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Report to the Ranking Minority Member, Committee on Science, House of Representatives

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ELECTRICITY SUPPLY

Consideration of Environmental Costs in Selecting Fuel Sources

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Resources, Community, and
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The Honorable George Brown
Ranking Minority Member
Committee on Science
House of Representatives

Dear Mr. Brown:

Electricity rates do not reflect all of the costs of the adverse environmental effects of electricity production. In meeting federal environmental requirements, utilities incur costs—for pollution control equipment, for example—that are considered internalized environmental costs because they are included in the electricity rates. However, there are other costs—for residual pollution emissions, which are not controlled—that are not reflected in the electricity rates; the costs of the health and environmental impacts of these residual emissions are considered external costs, which are referred to as externalities. Many states require utilities to consider these externalities for different energy sources (such as coal, nuclear energy, natural gas, and renewable energy) in deciding how to produce electricity.

This report responds to your request that we review whether the consideration of externalities affected the use of renewable energy, such as wind, solar, or geothermal power. In addition, you asked how the states consider externalities in planning for electricity needs and what the Department of Energy's (DOE) role is in this activity. (This process is discussed in app. I.) As agreed with your office, we also obtained more detailed information on California, a leader in the generation of electricity from renewable energy, and New York, a leader in the consideration of externalities. (This information is in apps. II and III.)

Background

States—not DOE—have the responsibility for deciding whether and how to consider externalities for their regulated electric utilities. The consideration of externalities in the states that undertake it is generally motivated by a desire to "level the playing field" in regard to concerns about the environmental consequences of electricity production. The environmental costs of producing electricity with renewable energy are considered to be relatively low, in contrast to those for fossil fuels. Therefore, to consider all costs related to the production of electricity, the costs or values of externalities are estimated and added to or otherwise

factored into the various fuel source options, usually during the planning process.

Results in Brief

The consideration of externalities in the planning process for electricity production has generally had no effect on the selection or acquisition of renewable energy sources, according to experts and representatives of various sectors of the electricity industry. According to these sources, the basic reason is that electricity from renewable energy usually costs so much more than electricity from fossil fuels that externality considerations do not overcome the difference. Also, in cases in which renewable energy has been used to produce electricity, according to some experts, its use has primarily been the result of special programs, such as federally legislated requirements or state set-asides[1] that require such use.

States vary greatly in their consideration of externalities, as discussed in appendix I. Of the 50 states and the District of Columbia, 16 states assign a quantitative value to externalities, such as dollar costs, and 9 states and the District of Columbia treat externalities qualitatively, by using, for example, a subjective ranking system for anticipated environmental impacts. The remaining 25 do not have requirements concerning externalities. DOE's role in considering externalities has primarily been to conduct and support research.

Consideration of Externalities Has Not Increased Use of Renewable Energy

The consideration of externalities has not influenced the selection or acquisition of renewable energy (sometimes called renewables) or any other type of energy for electricity production, according to officials representing various sectors of the electricity industry. These officials include those representing state agencies and utilities in California and New York; officials from DOE and two of DOE's laboratories, the National Renewable Energy Laboratory and Lawrence Berkeley Laboratory; and officials from the Energy Information Administration and the Electric Power Research Institute, a privately funded research organization; and other experts. They said that they were not aware of any instances in which the consideration of externalities made a difference in the fuel source selection. In California, which produces more electricity from renewables than any other state, officials representing the California Public Utilities Commission and Pacific Gas and Electric, the largest utility in California, could not provide any examples in which the consideration of externalities made a difference in the acquisition of renewables.

[1]A set-aside is a block of electricity production designated for renewable sources only.

The basic reason is that the average cost of electricity produced from renewable sources has generally been so much higher than the cost of electricity produced from fossil fuels that the consideration of externalities did not outweigh the price difference. According to officials from DOE's National Renewable Energy Laboratory, Lawrence Berkeley Laboratory, Energy Information Administration and the Electric Power Research Institute, fossil fuels—especially natural gas—have been relatively inexpensive. In addition, new technologies have made fossil fuels more efficient. Also, the Office of Technology Assessment concluded in a September 1994[2] study that no clear consensus exists on the quantitative estimates of externalities or on the methods for making the estimates. In states where externalities are assigned a monetary value, the value is usually too small to cover the difference in cost between renewables and fossil fuels.

According to a June 1994 study by the National Renewable Energy Laboratory,[3] price was the greatest factor working against the selection of renewables as a fuel source. According to one of the study's authors, there were two cases in which renewables were selected, but both involved expansion of existing geothermal and hydroelectric projects' capacity, which resulted in a competitive price. The study, which analyzed data from 16 states on bids that were released in 1993 and open to providers of electricity from all types of fuel, showed that bidding results announced for 3,583 megawatts[4] of power resulted in the selection of only 55 megawatts (or 2 percent) for renewable fuel sources at these two projects. According to the study, externalities were secondary considerations.

Refinements in fossil fuel technology, as well as recent environmental regulations, have also contributed to the limited impact of externalities. New technologies have reduced the adverse environmental effects of fossil fuels. Furthermore, renewables are often compared to new fossil fuel generating facilities, which tend to be environmentally cleaner than older ones as a result of recent environmental requirements. Finally, industry's compliance with these requirements has had the effect of internalizing these environmental costs, thus reducing external costs.

[2]Studies of the Environmental Costs of Electricity, Office of Technology Assessment (OTA-BP-ETI-134, Sept. 1994).

