in a social cost–benefit analysis as:

1. the recognition of a problem;
2. the definition of goals and objectives;
3. the identification of all feasible alternatives;
4. the identification of the consequences of each alternative; and
5. the evaluation of consequences and alternatives, and the selection of the best alternative.

In this chapter we begin to examine some of the problems with social cost–benefit analysis by analyzing each of these five tasks in detail. This chapter looks at the first four tasks to determine the effects on analysis of: different problem definitions and goals; the difficulty in determining a universal set of social goals; the theoretical problems associated with measuring goal achievement; the importance of generating alternatives; and the uncertainty in identifying and measuring project impacts. Chapter 4 then examines some problems encountered in the fifth task of analysis, the evaluation of alternatives.

3.1 PROBLEM FORMULATION AND EVALUATION

Social cost–benefit analysis begins with a problem. Alternatively, we might say it begins with an opportunity. How can we meet an anticipated energy shortfall? Should we build a hydroelectric project? Which hydroelectric project should we build? Generally, the nature of problem or opportunity formulation is this:

for an analysis to take place, someone must have or anticipate a problem, that is, must be dissatisfied with some aspect of the current or projected state of affairs and want to consider a
decision in terms of altering it (Quade, 1975, p. 49).

The way a problem is defined affects all other stages of the decision process -- what objectives will apply, what alternative solutions are possible, what impacts are likely to occur, and what the result of evaluation will be. Defining a problem involves specifying "where you are now and where you want to be" (Downs and Larkey, 1986, p. 131), or alternatively, where you don't want to be in the future. It also involves identifying the constraints that apply to a proposed solution: how much it can cost, how quickly it must be implemented, as well as the ethical, legal and technological constraints that apply (Quade, 1975, p. 35; Hollick, 1981a).

What can we say about public policy problems in general? Quade (1975, p. 8) calls them "messy and ill-defined" and suggests that they are "wicked problems" (see also Mason and Mitroff, 1981, p. 9). A wicked problem has two characteristics: it is complex and that complexity is organized. The complexity of public policy problems means that a problem is actually composed of many problems and issues which are interrelated and difficult to isolate (Mason and Mitroff, 1981, pp. 4-5). Because this complexity is organized, it affects the types of analysis which can be used. Modelling -- exploring the structural relationships among system components -- becomes crucial. Statistical methods suitable for problems with "many individual elements exhibiting independent, probabilistic behavior" are less reliable when applied to problems with many interrelated and inseparable components (Mason and Mitroff, 1981, p. 6).

The prediction of future energy demand is an example of a wicked problem. Energy demand levels in ten years might not be accurately predicted by extrapolating historical growth rates. Demand levels will depend on general economic conditions, both regional and world-wide; the price and relative scarcity of energy resources in general; government policies affecting industrial expansion or energy conservation; and technological
innovation affecting firms’ production processes or creating new industries. These are only a few of the many interrelated factors that influence energy demand which are themselves difficult to predict.

Wicked problems are not only difficult to define, they may be defined differently by different people: many public policy problems are therefore ambiguous. Consider the problem of meeting a region’s future energy demand requirements. We might try to determine the best hydroelectric project to meet future demand, the best conventional energy project (hydroelectric, thermal or nuclear), or the best conventional or non-conventional project (which might encompass geothermal, solar, wind or tidal energy projects as well as conservation incentives and/or energy pricing to reduce demand). Each of these possible problem definitions implies a different set of possible solutions.

The types of public policy problems that become the subject of a social cost–benefit analysis are only a small subset of the vast array of problems that governments face in day-to-day decision-making. As the history of project evaluation has shown, it has typically been only large-scale projects which are required to undergo a social cost–benefit analysis, and it is usually only those large projects likely to have major environmental and social effects that will be evaluated. This is not to say that governments do not perform any analysis if a SCBA is not conducted. Over the last decade, a variety of mechanisms have developed to manage environmental resources, such as leases, licences and permits, referral processes, project approval guidelines, planning processes, inter-agency committees, and multi-agency task forces (for a detailed description, see Dorcey, 1986).

The problems which fall under the purview of impact assessment and social cost–benefit analysis are frequently defined by the agency responsible for project construction. The definition of the problem is affected by an agency’s mandate and its
unofficial preferences. Because SCBA is used primarily for project justification rather than for project planning, problems tend to be defined in one of two ways:

1. Should a particular project be built?
2. Which of several facilities within an agency’s mandate should be built?

Downs and Larkey (1986, p. 119) suggest that the first type of problem definition is the most common in social cost-benefit analysis. Problems are not defined in a broad context in which the one or few proposed projects are only a small subset of solutions to a much larger problem. Problems are not necessarily formulated to optimize the activities of an agency, let alone of a government as a whole; they are formulated only to ensure some minimum level of acceptable activity.

The way a problem is defined will affect whether social cost-benefit analysis can state that a project should be undertaken because it maximizes social welfare, or if it can only state that social welfare will not decrease because a project is undertaken. This point is important to stress because the theory of welfare economics is designed to make statements about optimal resource allocation in society for marginal projects: hydroelectric projects, highways or rapid transit. In contrast, the field of planning attempts to grapple with non-marginal projects: managing the forestry resources of a province, or coordinating industrial development with environmental protection in a region. Analysis of marginal projects is useful and appropriate, but if too few alternatives are considered, we cannot be sure that we are undertaking the best possible project. If we look only at one project and find its benefits exceed its costs, we do not know that other projects might not be better.

Where the single public project that is analyzed comes from is never clear. Why that project and not others? Most public projects probably begin as a gleam in the eye of a citizen or politician who sees potential benefits or in the eye of an engineer in the Army Corps of Engineers who sees a potentially interesting solution to a flooding, irrigation, or water supply problem. There is no persuasive theory of "the optimality of gleams" (Downs and Larkey,
In summary, perceptions and definitions of problems have important implications for the subsequent steps in analysis. People may define problems differently and apply different constraints. The differences may be the result of accurate but fundamentally different perceptions based on values, beliefs, the best available information, or the realities of organizational life; differences may also be the result of problems that are dynamic and inherently difficult to define.

3.2 OBJECTIVES AND EVALUATION

The goals which society pursues are the criteria by which projects are evaluated. In the words of Winch (1971, p. 15), "one cannot assess the appropriateness of a particular policy, nor choose among alternative policies, unless one pays attention both to the probable consequences of those policies and the objectives that are sought." A project's impacts are defined as movements toward or away from these specified chosen goals. Costs and benefits, in turn, measure the relative value of those impacts.

A social cost–benefit analysis could be conducted according to a number of different goals. For example, an analysis could be done from the point of view of one particular individual affected by a project using his or her personal goals, such as maximizing income or acting in accordance with certain religious principles. Alternatively, an analysis might be done according to the objectives of bureaucratic or political decision-makers, which might include the goals of staying in power or maximizing the size of budgets and personnel. The theory of welfare economics, however, says that a social cost–benefit analysis should focus on social welfare, the general welfare of all individuals in society (Krutilla, 1961). Just what constitutes social welfare is as difficult to determine as defining the public interest. Possible determinants of improved social welfare include
higher output (the efficiency objective), a different distribution of income (the equity or redistribution objective), employment opportunities, national prestige or self-sufficiency, or the production of particularly desirable goods or services (generally, see Marglin, 1967; Henderson, 1970; Dasgupta, Sen and Marglin, 1972; Heaver, 1973).

In order for these objectives to provide useful guidelines for analysis, each objective must be defined operationally. For example, economic efficiency could be translated into "increasing the country's GNP." The income redistribution objective must specify what redistribution goals are sought, perhaps according to income levels or regions. Similarly, an environmental quality goal would be translated into more specific objectives such as certain levels of air quality, water quality, or acceptable concentrations of toxic substances. In addition, the relative importance of one objective versus another must be determined if some measure of the overall desirability of each alternative is desired. This would involve stating that economic efficiency is, for example, twice as important as environmental quality, or vice versa.

How can an analyst decide which objective(s) should be used in a social cost–benefit analysis? Welfare economists say that society's objectives should be used, but do not reveal how these objectives can be identified. Different objectives can produce radically different analyses, and the techniques for dealing with some objectives are better developed than for others. The following sections examine the most common objectives addressed in welfare economics: economic efficiency, income redistribution and employment.

3.2.1 The Efficiency Objective

The economic efficiency objective is used in social cost–benefit analysis, almost to the exclusion of all other possible objectives. While techniques have been developed to incorporate multiple objectives in SCBA (e.g. Marglin, 1967; Dasgupta, Sen and Marglin,
1972; Lichfield et al., 1975), these are rarely adopted in practice. This emphasis on the economic efficiency objective perhaps stems from the development of cost–benefit analysis as a device for encouraging fiscal responsibility in government decision-making.

Why should analysis focus only on economic efficiency? Several arguments are possible. Firstly, the efficiency of government decisions should act as a counter-balance to the non-efficiency bias of politicians (Dasgupta and Pearce, 1972, p. 67). Secondly, income redistribution can occur after efficient resource allocations have been made. Thirdly, economic efficiency is the only component of the social welfare function — multiple objectives do not exist. Finally, economic efficiency analysis is more "objective" than more broadly focussed analyses. As noted earlier, this last argument is the one most frequently espoused by economists. As Tribe (1976) notes, analytic tools which focus on single objectives, such as economic efficiency, can be very powerful, but are subject to major limitations as well. The theory of welfare economics reveals several weak links in the underlying structure of social cost–benefit analysis that create doubt about the ability of analysis to lead to conclusive statements about economic efficiency. These weaknesses will be explored in this section.

The welfare economics theory applying to social cost–benefit analysis looks at changes in individual welfare, or consumer surplus, that result from proposed projects or policies. By using the economic efficiency objective, the economist assumes that changes in an individual’s level of consumption are an adequate measure of changes in welfare. A variety of decision rules could be applied to these individual changes in welfare to determine how social welfare is affected. Possible decision rules include, among others: (i) the Pareto criterion, which involves selecting only those projects that do not decrease the welfare of even one person; (ii) the potential Pareto criterion (also known as the Hicks–Kaldor rule or compensation principle), by which a project is undertaken if the sum
of welfare changes for those who benefit from a project is greater than the sum for
those whose welfare decreases; or (iii) the "actual" compensation principle, which is the
potential Pareto rule modified by a requirement that compensation of the "losers" by the
"winners" actually occur.

The selection of a decision rule is ultimately an ethical choice (see Section 4.2 for
a detailed discussion; also Nash et al., 1975). Cost–benefit analysis adopts the
Hicks–Kaldor rule which says that a project would be undertaken if total project costs are
greater than total benefits (for an example of relaxing the Hicks–Kaldor rule in SCBA,
see Brent, 1984). There is no requirement in the Hicks–Kaldor rule that compensation
actually take place (Pearce, 1976).

Krutilla (1967, p. 227) identified three conditions that must hold for the
Hicks–Kaldor rule to lead to an increase in economic welfare:

1. prices equal marginal cost in all sectors of the economy;
2. the income distribution is optimal, or ideal; and
3. the project effects do not alter the existing distribution of income.

How likely is it that the above three conditions will hold, so that the Hicks–Kaldor rule
will actually lead to an increase in economic welfare? Each of these conditions will be
addressed in turn.

Market Prices and Marginal Cost: The Problem of "Second Best"

In an economy, all prices equal marginal cost only in equilibrium in a perfectly
competitive economy. In reality, there are often violations of this rule, such as imperfect
factor and product markets, economies of scale, or divergences between marginal private
cost and marginal social cost (Dasgupta and Pearce, 1972, pp. 105–9). Shadow pricing is
undertaken to correct these violations and to assign prices to non–market resources. A
shadow price is simply "the price the economist attributes to a good or factor on the argument that it is more appropriate for the purpose of economic evaluation than its existing market price, if any" (Mishan, 1982, p. 83).

Although shadow prices can be applied in a social cost-benefit analysis, a problem can result if such shadow prices are not used in all sectors of the economy. When the prices of all goods and services in society do not equal their marginal cost, a "first best" world does not exist and the state of "second best" arises (in general, see Lipsey and Lancaster, 1957). The theory of second best states that, if all prices do not equal marginal cost, there is no theoretical proof that the Hicks-Kaldor rule will actually result in an improvement in economic welfare (see also Krutilla, 1967; Winch, 1971). This means that selecting projects whose total benefits exceed total cost may not result in an improvement in economic welfare. It also implies that, if shadow prices are not used in all sectors of the economy, there is no guarantee that their use in the public sector alone will result in an increase in economic welfare.

Optimal Income Distributions

The second condition for the Hicks-Kaldor test to lead to an increase in economic welfare is that the existing distribution of income must be optimal. Optimality means that society would not feel better off by changing the existing distribution of income in any way: "people deserve rewards equal to their contribution [to society], and hence the distribution of income is good" (Nash et al., 1975, p. 126). Implicitly, social cost-benefit analysis accepts the existing distribution of income as the optimal one by relying on market prices. These market prices are determined by the distribution of income (Foster, 1966).
Is it reasonable to assume that the income distribution existing today is optimal? While some members of society might believe that poor or unemployed citizens deserve their lot, many would disagree. If the income distribution is not optimal, is it nevertheless reasonable to proceed with analysis using this assumption? Several arguments to support this have been put forward. For example, the income distribution may not be optimal, but the costs of redistribution might be greater than the benefits of redistribution; hence, some inequity is tolerated (Krutilla, 1961). Similarly, if redistribution could be more effectively achieved through direct means such as transfers and subsidies, then redistribution could occur after the efficient allocation of resources is determined and concerns about distribution need not affect project selection (Foster, 1966; Henderson, 1970, p. 287). Alternatively, the redistributive effects of a project may be trivial (Foster, 1966) or cancel out across a number of projects (Dasgupta and Pearce, 1972, p. 92). This final argument, however, "does not mean that benefit-cost analysis is free of distributional value judgments" (Krutilla, 1961, p. 229), as it still accepts price data based on the existing distribution of income. According to Foster (1966, p. 310), it is better to argue that the distribution of income is optimal because a democratic society has the power to change it: "One can only counter by flat denial that the existing distribution of income is generally agreed to be the best possible, or by producing evidence that this is not in fact a consensus or even a majority view."

But what if the existing income distribution is not optimal, and none of the previous arguments apply? Then, according to Krutilla (1961), the use of the efficiency objective alone will not guarantee an increase in economic welfare. Changes in consumer surplus cannot be measured directly by market prices because people's "deservingness" might differ from the incomes they actually receive. Market prices could be weighted to reflect a more preferred income distribution (the implications of this are discussed in Section 3.2.2).
The results of these musings about income distribution are mixed. Whether or not the existing distribution is optimal seems arguable. The validity of ignoring redistribution as an objective depends on (i) how far from optimal is the current distribution, and (ii) if it is not optimal, how effective, efficient and desirable are more direct methods of income redistribution (Henderson, 1970, p. 288).

Altering the Distribution of Income: The Scitovsky Reversal Paradox

Additional difficulties arise with the third condition which must hold for the Hicks-Kaldor test to lead to an increase in economic welfare. What happens if the distribution of income is not the same both before and after the project is implemented? If a project changes the distribution of income, economic welfare is maximized only if compensation actually takes place (Krutilla, 1961). If a project changes the existing distribution of income regardless of such compensation, it may be possible to fall into a trap: "we can hypothesise a project involving a move back to the initial position and this project may be sanctioned by the very same test used to justify the move away from that initial position" (Pearce, 1983, p. 17). This is known as the Scitovsky reversal paradox, in which Policy X may be abandoned at time $t=0$ in favor of Policy Y based on their respective net benefits; but when both policies are re-evaluated at time $t=1$ (after Policy Y has been implemented), the analysis suggests abandonment of Policy Y in favor of the old Policy X.

Economic Welfare and Social Costs

It is sometimes incorrectly assumed that a SCBA based on the economic efficiency objective can somehow ignore (other than by accident) non-economic costs and benefits. One definition of SCBA suggests it is a technique "designed to serve the single goal of economic efficiency which is defined solely in terms of economic resources" (Davis, 1984,
Analyses that fail to include non-economic effects will misstate welfare effects. If the production of externalities is a necessary condition for the production of some marketed output, then

\[ \ldots \text{the likelihood that these effects will be generated, and their prospective strength and influence, have to be taken into account in any sensible calculation of the net efficiency benefits of a project (Henderson, 1970, p. 281).} \]

If externalities exist that are difficult to quantify, it may not be possible to calculate an estimate of net benefits without some reference to qualitative factors that cannot be priced (see Section 4.1).

3.2.2 The Efficiency Objective and Income Distribution Weights

Income redistribution weights are sometimes incorporated into a social cost–benefit analysis to reflect more desirable income distributions (e.g., Krutilla, 1961; Weisbrod, 1968; Henderson, 1970). Various weighting procedures have been proposed, but there is no consensus in the literature as to which method to adopt. Five possible weighting procedures include:

1. assigning weights based on the marginal utilities of income of all individuals;
2. assuming that the poor have higher marginal utilities of income;
3. combining #1 or #2 above with a concept of the deservingness of certain groups;
4. assessing deservingness alone (generally, see Henderson, 1970; Dasgupta and Pearce, 1972; Pearce, 1976); or
5. deriving the weights implicit in past policy decisions (Weisbrod, 1968).

Assigning weights based on an individual’s marginal utility of income is an extremely complex task. It requires identifying the specific individuals affected by a project and measuring each individual’s income utility. This requires identifying costs and benefits
at a level of detail not easily obtained, if at all. Even if it were possible to identify all affected individuals, there is no clear theoretical method for measuring income utility (Henderson, 1970).

Because of the difficulties in measuring actual income utility, economists often assume that the poor have higher marginal utilities of income than the wealthy, and then develop methods for reflecting this assumption. Foster (1966), for example, suggests weighting costs and benefits by the ratio of mean population income to an individual's income.

Another common method for estimating income utility is to rely on marginal tax rates which are usually lower for low-income individuals. Nwaneri (1970) derived a variety of weights to scale down costs and benefits to project beneficiaries, while leaving costs to sufferers unchanged. His weights reflect: (i) the marginal tax rate; (ii) the marginal tax rate and the size of the community; (iii) the marginal tax rate, size of community and house price depreciation; (iv) the marginal tax rate and degree of community disruption; and (v) differences in estimated marginal utilities of income.

Deservingness is based on some social judgment about equity; it reflects what society believes individuals deserve, not what individuals believe they deserve or desire themselves. Weights might also be based on an analysis of weights implicit in past policy decisions. These implicit or revealed behaviour weights (Weisbrod, 1968) would be determined by ranking previous decisions and options according to their efficiency costs and benefits, and then weighting various population groups in various ways until the solution is found that makes the actually chosen alternative superior to the others. Those revealed weights would then be used in subsequent analyses.
The inclusion of equity weights in SCBA based on income utility is a relatively contentious procedure. Pearce and Wise (1972, p. 324) criticized Nwaneri's methods as they doubted "the extent to which adjustments for income utilities have anything to do with value judgments concerning equity." Calculating income utilities directly or assuming that the poor have higher marginal utilities of income does not necessarily imply that the resulting weights reflect society's notion of an ideal or more equitable distribution of income. While there is no acceptable theoretical method for determining utility weights and their usefulness may be questioned, there may also be considerable political risk for government decision-makers in applying utility weights or expressing deservingness weights (Henderson, 1970). Ultimately, the selection and specification of utility and/or deservingness weights is an ethical decision.

The use of income distribution weights, however derived, is also criticized because of the resulting effects on the economic efficiency objective. As Pearce (1976, p. 11) notes, these weights "abandon Pareto optimality as an objective" and jeopardize the achievement of the efficiency objective (Winch, 1971, p. 99). Thus, the use of income distribution weights might accept projects that would be rejected on the basis of economic efficiency alone.

3.2.3 The Efficiency Objective and the Redistribution Objective

Income redistribution is pursued as a separate objective in SCBA (rather than incorporated in an analysis as weights) if the distribution existing at the time of the analysis is not the desired one and if redistribution is deemed to be an important function of project selection. According to Henderson (1970, p. 289),

If account is to be taken of distribution effects, especially those between regions, then benefits have to be conceived in much wider terms than is the case when efficiency aspects alone are under consideration. It is not a matter of looking merely at the net efficiency benefits, and trying to determine to whom these are
likely to accrue.

If income redistribution is a component of social welfare, an additional category of costs and benefits would be added to the analysis in which redistribution costs and benefits would be measured as movements toward or away from an income redistribution goal being pursued by society.

The incorporation of efficiency and redistribution (or equity) in a social welfare function is based on the assumption that consumption alone does not have independent value, but rather that the utility derived from consumption has independent value (Henderson, 1970). This utility is assumed to be derived from both the level and distribution of consumption (Lichfield, 1966a, p. 342), and hence both economic efficiency and income redistribution are treated as separate objectives. Maximizing consumption alone (the economic efficiency objective) would be equivalent to maximizing the utility of consumption if all individuals had the same marginal utilities for changes in consumption (Henderson, 1970). Because it is difficult to determine consumption utilities, it is a normative question whether or not marginal utilities are likely to be the same for all individuals.

3.2.4 Other Objectives in Evaluation

Marglin (1967) and Dasgupta, Sen and Marglin (1972) explain how analysis might take into account objectives such as increased employment, national self-sufficiency and the production of merit goods. Because much attention is given to job creation in public policy, this section will focus on the treatment of employment effects and the relationship of employment to other objectives. The concepts underlying this discussion are taken largely from Dasgupta, Sen and Marglin (1972, pp. 85–98).
How is employment reflected in the traditional economic efficiency approach to social cost–benefit analysis? For example, if a hydroelectric project will require 2500 direct construction jobs per year for 10 years, is this a cost or a benefit of the project? Employment is certainly beneficial, but in the economic analysis of a project employment is, strictly speaking, a cost. Money spent on employment (or on capital equipment) represents resources that are consumed in the hopes of creating something more valuable or beneficial.

Whether the economic efficiency approach reflects all the value society places on employment depends on the reasons for which employment is valued. For example, employment might be valued because it generates production and increases a nation's GNP, because it prevents the skills of the labour force from deteriorating, because it reduces or eliminates poverty, or because unemployment results in psychological distress to individuals.

If employment is valued because it generates production, the economic efficiency objective is sufficient for reflecting that value. Although wages are a cost, they are costs that are borne when the benefits of a project — the outputs of that labour — merit it. If employment is valued because it prevents labour skills from becoming rusty, this is also reflected in the economic efficiency objective. However, if employment is valued because it eliminates or reduces poverty, the economic efficiency objective is not sufficient. Such value would be correctly reflected in a redistribution objective. When employment is valued because unemployment has negative psychological effects not related to inadequate income but to the underutilization of human potential, then both the economic efficiency and redistribution objectives are insufficient. Only in this case would employment be treated as a separate objective in SCBA. Using this objective requires careful consideration of the negative effects of open unemployment (people without any work) and underemployment; specifically, how much must be an individual's contribution to society for it to be
considered adequate, and how should it be measured — in hours worked or in more personal measures of individual human potential?

3.2.5 Determining the Social Welfare Function

From the preceding discussion, it should be apparent that selecting objectives for social cost–benefit analysis rests upon value judgments concerning what social welfare is or is likely to be, or upon the aims of analysis — to maximize some broad conception of social welfare or merely to gauge government efficiency.

Little (1957) recognized thirty years ago that there is a tendency in SCBA to confuse social welfare with economic welfare. Economic welfare is only one component of a social welfare function; if it is not the only component, there is no reason to assume that the results of evaluations are making valid claims about improved social welfare. That the use of welfare economics involves making ethical assumptions is rarely recognized in practical applications of SCBA. Little's (1957, p. 77) comments about the abuse of welfare economics are worth repeating at length here.

The truth of the contention that welfare conclusions are value judgements is borne out by the ease with which welfare economists slip from talking about economic welfare into using a frankly ethical terminology.

First, the word "economic" usually gets left out. This greatly increases the emotive effect. If I say "this change will increase economic welfare", it is open to anyone to say "perhaps, but it will not increase political welfare, or welfare in general". This reply is not open if I leave out the word "economic". Putting it in always suggests that the economist's conclusion is not the last word, and that, therefore, the conclusion is not to be taken as a definite recommendation.

Secondly, the word "social", or "community", or "national" is often inserted where "economic" is left out. This also increases the persuasive effect, for all these words are highly emotive to different classes of people. Thirdly, instead of "increase of economic welfare" we very often find the word "benefit". "Benefit" is obviously an ethical word. "Social benefit" and "social advantage" have also been used.
If we are uncertain that economic welfare is an adequate measure of social welfare, a social welfare function must be defined. Kenneth Arrow (1951, 1963, 1983) addressed the challenge of constructing a social welfare function in his book, *Social Choice and Individual Values* (1951).

Arrow defined five conditions that would define an acceptable process for amalgamating individual preferences to produce a ranking of social preferences. Arrow's first condition is that of Collective Rationality: the social welfare function must "give rise to a true social ordering" (1983, p. 15). The second condition, the Pareto Principle or Positive Association of Social and Individual Values, requires that "the social welfare function does not reflect individuals' desires negatively" (1983, p. 24). The third condition, the Independence of Irrelevant Alternatives, holds that "the choice between [two alternatives] x and y is determined solely by the preferences of the members of the community as between x and y" (1983, p. 17). This implies that "all methods of social choice are of the type of voting" (1963, pp. 27–8). The fourth condition is the Condition of Citizens' Sovereignty, which requires that "the social welfare function is not to be imposed" (1983, p. 18), whether by religious, ethical or traditional societal norms. The fifth condition, the Condition of Nondictatorship, requires that "the social welfare function is not to be dictatorial" (1983, p. 19), such that a social welfare function could not be defined by the will of only one person.

