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THE INCLUSION OF EXTERNALITIES IN ELECTRIC GENERATION RESOURCE PLANNING: COAL IN THE CROSSFIRE

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I. INTRODUCTION

Until recently, electric utility executives studied options for new generating capacity in the traditional way: the engineering department determined how much each resource option would cost to build and maintain, the fuels department determined how much each would cost to operate, and the system operator projected the hours of operation of each potential resource. The option that minimized the accounting cost of generating electricity to meet the projected system loads was chosen. The state regulatory commission, if it had jurisdiction at all, generally approved the choice, and construction would commence.

How times have changed! During the 1970s, far-reaching environmental laws such as the National Environmental Policy Act of 1969, the Clean Air Act of 1970, and the Federal Water Pollution

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Control Act Amendments of 1972,\(^4\) required more detailed study of the environmental and societal effects of these options. These considerations resulted in, among other things, technological advancements, site location compromises, and the inclusion of new emission-reducing systems to mitigate the environmental effects of generating electricity. During the 1980s, the effects of the passage of the Public Utility Regulatory Policies Act of 1978 (PURPA)\(^5\) began to be realized as a variety of nonutility owned generating resources began to compete with electric utilities for the right to supply the next required generating unit.\(^6\) In short, toward the end of the 1980s, the electric utility’s system planning had become necessarily more complex and more sophisticated and its results less predictable. Despite these new factors, the process was still generally driven by an economic analysis of alternatives developed on the basis of accounting costs.\(^7\)

---

6. PURPA requires electric utilities to pay for power from qualifying cogenerators and small power producers (QFs) at a price that does not exceed the utility’s “incremental cost . . . of alternative electric energy.” 16 U.S.C. § 824a-3(b) (1988). The Federal Energy Regulatory Commission adopted implementing regulations of PURPA and required that costs paid to QFs be based on the utility’s “avoided costs.” 18 C.F.R. § 292.304 (1992). The determination of avoided costs has been controversial; nevertheless, the calculations generally have been based on estimates of future accounting costs.
7. Section 111 of the Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2776 (1992) (amending 16 U.S.C. § 2601 and following), (the “1992 Act”) requires each electric utility to “employ integrated resource planning” and allows for “the opportunity for public participation and comment” in the creation of such a plan. The term “integrated resource planning” is defined to require “a planning and selection process for new energy resources that evaluates the full range of alternatives . . . in order to provide adequate and reliable service to its electric customers at the lowest system cost.” 1992 Act, § 111(d)(19), 106 Stat. at 2796. The term “system cost” means “all direct and quantifiable net costs for an energy resource.”

The 1992 Act passed the House of Representatives with a specific requirement to include consideration of externalities: “The utility’s least cost plans shall include, to the greatest extent practicable, the external costs and benefits of providing electric service, including but not limited to environmental impacts, maintaining access to foreign and domestic sources of supply, employment opportunities, economic development, and health.” 138 CONG. REC. H3515 (daily ed. May 20, 1992). That provision was dropped in the Conference Committee’s report of the 1992 Act.
Just as the electric utility planners were getting comfortable with these analytical complexities in studying generation expansion plans, a new, potentially overwhelming, regulatory concept arose in several states: the requirement in the resource planning exercise to increase the projected costs of coal-fired generation to reflect the additional costs to society “wherever they may occur, which result from harm or risks of harm to the environment after the application of all mitigation measures required by existing environmental regulation.” These costs have been labeled “externalities” because they are not internalized; that is, they are not accounted for in the projected costs of the construction of a new generating unit. The effect of monetizing externalities has had the most effect on coal-fired generation resources. Imputing these external costs to coal-fired generation increases significantly the projected cost of generating electricity with coal, thereby damaging, if not destroying, the likelihood that coal generation can emerge as a least-cost alternative in a generation expansion exercise.

The debate is not whether externalities exist—they surely do exist, both positively and negatively, throughout society as a result of all types of production activities. Rather, the debate is whether the monetization of externalities is economically efficient, whether the whole range of externalities can be monetized today with reasonable certainty, whether they should be applied virtually exclusively to coal-fired electric generation in the resource planning process, and whether it is appropriate for individual states to impose these external costs without a more coordinated approach in society as a whole.

9. “Externalities are defined as all the costs and benefits not borne by producers or consumers in the course of production or consumption.” Marc W. Goldsmith, Comments Before the Georgia Public Service Commission, Dkts. 4131-U and 4134-U at 6; see discussion infra part II.A.
10. Professor Paul L. Joskow of the Massachusetts Institute of Technology, has stated that the addition of externalities as now calculated by several of the regulatory commissions can be determinative in the resource planning exercise: “The cost of control approach [to determine the value of externalities] yields very high numbers that have absolutely no relationship to environmental damages . . . . They are often so high that the choice of adders completely dominates the resource selection process.” Paul L. Joskow, Externalities: Let’s Do It Right!, ELECTRICITY J., May 1992, at 60.
This Article will discuss the nature of externalities and the need to analyze the societal costs and benefits of imposing externalities in the generating resource selection process. Thereafter, specific examples of the use of externalities by several state regulatory agencies in the resource planning process will be examined. The Article will conclude with a critique of the persuasiveness of the environmental data underlying these regulatory decisions and the general inappropriateness of imputing a monetary value to these externalities given the existing legislative and regulatory structure in place to mitigate emissions.

II. EXTERNALITIES—AN ECONOMIC ANALYSIS

A. Externalities Defined

Externalities are defined as costs imposed on a party by the actions of another party that are not borne by the acting party. In the course of its activities or operations, an economic unit—an individual, firm, municipality or public agency—may, in addition to its costs of operation, impose costs on others. The smoke emitted by a factory may impose costs on a nearby laundry; the effluent from the laundry may increase the cost of providing drinking water to the nearby community. Because these third-party costs (or benefits) do not influence the behavior of the acting party—they are not "internalized" by the acting party—the actions of such party are not efficient from an economic perspective.


12. Externalities can be “positive” as well as “negative.” Activities of one person can bestow benefits on independent third parties.

13. RICHARD G. LIFSEY ET AL., ECONOMICS 412-13 (8th ed. 1987). Efficiency is defined as the absence of waste or using the economy’s resources as effectively as possible to satisfy the needs of individuals. SAMUELSON & NORDHAUS, supra note 11, at 27-28.
1. Externalities and Economic Efficiency

When a firm purchases and uses a scarce resource, the value of the output derived from the use of that resource must justify the cost of the resource. This ensures that the resources are used efficiently. However, when a firm dirties the air or water without paying for it, costs are imposed on society that are not paid for by the producer and are not justified by the value to consumers of the goods produced by the firm. Because the firm is able to produce goods using resources or imposing costs it does not pay for, the result will be that (1) more of the output will be produced than is justified on an economic basis, and (2) too much of the free resource will be used in the production of a given amount of output. The opposite will be true in the case of a positive externality. If the externality is beneficial, the producer should be encouraged to engage in the process producing the externality even more than his private self-interest would dictate.