[3]Competitive Bidding and Renewable Energy: 1993 Update, National Renewable Energy Laboratory (June 1994).

[4]A megawatt is 1 million watts, with a watt being the basic unit of measurement of electrical power.

Another reason that externalities have not affected the selection of renewables relates to the fact that there has been a limited need for additional electrical capacity since states began considering externalities. The consideration of externalities is usually limited to the planning process for developing new capacity and, according to an official of the Electric Power Research Institute and a December 1994 Energy Information Administration study,[5] the country has not experienced much of a need for new electrical capacity since the first state began considering externalities in 1989.

As a result, electricity produced from renewable energy has generally been introduced through some special program, such as a federally legislated requirement or a state set-aside program, rather than under direct competition with fossil fuels. For example, enacted in part to encourage the development of alternative energy resources, the Public Utility Regulatory Policies Act of 1978 requires utilities to purchase power from certain nonutility facilities at prices established by state regulators. These nonutility facilities include generators that produce electricity using solar, wind, waste, or geothermal energy sources and cogenerators that produce both electricity and heat or steam for industrial or commercial purposes. States that established relatively high initial prices for this electricity saw a rapid expansion in the number of nonutility generators, mostly cogenerators. However, according to a September 1993 report by the National Renewable Energy Laboratory,[6] through the 1980s utilities, under this act, contracted for only about 10,000 megawatts of electricity from projects using renewable energy. The Energy Information Administration's December 1994 study states that new capacity from renewable energy peaked in the mid-1980s, but has waned since then.

According to this same report, set-asides offer an alternative that ensures recognition of the attributes of renewable energy, such as environmental benefits. The report notes that California and New York have established set-asides for renewables. The California Public Utilities Commission

[5]The Impact of Environmental Externality Requirements on Renewable Energy, Energy Information Administration (Dec. 1994).

[6]The Impact of Competitive Bidding on the Market Prospects for Renewable Electric Technologies, National Renewable Energy Laboratory (NREL/TP-462-5479, Sept. 1993).

directed each of the investor-owned utilities to allocate to renewables a certain percentage of capacity increases announced for bidding in 1993.[7]

In another set-aside, New York's 1994 energy plan describes a 300-megawatt market test and demonstration program for renewables. However, as of April 1995, the parties to a Public Service Commission-approved settlement, which would initiate the program, have raised objections to the settlement, which, according to an official with the Commission, are pending resolution. Finally, as identified in our April 1993 report,[8] a number of states have adopted measures that encourage developments in wind power, such as set-asides, as mandatory or voluntary goals to generate a specified amount of electricity.

Agency Comments

We discussed the factual contents of this report with officials from DOE's Office of Assistant Secretary for Policy and Office of Assistant Secretary for Energy Efficiency and Renewable Energy, California's Public Utilities Commission, and New York's Public Service Commission. In general, these officials agreed with the facts presented. They provided clarifying information, and we revised the text as appropriate.

We conducted our work from August 1994 to April 1995 in accordance with generally accepted government auditing standards. For our analysis, we relied heavily on interviews with federal and state officials and experts in the field, as well as on relevant studies and reports, but we did not independently evaluate these documents. Appendix IV describes the objectives, scope, and methodology of our review in detail. Appendix V lists major contributors to this report.

[7]In February 1995, the Federal Energy Regulatory Commission found that because California's 1993 bid process violated the Public Utilities Regulatory Policies Act of 1978 and the Commission's regulations, the California Public Utilities Commission cannot compel California's investor-owned utilities to award contracts to the 1993 bid winners. No decision has been made by the commission as to whether it will appeal this decision.

[8]Electricity Supply: Efforts Under Way to Develop Solar and Wind Energy (GAO/RCED-93-118, Apr. 16, 1993).

If you have any questions concerning this report, please call me at (202) 512-3841.

Sincerely yours,

Victor S. Rezendes
Director, Energy and Science
Issues

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Abbreviations

CEC	California Energy Commission
CPUC	California Public Utilities Commission
DOE	Department of Energy
DPU	Department of Public Utilities
EPRI	Electric Power Research Institute
EXMOD	Environmental Externalities Model
FERC	Federal Energy Regulatory Commission
GAO	General Accounting Office
ICEM	iterative cost-effectiveness methodology
kWh	kilowatt hour
MW	megawatt
NREL	National Renewable Energy Laboratory
NYEECS	New York State Environmental Externalities Cost Study
OTA	Office of Technology Assessment
PSC	public service commission
PUC	public utility commission
PURPA	Public Utilities Regulatory Policies Act of 1978

States' and the Department of Energy's Activities Addressing Environmental Externality Issues

Many states, primarily through their public utility commissions (PUC), have been in the forefront in requiring regulated utilities to consider externalities in planning to meet their electricity needs. However, states vary significantly in terms of whether or not they consider externalities and how they consider them. Of the 50 states and the District of Columbia, 16 states assign a quantitative value to externalities, such as dollar costs, and 9 states plus the District of Columbia treat externalities qualitatively, by, for example, using a subjective ranking system for anticipated environmental impacts. The Department of Energy's (DOE) role in considering externalities has primarily been to conduct and support research.