In addition to these five conditions, Arrow defines two axioms which describe rationality in the context of choice between alternatives. Axiom I says that "for any pair of alternatives x and y, either x is preferred to y or y to x, or the two are indifferent" (1963, p. 13). Axiom II states that "if x is preferred or indifferent to y and y is preferred or indifferent to z, then x must be either preferred or indifferent to z" (1963, p. 13).
Based on these five conditions and two axioms, Arrow derives two theorems which many people believe have astounding implications for the possibility of constructing a social welfare function. The *Possibility Theorem for Two Alternatives* predicts that when there are just two alternatives, a decision reached through majority voting will produce a social welfare function that satisfies the given conditions (1963, p. 48). This result does not extend to a situation in which there are more than two alternatives. Arrow's *General Possibility Theorem* says that:

If there are at least three alternatives which the members of society are free to order in any way, then every social welfare function satisfying Conditions 2 and 3 and yielding a social ordering satisfying Axioms I and II must be either imposed or dictatorial [emphasis added] (1963, p. 59).

The implications of the General Possibility Theorem are clear: majority voting is incapable of producing a social welfare function which meets Arrow's five conditions. Arrow has also shown in his *Impossibility Theorem* that all methods of producing a social welfare function, and not just majority voting, are incapable of "simultaneously satisfying the conditions of Collective Rationality, the Pareto Principle, the Independence of Irrelevant Alternatives, and Nondictatorship" (1983, p. 72). In other words, there is no theory of social choice from which a social welfare function can be derived which does not violate one or more of Arrow's conditions.

Dasgupta and Pearce (1972, p. 80) summarize the resulting dilemma for social cost–benefit analysis:

In effect, Arrow's theorem states that there exists no method for determining the social ranking of alternative social states which is both based on individual preferences and satisfies some intuitively plausible criteria of "reasonableness" for social choice. The links between collective rationality and individual preferences are thus severed. Hence, Arrow's work has damaging consequences for the theory of welfare economics which has traditionally been regarded as providing precisely such a link. And if this link does not exist for welfare economics, it does not exist for cost–benefit analysis,
which is based upon welfare economics.

Some critics have challenged Arrow's theorem by refuting his methodology or the validity of his conditions. For example, Hildreth (1953) proposed conditions similar to Arrow's but developed a social choice model in which interpersonal comparisons of utility are allowed. Specifically, he alters Condition 3 to allow individuals to express the intensity of their preferences. His results show that there are several methods by which a social ordering can be derived. Similarly, Coleman (1966) argues that Condition 3 should be altered because it is not consistent with individual rationality: individuals vary in their preferences and in their power to implement their preferences in practice. Based on this political model, Coleman derives a weighting scheme for various alternatives whereby the value of each is "equal to the sum of the interests of each individual in the decision, but weighted by the power of the individual. In turn, the individual's power depends upon the value of those issues over which he has some control" (p. 120).

These utilities and preferences are easier to define in theory than identify in practice. According to Dasgupta and Pearce (1972), "the only possible escapes [from Arrow's Impossibility Theorem] foundered upon serious obstacles" (p. 94). The most serious obstacle is measuring interpersonal utility.

3.2.6 Objectives and Analysis

This section has argued that analysis depends on objectives; different objectives produce different analysis and the choice of objectives involves value judgments. Arrow has demonstrated that there may be no way to combine individuals' goals or preferences into a unique social welfare function without violating reasonable rules for aggregation. If this is the case, then adopting any objective(s) is at best a compromise and at worst, irrelevant. No analysis can claim to be the "correct" SCBA for society as a whole.
Instead, different and competing analyses have some claim to validity. And, regardless of the objectives chosen, there is no guarantee that they will actually be achieved because of the weak links in the theory upon which SCBA rests: the theory of "second best," the Scitovsky reversal paradox, and the necessity for compensation to actually take place if the original income distribution was not optimal.

3.3 ALTERNATIVES AND EVALUATION

The way a problem is defined will affect the formulation of alternatives, and the specified constraints will limit the number of acceptable ones (Downs and Larkey, 1986, p. 131). For example, alternatives designed at a project level might refer to certain design features of a hydroelectric dam at one project site. At the program level, a variety of hydroelectric projects at different sites could be appropriate alternatives. And at the policy level, all possible energy programs would constitute the range of alternatives, including hydroelectric and thermal energy, conservation, and non-conventional alternatives such as geothermal, tidal and solar power.

In designing alternatives, an analyst relies on two sources of information: first, the decision-maker or government agency might provide a list of alternatives; and second, the analyst himself may have to seek out alternatives through independent research or in consultation with experts and/or the public. Essentially, the selection of alternatives is a creative process, but two broad types of alternatives do exist: those that differ in nature (e.g., different types of projects with different time horizons) and those that differ in scale (McKean, 1958; Quade, 1975).

Searching for good alternatives is critical to problem-solving because "it is not possible to choose a better alternative than the best in the set that is considered" (Downs and Larkey, 1986, p. 132). The selection of biased alternatives by an agency that both
conducts the SCBA and is responsible for implementing the chosen project is often a more obvious sort of manipulation than "padding" benefits or understating costs. A social cost–benefit analysis is only as good as its alternatives, regardless of the effort and ingenuity spent in identifying impacts and deriving shadow prices.

While it is better to have many alternatives rather than few, time and cost constraints usually prohibit considering all of them. Criteria for selecting alternatives must therefore be developed. Downs and Larkey fear that the criteria used to select alternatives are usually "highly arbitrary."

While benefit–cost analysis has been advertised, in theory and in getting it accepted as a requirement for water resources projects, as an analytic tool for allocating scarce resources among competing projects, there is little competition in practice. There has rarely been simultaneous consideration of different public projects to accomplish the same objective or different projects to accomplish different objectives" (Downs and Larkey, 1986, p. 119).

When important alternatives are ignored due to error or deliberate bias, it is impossible for a SCBA to legitimately claim that a project is the best one to undertake; it can only reveal that the project is superior to a set of inferior projects.

3.4 IDENTIFYING CONSEQUENCES

The identification of project consequences often involves predicting future changes to social, economic and environmental parameters that are affected by the implementation of a project. Downs and Larkey (1986, p. 124) note that "Prediction is the critical problem for benefit–cost analysis." The modelling requirements needed to identify the economic, social and environmental impacts of projects are enormous. Consider the task of identifying just the environmental impacts resulting from the construction of a hydroelectric dam. These impacts might occur upstream or downstream from a dam site or in the reservoir area. The nature of these impacts may be physical, chemical and/or biological (Langford, 1983). Physical aspects include changes in river sedimentation patterns, hydrological regimes of
surface and ground waters, microclimate change, and induced or increased susceptibility to seismic activity. Chemical aspects include both geochemical and biogeochemical changes in water quality, nutrient levels and trace element levels. Biological aspects include changes in aquatic and terrestrial ecosystems (adapted from El-Hinnawi, 1981, p. 261).

A possible array of impacts resulting from the construction of a hydroelectric dam could include upstream effects such as an increased water table with either increased groundwater availability or waterlogged soils. Aggradation of the river channel might result in a silty water supply for upstream users or increased upstream flooding. In the reservoir area, there may be a loss of productive lands which support critical wildlife habitat. The shoreline of the reservoir could lose vegetation, become a barren shore, or suffer bank erosion of up to 12 metres per year (Geen, 1974; Baxter and Glaude, 1980). Stabilization of downstream river flows and the entrapment of nutrients in the reservoir might lead to a loss of fish habitat and lowered estuary productivity.

These examples are only a few of the potential effects arising from hydroelectric developments (generally, see Baxter and Glaude, 1980). Table II provides a more detailed, yet still incomplete, list of the possible effects on upstream, downstream and reservoir areas of the dam construction phase, pre-clearing of the reservoir, and subsequent filling of the reservoir. Table II also describes potential impacts that result after the dam is complete and in operation, such as the impacts of induced erosion, possible water quality changes, the effects of altered flow regimes, biological (habitat) effects in the river system, and the possible results of induced seismicity in the reservoir area.

Potential socio-economic impacts are similarly numerous. These could result directly from the social and environmental effects of projects, or indirectly from the economic activity generated by the project. These impacts can be classified in four categories: land use effects, recreation-specific effects, aesthetic effects and sociological effects. Land use
<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>UPSTREAM</th>
<th>RESERVOIR AREA</th>
<th>DOWNSTREAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir Site</td>
<td></td>
<td>Leave trees:</td>
<td>Log trees:</td>
</tr>
<tr>
<td>Preparation</td>
<td></td>
<td>- reservoir slope stability</td>
<td>- decreased slope stability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- good physical fish habitat</td>
<td>- increased bank erosion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- poor chemical fish habitat</td>
<td>- increased recreational value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- lost timber value</td>
<td>- poor fish habitat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- dangerous recreational area</td>
<td>- improved navigation</td>
</tr>
<tr>
<td>Flooding</td>
<td>Groundwater effects:</td>
<td>- loss of agricultural land</td>
<td>- permafrost undergoes rapid erosion</td>
</tr>
<tr>
<td></td>
<td>- increased water table</td>
<td>- loss of timberland</td>
<td>- increased bed and bank erosion</td>
</tr>
<tr>
<td></td>
<td>- increased water availability</td>
<td>- loss of wildlife habitat</td>
<td>- increased sediment budget</td>
</tr>
<tr>
<td></td>
<td>- waterlogged soil</td>
<td>- shoreline ecotone disruption</td>
<td>- increased stream meander</td>
</tr>
<tr>
<td></td>
<td>- contamination of groundwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion</td>
<td>- upstream aggradation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- increased flooding</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE II (cont')

POTENTIAL EFFECTS OF HYDROELECTRIC DEVELOPMENTS

<table>
<thead>
<tr>
<th>EFFECTS</th>
<th>UPSTREAM</th>
<th>RESERVOIR AREA</th>
<th>DOWNSTREAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality</td>
<td>- increased sediment load</td>
<td>- suspended materials settle out</td>
<td>- oxygen-deficient water harms fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- upstream nutrient inputs accumulate</td>
<td>- turbines increase nitrogen content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- release of toxic substances from soil</td>
<td>- waste discharges less dilute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- release of PCB's from power plant</td>
<td>- changed thermal regime of flows</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- agricultural runoff accumulates</td>
<td></td>
</tr>
<tr>
<td>Flow Regime</td>
<td>- increased flooding upstream</td>
<td>- shoreline vegetation not stabilized</td>
<td>- reduced flows in spring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>by periodic flooding</td>
<td>- more even flows throughout year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- delayed spring break-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- earlier freeze-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- increased saltwater wedge (coastal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- river deltas dry up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- loss of habitat</td>
</tr>
<tr>
<td>Induced Seismicity</td>
<td></td>
<td>- complete dam failure</td>
<td>- downstream physical damage</td>
</tr>
<tr>
<td>and Dam Failure</td>
<td></td>
<td>- flood waves</td>
<td>- dispersal of chemicals trapped in reservoir</td>
</tr>
<tr>
<td>Biological Effects</td>
<td>- loss of anadromous fishery habitat</td>
<td>Temporary changes:</td>
<td>- side channels dry up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increased lake productivity</td>
<td>- changed thermal regime</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- increased fish population</td>
<td>- changed estuary productivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- change in fish species</td>
<td>- bubble gas disease in fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- change in fish parasites</td>
<td></td>
</tr>
</tbody>
</table>

effects include: the loss of agricultural and grazing lands; loss of lands which support commercial fishing, hunting, guiding, trapping or mining activity; and loss of park or wilderness areas. Recreation-specific effects include changes in the availability of areas for boating, swimming, camping and picknicking. Aesthetic impacts involve changes in scenic vistas and the loss of unique, historical or archaeological sites. Sociological effects include changes in human health and safety, employment, lifestyles, and population patterns (adapted from Ableson, 1979, pp. 78–79). A more complete list of possible impacts is given in Table III.

The preceding discussion has focussed on environmental, social and economic consequences of projects but there are other types of consequences which arise but which might be ignored. Fischhoff et al. (1981, p. 13) identify psychological and political/ethical consequences. Psychological consequences include worry and anxiety, alienation and confidence in the future. Political/ethical consequences may affect the centralization of societal structure, personal freedom, international relations and societal resilience.

To measure impacts we obviously need to define what an impact is. In SCBA, an impact is defined as the difference between the conditions that would exist if the project were not implemented and the conditions that result after implementation. This approach does not take into consideration the effects of a project on any existing economic, environmental and social goals and does not take into account other projects that may have impacts on the same resources. The problem that may result is one of cumulative impacts, in which individual project impacts are measured against continuously deteriorating baseline conditions because there is no coordination between projects and because the effects of a project on existing goals are not recognized. If a hydroelectric dam will decrease the habitat and population of an endangered species which is being managed to increase its population, is the true impact measure the decrease in population from today's
# TABLE III

POTENTIAL SOCIO-ECONOMIC IMPACTS

<table>
<thead>
<tr>
<th>LAND USE:</th>
<th>CULTURAL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grazing</td>
<td>Acquisition Effects</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Accessibility Effects</td>
</tr>
<tr>
<td>Fishing</td>
<td>Noise Effects</td>
</tr>
<tr>
<td>Trapping/Guiding</td>
<td>Population Effects</td>
</tr>
<tr>
<td>Residential Development</td>
<td>Population Distribution</td>
</tr>
<tr>
<td>Commercial Development</td>
<td>Employment Effects</td>
</tr>
<tr>
<td>Industrial Development</td>
<td>Cultural Patterns</td>
</tr>
<tr>
<td>Mining</td>
<td>Human Safety</td>
</tr>
<tr>
<td>Resort Area</td>
<td>Human Health</td>
</tr>
<tr>
<td>Special Purposes</td>
<td>Rehousing Effects</td>
</tr>
<tr>
<td>National Park</td>
<td>Resident Response</td>
</tr>
<tr>
<td>Wilderness</td>
<td>General Public Response</td>
</tr>
<tr>
<td>Port Development</td>
<td>Special Group Response</td>
</tr>
<tr>
<td>Defence Establishment</td>
<td></td>
</tr>
<tr>
<td>Active Recreation</td>
<td></td>
</tr>
<tr>
<td>Passive Recreation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AESTHETIC:</th>
<th>RECREATION SPECIFIC:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenic Views</td>
<td>Hunting</td>
</tr>
<tr>
<td>Natural Bushland</td>
<td>Fishing</td>
</tr>
<tr>
<td>Open Space</td>
<td>Boating</td>
</tr>
<tr>
<td>Landscape Design</td>
<td>Swimming</td>
</tr>
<tr>
<td>Unique physical features</td>
<td>Sporting</td>
</tr>
<tr>
<td>Parks &amp; Reserves</td>
<td>Camping</td>
</tr>
<tr>
<td>Playing Fields</td>
<td>Hiking</td>
</tr>
<tr>
<td>Monuments/Historical Sites</td>
<td>Picknicking</td>
</tr>
<tr>
<td>Archaeological Sites</td>
<td>General Aviation</td>
</tr>
<tr>
<td>Visual Impact</td>
<td></td>
</tr>
<tr>
<td>Foreshore Reserves</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Abelson, 1979, pp. 78-80.
levels or the effect of this decrease on the goals we are attempting to achieve?

How predictions are made, and by whom, will have an important bearing on the accuracy of prediction. Because of the breadth of impacts involved in large projects such as dams, an inter-disciplinary approach to social cost-benefit analysis is probably required:

For a dam project you may want an electrical engineer to forecast the hydroelectric power that will be produced; a hydrologist to project impacts on water supply; an agronomist to forecast the impact of increased water supply on crop yields; a commodities trader or an agricultural expert to forecast the value of changes in crop yields; and a recreation expert familiar with the area to forecast in consultation with an ichthyologist and a psychiatrist, the recreational usage of the reservoir; and so on (Downs and Larkey, 1986, p. 135).

Not only are the modelling requirements for impact prediction enormous, but some impacts may be extremely difficult to predict. Causal relationships among system components (whether economic, environmental or social systems) may not be well understood when systems are complex. Impact predictions will have large margins of uncertainty, while some impacts may not be successfully identified at all. As Quade (1975, p. 166) notes, it was impossible at the beginning of the twentieth century to predict the impact that the motor car would have on lifestyles and economic activity. Similarly, it would have been difficult to predict a century ago the importance of plant and animal derivates in today's pharmaceutical industry (Kellert, 1984, p. 356).

Because of the uncertainty and complexity of future impacts, many predictions are no more than the educated guesses of experts. Even sophisticated predictive models are not immune to subjectivity.

The point is that every so-called quantitative analysis, no matter how innocuous it appears, eventually passes into an area where pure analysis fails and subjective judgment enters. This is important; in applying this judgment the real decisions may be being made. In fact, judgment and intuition do not merely enter quantitative analyses when assumptions are made and when conclusions are drawn; they permeate every aspect of analysis in
limiting its extent, in deciding what hypotheses and approaches are likely to be more fruitful, in determining what the "facts" are and what numerical values to use, and in finding the logical sequence of steps from assumption to conclusions (Quade, 1975, p. 164).

Perhaps even more serious than the existence of uncertainty and analyst judgment is the failure to explicitly recognize this uncertainty and judgment in SCBA: "not in the use of judgment but in the failure to emphasize the difference in results and recommendations based on judgment alone" (Quade, 1975, p. 165). If the uncertainty of predictions is not clearly stated, the evaluation of impacts may be made meaningless. As Downs and Larkey (1986, p. 124) note,

It is not unusual to find an economist exercising great genius (and spending a lot of time and money) in pricing "recreation user days" or "pain and suffering" when the forecast quantities are only accurate within 200 percent.
CHAPTER 4
EVALUATION ISSUES IN SOCIAL COST-BENEFIT ANALYSIS

This chapter explores the problems that arise in the fifth task of SCBA — evaluation. In particular, we will address the evaluation of environmental resource impacts: how physical environmental impacts are transformed into economic costs and benefits, how future impacts are discounted, and how uncertainty is reflected in the evaluation.

A social cost-benefit analysis is used in two ways: to determine if the benefits of one alternative outweigh its costs and to compare several alternatives against each other in order to determine which one alternative best meets the objectives of the analysis. The chosen alternative is selected based on its excess of benefits over costs; the alternative with the highest net benefits contributes most to the achievement of objectives (see Pearce, 1983 for a discussion of the limitations of net benefits and the benefit/cost ratio). In order for the goal of evaluation to be accomplished,

1. all impacts must be expressed in the same units — changes in non-market resources must somehow be expressed in dollars;
2. impacts at different points in time must somehow be made comparable — a decision must be made whether or not to discount future costs and benefits and at what rate;
3. uncertain impacts must be reflected in the evaluation.

This chapter will explore some of the economic issues in SCBA in each of these areas.

4.1 NON-MARKET RESOURCES

Non-market resources, also called environmental resources or unmarketed goods, are resources "capable of producing amenity services that are generally consumed on site, with little or no transformation by ordinary productive processes" (Fisher and Krutilla, 1975a, p.
Hufschmidt and Hyman (1982) have grouped these non-market resources into three categories:

1. outdoor recreational services;
2. outstanding scenic, historic, cultural and scientific resources of a collective goods nature; and
3. services associated with the capacity of an environment to function naturally and assimilate the residuals of human activities (p. 37).

If a project changes non-market resources in some way, those changes must be reflected in a social cost-benefit analysis. Because there are no markets for such resources, they are referred to as external effects (Dasgupta and Pearce, 1972). Non-market resources are important to project evaluation in order to compare losses and gains of different types and determine if a project results in net benefits or net losses. It is also important in the comparison of different project alternatives. Evaluation, therefore, tries to express impacts of different types (such as the loss of 100 acres of wildlife habitat and an increase in national income) in the same units.

When markets for resources do not exist, how can they be included in a social cost-benefit analysis? Because an analyst has no direct measure for estimating how individuals value non-market resources, he must derive a shadow price. He is faced with such questions as: How much is a scenic view worth? How can that worth be expressed? Economists have developed a variety of evaluation techniques for answering such questions (described below). All of these methods generate some dollar value which individuals might place on a scenic view or a wilderness area, for example. Although dollars are used as the measuring unit, the units could just as easily be conch shells. It is important to understand why dollars are used. Pearce’s (1983, p. 5) comments are reproduced at length here.

It has nothing to do with being obsessed with money, and everything to do with the fact that markets are the only contexts in which individuals express millions of preferences daily. The political system does not begin to compare. We would have to
have endless referendums and elections to get remotely near the complexity of the market-place, whether it be the local fish market, the Stock Exchange or something as complex as the foreign exchange market.

Within these markets countless individuals express their preferences for or against goods and services. They vote for them by buying them and against them by not buying them. The means that they use to express their votes is, of course, money. Those votes could be expressed in terms of any measuring-rod. It so happens that money has evolved as a convenient measuring-rod. Had it been cowrie shells or camel bells they would still have been "money", which is simply a word for the medium of exchange. In this respect there can be no objection to a technique which seeks to elicit preferences expressed in terms of money.

In social cost-benefit analysis, two general approaches for valuing changes in non-market resources have been developed: economic surrogates and hypothetical valuation. Economic surrogate methods include the travel cost approach (Clawson method), property value studies and related expenditures on complements or substitutes. Hypothetical valuation techniques involve the use of surveys of willingness-to-pay (WTP) or willingness-to-sell (WTS), contingency games and tradeoff analysis (for a general description of these techniques, see Hufschmidt and Hyman, 1982). The most widely used methods are the economic surrogate methods as well as WTP and WTS surveys. The critical questions associated with these methods are whether or not they reflect all the changes in welfare or value associated with non-market resources, and whether or not all the changes in value can be measured in dollars.

4.1.1 Valuing non-market resources: non-users, bias and option value

Economic surrogate and hypothetical valuation techniques are usually designed to measure what people would be willing to pay to use a resource: what someone would pay to use a park facility, to have a scenic view or to reduce pollution in a lake. The derived measures would be approximations of the consumer surplus benefit resulting from the use of a natural environment (Greenley et al., 1981). Both the Clawson and related
expenditure methods attempt to indirectly assess the value of non-market resources by estimating how much money a person spends to use a non-market resource, including costs of travel and costs incurred for any associated market goods. For example, to estimate the value of a camping ground, one could calculate the average expenses incurred travelling to the site plus assign some portion of the value of goods required on a camping trip (such as tents, fishing rods, etc.). Alternatively, an analyst might compare property values of land surrounding a scenic site to similar land without a scenic view. Higher property values in a scenic area would supposedly reflect the premium people were willing to pay to have access to such a resource; it is an estimate of the value of that non-market resource.

There are many practical problems involved in applying economic surrogate methods. In the property value approach, it may be difficult to find areas with identical characteristics. Differences in property values might easily reflect characteristics other than proximity to a scenic site, such as different community facilities, lower crime rates, less traffic, etc. Although the related expenditures approach has been used to value recreation benefits and pollution costs, it is weak for recreation because substitutes and complements may also be unpriced, and questionable for pollution as the procedure focusses on equating costs of abatement with demand or value, an equality which may not hold in an imperfect market of unpriced collective goods (Hufschmidt and Hyman, 1982, pp. 40-1).

Maler (1977) has criticized the property value approach to valuing environmental quality because it only measures the willingness-to-pay of those who use the resource. It thus embodies an implicit assumption that

an individual is only concerned about environmental quality if he is consuming a positive amount of the private good. Applied to sport fishing the assumption would imply that an individual is concerned about water quality in a lake if he is using the lake for sport fishing. If he is not using the lake, then he would not be willing to pay anything for quality improvements in the lake (p.
McAllister (1980, p. 129) criticizes the Clawson method for also failing to reflect the preferences of non-users, while Meyer (1974) expresses concern that this method underestimates use value when a high concentration of users live close to a recreation site. In response to these criticisms, some economists have recently developed methods to reflect non-consumptive uses of natural resources such as wildlife and wilderness (see, e.g., Hay and McConnell, 1979; Brookshire et al., 1983; Walsh et al., 1984).

Hypothetical willingness-to-pay surveys are a common alternative to economic surrogate techniques. Through the use of surveys, an analyst directly asks an individual what he or she would be willing to pay to obtain some desired non-market resource such as a campground or a pollution-free lake. While seemingly more simple and direct than the economic surrogate approach, the use of surveys suffers from the difficulty of encouraging people to reveal their true preferences. Fischer (1975, pp. 31–2) has summarized this problem of strategic bias as follows:

... if people believe their responses to willingness to pay questions will affect their actual taxes or prices they will have a monetary incentive to understate their true preferences or satisfaction levels. On the other hand, if people believe their responses to such questions will not affect their taxes or prices they will have an incentive to overstate their true value estimates. In addition, they have the additional incentive to be a "free rider" on other people's willingness to pay if they believe the government will implement the environmental program regardless of the amount they specify.

Other types of bias that may exist include information bias, hypothetical bias, and sampling, interviewer and non-respondent bias (see Schulze et al., 1981). In a comparative analysis of six willingness-to-pay studies, Schulze et al. (1981) found no overriding problems with bias and also found that economic surrogate and hypothetical valuation approaches produced similar results.
All evidence obtained to date suggests that the most readily applicable methodologies for evaluating environmental quality — hedonic studies of property values or wages, travel cost, and survey techniques — all yield values well within one order of magnitude in accuracy. Such information, in our view, is preferable to complete ignorance.

An additional problem with both economic surrogate and hypothetical valuation techniques arises because these methods generally rely on estimating the preferences of people that actually use non-market resources. There may be people who do not directly use such resources but who nevertheless derive some benefit from them and who would be willing to pay some amount of money for their preservation. Weisbrod (1964, p. 472) has suggested the existence of a value other than use value, called option value, which arises from "people who anticipate purchasing the commodity (visiting the park) at some time in the future, but who, in fact, never will purchase (visit) it. Nevertheless . . . they will be willing to pay something for the option to consume the commodity in the future."

The two necessary conditions for the existence of option value are uncertain future demand for a resource, and a project that has an irreversible effect on that resource. An irreversible effect is one that is infinitely costly to reverse and whose authenticity of reversibility is questionable (Arrow and Fisher, 1974; Fisher and Krutilla, 1975b; Pearce, 1983).