2. The Case of Air Pollution

In the case of air pollution, when clean air is used but is not paid for by the user, considering all costs involved, the output is too large and the amount of pollution is too great. A firm maximizes profits

---

14. SAMUELSON & NORDHAUS, supra note 11, at 772. If the use of a resource is costless, the use of that resource will be excessive, because, to the extent substitution is technically possible, firms will reduce the use of resources they must pay for by using more of the free resources. For example, assume waste can be hauled away or dumped in the river. Dumping is costless; hauling is not. Because hauling and dumping are substitutes in production, the firm will minimize the cost of production by dumping all of its waste and hauling nothing. But if a cost is imposed for dumping, dumping will be reduced and hauling will be increased to the point where the relative prices of hauling and dumping equal the relative incremental values of hauling and dumping in the production process. For a more complete discussion of the substitution of factors of production, see id. at 533-37; EDWIN MANSFIELD, MICROECONOMICS, THEORY AND APPLICATIONS 167-175 (1988). This excessive use of free resources has also been called the “tragedy of the commons.” Garrett Hardin, The Tragedy of the Commons, 162 SCI. 1243, 1244 (1968) (“Freedom in a commons brings ruin to us all.”); see also ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 33-49 (1992).

15. SAMUELSON & NORDHAUS, supra note 11, at 772.
where the incremental cost of the last unit produced equals the revenue received by the firm from the sale of that unit. For competitive firms, profits will be maximized where the price of the product they produce equals its marginal cost of production.\textsuperscript{16} This is shown as point $Q^*$ in Figure 1.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Figure 1}
\end{figure}

On the other hand, if the production process creates a negative externality, there are costs imposed on society, “social costs,” that are

\begin{itemize}
\item \textsuperscript{16} LIPSEY ET AL., \textit{supra} note 13, at 214-18. Competitive firms perceive that the price of the product they produce is not affected by their level of output, so price and marginal revenue are equal. If profits are maximized, price equals marginal cost. \textit{Id.}
\end{itemize}
not paid by the producer. Economic efficiency requires that price (and, thus, "value") equal or exceed the cost of producing each unit of output, including social costs. If social costs exist, they must be added to the incremental private costs, and the optimal output is reduced from \( Q^* \) to \( Q_1 \). Thus, if externalities exist, profit maximizing behavior by competitive firms produces an inefficient result.

B. Internalization of Externalities

This analysis suggests that the externality must be "internalized"—a cost must be imposed on the use of a free resource—so that the use of the resource will be treated in the production process in the same manner as other resources that pass through a market. The implicit solution is to create an arrangement with respect to the free resource that mimics the competitive market. An artificial price could be imposed on the right to pollute (i.e., a charge for the right to "use" clean air or water), which would be set at the level to cause the desired (efficient) use of the resource. A price on emissions that is too high would force the level of pollution to a level below that which is efficient. In contrast, a price that is too low would leave the level of pollution unacceptably high. One option is to impose a tax on a firm's air or water emissions. Alternatively, marketable permits allowing a specified aggregate quantity of emissions could be sold, allowing the market for such permits to determine the price.

17. Id. at 248-50. The price of any good indicates what each consumer is willing to pay for the last unit of the good purchased and, therefore, represents the good's incremental "value." Id. at 248.
18. Id.
20. Id. A tax could be imposed on the production and sale of final product, which would raise its price and reduce production toward \( Q_1 \) in Figure 1. This policy would not, however, have any affect on the over utilization of the free resource in the production process; i.e., pollution will be excessive with respect to the level of output.
21. Id. at 12-13. To be internalized, however, monies need not be paid out by the acting party. Costs will be internalized if the actor forgoes a payment or other reward (revenues from the sale of a marketable right to pollute, for example) for imposing a cost on another. Coase, supra note 11, at 35. But see Jonathan Hamilton et al., Production Externalities and Long-Run Equilibria: Bargaining and Pigouvian Taxation, 27 ECON. INQUIRY 453, 454 (1989) ("Other . . . structures, such as subsidies for pollution abatement, sus-
Pollution reduction has both a benefit and a cost to society. The cost comes in the form of spent resources and potentially lost jobs as pollution is reduced. Figure 2 shows that the incremental or "marginal" benefit of reducing pollution declines as the level of pollution gets closer to zero. The incremental cost of reducing pollution increases as more costly measures must be used to reduce the last increments of pollution: Therefore, the marginal cost of pollution abatement rises.

Figure 2

If the government imposes a tax on pollution equal to $P_1$, firms will spend up to $P_1$ dollars to remove additional or incremental units of pollution, but the value to society of eliminating the last increment-
tal unit of pollution is only \( P_0 \). With a pollution tax equal to \( P_1 \), the incremental cost of removal exceeds the benefit of such removal, and the result is inefficient. Theoretically, the optimal solution is to impose a tax of \( P^* \) for each unit of pollution emitted,\(^{23}\) which will cause firms to reduce their pollution to \( Q^* \), where the marginal benefit of pollution removal equals the marginal cost of removal.\(^{24}\) Pollution will exist, but the cost of pollution will have been fully internalized and it would be inefficient to attempt to reduce (or tax) pollution any further.

The cost-benefit analysis shown above suggests that reducing pollution below the efficient level is undesirable from an economic point of view. To reduce pollution below the efficient level will impose costs which exceed the value of the incremental units of pollution removed. Such a policy may cause reductions in production, which may result in the closing of factories and the loss of a significant number of jobs. Economic efficiency requires a balancing of the cost of reducing the level of pollution against the damage resulting from

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23. While it is possible to identify many of the costs associated with pollution, it is unlikely that all of the costs can be identified, and even more doubtful that accurate estimates of these costs across the relevant range of decision-making can be developed. ROY J. RUFFIN, MODERN PRICE THEORY 475 (1988) ("It is one thing to consider the optimal governmental action in the case of externalities; it is quite another matter for the government to actually determine and carry out the optimal decision."). Numerous scholars have raised concerns regarding informational and technical problems associated with government tax policies designed to remedy the problem of externalities. See, e.g., Coase, supra note 11, at 41-42; F. Trever Dolbear, On the Theory of Optimum Externality, 57 AM. ECON. REV. 90, 99-103 (1967); Otto A. Davis & Andrew B. Whinston, On Externalities, Information and the Government-Assisted Invisible Hand, 33 ECONOMICA 303, 316-18 (1966).

24. Assuming perfect knowledge on the part of regulators, setting \( P^* \) and allowing producers to adjust to \( Q^* \) is equivalent to setting \( Q^* \) and allowing the price of discharge permits to adjust to \( P^* \). In the fee system, regulators set the effluent fee to restrict emissions to the target level. If permits are used, regulators set the emissions at the desired level and the market for the permits determines their price. Oates, supra note 19, at 12. Without perfect knowledge, marketable permits are preferable to effluent charges. \( Id \). There seems to be a consensus emerging among environmental economists in the United States that marketable emissions permits, rather than effluent charges, are the more promising policy alternative for control of major air and water pollutants. See Paul R. Portney, EPA and the Evolution of Federal Regulation, in PUBLIC POLICIES FOR ENVIRONMENTAL PROTECTION, 7, 17-19 (Paul R. Portney ed., 1990).
not further reducing the level of pollution. When costs are fully internalized, the externality is eliminated, but pollution is not. It would be inefficient, and, therefore, undesirable, to assess additional costs on emissions if regulation has fully internalized the externality by employing, for example, marketable permits. In short, imputing external costs to coal-fired generation without an evaluation of the incremental benefits, if any, results in an incomplete economic analysis and will likely lead to an economically inefficient result.

III. STATE REGULATORY COMMISSIONS' RESPONSES TO EXTERNALITIES

The National Coal Council (NCC) issued its Special Report on Externalities to the Secretary of Energy on May 21, 1992. The Report included an up-to-date survey of the use of externalities by state regulatory commissions. Briefly stated, the NCC Report found that four states have monetized externality values, and eighteen states have adopted qualitative methods; still others are in the process of considering the issue. There are also several states that have not included externalities in the planning process. A review of the logic and holdings of several state regulatory commissions that have adopted or rejected the inclusion of externalities will convey the general scope of the issues.