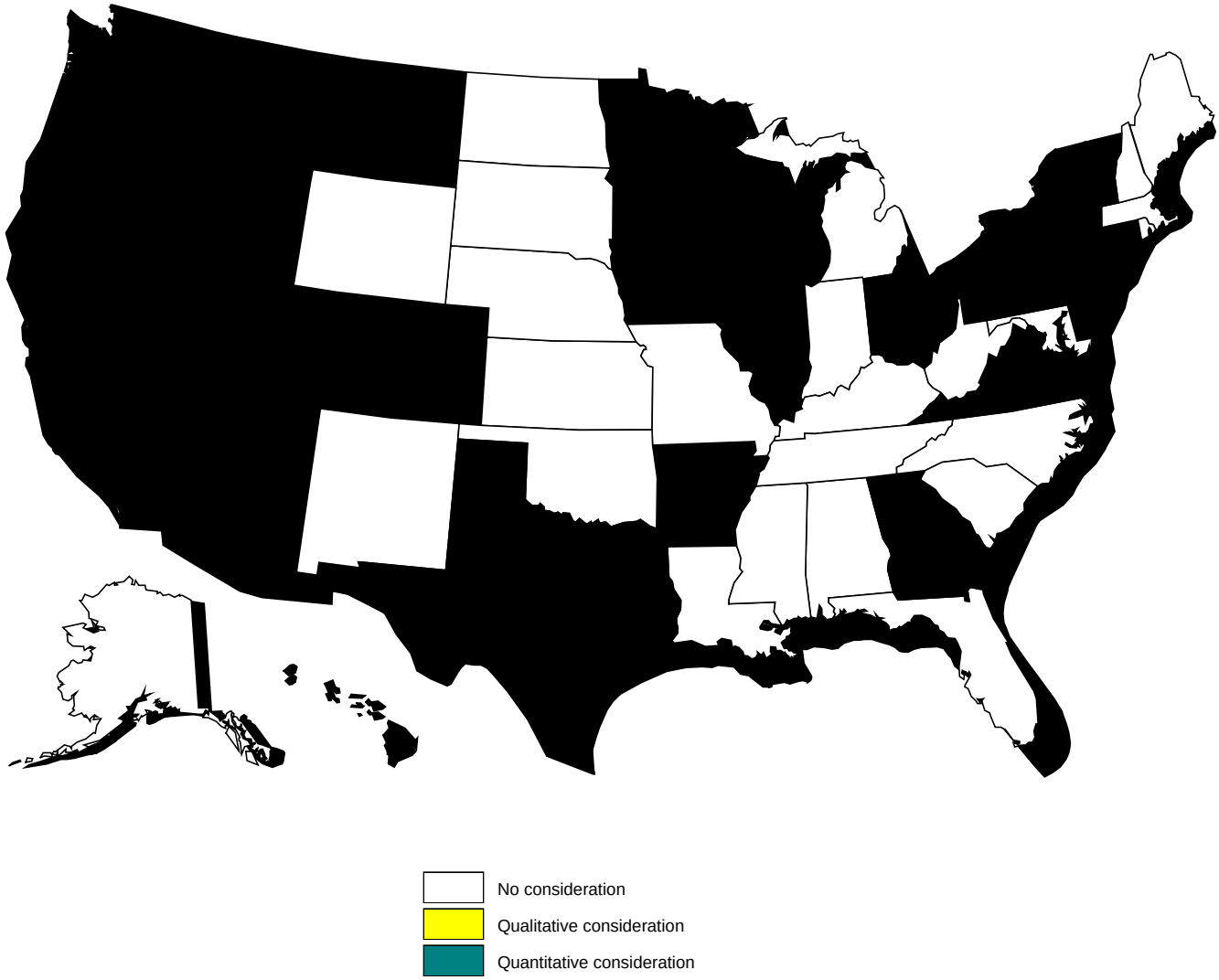
States' Activities in Considering Externalities

States vary significantly in terms of whether they consider environmental externalities and, if so, whether they consider them quantitatively or qualitatively. States also differ in how they consider emission types and how they address the impact on air, water, and land. Some states, after studying the issue, have decided not to consider externalities, whereas other states have not taken a position on the issue. Recently, two states have changed the way that they consider externalities because of challenges in the courts or during externality proceedings at the PUC. The material contained in this appendix is primarily based on data from the National Renewable Energy Laboratory (NREL) and Electric Power Research Institute (EPRI) for all 50 states and information we obtained from selected states. We did not verify NREL's and EPRI's information with each state.

States' practices on environmental externalities are still evolving in terms of whether and how externalities are considered in resource planning. In 1990, 17 states had requirements to consider externalities in their resource planning, according to a study by the National Association of Regulatory Utility Commissioners. As of April 1995, 25 states and the District of Columbia required electric utilities to consider environmental externalities in their resource planning processes. Currently, three other states are considering adopting similar requirements.

States' consideration of externalities varies widely, from the 16 states that consider them on a quantitative basis, to the 9 states and the District of Columbia that consider them on a qualitative basis, to the 25 states that do not have any requirements concerning externalities. (See fig. I.1.)

Figure I.1: States' Consideration of Externalities



States that require the consideration of externalities differ in other areas. Externalities apply only to regulated utilities, which in many states are only the investor-owned utilities. Generally, externality considerations do not apply to municipal utilities, rural electric utilities, and nonutility

generators, which include independent power producers, cogenerators, and self-generators. Nonutility generators are becoming an increasingly larger part of the electricity market. Utilities generally oppose the consideration of externalities because of the limited applicability to only regulated utilities. They believe that this may give the independent power producers and nonutility generators an advantage in a competitive market.