Krutilla (1967) expanded Weisbrod's (1964) definition of option value to reflect values placed on natural environments not necessarily associated with potential future use, such as existence and bequest values. Option, existence and bequest values (Krutilla, 1967, pp. 780-4) are defined as:

Option value: a willingness to pay for retaining an option to use an area or facility that would be difficult or impossible to replace and for which no close substitute is available.

Existence value: satisfaction from knowledge that part of wilderness
North America remains even though [an individual] would be appalled by the prospect of being exposed to it.

Bequest value: a desire to leave one’s heirs an estate [of natural resources].

Practical applications of economic surrogate and hypothetical valuation approaches designed to measure consumer surplus have been criticized for their neglect of option, existence and bequest values. Arrow and Fisher (1974) have shown that option values are distinct from use value, or consumer surplus. In an experimental study, Greenley et al. (1981) found that option value was non-trivial in relation to use value. The benefits of preserving a particular natural environment were equal to $958 million when option, existence and bequest values were included, in contrast to the estimate of $414 million for use value alone. Differences in method in this instance clearly result in differences in analysis.

The option value concept, however intuitively appealing, has been the focus of a complex theoretical debate. For example, Schmalensee (1972) has shown that option value can be positive, negative or zero and therefore recommends ignoring option value. More recently, Bishop (1982) has claimed that option value is positive when the supply of a resource is certain, but may be either positive or negative when demand is uncertain.

4.1.2 Valuing non-market resources: economic principles and legal rights

There are more troublesome problems associated with marginal willingness-to-pay measures than the problems of bias, neglect of non-users, and option value. These problems are associated with the way in which estimates of consumer surplus (or marginal WTP) are derived. Both the economic surrogate and hypothetical valuation approaches attempt to calculate the amount an individual would be willing to pay to continue his present use of some environmental resource. In the jargon of welfare economics, this is known as the
"compensating variation" (CV). There is another measure of consumer surplus based on the amount of compensation an individual would require to forego his present use of a resource, the "equivalent variation" (EV) (see Gordon and Knetsch, 1979). Many economists have assumed that these two measures of consumer surplus, CV and EV, are the same. Because it is difficult to calculate CV's and EV's, they have also assumed that a simpler method of calculating consumer surplus can be used to estimate willingness-to-pay. That simple measure, based on changes in prices and quantities irrespective of income effects, is the widely used "Marshallian estimate" (see Pearce, 1983).

There are several problems associated with measuring the consumer surplus of environmental or non-market resources which affect both the Marshallian estimate and the CV and EV estimates. Randall and Stoll (1980, p. 450) have found that the Marshallian estimate can be validly used to measure consumer surplus except when analyzing "projects or programs which have the potential to significantly modify unique environments, endangered species, threatened cultures, or the life and health expectancies of human beings." This implies that the use of a Marshallian estimate for valuing environmental resources may not be valid; instead, CV or EV measures are required.

Randall and Stoll (1980) further note that estimates of CV and EV are likely to diverge for non-market resources. In particular, the CV estimate (or WTP) of a welfare gain will be much smaller than the EV estimate (or WTS) (and vice versa for a welfare loss). The difference between these two measures is usually assumed to be the result of an income effect -- WTP does not reflect the marginal utility of income (Dasgupta and Pearce, 1972, p. 44).

Given two divergent estimates of consumer surplus, which one should be used for environmental resources, WTP or WTS? (Note that these are more correctly call "marginal WTP" or "marginal WTS"). Krutilla and Fisher (1975, p. 36) claim that WTP should be
used for measuring welfare gains and WTS for measuring welfare losses (see also Meyer, 1979). In a study of fish and wildlife valuation, Meyer (1979, p. 225) states that

the welfare criteria . . . requiring that for any reallocation of society's resources, gainers must be able to compensate losers, would seem to clearly require that "losses" of fish and wildlife amenities be measured by a willingness-to-sell approach.

In practice, most techniques for measuring consumer surplus rely on willingness-to-pay. Meyer (1979) suggests that this is the result of a belief that WTP and WTS do not diverge; but recent evidence to the contrary has not changed the prevalence of the WTP approach.

The application of WTS in social cost-benefit analysis seems to be limited to situations in which the cost or benefit received by an individual affects something to which he has a right (see Banford et al., 1980, p. 34; McAllister, 1980, p. 98; Dasgupta and Pearce, 1972). If an individual does not have a right to a resource, a WTP estimate will apply and his preference will be constrained by his income. If he does have a right, such as a property right, WTS would be used and the compensation he demands might well exceed his WTP. Because the use of WTS involves a very different notion of individual rights than that inherent in WTP, Meyer has examined the legal positions of individuals with respect to publicly-owned environmental resources. In his estimation, "In Canada, the doctrine of individual rights under a concept of public trust seems not well advanced" (Meyer, 1979, p. 231). Because the legal positions of individuals are ambiguous with respect to publicly-owned resources, they are not asked what they would require in compensation (WTS) to give up those resources. Rather the estimate is based on what they would be willing to pay to receive or "buy" those resources from the government. Meyer seems to prefer the economic principle over the legal one: the "economic principle would seem to require that the compensatory needs of those citizens experiencing losses be properly considered" (1979, p. 233).
The choice between WTP and WTS measures is not clear-cut because of these differences between economic and legal principles, and it is further complicated by the difficulty of calculating either measure. Gordon and Knetsch (1979) attempted to test whether or not the differences between a WTP and WTS estimate could be explained by an income effect, as commonly assumed. Their analysis, while not conclusive, provided "no support for the income effect being the complete explanation of the difference. . . . Indeed, the results seem to offer contradictory evidence. The amounts of compensation demanded as well as the willingness-to-pay figures are positively related to household incomes" (p. 5).

The calculation of WTP or WTS estimates is also complicated by the role that information plays in determining and valuing preferences. Hufschmidt and Hyman (1982, p. 40) question the usefulness of both economic surrogate and hypothetical valuation approaches because they require individuals to possess high levels of rationality and knowledge. According to Fischer (1975, p. 30), for an individual to be able to maximize the satisfaction he derives from his income he must have:

- full knowledge about the full range of available goods and services,
- full knowledge of the relationship between the goods or service and the satisfaction derived, full knowledge of prices of alternative goods and services, full knowledge of money incomes over his planning horizon, and full knowledge that his behaviour will not affect prices.

This knowledge may not be available for non-market resources such as environmental quality because "environmental quality levels are not directly exchanged and are rarely the result of deliberate choices" (Fischer, 1975, p. 32). Therefore, while the amount an individual is willing to pay will depend on his knowledge of the situation, this knowledge may not coincide with what actually occurs.
4.1.3 Intangible Effects

Intangible project effects are those too subtle or elusive to fully describe, measure in some meaningful way, or adequately price. Tribe (1972, p. 33) classifies intangible effects, or fragile values, into three kinds. First, there are those resources that are "intrinsically incommensurable" which play a central but often unrecognized role in human satisfaction: ecological balance, species diversity and unspoiled wilderness, for example. Secondly, there are those resources with "inherently global, holistic, or structural features" that cannot be reduced to a set of independent attributes: urban aesthetics, community cohesion, and ecological balance. Thirdly, there are the more personal and emotional resources or values, such as the integrity of the body (the right to see, hear, breathe or live) and the integrity of the community or neighbourhood. A body of techniques for valuing different types of project effects is rapidly growing (see, for example, Crutchfield, 1983; Livengood, 1983; Walsh et al., 1983; Crocker, 1985).

Some economists, such as Hill (1973) and Pearce (1976), are confident that ultimately all effects can be priced. Critics such as Fischer (1975), Tribe (1976), Kelman (1982) and Swartzman (1982) are skeptical of such claims because of what they describe as the reductionist nature of quantitative techniques. Assigning prices to the more intangible non-market resources, such as scenery or wilderness hiking, might actually reduce their value for two reasons (Kelman, 1982): (i) due to the loss of positively-valued feelings associated with non-market exchanges (which Swartzman summarizes as the problem of assigning an instrumental value to an intrinsic value); and (ii) because some things may be "not for sale," a label used as a value-affirming or value-protecting device (Kelman, 1982, p. 147). This notion of something being "not for sale" and having intrinsic value -- such as fundamental political rights -- emphasizes the non-utilitarian principles (see Chapter 5.2) which are by their very nature left out of any quantitative analysis. Tribe
(1976) warns that SCBA’s emphasis on quantification has moved environmentalism away from being an ethical tenet toward being merely a utilitarian index of costs and benefits, an emphasis which he feels may erode the original sense of ethical obligation expressed in non-utilitarian principles (see also Dorfman, 1976, p. 167).

The alleged reductionist nature of quantification can also "foreshorten value discontinuities" (Tribe, 1976). A value discontinuity may arise when tradeoffs must be made between utilitarian and non-utilitarian aspects of a decision (Kelman, 1982). For example, assume that a decision-maker made a decision in the past by choosing a project that involved a risk of ten human deaths. The decision-maker might have been concerned about a variety of objectives, such as economic efficiency, political acceptability, environmental quality, ethicality, as well as risk to human life. Because some of these concerns may be non-utilitarian, the decision-maker would engage in deliberative judgments about these "additional elements . . . which cannot be reduced to whether benefits outweigh costs" (Kelman, 1982, p. 142). That is to say, his decision would involve tradeoffs between the economic efficiency calculations in an SCBA and several non-utilitarian objectives. If we examine the decision that was made and discover that an alternative project was rejected which had additional net benefits of $100 million but also involved the risk of an additional twenty deaths, we might be tempted to say that the value of one human life is equal to $5 million. We could then use this $5 million figure in future decisions. But Kelman (1982) argues that this calculation, or equivalency, foreshortens the value discontinuities because it does not identify other non-utilitarian tradeoffs that might have been made — such as human life versus environmental quality versus political popularity or votes (see Chapter 5.2 for further discussion of ethical frameworks). The equivalency was not used by the original decision-maker as an input to the decision process; it represents only an end-product which does not fully reflect the process of deliberative judgment.
4.2 THE DISCOUNT RATE

Once cost and benefit streams have been measured in common units such as dollars, SCBA attempts to make these different streams comparable by discounting future costs and benefits. Why should future costs and benefits be discounted? As Pearce (1983) notes, the reasons for discounting arise from the value judgment implicit in SCBA that consumer preferences matter (see Chapter 5.1). Consumer preferences for discounting future impacts are revealed through the existence of a positive rate of interest in the economy or may be assumed by the notion that people generally prefer current rather than future benefits (Pearce, 1983, p. 38).

In economic theory, there are two approaches for calculating a discount rate which reflect the two rationales given above for assigning a positive discount rate. The social opportunity cost of capital (SOCC) is the rate of interest that an alternative project would produce — generally equivalent to some type of market rate (Pearce, 1983, p. 43). The social rate of time preference (SRTP) represents the rate at which society is willing to trade present for future consumption — often assumed to equal the long-term rate on riskless government bonds (generally, see Baumol, 1968; ELUC, 1977; Pearce, 1983; Treasury Board Canada, 1976).

In theory, and in a perfect market, the SRTP and the SOCC should be equal. In reality, they differ. The SRTP may be lower than the SOCC for several reasons: first, due to the existence of tax which increases the rate (SOCC) which the private sector must earn in order to achieve an after-tax return equal to the SRTP; second, because government is less risky than the private sector, the government can get funds at a lower rate (see Pearce, 1983). Sen (1961) has additionally suggested that the SOCC and the SRTP may not always be identical because of the isolation paradox, in which "individuals would voluntarily enter into a social contract committing them to increase their total
savings, for the benefit of future generations, above the level they chose privately" (Warr and Wright, 1981, p. 129). This divergence between individual and social interests might suggest a SRTP lower than the SOCC. According to Baumol (1968), the SRTP should not be higher than the interest rate on riskless government bonds, but could be lower if it was thought that society's perceptions with regard to future generations were myopic (i.e., resources were being consumed too rapidly, at a non-optimal rate). Fisher and Krutilla (1975a) find that shadow pricing to reflect the scarcity of natural resources is a more direct way of dealing with myopic perceptions.

The existence of two different discount rates can be handled in several ways. For example, both the SOCC and SRTP could be estimated and both used to discount at a variety of rates, such as 5, 10 and 15 percent (Treasury Board Canada, 1976, p. 26). An alternative would be to apply the SOCC and SRTP differentially to project costs and benefits (Pearce, 1983). Costs would be discounted by the SOCC when financed by borrowing (foregone private investment) and discounted by the SRTP when financed by taxes (foregone consumption). Similarly, benefits accruing as cash flows would be discounted by the SOCC while all other benefits would be discounted by the SRTP (Pearce, 1983, p. 49).

The use of a discount rate lower than the market rate is not accepted by all economists. Warr and Wright (1981) submit that the existence of the isolation paradox is a matter of individual judgment, and even if such a paradox did exist, the appropriate discount rate to use is still the market rate of interest; discounting at a rate lower than the market rate would not create a welfare gain. Fisher and Krutilla (1975a, p. 370; see also Krutilla and Fisher, 1975, p. 64) claim that inefficiency results if a discount rate lower than the market rate is applied to public-sector projects. If this rate were applied to all projects in the public and private sectors, it might actually increase the rate at
which exhaustible or non-renewable resources were depleted (see also Scott, 1955, pp. 120-1; for a statement to the opposite effect, see Pearce, 1976, p. 151).

Because of the uncertainty surrounding the selection of an appropriate discount rate, many analyses discount at a variety of rates around the market rate. In Lichfield's Planning Balance Sheet, capital and operating costs are discounted at a market rate; but because Lichfield's use of PBS has involved little quantification of benefits in dollars, he has offered little guidance as to how he perceives PBS should approach the discounting dilemma. Hill (1973, p. 29) suggests that discounting in the Goals Achievement Matrix should be done at some politically-determined rate corresponding to social objectives, presumably the SRTP rather than at the market rate.

The advantage of using a market-derived discount rate is that it is more readily ascertainable than the SRTP. Derivation of the SRTP relies on government or social judgment. Hufschmidt and Hyman (1982) note that government's time horizons may also be myopic; it is partly for this reason Warr and Wright (1981) warn that public policy seldom resembles "the form of all-embracing social contract" required to resolve the isolation paradox and derive a SRTP. The disadvantage of using the market-based SOCC is that it changes over time in response to changes in the amount and distribution of real income, tastes and technological change. Whether the SOCC or SRTP is used, the use of a constant discount rate applied to distant future cost and benefit streams ignores the possibility of changing market rates or social time preference rates in the future.

The practical result of applying any positive discount rate against future costs and benefits is to give less weight to future impacts in a cost-benefit calculation. Some critics dislike the implicit ethical assumption of discounting the preferences of future generations (e.g., McAllister, 1980; Pearce, 1983), while others counter that the use of a zero or low discount rate discriminates against present society by redistributing resources to a probably
wealthier future society (Baumol, 1968, p. 801). Several adjustments to cost-benefit analysis have been suggested to accommodate concern for future generations. Pearce (1983) suggests the use of an inter-generational compensation fund based on the premise of applying the Hicks–Kaldor criterion across generations as well as within current society. McAllister (1980, p. 112) would like to limit the use of discounting to "first-generation" costs and benefits, using a zero rate of interest for second and subsequent generation impacts.

4.3 RISK, UNCERTAINTY AND IRREVERSIBILITY

This section examines the effects of risk, uncertainty and irreversibility on project costs and benefits. Risk is defined as a situation in which the range of possible outcomes is known, as are the probabilities associated with each outcome. Such probabilities would be objective probabilities based on past experience or on models of system behavior. Uncertainty is of two types: first, the range of possible outcomes may be known, but the probabilities associated with those outcomes are unknown (Pearce, 1983, p. 73); and second, neither the outcomes nor their probabilities are known.

There are two methods for dealing with risk in evaluation. The first is to calculate the "expected values" of costs and benefits by multiplying the various outcomes by their probabilities and summing them. This approach assumes that individuals are risk-neutral; if individuals, or society, are risk-averse, the "certainty equivalent" of the uncertain costs and benefits must be derived by applying an individual or societal risk-utility function to the expected values (Pearce, 1983, p. 80).

Because society's risk-utility function is difficult to observe, it becomes difficult to calculate this certainty equivalent and resolve risk effects under conditions of risk aversion. Arrow and Lind (1970) have argued, however, that when there are many people across which to pool risks and projects are independent, individual risk is reduced and society
may be perceived to be risk-neutral. Environmental risks are an exception to the Arrow-Lind theorem if they are in the form of public goods — or bads, such as pollution — in which case the risk to a particular group is not reduced by "spreading" the risk over a larger group (Fisher and Krutilla, 1975b; Pearce, 1983; Price, 1984). Noise, for example, is a public good but its detrimental effects on a region will not be reduced as the population increases; "consumption" of noise by one individual does not reduce the amount left for others to consume. It is in this sense that certain risks cannot be pooled.

Because prediction of many environmental impacts is characterized more by uncertainty than by risk, methods for dealing with uncertainty may be more appropriate for evaluation techniques. When uncertainty exists, it becomes impossible to reduce the range of outcomes and probabilities to a single figure, such as the expected value or certainty equivalent, because the probabilities of those outcomes are not known. For example, an analyst might determine that individuals may be willing to pay between $16 and $24 to use a provincial park, but he would not know the probability associated with any of these values. Alternatively, the analyst might not be able to identify any possible amounts that individuals would be willing to pay.

There are several ways in which uncertainty can be reflected in evaluation. The first method is to develop subjective probability estimates based on the educated guesses of experts. Using these subjective probabilities an analyst could treat uncertainty in the same way as risk. Secondly, an analyst could conduct sensitivity analyses by examining the effect of different WTP measures on the cost-benefit calculations. A third method might be to add a risk premium to the discount rate. Pearce (1983) and Price (1984) note that when the uncertainty is related to costs, the risk premium may create more optimistic results rather than more conservative ones and the premium may impose an inappropriate time path on risk.
All of these methods for reflecting risk and uncertainty in an evaluation accept either WTP or WTS measures as the basis for evaluation. Recent work by Gallagher and Smith (1985) suggests that the valuation of environmental uncertainties using conventional WTP or WTS measures may be inappropriate because individuals may value certain changes differently than uncertain changes in resources when they are also faced with limited opportunities to insure themselves against this uncertainty. If individuals have access to fair markets to allocate risk, the valuation of an environmental uncertainty will lie somewhere between the WTP and WTS estimates. However when valuing non-market resources, fair markets for contingent claims may not exist (Gallagher and Smith, 1985, p. 141).

When fair markets do not exist, an individual's valuation need not fall between WTP and WTS estimates. Instead, the correct measure would be

\[ \ldots \text{the change in an individual's income that would be required to maintain a given level of expected utility as the probability distribution associated with the availability of the amenity services changes. The magnitude of this income change, or what we will refer to as an access value, depends on the opportunities available to the individual for allocating income among claims to the states of nature at risk (Gallagher and Smith, 1985, p. 136).} \]

The implication of this finding for evaluation is to force a reconsideration of the way WTP or WTS methods are used for valuing changes in uncertain environmental resources.

Risk and uncertainty may relate to economic, technological, social or environmental parameters. A special type of environmental parameter which has interesting implications for evaluation is the concept of irreversibility (an action infinitely costly to reverse and whose authenticity of reversal is questionable) (Fisher and Krutilla, 1975b; Pearce, 1983). For example, once a dam has been constructed it could be torn down at great cost, but the likelihood that the natural environment can return to its original state is doubtful. Fisher and Krutilla (1975b, p. 278) state that scientific, ethical, religious or aesthetic
concerns might create a highly inelastic demand for "original" environments.

Because irreversible decisions reduce our future options, the concepts of option, bequest and existence values might be seen as premiums for risk bearing (Arrow and Fisher, 1974; Fisher and Krutilla, 1975b). The use of option values when irreversible decisions are involved would increase preservation benefits, thus reducing the net benefits of a development project. Irreversible decisions would then affect projects by either decreasing the probability that the entire area in question would be developed, or reducing the amount of the area that would be developed (Arrow and Fisher, 1974). Cicchetti and Freeman (1971) have shown that option value is positive for risk-averse individuals, implying that option value could simulate the effects of irreversibility in evaluation techniques under conditions of risk-aversion.

The problem with the option value approach is that it is designed to reflect the loss of individual benefits in the future that are derived from environmental systems, but it is not related directly to the effect of changing environmental parameters on costs and benefits. Reliance on the option value approach alone would be insufficient as it would not foster increased understanding of environmental systems and could seriously misstate the nature of environmental uncertainty.

Fisher and Krutilla (1975b) explore the effects of changing preferences and changing discount rates on projects with irreversible effects. Their arguments support the conservative estimates derived from including option values. If discount rates change in the future, it is possible that a decision-maker might want to revise his original "optimal" decision. Similarly, if preferences change in the future such that some effects are valued less than they were in the original society that made the decision, the future society might wish the original decision to be altered. The result of both of these situations would be for future decision-makers to wish they could go back in time and pay some
amount to the original decision-makers to prevent them from undertaking a particular project. Fisher and Krutilla (1975b, p. 288) argue that

the optimal commitment of resources to activities that are (irreversibly) destructive of the environment is smaller than commitments to activities whose consequences are reversible. This conclusion is strengthened if there is uncertainty as to the magnitude of the consequences, and inconsistency in their evaluation over time.

Viscusi (1985) has also shown that optimal investment decisions might be uncertain if the occurrence of an irreversibility is uncertain. However, he points out that there is no simple rule-of-thumb which says that investment decisions must necessarily change when certain or uncertain irreversibility exists. The effect of an irreversible decision will depend upon the probability of the irreversibility, the likelihood that future preferences will change, and the weight that current society places on future preferences.
Social cost-benefit analysis is a normative procedure, a fact too easily forgotten by economists, government administrators and the public. This chapter explores the ethical assumptions implicit in the cost-benefit methodology and illustrates how different value judgments and ethical frameworks affect social cost-benefit analysis.

5.1 VALUE JUDGMENTS IN SCBA

The normative aspects of social cost-benefit analysis can be analyzed by outlining the value judgments required in the cost-benefit methodology. Nash et al. (1975) and Pearce (1976, 1983) have identified two value judgments which must be made: that preferences count and that these preferences must be weighted. The first value judgment requires considering whose preferences should count and when those preferences should be included. The types of preferences that should be included (also part of this first value judgment) will be discussed separately in the following section on moral frameworks (Section 5.2). The second value judgment requires an analyst or decision-maker to make a statement about how individual preferences will be weighted and aggregated.

5.1.1 Value Judgment #1: Preferences Count

Whose Preferences: A social cost-benefit analysis attempts to include the preferences of all individuals in society. Welfare economics is based on an assumption that general social welfare is the proper focus of public policy decisions (Krutilla, 1961, pp. 226–7). According to this conception of social welfare, "only benefits to man matter" (Abelson, 1979, p. 39). In SCBA, values attached to the environment are normally included in an
analysis only insofar as they have instrumental value: "values attached to the environment in its own right and without reference to human use . . . are normally ignored in CBA" (Abelson, 1979, p. 38). An objective with instrumental value is desired for its contribution to some supraordinate objective or goal, such as human happiness or welfare, while an objective with independent value is legitimate in its own right, such as an ethical or religious principle. Social cost–benefit analysis therefore does not attempt to determine preferences not associated with people, such as the preferences of plants and non-human animal life.

It is possible that the preferences of some individuals might be excluded from a social cost–benefit analysis. For example, McAllister (1980) states that children, the mentally ill and the senile might not be considered in a decision. Hurter et al. (1982, p. 91) imply that those not directly affected by a project, who suffer only some psychological disbenefit, should not be included in project evaluation. These exceptions are not widely accepted and may in fact be inconsistent with the value judgment that individual preferences count. Nash et al. (1975) claim that accepting individual preferences as the basis for evaluation implies accepting the preferences of all individuals. Krutilla (1961) also states that cost–benefit analysis should focus on the general welfare of all individuals rather than on "personal or specially interested clients" (see also Winch, 1971, p. 13). Tribe (1972, p. 41) warns that there is a risk of excluding those preferences "too widely diffused over space (or too incrementally affected over time) to be strongly championed by any single client of a policy analyst."

Although some project impacts might last for 20 or 30 (or more) years -- and therefore affect more than one generation -- a SCBA measures the preferences of current generations only (Dasgupta and Pearce, 1972; Tribe, 1972). To acknowledge the preferences of future generations, one must have access to knowledge of what future preferences might
be, hypothesize what they might be, or assume that future generations will have preference structures similar to the present. Even using this latter assumption, discounting future costs and benefits will give less weight to those future preferences. The suggestions for discounting given by McAllister (1980) and Pearce (1983), discussed in Section 4.2, are modifications that try to take into account the possibility of changing preferences in the future.

*When to include individual preferences:* There may be situations in which it is "theoretically" appropriate to exclude individual preferences in a social cost–benefit analysis. For example, the existence of *public or collective goods* in a competitive economy often results in an undersupply of such goods by private markets (Gramlich, 1981, p. 19). Public goods are characterized by non–excludability and non–rivalry of consumption (Pearce, 1976, p. 20). Non–excludability means that the goods, if made available to one person, are available to all persons. Non–rivalry of consumption means that consumption of a public good by one individual does not make less of that good available for other individuals. An example of a public good is national defence, while an example of a public "bad" would be pollution. Government intervention to increase the production of these goods (or limit them in the case of pollution) is undertaken not to override individual preferences but to correct a market failure which prevents individual preferences from being fully reflected in market activity.

5.1.2 Value Judgment #2: Preferences must be weighted

Preferences must be weighted in order to be aggregated in some meaningful way. Several possible methods for weighting preferences have been put forward: the Pareto principle, the Hicks–Kaldor rule, utility weights, WTS and WTP, market voting, and the management science approach (see Nash et al., 1975). The approach underlying these methods is to gauge the intensity of individuals' preferences, unlike simple voting mechanisms which give
equal weight to the preferences of all individuals.

