Ethical Limitations of Social Cost Pricing: An Application to Power Generation Externalities

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According to neoclassical economic theory, the valuation of different externalities is necessary for assisting market processes and for socially efficient choices. For example, environmental effects that are unpriced in any market need to be assigned hypothetical monetary values. Taxes and subsidies that reflect these external costs will then ensure that profit-maximizing firms select the mix of goods and production technologies that best satisfy environmental and economic goals.

In recent years, policymakers and economists have particularly targeted the environmental damages arising from power generation. A series of valuation studies that attempt to estimate the environmental costs of various power-generating technologies have been commissioned by governmental authorities such as the European Commission, the U.S. Department of Energy, and the U.K. Department of Trade and Industry [Hohmeyer 1988; European Commission 1995a; Ottinger et al. 1990; Pearce et al. 1992]. These all underline the need to "get prices right" and to incorporate environmental externalities into market mechanisms. In his review and methodological critique of these studies Andrew Stirling [1998, 268] concludes that

. . . there is little doubt that neoclassical environmental valuation techniques are the approach to environmental appraisal currently preferred by the official bodies responsible for the formulation, implementation, and international coordination of environmental regulation in the electricity supply sector.

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There are a number of valuation methods in use (e.g., abatement cost, contingent valuation, hedonic pricing, etc.), but ultimately they all aim at discovering people's willingness to pay (WTP) for environmental goods and services. While Stirling's work [1997, 1998] has dealt primarily with the methodological and measurement problems associated with these methods, this paper focuses solely on the philosophical and ethical aspects of environmental valuation when applied to power generation.

The purposes of the paper are (1) to explore some of the ethical limits of neo-classical environmental valuation, and (2) to discuss what the implications are of these limits for the social choice between power-generation technologies. The central message put forth is that the scope of electricity externalities where environmental valuation can be applied from an ethical point of view is likely to be narrower than commonly assumed. Consequently, since various power sources give rise to different types of externalities—some less amenable to social cost pricing than others—the choice between different technologies becomes much more complex than is implied by economic theory (and hence by the above environmental valuation studies).

In the next section, we review briefly the ethical foundations and the limits of environmental economics and discuss alternative philosophical approaches to social choice. The subsequent section analyzes these ethical limitations in the empirical context of power generation externalities, while the final section provides some concluding comments.

Ethical Limitations of Neoclassical Environmental Economics

Since the basic thesis of this paper is that monetary valuation of environmental externalities relies on specific ethical foundations, it is useful to review these before discussing alternative ethical bases for social choice. In neoclassical economics, human beings are treated as autonomous individuals who seek to satisfy their private preferences, which are exogenously determined. This implies that individuals have given preferences ("indifference maps") for public goods and are willing to consider tradeoffs in relation to the quantity or quality of these goods. The role of the economist is to discover these preferences and to aggregate them into the overall preference of society. The policy that maximizes total preference satisfaction should be chosen. The fundamental philosophical position is thus that the net utility (benefit over cost) from the *consequences* of an action determines whether that action is right or wrong.

However, while neoclassical environmental valuation adopts a utilitarian approach, the environmental stance of individuals is in many cases likely to be based on a deontological or rights-based approach to decision making [e.g., Brennan 1995]. In this context, decisions are made on the basis of whether the act itself is

right or wrong regardless of its consequences, i.e., this approach recognizes the priority of the right over the good. For example, people may believe that aspects of the environment, such as wildlife threatened by a hydropower development project, have an absolute right to be protected. They are thus willing to defend the existence or the well being of the environment apart from any instrumental value it provides.¹ In other words, deontology denies the rationality attributed to making tradeoffs, whatever the commodity, and therefore suggests the existence of so-called lexicographic preferences.²

Clive L. Spash and Nick Hanley [1995] and Thomas J. Stevens et al. [1991, 60] find evidence that supports the existence of a deontological ethics.³ The latter study performs a contingent valuation study of species preservation in New England. A majority of the respondents (79 percent) agreed with the statement that "all species of wildlife have a right to live independent of any benefit or harm to people." Still, when confronted with the WTP question, most of the respondents refused to pay. In other words, they were reluctant to choose between something of instrumental value (private goods) and a true moral position [Booth 1994].

The motivation for the existence of a rights-based ethics, however, need not rely solely on empirical evidence. It is equally important to recognize that utilitarianism (and consequentialism) will not in itself be a sufficient moral theory for social choice. Since we cannot evaluate the net utility of an infinite number of alternatives, some options have to be ruled out. This selection cannot be justified in utilitarian terms; instead we need to choose among options that we regard as morally or politically worth considering. In other words, "the collective choice problem is, first of all, about advancing common ways of understanding what the pertinent issues are about. Only then can we develop a basis for collective choice predicated upon the elicitation of individual choice" [Vatn and Bromley 1994, 142].