Among the 25 states that currently have no requirements concerning externalities, 3 are in the process of considering the need for such requirements, and another 6 considered but rejected requirements to incorporate environmental externalities in the planning process. The reasons cited by several states rejecting requirements include the following: Imposing such requirements is beyond their current authority; the PUC lacks the expertise, staff, resources, and statutory authority to impose the requirements; information on state-specific externalities is lacking; and new generating resources in the future are not anticipated.

Methods for Addressing Externalities

The consideration of externalities in utilities' resource planning process can occur in several different ways. State PUCs have experimented with various approaches. According to NREL, seven approaches for addressing externalities are in use or have been proposed. These include the qualitative treatment and six different quantitative approaches. Nine of the 25 states and the District of Columbia have adopted a qualitative treatment, while the remaining 16 states apply a quantitative approach.

The qualitative approach to incorporating externalities generally follows informal and loosely defined guidelines. Under this approach, a utility lists the types and rates of emissions and pollutants, describes the potential impacts, and characterizes the externalities, using categories such as "no impact," "moderate impact," or "substantial impact." This information is then subjectively factored into the resource selection process. A November 1994 NREL study[9] lists the strengths and weaknesses of the qualitative approach as follows. Its cited strengths are that it is simple and easy to apply and applicable to nonquantifiable externalities, such as the value of endangered species, biodiversity, and impacts from carbon dioxide. Its weaknesses include subjectivity and an implicit trade-off among options.

[9]Issues and Methods in Incorporating Environmental Externalities Into the Integrated Resource Planning Process, NREL (NREL/TP-461-6684, Nov. 1994).

Quantitative treatment of externalities can vary markedly among states. The quantitative treatment of environmental costs and impacts is an approach that typically involves assigning a value to the environmental effects of electricity generation. This may include determining a monetary value for various environmental impacts of electricity production. This direct quantification or valuation of externality costs may be referred to as the "monetization" of externalities. For example, some states may determine a value (the dollars per ton) for various pollutant emissions.

Another quantitative approach is for utilities to establish an "adder" valuation. Under this method, a specific value is added or subtracted to the estimated costs of a resource option during the planning process. The specified value may be a fixed percentage (e.g., a 10-percent credit for renewable energy options) or dollars per unit of energy (e.g., $0.02 per kilowatt hour [kWh][10]). Adders can be applied easily and immediately; and, as better information concerning externalities becomes available, the values can be adjusted to incorporate the new information, according to NREL.

Some alternative approaches to arriving at the monetized value of externalities that have met considerable controversy include control costs or damage costs. Control costs represent the additional costs of, for example, equipment to control emissions to some specified level, while damage costs are estimates of the actual damage to the environment caused by emissions.

Among those states that require explicit consideration, 9 states and the District of Columbia apply a qualitative treatment; the remaining 16 states require the use of quantitative approaches. Included among the states requiring quantitative approaches are those states that do not specify a particular quantification or monetization approach or method but simply direct a utility to quantify environmental externalities to the extent possible and practicable. Seven states are in the "no specified quantitative approach" category. The other nine states have adopted specific approaches when applying monetized externalities, including percentage adders, specific dollar values per unit of energy, and monetized values for specific emissions. (See table I.1.)

States are increasingly considering environmental and other socioeconomic externalities as part of the electricity resource planning and acquisition process. However, both the methods utilized and the scope

[10]A kilowatt hour is 1,000 watts of power supplied steadily for 1 hour.

of these considerations differ widely. According to NREL, to date there does not appear to be as much attention being paid to developing externality-related values for projects involving renewables as for projects involving fossil fuels.

Table I.1: State PUCs' Information on Externalities

			Quantitative			
State	No requirements	Qualitative	Not specified	Percentage adder	$ per energy unit	By emissions
Alabama	X					
Alaska	X[a]					
Arizona			X			
Arkansas			X			
California						X
Colorado		X				
Connecticut		X				
Delaware		X				
D.C.		X				
Florida	X					
Georgia		X				
Hawaii			X			
Idaho		X				
Illinois		X				
Indiana	X					
Iowa				X[c]		
Kansas	X[b]					
Kentucky	X					
Louisiana	X					
Maine	X[a]					
Maryland	X					
Massachusetts	X					
Michigan	X[a]					
Minnesota						X
Mississippi	X					
Missouri	X					
Montana			X			
Nebraska	X					
Nevada						X

(continued)

			Quantitative			
State	**No requirements**	**Qualitative**	**Not specified**	**Percentage adder**	**$ per energy unit**	**By emissions**
New Hampshire	X					
New Jersey					X	
New Mexico	X[b]					
New York						X
North Carolina	X[a]					
North Dakota	X[a]					
Ohio			X			
Oklahoma	X[b]					
Oregon						X
Pennsylvania		X				
Rhode Island	X					
South Carolina	X[a]					
South Dakota	X					
Tennessee	X					
Texas			X			
Utah			X			
Vermont				X		
Virginia		X				
Washington		X				
West Virginia	X					
Wisconsin						X
Wyoming	X					
Total	**25**	**10**	**7**	**2**	**1**	**6**

[a]The state has considered the issue of externalities and rejected addressing it; therefore, no requirements exist.

[b]As of April 1995, the state was in the process of considering the issue of externalities, but no requirements are in place.

[c]Iowa also uses an adder expressed in terms of dollars per energy unit for the first 120 megawatts of energy produced from renewable resources.

