Keeping Up With Environmental Externality Developments

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KEEPING UP WITH *ENVIRONMENTAL EXTERNALITY* DEVELOPMENTS

Prepared for

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ABSTRACT

An introduction to the current *environmental externalities* debate as it is emerging in the context of state Integrated Resource Planning (IRP) requirements applied to electric utilities, with a discussion of the underlying economic concepts, the approaches that are being adopted, the complex issues that are involved, the developments that are underway, steps that organizations in the gas industry may want to take as they prepare to participate in debates and proceedings, and conclusions about the status and outlook for state environmental externality requirements.

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EXECUTIVE SUMMARY

During the past two years, the term *environmental externalities* has become increasingly important in energy industries. The economic concept of *externalities* has been around for a long time, but state requirements that electric utilities factor *environmental externalities* into plans and decisions are a relatively new development.

State environmental externality requirements applicable to electric utilities are important to organizations in the gas industry because they will affect the market for gas for electric generation, the relative competitiveness of gas and electricity and, potentially, future state requirements applicable to gas utilities.

The INGAA Foundation decided to commission this objective, introductory paper on environmental externality developments to provide a basis for further discussions among organizations in and supportive of the gas industry.

In brief, the paper reviews the underlying economic concepts and the relationship of recent state externality developments to other government efforts to force *internalization* of *externalities*, summarizes state Integrated Resource Plan (IRP) requirements for electric utilities which have become the vehicle for considering environmental externalities, explains how externality developments can affect utility decisions and fuel choices, and identifies complex issues raised by state environmental externality requirements.

The paper points out that the fact that some states adopted externality values that were much higher for coal-fired generating units than for gas-fired units may have led some in the gas industry to conclude that commission actions requiring consideration of environmental externalities should be encouraged. However, it may be too early to predict the outcome of state environmental externality efforts or how they will affect the market share of competing energy sources.

The paper also describes important externality developments now underway, identifies key players and interests in externality debates and proceedings, and lists steps the gas industry may want to address in preparing for participation in debates and proceedings.

The analysis underlying this paper leads to the following observations:

1. The *underlying* objective in recent environmental externality developments is not new and it will not "go away." The underlying economic concept is correct and society can benefit from valid actions to achieve greater internalization of the costs to society of environmental degradation. Furthermore, public opinion—whether or not based on accurate perceptions—is

decidedly in favor of reducing environmental degradation.

2. State public utility commission actions to require or encourage regulated electric utilities to take environmental externalities into account have provided a new "lever" to focus attention on a long-standing objective (i.e., increase internalization of external social costs), but the state efforts are one of several levers.

3. State efforts have revealed complex problems, including methodological issues, inadequate scientific data and serious public policy issues, that will have to be confronted.

4. The complex problems will slow public utility commission efforts to take environmental externalities into account, but are unlikely to stop them. Even if the state PUC efforts were slowed or stopped, other federal, state, and local efforts via environmental, health and safety regulations and taxation will continue. Ignoring the matter isn't an option.

5. There are dangers in the state PUC efforts, as in the case of all efforts with similar objectives, that overall societal benefits will not be increased as much as possible or as efficiently as possible because:

   a. Requirements may create situations where marginal costs of reducing adverse environmental impact will exceed marginal benefits. For example, damage values could be overstated or the cost of corrective measures understated—with the result that electric or gas utilities *and their customers* would have to spend more than the environmental benefits achieved are really worth; and/or

   b. Requirements may force attention and spending by utilities and their customers on environmental protection actions that are not, in fact, the highest priority. The Federal government does not now do a good job in prioritizing risk-reduction efforts (i.e., work to reduce the most important risks first). State governments are unlikely to do substantially better.

   These dangers are present in most efforts to protect health, safety and the environment.

6. The state PUC efforts are an important experiment in "Federalism" and in the allocation of authority and responsibility among state government agencies. That is, the state PUC actions are tending to put more energy and environmental policy issues on state PUC agendas and to shift responsibility from state environmental and energy agencies to PUCs. The state PUC actions, apart from their direct effects, provide a basis for experimentation with different approaches—compared to Federal requirements imposed nationwide. These effects, themselves, have benefits and costs, depending upon one's interests. For example:

   - Environmental requirements could differ widely from one state to another.

- Costs will generally be borne by citizens within the state establishing the requirements but the benefits of reduced adverse environmental effects may not. Depending upon the target (e.g., the particular emissions, discharges or other effects), the benefits may occur within or outside the state boundary.

- Costs of utilities' actions are passed through to customers and thus affect the cost of doing business and living within the state establishing the requirements.

- Control at the state level permits states to take into account interests (e.g., protecting coal mining or oil and gas exploration and production jobs) that may not get equal weight if requirements are established by the Federal government.

7. Environmental externality actions by up to 50 state governments will be more difficult for all interest groups to monitor, compared to actions taken only at the Federal level.

8. Environmental externality actions will increase demands for more and better scientific evidence on relationships between energy activities and environmental damage, and for economic data and analysis to support positions taken by the various parties participating in debates and proceedings.

9. As environmental externality actions become more sophisticated, increased attention is likely to be focused on all aspects of a fuel cycle (i.e., from resource exploration and extraction through end use and waste disposal) rather than being limited to emissions and discharges at the point where energy is used.

10. Actions to take environmental externalities into account will result in "winners" and "losers," compared to the status quo, among producers, transporters, those who convert energy to other products, including electricity, and the ultimate users of energy.

For those without time to review the entire paper, this executive summary is followed by a detailed 3-page table of contents identifying pages where various topics are discussed.

For those who wish to delve directly into the 47-page paper, its basic organization is explained on page 2, immediately following the explanation of the INGAA Foundation's rationale for commissioning the paper.

Keeping up with *Environmental Externality* Developments

Summary and Contents

Keeping up with *Environmental Externality* Developments

INTRODUCTION

During the past two years, the term *environmental externalities* has become increasingly important in energy industries. The economic concept of *externalities* has been around for a long time, but, as explained below, the meaning of environmental externalities as it is being applied in new state requirements is still evolving. These new requirements being adopted by some state public utility commissions have made it necessary for leaders in energy industries to pay more attention to environmental externalities.[1]

State *environmental externality* developments are important to organizations in the gas industry because:

- Requirements applied to *electric utilities* by state public utility commissions are likely to have an impact on both the amount of energy that will be needed by the electric generation industry and the share of that market served by natural gas;

- State public utility commissions will probably be mindful of the requirements applied to *electric utilities* as they develop Integrated Resource Planning (IRP) requirements for *gas utilities*—even though the situations are quite different; and

- Requirements may affect the relative *competitiveness* of gas and electricity in residential, commercial and industrial markets.

Recognizing the above, the INGAA Foundation decided to commission an objective, introductory paper for leaders in the gas industry and supporting organizations that would summarize and comment upon environmental externality requirements now being developed for electric utilities.

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1 This paper will not deal with requirements in the Superfund Law with respect to externalities related to oil spills. Apparently, the Departments of Interior and Commerce (National Oceanic and Atmospheric Administration) are developing regulations to implement those requirements.

This paper is not a decision paper or action plan. Instead, the intent is to provide a foundation for further discussion of environmental externalities within and among organizations in and supportive of the gas industry. The Foundation recognizes that environmental externality developments are sufficiently new that many executives haven't had time to:

- Refresh their memories on the underlying concepts and keep up with recent actions that apply externality concepts to environmental effects associated with electric and gas utility activities,

- Determine whether and how they should participate in ongoing debates and proceedings involving environmental externalities, or

- Determine how their companies' interests may best be protected and advanced in the ongoing debates and proceedings, or in the longer run.

ORGANIZATION OF THE PAPER

The remainder of this paper is divided into nine segments:

- The **first** reminds readers of the economic concepts behind recent environmental externality developments, and points out the relationship of these developments to other ways that governments seek to force *internalization* of *environmental externalities*.

- The **second** summarizes state Integrated Resource Plan (IRP) requirements, principally those applied to electric utilities, which are important because they have provided a vehicle to require consideration of environmental externalities.

- The **third** illustrates the way environmental externality requirements can affect electric utility resource decisions; i.e., the choice between demand-side (conservation and load management) and supply-side (more generating, transmission and distribution capacity) alternatives, and choices among sources of energy for generating electricity.

- The **fourth** describes fourteen complex issues raised by environmental externality requirements, which issues are now being debated. The emergence of these issues has slowed state efforts to require consideration of environmental externalities.

- The **fifth** points out that the relative competitive position of gas vs. other sources of energy for electric generation depends on the potential environmental effects considered in externality requirements and the way values are set.

- The **sixth** lists important environmental externality developments now underway.

- The **seventh** identifies interests that are at stake in the application of environmental externalities and key players involved in state proceedings.

- The **eighth** lists matters that the natural gas industry may want to address in order to be better prepared to participate in environmental externality debates and proceedings.

- The **ninth** and final section provides the author's concluding observations about trends underway in the various environmental externality debates and proceedings.

1. THE CONCEPTS AND OBJECTIVES BEHIND CURRENT ENVIRONMENTAL EXTERNALITY DEVELOPMENTS ARE NOT NEW.

Before considering recent environmental externality developments, this section of the paper reviews the meaning of the concept as intended by economists and points out that current state activities are only one of the ways that governments have sought to force internalization of externalities.

a. The economists' concept of *externalities:*

Economists have long[2] and correctly contended that all the real costs and benefits to *society* of actions taken by individuals or organizations often are not reflected in the price paid by consumers for the products and services that are used or consumed. Those costs and benefits that *are* reflected in the market price are referred to as *internal* or *private.* Those that are *not* reflected are referred to as *external* or *social* costs and benefits.[3]

Economists and others have pursued public policies that would result in *internalizing* the externalities in one way or another. *Internalize,* as used here, means that the costs and benefits *would* be reflected in the price paid by consumers. If this were done, the theory goes, consumers would see the right "price signals" and consume only those goods and services for which they were willing to pay a price that properly compensates society. The implication is that when prices correctly reflect the true social costs, the demand for the product or service will approach its optimum level from an overall societal point of view.