25. SAMUELSON & NORDHAUS, supra note 11, at 773.
26. Richard L. Schmalensee, Testimony before Commonwealth of Massachusetts Dep't of Public Utilities, D.P.U. 91-131 at 13-14 (1992); Joskow, supra note 10, at 55 ("More generally, once we have introduced environmental regulations to control pollutants it is incorrect to infer that anything more necessarily must be done merely from the observation that there are residual environmental impacts."); see also Coase, supra note 11, at 42 ("The aim of such regulation should not be to eliminate . . . pollution but rather to secure the optimum amount of . . . pollution . . . ").
27. NATIONAL COAL COUNCIL, EXTERNALITIES, A NATIONAL COAL COUNCIL SPECIAL REPORT (May 21, 1992) [hereinafter NCC REPORT]. The National Coal Council is a federal advisory committee to the Secretary of Energy with the sole purpose of advising the Secretary in matters relating to the coal industry. The Council receives no federal funds and relies on voluntary contributions of its members to support its activities. Id. at Preface.
28. Id. at 1.
A. Massachusetts

In 1990, the Massachusetts Department of Public Utilities (DPU) issued an initial order concerning integrated resource planning for electric utilities in which it analyzed and justified the need for monetizing externalities in that process. Less than a year later, the DPU issued its Implementation Order describing how it would measure externalities, and it adopted a monetized range of values to be included with the projected costs of a coal-fired generator. These procedures were confirmed, and the values updated by the Massachusetts DPU in late 1992.

The DPU stated in its 1990 IRM Order that there was “virtual consensus” among parties that including environmental externalities in the integrated resource management (IRM) plan would be a “positive development that would allow resources with varying degrees and types of environmental impacts to be compared more accurately.” The DPU agreed with that “consensus” and moved on to two implementation issues: how should externalities be estimated, and should externalities be considered on a site-specific basis or should they be generic to all coal-fired generating units?

1. Estimating the Costs of Externalities

The DPU required estimates to be made for the costs of externalities for each proposed project, taking into account the “particular expected emission levels” of each proposal, although it acknowledged that “externality values are highly uncertain.” The DPU rejected a simple weighting and ranking scheme in favor of the more

32. IRM Order, supra note 29, at 87.
33. Id. at 88.
34. Id.
35. Id. at 89.
direct approach of monetization of each impact. In fact, where cost estimates do not exist for the particular environmental impact, "the utility must make its best efforts to estimate monetary values with magnitudes appropriately weighted relative to better known values."\textsuperscript{36}

There are generally two methods for measuring the costs of externalities: the "cost of control" and the "cost of environmental damages."\textsuperscript{37} The cost of control approach is described as follows: "The basic rationale for using cost of pollution control as a measure of the value of pollution reduction is that the cost of pollution controls required by the government provides an estimate of the price that society is willing to pay to reduce the pollutant."\textsuperscript{38} Essentially, the cost of control approach attempts to measure the cost of installing hardware to reduce the emissions level to zero. In contrast, assessing the costs of environmental damage is not premised on the costs to abate the pollution but rather requires "an estimate of environmental damage values associated with each resource."\textsuperscript{39}

The Massachusetts Electric Company opposed the use of the cost of control method for several reasons:

\textsuperscript{36} Id.\textsuperscript{37} See discussion infra part IV for a critique of these types of studies.\textsuperscript{38} IRM Order, supra note 29, at 91. The Tellus Institute, a proponent of the cost of control methodology, has stated that because deriving actual environmental damages "can be a large and exceedingly complex task, fraught with uncertainty ... and the valuation of these damages can be both difficult and controversial ... many analysts have chosen to use control or prevention costs as surrogates for damage costs." STEPHEN S. BERNOW & DONALD B. MARRON, TELLUS INSTITUTE, VALUATION OF ENVIRONMENTAL EXTERNALITIES FOR ENERGY PLANNING AND OPERATIONS, Update 3-4 (1990) [hereinafter TELLUS REPORT]. This cost of control method has also been identified as the "revealed preference" approach or "shadow pricing":

In this approach, existing and proposed environmental regulations are analyzed in order to estimate the value that society implicitly places on specific environmental impacts ... In analyzing the regulations, we can identify the highest (or marginal) cost reduction strategy required by the regulations. This can be taken as an estimate of the value that regulators (and society) have placed on air emissions. A[I][I] the very least, it can be argued that this value represents the "revealed preferences" of regulators, and that, to be consistent, it ought to be applied when decisions affecting these environmental impacts are made.

\textit{Id.} at 4-5.\textsuperscript{39} IRM Order, supra note 29, at 90.
—it tends to overstate the value of externalities;

governmentally mandated restrictions on emissions have been
developed where the marginal cost of control equals the marginal
value of potential environmental benefits, and thus, the marginal cost
of further abatement "must be greater than the marginal benefit society
receives from such abatement";

cost of control equates inappropriately "two separate and distinct
concepts, the cost of controlling emissions and the value of environ-
mental externalities"; and

the cost of control varies widely among utilities and, therefore,
cannot be determined generically as results from the cost of control
method. 40

Notwithstanding these criticisms, the DPU adopted the cost of
control methodology because the political process has provided "a
reasonable, rough proxy for what society is willing to pay to avoid
environmental externalities." 41 The DPU's goal was a consistent meth-
od of valuing externalities to allow comparisons among various gener-
ating resources and conservation initiatives. The cost of control meth-
ods were deemed to be "the best available proxy" until comprehensive
damage cost estimates could be calculated. 42 The DPU adopted the
cost of control values of the Division of Energy Resources as follows: 43

40. Id. at 91. Professor Joskow has reviewed both methods of valuation and rejected
out-of-hand any reliance on the cost of control method: "The highest cost of control meth-
odology is meaningless, arbitrary and capricious. It is not a second-best method for measur-
ing environmental damages. It is absolutely worthless!" Joskow, supra note 10, at 64.
41. IRM Order, supra note 29, at 92. The DPU expanded on this finding in the 1992
Order:
Since environmental regulations are established through a political decision-making
process involving input from the scientific community, members of the public,
environmental organizations, and competing economic interests, the [cost of control]
method represents a reasonable proxy for what society as a whole is willing to
pay to avoid damages from pollutant emissions.
1992 Order, supra note 31, at 44.
42. IRM Order, supra note 29, at 93.
43. Id. at 98. Each of these costs was confirmed and updated to 1991 dollars in the
1992 Order, supra note 31, at 51 (nitrogen oxides), 48 (sulfur oxides), 54 (volatile organic
compounds), 56 (total suspended particulates), 58 (carbon monoxide) 76 (carbon dioxide), 78
(methane and nitrous oxide), and 91 (summary).
TABLE 1
Summary of Environmental Externality Values to be Used by Companies in Evaluating the Emissions of Energy Resource Options⁴⁴
Northeast United States
(All Costs are in 1989 Constant Dollars)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>$/ton</th>
<th>$/lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Oxides (NO₂)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Air Quality</td>
<td>6,500</td>
<td>3.50</td>
</tr>
<tr>
<td>Greenhouse</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Total NOₓ</td>
<td>6,500</td>
<td>3.50</td>
</tr>
<tr>
<td>Sulfur Oxides (SO₂)</td>
<td>1,500</td>
<td>0.75</td>
</tr>
<tr>
<td>Volatile Organic Compounds</td>
<td>5,300</td>
<td>2.65</td>
</tr>
<tr>
<td>Total Suspended Particulates</td>
<td>4,000</td>
<td>2.00</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Air Quality</td>
<td>820</td>
<td>0.41</td>
</tr>
<tr>
<td>Greenhouse</td>
<td>50</td>
<td>0.02</td>
</tr>
<tr>
<td>Total CO</td>
<td>870</td>
<td>0.43</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>22</td>
<td>0.011</td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td>220</td>
<td>0.11</td>
</tr>
<tr>
<td>Nitrous Oxide (N₂O)</td>
<td>3,960</td>
<td>1.98</td>
</tr>
</tbody>
</table>

Each of these values must be multiplied by the projected emissions of each option to obtain an additional externality cost attributable to that resource.