This line of reasoning mirrors the work of Mark Sagoff [1988]. He suggests that individuals have two distinct roles; they act both as consumers with private preferences and as citizens with public preferences. Private preferences reflect what the individual thinks is good from a pure utility maximizing perspective, e.g., he or she prefers Coke to Pepsi. Public preferences, in contrast, state what a person believes is best or right for the community as a whole, e.g., "society should not legalize drugs." Although this is a distinction that is hard to operationalize, the consequences of not understanding the difference can lead to results that we would normally like to avoid. For example, economists usually argue that for the purpose of cost-benefit analyses it does not matter *why* people value environmental goods. As such, economists assume that all preferences are private, and they grant equal credibility to every motive that underlies these preferences. To base social choice on this approach, Sagoff argues, is the equivalent of trying to decide whether a person on trial is guilty by discovering, before any evidence has been heard, what the preferences of the jury are in this regard, and then calculating the net benefits of the two possi-

ble verdicts. It thus involves "an underlying confusion between preferences that may be priced and values that are to be heard, considered, criticized, and understood" [Sagoff 1988, 95].

This suggests therefore that, apart from simply "speaking out" their given private preferences, individuals engage in a social process in which they form a collective understanding as citizens about the value of public goods and construct a *basis* for social choice. In other words, public preferences are endogenous rather than exogenous. For this reason, public values are context relative, i.e., they are determined by social processes that play important roles in internalizing norms and beliefs about what is right and wrong. Preferences are also likely to change over time due to the influence of education and cultural variations [Norton et al. 1998].

The social learning process becomes particularly important when individuals are confronted with public goods for which they have little past experience or with goods that have very complex characteristics. This is often the case when environmental goods are involved. The myriad of different classes of environmental effects and the many cross-cutting dimensions of these effects cannot be casually separated in many cases. In addition, the conventional way of learning about the attributes of a good—learning by doing—becomes difficult and indeed often risky. It is one thing to choose between Pepsi and Coke, but another to choose between the preservation of an entire ecosystem and the development of a hydropower plant.

To sum up, in this section we have suggested that environmental goods and services embody characteristics that present serious ethical complications when social choices are to be made on the basis of recommendations derived from private preferences. Preferences toward public goods are often endogenous to the political process, and there is thus an important distinction to be made between private and public preferences. The latter includes not only utility maximizing motives, but also other ethical positions, such as a deontological approach to decision making. In many cases, therefore, the initial challenge lies not in "discovering" private preferences, but in specifying the conditions for public discourse over what is worth valuing and for what reason.⁴ This becomes particularly important for many environmental goods, which are often both "new" (e.g., global warming) and "complex" (e.g., ecosystems).

An Application to Power-Generation Externalities

Tables 1-2 present the different externalities quantified and priced within the so-called ExternE project [European Commission 1995a]. The project aims at evaluating the external costs of the different power generation fuel cycles in the European Union. As this project represents one of the most ambitious attempts at coming up with "true" social cost estimates for the different power technologies, it serves well as a case study of the ethical limits of environmental valuation.

Table 1. Externalities Priced within the ExterneE Project: Coal, Oil, and Gas

Externality	Coal	Oil	Gas
Public health	PM, ozone, and accidents: Mortality, morbidity, and transport impacts	PM and ozone: Mortality, morbidity, and transport impacts	PM: Mortality, morbidity, and transport impacts
Occupational health	Diseases from mining and accidents during mining, transport, construction, and dismantling	Accidents: death and injury impacts	Accidents: death and injury impacts
Agriculture	Sulfur, acidification, and ozone: crop and soil impacts	Sulfur, acidification and ozone: crop and soil impacts	
Forests	Sulfur, acidification, and ozone damages	Sulfur, acidification, and ozone damages	
Marine	Acidification impacts	Accidents with oil tankers	Fishery: extraction impacts
Materials	Sulfur and acidification damages on surfacrs	Sulfur and acidification damages on surfaces	Sulfur and acidification damages on surfaces
Amenity	Noise: operational road and rail traffic impacts		Noise: operational impacts
Global warming	CO ₂ , CH ₄ , and N ₂ O damages	CO ₂ , CH ₄ , and N ₂ O damages	CO ₂ , CH ₄ , and N ₂ O damages
Total estimate (US cents/kWh)	2.8-4.1*	2.7-2.9*	1.7*

Source: European Commission [1995a].

*The global warming impacts constitute roughly half of the reported external cost estimates (for coal-, oil-, and gas-fired power). Still, these estimates are drawn from Cline [1992], whose global warming values are generally lower than those found in other studies.