Economists generally agree that the environment has been treated as a *public good* (i.e., a good that is available free or cheaply) and has, therefore, been *overused* for purposes that are not in the best interests of society as a whole. They also agree that those who are

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2 According to Joskow, "The first comprehensive discussion of the theory of external costs and benefits is generally attributed to the work of the famous British economist A.C. Piqou in the 1930s." Joskow, Paul L., "Dealing with Environmental Externalities: Let's Do It Right!" The Electricity Journal, vol. 5, no. 4, May 1992, pp. 53-66.

3 Various economists use different words to define or explain the concept, but there appears to be general agreement on its meaning. Pindyck and Rubinfeld indicate that an externality occurs "...when the actions of either consumers or producers result in costs or benefits that do not show up as part of the market price." Further, according to Pindyck and Rubinfeld, "[e]xternalities can be *negative*—when the action of one party imposes costs on another party—or positive—when the action of one party benefits another party." "A negative externality occurs, for example, when a steel plant dumps its waste in a river that fishermen downstream depend on for their daily catch....The negative externality arises because the firm has no incentive to account for the external costs that it imposes on fishermen when making its production decision. A positive externality would occur when a homeowner repaints her house and plants an attractive garden. All the neighbors benefit from this activity, yet the homeowner's decision to repaint and landscape probably did not take these benefits into account." Pindyck, Robert S. and Daniel L. Rubinfeld, *Microeconomics*, 2nd edition, 1992, pp. 290 and 640.

responsible for environmental degradation should avoid such degradation or compensate society for it. If costs to society were fully internalized, free or public goods such as the environment would not be overused.

b. Economists' views on marginal costs and benefits, and cost-effectiveness.

Marginal costs and *marginal benefits* are related concepts that are important in the ongoing environmental externality debate. Economists generally agree that the *marginal* cost of reducing environmental degradation (i.e., the cost associated with reducing the next increment of degradation) should not exceed the marginal benefit of reducing that increment. Society is worse off when marginal costs exceed marginal benefits.

Economists generally agree, also, that actions to reduce environmental degradation should be focused first on steps that will provide the greatest benefit for the least cost (i.e., the highest benefit to cost ratio), and with highest priority given to the most serious adverse environmental effects (i.e., those with highest environmental cost or risk).

c. State environmental externality requirements are only one of the ways that governments seek to force internalization of externalities.

State environmental externality requirements—the primary focus of this paper—are but one of the ways that governments have sought to force *internalization* of *externalities*. Regulations and taxes are other ways that federal, state and local governments pursue the same objective. For example, many existing statutes and regulations have the objective of protecting public and occupational health and safety or the environment. Most such measures now on the books are designed to encourage or force an organization carrying on activities that may affect health, safety or the environment to take actions to reduce or prevent that effect, with the expectation that the costs involved will be reflected in the price of the product or service that is produced.

Another approach is to put a tax on the "undesirable" action with the expectation that the tax will either be sufficient to cause cessation of the "undesirable" activity[4] or to force a sufficient increase in price for the product or service involved so that demand for it is reduced. The Federal tax applied to CFCs (chlorofluorocarbons) is one example of such a tax. The revenue collected from a tax adopted for the purpose of forcing *internalization* of *externalities* should compensate those who are harmed by the undesirable activity. Whether the compensation actually reaches those harmed is highly questionable.

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4 In the case of environmental degradation, those responsible could be expected to avoid the degradation if the marginal cost of reducing the degradation is less than the marginal tax rate they would have to pay to "continue polluting."

2. STATE *INTEGRATED RESOURCE PLANNING* (IRP) REQUIREMENTS FOR ELECTRIC UTILITIES HAVE PROVIDED A CONVENIENT VEHICLE FOR ADDRESSING *ENVIRONMENTAL EXTERNALITIES.*

State environmental externality requirements have become important because they are being adopted as an integral part of state IRP requirements applied to electric utilities. Accordingly, this section of the paper summarizes IRP requirements for electric utilities so that the context for recent state environmental externality developments will be clear.

Many states, following a movement that started on the East and West coasts, are requiring that electric utilities prepare and implement "Integrated Resource Plans."

a. Integrated Resource Plans are an expansion, refinement, and formalization of a planning process long followed by electric utilities.

The primary purpose of the planning process is to bring estimated demand for electricity and estimated supplies into balance. Electric utilities have long had the responsibility for developing and implementing plans to achieve this purpose, but requirements for IRPs have added new dimensions.

IRP requirements differ from state to state. The more comprehensive requirements call upon utilities to:

1) Consider ways to reduce energy demand (through conservation[5] and load management[6] activities) as well as ways to increase electric supply (generation, transmission and distribution) when planning to achieve the desired balance.

2) Use the same or similar economic criteria when evaluating both supply-side and demand-side alternatives.

3) Select the measure(s)—whether supply-side, demand-side, or both—that results in *least cost*[7] to *customers.*[8]

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5 The term "conservation" has come to include a wide variety of actions that have the effect of reducing the amount of energy (Kwh) used. Conservation measures often result in more efficient use of energy, such as improved lighting. Thus the term "conservation" includes actions that result in reduced fuel use and reduced or avoided environmental impact, whether through more efficient use of energy or through avoiding energy use.

6 The objective of "load management," in the case of electric utilities, is to reduce peak demand (Kw) or shift peak demand to off-peak periods. Reducing peak demand reduces the need to build new generating capacity or to buy power from other electric generators.

7 At an earlier stage of development, *Integrated Resource Plans* were referred to as *least-cost*, or, in some cases, *best-cost* plans. The term *best cost* apparently is intended to avoid the connotation that reliability of service

4) Use competitive bidding. That is, the utility should specify the amount of capacity to be avoided or added, specify criteria for selection among bids or proposals, and open bidding to all reasonable contenders. In most cases, the utility itself can participate in the bidding.[9]

5) Most importantly, for purposes of this paper, take *environmental externalities* into account when calculating costs and benefits of the alternative approaches for bringing demand and supply into balance. (Illustrations will be provided in Section 3, below.)

In addition, it should be noted that a growing number of state utility commissions are:

- Establishing IRP requirements—which differ from those applied to electric utilities—for local gas distributing companies (LDCs);[10] and

- Seeking joint demand-side programs from gas and electric utilities serving the same areas.

b. Evolving state IRP requirements are having important effects.

Evolving IRP requirements are having important effects. For example, they are:

1) Forcing utilities to look at the economics of demand-side vs. supply-side measures. This has led to the realization that some demand-side measures are indeed cheaper for customers in the long run than increasing supply.

2) Creating markets for products and services that are focused on energy efficiency and conservation (e.g., more efficient lighting, motors, building materials). IRP requirements, along with mandated efficiency standards, are stimulating the development of new energy-efficient technologies and products.

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or other objectives would be sacrificed in order to achieve *least* cost.

8 Identifying the customers to be considered in this evaluation is a complex issue; e.g., should it be each customer, all current customers, all current and future customers, or all of society. The answer to this question determines the extent to which some classes or generations of customers will be called upon to pay for benefits enjoyed by others (i.e., cross-subsidies).

9 When competitive bidding is required, the utility may be allowed to retain the right to make the selection from among the alternatives, but may be permitted to recover costs (i.e., through rates charged customers) only up to those provided for in the "lowest" qualified bid.

10 See brief summary of growth in state utility commission requirements for IRPs for gas utilities in section 7e.

3) Reducing the rate of growth in demand for electricity which, in turn, is reducing the rate of growth in demand for energy, including natural gas, that is used to generate electricity.[11] Slowing the rate of growth in electricity demand (particularly peak demand) reduces the need for new generating capacity, much of which could be gas-fired.

4) Making states and the policies and philosophies of state officials—particularly utility commissions—much more important in addressing complex energy and environmental policy issues.

5) Increasing the likelihood that energy and environmental policies and requirements will differ from state to state. The cost of complying with the requirements will have to be reflected in rates paid by electric customers. State-to-state differences in electric rates can affect the ability of states to attract and retain business enterprises.

6) Establishing specific and deliberate timetables for the submission of IRPs by utilities in the state, which has the practical effect of giving those who wish to intervene and participate in the review more time to prepare;

7) Increasing the level of detailed PUC involvement in utilities' planning and decisions and moving closer to a situation where IRPs are *approved* by the state commissions. To the extent that this occurs, utilities will have some additional assurance that their actions to implement the plan will not later be found "imprudent."

8) Reflecting increased interest by PUCs in "decoupling" utilities' earnings from sales. Some commissions have sought to make actions to improve energy efficiency, promote conservation, and reduce peak demand at least as profitable as actions to increase sales.

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11 Electric utilities are a major market for energy, consuming in 1991 37.2% of all the energy BTUs consumed in the U.S. and providing 92.3% of the electricity sold in the U.S. The other 7.7% was provided by non-utility generators (NUGs), i.e., industrial and commercial cogenerators, small power producers and independent power producers. (Source of data: U.S. Energy Information Administration, *Monthly Energy Review*, March 1992; Edison Electric Institute, *1990 Capacity and Generation of Non-Utility Sources of Energy*, December 1991.)

3. STATES REQUIRING CONSIDERATION OF ENVIRONMENTAL EXTERNALITIES HAVE TAKEN A VARIETY OF APPROACHES.

Now that the context for state environmental externality requirements has been covered, this paper will shift to a more detailed look at the approaches being taken by various states and will illustrate *how* some states require that externalities be "taken into account." The next section of the paper (Section 4) will identify a long list of complex issues raised by state environmental externality requirements. Before turning to those issues, this section will give the reader some basic information on the approaches that various states have taken when prescribing the way that environmental externalities are to be taken into account. This section will also illustrate the impact that certain state requirements could have on utilities' choices.