2. Scope of Externalities

The DPU considered, but rejected, the inclusion of the costs (positive and negative) of externalities associated with:

—a specific site for the generating unit (e.g., visual, noise, and wetland impacts) in lieu of generic cost of control values;

⁴⁴. DOER Estimates (DOER Comments (Update), 4/18) (based on estimates provided in the TELLUS REPORT, supra note 38).
—fuel cycle (e.g., extraction, transportation, facility construction, plant operations, and waste disposal); and
—economic and societal impacts (e.g., tax benefits, economic development, research and development, and local job creation).\textsuperscript{45}

In each case the DPU recognized the ultimate value of including such costs but chose not to include those costs because of the difficulties of calculation. The DPU urged each electric utility to continue to study these issues.\textsuperscript{46}

The Implementation Order followed the request of the Eastern Electric Company (EECo) and several other small electric utilities for approval of their Requests for Proposal to solicit power from QFs. EECo proposed, among other things, to reduce the externality cost (1) of carbon dioxide (CO\textsubscript{2}) from $22 per ton (justified in the Tellus Report as the cost of planting trees to mitigate CO\textsubscript{2} emissions) to $7 per ton (the middle of the range in the Tellus Report) and (2) of nitrogen oxide (NO\textsubscript{x}) from $6500 per ton to $5360 per ton based on EECo’s own cost of control from a 75 megawatt (MW) combustion turbine unit.\textsuperscript{47} EECo also argued that the DPU-approved costs of externalities discriminated against base load (i.e., coal) technology.\textsuperscript{48}

Several parties objected to EECo’s proposed changes. Boston Gas Co. objected that these proposed costs were “insufficiently documented” and cited “28 values from nine studies on the cost of reducing CO\textsubscript{2}, showing only one value less than $22 per ton, five of $23 to $28 per ton, and nine above $100 per ton.”\textsuperscript{49}

The DPU rejected EECo’s proposed changes to the externality cost of CO\textsubscript{2} and NO\textsubscript{x}.\textsuperscript{50} The DPU questioned the relevance of EECo’s claim that the CO\textsubscript{2} value discriminated against base load technology

\hspace{1cm}

\textsuperscript{45} IRM Order, \textit{supra} note 29, at 95-96. The DPU also did not monetize any of these “costs” in its 1992 Order.
\textsuperscript{46} \textit{Id}.
\textsuperscript{47} Implementation Order, \textit{supra} note 30, at 256.
\textsuperscript{48} \textit{Id}.
\textsuperscript{49} \textit{Id}. Neither Boston Gas Co. nor the DPU seemed concerned that the externality value of CO\textsubscript{2} could vary so significantly from study to study.
\textsuperscript{50} \textit{Id} at 257.
because EECo sought a peaking unit. The DPU also found insufficient evidence to support the new proposed costs.51 Again, showing little interest in utility-specific costs, the DPU stated: “Moreover, EECo’s value for NO\textsubscript{x} represents the control cost for a utility-specific facility size and type, and so is not representative of the value which society places on residual emissions of NO\textsubscript{x}.”52

Nantucket Electric Company (NEC) argued in this same proceeding that its externality costs should be much lower because NEC serves exclusively on an island and the prevailing winds take the emissions out to sea.53 The DPU did not argue this point but rejected it because the values in the IRM Order “were developed on the basis of global/regional impact, and are to be applied generically and consistently across all utilities.”54

The DPU rejected for lack of record evidence, as it had in the IRM Order, consideration of a multitude of other externalities such as aquatic impacts, terrestrial impacts, fuel cycle, and solid waste disposal.55

B. California

In 1991, the California Public Utilities Commission (CPUC), like the Massachusetts DPU, required the inclusion of the costs of externalities in the resource planning for supply options and required their measurement through the cost of control methodology:

ICEM [iterative cost-effectiveness method] will henceforth reflect the ‘residual emissions’ (those remaining after application of appropriate control technology) associated with the operation of any resource being tested for

51. Id.
52. Id.
53. Id.
54. Id. at 258. Professor Richard L. Schmalensee, Professor of Economics and Management at the Massachusetts Institute of Technology, disagrees with ignoring site-specific results: “Externality values for some pollutants should differ depending upon exactly where the proposed power plant is to be located . . . . [I]t is surely unjustifiable to raise electricity rates to reduce emissions that simply do no damage.” Schmalensee, supra note 26, at 23-24.
55. Implementation Order, supra note 30, at 262.
cost-effectiveness. The (negative) value of such emissions will be determined using the principle of ‘revealed preference,’ which means that the costs imposed by relevant regulatory agencies, for example, in requiring certain pollution abatement actions, will be analyzed to calculate the implicit monetary value assigned to avoid a given quantity of a given pollutant.56

Also, similar to the Massachusetts DPU, the CPUC considered only air quality values, although it stated it will consider additional impacts to land and water values in the future.57 Unlike the Massachusetts DPU, however, the CPUC required externality values to reflect the air quality within the region in which the electric utility served.58 Thus, for example, San Diego Gas and Electric and Southern California Edison were required to use the cost of control values derived by the South Coast Air Quality Management District (SCAQMD), while upstate utilities, such as Pacific Gas & Electric, serving in areas with higher air quality, could ratio down the SCAQMD costs for NOx and the “[v]alues for most other residual emissions should come from the Pace University Study.”59 Carbon dioxide (CO2) was treated specially because of its status as a “greenhouse” gas and the concern for “global warming.” All utilities were required to include a cost of $26 ton in 1987 dollars for carbon emissions.60

The CPUC decided that the projected cost of power generated outside, but imported into, California also must be increased for the
costs of externalities in the area where the electricity will be used. The CPUC rejected complaints that such a policy has California residents paying to clean up the environment in neighboring states. Instead, the CPUC held that the marginal costs of emission controls “[are] the cost of abatement actions required in those air basins where the utilities face major costs of compliance with air quality standards,” and further held that to find otherwise would “confer an enormous competitive advantage” on out-of-state projects that “foul someone else’s air.”

A former CPUC Commissioner, Mr. Stan Hulett, took the CPUC to task for these findings, calling them “terribly complicated” and disastrous to coal-fired generation in that they

foreclose the potential of any movement of any coal-fired generation from anywhere in the Western United States into California . . . .

Arizona and New Mexico are also upset because the California market has been an important market for them for a long time . . . . If these plants meet federal standards, why should California impose a state standard on them?

The supervisor of the CPUC’s advisory and compliance division, William Meyer, seemingly confirmed Mr. Hulett’s impression of the future California market for coal-fired generation: “It [the CPUC’s Biennial Resource Plan Update] may very well have the effect of pricing some dirty technologies out of the market.”