When inspecting Tables 1-2 we first note that most of the fuel cycles involve impacts on the health and deaths of humans ("public and occupational health"). However, according to deontological ethics, human beings are moral ends in themselves, and there is thus no compensation for the death of a human being. This comes into direct conflict with the ethical basis of the ExterneE project, which (implicitly) aims at maximizing society's total utility.⁵ The above does not suggest that we should spend the entire public budget on saving lives; it simply points to the fact that mortality impacts involve a moral dilemma. To what extent should we treat humans as means to an end (utility) or as ends in themselves? This question cannot be resolved with the help of cost-benefit analyses, but rather within the realms of public discourse. We may not agree on fundamental moral principles but may still be able to

Table 2. Externalities Priced within the ExternE Project: Nuclear, Hydro, and Wind

Externality	Nuclear	Hydro	Wind
Public health	Radiation and non-radiation: mortality and transport impacts from operations and accidents		Accidents: travel to and from work
Occupational health	Radiation and non-radiation: mortality and transport impacts from operations and accidents	Accidents during construction and operation	Accidents during manufacturing, construction, and operation of turbine
Agriculture		Loss of grazing land	Acidification: damage on crops
Forests		Forest production loss due to flooding and land use	Acidification damages
Marine		Water supply and ferry traffic	Acidification damages
Materials			Acidification damages
Amenity		Visual amenity loss	Noise and visual amenity loss: operational impacts
Global warming			CO ₂ , CH ₄ , and N ₂ O damages
Recreation		Fishing and hunting	
Cultural objects		Objects of cultural and archeological interest	
Biodiversity		Terrestrial and aquatic ecosystems	
Total estimate (US cents/kWh)	0.0003-0.01	0.3	0.1-0.3

Source: European Commission [1995a].

reach an agreement on moral aspects of practical issues. It is not enough in this instance to make the remark that we do already reveal our preferences against health and death risks by our daily risk-taking behavior. "Precisely because we fail . . . to give life-saving the value in everyday personal decisions . . . we may wish our social decisions to provide us the occasion to display the reverence for life that we espouse but do not always show" [Kelman 1981, 38].

Since power-generation sources differ in terms of their relative impact on mortality and morbidity, the above concerns may have a direct impact on the actual

choice between fuels. For example, the risks presented by nuclear power are generally more dominated by disease impacts than those of, say, gas and hydropower. In addition, the aggregation of effects of different severity (e.g., morbidity versus mortality) into a single monetary value also raises the ethical question of how society should weigh the importance of each of these impacts.

A similar ambiguity in how to deal with novel social choice problems arises when one considers the fundamental differences in the nature of risk between the different electricity alternatives. With nuclear power, an option with very low probabilities of very large negative impacts has been introduced on the electric power arena. This is in contrast to fossil-fueled power generation, which gives rise to continuous but also comparably modest impacts. People are often unimpressed by arguments stating that the *expected* damages of nuclear power are lower than those of other alternatives. There is, instead, a large degree of "catastrophe aversion" among the public. This is far from an indication of "irrational" behavior; instead, it expresses that the willingness to accept a certain risk is related to the capacity to deal with the consequences should they arise [Stirling 1997]. For example, nuclear waste management risks are essentially irreversible after the plant has been commissioned, while the visual amenity impacts from wind power are more or less reversible since the plant can be removed. Such differences are likely to affect the public preferences toward power-generating technologies.

Furthermore, in trying to evaluate and assess the problems of nuclear waste management (not priced within the ExternE project) and radiation, individuals need to rely heavily on the statements of scientists. These can provide important information about the main physical relationships and may be able to present different scenarios and discuss the outcome of each. Still, the perceptions of what constitutes a significant risk are essentially socially constructed, and the question of how risk should be evaluated therefore requires a broader public discussion.⁶ In the 1980s, many countries put a moratorium on further nuclear expansion. This political outcome does not primarily reflect the fact that nuclear energy was found economically inefficient [e.g., Söderholm 1998]. Rather they indicate that nuclear energy is essentially a new "good" with complex and far-reaching risk characteristics, for which most societies have not yet found an overall ethical position on which to base public and private decisions.

This latter argument applies to the impacts of global warming (primarily caused by carbon dioxide emissions from power plants) as well. If it were not for reports from scientists, people in general would know nothing of their existence. The effects of global warming are inherently global, irreversible, long-term, and asymmetrically distributed over time. This is in heavy contrast with other emissions from the power sector (e.g., sulfur dioxide), whose impacts are more tangible and directly connected to present human (dis)utility. Again, society (and in this case *societies*) need to establish the conditions on which to base social choices in this matter. For

example, an ethical position about the claims of future generations needs to be chosen. In this process, the need for *actual* compensation when there are damages to future generations,⁷ as well as any inviolable rights of coming generations would have to be considered [Spash 1993].

Finally, the ExternE project includes a contingent valuation (CV) study of some of the impacts of hydropower development in Norway [European Commission 1995b]. These impacts comprise three basic components: losses of recreation, cultural objects and ecosystems/nature. The respondents were asked how much they were willing to pay to avoid the above impacts.⁸ This substudy, we argue, involves in essence all of the ethical dilemmas posed in this paper.