According to a National Coal Council report[12] submitted to the Secretary of Energy in May 1992, 32 states had adopted requirements and/or approved electric utility proposals that involve consideration of "environmental externalities" when the utilities make resource decisions (i.e., attempt to bring demand and supply into balance). Another five states have such requirements under consideration. A map prepared by the Council and showing various states requirements is attached to this paper. Some states may have established or changed their requirements since the Council completed its survey.

The way externalities are to be taken into account varies widely from state to state. In theory, the objective in each state is to find a way to *internalize* environmental externalities; i.e., to *require that utilities take into consideration in their planning and decision processes the costs to society of environmental degradation that are not currently reflected in the price paid for electricity.*[13]

The illustration below should help make clear that the environmental externality requirements that have been issued or are being considered by some states can have a significant impact.

Three different approaches to the incorporation of environmental externalities are reflected in the requirements that have been adopted by one or more states thus far, with the first being the most specific:

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12 National Coal Council, *Special Report on Externalities*, May 21, 1992.

13 In some states, externalities are to be taken into account during planning, in others when evaluating bids received for supply and/or demand side measures, and in others when *decisions* are made.

a. *Monetization* Approaches.

This approach involves assignment of dollar amounts to specific emissions and discharges which affect, or may affect, the environment.

A specific example may help. (The numbers used in this example are merely for illustration. They are not intended to represent actual costs or any state's externality values.)

1) Start by assuming that the costs of producing electricity from:

   - A coal-fired generating plant meeting new source performance standards was $.045 per Kwh; and
   - A gas-fired combined cycle generating unit was $.040 per Kwh.

2) Also assume that the costs of a "conservation" measure (let's say a subsidy to help pay for the costs of installing more energy-efficient lighting or motors) was $.05 per Kwh of electricity *not* used.

3) Next, assume also that the calculated *externality* value of the emissions (CO_2, SO_2, NO_x, etc.) from:
   - The coal-fired unit was $.03 per Kwh
   - The gas-fired unit was $.015 per Kwh

4) There would be no externality value associated with the Kwh that is *not* used because of the conservation measure, since there are no emissions.

5) The total "costs" per Kwh can now be compared as follows:

Alternative:	Coal unit	Gas unit	Conservation
• Internalized cost (capital, O&M, etc):	$.045	$.040	$.05
• Externality value	.030	.015	.00
• Total societal cost	.075	.055	.05

6) In this example:
   - The conservation measure results in the lowest total cost to society ($.05 per Kwh),
   - The gas-fired unit ($.055 per Kwh) the next lowest, and

- The coal-fired unit ($.075 per Kwh) the highest.

In the above example, the conservation alternative would be selected even though a gas-fired unit was the lowest in cost *before* externality values are added. If an externality value had *not* been assigned, the gas-fired unit would be selected as the lowest cost alternative.

Massachusetts environmental externality regulations[14] identify eight air emissions and assign the dollar values per ton of *emission* shown in the table below. (The origin of these numbers is not important at this point. The numbers and their derivation are controversial. The issue of externality values will be discussed later.)

- Carbon Dioxide (CO_2) - $24
- Nitrogen Oxides (NO_x) - $7200
- Volatile Organic Compounds (VOCs)[15]- $5900
- Methane (CH_4) - $240
- Sulfur Dioxide (SO_2) - $1700
- Particulates (TSP) - $4400
- Carbon Monoxide (CO) - $960
- Nitrous oxides (N_2O) - $4400

Under the Massachusetts monetization approach, quantities of each of these emissions would be identified for each alternative way of increasing supply or reducing demand for electricity. The quantities and the per ton values would then be used to calculate an *environmental externality* value per kilowatt hour of electricity.

As in the example above, the environmental externality value would then be added to the estimate of the cost per Kwh that have already been internalized; e.g., the estimated cost of producing a kilowatt hour of electricity from a particular type of coal-fired powerplant. The estimates of *internalized* costs wold include all those normally taken into account; i.e., costs of capital, fuel, operations, maintenance, and administration.

The Massachusetts regulations contemplate that the sum of the *internalized* cost per Kwh and the *externality* value per Kwh would be used in a utility's planning, bidding and decision processes.

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14 Commonwealth of Massachusetts, Department of Public Utilities, DPU 91-131, November 10, 1992, p. 91. Values are in 1992 dollars.

15 Also referred to as "reactive organic gases" or ROGs.

b. Less "Precise" Adder and Discount Approaches.

Another approach to the establishment of externality values adopted by some states is the assignment of arbitrary or judgmental percentages or cents per kilowatt hour. The most common approach in this category involves some specified "adder" for some or all supply-side measures (e.g. for all fossil fuels). Alternatively, a discount might be applied for conservation measures. (In some cases, renewables or nuclear also receive a discount.)

In Wisconsin, for example, a 1990 order established a 15% non-combustion credit available to conservation, hydro and nuclear. Iowa regulations require adding 10% to avoided capacity costs to account for externalities.[16] New Jersey, in a 1991 order, established a $.02 per Kwh externality adjustment factor for conservation.

Using the example from section 3.a. on page 12, above, the calculation in New Jersey would work as follows:

Alternative:	Coal unit	Gas unit	Conservation
• Internalized cost (capital, O&M, etc):	$.045	$.040	$.05
• Externality value	.000	.000	-.02
• Total societal cost	.045	.040	.03

In this case, conservation would be the choice, even though gas was lowest in cost before the externality adjustment is added.

Other states using similar approaches include Montana which permits conservation measures up to 115% of avoided capacity costs and Colorado which adopted a scoring system that assigns points on the basis of fuel source. Some states have considered ranking systems.

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16 As used here, *avoided capacity costs* refers to the *internalized* cost per kilowatt hour that the utility would incur in providing the next increment of generating capacity.

c. Qualitative Approaches.

A third, more qualitative approach to environmental externalities is followed by some other states (e.g., Idaho, Texas). Some states may require that environmental impact be taken into account in resource planning but do not assign specific amounts or percentages. Instead of assigning a value to externalities, they may provide an incentive, such as a higher rate of return, for utilities that emphasize conservation or other measures having less adverse environmental effects.

The above descriptions are merely examples of the existing approaches. Most states that have adopted specific monetary values or less precise adders and discounts allow utilities to propose alternatives. Further, some states allow more than one approach and still others have requirements under development or further review in anticipation of changing their approach.

d. Effect of environmental externality "adders" on electric bills.

It is important to recognize that the prescribed *externality adders* are "shadow" prices. That is, they are not actually paid by the utility. However, taking these externality values into account may result in higher electric bills for customers than would occur if externalities were not taken into account. A simplified example, using the numbers from the illustration on pages 11 and 12, may help make this point. (The numbers relate only to a choice among three alternatives, not a utility's total costs or customers' total bills.)

	Internalized Cost	Externality Adder	Total (Col.	Cost to be recovered in customers' bills*		
Alternative	Per Kwh**	Per Kwh	2+3)	Coal-fired Unit	Gas-fired Unit	Conservation Subsidy
Coal-fired unit	$.045	$.030	$.075	$.045		
Gas-fired unit	$.040	$.015	$.055		$.040	
Conservation	$.050	$.000	$.050			$.050

* Only the internalized cost shows up in customers' bills.

** Capital, operations, maintenance, fuel, administrative. For simplicity, assume these are the net costs, after adjustments for transmission & distribution losses, etc.

If the utility were required to make its choice on the basis of the total of the internalized cost and the externality adder, the conservation subsidy alternative would be selected ($.050 per kwh). The entire cost ($.050) is internalized cost and would be reflected in customers' electric bills.

If the coal-fired unit was selected, the internalized cost of $.045 would be reflected in customers' bills (not the $.030 externality adder).

If the gas-fired unit were selected, the internalized cost of $.040 would be reflected in customers' bills (not the $.015 externality adder).

It is important to recognize that taking environmental externality values into account in decisions tends, over time, to result in the selection of the alternatives with higher internalized costs, thus raising the costs per kilowatt hour of electricity that must be recovered from customers.

4. ATTEMPTS TO TAKE ENVIRONMENTAL EXTERNALITIES INTO ACCOUNT HAVE REVEALED COMPLEX UNDERLYING ISSUES.

Thus far, this paper has not provided a clear identification or definition of an *environmental externality* or shown *how* one should be measured or valued. That task has been deferred in order to make clear first the potential significance of the state requirements.

In fact, there is considerable disagreement as to the proper scope of efforts to take environmental externalities into account, and how they should be defined, measured and valued. States that have adopted requirements have reached different conclusions. None of the requirements has proven fully acceptable to all involved.

As illustrated in Section 3, above, state requirements can have a significant effect on choices made by electric utilities, on costs that will be incurred and eventually paid by electric customers, on choices of fuel for generating facilities and, presumably, on the amount of additional environmental protection that will be achieved as a result of the efforts. Inadequate data and uncertainties plague the state environmental-externality decision-makers.

There will be winners and losers as a result of the decisions made by regulators and utilities, so the debates and proceedings are important.

In addition, economists will be quick to point out that, if regulators end up setting environmental externality values that are too high or too low, they may increase—not reduce—total costs to society. Incorrect values may also cause resources to be spent on efforts that do not return significant benefits for the costs that are incurred.

This section of the paper describes fourteen of the complex and controversial issues that are raised in one way or another by attempts to require that environmental externalities be taken into account. These issues are being addressed in ongoing debates and proceedings.

a. Should environmental externality values be based on *damage* to the environment or on the *cost of controlling* activities leading to the undesirable effects?

Once a state commission decides to require that environmental externalities are to be taken into account in utility decisions, it must then decide:

- How broadly to define the environmental effects that it wishes to address. This issue will be discussed paragraph b, below.

- Whether it wishes to assign specific values, such as those described under "Monetization" Approaches in Section 3.a., or the less precise adder and discount approaches described in Section 3.b. or the even more subjective approaches such as described in Section 3.c.