Source: Compiled from NREL's data and EPRI's EPRINET Environmental Externalities Clearinghouse data base, as updated by GAO with assistance from Barakat & Chamberlin, Inc., the contractor responsible for maintaining the data base.

States' Recent Activities Changing the Consideration of Externalities

Two states, Illinois and Massachusetts, have recently changed their approach to considering externalities. Specifically, the Illinois Commerce Commission in a November 22, 1994, ruling requires utilities' resource plans to include a qualitative discussion of environmental externalities. The Commission had considered, but rejected, requiring utilities to use the following approaches: (1) using a monetary adder for five specific emissions or (2) adding in the cost of controlling emissions to comply with future environmental regulations. However, the Commission reaffirmed earlier rulings that the state's least-cost planning laws must require the consideration of the adverse external environmental impacts of providing utility service.

Massachusetts' currently has no requirements to consider externalities because of the Massachusetts Supreme Court ruling in December 1994. Massachusetts' Department of Public Utilities (DPU) now only directs that utilities continue to consider "reasonably foreseeable environmental control requirements with cost implications for ratepayers in weighing resource procurement alternatives." This approach is more limited than how externalities have been considered in the recent past. DPU had previously required the consideration of environmental externalities in utilities' decisionmaking from 1988 to 1994, specifically requiring the use of monetized values for specific emissions since 1990. The Court ruling stated that DPU exceeded its statutory authority by requiring utilities to use environmental externality adders in resource planning to account for effects with no cost implications for ratepayers.

Massachusetts may yet again change its position with regard to environmental externalities, according to the Massachusetts Assistant Attorney General's comments made in January 1995. The Assistant Attorney General stated that DPU retains the authority to apply externality values even after the Supreme Court decision. Even though the Supreme Court ruled that DPU cannot consider environmental costs that would not potentially affect utilities' costs and therefore rates, it affirmed DPU's authority to address environmental costs, he elaborated.

DOE's Role in Considering Externalities

DOE's role in considering externalities has been primarily to conduct and support research. During the 1980s and 1990s, many externality studies were completed under the sponsorship of DOE, state agencies, and utilities. The Office of Technology Assessment (OTA) identified eight of these studies as major efforts on the basis of their comprehensiveness, their influence, and the extent of their methodological discussion and included

an analysis of them in a September 1994 report.[11] OTA concluded that no clear consensus exists on quantitative estimates of environmental externality costs or on the methods for making those estimates.

DOE has recently supported two major studies on developing quantitative estimates. The first study, prepared in 1990 by the Pace University Center for Environmental Legal Studies, surveyed the state of knowledge on externalities and attempted to establish externality values for a range of fuels and technologies. Subsequently, in a December 22, 1992, letter to the State Public Service Commissioners, DOE stated that peer reviewers had identified "substantial flaws" in the study and that the agency "did not support" the externality cost estimates.

The second DOE study, being done in conjunction with the Commission of the European Communities, is examining the external costs of fuel cycles for fossil, nuclear, and some renewable fuels. The eight-volume study is only partially complete. Three volumes, one on the coal fuel cycle and two others on background and methodology, are now available. The remaining five volumes, according to DOE officials, will probably be available by the end of the year. The study is intended to summarize what is known and unknown about quantitative estimation of externalities. It cautioned against national or even statewide estimates of externalities by fuel source, which has been done in previous major studies. For each fuel source, the study uses existing data from two sites, one in the Southeast and one in the Southwest. The coal fuel-cycle study includes estimates of the damage costs for various impacts and presents an externality value in cents per kWh for the sites studied. It concludes that the damages caused by emissions for the specific site at the southeastern location are greater than those for the specific site of the southwestern location largely because of the higher population density in the Southeast.

According to DOE officials, federal funding for the study was about $3.5 million, more than 80 percent of which was spent under the prior administration. DOE has not had sufficient funds available to edit, publish, and distribute the reports. Rather, the Oak Ridge National Laboratory, the lead author of the study, is completing the project using its own resources.

The Federal Energy Regulatory Commission (FERC) supported DOE's fuel-cycle study by commenting on drafts of the report and contributing funds. Section 808 of the Clean Air Act Amendments of 1990 required FERC in consultation with the Environmental Protection Agency to, among other

[11] Studies of the Environmental Costs of Electricity, OTA (OTA-BP-ETI-134, Sept. 1994).

things, calculate the net environmental benefits of renewables, compare renewables with nonrenewable energy, and to report its findings to the Congress. In December 1992, FERC submitted its report to the Congress,[12] citing its participation in DOE's fuel-cycle study as fulfilling its requirements to study externalities.

[12]Report on Section 808 Renewable Energy and Energy Conservation Incentives of the Clean Air Act Amendments of 1990, FERC (Dec. 1992).

California

California leads the nation in producing electricity from renewable energy sources. Traditionally, the utilities constructed and operated their own power plants. However, in the 1970s, events such as the oil embargo of the Organization of Petroleum Exporting Countries and the environmental conservation movement prompted the state to reduce its dependence on oil and to diversify its fuel sources with nuclear and renewable resources. According to the state's 1992 energy report, renewable resources supplied 11 percent of the state's electricity generation and over 5 percent of its capacity in 1991.