First, the complexity of the three "goods" differs greatly. Recreation is essentially a private good, and a hypothetical bid for, say, hunting permits may be as trustworthy as any market price. But as soon as the valuation range is broadened to include entire ecosystems, the problem of what is actually valued—and for what reason—becomes apparent. In a CV study, ecosystems are described in a manner that renders them commodity-like (with a use value and an existence value), and there is little room for what we would normally claim is the most important aspect of an ecosystem—its functional aspects (e.g., its life-supporting mechanisms and the role of ecological diversity) [Vatn and Bromley 1994]. *Second*, the complexity of ecosystems is also related to the moral philosophies held by individuals. If we believe that a particular ecosystem is essential for life to be worthwhile, there is an indirect moral commitment to the system itself. According to this view there would be no substitute means for achieving human satisfaction, and this invalidates a contingent pricing analysis.⁹ A similar argument can be made for some cultural objects. People wish to see some pattern to their lives, and they want their lives to be set in some larger context. In many instances, cultural phenomena provide exactly that desired context. This is in contrast to a pure recreation good; it can normally be replaced by something else with an equivalent value. For the above reasons, it is probably fair to conclude that the values derived from this study are likely to serve as an insufficient and a biased guide toward an informed choice between preservation and hydropower development.

Concluding Remarks

Environmental valuation of power-generation externalities, it is argued, is necessary for making consistent and meaningful comparisons between technologies. Tradeoffs (however unfair they may seem) must always be made, and it is best to make them explicit in a cost-benefit analysis. Our main argument in this paper, however, has been that this position assumes that all choices are (and should be) made on the basis of a utilitarian approach. We do not claim that one has to choose

this philosophy or reject it; we simply point to the fact that choosing only one perspective gives us only partial insight into many environmental issues.

In practice, most societies adopt a two-step approach to achieving environmental goals, and—as we have tried to show in this paper—probably for good reasons. Take the example of the U.S. sulfur allowance system. First, the government sets limits on the behavior of firms and individuals. For example, the Environmental Protection Agency (EPA) sets a cap on overall sulfur dioxide emissions. These limits (or minimum standards) reflect society's attitude toward risk and its ethical commitments towards natural amenities and ecosystems. In a second step, the EPA encourages electric utilities to buy and sell emission allowances. The utilities will do so only when benefits exceed costs. Thus, within the overall emission limit, pure cost-benefit principles are allowed to dominate choices.

It may well be that the American government, in some sense, allows too much or too little sulfur emission. However, it is hard to see in what way a cost-benefit analysis of the "full" cost of electricity would help us resolve this. Neoclassical environmental valuation is only a tool for aggregation of private preferences and not for discussion. In a democratic society, however, the discussion itself is important, since ethical positions and public preferences tend to be endogenous to the political process. Any talk of the "full" cost of electricity thus has to be understood as, at best, metaphorical.

Notes

1. This is in line with Amartya Sen's [1977] distinction between *sympathy*, where concern for others forms one part of the utility function, and *commitment*, where acts of altruism are chosen, even though they may result in lower utility for the individual.
2. In this case, the axiom of continuity is violated, and therefore the utility function is undefinable for an individual. Thus, the indifference curves collapse to single points, denying the principle of substitution.
3. See also Commons et al. [1997], who summarize additional survey evidence on this particular issue.
4. See also the work by K. William Kapp, who concludes: "Indeed the really important problems of economics are questions of collective decision-making which cannot be dealt with in terms of calculus deductively derived from a formal concept of individual rationality under hypothetically assumed and transparent conditions" [Kapp 1978, 288]. Thus, for Kapp, environmental policy was a question of political economy rather than a technical issue to be decided by cost benefit analysis.
5. Within the ExternE project, the value of a statistical life (approximately US \$3.4 million) is used to calculate the external costs of mortality.
6. The problem is complicated further by the fact that most scientists tend to transform genuine *uncertainty* into *risk*, where risk reflects a situation where the probabilities of different outcomes are known. In other words, they make an implicit assumption that their understanding of causal effects and overall system behavior (e.g., the nuclear power process) is correct [Shackley and Wynne 1996].
7. This differs from the ethical approach in neoclassical economics, which builds on a *potential* compensation criterion.

8. It is worth noting that the hypothetical price derived from this CV study basically equals the total external cost of 0.3 U.S. cents per kWh. The remaining external costs are, in other words, comparably small and range between 0.0004 and 0.001 U.S. cents per kWh [European Commission 1995b].
9. This dilemma is probably best illustrated by the building of China's Three Gorges dam. It leads to the flooding of large tropical forests and to the displacement of millions of people [e.g., "Water Power in Asia . . ." 1999].

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