The CPUC probably would not agree on the record with either Mr. Hulett or Mr. Meyer because it believed its Biennial Resource Plan Update properly balanced the interests of all parties:

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61. Biennial Resource Plan Update, supra note 1, at 196. In other words, the same electricity would be priced differently depending on whether it will be purchased by a downstate or upstate electric utility for resale.

62. Id. at 196-97.

63. Kimberly Dozier, Hulett Blasts Commission’s Externality Pricing Plan, ENERGY DAILY, Jan 2, 1992, at 1, 2.

64. Id.
Today's decision is a compromise that reasonably reflects the tradeoffs society must make in everyday economic choices. At one extreme, environmentalists who oppose all resources that increase net emissions will not be satisfied. Our procurement process considers clean air along with other benefits, and a bidder’s other benefits may outweigh its residual emissions in some circumstances where competing bidders have lower emissions. We want clean air, but we are limiting the price we are willing to pay for it.68

The CPUC issued its 1992 Plan Update Order on April 22, 1992, following its review of the resource plans of individual electric utilities.66 The CPUC reaffirmed the use of externalities and stated that the "[c]ommission must and will continue to balance many electric resource planning objectives along with environmental quality."67 The CPUC, however, made two changes from its 1991 Order. First, the CPUC eliminated the requirement that residual emissions be valued uniformly regardless of where they occurred and allowed the value assigned to depend on the location where the emissions were generated: The 1992 Order stated, "Emissions occurring in nonattainment areas were still to be valued using the purchasing utility’s marginal cost of control, but emissions occurring in attainment areas [would be] assigned values adopted by the Nevada Public Service Commission."68

The CPUC stated that this finding was premised on the "drastic air quality differential" that exists within California and within the region.69

The second change by the CPUC was to eliminate entirely the need to account for externalities in short term—five years or less—purchases of power:

We recognize that state policy to directly incorporate environmental costs is a change. In some instances, the relative cost-effectiveness of proposed purchases from fossil-fired resources, and in particular, from existing coal

67. Id. at 219.
68. Id. at 250-51; see discussion infra part III concerning the holdings of the Nevada Public Service Commission.
69. Id. at 251.
plants, turn on these costs. In considering these proposed purchases, we make a crucial distinction between long-term and short-term purchases.

As part of our overall strategy to manage the transition to a more environmentally sensitive resource planning framework, we will judge the cost-effectiveness of short-term purchases on a private least-cost basis, i.e., without consideration of residual emissions. 70

These two changes assist the coal industry in that they revive and allow, in the short-run, a market to exist for out-of-state coal-fired generation. The CPUC stated, however, that it will continue to study uniform valuations, 71 as well as the use of externalities in decisions concerning the daily dispatch of generation resources. 72

C. Nevada

The Nevada Public Service Commission has adopted comprehensive values for externalities and has required all electric utilities to include the values tabulated below in their resource planning. 73 Each company must use the following values for environmental costs unless "the utility justifies deviating from these values": 74

70. Id. at 223.
71. Id. at 276 n.94.
72. Id. at 271 n.23.
74. Id. at 268.
### TABLE 2
Valuation of Environmental Costs
Nevada Public Service Commission

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Valuation (1990 $/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>0.011</td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td>0.11</td>
</tr>
<tr>
<td>Nitrous Oxide (N₂O)</td>
<td>2.07</td>
</tr>
<tr>
<td>Nitrogen Oxides (NO₂)</td>
<td>3.46</td>
</tr>
<tr>
<td>Sulfur Oxides (SO₂)</td>
<td>0.78</td>
</tr>
<tr>
<td>Volatile Organic Compounds (VOC)</td>
<td>0.599</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td></td>
</tr>
<tr>
<td>Ambient Air Quality +</td>
<td>0.43</td>
</tr>
<tr>
<td>Global Warming Contribution</td>
<td>0.03</td>
</tr>
<tr>
<td>Total CO</td>
<td>0.46</td>
</tr>
<tr>
<td>Total Suspended Particulates/</td>
<td>2.09</td>
</tr>
<tr>
<td>Particulate Matter (diameter &lt; 10MM)</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide (H₂S)</td>
<td>NA</td>
</tr>
<tr>
<td>NH₁</td>
<td>0</td>
</tr>
<tr>
<td>Water Impact</td>
<td>Site Specific</td>
</tr>
<tr>
<td>(Determined by Utility)</td>
<td></td>
</tr>
<tr>
<td>Land Use</td>
<td>Site Specific</td>
</tr>
<tr>
<td>(Determined by Utility)</td>
<td></td>
</tr>
</tbody>
</table>

75. *Id.* at 265.

76. The value is applicable to EPA attainment areas. The value for an EPA nonattainment area is equal to or greater than the amount and is likely to be site specific.

77. The value for VOC has been adjusted to reflect the state of Nevada's status as attainment for VOC. This value is representative of an actual cost incurred in Nevada to control fugitive VOC emissions from gasoline. The value for an EPA nonattainment areas is $2.75/lb.

78. The value is applicable to EPA attainment areas. The value for an EPA nonattainment area is equal to or greater than the amount and is likely to be site specific.

79. The value is applicable to EPA attainment areas. The value for an EPA nonattainment area is equal to or greater than the amount and is likely to be site specific.

80. A national marginal control cost for H₂S in attainment areas would be approximately $0.9 per lb. (OTA, 1989). The valuation of H₂S in progress at this time.
Importantly, each utility’s resource plan must also include and consider the “net economic benefits added to the state from each option for future supply.” These economic benefits include those expenditures within Nevada for land, equipment, materials, fuel and supplies, wages paid for work performed within Nevada, and fees and taxes paid within Nevada.

D. Other States, Other Methods

Several other states have adopted a range of other methods for including externalities in the resource planning or procurement process. The National Association of Regulatory Utility Commissioners (NARUC) categorized these methods as follows:

Most PUCs [public utility commissions] mandated that utilities consider environmental externality costs in resource planning and/or acquisition processes, which is typically done in one of three ways. The first approach lies on qualitative treatment by the utility during the resource planning process. A second approach involves use of a percentage adder that either increases the cost of supply resources or decreases the cost of DSM [demand side management] resources in the utility’s planning process. A third approach involves direct quantification of the cost of the externality . . .

Also, some states allow electric utilities to increase their authorized rates of return for the investment in DSM programs.

For example, by statute in the State of Washington, conservation has been encouraged by allowing the electric utility to earn an additional two percent rate of return on the common equity related to the funds invested in conservation. In Connecticut, Public Law 88-57 allows the utility to earn a higher return on rate base associated with

81. Rulemaking Regarding Resource Planning Changes Pursuant to SB 497, supra note 73, at 266.
82. Eighteen according to the NCC REPORT, supra note 27, at 1.
83. S. D. COHEN ET AL., NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS, EXECUTIVE SUMMARY TO ENVIRONMENTAL EXTERNALITIES: A SURVEY OF STATE COMMISSION ACTIONS iii (July 11, 1990) [hereinafter NARUC EXTERNALITIES REPORT].
conservation and load management investment. The New Hampshire Public Utilities Commission allowed electric utilities financial incentives for choosing effective conservation and load management programs:

When utility managers choose options that offer extraordinary benefits for ratepayers, something over and above what prudent utility management requires, financial incentives may be warranted. To the extent that the commission wishes to influence utility decisions within that range of reasonableness, to secure benefits for ratepayers that would not occur in ordinary circumstances, it is appropriate to offer utility managers financial incentives.