Externality Values for Air Pollutants Adopted

In 1990, California passed legislation requiring the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) to place values on the costs and benefits of environmental impacts and explicitly consider them in the resource planning process. As a result, CPUC adopted externality values for five air pollutants: nitrogen oxide, sulfur oxide, particulate matter, reactive organic gases, and carbon. The externality value for carbon, developed by CEC, is applied uniformly statewide. The externality values for the other four pollutants differ depending on the air quality in the location of the proposed generating facility. If the proposed facility is located in an air quality "attainment area," defined in accordance with the Clean Air Act, CPUC uses the externality values adopted by the Nevada Public Service Commission. If the proposed facility is located in a nonattainment area in southern California, CPUC uses the South Coast Air Quality Management District's externality values. If the proposed facility is located in a nonattainment area in northern California, CPUC uses the Pace University study's externality values for sulfur oxide and particulate matter, CEC's values for reactive organic gases, and a combination of the South Coast Air Quality Management District's and CEC's information for nitrogen oxide. (See table II.1.)

Table II.1: Externality Values for Residual Emissions

1997 Dollars per pound

Proposed location of facility	Nitrogen oxide	Sulfur oxide	Particulate matter	Reactive organic gases	Carbon
Nonattainment area					
Southern CA	20.14	15.05	4.36	14.39	0.02
Northern CA	5.84	2.87	1.68	2.71	0.02
Attainment area	4.80	1.10	2.95	0.83	0.02

Source: CPUC, Biennial Resource Plan Update: A Primer (Oct. 1993).

Externality Values Resulted in Little Impact

These externality values were applied for the first and only time during the resource planning process in 1993 and ultimately had little impact on increasing the use of renewables. In 1993, California sought proposals from facilities qualified under the Public Utilities Regulatory Policies Act of 1978 (PURPA) to provide a total of 1,358.5 megawatts (MW) of new capacity between 1997 and 1999, identified through a complex analysis called the iterative cost-effectiveness methodology (ICEM).[13] The results of this analysis provided the justification for new resources and determined the "benchmark" price the PURPA-qualified facilities must compete against. In the ICEM analysis for the 1993 bidding process, externality costs were considered for the first time, and, as a result, the need for new capacity was justified on the basis of environmental as well as efficiency reasons. According to CEC, the consideration of externality costs typically justifies accelerating the addition of a new resource by 1 to 4 years. However, the California legislature passed a law, which became effective in 1993, stating that externality values cannot be used to justify accelerating a utility's need for new additions by more than 15 months, nor can they be used to force a utility to decommission a power plant. Consequently, the passage of this law effectively precluded accelerating the need for adding new resources beyond 15 months, diminishing the benefit of incorporating externality costs into the ICEM analysis.

Nevertheless, the consideration of externality values continued to affect the process in other ways. The "benchmark" price established for bidding was increased because the externality values were incorporated. And once contracts are awarded, payments are to include an "adder" or a "subtractor" based on the net difference in emissions from the contracting facility versus the projected emissions used in determining the "benchmark" price. Thus, PURPA-qualified facilities could lower their bids by the amount they expected to receive from an "adder."

However, before the 1993 bidding process was complete, other events intervened that further diminished any potential impact of having incorporated externality costs into the process. In 1991, the state legislature passed a bill directing that until CPUC completes an electricity procurement process that values the environmental and diversity costs and benefits, the Commission shall set aside a portion of future purchases of new capacity for renewable resources. As a result, 297.5 MW of the total

[13]ICEM is designed to determine the type, size, and timing of additions to a utility's portfolio of resources that would be most cost-effective. ICEM is a sequential process that evaluates candidate resources one by one to determine how the addition of each resource would affect the utility's total system costs on the basis of the candidate resource's capital costs and variable costs during the first year of planning and the life of that resource.

1,358.5 MW of needed capacity announced for bidding in 1993 was set aside exclusively for renewable resources.

Consequently, while bidders that would use renewable resources successfully competed to supply 495.05 MW of the 1,428.65 MW[14] of capacity covered by the bids selected in the 1993 process, 304.75 MW was attributable to the set-aside requirement rather than the incorporation of the quantified externality values for air pollutants. Only 190.3 MW of the non-set-aside capacity was successfully competed for by bidders that would use renewables. And even in these cases, the CPUC officials we spoke with were reluctant to attribute the success of these bidders to the consideration of externality values. According to CPUC officials, some of the winning bids were low enough to have been competitive even without any consideration of externality values or potential "adders."

In addition, the entire process became very controversial. Utilities, independent power producers, as well as PURPA-qualified facilities challenged and protested the state's 1993 competitive bidding process, causing numerous delays in awarding the contracts, which are still not finalized as of May 1995.[15] As a result, California has proposed to abandon this process in the future as its means of allocating contracts to PURPA-qualified facilities. However, CPUC officials said that they are not planning to replace this resource planning process because the state is moving toward restructuring its electric services industry and allowing consumers direct access to an open and competitive market for electricity services.

[14]California investor-owned utilities were allowed to select winning bidders providing up to 110 percent of the announced capacity needs.

[15]In February 1995, FERC found that because California's 1993 bid process violated PURPA and FERC's regulations, CPUC cannot compel California's investor-owned utilities to award contracts to the 1993 bid winners. No decision has been made by CPUC as to whether it will appeal FERC's decision.