The *Pareto principle* was derived from Vilfredo Pareto (1848–1923) and says that for one project to be better than another, at least one person must be made better off and no one made worse off. This would mean that no project which resulted in a net cost to any one person would be undertaken. Because almost all projects impose some costs on some individuals, this rule is a very strict one. In the 1930s, two economists, Hicks and Kaldor, developed a modification of the Pareto principle, called the *Hicks–Kaldor rule*, in which the sum of benefits to beneficiaries of a project must exceed the sum of costs to losers for that project to be acceptable. This is also known as the "compensation test," whereby winners *could* compensate losers but need not actually do so. Welfare economics, and social cost–benefit analysis, is based on the Hicks–Kaldor rule.

The *Hicks–Kaldor rule* relies on measuring the strength of preference of all individuals affected by a project by calculating each individual’s WTP (or sometimes WTS) to avoid a cost or obtain a benefit. The WTP method relies on the prices of goods and services in the marketplace as estimates of WTP. Because these prices reflect the existing distribution of income (see Krutilla, 1961), use of the Hicks–Kaldor rule involves making a value judgment "that the distribution of income used to weight the preferences of individuals is in some sense the best one" (Pearce, 1983, p. 6). The WTP method, based on the concept of consumer sovereignty, has been criticized for the simple but significant fact that an individual’s WTP is constrained by his income, creating what some have called a "dollar democracy" (Krutilla, 1961; Foster, 1966) in which the individual’s "vote" in the social welfare function is weighted by his income.

The use of value judgment #2 might result in a social cost–benefit analysis that reflects consumer preferences based on income levels rather than individual preferences irrespective of income. Some economists argue that this becomes a problem only if the
existing distribution of income is not viewed as ideal by society. If it is optimal, they argue, then it is legitimate to have preferences constrained by income. This claim will remain unpalatable to some because the practical result of reflecting even an ideal distribution in SCBA could be to continue to make the poor worse off as their preferences have less weight than the preferences of the wealthy (e.g., Pearce, 1983, p. 7).

An alternative measure of individual preferences is based upon willingness-to-sell rather than willingness-to-pay. The *willingness-to-sell* (WTS) approach overcomes the income effect of WTP by asking individuals what they would be willing to receive in compensation for giving up a right rather than what they would be willing-to-pay to receive or maintain a right. As discussed in Section 4.1.2, the use of WTS in social cost-benefit analysis seems to be limited to situations in which the cost or benefit received by an individual affects something to which he has a right.

This highlights an additional normative proposition in social cost-benefit analysis that valuations should reflect the existing distribution of property rights (Dasgupta and Pearce, 1972). Property rights present a relatively unambiguous interpretation of rights that inhere with an individual; more controversial are individual rights to clean air or water, usually evaluated with WTP measures as if they were not rights that belonged to individuals. Tribe (1976, p. 66) argues that some rights, such as the right to see or breathe, belong "to the individual because the capacity it embodies is organically and historically a part of the person that he is and not for any purely contingent and essentially managerial reason." Ultimately, the decision to use WTS figures requires a value judgment about the types of rights which society is willing to grant to an individual.

*Utility weights* may be used to weight WTP figures if the distribution of income in society is not optimal. These weights provide a more "pure" measure of the intensity of an individual’s preference which is not affected by income levels. Equity weights may
be combined with utility weights, making a value judgment about a socially desirable
distribution of utility. However, as Nash et al. (1975, p. 128) note, there is "nothing
necessarily fair or democratic in such an approach."

What Nash et al. (1975) call the Market Voting principle is a weighting scheme
designed to measure strength of preference, or WTP, as if every individual had the same
income. In the Democratic Strength of Preference rule (Foster, 1966), social costs and
benefits, other than financial flows, would be weighted by the ratio of mean population
income to the income per head. This approach would measure strength of preference and
equalize the income constraint by scaling down the WTP measures of high income
individuals while scaling up the WTP measures for low income individuals.

Finally, Nash et al. (1975) suggest a Management Science approach to weighting in
which WTP weights would be derived from the weights implicit in past policy decisions.
Use of this approach is based on an assumption that past policy decisions have been
optimal and that they are consistent (see also Weisbrod, 1968).

In summary, these value judgments emphasize the normative nature of social
cost–benefit analysis and reveal that it is not a value–free or impartial process. Different
analyses will result when different value judgments are used. Copp and Levy (1982) and
Self (1975) have additionally shown that cost–benefit analysis is not value–free or impartial
by looking at the theory of cost–benefit analysis as part of the theories of rational and
moral choice. In essence, their argument states that social cost–benefit analysis, in its
pursuit of objectives such as economic efficiency, is part of the theory of rational choice
and therefore part of value theory (Copp and Levy, 1982, p. 165; Self, 1975, p. 9). In
other words, objectives are defined in order to achieve certain values or goals; they
cannot be "rational" without some reference to values (Winch, 1971, p. 25). If a social
welfare function cannot be defined, then social values are just as ambiguous. The dilemma
is to decide whose values to use. Our inability to solve this dilemma means analyses based on different values have some claims to validity.

Copp and Levy also argue that, in cases such as the Prisoner’s Dilemma where individual utility maximization does not lead to a collective utility maximum, the concept of rationality as utility-maximizing behavior is questionable (1982, p. 165). Garrett Hardin’s (1968) “tragedy of the commons” is a typical example of a Prisoner’s Dilemma. In the tragedy of the commons, individuals making rational decisions in their own self-interest bring about a collective disaster because long-term collective costs have been ignored (see also Messick and Brewer, 1983; Schelling, 1978). The following section will show that, because social cost–benefit analysis relies on utilitarian principles, it is also part of the theory of moral choice and therefore also part of value theory (Copp and Levy, 1982, p. 165).

5.2 ETHICAL FRAMEWORKS IN SCBA

Can analysis simultaneously accommodate different ethical frameworks or does analysis vary with the ethical framework adopted? According to Pearce (1983), value judgment #1 (that preferences count) involves deciding which preferences should be included in an analysis. If all types of preferences can be included, then a decision process would be ethically neutral; if analysis varies with the ethical framework chosen, it is not ethically neutral.

Social cost–benefit analysis is not ethically neutral. It is based upon a particular type of moral principle called utilitarianism. Utilitarianism is a form of consequentialist moral principle which “appraise[s] actions on the basis of the consequences they can be expected to produce” (Copp and Levy, 1982, p. 167). There are two types of consequentialist moral principles: maximizing (or utilitarian) and non–maximizing. Maximizing consequentialist principles, or utilitarian principles, would accept projects in which good
consequences outweighed bad ones. This is clearly the principle upon which the Hicks–Kaldor rule used in cost–benefit analysis is based. Non–maximizing consequentialist principles are based on the same concept but include the notion of a threshold of harm, "such that, if an action's consequences exceed that threshold, then it would be wrong, and no amount of good would tip the balance" (Copp and Levy, 1982, p. 168). In other words, if costs exceed some level, a project would not be accepted regardless of the magnitude of the total benefits. In contrast, non–consequentialist moral principles do not judge actions based on a weighting of their good and bad consequences, but instead deem certain actions right or wrong for their intrinsic nature. For example, some people might feel it is morally wrong to kill seals (but not cattle) or to develop nuclear energy.

Because SCBA is based on utilitarianism, it is not well suited to reflect non–maximizing consequentialist principles or non–consequentialist moral principles (Copp and Levy, 1982). At best, non–utilitarian moral principles can be included in a social cost–benefit analysis only as constraints or qualitative factors. The calculation of net benefits implies that people are willing to make trade–offs between good and bad consequences; individuals holding non–consequentialist principles might be unwilling to make certain trade–offs.

Clearly, social cost–benefit analysis is not ethically neutral because it favors the views of individuals with maximizing consequentialist principles (see Copp and Levy, 1982, p. 168). Welfare economics is "a branch of ethics" based on utilitarian principles (Little, 1957, p. 8). But welfare economics is not the only discipline that requires ethical or normative claims. As Tribe (1976, p. 65) points out, some of the ethical dilemmas that arise with intangibles do not reflect "any intrinsic weakness of the analytic methodology as applied to non–monetizable values, but rather the universal difficulty of choosing among incommensurables — a difficulty that can be obscured but never wholly eliminated by any
method of decision making."

The effect of different moral frameworks on SCBA is illustrated in a recent study by Schulze and Kneese (1981). Many environmental externalities have long-term and sometimes irreversible consequences for which compensation is never given. Schulze and Kneese explore the implications of different ethical frameworks on the acceptability of such uncompensated risk by showing how results of SCBA differ according to the ethical framework chosen. A typical example would be the risk of dam failure, which is not only an uncompensated risk but one rarely included in cost–benefit calculations (see Baecher et al., 1980). By applying distributional weights to reflect different ethical principles, Schulze and Kneese (1981, p. 86) derive the following results: where a utilitarian-based cost–benefit analysis would accept uncompensated risk regardless of individuals’ incomes, a utilitarian ethic adjusted for income and an egalitarian ethic would reject uncompensated risk on those with lower incomes, while an elitist ethic would reject uncompensated risk imposed on those with higher incomes, and a libertarian ethic would reject all uncompensated risk. Furthermore, traditional social cost–benefit analysis would not protect individual rights against majority rule, while such rights would be protected in egalitarian, elitist, libertarian and income–adjusted utilitarian ethical systems (Schulze and Kneese, 1981, p. 88).

Several authors have suggested that too much blame for the neglect of certain moral principles should not be attached to the utilitarian concept underlying evaluation. Tribe (1976) has noted that SCBA’s reliance on maximizing utilitarian principles does not necessarily force a narrow conception of social welfare based only on evaluating impacts on humans. According to Tribe (1976, pp. 70–1), "Such utilitarian philosophers as Bentham [perceived] human obligations as extending to all entities capable of experiencing pleasure and pain." Dorfman (1976, p. 162) has also pointed out that the utilitarian J.S. Mill
recognized that "social policy must be informed by higher moral purpose." In the words of Mill, himself,

> We may consider, then, as one criterion of goodness of a government, the degree in which it tends to increase the sum of good qualities [moral and intellectual] in the governed, collectively and individually; since, besides that their well-being is the sole object of government, their good qualities supply the moving force which works the machinery (p. 337).

Brooks (1976) suggests that by broadening our definition of utilitarianism by increasing our concern for the natural environment, a wider variety of moral principles might be incorporated in an analysis. In effect, this involves creating surrogate markets for values not normally expressed in a competitive marketplace: "We can go a long way, at least in principle if not in practice, in treating nature like any other economic investment for a future stream of economic benefits" (Brooks, 1976, p. 121)

### 5.3 VALUE JUDGMENTS AND ANALYSIS

This analysis of value judgments implicit in social cost-benefit analysis has shown that welfare economics assumes the proper basis for government decision-making to be the social welfare of all individuals in society rather than the welfare of decision-makers, bureaucrats or special interest groups. As a result, a social cost-benefit analysis is based on the preferences of individuals in society, and these preferences must be capable of being expressed in economic markets. Because SCBA is based on utilitarian principles, the preferences of individuals who hold non-utilitarian principles might be excluded from the analysis. Similarly, individual preferences might be ignored if a government wishes to act in a paternalistic manner toward certain individuals. A social cost-benefit analysis might weight or measure preferences based on income levels and may often assume that the distribution of income in society is optimal. While preferences are constrained by an individual's ability to pay, they could be weighted in some manner to reflect social
judgments about the deservingness or social worth of the preferences of certain individuals. And finally, preferences are aggregated on the basis of total costs and benefits to society rather than on the number of individuals suffering costs or benefits -- total benefits must exceed total costs, but the number of people receiving benefits need not exceed the number of people suffering costs.

The purpose of highlighting these value judgments is not to condemn cost-benefit analysis because of them. As Pearce (1983) notes, value judgments must be made about which preferences to count and how they will be weighted. But,

If we remember that value judgements are inescapable in reaching policy decisions and that such value judgements can themselves be argued about, CBA can be an extremely useful tool of decision-making. For by making such judgements explicit and, as far as possible, spelling them out in precise quantitative terms, it makes clear thinking about policy matters possible" (Dasgupta and Pearce, 1972, p. 93).

This arguing over value judgments is often at the heart of the conflict over major government projects.
CHAPTER 6

POLITICS AND SOCIAL COST-BENEFIT ANALYSIS

The preceding chapters have explored the problems encountered when using social cost-benefit analysis to make decisions about projects. But, such decisions are not made on the basis of social cost-benefit analysis alone. Probably everyone can recall an instance in which a government made a decision that appeared inconsistent with the rational analysis of SCBA. Yet, this does not necessarily imply that government decision-making is irrational; it may simply indicate that there is another type of rationality than that of SCBA and other types of costs and benefits that are important to decision-makers. For convenience, we can call this other type of rationality political rationality. This chapter explores how political factors affect project evaluation.

Hilsman (1967) has identified three characteristics which describe decision-making in a political environment:

1. a diversity of goals and values that must be reconciled before a decision can be reached;
2. the presence of competing clusters of people within the main group who are identified with each of the alternative goals and policies; and
3. the relative power of these different groups of people involved is as relevant to the final decision as the appeal of the goals they seek or the cogency and wisdom of their arguments (pp. 553–555).

The previous chapters have suggested how individuals might differ in their problem definition, in their objectives and in the alternatives they prefer. But groups and individuals in a political world also differ in their power to promote and implement their preferred decisions. This characteristic has important implications for the preparation and review of a social cost-benefit analysis. In essence, it suggests that problems are not solved by rational analysis alone, or at least not by the types of rationality embedded in
social cost-benefit analysis; problems are solved to some extent by analysis and to some extent by the power and influence of groups to implement their chosen solutions based on their individual or group desires. In this political environment "the roles of such 'unrational' procedures as bargaining also become more clear" (Hilsman, 1967, p. 55).

Bargaining is as much a part of decision-making as of any other arena of government decision-making. Dorsey (1986, pp. 1–2) suggests several events that might be taking place on any given day that affect environmental resources.

- The Prime Minister is meeting in Ottawa with representatives of the native Indians to agree on an agenda for negotiation of their marine resource claims.

- The federal Minister of Fisheries and Oceans is finalizing an agreement with the provincial Minister of the Environment on the cost-sharing arrangements for salmonid enhancement projects.

- The federal Minister of the Environment is having lunch with the Chairman of the Board of an oil company to discuss their application for permission to begin offshore exploration.

- Members of the provincial government caucus are meeting with a group of people who plan to develop a coastal island as an international resort.

- A group of forestry company executives are reviewing their strategy for obtaining increased stumpage allowances from the provincial government and faster approvals from the federal Department of Fisheries and Oceans.

- A municipal council is arguing over the industrial rezoning of waterfront lands for a marina and fish-processing plant.

- An environmental interest group is holding a press conference to release a report and a slide show on the pollution of an estuary and identifying the discharges that are violating permit conditions.

- Two scientists are discussing how the results of their laboratory studies can best be used in an upcoming court case.

- Beside a stream a federal fisheries biologist is talking to a forest manager, who is asking to be allowed to build his road where it is planned if he agrees to put a road further up the hillside in the next drainage he logs.
The outcome of bargaining is not decided solely by technical or economic rationality but also by political rationality. Political rationality is concerned with "maintaining or enhancing the powers of the group or individual making the decisions" (Hollick, 1981a, p. 69). In contrast, the rationality of social cost-benefit analysis and environmental impact assessment is based on technical and economic rationality. Assuming a set of objectives exists, technical rationality involves "the selection of means to achieve a given end" (Hollick, 1981a, p. 66), or generating alternatives. Economic rationality involves "allocating scarce resources between alternative ends in order to achieve the greatest total benefit" (p. 67), or evaluating alternatives. Bargaining, which is really another word for political rationality, is not "unrational" as Hilsman put it, but rational in a very different way. This chapter will explore the effects of political rationality on the operation of social cost-benefit analysis.

Organizing Concepts

Allison (1971) has advanced some organizing concepts which can be used to analyze a political decision-making situation. These concepts can be reduced to two major issues (pp. 164-173):

1. What is the game?
   a. what are the action-channels, or points of access, for various groups and individuals, and
   b. what are the rules of the game?
2. Who plays the game and how can they be differentiated?
   a. what is their perception of the problem,
   b. what are their goals,
   c. what are their positions or roles, and
   d. what power do they have?
According to this framework, the actors in a political decision-making process will differ in four fundamental ways: (i) goals; (ii) roles in the policy process; (iii) power; and (iv) opportunities for access to the policy process. Actors will also differ according to their perceptions, but those perceptions can only be defined in the context of specific situations. The following sections will characterize the actors in a decision-making process according to the four parameters identified. To do this, several tasks must first be achieved. Section 6.1 will describe the "game" of decision-making in the context of public-sector project evaluation, and Section 6.2 will develop a framework of the types of groups involved in the assessment of public-sector projects. The goals, roles, power and access points for these groups will then be addressed in Section 6.3. Finally, the impact that political environments have on social cost-benefit analysis will be explored in Section 6.4.

6.1 THE DECISION-MAKING PROCESS

In government, decision-making takes place in a variety of different environments and under a variety of different rules. Allison (1967) characterizes these environments according to (i) "action-channels," the nature of the formal or informal environment in which decisions are made, and (ii) "rules of the game," or behaviour that constitutes appropriate action. The decision-making environment for approving large public-sector projects is often a formal, highly structured environment, but it also contains many informal and less structured elements. For example, rules concerning the conduct and review of SCBAs may be embedded in legislation such as the B.C. Utilities Commission Act, or in policy directives such as the federal government's environmental assessment review guidelines. Within these formal legislative or policy contexts, many informal and discretionary procedures operate. Ministerial discretion may exist over whether a social cost-benefit analysis should be done, or an analyst might have discretion over how it should be done.
Generally, the preparation of a SCBA is subject to less formality than its review.

Procedures for conducting SCBAs and assessing them vary according to province, jurisdiction, and type of project or policy. The process applying to energy developments in British Columbia, the *Utilities Commission Act* (SBC 1980, Ch. 60), has been selected for a more detailed examination.

The use of social cost–benefit analysis in British Columbia is a fairly recent addition to government decision-making, at least in the area of energy developments. Prior to 1980, decisions to build hydroelectric projects were proposed by B.C. Hydro and evaluated through an internal government review process as part of the B.C. *Water Act* (RSBC 1979, c.429). This evaluation consisted of determining whether or not a water licence required for the hydroelectric development should be granted. While informal evaluation procedures may have considered questions of supply and demand as well as environmental and social impacts, such questions were not central or even necessarily part of the decision to grant a water licence. Under the *Water Act*, water licences and permits were granted primarily on the basis of available water supply, and written objections to the project could be filed with the provincial Comptroller of Water Rights.

The *Utilities Commission Act* was enacted in the provincial legislature in 1980. The Act established the B.C. Utilities Commission (BCUC) which has as one of its responsibilities the review of major energy projects, including hydroelectric developments proposed by a public utility. The review process (see Figure 1) begins with the application for an Energy Project Certificate by the project proponent for a specific hydroelectric development. A government committee, the Energy Project Coordinating Committee (EPCC), directs the preparation of appropriate impact studies and a social cost–benefit analysis by attempting to ensure that adequate information is generated by the proponent. Public involvement may occur at this stage at the discretion of the proponent.
FIGURE 1

THE PROJECT REVIEW PROCESS
OF THE B.C. UTILITIES COMMISSION ACT

Proponent applies for Energy Project Certificate

Energy Project Coordinating Committee directs
Proponent to prepare Impact Statements and
Social Cost-Benefit Analysis

EPCC makes recommendation on hearing

no public hearing recommended

public hearing is recommended

Ministers of Energy and Environment make joint recommendation on hearing

hearing is waived

hearing is required

B.C. Utilities Commission conducts hearing

B.C.U.C. makes recommendation on project

Final decision on Energy Project Certificate application made by Provincial Cabinet

Source: derived from Thompson et al., 1981
Once the appropriate impact statements and cost-benefit document have been completed by the proponent, the EPCC makes a recommendation to the Minister of Environment and the Minister of Energy, Mines and Petroleum Resources concerning the disposition of the Energy Project Certificate application. The EPCC will recommend whether a public hearing should be held and would draft the terms of reference for the hearing. The two Ministers then jointly make a recommendation on the disposition of the application by recommending or waiving the public hearing requirement and approving the terms of reference for a public hearing, if applicable.

If the public hearing is waived, the application is then referred to the provincial Cabinet for a final decision. If a hearing is required, the reports and terms of reference are forwarded to the B.C. Utilities Commission which is responsible for conducting the public hearing and producing a final report in line with the guidelines in the terms of reference. The Commission’s report, when completed, is then given to the Cabinet for a final decision; Cabinet either accepts or rejects the Commission’s recommendations and decides if and when to make the Commission’s report public (for a more detailed description, see Thompson et al., 1981; Utilities Commission Act, SBC 1980, c.60).

6.2 THE ACTORS IN THE DECISION-MAKING PROCESS

How can we characterize the types of individuals and groups that become involved in the review of large public-sector projects? Allison (1967), based on the work of Almond (1950), suggests four groups that are commonly involved in government decision-making, each group a subset of the one preceding it: (i) the general public, (ii) the attentive public, (iii) the policy and opinion elites, and (iv) the official policy leadership (see Figure 2).
FIGURE 2

THE ACTORS IN DECISION-MAKING

OFFICIAL POLICY LEADERSHIP
- Cabinet
- Opposition

POLICY AND OPINION ELITES
- government review agency
- other government agencies
- public sector proponent
- private sector proponent

ATTENTIVE PUBLIC
LOCAL
- business interests (Chambers of Commerce, local governments, local businessmen)
- labour interests (union locals, unemployment action centres)
- environmental groups
- native Indian bands

REGIONAL
- business interests (business councils, manufacturers associations, consumer groups)
- labour interests (union headquarters)
- environmental groups
- native Indian Tribal Councils
- research organizations

GENERAL PUBLIC
- voters
- newspaper readers
- general public
The official policy leadership consists of politicians, including the elected representatives that form the Cabinet and those that make up the Opposition. Under the Utilities Commission Act, the chairman of the Commission has the power to make recommendations only; the final decision concerning an energy project is made by the provincial Cabinet. However, the Commission, as well as other government departments, agencies and crown corporations, are part of the policy and opinion elites. These groups provide advice and information to the policy leadership. The project proponent, who is a private-sector firm or public-sector agency responsible for constructing the project, is also one of the policy elites because of its specialized knowledge. The policy and opinion elites include review agencies, other government agencies that support or oppose a particular project, and project proponents.

The attentive public consists of interest groups. The types of interest groups that become involved will depend largely on the nature of the project in question and on the significant issues that might result from it. If the project is a hydroelectric dam, these groups might be differentiated by their base of support, whether local or regional (Figure 2). Local interest groups which might become involved in the assessment of a hydroelectric project are business interests, labour interests, environmental groups, and native Indian bands. Regional interest groups might also include business groups, labour unions, national or international environmental groups, native Indian tribal councils, as well as research groups.

The fourth type of group involved is the general public. These are the citizenry at large, voters, casual newspaper readers, etc.

The interest groups and general public can also be differentiated according to the positions they take: they might be in favour of a project, against it, or undecided. For a hydroelectric dam proposal, the groups might be divided along the following lines. Those
tending to be in favour of the project could include local and regional business and labour groups as well as certain business research groups. Those more likely to be opposed to the project might be members of local and regional environmental and native groups as well as regional research organizations. Members of the general public would likely have a range of positions.

Willard and Swenson (1984) suggest categorizing these interest groups not by the positions they take but by the magnitude of gains and losses each will experience as a result of the project. Hydroelectric dams constructed in remote regions frequently incur significant local costs in terms of environmental disruption. Comparable regional costs often do not occur. The benefits of the project often flow out of the local area to large urban or industrial centres where hydroelectric power is required. Local areas may benefit from construction jobs (although many workers may be brought in from regional centres) or from businesses that these construction jobs generate. However, it is likely that local regions will experience larger costs of a long-term nature, while their benefits will be short-term. Regional areas will suffer fewer costs but receive significant long-term benefits.

Table IV identifies the magnitude of costs and benefits associated with local and regional interest groups. Of all interest groups involved in the assessment and review of a hydroelectric dam project, it is probably local groups that experience relatively large losses, as they make greater use of the environmental resources affected by the dam. Local groups which receive large benefits from the construction of the dam in the form of increased business and employment opportunities might be in favour of the project, depending on the exact magnitude of gains and losses they receive. Local and regional groups that receive less benefit, or place less value on such benefit, relative to their losses will more likely be opposed to the project.
### TABLE IV
CHARACTERIZING INTEREST GROUPS BY GAINS AND LOSSES

<table>
<thead>
<tr>
<th>SIZE OF LOSS</th>
<th>SIZE OF GAIN</th>
<th>PRO LOCAL</th>
<th>CON LOCAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>Large</td>
<td>- local businesses</td>
<td>- environmental groups</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td>- labour groups</td>
<td>- native Indian groups</td>
</tr>
<tr>
<td>Small</td>
<td>PRO REGIONAL</td>
<td>- business groups</td>
<td>- environmental groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- labour groups</td>
<td>- native Indian councils</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- research groups</td>
<td>- research groups</td>
</tr>
</tbody>
</table>
Regional groups will probably experience fewer losses than local groups because the environmental resources affected by the project will be more distant and they will have a wider range of alternative environmental resources closer at hand. They may also benefit from the project because of employment opportunities or the hydroelectricity provided. The regional proponents are therefore placed in quadrant 4 of the matrix.

This definition of groups will vary by the type of project under evaluation and the specific costs and benefits that arise. In another context, a different definition of groups might be more appropriate. However, for the purposes of this paper it is sufficient to begin with this fairly simple approach. The following section will characterize these major actors -- politicians, bureaucrats/proponent, interest groups and general public -- according to their goals, roles, power and points of access into the decision-making process.

6.3 GOALS, ROLES, POWER AND ACCESS

6.3.1 Politicians: The Official Policy Leadership

The characteristics of the Cabinet differ considerably from those of the Opposition in the context of public-sector project evaluation (and in other areas of government decision-making). Each of these groups will be addressed in turn.