These types of incentives for choosing conservation options are, in effect, the imputation of "positive" externalities to favor a certain type of resource planning option—conservation and load management initiatives—which, by definition, disadvantage other options (i.e., coal generation) in the comparison. These types of incentives have the value of being simple to calculate (as opposed to quantifying externalities) and the illusion of being straightforward to implement. However, no particular nexus between the benefits sought and the level of the incentives allowed exists. In short, the incentives may well produce the intended result of additional investment in conservation and load management without any relationship to a cost-benefit analysis of doing so.

E. Other States Have Not Monetized Externalities

Many states have not adopted externalities for use in the generation planning process. Moreover, several states have rejected the


87. NARUC characterized 24 states as not having adopted explicit procedures for the inclusion of externalities in the resource planning process. NARUC EXTERNALITIES REPORT, supra note 83, at 4.
quantification of externalities because of the primitive state of the necessary underlying calculations. 88 The Idaho Public Utilities Commission followed its staff’s recommendation that the calculation of externalities is “unsettled” and rejected the monetization of externalities: “We find that the method for quantifying environmental externalities needs to be further explored and developed to support its use in avoided cost calculations. Until such time we will give environmental factors qualitative, not quantitative, consideration.” 89 The Utah Public Service Commission reached a similar result to that of the Idaho Public Utility Commission:

[U]ntil a better understanding of the problems of second best and global efficiency associated with externalities can be obtained, along with a reduction in the variance of estimates of their associated costs, the Commission, for now, will reject the recommendation to explicitly include external costs into the calculation of least cost and the subsequent acquisition of resources. 90

The Virginia State Corporation Commission rejected consideration of externalities in resource planning for several basic reasons: 1) the federal and legislative branches, not the regulatory agency, should deal with externalities from a broader perspective, 2) the calculation of externalities are speculative, and 3) including only selective externalities can distort the planning process and result in higher electric rates. Specifically, the Commission stated:

We believe that it would be speculative, and thus contrary to our legal authority, to include adjustments in rates for external environmental factors. Moreover, . . . incorporating selected externalities, but ignoring the impact of others, could distort the balancing process and lead to economic inefficiency, resulting in higher utility rates for all customers . . . . Congress and the General Assembly are the proper bodies to provide this [broader] perspective. 91

88. See discussion infra part IV concerning the environmental issues and the difficulties of calculating externalities.
This decision encapsulates the policy arguments against the inclusion of externalities in the planning process: speculation, selectiveness, and broad governmental policies cannot be ignored in the consideration of externalities by any state.

IV. RESIDUAL EMISSIONS OF COAL-POWER GENERATION HAVE NOT BEEN PROVEN TO IMPOSE A SIGNIFICANT COST ON SOCIETY

Having described generally the methodologies being used in several states to monetize air emission externalities, this section describes in general terms the federal legislative and regulatory programs established to reduce air emissions from all types of power plants and assesses whether attempts to value the societal costs of residual emissions are appropriate.

A. The Clean Air Act Constructs an Elaborate Program of Emission Controls

Power plants, whether coal-fired or otherwise, cannot be constructed or operated unless they meet the requirements of the Clean Air Act (CAA or Act). Since 1970, the Act has been effective in its twopronged approach to controlling most of the air emissions of interest to an externality analysis. The first prong regulates emissions principally from existing sources by establishing national ambient air quality standards, that is, ceilings on the concentrations of substances in the ambient air set at the level necessary to protect public health and welfare. The second prong addresses new sources and requires them to be constructed with state-of-the-art controls designed to achieve air quality levels even cleaner than those mandated to protect public health and welfare.

92. See supra note 3.
93. While there are many components of the CAA for the regulation of stationary sources, none rival in importance the two discussed here.
94. As explained below, no new sources can be built if they contribute to an exceedance of an ambient standard. 42 U.S.C. § 7475(a)(3) (1988).
The first prong of the Act was designed to achieve the high priority goal of protecting public health and welfare consistent with statutory deadlines without reference to the economic cost or current technological feasibility of attaining that protection. On the other hand, the second prong takes advantage of the lower costs associated with installing emission controls at the time of construction, as compared with retrofitting existing sources, thereby deferring further improvement in air quality until existing sources are retired and new sources have come on line. Thus, the first prong provides for relatively immediate, high-priority protection, while the second seeks to ensure even greater—though lower priority—improvements on a slower timetable.

1. The First Prong: Ambient Standards

a. Primary Standards to Protect Public Health

The ambient standard prong of the CAA is comprised of the basic building blocks of the federal regulation of air quality, the primary and secondary national ambient air quality standards (NAAQS). These standards regulate emissions from numerous and diverse mobile or stationary sources that “cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.” The primary NAAQS are standards of air quality that are necessary to protect the public health. They must include “an adequate margin of safety” to account for uncertainties in scientific knowledge. In order to meet this goal, the primary NAAQS establish levels of ambient air quality at which there are no adverse health effects among those segments of the population that are particularly sensitive to the regulated pollutants. The NAAQS are not designed to protect

100. Id.; Lead Indus. Ass'n, 647 F.2d at 1150 (citing S. REP. No. 91-1196).
101. By gauging the level of the primary NAAQS in reference to sensitive sub-popula-
against all possible effects, but only against adverse effects on sensitive subsets of the population. Therefore, air quality at or even below the level of the NAAQS still may provoke responses in exceptional cases. However, because the Environmental Protection Agency (EPA) considers all known responses to sensitive sub-populations when setting the level of the NAAQS, any effects caused by air quality at or below the NAAQS cannot be regarded as threats to the public health.102

b. Secondary Standards for Public Welfare

The secondary NAAQS are to be set at a level that is necessary "to protect the public welfare from any known or anticipated adverse effects."103 Public welfare effects "include[], but [are] not limited to, effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being."104 Thus, the secondary standards call for air quality even better than that necessary to protect public health and directly address the comfort and well-being of individuals, a matter not addressed by the primary ambient standards.

c. Administrative Implementation

The EPA has thus far established primary and secondary NAAQS for six pollutants: sulfur dioxide, carbon monoxide; nitrogen oxides,
particulate matter, ozone, and lead.\textsuperscript{105} The existence of these standards confirms that the health and personal well-being of the American public is being protected from these substances and that the environment is being protected from effects caused by air quality levels to which human health is sensitive.

d. The 1977 Amendments

While the ambient standards program has been amended twice since the CAA’s initial passage in 1970, the basic approach has been retained. However, with each iteration in 1977 and in 1990 the program has been made more strict. In 1977, Congress added provisions to prevent significant deterioration (PSD) in air quality in areas that attain or surpass the ambient standards.\textsuperscript{106} The goal of the PSD program is to ensure that air quality in areas that attain the level of the NAAQS will remain “cleaner” than that level. The PSD program limits increases in emissions in attainment areas to specified increments. In no event can emissions in such areas exceed the ambient standards.\textsuperscript{107}

e. The 1990 Amendments

Although the CAA produced substantial improvements in air quality in the 1970s and 1980s, Congress further amended the regulation of existing sources under the Act in 1990.\textsuperscript{108} In addition to greater encouragement to attain the ambient standards, the 1990 Amendments deviated somewhat from one policy underlying the ambient standards program by ordering substantial regional scale reductions in SO\textsubscript{2} and NO\textsubscript{x} emissions from \textit{existing sources} in excess of those required by the ambient standards. In other words, these retrofit reductions were ordered even in areas where the ambient standards or increments were

\begin{enumerate}
\item[105.] 40 C.F.R. § 50 (1992).
\item[107.] The Nonattainment Area provisions were also added to the CAA in 1977 to spell out strict new provisions for areas not attaining the ambient standards. 42 U.S.C. §§ 7501-7508 (1988).
\end{enumerate}
already attained. Congress rejected waiting for the effect of the introduction of new sources for these reductions.

