NREL/TP-462-5175 • UC Category: 233 • DE93000032

Status Report on Renewable Energy in the States

B. Swezey and K. Sinclair

National Renewable Energy Laboratory
(formerly the Solar Energy Research Institute)
1617 Cole Boulevard
Golden, Colorado 80401-3393
A Division of Midwest Research Institute
Operated for the U.S. Department of Energy
under Contract No. DE-AC02-83CH10093

Prepared under Task No. AS115440

December 1992

NOTICE

Printed in the United States of America
Available from:
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Price: Microfiche A01
Printed Copy A06

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Acknowledgments

The authors would like to acknowledge the assistance of the NARUC Subcommittee on Renewable Energy in the performance of this work, particularly, the subcommittee Chair, the Hon. Renz Jennings of Arizona, and subcommittee staffmembers David Morse of California and Morey Wolfson of Colorado. The NARUC headquarters staff also provided logistical support in the dissemination of the renewable energy questionnaire. In this regard, we would like to thank Michael Foley of NARUC in particular.

We would also like to recognize the Integrated Resource Planning (IRP) Program of the U.S. Department of Energy both for their financial support and their vision of the growing importance of renewable energy in the utility resource planning process.

Finally, we wish to acknowledge the support and response of the many state regulatory commission staff who took the time to respond to the questionnaire and provide follow-up information and materials. A listing of these state contacts is provided in Appendix A. This report would not have been possible without their assistance.

Executive Summary

As the concept of integrated resource planning has spread among states and utilities, a reexamination of the role of renewable energy sources in the utility resource mix is taking place. This report documents the findings of a study of state regulatory commissions undertaken to: (1) help assess the state of knowledge and awareness about renewable energy resources and technologies; (2) assess the impacts of state policies on renewable energy development; and (3) identify important information needs. The key findings from this effort are:

- Renewable energy development has occurred only slowly over the last decade, and a small number of states account for the bulk of development. The development that has occurred has been limited to non-utility entities.

- Directed state policies have been a key driver in renewable energy development.

- Those states not currently addressing renewables may need more data and information before they proceed with directed policies.

Other important observations are:

- The cost of renewables is an overriding concern.

- Regulators distinguish between "emerging" and "established" renewable energy technologies.

- Specific data are lacking on state-level renewable energy development.

- Detailed renewable resource assessments have yet to be performed in many states.

This report identifies renewable energy information needs of state regulators. However, a number of concerns are also identified that must be addressed before renewables will receive serious attention in many of those states with limited renewables experience. Finally, the report catalogs a wide variety of policies that have been utilized in the states to promote greater development of renewable energy.

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1. Introduction

The electric utility planning environment is being increasingly driven by a new set of factors that reflect a fundamental change in the industry's market conditions. Competition, rising costs, and increasing attention to environmental and other social concerns have prompted a rethinking of both the structure and regulation of the utility industry. The concept of integrated resource planning (IRP) has arisen as a framework to help utilities and regulators address the increased uncertainty facing the industry in the sale and delivery of its product.

The essence of IRP is the equivalent consideration of the costs and benefits of all energy resource, technology, and service options in the utility resource planning, procurement, and delivery process. An early distinction was drawn between supply-side and demand-side service options. However, the scope of IRP is being increasingly broadened to examine the entirety of utility options and operations.

As the concept of IRP has spread among states and utilities, a reexamination of the role of renewable energy sources is taking place.[1] Renewables possess a number of positive attributes and in concert have the potential to help reduce utility planning uncertainty in a cost-effective manner. The Integrated Resource Planning Program of the U.S. Department of Energy (DOE) is supporting efforts to define and assess the many attributes of renewables and to identify and address institutional barriers to the greater use of cost-effective and high-value applications of renewable energy resources.

In 1989, the Conservation Committee of the National Association of Regulatory Utility Commissioners (NARUC) formed the Subcommittee on Renewable Energy. The first major activity of the subcommittee was to undertake a project to assess experience and ideas on the practical development of renewable energy resources and technologies. This activity, documented in an April 1991 report entitled *Renewable Energy and Utility Regulation,* concluded that "renewable energy resources have demonstrated competitiveness and are making a substantial contribution to energy supply; but, very large untapped potential remains" and that "a most significant impediment to the development of renewable energy resources is lack of current information on the level of exploitable renewable energy resources and the cost, potential availability, and performance of renewable energy systems" (NARUC 1991)

As a follow-on to the 1991 report, the subcommittee has commissioned the development of a *White Paper on Renewable Energy in State Regulatory Processes* to more clearly identify and

[1]Renewable energy sources are generally defined to include hydropower, geothermal, wind and solar energy, and a number of biomass-based energy sources (wood and agricultural wastes, municipal solid waste, and landfill methane).

articulate state regulatory impediments to renewable energy in such areas as ratemaking, competitive bidding, and planning processes. The inclusion of state experiences with renewable energy is an essential component of this work.