- If a state commission decides to assign *values*, it faces the difficult task of coming up with those values or requiring that the regulated utilities come up with the values and then reach a judgment as to whether the proposed values are acceptable.

This first issue focuses on the matter of setting values. As indicated earlier, the purpose in prescribing values or "adders" to represent environmental externalities is to make it possible to take them into account in a planning or decision process, preferably in a way that will be clear to all involved.

Two schools of thought, with substantially different approaches, have dominated recent debates and proceedings on the matter of setting externality values.

1) Focus on damages.

The approach that seems to be favored by most economists is to focus on environmental *damages* that are caused by an electric utility's activities (principally the generation of electricity). The approach is commonly called the *Damage Function Approach* (DFA). Some label it *direct cost* or *direct assessment and valuation.*

The Pace University study published in 1990 focuses on damages.[17] The electric generation fuel cycle externality analyses being sponsored by the U.S. Department of Energy (DOE) and the Commission of the European Community (EC) described in Section 6, below, also follow the DFA approach. Researchers at Resources for the Future (of Washington, DC), who are key participants—along with the Oak Ridge National Laboratory—in the DOE-EC studies are leading proponents of the damage approach to the setting of externality values.[18]

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17 Pace University Center for Environmental Legal Studies, Ottinger, Richard L., et al., *Environmental Costs of Electricity*, prepared for the New York State Energy and Development Authority and U.S. Department of Energy, 1990, Oceana Publications, Inc., 767 pages.

18 See, for example, Burtraw, Dallas and Alan J. Krupnick, "The Social Costs of Electricity: How Much of the Camel to Let into the Tent," Discussion Paper QE92-15, Resources for the Future, 1992; and Freeman, A. Myrick, Dallas Burtraw, Winston Harrington and Alan J. Krupnick, "Accounting for Environmental Costs in Electric Utility Resource Supply Planning," Discussion Paper QE92-14, Resources for the Future, 1992.

An important problem with DFA is the difficulty involved in setting values. Setting *accurate* values for damages requires several steps. Specifically, to set values on the basis of damages, one must identify:

- First, the emissions and discharges that come from a particular facility or activity, such as a power plant that generates electricity;
- Second, the *pathways* from the source(s) to the *receptor* (i.e., that which is affected);
- Third, the *impact* of the emission or discharge on the *receptor;*[19]
- Fourth, the effects or *damage* associated with the *impact;* and
- Fifth, the *value* of that damage (e.g., the cost, including marginal cost, of bearing the damage or correcting it).
- Finally, the portion of the damage value that can appropriately be classified an externality, since some portion of the damage value may already be internalized.[20]

The primary sources of information on potential damages is the extensive but far from complete scientific literature on environmental, health, safety and economic effects of emissions and various other substances. Hundreds of millions of dollars have been spent on this scientific research, particularly during the past 30 years, to provide the basis for various health and environment regulatory standards (e.g., primary ambient air quality standards under the Clean Air Act) and proposed legislation.

The largest shares of funds for scientific research to identify effects on human health and the environment have come from the Public Health Service, National Institutes of Health, the Environmental Protection Agency, and Department of Energy (and its predecessor agencies). Additional research has been conducted or sponsored by other Federal agencies, state governments, private foundations, and private industrial organizations and associations in connection with substances of most immediate concern to them.

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19 To complicate the task, it may also be necessary to identify other sources of the same emission or discharge that may have an impact on the receptor, and other, different emissions or discharges that may have a similar or compounding impact on the receptor.

20 Environmental *damage* is not necessarily the same as an environmental *externality* because some of the social cost related to the damage may already be internalized in the price of the product or service involved; e.g., in the form of costs associated with reducing emissions under a system that permits "bubbling" or emissions trading, or in the form of costs associated with a tax (e.g., as in CFCs).

In many cases, there is little or no scientific information to define environmental damages or market information to determine willingness to pay to avoid environmental damages. Other, less rigorous, ways of establishing damage values and proxies for market that have been advanced by some who favor the damage approach include:

- Using scientific data to assess the *relative potency* of various emissions;
- "Polling" of experts to collect their opinions as to the value of a resource, the costs, or the value of damages; and
- "Contingent valuation," which involves asking people—not necessarily experts—their opinion as to the value of an environmental resource (e.g., "What is a clear view of the Grand Canyon worth to you?" or "What is the value of the resource damaged by the Exxon Valdez oil spill?"). Contingent valuation has been used by some courts in environmental damage cases.

2) Focus on the *cost of control* or *abatement*.

Others involved in ongoing debates and proceedings concerning state requirements argue that it is too difficult to set accurate values based on direct costing of damages. They propose, instead, that environmental externality values be based on *the cost of controlling or abating emissions or discharges*. The logic for the approach is that the cost of complying with "...the required control measure serves as an estimate of the price society is willing to pay to reduce the pollutant."[21]

Staff of the Tellus Institute of Boston are leading proponents of the cost of control approach.[22] This approach has been used in values established in regulations issued by the California, Massachusetts, New York and Nevada commissions.

The method used by some "cost of control" advocates is to find the **highest** cost involved in meeting a requirement for reducing the emission in an existing or expected statute or regulation. Proponents of this approach have recommended using the highest cost of control that they identify, even if the requirement is applicable in a state other than the one establishing the environmental externality requirement.[23]

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21 Chernick, Paul and Emily Caverhill, "Methods of Valuing Environmental Externalities," *The Electricity Journal*, March 1991, p. 50.

22 Bernow, Stephen S. and Donald B. Marron, *Valuation of Environmental Externalities for Energy Planning and Operations*, The Tellus Institute, May 18, 1990.

In the case of emissions for which control or abatement requirements have not been established, proponents of this approach often rely on *experts'* estimates of the cost of reducing or avoiding a like amount of the emission in question (e.g., tree planting to sequester carbon; substituting hydro power for fossil energy; or substituting conservation to reduce the need for electricity).

b. Which emissions, discharges or potential environmental impacts should be considered when seeking to internalize environmental externalities?

The environmental externalities being addressed vary from state to state. As indicated earlier (Section 3.a, on page 13), Massachusetts seeks to assign values for eight air emissions. Nevada, which also used the Tellus Institute approach, also assigns values for eight air emissions. California has assigned values for five of these eight air emissions (SO_2, NO_x, VOCs, particulates, and CO_2, while omitting carbon monoxide, methane and nitrous oxides). New York also omits VOCs.

New York, however, also requires that impacts on water use and land use be considered by electric utilities when valuing externalities.[24] Land use values being considered by one or more states include landfill and hazardous waste disposal and facility locations.[25] Effects on water include surface and ground water contamination and thermal effects.

Nuclear related externalities under discussion include accidents, water disposal and plant decommissioning.

The potential list of externalities is long if limited to *environmental* externalities and even longer if extended to other externalities.

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23 Among those favoring the cost-of-control approach, opinion seems to be divided as to whether the *highest* cost of control that must be incurred some place in the U.S. to meet requirements applicable to an emission or for discharge is the proper value for all emissions or discharges of that pollutant. The logic for using the *highest* cost of control that can be identified apparently is that this is truly the *marginal* cost that will have to be incurred to eliminate that last increment of pollution needed to meet a prescribed environmental requirement.

24 Wiel, Stephen, "The New Environmental Accounting: A Status Report," *The Electricity Journal*, November 1991, p. 50.

25 Thus far, none of the states has added a specific value for use of "disruption" of land. However, it is quite conceivable that such values will be added at some point. Considerable opposition has developed, for example, to the disruption of land and the environment in Quebec as large hydropower projects are developed. Quebec intends to export much of this electricity to the U.S.

c. What are the appropriate targets for attempts to take environmental externalities into account: emissions or discharges greater than zero or only those above a specified level (such as the applicable environmental standard)?

This question is, in effect, already answered if values are based on *damages*. However, it must be addressed if values are based on *cost of control or abatement*. Some state regulations (e.g., those using the *cost of control* approach—Massachusetts, Nevada, New York and California) apparently intend the assigned values to apply to all emissions (i.e., anything above zero). Those favoring the *damage* approach point out that:

- Health or environmental damages have been identified only at or above certain levels of concentration. (In fact, primary air quality standards set by EPA must, under the Clean Air Act, be set to protect human health, "with a reasonable margin of safety.")

- When regulations are already in effect, the costs of complying are internalized so there is no basis for assigning externality values to emissions that are within statutory and regulatory limits.

- Absent evidence of adverse health or environmental effects, there is no basis for attributing an externality value.

d. Should only "direct" or "primary" effects be considered?

Thus far, most attention in state requirements affecting electric utilities has been confined to "direct" or "primary" sources of emissions, discharges or environmental effects, such as those effects identified in b., above, that are directly attributable to an electric utility's activities.

However, studies underway under the sponsorship of the U.S. Department of Energy and the European Community (described in Section 6, below) focus on the entire electric generation fuel cycles. That is, in the case of a fossil fuel, the focus is on all effects from the development and extraction of the resource (e.g., mining of coal or producing gas) through the use of that resource in a power plant and the disposition of the waste.

Arguments can be made that "indirect" or "secondary" sources should also be considered. For example, it is conceivable that one should count air emissions from a steel mill that produced the steel used in mining equipment, rails and rail cars used to produce and transport coal used by an electric utility, or the steel used for drilling equipment and

pipeline used in gas exploration, production and transportation.

e. Should the same emissions or discharges have different values in different states or regions?