The goals of the elected representatives that form the Cabinet are, first and foremost, to stay in power and maintain their base of support (Downs, 1957). This requires staying in the public's favour by doing the "right thing" at the right time. What constitutes the right thing in the public's eye is often vague and ephemeral, but it is safe to say that it is seldom concerned with economic efficiency; distribution or redistribution is usually more important (Stanbury, 1986). For this reason, it has been said that the goal and function of politicians, especially the Cabinet, is to decide "who gets what, when and
how" (Lasswell, 1958). We would therefore expect politicians to be concerned with both the efficiency and distributional aspects of a project (to whom do they accrue and in what magnitude). The Cabinet will also be concerned with the means by which projects generate and redistribute income, and with the timing of project decisions.

The role of Cabinet, or of selected Ministers, in project evaluation is twofold: first, to determine whether or not a project should be required to undergo a comprehensive evaluation and review, and second, to determine whether or not a project should proceed. In general, the Cabinet has access to all of the legitimate coercive power of the state. More specifically, Cabinet has the power to define and alter the review process, to define the terms of reference for analysis, to allocate budgets, and to make ultimate project decisions. The constraints on this power include the countervailing powers of other actors, constitutional and legal constraints, economic and budgetary considerations, foreign relations (when projects have international implications), public opinion polls, and elections.

The Cabinet's access to the review process begins prior to the formal public announcement of a project, especially if the project proponent is a public-sector department or agency. While project analysis is being done and during the formal review process, Cabinet might willingly restrict its access in order to avoid accusations of manipulation and bias.

The goals of the elected representatives that form the Opposition are to gain power, form a government, or at least retain their seats. This involves trying to erode government support by criticizing and opposing the Cabinet's policies and actions. The role of the Opposition in the review process is much more limited than that of the Cabinet's. The Opposition is relegated to the role of watchdog by commenting, criticizing, pressuring, opposing and stalling.
The Opposition has less power than the Cabinet, unless there is a minority government. The Opposition may provide funds for other actors, try to influence Cabinet and the public, and attempt to delay decisions. Their access is also limited, but unlike the Cabinet, they might become more actively involved in the review process by acting as intervenors.

6.3.2 Bureaucrats: The Policy and Opinion Elites (I)

The goals, roles, power and access of civil-service bureaucrats in the evaluation and review of public-sector projects depends on whether they are proponent agencies that prepare SCBAs for projects within their mandates, opponent agencies who do not want the project to proceed, or review agencies the review SCBAs and conduct public review. Review agencies might be part of a government treasury department, be inter-departmental committees, or be part of specific environmental resource departments.

The goals of the review agency responsible for reviewing SCBAs are process-oriented. The rules governing review procedures are often set down in legislative mandates, policy guidelines, or precedent. These rules vary in specificity but generally include guidelines for preparing a SCBA. The role of the review agency is to supervise analysis by directing, assessing and conducting a public inquiry and to generate analysis by requesting information from other government departments or by commissioning its own analysis. As part of the civil service, the review agency's role also includes being sensitive to political and administrative elements in decision-making (Stanbury, 1986), such as inter-departmental rivalries or contentious public issues.

The powers of the review agency are those which have been assigned to it in legislation and specified in the terms of reference from Cabinet. Some of its formal powers include the ability to perform and supervise analysis, the requesting of information
from other departments, access to confidential data, and the allocation of intervenor funding. Informal powers might include the ability to influence Cabinet via its recommendations, and the power of "relative" independence from direct political influence. Because the review agency supervises and reviews analysis, its access is considerable. But this access is dependent upon Cabinet discretion and formally ends once it has submitted its recommendations.

The goals of support agencies that provide information to project proponents have both political and administrative elements. Politically, civil service departments must be responsible to and supportive of their Minister. Administratively, their goals may be to maintain their traditional domains of action and influence, and expand these domains. They may seek to maximize the size of their budgets and the number of their employees relative to other departments, and will seek to influence the policy decisions of other departments that affect their own domains. Their role is therefore to provide comment and information. They may also have a role to play in project implementation once the assessment is completed and approved.

The power of support agencies comes from four sources: information and expertise, legislation, influence over project implementation, and the interests they represent (e.g., mining, industry or commercial fishing interests). Their access to the review process might involve consultation with the project proponent prior to the formal review, comment during the review, and management after the review.

The goals of opponent agencies might be to prevent projects from proceeding or to obtain project modifications to meet the agency's management policies or legislation. The power of opponent agencies stems from their legislative mandates or from their influence over key decision-makers. For example, a fisheries department may have considerable statutory power to withhold approvals for hydroelectric projects that damage significant
fishery resources.

6.3.3 Proponents: The Policy and Opinion Elites (II)

A proponent, in this context, is a private-sector firm or public-sector agency that is proposing to build a project. The goal of a private-sector proponent is to have its project approved as it will contribute to its more general goals of profit, survival and growth (Stanbury, 1986). The goal of a public-sector proponent is also to have its project approved; but unlike its private-sector counterpart which seeks to maximize earnings, the public-sector proponent seeks to maximize "gettings" (allocations from general revenue) unless its mandate specifies funding its activities through its own operations.

The role of a project proponent, whether in the public or private sector, is to act as the official advocate of a project (although they may be responding to Cabinet pressure to advocate a certain project, for example). Through the activities of problem search and definition, the proponent identifies possible solutions and eventually proposes a project. This proposal initiates the evaluation and review process (if, of course, that project falls within the purview of some project review guidelines -- many projects require no such review). The role of the proponent often includes analysis, and almost always includes implementation.

The power of proponents stems from problem definition, information, expertise, and analysis. Their access is continuous throughout the review process, but a private-sector proponent may have more limited access to the Cabinet and bureaucracy than a public-sector proponent.

6.3.4 Interest Groups: The Attentive Public

Many types of interest groups become involved in a review process. Their goals will vary
widely, but their roles, power and access will be similar in nature if not in extent. Therefore, before defining the goals of particular interest groups, we will look at their common characteristics.

The role of an interest group is to influence government decisions or attempt to do so (Hartle, 1979), by acting as an intervenor in the review process, by building coalitions with other interest groups to increase their base of support, or by lobbying politicians or the public. Their power may take the form of money to support analysis or of actions to support, denounce, or obstruct decisions. Their access is formally limited to their role as intervenors and is subject to the rules governing procedure. But they do have access to the informal elements, namely the media and public opinion.

Interest groups differ with respect to their goals. When large hydroelectric projects are proposed, it is not uncommon for environmental interest groups to become involved (see, for example, Martin, 1985; Popper, 1985). Different environmental groups have a wide variety of mandates and goals to which they aspire and are willing to adopt very different lobbying tactics to achieve their goals. Some groups may actively pursue civil disobedience while others might never use or advocate it. One group's mandate may deal entirely with a particular region or a particular type of environmental issue while other groups might have national concerns and a wider variety of issues to which they address themselves.

While these two parameters, breadth of issues and range of lobbying tactics, may not provide a complete categorization of environmental groups, they do provide a useful starting point. Popper (1985) has identified two types of environmental groups which fall at opposite ends of these spectra: the "NIMBY" and the "ideal" environmentalist. A "NIMBY" (acronym for Not-In-My-Back-Yard) is a local organization which forms to oppose a project: "although the opposition does not necessarily form a majority, it
constitutes a substantial body of local opinion and cares enough to form an organization" (Popper, 1985, p. 8). This group may be willing to use civil disobedience as a means of achieving their goal. The stereotypical NIMBY seeks direct influence over outcomes, and they desire their outcome by any process. Their goals appear to be the prevention of any project with negative environmental impacts rather than the encouragement of projects with acceptable or wisely-managed environmental impacts. NIMBY's are most closely associated with LULU's, "locally unwanted land uses," such as hydroelectric projects, mine developments or anything else with a significant and noticeable local environmental impact.

In contrast to NIMBY's are what Popper (1985) has defined as "ideal" environmentalists, although many people might disagree with Popper's notion of ideal. These are often regional or national groups with fairly broad mandates who are willing to "play by the rules" of a review process and who do not advocate civil disobedience. The ideal environmentalist does not take a hard-line position against LULU's but encourages a "practical working relationship between valid national and regional goals and valid local ones" (Popper, 1985, p. 39). They also encourage planning, seek ways to accommodate environmental and economic concerns, and advocate streamlining of regulatory procedures where possible. Overall, the ideal environmentalist tries to find ways to speed the siting of these projects [LULU's], while at the same time allowing for the public's long-standing environmental concerns and the pro-development side's new economic ones (Ibid., p. 40).

In contrast to the NIMBY which seeks direct influence over outcomes, the ideal environmentalist seeks influence over processes. A simple but useful rule to differentiate between the two is to consider whether a group is willing to live with what it perceives to be an unfavourable outcome as long as it was the result of a fair process (the ideal environmentalist), or whether a group will seek to alter an unfavourable outcome regardless of the process that generated it (the NIMBY).
6.4 ANALYSIS AND POLITICS

What effect do the different goals, roles, power and access of the various interest groups have on the conduct and outcome of social cost-benefit analysis in a political environment? This section addresses this question by summarizing some of the outcomes that have been observed or predicted in the literature.

6.4.1 Analysis and Politicians

Downs and Larkey (1986) note that the language of analysis is not the language of politics and politicians have weak incentives to do analysis or to follow the recommendations of analysis. The language of politics differs from that of analysis because of the constraints at odds with the rationality of analysis. As Hollick (1981a) has explained, social, legal and political rationality may differ from the technological and economic rationality that dominates social cost-benefit analysis. Therefore, not all of the consequences or possible solutions of concern to a politician will be reflected in the analysis. For example, Table IV suggests that groups in favor of or against projects arise partly because of the distribution of costs and benefits. Politicians might want to weight the various costs and benefits received by various groups according to the political threat posed by each group or by the number of votes they represent.

The range of alternatives of concern to politicians might also differ from those suggested in most project evaluations. Compromise, logrolling and delay have important roles to play in government decision-making (Allison, 1971, p. 157). Some problems may be solved effectively with symbolic gestures, as such gestures do not foreclose future options and give the appearance of concern. Furthermore, politicians may be more concerned with staying in power than solving technical problems. They may prefer to diffuse issues and consequences rather than highlight and sharpen them through analysis.
Politicians might also have weak incentives to perform analyses or act upon them. A social cost-benefit analysis is designed to promote *efficient* decisions. Downs and Larkey (1986, p. 137) note that politicians do not have incentives to be efficient; they are faced with disincentives to corrupt and immoral behaviour:

The congressman who is sniffing cocaine at a private party, even at home, is in much more political jeopardy than one who has a hand in wasting billions of dollars in a sincere, stupid way.

The preparation and public review of a SCBA might take several years, but the timing of a decision for maximum political advantage — such as decisions used as election promises or to counter falling opinion polls — might not coincide with the timing of analysis (Quade, 1975). Analysis is not only time-consuming but costly, and politicians may be wary of spending large sums of money on SCBAs for projects that might never be built.

Fischhoff et al. (1981) also note the unwillingness of politicians, and decision-makers in general, to abandon bad ideas once they have become committed to them. The result of this "overcapitalization-rip-off" is that sunk costs are relevant.

The fact that no major dam in the United States has been left unfinished once begun shows how far a little concrete can go in defining a problem (Ibid., p. 13).

### 6.4.2 Analysis and Bureaucrats

Bias, if left unchecked, seems to be the greatest danger in analysis by bureaucrats (Quade, 1975; Downs and Larkey, 1986). Biased viewpoints can be useful if different groups challenge each others' perceptions. The danger with some project review processes is that they do not allow for an adequate counter-balancing of viewpoints; bias then becomes detrimental. Bias can be the result of several factors: parochialism, protectivism, or inadequate staff and funding.
Parochial analysis may arise because bureaucratic organizations simply do what they have always done; problems and alternative solutions are seen in the same context as past problems and actions (Allison, 1971; Downs and Larkey, 1986). Biased analysis might also result from a bureaucratic desire to protect traditional areas of operation and spheres of influence. Problems are therefore defined to ensure the agency's staff are part of the solution (Quade, 1975). An unbiased and thorough analysis might provide opponents with too much ammunition and thus endanger the agency's existence. More simply, bias might be the result of insufficient resources (Downs and Larkey, 1986). Streamlined organizations might handle day-to-day problems efficiently but find themselves strained when large-scale projects and analysis are undertaken. Bias then creeps in inadvertently from quick and superficial analysis.

These influences have several effects on a social cost-benefit analysis. A project proponent might define problems so that only those projects within its particular mandate are possible solutions. Only those alternatives that contribute most to the employment of personnel and an increase in agency influence and importance might be considered. There may also be a tendency to overstate benefits, understate costs and ignore certain controversial impacts, which results overall in inadequate analysis. In contrast, review agencies would be expected to exhibit less bias and produce more objective and complete analyses, depending on their autonomy from Cabinet, on the terms of reference given to them, and on their level of funding and staffing.

6.4.3 Analysis and Interest Groups

Special interest groups, by definition, are not concerned with the effects projects have on social welfare; they are concerned with effects on their group welfare. They will like analysis that supports their position and denounce analysis that supports an opponent's position because it is politically motivated (Quade, 1975, p. 271).
Interest groups might also favor direct influence over outcomes rather than indirect influence over social goals and processes (Hollick, 1981a, p. 72). Because their group desires may differ from more general social goals, "unconstructive criticism may seem eminently fair and rational" (Fischhoff et al., 1981, p. 118). As long as there are multiple interest groups pursuing a variety of goals, problems will not stay solved because these groups will not abide by the rules of a review process. The "ideal" type of interest group posited by Popper is not what is usually expected.

The "unconstructive" actions of interest groups are usually blamed for lengthy and costly public hearings, but there are positive aspects of interest group behaviour. Their comments act as checks on political or bureaucratic decisions resulting from bias, parochialism, logrolling or symbolic gestures.
CHAPTER 7

A CASE STUDY: THE SITE C HYDROELECTRIC PROJECT

This chapter illustrates, with the use of a case study: (i) how individuals might vary in their definition of a problem, in the objectives they choose for evaluation, in the selection of alternatives and identification of consequences, and in their use of evaluation methods; (ii) how these differences could result in more than one version of a social cost-benefit analysis; and (iii) how political factors affect the use of SCBA as a guideline for government decision-making.

The case study chosen for analysis is the Site C hydroelectric development in northern British Columbia (see Figure 3). The Site C dam and generating station was first proposed in 1975 by B.C. Hydro, a provincial Crown corporation responsible for supplying the energy requirements of the province of British Columbia. The dam was to be located on the Peace River, downstream from two existing hydroelectric developments (the Bennett and Peace Canyon dams). Largely due to the potential environmental effects of the Site C dam and doubts about the necessity of additional generating capacity, considerable opposition to the proposed project arose. A series of public hearings were held under the auspices of the B.C. Utilities Commission (BCUC) between 1981 and 1983 to review B.C. Hydro's social cost-benefit analysis of the project. A decision that the Site C dam should not be built at that time was made by the provincial Cabinet in November, 1983.

The information on which this section is based is taken from three major sources: (i) the written submissions of various groups to the B.C. Utilities Commission; (ii) newspaper reports during the period under analysis; and (iii) the final report of the BCUC (1983).
FIGURE 3

MAP OF B.C. AND THE PROPOSED SITE C DAM

The key actors in the Site C controversy were B.C. Hydro (the project proponent), the B.C. Utilities Commission (the review agency), and the Peace Valley Environmental Association (PVEA) and the Society for the Promotion of Environmental Conservation (SPEC), both of whom were interest groups opposed to the Site C project. SPEC was the most active provincially-based interest group. The most vocal association of local residents was the Peace Valley Environmental Association. Although there were other groups in favor of the project (such as Chambers of Commerce, labour unions and various industry associations) as well as others opposed to it (including Regional District boards, native indian bands and private citizens), these groups played much smaller roles in the evaluation process than did SPEC or PVEA.

The nine year period chosen for analysis (1975–1983) can be divided into three phases. The first phase, Project Initiation (1975 to 1976), began with B.C. Hydro's announced intention to build the Site C dam and includes the subsequent, immediate response of project opponents calling for a comprehensive project review process. The second phase, Project Analysis (1977 to 1980), is characterized by the emergence of arguments for and against construction of the Site C dam, and the introduction of impact assessment legislation, the Utilities Commission Act. The third phase, Evaluation and Resolution, spanned the years 1981 to 1983 during which the Utilities Commission hearings took place, culminating in the provincial Cabinet's decision in November 1983 to delay the project.

Project Initiation: 1975–1976

In 1975, B.C. Hydro announced that planning for the construction of the Site C dam would begin. Environmental, social and economic impact studies of the Site C project were to be commissioned. Preliminary impact reports were released by B.C. Hydro in 1976, indicating that the earliest completion date for the project would be 1984. In
response to these announcements, residents of the Peace River Valley opposing the project joined together to form the Peace Valley Environmental Association (PVEA). At the same time, existing provincial environmental groups such as the B.C. Wildlife Federation, the Sierra Club and SPEC, voiced their concerns about the adequacy of the process by which hydroelectric developments were evaluated (Vancouver Sun, Jan. 17, 1977, p. 29).

During this period, no formal process for the evaluation of energy policy and supply alternatives existed in provincial legislation. Prior to 1975, hydroelectric energy projects were reviewed by the government under the guidelines and requirements of the B.C. Water Act (RSBC 1979, c.429). The Water Act did not require a SCBA to be performed; the decision to approve or reject projects under the Act was based largely on the availability of water supply for the proposed project. Provincial environmental groups, concerned about the environmental effects of the Site C project and dissatisfied with the planning process for the previous hydroelectric development (Revelstoke), wanted not only a complete evaluation of Site C that would include some mechanism for public participation, but also an evaluation process that would apply to all energy projects.


The years between 1977 and 1980 were characterized by the emergence and development of arguments for and against the Site C project. Opponents, led by PVEA and SPEC, were active in disseminating information about their positions and the project, raising funds, producing pamphlets and remaining vocal in the media. They challenged B.C. Hydro’s decision to build Site C by asking (i) if additional power was needed in the province, and (ii) if so, if Site C was the best energy project to meet those needs. During this period, Hydro performed a variety of impact studies, including a social cost–benefit analysis (B.C. Hydro, 1980a) which justified the need for Site C by 1986 and showed that its social benefits were greater than its costs. Hydro’s chairman, Robert
Bonner, was critical of "self-styled environmentalists" who pursued "selfish interests" and opposed any hydroelectric project with "well-organized propaganda" (Vancouver Sun, June 16, 1978). Late in 1979, B.C. Hydro continued to claim that Site C was the "most feasible, lowest cost supply relative to all other alternatives" (Province, Oct. 3, 1979, p. A1), and in October of that year, formally applied for the necessary licences and permits under the B.C. Water Act.

The Utilities Commission Act (SBC 1980, c.60) came into force just several months after B.C. Hydro's applied to build Site C. The Act set forward detailed guidelines for the review of energy projects and provided for public participation in the form of hearings, if requested by Cabinet. B.C. Hydro re-applied under this new process in November 1980.


Formal public review of the Site C project began in 1981 under the provisions of the Utilities Commission Act. A panel, headed by Keith Henry of the Utilities Commission, was formed to conduct the review. The hearings were conducted by the B.C. Utilities Commission and proceeded in five stages: (i) project justification based on energy supply and demand analysis; (ii) Site C project design; (iii) environmental, land use, social and economic impacts of Site C; (iv) financing; and (v) other matters relating to the issuance of specific permits. During the hearings the arguments of various interest groups were presented, and additional evidence was provided by numerous provincial government ministries.

The role of the Utilities Commission was to judge the competing evidence and analyses, and then present its own recommendations to the provincial Cabinet on whether or not to proceed with Site C. In its final report (BCUC, 1983), the Commission found
that Hydro had overestimated energy demand to such an extent that construction of a new project need not begin at that time. It also determined that Hydro had not proven Site C to be the best project to meet future demand because too few alternatives had been considered in its SCBA. The Commission recommended that Cabinet hold future public hearings related to energy demand and project alternatives when it became time to consider a new energy project (BCUC, 1983, pp. 126-7).

The provincial Cabinet released the Commission’s recommendations to the public in November 1983 (six months after it received them) and simultaneously announced its own decision. The Energy Minister revealed that construction of Site C would not begin at that time and that future public review would not be necessary (Vancouver Sun, November 9, 1983, p. C3).

7.1 DEFINING THE PROBLEM AND ALTERNATIVES

This section explores the problems and alternative solutions seen by the key actors in the evaluation of Site C: the Utilities Commission, B.C. Hydro, SPEC and PVEA. Much of the information needed must be inferred by the actions and statements of these groups; evidence is presented in this section to support these inferences.

7.1.1 The Utilities Commission

The Utilities Commission’s problem definition is outlined in a general policy statement of the Ministry of Energy, Mines and Petroleum Resources (1980) and in the specific terms of reference drafted for the Site C hearings by the Ministers of Environment and Energy, Mines & Petroleum Resources (BCUC, 1983, Appendix 4). The policy statement outlines that energy project reviews would

examine the broad justification for the project, including energy demand projections, alternative energy sources (including conservation) and general environmental and social factors.

In the terms of reference for the Site C review, these "guidelines" were defined as those for social cost–benefit analysis published by the provincial Environment and Land Use Committee (ELUC, 1977). The Utilities Commission was therefore required to determine if energy demand justified the construction of a new hydroelectric project and ascertain the social costs and benefits of Site C, based on a comparison with other project alternatives including conservation measures (BCUC, 1983, p. 38).

7.1.2 B.C. Hydro

There were three key elements in B.C. Hydro's problem definition which this section demonstrates: first, Hydro saw itself facing a need to generate additional electricity; second, this electricity was needed by 1986; and third, only large hydroelectric and thermal developments were suitable alternatives. Hydro's problem definition did not include the possibility that actions could be taken to reduce future energy demand; it did not consider in its SCBA that demand might be needed sooner or later than 1986; it did not evaluate the development of small hydroelectric projects; and it did not consider projects other than hydroelectric or coal–fired thermal developments. The reasons why Hydro might have defined the problem as it did will also be explored here.

Generating additional electricity: Hydro's problem definition and project justification are documented in its Site C Cost–Benefit Analysis (1980a). Part of Hydro's ongoing organizational activity involves predicting future energy demand. Its forecasting procedures generated three energy demand scenarios: low, medium, and high. For each scenario, the year of an expected supply deficit was calculated and a list of possible project alternatives derived (see Table V). The absence of energy conservation options in Table V makes it
### TABLE V

**B.C. HYDRO PROJECT JUSTIFICATION**

<table>
<thead>
<tr>
<th></th>
<th>Low Demand</th>
<th>Medium Demand</th>
<th>High Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Deficit</td>
<td>1988</td>
<td>1986</td>
<td>1984</td>
</tr>
<tr>
<td>Supply Alternatives</td>
<td>Site C¹</td>
<td>Site C¹</td>
<td>none identified</td>
</tr>
<tr>
<td></td>
<td>Hat Creek²</td>
<td>Hat Creek²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Murphy Creek¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>East Kootenay¹</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. hydroelectric project  
2. coal-fired thermal project

Source: B.C. Hydro, 1980a, p. 2.11-2.12.
clear that Hydro preferred to increase supply to meet future demand rather than decrease demand to meet existing supply, or both increase supply and decrease demand.

Hydro's viewpoint could have been the result of several forces: some inherent organizational bias (e.g., conservation measures involve fewer jobs for existing Hydro staff than do new supply projects); an accurate perception of the problem (conservation measures were not feasible alternatives due to technological or cost constraints); or legislative or policy constraints (Hydro perhaps did not have the political authority to recommend severe conservation measures through dramatically increased energy prices, for example). It is possible that each of these factors contributed to Hydro's approach. The agency is a hydroelectric authority and not a conservation authority; previous supply problems had been met largely through the construction of new hydroelectric generating facilities.

The 1986 supply deficit: B.C. Hydro remained convinced throughout most of the Utilities Commission hearings of an energy supply deficit in 1987. Although Hydro generated demand scenarios for low, medium and high demand forecasts, the published SCBA considered the medium demand (1986 deficit) scenario only. The reasons why Hydro was convinced that this was the "most likely" scenario are not clear. The Utilities Commission, however, became convinced that this medium scenario was the maximum possible rather than the most likely one (BCUC, 1983, p. 5).

During the Utilities Commission hearings, several problems with Hydro's forecasting methods became apparent. The Commission found that Hydro's methods were based on relatively unsophisticated non-econometric models, did not consider statistically significant past behavior, and did not incorporate price effects (BCUC, 1983, p. 4). A small study commissioned by SPEC (Overstall, 1982) illustrated the inaccuracy of Hydro's forecasts. SPEC was able to confirm only 49% of the future demand requirements claimed by B.C.
Hydro for a number of large industrial consumers.

*Large-scale hydroelectric and coal-fired thermal alternatives:* B.C. Hydro only identified hydroelectric and thermal projects as suitable alternatives for the generation of electricity under all three demand scenarios (see Table V). B.C. Hydro's published SCBA only considered two projects: Site C and the Hat Creek coal-fired plant. Because the planning and development of energy sources often requires extensive lead-times to bring projects on stream, it is possible that Hydro's selection of alternatives reflects a realistic interpretation of the supply opportunities available. Alternatively, their project selection might have been the result of the perceptual lens of a hydroelectric utility that focussed its planning activities on hydroelectric and, more recently, coal-fired thermal energy projects.

The results of the Utilities Commission hearings would seem to preclude Hydro's project selection as an entirely realistic interpretation of supply alternatives. Several intervenors in the Utilities Commission hearings presented evidence on the development of non-conventional energy alternatives, as well as on the use of pricing schemes (Cooper, 1982; Friends of the Peace, 1982). Non-conventional alternatives such as geothermal power or demand management (using prices to reduce energy demand and postpone the supply shortfall) were not addressed by B.C. Hydro in its social cost-benefit analysis, even though the Commission felt these options warranted more attention (BCUC, 1983, p. 8). Hydro's list of conventional alternatives also seemed less than complete. The possibility of constructing other hydroelectric and thermal projects or entering into contingency purchases from industry or other utilities was treated only superficially. As well, Hydro's project justification outlined in Table V leaves the impression that nothing could have been done in 1980 to meet a potential supply deficit in 1984.