In support of the NARUC effort to identify both the regulatory barriers facing renewables and the information needs of state regulators, the National Renewable Energy Laboratory (NREL) undertook a study to help assess the state of knowledge and awareness about renewable energy resources and technologies, to assess the impacts of state policies on renewable energy development, and to identify the information needs of state regulators. This report summarizes the NREL effort.

Two important caveats are in order. First, the information contained in this report is current as of spring 1992 when the questionnaires were completed. And second, this report contains only that information provided by the questionnaire respondents. To the extent that policies have been more recently adopted or pertinent information was not provided by the respondents, the information in this report may not be definitive.

2. The NARUC Questionnaire on Renewable Energy

In early 1991, the NARUC Subcommittee on Renewable Energy developed a questionnaire on renewable energy for dissemination to state utility regulatory agencies. A copy of the questionnaire is provided in Appendix B. The questionnaire requested responses in the key areas summarized below.

Renewables Data

Each state questionnaire was customized with estimates of state renewable energy generating capacity and energy use obtained from two published sources. Estimates on renewable electric capacity for 1989 were excerpted from a NREL data base of renewable electric projects; estimates for nonelectric energy use, encompassing industrial and residential wood energy, alcohol fuels, direct heat utilization of geothermal resources, and active solar collection systems, were cited from a 1990 report on renewables published by Public Citizen (Swezey and Porter 1990; Rader 1990).

The state representatives were asked to respond to several questions regarding the existence of state-prepared renewable energy estimates, the amount of renewables-based generating capacity added since 1980, and the primary vehicle(s) for acquiring renewables-based capacity.

Renewable Energy in Resource Planning and Acquisition

Several questions were posed regarding the consideration of renewables in utility resource planning and acquisition, including any policies enacted by the state to expressly encourage this consideration. Information was also requested on avoided cost rates and the eligibility of renewables-based projects for utility capacity payments.

Renewable Resource Development

This section sought (1) information on any state-specific renewable resource assessments that have been conducted and (2) opinions on the primary obstacles to renewable energy development. A matrix was provided for respondents to identify what, in their opinion, are the most important obstacles to development for each of the major renewable energy sources and technologies. The categories provided were: *Too Costly; Inadequate Resources; Resources Fully Developed; Immature Technology; Unreliable Technology; Operational Issues; Utility Reluctance; Transmission Constraints; Institutional Resistance; Environmental Issues; Lack of Information;* and *Other,* for which the respondent was asked to specify any additional barriers.

Renewable Energy Policies

Information was requested on any formal policies that the state enacted specifically to encourage the development of renewables and how much development has occurred as a result.

Renewable Energy Information Needs

The final section of the questionnaire specifically addressed the information needs of state regulators regarding renewables, asking (1) Is it felt that the available information is adequate? and (2) If not, what types of information would be valuable? The information response options were: *Resource Studies; Economic Evaluations; Operational Characteristics; Technology Descriptions; Regulatory Analyses; Workshops/Conferences on the Status of Renewables;* and *Other,* for which the respondent was asked to elaborate.

Questionnaire Dissemination and Responses

The questionnaire was mailed in early April 1992 to the chair of each state regulatory agency and was accompanied by a letter from Subcommittee Chair Renz Jennings of Arizona. The letter stressed the importance of this effort in helping "to identify and address the needs of state regulatory commissions in developing a better understanding of the role renewables can play in the state energy mix."

Responses were received from 49 states and the District of Columbia, an exceptional response rate (only Louisiana did not formally respond). During the response period, NREL was in contact with many of the states to provide elaboration on the questionnaire and to follow up on information sources and the interpretation of the state responses.

The responses to the questionnaire were carefully reviewed and are documented in the following sections.

3. Renewable Energy Data and Acquisition

Respondents were asked to review for accuracy state-specific renewable energy data from two published sources and to answer related questions regarding state collection and preparation of renewable energy data.

State Collection and Preparation of Renewable Energy Data

(1)(A) Does your state prepare similar estimates of renewable energy use?
[Refer to Figure 3-1 for a sample of the data contained in question 1.]

(1)(B) If you answered "Yes" in (A), do your state's estimates differ and/or do you have more recent data?