Four states that have issued regulations based on cost of control and monetization of externality values have set different values for the same emissions. California assigns different values for the same emission in different locations. The table below illustrates the differing values for four air emissions:

Monetized Externality Values ($/ton, 1991 dollars)[26]

Jurisdiction	CO_2	NO_x	SO_2	CH_4
California PUC				
Pacific Gas & Electric	$30.42	$8,313	4,750	
Southern California Edison	$30.42	$28,665	$21,411	
Massachusetts DPU[27]	$24.00	$7,200	$1,700	$240
Nevada PSC	$22.80	$7,054	$1,618	$228
New York				
Energy Planning Office	$5.00	4,000	$850	
Public Service Commission	$1.10	$1,832	$832	

There is a variety of reasons that may justify setting different values in different areas, including:

- Differing concentration of the emission in certain areas and thus potentially greater damage;
- Differing costs of control (e.g., the *cost of buying* an SO_2 allowance in California's South Coast Air Quality Management District, where stringent SO_2 reduction requirements have been in place for a long time, apparently is something in excess of $20,000 per ton);

26 National Coal Council, *Special Report on Externalities*, May 21, 1992, Arlington, Va., p. 12.

27 Massachusetts values are in 1992 dollars. Commonwealth of Massachusetts, *op cit.*, p. 91. Values are based on "The Tellus Report," S.S. Bernaw and D.B. Marron, *Valuation of Environmental Externalities for Energy Planning and Operations*, Tellus Institute, Boston, Mass., May 1990.

- Differing concentration of "receptors" (e.g., people) potentially affected by the emission, and thus higher or lower damages (e.g., mortality, morbidity); and

- Differing local values.

Chances are high that values will differ among state requirements because of factors such as these.

f. How should a state treat environmental externalities when impacts occur beyond state borders (i.e., other states or nations)?

Many of the environmental issues being considered in state environmental externality requirements involve impacts that occur beyond the boundaries of the state where emissions occur. (For example, sulfur dioxide emissions from sources in one state may contribute to acid precipitation well beyond the state's boundaries. Carbon dioxide emissions are related to concerns about *global* climate change.)

Therefore, state utility commissions must consider the extent to which they wish to impose requirements and costs of emission reduction on electric utilities and electric customers within *their* jurisdiction when the environmental benefits of the reduced emissions accrue outside their jurisdiction.

g. If environmental externalities are to be taken into account, how should potential but unproven environmental effects be treated?

Uncertainties about health and environmental effects and cause and effect relationships present serious problems. There is somewhat greater comfort in attempting to establish values for externalities when substantial research, such as that conducted over the past 30 years, links particular emissions or discharges to specific effects (e.g., mortality or morbidity in the case of human health), and the findings are generally accepted among experts.

Quite a different situation exists in the case of such effects as global warming (or cooling) and, for example, the role of carbon dioxide or methane in the process. Considerable disagreement remains among experts as to the nature and extent of global climate change and the role of particular substances in the process. Global climate change[28] clearly represents a concern, but many remain unwilling to agree that it is a demonstrated threat or

28 Other far-reaching concerns have emerged in recent years. One is "biodiversity," which reflects concern about the extinction of species.

that enough is known about causes and cause-effect relationships to justify assigning "externality" values to carbon dioxide emissions or methane.

As shown in the table in paragraph e, above, four states that have *monetized* some externality values for electric utilities have set values for CO_2 emissions. Massachusetts and Nevada have also set values for methane (CH_4). Those values are 10 times the value set for CO_2, apparently based on the view that methane is a more potent *greenhouse gas* than CO_2, even if it is shorter lived when released to the atmosphere.

Other serious studies appear to conclude that concerns about global warming are still too speculative to warrant assignment of damage values for carbon dioxide and methane emissions.

h. Should externality *benefits* as well as *costs* be taken into account?

Thus far, state utility commission interest in environmental externalities has focused primarily on *adverse* environmental impact or costs. However, the underlying concept of externalities, as conceived by economists, includes external *benefits* (positive externalities) as well as *costs* (negative externalities).

An organization producing a product or service may provide benefits to society that are not reflected in the price for that product or service. Among benefits often cited are employment, national security, economic growth, and improved productivity and competitiveness. Some argue, for example, that economic activity that involves creation of a job gives someone an opportunity to be self-supporting who, without the job, would be a ward of society. Also, in the case of a hydroelectric project, recreation benefits may result that were not previously available (e.g., boating or fishing).

Economic activity associated with the production and delivery of goods and services can provide other benefits. Research and technology development are often cited as other examples of activity that can produce benefits for society for which the organization supporting the research is never fully compensated in the price charged for the product or service resulting from the research.

i. Should environmental externality requirements be applied only to new resource decisions or also to existing facilities?

Thus far, state environmental externality requirements have been applied only to *new resource* decisions; i.e., adding new generating capacity or undertaking demand-side activities. In some proceedings,[29] however, the question has been raised as to whether such requirements should also be extended to existing facilities. The implications are potentially very important to the electric generation industry, fuel suppliers and electric customers.

When applied only to new resource decisions (supply-side or demand-side), the alternatives considered are only future actions to bring estimated supply and demand into balance. Thus, a new coal, gas, or renewable energy-fueled facility would be evaluated alongside various conservation and load management alternatives. Emissions, discharges and other environmental impacts resulting from existing facilities would not be considered.

The distinction is quite important because existing facilities often have much higher emissions than new facilities which must meet more exacting new source performance standards. Thus, instead of the $.03 cent per Kwh monetized value added for a new coal-fired generating unit in the example in paragraph 3.a. on pages 11 and 12, the value to be added might be twice that. This might mean that a lot more conservation or a new combined-cycle gas unit could be justified. Such a result would then leave the electric utility, its customers and regulators with two key questions:

- What should be done with the existing generating unit and who pays for the investment in it? Should the unit be shut down and the unamortized value be recovered from customers—along with the costs of the new generating unit, or should some attempt be made to require that the unamortized value be written off at the expense of shareholders?

- What is the impact of a shut-down decision on customer rates? Apart from externality values, the new unit (or the new demand-side measures justified in this way) is almost certainly to have higher *internalized* costs per Kwh of electricity than the old unit. Those higher costs would now have to be recovered in customer rates.

Because of considerations such as the above, state commissions have been reluctant to propose extending requirements to existing facilities.

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29 Commonwealth of Massachusetts, Department of Public Utilities, Investigation into Environmental Externalities, DPU Docket No. 91-131 and previous Docket 89-239.

j. Are there more efficient ways of internalizing externalities; e.g., emission caps and tradeable allowances? Taxes on emissions? Environmental dispatch of generating units? Changing rate designs to make peak users pay more?

Some who have considered environmental externality issues (electric utility officials and others) have taken the position that state efforts to apply such requirements are far too complex and too likely to introduce unintended distortions in decision processes.

Two approaches advanced by one or more electric utilities —but opposed by others—are:

- Establishing caps on emissions and providing for tradeable allowances (as has been done for SO_2 emissions in the 1990 Clean Air Act Amendments), and

- Putting a tax on emissions (e.g., carbon).

Such approaches have the virtue of allowing the industry being regulated to find the most cost-effective alternatives for achieving reductions—thus keeping costs to society lowest, and reducing the likelihood of unintended distortions that would result from assigning the wrong values to the environmental externalities.

Others, usually from outside the electric utility industry, have advanced the concept of *environmental dispatch* of electric generating units. Under procedures now followed by power pools and large generating systems, the generating unit with the lowest incremental cost is run first. This is referred to as *economic dispatch.* The concept in *environment dispatch* contemplates that environmental impacts would also be taken into account in determining which units are dispatched.

Still others have suggested that one of the underlying objectives of state environmental externality requirements—reducing adverse impact from the generation, transmission and distribution of electricity—could be achieved most efficiently by increasing the rates charged for electricity—particularly during periods of high demand. This, it is argued, would cause users to decrease their use of electricity and, accordingly, reduce the need for new generating capacity.

k. How are state-established environmental externality requirements to be coordinated with Federal and state environmental requirements and state utility commission responsibilities with respect to the reliability and cost of electricity?

1) Other environmental requirements. As indicated earlier, state environmental externality requirements are but ways that governments seek to force internalization of environmental externalities. A considerable body of statutes and regulations is already in place that has the same or similar objectives—at least for those emissions and discharges that are now regulated (e.g., SO_2, NO_x, VOCs, particulates). In some cases, the environmental externality requirements would be duplicative and, perhaps, even contradictory.

   For example, the 1990 Clean Air Act Amendments set up a system for reducing SO_2 emissions that is based on a nationwide cap on SO_2 emissions, the allocation of *allowances* to each electric utility, and the right to trade allowances. Under this approach, emissions from some plants would not have to be reduced—as long as reductions are achieved elsewhere. States requiring monetized adders would appear to ignore the new Federal requirements and apply a "penalty" to all SO_2 emissions.

2) Reliability and cost of electricity. Historically, public utility commissions have focused primarily on matters relating to the reliability and cost (rates charged to users) of electric service. Imposition of environmental externality requirements are quite likely to have the effect of increasing the cost of electricity that shows up in customers' electric bills. PUCs adopting externality requirements will have to satisfy themselves that higher electric bills resulting from environmental externality requirements are justified. Clearly, externality requirements make the task of utility commissions more complex.

l. Why should electric utilities be required to incorporate environmental externalities, probably raising electricity prices, when other energy producers and other emitters of the same pollutants are not required to do so?

Thus far, state environmental externality requirements have been applied only to regulated electric utilities, though it is conceivable that such requirements will be extended to gas local distributing companies (LDCs) as states continue expanding IRP requirements to cover LDCs. The principal reasons for the focus on regulated electric utilities are, first, that they are already subject to the regulatory jurisdiction of utility commissions and, secondly,

that they are major users of energy[30] and major sources of environmental impact.

Applying environmental externality requirements only to electric utilities, however, raises several competitive, equity and efficiency questions. For example:

1) Applying such requirements is likely to increase the economic cost of electricity and thus customer rates and bills. No similar requirements are being imposed on alternatives to electricity; i.e., direct use of gas, oil, or coal.