2. The Second Prong: New Source Requirements

The CAA's second prong was initially established in 1970 when Congress enacted the New Source Performance Standards (NSPS) section of the Act.109 As noted above, this provision requires the imposition of control technologies on new sources of air pollution in order to ensure that, as new sources replace old ones, air quality will improve well beyond that established by the ambient standards as the new sources' low emission rates substitute for the higher emission rates of existing sources.110 In particular, the NSPS section authorizes the Administrator of the EPA to identify categories of stationary sources that "cause[] or contribute[] significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare."111 Once these sources are identified, the Administrator is either authorized to or must set stringent control technology requirements for all new sources in these categories.112

The PSD program, adopted in 1977,113 also includes a provision for control technology. All new or modified major sources in PSD areas must receive a preconstruction permit.114 The administrative

110. See National Asphalt Pavement Ass'n v. Train, 539 F.2d 775, 783 (D.C. Cir. 1976).
111. 42 U.S.C. § 7411(b)(1)(A) (1988). The substances regulated under this section are not limited to those for which EPA has established a NAAQS. Section 111 applies to "air pollution" from stationary sources. For example, various performance standards regulate volatile organic compounds, e.g., 40 C.F.R. §§ 60.112, 60.312, & 60.606 (1992); fluorides, 40 C.F.R. § 60.202 (1992); and total reduced sulfur (TRS), 40 C.F.R. § 60.283 (1992), for which there are no ambient standards.
114. A "source" is defined as "any building, structure, facility, or installation which emits or may emit any air pollutant." 42 U.S.C. § 7411(a)(3) (1988). A source is "new" if it commences construction after the 1977 Amendments were enacted. 42 U.S.C. § 7475(a) (1988). Modification is defined as "any physical change in, or change in the method of operation of, a stationary source which increases the amount of any air pollutant emitted by
process requires, among other things, that the new source cannot be constructed unless it agrees to install the Best Available Control Technology (BACT).\textsuperscript{115} This case-specific control technology review basically replaces the NSPS requirements because the BACT requirements are stricter.\textsuperscript{116}

In 1990, Congress increased the burdens on new power plants by requiring them to obtain offsets for their emissions of SO\textsubscript{2} from existing sources. This program was designed to preserve the gains associated with the emission reductions ordered under Title IV of the 1990 Amendments from erosion by future increases in emissions occasioned by new sources and will be implemented through a cap on total SO\textsubscript{2} emissions. Starting in the year 2000, all new sources must obtain offsets from the sources already controlled under the ambient standards, PSD increments, and Title IV programs.\textsuperscript{117}

Thus, Congress through the CAA has put in place an aggressive emission control program. Although it is strict, the CAA typically does not zero out emissions. Accordingly, a power plant can comply with all requirements for ambient standards, increments, BACT, and Title IV’s SO\textsubscript{2} emission rollbacks and still be allowed residual emissions of substances such as SO\textsubscript{2}.

\textsuperscript{116} In recognition of the fact that some NAAQS are not attained in parts of the United States, Congress mandated even more stringent technology-based controls on all existing and planned major sources in nonattainment areas. All existing major sources are required to apply Reasonably Available Control Technology (RACT). All new major sources and modifications to existing sources must receive preconstruction permits that limit possible emissions to the Lowest Achievable Emission Rate (LAER) and contain specific provisions for emission offsets from existing sources in the area so that emissions from the new and offsetting sources, when combined, will result in lower overall emissions than were present before construction of the new or modified source. 42 U.S.C. § 7503 (1988). In attainment areas, on the other hand, BACT must be applied, but the requirements of the PSD program permits the balancing of factors in specifying BACT. 42 U.S.C. § 7479(3) (1988 & Supp. 1990).
B. The Available Studies Do Not Quantify the Effects of the Residual Emissions

Taken together, the controls on existing and new power plants are designed to suppress residual emissions to the level necessary to meet the public’s air quality objectives; regional SO₂ emission reductions are in excess of those required to comply with the ambient standards. The question is whether these residual emissions have been demonstrated to cause effects to the public health or the environment of sufficient magnitude that they should be the basis for public policies that discourage coal use with respect to other fuels.

As discussed above,¹¹⁸ most externality studies have relied on two basic methods of arriving at dollar values for adjusting the accounting costs historically used in private and public decision making. These methods either determine the cost of environmental controls required by governmental entities or assess society’s willingness to pay (WTP) to avoid the risk of environmental damage, often described as the cost of damages from the residual emissions. Both approaches suffer from important methodological limitations.

1. Cost of Control Studies are Methodologically Flawed

The cost of control method of valuation uses the cost of the technology required by statutes such as the CAA as a measure of the environmental costs that result from the emissions that the technology is designed to prevent.¹¹⁹ Although the cost of control valuation method is relatively easy to perform, it has serious methodological problems. At the outset, the methodology assumes that Congress, when it drafted the CAA, created a program that required EPA to peg the marginal cost of control at the marginal value of economic benefits. The cost of achieving a particular air quality level, however, may not

¹¹⁸ See supra part III.A.
¹¹⁹ The Massachusetts DPU stated that the cost of control methodology monetizes externalities using “the ‘marginal’ technology [which] is the most expensive control technology that society has revealed a willingness to require in order to meet environmental objectives.” 1992 Order, supra note 31, at 18.
be considered when health-based NAAQS are set. Moreover, BACT requirements are imposed irrespective of the level of attainment of the ambient standards. Finally, the cost of control is not a constant. It varies from utility to utility and from plant to plant operated by the same utility and cannot be calculated as a generic cost.

Thus, it is clear that the cost of control valuation does not have a reliable frame of reference and likely overstates the value of externalities. One way to test this conclusion is to compare the results of cost of control studies with other public judgments. Using a cost of control method, the Massachusetts DPU has chosen to value SO\textsubscript{2} emissions at $0.75 per pound, a figure that produces a total value of $36 billion dollars per year. When encouraging the public and Congress to reduce SO\textsubscript{2} emissions under the 1990 amendments to the CAA, however, President Bush stated that those reductions were worth between $200 million and $4 billion dollars per year.

2. The Willingness to Pay Approach

The most complete externalities study to use the WTP approach to value those externalities is the Pace Report. The Pace Report purports to survey existing literature on the public’s WTP to avoid the environmental damage attributed to utility operations and then combines these results with another literature survey to find estimates of the extent of damage. This combination develops estimates of the value to society of reducing each pound of emissions.

In order to evaluate the Pace Report’s results, it is instructive to look more carefully at its discussion of the costs attributable to SO\textsubscript{2} emissions. The Pace Report began with a study of health effects.