Because Hydro considered such a limited number of project alternatives, its framing of the problem cast doubt upon the objectivity of its analysis. As Fox (1981) noted,
... the mere fact that Site C may be a better project than Hat Creek does not demonstrate that construction of Site C best serves the public interest. A conclusion based on such a demonstration is comparable in logic to proving that since severing my hand will be less debilitating to me than severing my arm, then amputating my hand is in my best interest even though there may be no need to do so (p. 4).

7.1.3 SPEC and PVEA

While B.C. Hydro's main concern was to supply electricity, SPEC's concern was to insure that all energy developments, including Site C, were assessed in some sort of comprehensive review process. SPEC and other environmental groups had been advocating the development of energy project review procedures since the mid-1970's (Vancouver Sun, Jan. 17, 1977, p.29; Daily Colonist, Feb. 23, 1978, p.22; Vancouver Sun, Aug. 8, 1980, p.A16). SPEC also advocated the use of renewable energy and conservation alternatives (Vancouver Sun, Aug. 8, 1980; Cooper, 1982).

From the time of Site C's announcement to the end of the Utilities Commission hearings, SPEC's framing of the problem consisted of asking if additional power was needed in the province and, if so, if Site C was the best energy project to meet those needs (Vancouver Sun, Oct. 16, 1981, p. A12). SPEC believed its efforts were best spent addressing the first question since they were confident that additional power was not required within the time frame proposed by Hydro. If Hydro could show that additional power was needed, SPEC believed that Site C was not necessarily the best project; they felt that several alternatives had been excluded from Hydro's analysis (such as demand management through pricing, conservation, and geothermal energy).

In contrast, the problem that faced the Peace Valley Environmental Association had little to do with energy supply for the province of B.C. Their goal was to prevent Site C or any other hydroelectric development from being built on the lower Peace River
(Province, Oct. 4, 1979, p. A4). This implies that they would not accept the construction of Site C even if it were shown to be the best project from a social cost-benefit point of view.

7.1.4 Problem Definition, Alternatives and Analysis

If each of the above groups had conducted its own social cost-benefit analysis, at least three different analyses might have resulted. Hydro, however, was the only one to conduct a complete analysis; the other groups revealed the type of analysis they would have performed by their criticisms of Hydro's SCBA.

The Utilities Commission and SPEC adopted similar approaches to analysis by outlining the requirements that a social cost-benefit analysis should fulfill: the energy supply deficit should be carefully predicted and a wide range of project alternatives should be considered. Restrictions on these alternatives should not be made *per se*, but each should be judged on the basis of its feasibility.

Hydro and PVEA both restricted the alternatives under consideration. PVEA did not want any projects in the Peace River Valley to be considered, while Hydro avoided types of projects with which it had less experience -- small-scale hydroelectric projects, non-conventional energy sources, conservation measures and pricing mechanisms.

Hydro also appeared to believe more firmly than was justified in the accuracy of its own predictions. By conducting analysis on the medium demand scenario only, Hydro was left with no analysis to support the construction of any project once the Commission determined its forecasts were too high. Had analysis been done for the low-demand scenario, those results might have been more applicable. This highlights the importance of making careful judgments about the accuracy of forecasts and their underlying assumptions.
7.2 OBJECTIVES AND EVALUATION

The objectives for the Site C cost-benefit analysis were defined in the ELUC (1977) SCBA guidelines mentioned in the Utilities Commission's terms of reference. These guidelines recommend that a cost-benefit analysis be based on economic efficiency and that the regional distribution of costs and benefits be identified, but not weighted (p. 11). The cost-benefit calculations are to be based on efficiency costs and benefits: distributional effects are identified for illustrative purposes only.

Discussion of the validity of these objectives for the Site C project did not seem to arise in the Utilities Commission hearings. The economic efficiency objective was either accepted by all participants in the hearings or participants were not aware of, or concerned about, using a different objective function. Discussion about the limitations of social cost-benefit analysis did not seem to arise. Participants appeared to focus their efforts on debating project justification (energy demand projections), disputing physical resource impacts, and producing different cost and benefit estimates. Throughout the hearing, the validity and robustness of social cost-benefit theory appeared to be taken for granted or of little concern.

7.3 IDENTIFYING PROJECT IMPACTS

This section addresses two aspects of the identification of project impacts: (i) the definition of the spatial boundaries of the analysis; and (ii) the measurement and prediction of impacts. The purpose of this section is to highlight how groups differed in their approach to these tasks and the results these differences would have on analysis.
7.3.1 Spatial Boundaries

All impacts identified in B.C. Hydro's SCBA of Site C, in the BCUC report, and in the proceedings of the review hearings appear to fall within the provincial boundaries of British Columbia. Nowhere is mention made of downstream effects beyond the provincial border (see BCUC, 1983; B.C. Hydro, 1980a and 1980b; Lord and Sydneysmith, 1982) although theory states that SCBA should at least take a national perspective (Pearce, 1983, p. 13). It is not clear whether this neglect arises because there are no potential impacts in other provinces (primarily Alberta) or because the evaluation of the Site C project was seen from a provincial perspective only. The implications of both of these issues are worth considering in some detail.

The effects of the Bennett Dam on the Peace-Athabaska Delta suggest that the Site C dam could result in similar downstream effects. The construction of the Bennett Dam on the Peace River in 1967 (located upstream from the proposed Site C) affected Alberta's Peace-Athabaska Delta. By 1970 it was becoming apparent that the delta, where the Peace River joins Lake Athabaska, was drying up. The Peace-Athabaska Delta Project Group -- comprised of the federal, Alberta and Saskatchewan Ministries of Environment -- assessed these impacts and reported the following changes (among others) in its 1973 report:

(i) a 36 percent loss of shoreline habitat essential to muskrats and nesting waterfowl;
(ii) a decline in muskrat populations from 250,000 to 17,000 in less than a decade;
(iii) a loss of habitat for bison;
(iv) a decrease in duck production; and
(v) an increased need for dredging and navigation aids (P.A.D.P.G., 1973, pp. 10-11).

The Group also recognized that "the economy of Fort Chipewyan and the lifestyle of its native people have been and continue to be closely linked with the trapping and fishing
in the Peace–Athabaska Delta" (p. 11). Although the Bennett Dam is considerably larger than the proposed Site C project, its impacts suggest that Site C's potential impacts on the Peace–Athabaska Delta should be addressed.

It could be argued that the scope of a social cost–benefit analysis in Canada should only include provincial impacts because the Canadian Constitution Act vests ownership of water resources in the provinces rather than in the federal government, and gives provinces management powers over hydroelectric developments (Sections 109 and 92A(1)(c)). Percy (1984, p. 87) suggests that "provinces have felt that they could authorize the diversion or pollution of inter–provincial waters with impunity. It seems that such an attitude prevailed at the time of the construction of the Bennett Dam on the Peace River." This attitude developed from provincial sovereignty over the water resource and from the lack of a binding mechanism in the Canadian constitution to resolve inter–provincial conflicts (in general, see Barton, 1984; Gibson, 1973; Percy, 1984).

Downstream provinces which suffer adverse consequences from the use of water by upstream provinces may still rely on private litigation in the courts. Two cases in the 1970's indicated a changing interpretation of provincial powers with respect to downstream users. In the Town of Peace River v. B.C. Hydro (1973 D.L.R. 29(3d)), the town of Peace River, Alberta, brought an action against B.C. Hydro for damages caused to the town's water utilities plant that resulted from the reduced flow of the Peace River after construction of the Bennett Dam. The case was decided in favor of Alberta, making B.C. Hydro liable for damages. The second case affecting inter–provincial waters was Interprovincial Cooperatives Ltd. et al. v. The Queen (1975 D.L.R. 53(3d)). In this case, mercury discharges licenced in Ontario and Saskatchewan entered waters flowing into Manitoba, requiring the temporary closure of a commercial fishery in Manitoba. Although the fishermen that brought the case to trial were unsuccessful in their court action, several
dissenting judges felt that Ontario and Saskatchewan could not validly licence activities in their provinces that had adverse consequences outside the province.

Because there have been so few cases involving disputes over inter-provincial waters it is difficult to assess what trend the courts will follow in the future. As one legal analyst notes, "At the very least, the possible trend in law evidenced by these cases must be taken into account by planners of projects which have a significant impact on inter-jurisdictional waters" (Percy, 1983, p. 118).

7.3.2 Identifying Consequences: Measurement and Prediction

The measurement and prediction of project impacts are important components of social cost–benefit analysis. The key groups involved in generating estimates of Site C's impacts were B.C. Hydro and three provincial government ministries: Agriculture, Environment, and Forests. The purpose of this section is to highlight some of the different estimates that arose.

Table VI identifies selected impact estimates produced by B.C. Hydro and the various government departments. These estimates were identified in the BCUC Site C report (1983). Although Table VI does not include all the differences that arose during the hearings, it does provide an example of the nature and magnitude of the differences that can arise in environmental impact assessment or social cost–benefit analysis. Section 7.6 will show how these different impact measures led to considerably different social cost estimates.

B.C. Hydro and the various government ministries differed in their estimates of: the amount of flooded land that would have been suitable for vegetable production; the area of flooded forest land and the volume of lost timber; future growth in recreation demand with and without the project; the number of lost hunting days resulting from
<table>
<thead>
<tr>
<th>RESOURCE CATEGORY</th>
<th>B.C. HYDRO</th>
<th>MINISTRY OF:</th>
<th>B.C. UTILITIES COMMISSION</th>
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<tbody>
<tr>
<td>AGRICULTURE</td>
<td></td>
<td>Agriculture</td>
<td></td>
</tr>
<tr>
<td>- flooded land for high value</td>
<td>80 ha.</td>
<td>400 ha.</td>
<td>400 ha.</td>
</tr>
<tr>
<td>vegetable production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORESTRY</td>
<td></td>
<td>Forests</td>
<td></td>
</tr>
<tr>
<td>- flooded forest land</td>
<td>3824 ha.</td>
<td>1724 ha.</td>
<td>1724 ha.</td>
</tr>
<tr>
<td>- decrease in allowable annual cut</td>
<td>8400 per cm.</td>
<td>4736 per cm.</td>
<td>1724 per cm.</td>
</tr>
<tr>
<td>GENERAL RECREATION</td>
<td></td>
<td>Lands, Parks &amp; Housing</td>
<td></td>
</tr>
<tr>
<td>- future growth (in user days)</td>
<td>4% per annum</td>
<td>1% per annum</td>
<td>1% per annum</td>
</tr>
<tr>
<td>WILDLIFE &amp; RECREATIONAL HUNTING</td>
<td></td>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>- moose population decrease</td>
<td>125-250 moose</td>
<td>125-250 moose</td>
<td>Hydro reasonable,</td>
</tr>
<tr>
<td>- deer population decrease</td>
<td>50-250 deer</td>
<td>25-250 deer</td>
<td>need better data</td>
</tr>
<tr>
<td>- lost hunting days per year</td>
<td>600</td>
<td>50-3175</td>
<td>50-3175</td>
</tr>
<tr>
<td></td>
<td>(928-2473 est. by consultant)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TABLE VI (cont')**

**SELECTED PHYSICAL RESOURCE IMPACTS**

<table>
<thead>
<tr>
<th>RESOURCE CATEGORY</th>
<th>B.C. HYDRO</th>
<th>MINISTRY OF: B.C. UTILITIES COMMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Environment</td>
</tr>
<tr>
<td>FISHERIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- maximum sustainable yield (# angling days)</td>
<td>4100-5600 (14000 est. by consultant)</td>
<td>11400-18000 neither estimate can be supported</td>
</tr>
<tr>
<td>- reservoir yield (# angling days)</td>
<td>4100-9900 (12000 est. by consultant)</td>
<td>4300-13500 neither estimate can be supported</td>
</tr>
</tbody>
</table>

flooding; and the maximum sustainable yield of fish populations in the Peace River and in the reservoir that would be created (see Table VI). In virtually all of these cases where Hydro and a government ministry had different estimates, the Utilities Commission determined that the ministries' estimates were more accurate. The only exception was for fisheries impacts, where the Commission decided that neither Hydro nor the Ministry of Environment had sufficient data to accurately predict impacts.

Table VI also reveals that Hydro's consultants derived impact measures for lost hunting days and sustainable fishery yields similar to the ministries' estimates; yet, Hydro did not use these figures as the basis for evaluation, but instead adopted significantly lower estimates.

7.4 CALCULATION OF PROJECT BENEFITS

This section presents the estimates of Site C's benefits determined by B.C. Hydro and SPEC. A common method of calculating benefits from hydroelectric developments is to "estimate the savings realized by not having to buy from an alternative source" (Prest and Turvey, 1967, p. 180). This source should be the next-least-cost alternative for generating power. Hydro interpreted this by estimating the savings achieved from not having to build the Hat Creek thermal project. Hat Creek was chosen as the next-least-cost alternative because it was the only alternative to Site C identified for Hydro's medium demand scenario. Capital, operating and environmental costs were calculated for Hat Creek and adjusted to reflect a power generation capacity similar to that of Site C. The sum of these costs is an estimate of the social benefits of Site C; they are benefits in the sense of being costs that can be avoided by constructing a different project. Hydro estimated the benefits of Site C to range between $714 million and $1,133 million (at discount rates of 6 to 10%).
The ELUC cost-benefit guidelines recommend the use of willingness-to-pay rather than the alternative-cost method for calculating project benefits (1977, pp. 20, 24). A study commissioned by SPEC (Lord and Sydneysmith, 1982) derived a WTP estimate for the value of Site C power based on the value of additional power to the citizens of the province. Lord and Sydneysmith’s benefit estimates range from $288 million to $855 million (with discount rates of 6, 8 and 10%) compared to B.C. Hydro's estimates of $714 million to $1133 million for the same range of discount rates (B.C. Hydro, 1980a, p. 7.2).

Both the alternative cost and WTP approaches should yield similar results. The different estimates generated by Hydro and SPEC can be partly attributed to errors in Hydro’s approach to benefit estimation. Firstly, Hydro had not proven conclusively that Hat Creek was the next-least-cost alternative to Site C. This makes overstatement of Site C’s benefits possible by comparing it to a much more costly alternative. The worse that alternative is, the higher are the project’s supposed benefits.

Second, the capital, operating and environmental costs of Hat Creek were not shown in any detail in the Site C SCBA and were not subjected to any sensitivity analysis other than a variation in the discount rate used (B.C. Hydro, 1980a). Because the estimated resource costs of Site C were contested at length during the Utilities Commission hearings (see Section 7.6), there is considerable justification for not accepting the social benefits of Site C (which include the resource costs of Hat Creek) as given by B.C. Hydro.

Third, Hydro's own recognition that it would be difficult to build Hat Creek by 1987 (B.C. Hydro, 1980a) casts doubt upon the usefulness of a comparison between Site C and a project with a later in-service date. If Hydro recognized that Hat Creek could not be built within the time frame required, then the analysis should have compared Site C to Hat Creek plus additional energy supplied from some other source between 1987 and
the year that Hat Creek would be completed. Had this been done, Site C's benefits might have increased. No estimate of Hat Creek's "actual" completion date was given in the cost-benefit document.

Fourth, the energy demand forecasts upon which the analysis rests were prepared in 1979. When load forecasts were revised downwards by Hydro only one year later, Hat Creek, with almost twice the generating capacity of Site C, was no longer a viable alternative. Because other alternatives had not been considered, Hydro's social cost-benefit analysis became meaningless (BCUC, 1983, p. 9) because it was very likely that Hat Creek was not the next-least-cost alternative. If this were true, Site C's benefits would be overstated.

Hydro's overestimation of energy demand, its limited consideration of alternatives and its overestimation of project benefits were major problems with the SCBA of the Site C project. The result was a biased or an incomplete analysis, or both, making the accuracy of Hydro's cost-benefit analysis highly suspect before the estimation of project costs is considered.

7.5 CALCULATION OF FINANCIAL COSTS

Three types of costs were identified in B.C. Hydro's cost-benefit analysis:

3. financial costs, which are the capital and operating costs of the project;
4. resource costs, or changes in environmental resources (B.C. Hydro calculated net costs because some changes were identified as benefits); and
5. regional social impacts, such as changes in lifestyles or other community attributes.

The capital and operating costs of Site C were estimated and discounted using several discount rates. The Utilities Commission concurred with Hydro's financial cost estimates,
agreeing that the project could be built for $1.5 billion ($1980) within a reasonable margin of error (BCUC, 1983, p. 114). Other groups did not dispute this estimate (see, e.g., Lord and Sydneysmith, 1982).

7.6 CALCULATION OF ENVIRONMENTAL COSTS

The potential environmental impacts identified by B.C. Hydro included changes in agricultural land, forestry resources, general recreation, hunting, fisheries and heritage resources. The following sections identify Hydro's estimates, the competing estimates given by various government departments, and the final values selected by the Utilities Commission as the most reasonable and accurate (see Table VII).

7.6.1 Agriculture

B.C. Hydro valued the loss of agricultural land by estimating various scenarios of potential production which might be foregone, rather than by calculating the amount of actual agricultural production that would be lost due to the flooding and disruption of agricultural land. This approach was based on "a presumption, supported by legislation that social value exceeds market value" for agricultural land (B.C. Hydro, 1980a, p 3.2). This assumes there is some value attached to productive potential even if that potential is not currently being used or demanded. In the context of a hydroelectric development where agricultural land will be lost, this method would produce a higher estimate of project costs than a method based on actual production foregone. Conversely, when applied to a hydroelectric project which provides irrigation, the result might overstate project benefits if agricultural production levels were constrained by factors other than the availability of irrigation.

The Ministry of Agriculture, the Utilities Commission, and B.C. Hydro adopted the "potential production foregone" approach, but their estimates vary considerably (see Table
<table>
<thead>
<tr>
<th>RESOURCE CATEGORY</th>
<th>B.C. HYDRO</th>
<th>MINISTRY OF:</th>
<th>B.C. UTILITIES COMMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRICULTURE</td>
<td>Agriculture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- net annual return on production of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vegetables</td>
<td>$1089 per ha.</td>
<td>$3337.5 per ha.</td>
<td>$3337.5 per ha.</td>
</tr>
<tr>
<td>other crops</td>
<td>$ 154 per ha.</td>
<td>$ 262.0 per ha.</td>
<td>$ 262.0 per ha.</td>
</tr>
<tr>
<td>- rate of increase in crop prices</td>
<td>1% per annum</td>
<td>1% per annum</td>
<td>0% per annum</td>
</tr>
<tr>
<td>- increase in economic return</td>
<td>2.5% per annum</td>
<td>2.5% per annum</td>
<td>1% per annum</td>
</tr>
<tr>
<td>Total Resource Loss</td>
<td>$8-52 mill.(^1)</td>
<td>$18-95 mill.</td>
<td>$59.8 mill.(^3)</td>
</tr>
<tr>
<td></td>
<td>$2-48 mill.(^2)</td>
<td></td>
<td>$24.0 mill.(^4)</td>
</tr>
<tr>
<td>FORESTRY</td>
<td>Forests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- stumpage value</td>
<td>$4 / cubic metre</td>
<td>$6 / cubic metre</td>
<td>$6 / cubic metre</td>
</tr>
<tr>
<td>- value of lost cutting rights</td>
<td>not estimated</td>
<td>$25 / cubic metre</td>
<td>$25 / cubic metre</td>
</tr>
<tr>
<td>Total Resource Loss</td>
<td>$0.36-1.0 mill.(^1)</td>
<td>$0.40-1.1 mill.</td>
<td>$1.0 mill.(^3)</td>
</tr>
<tr>
<td></td>
<td>$0.33-0.9 mill.(^2)</td>
<td></td>
<td>$0.5 mill.(^4)</td>
</tr>
<tr>
<td>GENERAL RECREATION</td>
<td>Lands, Parks &amp; Housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- recreational value</td>
<td>$29 per day</td>
<td>$16.60-$17.95</td>
<td>$29 per day</td>
</tr>
<tr>
<td>- value of river-based vs. reservoir-based recreation</td>
<td>1.2:1</td>
<td>1.5:1</td>
<td>1.5:1</td>
</tr>
<tr>
<td>Total Resource Loss</td>
<td>$4.0-51.6 mill.(^1)</td>
<td>$1.8-3.7 mill</td>
<td>$6.0 mill.(^3)</td>
</tr>
<tr>
<td></td>
<td>$3.4-103 mill.(^2)</td>
<td></td>
<td>$3.0 mill.(^4)</td>
</tr>
</tbody>
</table>
### TABLE VII (cont')

**SELECTED EVALUATION ISSUES**

<table>
<thead>
<tr>
<th>RESOURCE CATEGORY</th>
<th>B.C. HYDRO</th>
<th>MINISTRY OF: B.C. UTILITIES COMMISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WILDLIFE AND RECREATIONAL HUNTING</strong></td>
<td>Environment</td>
<td>$32 per day-WTP $64 per day-WTS $32 per day-WTP</td>
</tr>
<tr>
<td>- recreating hunting value</td>
<td>$32 per day-WTP</td>
<td>$64 per day-WTS</td>
</tr>
<tr>
<td>- non-consumptive value of wildlife</td>
<td>included in 1/3 value of general recreation hunting</td>
<td>included in general recreation</td>
</tr>
<tr>
<td>- indirect loss of wildlife</td>
<td>not estimated</td>
<td>$500,000 to be monitored</td>
</tr>
<tr>
<td>Total Resource Loss</td>
<td>$0.18-1.6 mill.</td>
<td>$2.0-3.7 mill.</td>
</tr>
<tr>
<td></td>
<td>$0.19-1.9 mill.</td>
<td></td>
</tr>
</tbody>
</table>

| **FISHERIES** | Environment | WTP WTS WTP |
|----------------|------------|------------|------------|
| - WTP or WTS-based estimates | WTP | WTS | WTP |
| Total Resource Loss | $0.3-10.0 mill. | $2.0-4.2 mill. | insufficient data. |
| | $8.0 mill. loss to $4.8 mill gain | |

**Table Notes:**

2. 1980 estimate (B.C. Hydro, 1980a)
3. estimate discounted with hybrid approach.
4. estimate discounted at 8%.

**Source:** BCUC, 1983, pp. 164-7, 175-8, 183-8, 190-6, 199-206; B.C. Hydro, 1980a, pp. 5.9, 5.12, 5.16, 5.27, 5.29.
VII). Hydro's original estimates ranged from $2-48 million, depending on the scenario and discount rate used (B.C. Hydro, 1980a, p. 5.27). Hydro later revised these upward to $8-52 million. In comparison, the Ministry's estimates ranged from $17.5-94.5 million. The final estimate adopted by the Utilities Commission was $59.8 million.

The evaluation methods used by Hydro, the Ministry of Agriculture and the Utilities Commission fail to take into account several concerns raised by other groups during the Utilities Commission hearings (see, for example, Fox, 1981; BCUC, 1983, p. 168). One concern was that valuing agricultural resource losses by potential production foregone fails to reflect adequately the land price effect of the Agricultural Land Reserve system in B.C., of which the Site C lands are a part. Fox (1981, pp. 14-5) argues that commercial land in the Lower Mainland of B.C. sells for five to ten times the price of agricultural land which is protected under the Agricultural Land Reserve system. This implies that shadow pricing could be applied to the lands affected by Site C using this approach and the results compared with the "production foregone" valuation approach. In Fox's estimation, "The Agricultural Land Reserves Act has clearly established a policy which recognizes values in agricultural land that are many times the values based on the value of agricultural products" (Fox, 1981, p. 17).

Other intervenors wished to see an option value attached to agricultural land to reflect future increases in agricultural land values in the event of significant world food shortages. The Commission felt that such values could not be "meaningfully quantified" and opted instead to stress the importance of compensation programs "designed to improve and intensify agricultural production" (BCUC, 1983, p. 169).

7.6.2 Forestry

The flooding of Crown forest land in B.C. cannot be valued by traditional market pricing
because there are no established market prices for stumpage. Valuing impacts to forest
lands must instead be done by calculating the loss of sustained yield (long-term) timber
production, called the "allowable cut effect." Because of this effect, the value of lost
timber is not equal to the stumpage value of the standing timber but is instead measured
by its contribution to the long-term sustained timber yield of an area.

B.C. Hydro and the Ministry of Forests differed in their approach to evaluation.
Hydro used lower stumpage values but applied them to a land base twice the size used
by the Ministry. The net loss figures calculated by both were therefore similar (see Table
VII) but based on very different assumptions. The Utilities Commission adopted both the
stumpage values and the land base figures provided by the Ministry of Forests.

An argument presented by Hydro, but discredited by the Utilities Commission,
claimed that because the forested land in the Site C area was not presently economically
recoverable, the actual forest resource loss "would be near zero" (B.C. Hydro, 1980a, p.
5.28). This argument is inconsistent with Hydro's approach to valuing lost agricultural
production, where Hydro was willing to recognize lost productive potential. Hydro's
argument was rejected because it failed to consider that the future value of the forest
lands might increase as more economical sources become scarce.

The approaches used by B.C. Hydro and the Ministry of Forests were criticized by
some participants in the Utilities Commission hearings because they do not recognize the
value of forested land for anything other than timber production. This issue will be
discussed together with the evaluation issues of hunting and trapping in Section 7.6.4.