2) Emissions and discharges of the type that are the focus of environmental externality requirements come from various sources—not just electric generation. For example, vehicles are major sources of (NO_x), refineries a major source of SO_2 and coal mines a major source of methane. From a *lowest cost to society* point of view, all sources should be considered and the most cost-effective reductions pursued first—which may or may not be the emissions from electric generating units.

m. Will application of environmental externalities result in higher electricity prices, giving the area affected a competitive disadvantage?

As indicated in Section 3 (on page 14), environmental externality requirements may result in higher costs and higher electric rates because electric utilities may select alternatives that have higher *internalized* costs (the costs that show up in rates and electric bills), but which have lower *total social* costs, *after taking externalities into account.*

Requirements are now being considered on a state-by-state basis with widely different conclusions as to whether and how to apply the requirements. States imposing requirements may be making the cost of electricity that shows up in electric bills higher for individuals and business. Higher electric rates may make the state less competitive than others.

In addition, the possibility of higher electric bills has raised the possibility of "by-pass" actions by large electricity users; i.e., customers using large amounts of electricity may decide to build their own generating facilities to avoid paying higher rates to the electric utility. This would have two potential impacts:

- The facility would not be subject to externality requirements; and
- The fixed costs of the electric utility would, thereafter, be spread to remaining electric customers, increasing their rates.

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30 See footnote 11.

Concerns such as these often lead to proposals that requirements be established on a national basis—with the expectation that the economic disadvantage to individual states is reduced.

Large users of electricity have already begun raising questions about and, in some cases, opposing the adoption of environmental externality requirements.

n. Do state regulatory commissions have the authority and the expertise to develop and administer environmental externalities?

When state commissions began developing environmental externality requirements, questions were raised as to whether they had the legal authority to do so. As indicated earlier, 32 states have proceeded with some kind of environmental externality requirements, apparently concluding that existing authority is adequate. The utility commission in at least one state (Virginia) concluded that it did not have statutory authority to require consideration of environmental externalities. Legislation to provide authority to deal with externalities is pending before legislatures in other states.[31]

The matter of expertise to develop and administer environmental externality requirements remains an important issue. The questions about environmental externalities described above should make clear that the expertise needed will be a considerable burden for the members and staffs of state commissions.

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31 National Coal Council, *Special Report on Externalities*, May 21, 1992, pp. 10 and 15.

5. WHETHER NATURAL GAS "WINS" OR "LOSES" AS A RESULT OF STATE ENVIRONMENTAL EXTERNALITY INITIATIVES IS NOT YET CLEAR.

The fact that some states adopted externality values that were much higher for coal-fired generating units than for gas-fired units may have led some in the gas industry to conclude that commission actions requiring consideration of environmental externalities should be encouraged. However, as suggested by the complex issues listed and described in Section 4, above, it is too early to tell with certainty the outcome of state efforts or how they will affect market share of the competing energy sources.

The monetized values initially adopted by PUCs in California, Massachusetts, New York and Nevada would result in higher externality values for coal-fired generating facilities than for gas-fired facilities. However, those states' action should not be regarded as the likely conclusion of all states that adopt externality requirements. First, strong opposition to the "cost of control" values has developed and both the approach and the values are being reconsidered. Secondly, it is quite unlikely that coal-producing states will prescribe as high externality values for coal emissions as non-coal producing states. Thirdly, coal-producing states may assign externality values to factors other than emissions, such as creation or preservation of jobs and economic activity. Neither is it certain that the Federal government would come to the same conclusions if statutes or regulations are adopted that explicitly address externality values. Further, much less attention has been given thus far in state requirements to non-fossil fuel cycles or, for that matter, to the full fuel cycle of fossil fuels—from resource exploration, development and extraction through waste disposal. The DOE-EC-sponsored studies described in Section 6.c., below, are likely to be important.

Three examples should help illustrate that externalities will not necessarily favor gas:

a. Alternative views on coal-related externality values.

The monetized values initially adopted by Massachusetts, California and Nevada focus on air emissions and set high values on coal-related emissions: CO_2, NO_x, SO_2 and particulates (TSP). Gas has advantages with respect to all four emissions.

However, the advantages for gas vs. coal would be substantially reduced if different conclusions are reached on some of the issues identified in Section 4, above. For example:

- Authorities could decide to assign no negative externality value for SO_2, NO_x, or particulates since all are regulated under the Clean Air Act and related state requirements. They might conclude that emissions at levels below those set in

regulations would not be penalized because no environmental damage has been demonstrated (and, if it were, it could be handled under Clean Air Act requirements). Costs for abating emissions above the standard have been or will already be internalized because measures have been or will be taken to meet prescribed standards.

- Authorities may also decide that no negative externality value should be set for CO_2 because the concerns about global warming remain speculative and the role of CO_2 in global warming is subject to disagreement among competent scientific experts.

Adoption of these two principles would virtually eliminate most of the externality values initially proposed by the PUCs listed above.

b. Renewables.

The relative position of renewables compared to natural gas in electric generation is not yet clear. Hydroelectric power involves few, if any, emissions but could be assigned large values if land-use considerations are taken into account.

A photovoltaic fuel cycle would appear to involve virtually no emissions, but may involve other considerations that would affect externality values.

The emissions associated with biomass are not yet well known.

c. Conservation and energy efficiency.

Apart from small emissions associated with the manufacture of devices, material and equipment that contribute to higher efficiency, conservation currently appears to have very few negative environmental externalities. In fact, conservation may "deserve" extra credits because electricity use avoided means that less energy (including natural gas) is needed to generate electricity, fewer emissions, less use of water, less waste and less electricity that needs to be transmitted and distributed.

6. IMPORTANT ENVIRONMENTAL EXTERNALITY DEVELOPMENTS UNDERWAY.

Environmental externalities are being discussed, debated or acted upon in some way in a variety of forums. Among the most important for executives in energy industries are the following:

a. **State utility regulatory commission proceedings.** As indicated earlier, regulatory commissions in more than 30 states have adopted Integrated Resource Planning (IRP) requirements that call upon electric utilities to take environmental externalities into account, to some extent, when determining how to bring estimated future electricity demand and supply into balance. Some of these states (e.g., New York) are reconsidering their requirements and other states have requirements under consideration. Commission proceedings have become important forums for discussing externalities.

b. **National Association of Regulatory Utility Commissioners (NARUC) conferences.** NARUC sponsored a national conference on environmental externalities in 1990 and includes the subject prominently in its annual conferences on IRP. These conferences have become a forum for presenting recent thinking on environmental externalities.

c. **U.S. Department of Energy (DOE) and the European Communities (EC) studies.** In February 1991, DOE and the Commission of the EC signed an agreement regarding externalities of electric generation fuel cycles. They agreed to "develop a comparative analytical methodology and to develop the best range of estimates of costs from secondary sources" for eight fuel cycles and four conservation options. Each organization established a research team. Both teams were to undertake analyses of the coal fuel cycle and conservation options. The U.S. was to take the lead on biomass, oil, natural gas and small hydroelectric energy; and the EC was to lead on the uranium, photovoltaic energy and wind cycles. The team established by DOE consisted of researchers from Oak Ridge National Laboratory (ORNL) in Tennessee and Resources for the Future (RFF) of Washington, DC.

These efforts appear to be, by far, the most ambitious studies ever undertaken to develop detailed damage-based estimates of external costs and benefits resulting from various electric-generation fuel cycles. A draft report relating to the coal fuel cycle was prepared by the U.S. team in early 1992 and has been reviewed within the DOE. In the fall of 1992, a revised version was presented to The Secretary of Energy Advisory Board (SEAB) with a request that a procedure be set up for peer review of, first, the methodology and the coal

fuel cycle report, and, later, the reports on other fuel cycles. These reviews would be conducted after completion of the internal DOE review and initial revisions by the team. Peer review, subsequent revision and submission of revised draft reports to DOE are tentatively scheduled to occur during 1993 for six fuel cycles: coal, biomass, oil, hydroelectric, natural gas and nuclear. The reports on the wind and photovoltaic fuel cycles and on conservation options are not expected during 1993.

d. **New York State study.** The State of New York has initiated an extensive study of external social costs based on the "damage function approach."[32] This 3-year effort is receiving financial support from the New York Energy and Developmental Authority (NYSERDA) and the Electric Power Research Institute (EPRI). The principal contractor for the New York study is RCG/Hagler-Bailly. The study will also rely in part on findings of the DOE sponsored work.

e. **Consumer Energy Council of America Research Foundation (CECA/RF).** The Washington-based CECA/RF, with participation of representatives from about 50 diverse organizations, has undertaken an effort to develop policy with respect to application of "environmental externalities." The Interstate Natural Gas Association of American (INGAA) is represented in this effort. Papers being drafted for this effort are focusing attention on major policy issues, such as those identified in Section 4 of this paper, and should provide an analytical framework for addressing the issues and a basis for defining the extent to which various interests agree and disagree.

f. **Federal energy legislation.** The House-passed version of the Energy Policy Act of 1992 included a provision on Integrated Resource Planning by electric utilities that called for "least-cost planning," and that such planning must include external costs and benefits, including "environmental impacts, maintaining access to foreign and domestic sources of supply, employment opportunities, economic development and health."[33] This language was not included in the bill as finally enacted.[34] However, the Act does include provisions encouraging integrated resource planning by both electric and gas utilities (Sections 111 and 115).

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32 Burtraw, et al., *op cit.*, p. 11.

33 "House Externality Language May Snag Least-cost Provision in Energy Bill," *Electric Utility Week's Demand-Side Report*, September 3, 1992, p. 6.