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120. See supra note 101 and accompanying text.
122. IRM Order, supra note 29, at 91.
123. Id.
124. Id. at 98.
125. The White House, Office of the Press Secretary, Fact Sheet: President Bush’s Clean Air Plan, June 12, 1989, at 4.
126. See supra note 59; PACE REPORT, supra note 59, at 20-21.
127. Id. at 20-21.
128. This discussion excluded costs attributable to the effects of acid deposition. Id. at
It surveyed a number of studies and ultimately chose to use data from a study commissioned by the Bonneville Power Administration from ECO Northwest (ECO) involving a hypothetical coal-fired power plant located near a highly-populated area in the State of Washington. ECO estimated the health effects of SO₂ by using a dispersion model and linear dose-response relationships.¹²⁹ ECO then relied on a previous study for its risk estimates¹³⁰ and wage studies for its final valuation.¹³¹ Rather than use these valuations, however, the Pace Report substituted others. After surveying wage differential studies, the Pace Report settled on statistical values of $4,000,000 in 1989 dollars per statistical life and $400,000 per statistical injury arising from emissions produced by electricity sources.¹³² The Pace Report presented an estimated mortality cost of $1.72/lb SO₂, which includes damages from both SO₂ and sulfates, and an estimated morbidity cost of $0.05/lb SO₂.¹³³ The Pace Report authors performed similar literature surveys for the costs of damage to materials and impairment of visibility from SO₂ emissions and determined that the total cost of all damages attributable to SO₂ emissions is $2.03/lb SO₂.¹³⁴

To establish the validity of this methodology, several issues must be addressed. First, because the Pace Report is based on a survey of existing damage studies, the validity of its results depends on the validity of the underlying studies. However, the Pace Report gives no indication that it has critically evaluated the work done by, for example, ECO or Mendelsohn and Orcutt, the study that ECO relied on for mortality estimates.¹³⁵ It would have been informative for the Pace Report to have explained why the EPA has not used this study in

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¹²⁹ Id. at 195.
¹³⁰ Id. ECO relied on a 1979 study by Mendelsohn & Orcutt.
¹³¹ Id. at 195-96. ECO relied on a 1983 study by Violette & Chestnut. ECO chose values of $3 million per life lost and no additional dollars per injury. Id. at 196.
¹³² Id. at 99. The PACE REPORT derived these mortality and morbidity cost figures by surveying existing studies that valued mortality and morbidity risks as measured by society's willingness to pay to avoid those risks or willingness to be compensated to accept them.
¹³³ Id.
¹³⁴ Id. at 209. The PACE REPORT valued materials damage attributable to SO₂ emissions at $0.12/lb and damage to visibility at $0.14/lb.
¹³⁵ Id. at 195.
setting ambient standards. The Pace Report also states that it did not independently review the dispersion models used in the ECO study. Moreover, the Pace Report does not provide enough information to allow users of the report to perform such an evaluation independently. It is therefore impossible to have any significant level of confidence in the Pace Report's results.

Second, the Pace Report implicitly depends on ECO's assumption that the use of linear dose-response relationships is valid. Recognizing the pitfalls of such an assumption, the Pace Report states: "This may be an acceptable assumption over the range of ambient air qualities considered in this study, but would not hold in areas with different ambient air pollutant concentrations." In addition, no attempt is made to justify the "acceptability" of this assumption in the case studied. The linearity assumption is consistent with the fashion in which Pace Report states its results: dollars per pound emitted as if each pound of SO$_2$ has the same effect. This approach ignores the likelihood that thresholds exist below which effects do not occur. This may be true as a practical matter when the environmental receptors for a particular pound of SO$_2$ are not sensitive to SO$_2$, or when the receiving atmosphere has different dispersive characteristics or different background air quality.

Third, the Pace Report fails to establish the representativeness of the study of one power plant in a densely populated area in the State of Washington. Where there are other sources with different emission characteristics, emitting into different background levels of ambient air quality in different areas with different dispersion parameters and different environmental receptors, the expectation is to find

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137. PACE REPORT, supra note 59, at 195.

138. Id.

139. Id. at 195-196.
very different environmental responses and different social values for those responses.

Fourth, the Pace Report approach to estimating the costs of mortality and morbidity is inherently flawed. It was based on the differences in wages for jobs with different risks. The assumption that people make employment choices based solely on assessments of risks misrepresents the available data.

Fifth, had the Pace Report applied some reality tests, the validity of its results would be easier to assess. The simple tests that can be applied here produce discouraging results. For example, the Pace Report valued all damages attributable to SO₂ emissions at $2.03 per pound, while, using a cost of control method, which is thought to overstate that value, the Massachusetts DPU chose the much lower value for SO₂ emissions of $0.75 per pound. In addition, applying the mortality figures of the Pace Report to the country generally suggests that 21,000 deaths annually can be attributed to SO₂ emissions. This is a staggering figure compared to the EPA's publication of the estimate of zero as the lower bound for this figure. Moreover, the Pace Report suggests three and one-half times more mortality than morbidity, when common sense indicates that the former should be a small subject of the latter.

In the same vein, the materials damage and visibility portion of the Pace Report implies a twelve billion dollar value to removing all SO₂ from the air. The analyses of the National Acid Precipitation

140. Id. at 97-99.
141. Id. at 209.
142. See supra note 124 and accompanying text.
143. The ECO study "implies an annual mortality cost of about $82.8 million due to SO₂ emissions." PACE REPORT, supra note 59, at 196. Division of that total amount by the Pace Report's chosen $4 million per statistical life yields 21,000 statistical deaths a year.
144. EPA, Strategies and Air Standards Division, Office of Air and Radiation, Draft Regulatory Impact Analysis on the Antioanl Ambient Air Quality Standards for Sulfur Oxides (Sulfur Dioxide) VII-10 to VII-12 (May 1987).
145. The Pace Report values the morbidity damages of SO₂ at $.05/lb. Multiplying 21.2 million metric tons by $.05/lb. yields approximately $2 billion for total morbidity costs. Division of that total by the Pace Report's chosen $400,000 per statistical injury yields approximately 20,000 annual statistical deaths calculated in note 143 yields the 3.5 ratio given in the text.
146. The Pace Report estimates annual SO₂ emissions at approximately 48 million
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Assessment Program (NAPAP) indicate that there may be a practical threshold for materials damage given that maintenance of materials may have to occur because of weathering, irrespective of the presence or effect of airborne SO$_2$.\textsuperscript{147} As to visibility, the EPA has not concluded that there is enough of an effect to warrant a visibility-based ambient standard.\textsuperscript{148} Until these issues are addressed in a reliable manner, it will be difficult, if not impossible, to conclude that the Pace Report results are valid. Finally, the Pace Report did not consider the benefits of coal use (such as energy security) or the societal costs of raising the costs of electricity.

V. CONCLUSION

Requiring electric utilities to use externalities in the resource planning process is a current phenomenon that has been pushed ahead of the data that can support the regulatory decisions. The CAA has been effective at reducing emissions of many substances from all power plants including those firing coal. The purpose of these emissions reductions has been to eliminate the adverse effects of air emissions to the public health and welfare. While these programs do not eliminate emissions, implementation of the CAA since 1970 through the period when the 1990 Amendments will have their greatest effect should significantly reduce the residual emissions of power generation and their associated effects. Efforts to estimate costs of these residual emissions must use valid methods and reliable input data. A review of the available analyses and the criticisms of them suggest that the type of reliable information needed to evaluate these costs does not exist. Until it does, arguments to depart from the approach adopted by Congress in the CAA—by using other means to add to its regulatory programs—should be viewed with skepticism and be avoided.

\textsuperscript{147} Gary and Teague: The Inclusion of Externalities in Electric Generation Resource Pl

\textsuperscript{148} National Acid Precipitation Assessment Program, 1990 Integrated Assessment Report § 2.4.3.3.

\textsuperscript{149} See 53 Fed. Reg. 14,926 (1988) (Proposed Decision Not to Revise the National Ambient Air Quality Standards for Sulphur Oxides (Sulphur Dioxide)).