7.6.3 General Recreation

In the general recreation category, B.C. Hydro included both the value of lost river
recreation based on a WTP approach and the value of "non-consumptive" uses of wildlife
and wilderness resources. Because the construction of a dam increases reservoir recreation and decreases river recreation, the net impact on recreation opportunities depends upon the relative demands for these types of recreation and the difference in value between reservoir and river recreation. While Hydro stated that it assumed river recreation to be 1.0 to 1.5 times as valuable as reservoir recreation, the data presented in its SCBA only reflect the assumption that river recreation was 1.2 times as valuable. In contrast to Hydro's approach, the Ministry of Lands, Parks and Housing assumed that river recreation was 1.5 times as valuable as reservoir recreation. The Ministry assumed that general recreation was valued by individuals at $16-18 per day, compared to Hydro's estimate of $29 per day. The Utilities Commission adopted both the higher river recreation value and the higher WTP value (see Table VII for results).

In general, B.C. Hydro's treatment of recreation benefits is not well documented in its cost-benefit analysis. Recreation benefits are aggregated and no indication of the value of non-consumptive types of recreation is given, although Hydro later clarified this during the course of the Utilities Commission hearings. During those hearings, both B.C. Hydro and the Ministry of Environment agreed that the non-consumptive value of wildlife was equal to one-third of the hunting value of wildlife. While this valuation overcomes to some extent the limitation of a Clawson approach -- which values wildlife "as if their main value is to be stalked and killed by sportsmen" (McAllister, 1980, p. 131) -- it is not clear whether this arbitrary figure reflects the true value of wildlife for recreational enjoyment, scientific research or ecological stability, for example.

7.6.4 Hunting and Trapping

In valuing hunting and trapping impacts, B.C. Hydro made several assumptions which were contested during the Utilities Commission hearings. The first was the willingness-to-pay approach used in Hydro's evaluation and accepted by the Utilities Commission. The
Ministry of Environment used a willingness-to-be-compensated (WTS) approach which gave a resource value twice as high as the WTP approach (see Table VII).

The second assumption used by Hydro was a presumption that losses in hunting and trapping potential are directly proportional to the loss in land area. In general, there seems to be no basis of support for such an assumption (Nemetz et al., 1980). For Site C, this assumption was somewhat borne out by trappers' claims that the 6 percent loss in area would create no more than a 10 percent reduction in trapping capacity (BCUC, 1983, p. 191).

Hydro's third assumption was to neglect of the value of lost enhancement potential on the grounds that there were "no specific plans for wildlife enhancement and no assured future demand for the increased stock" (BCUC, 1983, p. 190). The Ministry of Environment did have enhancement plans, and the Utilities Commission agreed that lost enhancement potential should be included in the valuation of resource losses. Hydro's argument again points out some inconsistencies in its resource evaluation approach in general. While Hydro accepted the evaluation of agricultural losses based on production potential without considering actual levels of future demand, it was unwilling to recognize lost potential of wildlife resources.

The fourth assumption made by Hydro, and not challenged by the Utilities Commission, was its neglect of uses of forest and wilderness areas for activities other than timber production, hunting and trapping, and non-consumptive use of wildlife. Other uses of forest land mentioned by intervenors included its use for fuel, as a climate modifier, for scientific study or for ecological stability (BCUC, 1983, p. 178).

7.6.5 Fisheries

B.C. Hydro estimated the net impact on fishing opportunities in the Site C area to range
from a loss of $300,000 to $2.0 million (see Table VII). In contrast, the Ministry of Environment estimated resource losses of $2-4 million. The evaluation of fishery impacts remained unresolved at the end of the Utilities Commission hearings. Disputes centered on estimates of maximum sustainable yield in the reservoir and estimates of demand. Hydro’s calculations showed the Site C dam would enhance angling days by almost 50 percent while the Ministry’s calculations determined that angling days would decline by 25 percent. The differences in this assumption largely accounted for the different estimates produced by Hydro and the Ministry. The Utilities Commission concluded that neither Hydro nor the Ministry of Environment had sufficient data upon which to base an evaluation of fishery impacts and charged them both with the responsibility of further study (BCUC, 1983, pp. 203-4). In general, the Commission agreed with the evaluation parameters used by the Ministry of Environment, except for its use of WTS rather than WTP as the basis for evaluation.

7.7 CALCULATION OF SOCIAL COSTS

Regional impacts were presented in B.C. Hydro’s cost-benefit statement (1980a, p. 7.10) but are not well documented. Impacts on physical infrastructure, family relocation, community stability and social infrastructure were rated according to their expected magnitude (insignificant, minor or major) with no additional information or description given (see Table VIII). Although more data were available in Hydro’s Environmental Impact Statement (1980b), no mention was made of these in its SCBA (1980a).

During the Utilities Commission hearings, more detailed evidence of regional social impacts was presented. The four issues which were addressed were: (i) resident versus non-resident employment, (ii) community impacts, (iii) health service impacts, and (iv) impacts on native communities. None of these considerations was explicitly incorporated into the Site C cost-benefit calculations, but the Commission did make recommendations
TABLE VIII

SOCIAL IMPACTS OF SITE C
(identified by B.C. Hydro)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Significance¹</th>
<th>Direction²</th>
<th>Potential for Mitigation³</th>
<th>Potential for Compensation³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical infrastructure</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>P</td>
</tr>
<tr>
<td>Relocation</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>P</td>
</tr>
<tr>
<td>Community stability</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>P</td>
</tr>
<tr>
<td>Social Infrastructure</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>F</td>
</tr>
<tr>
<td>Income</td>
<td>1</td>
<td>+</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Employment</td>
<td>1</td>
<td>+</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Aesthetic/Visual</td>
<td>2</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes:

1. 0 Insignificant  2. + Positive  3. F Full
   1 Minor           - Negative  P Partial
   2 Major

Source: B.C. Hydro, 1980a, p. 7.10.
concerning their treatment.

Because the distribution of project benefits depends to a large extent upon the locus of hiring, the Utilities Commission recommended the development of local hiring programs to be administered by Hydro (BCUC, 1983, pp. 224–225). The Commission also dealt with requests for compensation by four local Peace River communities by recommending a compensation package for Fort St. John, Hudson Hope and the Peace–Liard Regional District based on a monitoring program. The Commission turned down the town of Taylor’s request for compensation and a request from the Peace–Liard Regional District for intangible costs (BCUC, 1983, pp. 229–237). The Utilities Commission also recommended a monitoring program for impacts on native communities (pp. 240–246) with three restrictions: (i) compensation should be in kind rather than as direct cash payments to natives, wherever possible; (ii) any monetary compensation should be used to develop compensation schemes in conjunction with native input; and (iii) compensation should not be based on the cumulative impacts of various developments on the native subsistence economy but on specific Site C impacts only.

7.8 EVALUATION ISSUES

7.8.1 The Evaluation of Intangible Project Impacts

B.C. Hydro recognized several intangible resource impacts in its SCBA. The major impact discussed was on heritage resources, for which Hydro had "no satisfactory method for suggesting even an approximation to value" (B.C. Hydro, 1980a, p. 3.5). Both B.C. Hydro and the Utilities Commission agreed to participate in a cost-sharing program to salvage heritage resources. Under this program, Hydro would be responsible for up to $1.1 million and the province responsible for up to $500,000. Implicitly, one could assume the value of intangible heritage resources to be at least $1.6 million. This issue was not highly
contested during the Utilities Commission hearings.

The other intangible resource impacts mentioned in Hydro's social cost-benefit analysis were effects on air and water quality, and climatic effects. In little more than one sentence Hydro mentioned "unquantifiable visual, aesthetic and relocation impacts" (1980a, p. 7.9) but failed to elaborate upon these in any way, other than to provide a table listing the relative magnitude of these impacts (B.C. Hydro, 1980a). Although some additional information can be found in Hydro's *Environmental Impact Statement* for Site C (1980b), there is no reference to this document in the discussion of intangible impacts.

Hydro's treatment of these intangible resources leads to the conclusion that "unquantifiable" resources are synonymous with "undescribable" resources. Although Hydro felt that "benefits and costs which can be quantified are often the least controversial aspect of project analysis" (1980a, p. 7.9), it gave very little information on the supposedly more controversial intangible resource impacts. From the evidence presented at the Utilities Commission hearings, it seems that the *quantifiable* impacts proved to be the most controversial.

7.8.2 The Debate Over WTP vs. WTS

B.C. Hydro adopted a willingness-to-pay approach for all of its resource valuations. During the Utilities Commission hearings it became evident that the Ministry of Environment used willingness-to-be-compensated (WTS) figures for lost access to recreational resources on Crown land. Hydro itself recognized that recreation on Crown lands is an "inalienable public right" (1980a, p. 7.8), yet did not use WTS measures for these resources (see previous discussion in Section 4.1.1).

In contrast, the Utilities Commission denied this notion of any inalienable right of private citizens with respect to Crown resource losses. The Commission argued that cost
and benefit estimates should measure worth to the province as a whole and not to any special group of users (1983, p. 148). In the Commission's estimation, only WTP calculations are correct. The only use of WTS recognized by the Utilities Commission was for impacts "on native Indian rights under treaty" (BCUC, 1983, p. 148). This decision by the Commission may portend future debate over the blanket adoption of WTP measures in light of the ELUC's recommendation to use WTS to evaluate natural resource losses on publicly-owned land (1977, p. 37).

7.8.3 The Discount Rate

In its choice of a discount rate, B.C. Hydro calculated its social opportunity cost of capital as 6 percent, which it determined by weighting its various sources of funds. For purposes of sensitivity testing, B.C. Hydro adopted discount rates of 3, 6 and 10 percent.

There was a fair amount of debate during the Utilities Commission hearings over the selection of an appropriate discount rate. Fox (1981) argued that Hydro's estimate of the social opportunity cost of capital (SOCC) was inaccurate because it was based on a subsidized rate on trusteed funds given to Crown agencies such as B.C. Hydro at the expense of pensioners (such funds provided 43% of B.C. Hydro's capital requirements). The true SOCC would therefore be greater than 6 percent. Lord and Sydneysmith (1982) claimed that 6 percent was the lowest plausible discount rate and recognized that there were arguments to support an even higher rate. The ELUC cost-benefit guidelines (1977, p. 71) suggest using discount rates of 8, 10 and 12 percent if a true SOCC cannot be determined. Treasury Board Canada (1976) guidelines recommend 5, 10 and 15 percent.

Ultimately, the Utilities Commission decided to use a hybrid discounting approach in which (i) a 3 percent discount rate would apply to resource costs and benefits (based on the long-term risk-free government bond rate equaling the SRTP), and (ii) an 8
percent discount rate would apply to investment cash flows (based on the Commission's estimate of the SOCC). The Commission's approach appears consistent with the method advocated by Pearce (1983), but should not neglect the benefits of sensitivity testing on the SRTP and/or the SOCC.

7.9 A Summary of Benefit and Cost Estimates

Table IX summarizes the benefit and cost estimates that emerged during the Utilities Commission hearings for a range of discount rates. The discounted value of net benefits for Site C ranged from a high of $766.6 million (estimated by B.C. Hydro) to a low of $-409.2 (estimated by SPEC). The Utilities Commission did not produce final estimates of net benefits or cost/benefit ratios for Site C because Hydro had not correctly estimated project benefits, and fishery impacts had not been accurately determined.

It is possible to derive approximate net benefit measures for Site C based on the best information available at the end of the BCUC hearings. These are presented in Table X. Discount rates of 6, 8 and 10% were chosen because there seemed to be a consensus among participants that 6% was the lowest possible rate. These discount factors were applied to project benefits and capital costs. Because B.C. Hydro's benefit estimates were determined to be incorrect, the only other benefit estimates available were those calculated by Lord and Sydneysmith (1982). These are also shown in Table X. Both B.C. Hydro (1980a) and Lord and Sydneysmith (1982) agreed on the present value of capital and operating costs; the Utilities Commission did not appear to contest these.

The resource costs used in Table X are those recommended by the BCUC. Discounted present values using the hybrid discounting approach and an 8 percent rate are shown. However, these resource costs exclude the value of fishery impacts as the Utilities Commission determined there were insufficient data on which to base an evaluation. Using
### TABLE IX

A COMPARISON OF BENEFIT AND COST ESTIMATES
FOR SITE C ($ millions 1981)

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>Analysis by:</th>
<th>Present Value Benefits</th>
<th>Present Value Capital Costs</th>
<th>Present Value Resource Costs</th>
<th>Present Value Net Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>B.C. Hydro1</td>
<td>$2078.7</td>
<td>$1137.0</td>
<td>$175.1</td>
<td>$766.6</td>
</tr>
<tr>
<td>6%</td>
<td>B.C. Hydro1</td>
<td>1233.7</td>
<td>939.9</td>
<td>53.6</td>
<td>240.2</td>
</tr>
<tr>
<td></td>
<td>SPEC2</td>
<td>791.7</td>
<td>805.6</td>
<td>46.3</td>
<td>- 60.2</td>
</tr>
<tr>
<td>8%</td>
<td>SPEC2</td>
<td>445.5</td>
<td>712.9</td>
<td>23.1</td>
<td>- 290.6</td>
</tr>
<tr>
<td></td>
<td>BCUC</td>
<td>n.e.</td>
<td>n.e.</td>
<td>28.64</td>
<td>n.e.</td>
</tr>
<tr>
<td>10%</td>
<td>B.C. Hydro1</td>
<td>771.8</td>
<td>769.8</td>
<td>18.5</td>
<td>- 16.5</td>
</tr>
<tr>
<td></td>
<td>SPEC2</td>
<td>266.7</td>
<td>660.2</td>
<td>15.7</td>
<td>- 409.2</td>
</tr>
<tr>
<td>Hybrid3</td>
<td>BCUC</td>
<td>n.e.</td>
<td>n.e.</td>
<td>70.54</td>
<td>n.e.</td>
</tr>
</tbody>
</table>

Table Notes:

- n.e. Not estimated
- 1. B.C. Hydro, 1980a (converted from $1980 to $1981 at 8%).
- 2. Lord and Sydneysmith, 1982 (converted from $1982 to $1981 at 8%).
- 3. Hybrid discounting approach recommended by the B.C.U.C. for resource costs.
- 4. Excludes fishery resource impacts.

Source: B.C. Hydro, 1980a; Lord and Sydneysmith, 1982; BCUC, 1983.
TABLE X

ESTIMATED NET BENEFITS OF SITE C
($ millions 1981)

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>6%</td>
<td>$791.7</td>
<td>$805.6</td>
<td>$70.5</td>
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</tr>
<tr>
<td>8%</td>
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<td>712.9</td>
<td>70.5</td>
<td>28.6</td>
</tr>
<tr>
<td>10%</td>
<td>266.7</td>
<td>660.2</td>
<td>70.5</td>
<td>28.6</td>
</tr>
</tbody>
</table>

these data, the discounted value of Site C's net benefits range from -$393.5 million to
-$42.5 million; there are no net benefits to be gained from constructing Site C, only net
losses.

7.10 POLITICS AND THE SITE C PROJECT

In retrospect, B.C. Hydro's social cost-benefit analysis of Site C seems inadequate. A look
at the political events surrounding the Site C project casts further doubt on the usefulness
of SCBA in actually guiding government decisions. The story to be told deals with
problem definition and the related issue of energy exports. Specifically, was the real
problem being addressed by B.C. Hydro and the provincial government one of determining
how to avoid an energy shortfall, or of how to justify building Site C? The following
analysis makes the latter problem definition appear more likely.

The provincial government's policy toward energy exports in the late 1970s was to
allow exports of surplus electricity only, and on an interruptible basis; building projects
specifically for export markets was not pursued (Vancouver Sun, Aug. 30, 1985, p. A16).
At about the same time that B.C. Hydro announced its intention to build Site C for
domestic demand, Hydro chairman Robert Bonner was saying he was in favor of energy
exports and was actively looking into the possibility of developing export markets. He also
claimed that the province would have to start considering nuclear energy by the

Some time after Site C was announced, the provincial Social Credit government
tried to show its concern to avoid building projects unnecessarily in several ways: the
Utilities Commission review process was established; Energy Minister McClelland reiterated
the government's policy that overbuilding for energy export would not be allowed
(Province, Feb. 7, 1982, p. C1); and Premier Bill Bennett assured voters that large
development projects were not the answer to economic and unemployment problems (Daily Colonist, Feb. 23, 1978, p. 22). Members of the NDP Opposition party were nevertheless suspicious that Site C was linked to energy export rather than provincial energy demand (Province, Oct. 4, 1979, p. A4).

Because provincial policy did not encourage building energy projects for export, the Utilities Commission's review of Site C, and B.C. Hydro's argument supporting it, proceeded on the basis of provincial energy demand only. The potential benefits of energy exports were not considered. The BCUC recommendations to the provincial government were that Site C had not been shown conclusively to be the best project to build, and that future energy demand levels did not require construction to start at that time (BCUC, 1983).

After receiving the Utilities Commission's recommendations, the Social Credit government announced a ten year moratorium on the Site C project and simultaneously announced that further public review of demand and project alternatives would not be necessary (Vancouver Sun, Nov. 9, 1983, p. C3). Only several months after this government decision, B.C. Hydro applied to the National Energy Board for expanded export licences for surplus power from its recently completed Revelstoke hydroelectric project. Environmental groups feared that this application would re-open the possibility of constructing Site C for export (Province, March 15, 1984, p. 26).

The fears of Opposition members and environmentalists were justified one year later with Premier Bill Bennett's announcement on August 29, 1985 that Site C would be built for export if markets could be found. He also restated the government's earlier decision to avoid further public review (Vancouver Sun, Aug. 30, 1985, p. A16). In other words, Site C would be built for energy exports if markets could be found, regardless of the social costs and benefits of such a proposal.
Within a few months, not only did it seem likely that Site C would be built for export without conducting a SCBA, it also seemed that B.C. Hydro was again determined to build Site C to supply domestic energy. Despite the BCUC's admonitions that Hydro had not proven Site C to be the best energy project to meet provincial requirements from a social cost-benefit point of view, the new Hydro chairman Chester Johnson claimed that Site C would definitely be the next project undertaken: "We will build Site C, either for the export market or our own domestic needs. . . . Our aim is to be a provider of low cost electricity and that necessitates bringing on Site C" (Vancouver Sun, 1986).
CHAPTER 8
IMPROVING SOCIAL COST–BENEFIT ANALYSIS

The preceding chapters have made it clear that there are many economic, ethical and political problems with social cost–benefit analysis. The purpose of this chapter is to suggest some ways to improve SCBA and illustrate how such improvements could be adopted in practice. Section 8.1 will develop some general principles for improvement, followed by an application of these principles in Section 8.2 to the project evaluation process described in the Site C case study in the previous chapter.

However, before considering how social cost–benefit analysis could be improved, we should first consider why we want to improve it. Perhaps there are alternative methods of project evaluation that are better than social cost–benefit analysis.

Whether or not there are alternatives to social cost–benefit analysis depends on what one believes the purpose of project evaluation is or should be. There are at least four possible purposes which project evaluation can serve. The first is to ensure that wise social decisions are being made by government for the benefit of all society regardless of the power and influence of various sub–groups within society. This view most closely resembles that of the social economist who attempts to make decisions based on maximizing economic efficiency; if efficiency is maximized, governments can then establish programs to redistribute wealth or pursue other social goals as they see fit. Another purpose of project evaluation might be to guarantee some minimum level of fiscal responsibility to ensure that government projects stay within budgeted resources. This view might resemble the position taken by treasury departments or by politically conservative individuals who desire strict control over government spending. A third possible purpose of project evaluation is to coordinate the project decisions of one government agency with the
policy goals of other government departments. This view might reflect the approach taken by government planners responsible for developing and implementing regional economic development and environmental quality goals, as well as social programs. Finally, the purpose of project evaluation might also be to provide a backdrop for the lobbying and use of political power that often affects project decisions. This view takes a political approach, in which bargaining and political tactics are used to allow those who can get their way to have their way.

In reality, project evaluation must accommodate all four possible views because of the diversity of individuals and organizations involved in a project evaluation process. Governments face pressure to justify their decisions. People want to know that government funds are not being misallocated or being used in a grossly inefficient manner. Some people might also wish governments to show that they are making the best possible decision according to various criteria. Policies and goals exist in a wide variety of government departments, and there will be pressures from these departments to ensure that other departments' actions will not be counterproductive to their own. Because projects must be implemented as well as evaluated, governments will face pressure from those who have some power to oppose or obstruct implementation.

Social cost–benefit analysis is designed to fulfill only one of the four purposes that project evaluation might serve: the generation of wise social decisions from the perspective of economic efficiency or some modification thereof. It does not necessarily guarantee fiscal responsibility in government, nor does it necessarily provide for the coordination of government policies, or take into consideration the political forces that may thwart project implementation. And, as the previous chapters in this paper have shown, social cost–benefit analysis cannot guarantee that wise social decisions will be produced by following the cost–benefit methodology. What social cost–benefit analysis can do reasonably well is reveal
certain information about problems, alternatives, goals and objectives, consequences, and possible estimates of the costs and benefits to society of making various decisions. This information can be used to help individuals make decisions according to a variety of perspectives, be it wise social decisions, fiscal responsibility, planning and coordination, or political bargaining.

Is there an alternative to social cost-benefit analysis that meets all four purposes of project evaluation but that avoids the problems associated with SCBA? The Planning Balance Sheet and the Goals Achievement Matrix are touted, at least by their authors, as being alternatives to SCBA. However, SCBA, PBS and GAM are not different techniques but variations on a theme. They differ only in the way they define objectives. SCBA usually relies on economic efficiency, while PBS uses both economic efficiency and income redistribution, and GAM uses any of several objectives. Once the objectives have been defined, however, the three methods follow exactly the same procedure. All three are examples of a goal-dependent or substantively rational decision model which follows five steps: (i) the recognition of a problem; (ii) the definition of goals and objectives; (iii) the identification of alternatives; (iv) the identification of consequences; and (v) the evaluation of consequences. The previous chapters have shown that this goal-dependent model fails in many ways when applied to the complex projects that fall under the purview of social cost-benefit analysis.

If we accept this goal-dependent process for project evaluation, there really is no alternative to social cost-benefit analysis. But there certainly is room for improvement. However, before trying to improve SCBA it is essential to decide to what end we are seeking improvement. We could, for example, ignore the variety of perspectives on project evaluation and try to improve the way SCBA makes claims about wise social decisions from an economic efficiency perspective. Or, we could take a broader approach and
attempt to modify social cost–benefit analysis to allow it to generate information that would be useful from a variety of perspectives. The latter is the approach taken in the remainder of this paper.

8.1 ADDRESSING THE PROBLEMS

The various problems with social cost–benefit analysis are of five different types: empirical, methodological, theoretical, ethical and political. The matrix in Table XI classifies the problems discussed in preceding chapters according to the stage of analysis and type of problem.

Empirical problems arise in the observation and measurement of states of the world, or variables within a system, such as economic, social and environmental systems. The problems that arise include difficulty in obtaining certain measurements (e.g., the aesthetic value of a wilderness site) or the existence of different measurements of a variable produced by the same basic measurement technique (e.g., conflicting estimates of the amount of land flooded by a dam). Different measurements might arise because of some natural variability in the environmental, economic or social system being measured, or because of an inherent lack of precision in the measurement technique itself (there may be a margin of error or the method may be applied inconsistently).

The kinds of empirical problems that arise most often in cost–benefit analysis affect the identification and evaluation of project impacts. For example, the measurement technique for identifying the amount of flooded agricultural land may be as simple as defining agricultural land and measuring the acreage that would be lost, yet different estimates could result from different definitions of agricultural land or from the use of different maps as the basis for the calculations. Another empirical problem encountered in SCBA is the inability to measure or assign an economic value to changes in certain
<table>
<thead>
<tr>
<th>PROBLEM</th>
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<th>POLITICAL</th>
</tr>
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<td>Definition</td>
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<td></td>
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<td>- wicked problems</td>
</tr>
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<td></td>
<td>- wicked problems</td>
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<td>Objectives</td>
<td>- interpersonal utility</td>
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<td>- utility</td>
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<tr>
<td>Alternatives</td>
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<td>na</td>
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<td>- measurement</td>
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<td>Evaluation</td>
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<td>- biased techniques</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- option value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- non-users</td>
</tr>
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<td>- irreversible impacts</td>
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environmental resources. Intangible impacts are an empirical problem; there is no reliable instrument to measure their value.

Empirical problems might be resolved in several ways: improving the data on which analysis is based by improving data generation and reporting; increasing our understanding of systems to help determine which data should be collected; and improving the reliability of the techniques used for measurement either through more consistent application or through the creation of more accurate methods.

Methodological problems arise in the methods or rules followed in a discipline -- in its principles or procedures of inquiry. A methodological problem can exist when a measurement technique does not fully capture the values being sought because of some misspecification of the measurement technique itself (that is not accounted for by empirical problems of system variability or equipment variability).

In SCBA, methodological problems of economic evaluation techniques are revealed by the difficulty in deriving compensating variation and equivalent variation (WTP and WTS) measures of consumer surplus, by the different estimates produced by economic surrogate and hypothetical valuation approaches, by the omission of certain values (such as non-users and option values), and by the existence of biased estimates.

Methodological problems can be addressed by understanding the advantages and limitations of available techniques, identifying the sources of measurement problems, and developing and testing more theoretically consistent techniques.

Theoretical problems arise when the models, principles or theories used to explain events in the world do not correspond to events that actually occur or when general explanatory principles cannot be determined at all. Such problems result from a misspecification of the general principles used to build a theory; in other words, the
simplification necessary to construct a model cannot capture the complexity of some real
world systems.

The kinds of theoretical problems in the discipline of economics that affect social
cost-benefit analysis affect all stages of the analysis, ranging from the economic theory
used to predict future energy demand levels, to the theory of second best and the
Scitovsky reversal paradox, to the use of willingness-to-pay versus willingness-to-sell
estimates, to the selection of a discount rate.

Theoretical problems are resolved by refining existing theoretical models or by
developing new ones. However, there are constraints on our ability to solve these types of
problems, stemming not only from our limited ability to generate the required scientific
and technical knowledge but also from the need for timely analysis and the finite
resources available to conduct it.