34 The concept of considering environmental externalities appears not to have been totally eliminated from the bill. Sections 201-204 of the bill require preparation of IRPs by customers of the Western Area Power Administration and establish criteria for their approval. One criterion deals with "least cost options," and that term is defined in Section 201(4) to include minimizing "life cycle system costs, including adverse environmental effects...."

g. **U.S. Environmental Protection Agency (EPA) study of Clean Air Act costs and benefits.** The 1990 Clean Air Act Amendments require EPA to conduct a study of the costs and benefits of the Clean Air Act as amended. While not labelled a study of "externalities," it will have to deal with much of the same kind of information with respect to air pollutants as is being addressed in the DOE sponsored work described above, but, presumably, will not be limited to electric generation fuel cycles.

h. **Regulations pursuant to the Superfund Law.** While beyond the scope of this paper, it is important to keep in mind that the concept of "environmental externalities" also emerges in the context of the Superfund statutes. The Departments of the Interior and Commerce (National Oceanic and Atmospheric Administration—NOAA) are charged under the Superfund law with the responsibility for developing procedures for valuing "non-tangible" natural resources (i.e., those for which market values cannot easily be determined) that may be damaged by events such as oil spills. The concept being advanced for development of such values is "contingent evaluation," which is roughly similar to the way that concept is being discussed in state utility commission environmental externality activities.

7. MANY INTERESTS ARE AT STAKE IN ENVIRONMENTAL EXTERNALITY DEBATES AND PROCEEDINGS.

Participation in environmental externality proceedings before state utility commissions makes clear that many interests are at stake. The list below identifies some of the parties and lists examples of their demonstrated or potential interests or positions. The list and, certainly, the examples are not all-inclusive.

a. Electric utilities.

Electric utilities have been the primary focus of proceedings in all states that have undertaken environmental externality efforts. In general, the industry is very skeptical of the efforts and is concerned about all the issues listed in section 4, above. Positions differ among the various utilities on specific issues depending upon a variety of factors, including the relative strength of energy conservation and environmental advocates within the areas served, public attitudes and preferences, the attitudes and actions of state officials, and the philosophies of utility executives. Edison Electric Institute, the trade association for investor-owned electric utilities, opposed language dealing with externalities in the House version of the Energy Policy Act of 1992.

b. Gas utilities.

Gas local distributing companies (LDCs) appear to be less concerned about the possibility that environmental externality requirements might adversely affect their interests, probably because of the relative environmental advantages of gas over coal and oil. As indicated in Section 8.e., below (page 42), many states are establishing IRP requirements for gas utilities, but these requirements do not appear to be giving significant attention to potential environmental externalities.

Some LDCs have intervened in state commission proceedings (e.g., Boston Gas Company in proceedings involving electric utilities in Massachusetts).

In some cases, LDCs may assume that support of environmental externality requirements will result in higher electric rates and improve the competitive position of gas relative to electricity, or that focusing attention on environmental effect would help highlight the view that gas is a preferable fossil energy source of energy for electric generation. In at least one case, an LDC proposed that an electric utility provide subsidies—as a part of the electric utility's demand-side program—to low-income residential customers to pay the costs of converting from electric heat to gas heat. Also, some LDCs apparently see IRP and

externality proceedings as a potential opportunity to encourage utility commissions to require that electric utilities subsidize gas use (e.g., for heating or cooling), or require gas use as an explicit part of the electricity demand-side programs (i.e., "fuel substitution").

c. Independent Power Producers (IPPs).

Interest in obtaining an opportunity to capture a larger market share appears to be an important part of the motivation of IPP interests that have intervened aggressively in IRP and environmental externality proceedings. IPPs that wish to build new gas-fired facilities may see the potential for a larger market for such facilities if significant externality values are assigned to emissions from coal-fired generating units and the requirements are applied to **existing** facilities (the controversial issue described in 4.i., above).

Under such circumstances, IPPs may be able to demonstrate that a new, efficient gas-fired generating unit costs less than an older, less efficient generating unit (particularly coal-fired) when environmental externality adders are taken into account. That is, the internalized cost (that which is seen in rates and electric bills) of the old unit would typically be lower than the cost of a new generating unit. However, using the externality values assigned in some state requirements, the calculated total social costs (the internalized cost plus the prescribed externality adder), might be higher. If this approach were adopted, it might create a new market for new electric generating capacity in an otherwise stagnant market.

d. Architect-engineers and hardware suppliers for new generating units.

While apparently not evident in state proceedings, at least one architect-engineering (A-E) firm in New England has openly advocated the concept of replacing existing, older generating units with new gas-fired combined cycle units on grounds that this would be an effective way of reducing air emissions. (Electric utilities encountering this view are usually quick to point out that new generating units will almost certainly result in higher electric rates and customer bills.) In today's stagnant market for new generation, A-E's, hardware manufacturers, and others deriving business from the construction of new electric generating capacity may have similar motivation to that identified in paragraph c., above, for IPPs.

e. Coal producers and miners.

Coal producers have intervened in some State PUC proceedings opposing large externality adders for coal. Presumably, coal miners would have similar objectives.

Some leading coal-producing states (e.g., Kentucky, Alabama) have not established externality requirements. Some of the coal-producing states that have adopted IRP requirements(e.g., Ohio) appear to be giving considerable weight to factors other than or in addition to air emissions,[35] such as "social benefits" which, presumably, include the economic advantages of coal production in the particular state.

f. Conservation advocates.

Energy conservation advocates have been strong proponents of environmental externality requirements. There are few, if any, externality costs associated with actions to improve energy efficiency. As shown in the illustration in Section 3.a.1 on page 12, conservation generally has a significant advantage when environmental externalities are taken into account.

g. Industrial customers of electric utilities.

Some industrial users of electricity have been outspoken in their opposition to proposals for incorporating environmental externalities in resource decisions. The requirements that environmental externalities be taken into account are seen negatively because of the potential that electric utilities serving their needs will be required to select alternatives that result in higher internalized costs and thus larger electric bills. The Electricity Consumers Resource Council (ECON), which represents large industrial users of electricity, has opposed attempts by regulatory commissions to require that environmental externalities be internalized in IRPs.

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35 National Coal Council, *op cit.*, pp. 10 and 13.

h. State public utility commissions.

The foregoing sections of this paper should make clear that state PUC externality requirements have raised many questions. Positions taken by PUCs vary from state to state on basic questions such as:

- Whether or not PUCs should attempt to take environmental externalities into account;
- The scope of the environmental and other externalities that should be considered;
- The way that externalities are defined, identified and valued; and
- How externalities should be taken into account in electric utility plans and decisions.

State PUCs are likely to continue coming up with different positions, particularly when the varying economic interests of the states are taken into account.

8. THERE ARE STEPS THE NATURAL GAS INDUSTRY MAY WANT TO TAKE IN ORDER TO BE BETTER PREPARED TO PARTICIPATE IN ENVIRONMENTAL EXTERNALITY DEBATES AND PROCEEDINGS.

While natural gas is widely regarded as having significant environmental advantages over other fossil fuels, the gas industry may want to take additional steps to be sure that it is fully ready to participate in environmental externality debates and proceedings. Such steps might include:

a. Monitoring debates and proceedings.

As a minimum, organizations in the gas industry will need to monitor activities involving environmental externalities undertaken by state commissions. While well equipped to monitor activities in Washington via trade associations, the gas industry may be less well equipped to monitor, analyze and understand the broad implications of developments affecting electric utilities that occur in numerous state commission proceedings.

b. Intervening in state proceedings.

Some in the gas industry may want to consider intervention in various state regulatory proceedings, including those dealing with electric utility IRPs and externalities.[36] Environmental externality proceedings in Massachusetts demonstrated that electric utilities that are targets of such interventions object strongly, particularly if LDCs combine their interventions with proposed "fuel substitution" (i.e. substituting gas for electricity) measures that are to be subsidized by electric utility customers. As a minimum, electric utilities can be expected to propose that "fuel substitution" be a "two-way street." That is, electric utilities will want gas utilities to subsidize substitution of electricity for gas when such uses are found to have positive benefit-cost ratios after taking economic and environmental considerations into account.

c. Participating in conferences.

NARUC conferences, which often address externality issues, are generally open for participation by industry representatives and, at times, present opportunities for presentations by industry representatives.

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36 Some LDCs have intervened in electric utility IRP cases in efforts to keep electric utilities from subsidizing storage cooling projects (which summer peaking electric utilities have done to levelize load and avoid the need for new capacity); and to encourage (or have utility commissions require) electric utilities to use some of their load management or conservation subsidy money to subsidize installation of gas cooling (to reduce summer electric peaks) or subsidize conversion of electric heat customers to natural gas on grounds that it is more energy efficient.

d. Preparing for IRP requirements applicable to local gas distributing companies.

Surveys conducted in early 1991 by Lawrence Berkeley Laboratory (LBL) for the National Association of Regulatory Utility Commissioners (NARUC)[37] and in late 1991 by the American Gas Association (AGA) make clear that many state public utility commissions are moving ahead with plans to require LDCs to prepare IRPs. The requirements of Section 115 of the recently enacted Energy Policy Act of 1992 (see reference in Section 6.f., above) will add encouragement. The AGA survey indicated that 23 states had requested or were in the process of requesting IRP plans for gas utilities. Environmental externalities do not appear to be a major factor in state requirements at this stage. However, such requirements may become more important as LDC plans and state requirements become more sophisticated, particularly if greater emphasis in externality developments is placed on total fuel cycle considerations; i.e., exploration and production, transmission and distribution, and end usage.

e. Preparing to address environmental impacts associated with the production, transportation and use of natural gas.

As interest in environmental externalities continues, attention will almost certainly be focused on the environmental implications of natural gas. While all the concerns addressed appear well known to the gas industry, the industry may want to be sure that it is prepared to deal with the issues in all forums, including state utility commissions:

- First, as a preparatory measure in the event that some of the potentially negative implications become more important, and

- Second, as a way of getting a head start on potential problems—so that cost-effective actions can be taken—before regulators come up with inefficient requirements.

Concerns that often arise in discussions about increased natural gas use that may warrant renewed attention by the natural gas industry include:

1) *NO_x emissions*. Some claim that emissions of NO_x from natural gas are not substantially less than from other fossil fuels—unless expensive control measures are installed; i.e., low-NO_x burners (in boilers), steam or water injection (SWI) in gas turbine & combined-cycle units and/or selective catalytic reduction (SCR).