New York

New York was one of the earliest states to consider externalities and has developed a computerized model that can be used to estimate the value of externalities for a specific location. The state relies on a diverse set of fuels to generate electricity. According to the 1994 state energy plan, 22 percent of New York's electricity came from coal, 21 percent from natural gas, 19 percent from hydroelectric power, 17 percent from nuclear energy, and 12 percent from petroleum. Imported electricity contributed 8 percent, while renewable resources and conservation, or demand-side management, programs accounted for 2 percent. A collaborative effort by the New York State Energy Office,[16] the State Department of Environmental Conservation, and the New York State Department of Public Service, the state energy plan presents an "energy blueprint" to ensure that New Yorkers have a safe, affordable, and reliable supply of energy that will promote future economic growth and protect the environment.

Addressing Environmental Concerns in Electricity Generation

New York's Public Service Commission (PSC) did not have any specific legislative directive to address environmental externalities when the issue of quantifying them came up in a 1989 supply-side bidding proceeding. PSC wanted the bidding process to reflect the different environmental impacts of the different resources being considered and its belief that higher costs should be shown for resources with greater environmental impacts. As a result, PSC adopted for impacts on air, water, and land a set of monetary adders, such as the dollars per ton of various pollutant emissions, which were added to the price of a project. The externality costs for emissions to the air were based on control costs provided in the state energy plan. PSC drew upon the studies published by Bonneville Power Administration for estimating the costs of residual impacts on water and land. The externality values were added to bids in order to select the winning resources and were not paid to the winning bidders.

The maximum amount of all adders for an average new 100-MW coal-fired plant's impacts on air, water, and land was 1.4 cents per kWh. The following table shows the breakdown of this 1.4-cent adder.

[16]The State Energy Office was abolished in 1995.

Table III.1: New York PSC's External Cost Valuations

Cents per kWh	
Externality	**Mitigation cost**
Emissions to the air	
Sulfur oxides	0.250
Nitrogen oxides	0.550
Carbon dioxide	0.100
Particulates	0.005
Impacts on water	0.100
Impacts on land	0.400
Total	1.405

Source: Sury N. Putta, "Weighing Externalities in New York State," The Electricity Journal (July 1990).

These externality values reflected pollution control costs. The value for emissions of individual pollutants was based on averaging the costs of different control technologies in order to meet the pollutant-reduction goals set forth in the state energy plan. According to the PSC officials we interviewed, the value for carbon dioxide was an arbitrary number to serve as a proxy in the calculation to recognize that carbon dioxide has an externality cost, though it is difficult to calculate because the pollutant's impact is extensive. Therefore, the externality value for carbon dioxide was an interim number, reflecting land and tree-planting costs, because there was no agreed-upon value.

When New York developed the 1.4-cent externality value for the 1989-91 bidding proceedings, utilities could incorporate this value into their bidding programs in two different ways: (1) The externality costs of the bidders' projects could be translated into an environmental score and added to the scores of other factors for ranking the bids, or (2) the externality costs could be used to adjust the bid prices, with the selection of the bids based on the adjusted prices. Translating externality costs into an environmental score required analyzing the utility's method of scoring price and nonprice factors. For example, if the cost of power to the utility was 5.6 cents per unit and the maximum externality cost was 1.4 cents per unit, then the appropriate maximum score for the environmental factor would have been 25 percent (1.4/5.6) of the maximum score allocated for the price factor. Allocation of an environmental score in this fashion would place the environmental factor on an equal footing with the price factor and force the bidders to value the public resources in designing their projects and the projects' total costs.

According to the state energy plan, externalities were considered in competitive bidding for electric capacity from 1989 through 1991. The results of the bids, according to a September 1993 NREL study,[17] showed that out of the bid winners for generating 968 MW, only one project using renewable energy, a 17.7-MW waste-wood-fired project, was selected. Projects using renewable resources won 2 percent of the total amount awarded. According to PSC officials, the use of adders did not influence these decisions. No more recent bid proceedings have occurred. The following table shows the bids issued and the outcome of the awards.

Table III.2: Renewable Resources Selected From New York's 1989-90 Competitive Bids

Utility	Year	Requested (MW)	Total selected (MW)	Renewable resources selected (MW)
Orange and Rockland Utilities, Inc.	1989	200	198.5	0
Consolidated Edison Company of New York, Inc.	1990	200	214.2	17.7
Long Island Lighting Company	1990	150	150.0	0
Niagara Mohawk Power Corporation	1990	350	405.0	0

Source: The Impact of Competitive Bidding on the Market Prospects for Renewable Electric Technologies, NREL (Sept. 1993).

The state's 1992 energy plan recommended a 300-MW market test demonstration program for renewables. According to PSC officials, the PSC approved a settlement adopting such a demonstration program, but by April 1995, the parties to the settlement had raised objections to it, and resolution is pending.

Estimating Externalities Through a Computerized Model

In response to New York's 1989 PSC Order No. 89-15, dated May 23, 1989, the state began the State Environmental Externalities Cost Study (NYEECS) to account for environmental effects in its planning for procuring electricity resources. NYEECS produced the computerized New York Environmental Externalities Model (EXMOD) for the purpose of estimating certain externalities associated with select electricity resource options on a site-specific basis.

EXMOD utilizes a data-intensive damage-base approach, which is recognized by economists as the most appropriate methodology for valuing

[17]The Impact of Competitive Bidding on the Market Prospects for Renewable Electric Technologies, NREL (NREL/TP-462-5479, Sept. 1993).

environmental externalities. EXMOD assumes that the emissions are in compliance with environmental regulations. It attempts to estimate the amount associated with any residual emissions. As the name suggests, a damage-base approach attempts to quantify the cost of damages in a fairly specific manner. Costs depend not only on the type of the generating facility itself, but also on its location and the prevailing conditions there. For example, a coal-fired generating plant located in a densely populated area is likely to result in greater damages than an identical plant in a sparsely populated area. This approach is in contrast to a control cost approach of estimating external costs. This latter approach assumes that the cost of the externality is equivalent to the cost of eliminating it. This would include, for example, costs associated with installing scrubbers at a coal-fired power plant to remove emissions such as sulfur dioxide. Such costs vary less from one location to another.