Ethical problems arise from the conflicting interests and beliefs held by individuals
in society, particularly in individuals' different assessments of the desirability of certain
goals or actions.

In SCBA, ethical problems result in multiple problem definitions, the use of
different objectives for evaluation, and the specification of different sets of alternatives. In
the evaluation phase of SCBA, ethical problems complicate the aggregation and weighting
of costs and benefits, the assignment of rights and the use of WTP and WTS measures,
and the selection of a discount rate (in particular, its implications for future generations).

Ethical problems require some method of identifying and reconciling diverse
interests. Possible approaches might include providing an outlet for the expression of
different interests, accommodating them as far as possible in the analysis, reconciling them,
or ignoring them.
Political problems are loosely defined as pressures that encourage groups to manipulate analysis to support a desired outcome. This might take the form of intentional pressure to force a specific solution favored by some person or group, or unintentional or indirect pressure due to constraints on time and resources. Such political problems arise because of the different degrees of power held by individuals, or because of limited resources available for analysis.

The political problems that most frequently affect SCBA are biased problem definitions, missing objectives or hidden agendas, biased alternatives, overestimation of benefits and underestimation of costs, and the manipulation of project impact boundaries.

Political problems might be reduced by clarifying and strengthening the rules of analysis, or might be accommodated by creating more flexible project evaluation guidelines.

With these general concepts in mind we can now turn to specific problems that arise in each stage of a social cost-benefit analysis — from problem definition to evaluation — in the context of energy project planning and evaluation (see Table XII).

8.1.1 Problem Definition and Alternatives

Three specific problems can be identified in the problem definition phase of a SCBA (see Table XII): empirical difficulties in defining a problem; the ethical problem of conflicting problem definitions; and political incentives to bias the problem definition in the analysis.

To improve energy demand prediction, we could (i) implement ongoing monitoring and prediction of energy demand and supply conditions; and (ii) perform routine comparisons of predicted and actual outcomes to increase the accuracy of prediction and ensure that potential energy shortfalls are discovered as soon as possible.
<table>
<thead>
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<th>Economics</th>
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<tr>
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<td>Methodological</td>
<td>Theoretical</td>
<td>Ethical</td>
<td>Political</td>
</tr>
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<td><strong>Problem Definition &amp; Alternatives</strong></td>
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<td>- monitoring feedback</td>
<td>- review committee public input</td>
<td>- policy guidelines policy guidelines</td>
<td>- policy guidelines review committee public input</td>
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<td>- explore objectives</td>
<td>- sensitivity analysis</td>
<td>&quot;no net benefits&quot;</td>
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<tr>
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<td>- scoping referral process scoping referral process</td>
<td>- review committee</td>
<td>guidelines for qualitative</td>
<td></td>
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<td>- qualitative assessment</td>
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</tr>
<tr>
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<td>- guidelines</td>
<td>- guidelines</td>
<td>- guidelines</td>
<td>- experimentation</td>
<td>- experimentation guidelines</td>
</tr>
</tbody>
</table>

**TABLE XII**

ADDRESSING PROBLEMS IN SOCIAL COST-BENEFIT ANALYSIS
Multiple and conflicting problem definitions — which are closely linked to the specification of alternatives — are more likely to arise when problems have been defined narrowly rather than broadly. The broadest problem definition for energy project planning would be to ask how a future energy shortfall could be avoided. Various alternatives designed to increase supply or decrease demand could then be explored within a SCBA. However, government policy guidelines may exist which will dictate the range of "appropriate" alternatives regardless of the outcome of a social cost-benefit analysis: the construction of nuclear power plants might be temporarily banned, or governments might be explicitly or implicitly averse to demand-limiting measures. Similarly, there might be alternatives that need not be included in an analysis because they might not be technologically feasible by the time required or because they are too small or too large relative to the magnitude of the problem. Therefore, the best way to approach problem definition is to (i) begin with the broadest definition; (ii) exclude those alternatives specifically precluded by formal government statements (such as legislation or policy guidelines); and (iii) exclude any alternatives that would be inappropriate for size or technological reasons. This process of problem definition should be clearly outlined in a formal cost-benefit document. Any conflict that then ensues concerning problem definition will help government decisionmakers identify which policy guidelines are no longer appropriate, where new guidelines might be needed, or where more emphasis should be placed on technological research and development.

Biased problem definitions could be avoided by using the above approach, but the political problem facing social cost-benefit analysis is how to ensure that problem definition is done appropriately by an agency that may have internal incentives to bias the definition process. Agencies that possess the information and expertise needed to accurately define problems might try to hide a biased problem definition in highly technical concepts or limit verification of their definition by refusing access to important data. Achieving an
integrated approach to problem definition is not simple. It requires a policy and planning framework within government capable of addressing regional and resource sector policies (Cornford et al., undated; Marshall et al., 1985; Sadler, undated). A possible solution might be to use an independent agency or task force which would closely oversee or itself conduct the problem definition phase by providing it with the power to obtain the necessary information and the resources or personnel to analyze it.

This task force could be a permanent committee, composed of government personnel from a variety of departments, that would be responsible for coordinating demand prediction, problem definition and alternative selection among the various agencies with jurisdiction or expertise relating to energy project planning. Alternatively, the committee could involve participation by industry and interest group representatives, as well as by government, to reflect the diversity of interests that are affected by a project proposal.

8.1.2 Objectives

There are three problems that affect the specification of objectives for a social cost-benefit analysis: (i) theoretical problems associated with the theory of second best, the Scitovsky reversal paradox, and the need for actual compensation with non-marginal projects; (ii) the ethical problem of incorporating multiple objectives in light of Arrow’s Impossibility Theorem; and (iii) the political problem of hidden agendas.

The problems posed by the theory of second best and the Scitovsky reversal paradox have no practical solution. For example, it would be impractical and impossible to ensure that all decisions in the economy, in both the public and the private sectors, were made on the basis of social costs and benefits. Similarly, it would be administratively difficult to identify the individual people who receive benefits and have them compensate
all those people suffering losses from a project. Our inability to resolve these theoretical problems implies that the results of a social cost–benefit analysis must be taken with a grain (perhaps a block) of salt. However, the more marginal a project is relative to the economy, the less serious are these problems. It might also be possible to clarify the conditions under which actual compensation would be important. For example, individuals whose land is expropriated to make way for a hydroelectric dam are commonly compensated for the value of their lost property, but it might also be desirable for political or ethical reasons to compensate losses such as pain and suffering, lifestyle changes, the imposition of certain involuntary risks, etc.

The impossibility of defining a true, unique social welfare function is also a serious problem for social cost–benefit analysis if we assume that using SCBA will guarantee the wisest social decision — it cannot, as we have seen. The existence of positive net benefits cannot be an objective measure of a project’s desirability and hence should not be used as the sole justification for deciding whether or not to approve a project. What is needed instead is a clear statement of the purposes of project evaluation; if it cannot be to maximize social welfare, it must have a more specific purpose. Deciding that SCBA should evaluate only economic welfare is not a solution because we have seen that SCBA cannot guarantee this. There are two possible ways out of this dilemma. One way is to ignore the uncertainties posed by the various theoretical, methodological, empirical, ethical and political problems and develop strict rules for conducting SCBAs and specifying the benchmark level of net benefits that a project must exceed. The other way to approach the dilemma is to decrease SCBA's emphasis on net benefits by using the SCBA framework as an exploratory device that is as much qualitative as it is quantitative. This idea will be developed further in the following sections on consequences and evaluation, but in the context of objectives we can use the basic SCBA framework to:

1. explore the economic welfare costs and benefits of projects, both quantifiable
and non-quantifiable;

2. explore the non-economic welfare costs and benefits by considering:
   i) what other important objectives might there be?
   ii) which objectives are irreconcilable with the project and which are not?
   iii) what are the quantitative and non-quantitative effects of the project on these other objectives?

3. derive a range of net benefit estimates:
   i) from an economic efficiency perspective;
   ii) incorporating income distributional weights; or
   iii) incorporating other objectives,
   with as much emphasis on non-quantifiable impacts as on quantifiable ones.

8.1.3 Consequences

Two major problems affect the identification of consequences in a cost-benefit analysis: (i) the empirical, methodological and theoretical problems in the definition, measurement and prediction of economic, environmental and social impacts; and (ii) the politically motivated manipulation of project impact boundaries.

To avoid the problem of cumulative impacts that may arise from the way in which impacts are defined, a SCBA should measure impacts in the traditional method of "before" and "after" scenarios but also identify any economic, environmental or social goals that might be affected by the project in question. The identification of these goals would require some form of notification to and feedback from a variety of government departments concerning a project's expected impacts before a written cost-benefit document is produced. This feedback could then serve as a qualitative assessment of conflicting goals and indicate where mitigating measures, either in the project under review or in other departments' projects, would be required to ensure important goals would still be met.
Achieving this goal requires an integrated policy and planning framework similar to that required for coordinated problem definition and alternative selection. Moreover, it suggests that a two-tiered approach to project evaluation could be beneficial: the first stage would address general policy issues on, for example, energy development strategies and economic, environmental and social policy objectives, while the second stage would deal with the identification and evaluation of selected project alternatives (see, e.g., O'Riordan and Sewell, 1981; Marshall et al., 1985).

Although the complexities of impact measurement and prediction were addressed only briefly in this paper, some general problems seen in the case study of Chapter 7 include inadequate historical data on which to base predictions, adequate data but inadequate coordination among various government departments to secure that information, or inaccurate prediction. Overcoming these problems would be facilitated by identifying problems early enough to allow the planning and research required for impact measurement. For example, soon after a problem has been identified, objectives set and alternatives selected, a scoping session could be held by the agency conducting the SCBA along with other government departments to identify impact categories, identify what data are readily available, routinely collected and reliable, determine what data will need to be generated, and how that data can be generated with the time and funds available (Marshall et al., 1985; Sadler, undated; Whitney and Maclaren, 1985).

The use of post-implementation project audits, which involve monitoring actual impacts and comparing them to predicted impacts, could help improve the accuracy of predictive models as well as identify any compensation measures that should be taken to mitigate serious impacts. Post-implementation audits, also referred to as follow-through monitoring and management or adaptive impact assessment (Cornford et al., undated; Whitney and Maclaren, 1985), can be applied to the prediction of environmental, social
and economic impacts. The questions that might be asked in a post-implementation audit could include: Were important impacts identified? Did the process generate timely results? Was the information technically sound and sufficiently focussed to be of use to decision-makers? (see also Sadler, undated).

The manipulation of project boundaries can only be resolved with a clear political statement of the purposes of the project evaluation and approval process. A tendency for provincial governments to consider only those impacts within provincial boundaries may be politically justified, even if not sanctioned by welfare economists, but impacts to individuals outside the province may nevertheless occur and compensation for costs could be required. Such potential impacts and costs should be considered if a full accounting of a project is desired.

8.1.4 Evaluation

There are empirical, methodological, theoretical, ethical and political problems that affect the evaluation phase of a SCBA. These include: (i) the empirical problem of intangibles; (ii) the methodological problems posed by bias, option value, non-users' preferences, irreversible impacts, and diverging equivalent variation (EV), compensating variation (CV) and Marshallian estimates; (iii) the theoretical problems in selecting WTP versus WTS measures and the choice of a discount rate; (iv) the ethical problems of aggregating and weighting costs and benefits, using a non-zero discount rate, and determining rights; and (v) the political incentives to overstate benefits, understate costs, stress quantitative costs and benefits, and ignore qualitative ones.

Intangibles can be dealt with in several ways in a SCBA. Firstly, those in charge of establishing cost-benefit guidelines could keep abreast of research in evaluation techniques for as yet intangible resources, or even sponsor such research themselves.
Secondly, guidelines for reporting intangibles could be developed that would ensure a minimum level of specificity; for example, variables such as the nature of the impact, the potential population affected, a subjective assessment of impact magnitude, the location of the impact, and the worst possible outcome could be reported, along with a detailed statement of why an impact could not be measured or assigned an economic value.

There are three approaches for dealing with the various methodological problems in evaluation: research, guidelines and experimentation. As with intangibles, the branch of government responsible for cost–benefit guidelines could sponsor or keep informed of recent developments in the treatment of option value, non–users, etc. Specific guidelines stating how such cases will be handled could be developed, such as ignoring option values, non–users, and the effect or irreversible impacts because both the theory and methodology concerning their use is indeterminate. However, the case study in Chapter 7 suggests that such an approach might still generate conflict; people will not unanimously agree on the guidelines to be adopted. Alternatively, more flexible guidelines could be developed that would allow experimentation: in effect, a type of sensitivity analysis. Different cost and benefit estimates could be generated, some with option values and some without, some incorporating non–users and some using more traditional evaluation techniques, and some incorporating some additional measure for irreversible impacts. This would at least identify if such non–users, option values and irreversible impacts had any significant affect on the evaluation, or if they could easily be ignored.

The theoretical problems associated with selecting a discount rate and using WTP or WTS estimates for uncertain impacts can be dealt with by waiting for some definitive theoretical breakthroughs, establishing guidelines that state which discount rate or rates should be used and which value estimates should be used (as is currently done), or using such guidelines in combination with an experimental approach as suggested for
methodological problems. Awaiting the discovery of theoretical breakthroughs is probably not a practical alternative: developments could take decades. The advantage of using guidelines combined with experimentation is to ensure consistency in the evaluation of different projects, yet allow flexibility in individual analyses. For example, the recent practice of discounting financial costs and benefits by a market rate of interest and discounting non-financial costs and benefits at a lower social rate of interest seems to be a useful and theoretically appealing guideline for discounting. A range of discount rates could then be used for sensitivity analysis of both financial and non-financial impacts. Because of the relatively recent theoretical developments concerning the use of WTP and WTS estimates for valuing uncertain resource impacts, current valuation practices might continue as is, but the agency responsible for cost-benefit guidelines could continue to monitor future theoretical developments in this area.

The ethical problems that arise in evaluation must be identified before they can be resolved or analyzed within the context of a specific SCBA. The first step in tackling ethical problems is to create some method or process by which these concerns can be discovered before a cost-benefit document is produced so that they can be incorporated in the final analysis, but identified after people have become aware of the possible impacts of a project. The ethical dilemmas that have the most effect on SCBA are the existence of non-utilitarian frameworks, the assignment of rights to common-property resources, and the implications of the discount rate for future generations. If people express concerns about these issues, they might be addressed within a SCBA by (i) identifying the types of non-utilitarian principles held by groups or individuals and qualitatively assessing the effect of the project on those principles or quantitatively exploring, for example, the implication of weighting irreversible impacts or involuntary risks; (ii) exploring the magnitude of the difference between WTP and WTS estimates for common property resources; and (iii) comparing the use of a zero discount rate with some positive rate for non-financial costs.
and benefits.

The political incentives to overstate benefits and understate costs result when benefits are assumed to be more certain and costs less certain than they actually are. In a cost–benefit analysis, it is common to identify a range of impact measures for each variable affected by a project that spans from the worst possible outcome to the most likely and the best possible outcomes. Benefits can be overstated and costs understated by defining the most likely outcome to be that which would provide a more favorable outcome for the analysis. To avoid this possibility, explicit probability assessments of each impact scenario, derived by either expert judgment or more objective probabilistic assessments, could be used. These could then be tested and refined in post–implementation audits. The tendency to ignore qualitative impacts and stress quantitative ones could be countered by specifying a list of qualitative impacts and minimum levels beyond which such effects would be evaluated and described according to some criteria, such as those described for intangibles in this section.

8.2 REDESIGNING PROJECT EVALUATION PROCESSES

In this section, the previous suggestions are used to complement the basic project evaluation process existing within the B.C. Utilities Commission Act. The basic elements of this process, described in detail in Chapter 6 (see also Figure 4), include: (i) the use of a joint government, industry, and interest group coordinating committee to oversee the preparation of analyses; (ii) a clear separation of the impact identification and evaluation phases; and (iii) the use of flexible guidelines for preparing a social cost–benefit analysis. By incorporating modifications to these three basic elements, many of the problems with social cost–benefit analysis can be addressed.
FIGURE 4
THE PROJECT REVIEW PROCESS
OF THE B.C. UTILITIES COMMISSION ACT

Proponent applies for Energy Project Certificate

Energy Project Coordinating Committee directs
Proponent to prepare Impact Statements and
Social Cost-Benefit Analysis

EPCC makes recommendation on hearing

no public hearing recommended

public hearing is recommended

Ministers of Energy and Environment make joint
recommendation on hearing

hearing is waived

hearing is required

B.C. Utilities Commission conducts hearing

B.C.U.C. makes recommendation on project

Final decision on Energy Project Certificate
application made by Provincial Cabinet

Source: derived from Thompson et al., 1981
This new project evaluation process (see Figure 5) would begin by the preliminary identification of a problem, such as a pending energy deficit, by the project proponent. The proponent would set out the problem it perceives and submit it to a coordinating committee consisting of the Energy Project Coordinating Committee, plus one industry and one interest group representative (selected jointly by the Ministers of Environment and Energy). This committee would be responsible for (i) recommending that the problem be exempted from a detailed project evaluation according to existing criteria in the *Utilities Commission Act*, or (ii) developing a detailed Problem Statement in conjunction with the proponent and any other government departments that could provide needed information on, for example, economic forecasts for energy demand projections or potential energy developments. This analysis would be conducted by the Coordinating Committee itself rather than by the proponent, and would result in a detailed problem statement and list of project alternatives derived by considering government policy guidelines and technical feasibility. By vesting authority and responsibility for this phase of the analysis in the Coordinating Committee, the possibility of biased problem definitions and incomplete specification of alternatives should be reduced.

The Problem Statement prepared by the Coordinating Committee would then be released publicly and be followed by a 30 or 60 day period in which written submissions could be given to the committee by any concerned individuals or groups. This would provide the public with an opportunity to verify the Problem Statement and help the Coordinating Committee identify any overlooked items in the analysis or any weak areas in government policy. The purpose of this submission period is not to stage a formal debate on government policy; it is intended only as a check that existing government policies have been considered and been appropriately applied. For this purpose, written submissions, rather than public hearings, should be appropriate.
A NEW PROJECT REVIEW PROCESS

Proponent applies for Energy Project Certificate

Energy Project Coordinating Committee prepares Problem Statement

EPCC directs Proponent to prepare Impact Statement and coordinates joint agency input

EPCC makes recommendation on hearing

no public hearing recommended  public hearing is recommended

Ministers of Energy and Environment make joint recommendation on hearing

hearing is waived  hearing is required

Proponent prepares SCBA

B.C. Utilities Commission: conducts Impact Review hearing; drafts SCBA Guidelines; conducts Guideline Review hearing;

Proponent prepares SCBA

B.C.U.C. makes recommendation on project

Final decision on Energy Project Certificate application made by Provincial Cabinet
After the period for written submission has ended, the Impact Analysis stage would begin. The Coordinating Committee would have two tasks in this phase: (i) it would organize multi-agency scoping sessions; and (ii) it would generate guidelines on the types of impact analyses to be commissioned by the proponent. The purpose of the scoping sessions, which would include members of the proponent agency and various ministries (such as Forestry, Environment, etc.) would be to identify broad impact categories for the project alternatives under consideration and assess the availability and reliability of existing information, as well as determine what analysis would need to be generated. Based on the results of these scoping sessions, guidelines would be developed for the types of analysis the proponent should undertake. After the proponent has completed the Impact Statement, the results would be reviewed by the Coordinating Committee and members of the scoping sessions. This type of process would help avoid unnecessary duplication of analysis by utilizing data available from various government departments, where possible, and also help forge a consensus about the reliability of the impact measurements. Part of the review of the Impact Statement could include the development of probability estimates for uncertain resource impacts.

Once the preparation and review of the Impact Statements have been completed, the Coordinating Committee would develop and present its recommendations concerning a public hearing to the Cabinet. The Ministers of the Environment and of Energy, Mines and Petroleum Resources would then jointly make a final decision about the necessity of a public hearing. The decision they make, however, differs considerably from the decision made under the existing review process. Under the existing process, the Ministers make a recommendation on a public hearing after a cost-benefit document has been prepared by the project proponent (albeit, not necessarily an accurate one). In the new process suggested here, only the Impact Statement would be available at the time they made their decision. Thus, they would decide whether the impacts identified were of a serious and
controversial nature and whether the problem warranted more than the traditional economic-efficiency oriented social cost-benefit analysis.

If the Ministers make a decision against a public hearing, the Coordinating Committee would direct the proponent to commission a social cost-benefit analysis of the various project alternatives according to the government's existing, formal SCBA guidelines (ELUC, 1977) (and subject to many of the problems identified in this paper). However, this option would provide government decision-makers with some additional, valuable information to help them make decisions about non-controversial problems without as much additional cost and delay associated with a public hearing process.

If the Ministers decide that a public hearing should be held, their decision would be accompanied by the release of the Impact Statement. The Impact Statement would be released to the public and be distributed by the Coordinating Committee to each government ministry and to any provinces that might be affected by any of the projects under consideration. This procedure would ensure that government departments could be made aware of any project implications on their own departments' policies. Notification of potentially affected provinces would allow these provinces to notify the proponent of any costs for which they would seek redress or compensation.

A public hearing process would begin approximately 60 to 90 days after the release of the Impact Statement and would be conducted by the B.C. Utilities Commission. This shift in control from the Coordinating Committee to the Commission is followed in the existing project review process and provides a more neutral check on the analysis. The purpose of the public hearing would be twofold: (i) to check the accuracy of the Impact Statement; and (ii) to develop specific guidelines for the evaluation of project impacts in a social cost-benefit analysis.
The first phase of the hearing would deal exclusively with the Impact Statement (its accuracy, the nature of the impacts, and individuals’ ethical or other concerns about those impacts) and would be structured formally, like the Site C hearings, in which any concerned groups or individuals would give a presentation and be subject to cross-examination. Because the function of this stage is not only to assess public response to the various project alternatives and their impacts, but also to judge the accuracy of the analysis in the Impact Statement, the formal, court-like proceedings seem suitable. Based on the evidence presented at the hearings, the Commission would require the proponent to remedy any deficient analysis.

The Commission, once satisfied with the accuracy of the Impact Statement, would recess the hearings to draft guidelines for the preparation of the cost-benefit document. The Draft SCBA Guidelines would include the existing cost-benefit guidelines adopted by the government (ELUC, 1977); these cost-benefit guidelines should first be amended to clarify the treatment of intangibles. Modifications to these guidelines would be suggested by the Commission based on the concerns raised by participants in the hearing process. For example, the Commission might decide that objectives other than economic efficiency should be explored, that distributional weights should be applied, that irreversible impacts should be given extra weight, that option values or WTS values should be incorporated, or that certain ethical issues should be specifically addressed. It could also determine which impacts should not be evaluated but should be treated as intangibles. Based on these guidelines, the project proponent would be required to produce a traditional cost-benefit analysis in line with government guidelines and a more experimental social cost-benefit analysis as determined by the Commission. It is important to clarify the Commission's role in developing these guidelines; it is not to determine that the government's guidelines are inappropriate but to determine where there is substantial uncertainty or public concern about the appropriateness of traditional guidelines to warrant
a more experimental and exploratory use of SCBA.

After the Draft SCBA Guidelines have been prepared, the Commission would release the document to the public for comment and reconvene the hearing. At this stage, two approaches are possible. The Commission could listen to feedback about these guidelines and then produce a final version using its discretion. Alternatively, if it seemed feasible, representatives from key interest groups and organizations could attempt to formally negotiate appropriate evaluation guidelines. Such negotiated guidelines should not form a precedent for future project evaluation processes because the problems, project, issues and concerned parties will vary. Nor should the negotiated guidelines, or any guidelines produced by the Commission, be seen as replacing the government’s formal SCBA guidelines in any particular situation. Instead, these experimental guidelines should be seen as an additional and alternate way of analyzing the problem at hand.

Following the preparation of the SCBA Guidelines, the proponent would commission a social cost–benefit analysis. To avoid any intimations of bias, the Commission or the parties involved in negotiated guidelines could jointly select a contractor to conduct the analysis; the proponent would be responsible for the cost of preparing the SCBA Document.

When the SCBA Document has been completed, it would be submitted to the Commission. The Commission would then, within perhaps 30 days, make a determination from the results of the analysis. This would include: (i) a synthesis of the desirability of the various projects, commenting on, for example, the significance of option values or of various discount rates on the analysis, and on the significance of the ethical issues raised; and (ii) a specific project recommendation, if possible. The SCBA Document and the Commission’s general synthesis would be released publicly within 30 days, and its specific recommendations, if any, would be released confidentially to the Cabinet (following current
practice) at the same time. A final decision on project selection by the Cabinet would not follow for at least 30 days to allow for any final concerns to be raised directly in the political arena.

These recommendations by the Commission or by Cabinet should not be framed in terms of net benefits. Rather, they should be framed by weighting the effects of tangible and intangible effects and by weighting the relative importance of various economic, environmental, social, political and ethical implications.

From start to finish, this new project evaluation process should take no longer than the current process, and might well involve less time. The increased involvement of the Coordinating Committee should help create more relevant analysis by ensuring that problem definition and alternative selection are properly executed. This new process also adopts a more focussed use of public participation. The provision for public response to the Impact Statement in written form only allows considerable streamlining of the formal public hearing that need center only on discussion of the Impact Statement and development of SCBA Guidelines; the development of these SCBA Guidelines with the input of interested parties relieves the need for additional, formal public review of the SCBA Document once it is produced. The more active roles played by the Coordinating Committee and the Commission ensures less biased, more comprehensive analysis but maintains the burden of the cost of analysis on the project proponent. The Coordinating Committee, by holding scoping sessions with diverse government agencies, reduces duplication of analytical effort and therefore cost for the project proponent (who, in the case of B.C. Hydro, is itself a government agency). The suggested process, requiring more careful and comprehensive analysis, nevertheless does not reduce the discretionary powers of the responsible Ministers. And importantly, by allowing a more experimental use of social cost–benefit analysis, this process helps overcome at least some of the troublesome
problems associated with the technique.
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