37 Goldman, Charles, "IRP for Gas Utilities: The Train is About to Leave the Station," presentation to the DOE/NARUC Conference on State Regulation and the Market Potential for Natural Gas, Phoenix, Ariz., February 1992.

2) *Methane potency and "half-life" as a greenhouse gas.* Common wisdom now seems to indicate that methane (CH_4), when released into the atmosphere, is some 10 times more potent as a greenhouse gas than carbon dioxide (CO_2) but shorter lived than CO_2. If common wisdom is incorrect, it would be well to make the case. If it is correct, the industry may want to undertake measures to find cost-effective ways to reduce methane leakage from rigs, platforms, gas processing plants, pipelines and compressors if environmental externality requirements include upstream emissions.

3) *Cost of meeting NOx emission limits on electric generating units.* Some state environmental and/or siting authorities are requiring strong measures to reduce NOx emissions. Gas-fired generating units (existing and planned) may become targets, whether or not they present the most cost-effective way of reducing NOx emissions. Gas-fired boilers may have to be retrofitted with low-NOx burners, over-fire air and gas reburn technology, and new gas-fired combined-cycle generating units may have to be equipped with steam or water injection (SWI) and/or selective catalytic reduction (SCR).

4) *Upstream environmental effects.* Efforts to take externalities into account undoubtedly will extend to the full fuel cycle at some point, even though state public utility commissions have not yet undertaken such efforts. The gas industry will need to be prepared to address environmental issues associated with exploration, development, production and transportation as well as end use of natural gas.

f. Monitoring the DOE-EC fuel cycle environmental externality studies.

The coal industry and staff with coal-related responsibilities within the Department of Energy appear to be watching carefully the draft reports of the U.S. team that is seeking to identify environmental, health and economic impacts associated with the coal fuel cycle for generating electricity (described in Section 6.c. on page 33). Such an effort requires thorough familiarity with studies that have been done of the effects associated with all stages in the fuel cycle. The gas industry may want to be sure that it is well equipped to monitor the gas fuel cycle study and, perhaps, to be sure that all fuel cycles are treated with equal objectivity.

g. Data-intensive analysis.

Those participating in environmental externality developments will, it appears, have to be prepared to deal in a highly analytical, data-intensive environment.

9. CONCLUDING OBSERVATIONS

The review of environmental externality developments in this paper leads to several observations:

a. The *underlying* objective in recent environmental externality developments is not new and it will not "go away." The underlying economic concept is correct and society can benefit from valid actions to achieve greater internalization of the costs to society of environmental degradation. Furthermore, public opinion—whether or not based on accurate perceptions—is decidedly in favor of reducing environmental degradation.

b. State public utility commission actions to require or encourage regulated electric utilities to take environmental externalities into account have provided a new "lever" to focus attention on a long-standing objective (i.e., increase internalization of external social costs), but they are one of several levers.

c. State efforts have revealed complex problems, including methodological issues, inadequate scientific data and serious public policy issues, that will have to be confronted (which issues are outlined in Section 4 of this paper).

d. The complex problems will slow public utility commission efforts to take environmental externalities into account, but are unlikely to stop them. Even if the state PUC efforts were slowed or stopped, other federal, state, and local efforts via environmental, health and safety regulations and taxation will continue. Ignoring the matter isn't an option.

e. There are dangers in the state PUC efforts, as in all efforts with similar objectives, that overall societal benefits will not be increased as much as possible or as efficiently as possible because:

   1) Requirements may create situations where marginal costs of reducing adverse environmental impact will exceed marginal benefits. For example, damage values could be overstated or the cost of corrective measures understated—with the result that electric or gas utilities *and their customers* have to spend more than the environmental benefits achieved are really worth; and/or

   2) Requirements may force attention and spending by utilities and their customers on environmental protection actions that are not, in fact, the highest priority. The Federal government does not now do a good job in prioritizing risk-reduction efforts (i.e., work to reduce most important risks first). State governments are unlikely to do

substantially better.

These dangers are present in most efforts to protect health, safety and the environment.

f. The state PUC efforts are an important experiment in "Federalism" and in the allocation of authority and responsibility among state government agencies. That is, the state PUC actions are tending to put more energy and environmental policy issues on state PUC agenda and to shift responsibility from state environmental and energy agencies to PUCs. The state PUC actions, apart from their direct effects, provide a basis for experimentation with different approaches—compared to Federal requirements imposed nationwide. These effects, themselves, have benefits and costs, depending upon one's interests. For example:

   - Environmental requirements could differ widely from one state to another.

   - Costs will generally be borne by citizens within the state establishing the requirements but the benefits of reduced adverse environmental effects may not. Depending upon the target (e.g., the particular emissions, discharges, or other effects), the benefits may occur within or outside the state boundary.

   - Costs of utilities' actions are passed through to customers and thus affect the cost of doing business and living within the state establishing the requirements.

   - Control at the state level permits states to take into account interests (e.g., protecting coal mining or oil and gas exploration and production jobs) that may not get equal weight if requirements are established by the Federal government.

g. Environmental externality actions by up to 50 state governments will be more difficult for all interest groups to monitor, compared to actions taken only at the Federal level.

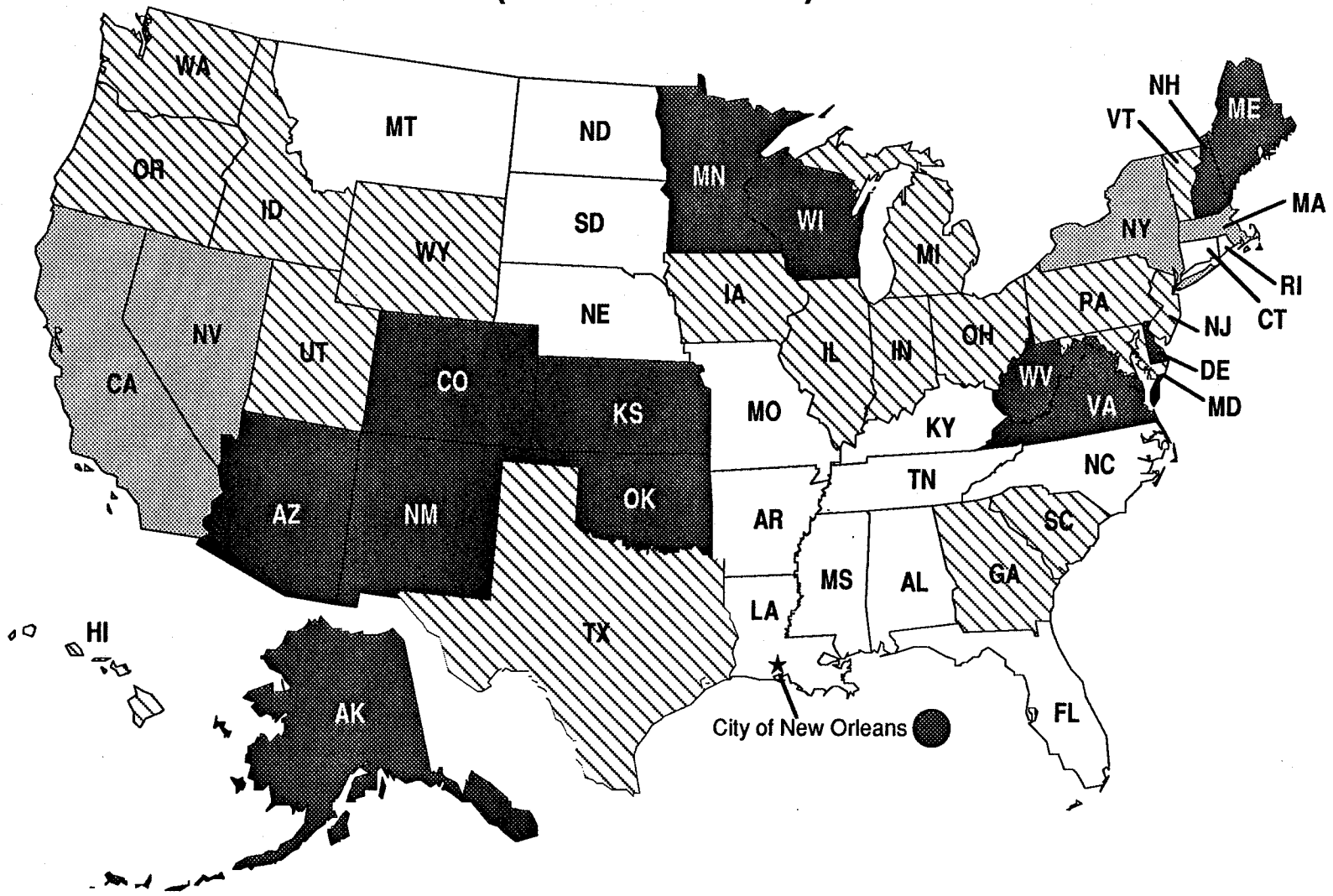
h. Environmental externality actions will increase demands for more and better scientific evidence on relationships between energy activities and environmental damage, and for economic data and analysis to support positions taken by the various parties participating in debates and proceedings.

i. As environmental externality actions become more sophisticated, increased attention is likely to be focused on all aspects of a fuel cycle (i.e., from resource exploration and extraction through end use and waste disposal) rather than being limited to emissions and discharges at the point where energy is used.

j. Actions to take environmental externalities into account will result in "winners" and "losers," compared to the status quo, among producers, transporters, those who convert energy to other products, including electricity, and the ultimate users of energy.

Attachment

Externality Status by State (Electric Utilities)



States which have monetized externality values

States which use one or more of the qualitative methods including points, adders or discounts, rate of return allowances, percentages, and ranking

States which have legislative or rulemaking activites in progress

Source: National Coal Council, "Special Report on Externalties," May 21, 1992, Arlington, Va.