The data imbedded in EXMOD include detailed emissions profiles of alternative electricity resources, detailed characterization of population distribution in the state, and prevailing climatic conditions at different locations in the state. EXMOD is capable of evaluating environmental impacts for 19 different electric resource options. The options include, for example, four different types of coal-fired plants, three types of gas-fired plants, a wood-burning (biomass) plant, and two types of solar plants. EXMOD places a monetary value on the environmental impacts of a given resource option on a site-specific basis.

EXMOD exhibits both strengths and weaknesses, according to its developers. Its strength lies in its ability to characterize options in a fairly detailed manner that is site-specific. For example, not only does EXMOD estimate different externality costs for different types of coal-fired plants, but it also will calculate different externality costs for the same kind of plant at a different location. Limited data and technical knowledge, however, place important limitations on EXMOD's ability to estimate externality costs. For example, the study to develop the model did not find sufficient scientific evidence to quantify damages from greenhouse gases, according to PSC officials. Therefore, externality costs are not included for carbon dioxide, which is an air pollutant that contributes to the greenhouse effect. Also, the model does not account for evacuation costs brought about by a nuclear accident.

EXMOD's estimates of external costs tend to be quite small relative to the "market" costs of electric generation in New York. For example, the average electricity rate in the state is about 11 cents per kWh, but EXMOD

estimates, for instance, that the externality cost of one type of 200-MW coal-fired plant sited in the "Capital District" (Albany) varies from 1.07 mills to 1.50 mills per kWh (or less than two-tenths of a cent).[18]

PSC initiated a proceeding in 1992 to consider the role of environmental externality costs in its resource selection. Due to concerns that negative impacts would outweigh positive ones, an administrative law judge recently recommended discontinuing the policy mandating monetized externalities and closing the case but acknowledged that utilities should exercise managerial judgment in utilizing externalities in their planning process. Reply briefs are due in May 1995, and according to PSC officials, a ruling is expected over the next few months. In the meantime, according to a PSC official, investor-owned utilities may use either the 1.4-cent externality value that PSC calculated or the values developed by EXMOD.

[18]One mill is one-tenth of a cent.

Objectives, Scope, and Methodology

States are concerned about the adverse environmental effects of electricity production. Therefore, many have required that utilities factor the impact of these effects into their decisions about the energy sources they use to produce electricity. The Ranking Minority Member, House Committee on Science, requested that we review (1) whether the consideration of these costs affected the use of renewable energy and (2) how states consider externalities in planning for electricity needs and what DOE's role is in this activity. The Ranking Minority Member's office also requested that we obtain more details on California's and New York's programs considering externalities.

To determine whether the consideration of these costs affected the use of renewable energy, we conducted a literature search and interviewed and reviewed information obtained from federal and state government officials, experts in the field, and representatives of various sectors of the electricity industry. At the federal level, we interviewed officials in OTA and DOE's Office of Electricity Policy and Office of Energy Efficiency and Renewable Energy, and the Energy Information Administration. At the state level, we interviewed officials of California's Public Utilities Commission, as well as New York's Public Service Commission, Department of Environmental Conservation, and State Energy Office. The organizations contacted that have expertise on the issue or that represent various sectors of the industry included DOE's NREL and Lawrence Berkeley Laboratory, EPRI, the National Association of Regulatory Commissioners, the Edison Electric Institute, American Public Power Association, and the National Rural Electric Cooperative Association. They also included the consulting firms of Energy Research Group, Inc., Resource Insight Inc., and Resources for the Future; the United States Association for Renewable Energy and Energy Efficiency Development; and the American Wind Energy Association. We also interviewed officials in selected utilities in California and New York.

To review how states consider externalities in planning for electricity needs, we interviewed representatives and/or obtained studies and information from the following organizations: DOE's NREL and Energy Information Administration; California's and New York's state commissions and utilities; EPRI and its state-specific electronic data base—EPRINET; the Environmental Externalities Clearinghouse; the Edison Electric Institute; the National Association of Regulatory Utility Commissioners; and other representatives of the electricity industry. Our work on this objective relied primarily on NREL's November 1994 study, which we updated with data from EPRI's EPRINET and supplemented with

data from selected states. We compared the data in the NREL study to data from other studies and resolved obvious differences, but we did not independently verify the data provided.

Information on DOE's role in this activity was obtained from interviews and information from officials in DOE's Office of Electricity Policy and Office of Energy Efficiency and Renewable Energy. We also spoke to a representative of Resources for the Future. This organization participated with DOE's Oak Ridge National Laboratory in the DOE-funded fuel-cycle study. We also interviewed a representative of FERC, which was a cofunder of the DOE study.

To obtain information on California's and New York's programs, we interviewed officials from each state's regulatory agency and planning commission, reviewed each state's energy plans, and contacted selected utilities and private interest groups in each state. In addition, we attended a seminar on New York's EXMOD and obtained documentation on it.

We conducted our work between August 1994 and April 1995 in accordance with generally accepted government auditing standards.

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