Out of 47 responses, 34 regulatory commissions answered by either verifying or modifying the renewable energy data provided. In most of these cases, the state estimates differed significantly from those provided in the questionnaire. At the same time, 24 respondents noted (with some overlap) that their state does not prepare estimates of renewable energy use.

There are several possible reasons for the data discrepancies noted, including varying data sources, different definitions of renewables, regulatory jurisdictional issues (e.g., coverage limited to jurisdictional utilities), and interstate location and ownership issues (e.g., with large hydropower projects).

State Renewable Energy Information Sources

(1)(C) What are the best sources for renewable energy data in your state?

If a coordinated effort does exist to collect state renewable energy data or prepare such estimates, it is generally the state energy office that performs this work. A listing of the renewables-specific data and information sources that were provided are cataloged in Appendix C. In several cases, respondents identified utilities as the best source of renewables data. However, data sources also included the state planning office, governor's office, other state agencies, universities, and local industries.

Figure 3-1. Sample of Question 1 — State of Arizona

(1) - Renewables Data

The following estimates of line-connected renewable electricity generating installations in your state have been published by the National Renewable Energy Laboratory (formerly the Solar Energy Research Institute) for 1989:

Hydropower - Total	**3642.1 MW**
Large Hydro	3420.7 MW
Small Hydro	73.1 MW
Pumped Storage	148.3 MW
Combined/Pumped Storage	
Biomass - Total	**.4 MW**
Agricultural Waste	.3 MW
Methane	.1 MW
Municipal Solid Waste	
Wood/Wood Waste	
Geothermal	
Photovoltaics	.4 MW
Solar Thermal Electric	
Wind	38 kW

The following estimates of renewable energy thermal applications in your state were made in 1990 by Public Citizen:

Industrial Wood	
Residential Wood	5,150 billion Btu
Alcohol Fuels	
Direct Heat Geothermal	233 billion Btu
Active Solar Collection Systems	
Domestic Hot Water	176,787 systems
Pool Heating	5,380 systems
Space Heating	873 systems

Renewables Capacity Installed Since 1980

(1)(D) How much total generating capacity (in MW) has been installed in your state since 1980?

(1)(E) What fraction of this capacity is renewables-based?

An overall assessment of the responses to these questions proved to be problematic for several reasons. First, many commissions regulate only investor-owned utilities (IOUs), and thus the renewables data provided were often limited to these utilities. Second, although pumped storage hydro units are generally classified as renewable energy sources (and were listed as such in the data table provided in the questionnaire), the electric energy used to pump the water for storage comes generally from either base load fossil or nuclear plants and thus is not truly renewables based. In several state responses, the installation of large pumped storage facilities during the 1980s clearly skewed the data. Because of the way the question was posed, the pumped storage capacity could not be separated from the total. Finally, large hydropower installations (including pumped storage units) can be located in one state but partially owned by utilities in another state. The attribution of this capacity was not consistent among respondents.

Because of these difficulties, we considered it potentially misleading to provide a summary of the data responses to this question and thus none is provided.

Vehicles for Acquiring Renewable Energy-Based Capacity

(1)(F) What has been the primary vehicle for acquiring this renewables capacity?

Table 3-1 summarizes the responses to the question regarding renewables acquisition. The primary vehicle for acquiring renewables capacity in most states was reported to be non-utility entities. Although the question addressed standard offer contract mechanisms, several states indicated that negotiated contracts were used as well. Competitive bidding was a vehicle for renewables in very few states. Utilities were mentioned as a vehicle in only 14 states. State-specific responses are presented in Appendix D.

Table 3-1. Vehicles for Acquiring Renewable Resources

Vehicles	Number responding
Non-utility entities through standard offer contracts	21
Other*	17
Utility constructed and operated	14
Non-utility entities through competitive bidding	4
N/A	4

*The *other* responses specified were:

non-utility -- in-house use only
state constructed and utility/state operated
congressional legislation (Western Area Power Administration)
non-utility entities through negotiated contracts
non-utility entities displacing utility energy
non-utility entities through Public Utility Regulatory Policies Act (PURPA) qualification
non-utility entities through nonstandard contracts
self-use - wood products
Bureau of Reclamation
non-utility commission approved rate orders
County Municipal Utility Authorities or equivalent
municipal construction of hydro facilities and small wind-powered electric generators
qualifying facilities under PURPA
non-utility development
non-utility generator/PURPA contract negotiations
non-utility through negotiations
experimental projects

Note that several of these *other* responses could pertain to one of the other categories specified in the table.

4. Renewable Energy in Resource Planning and Acquisition

In the utility resource planning process, energy resource and technology options are assessed and decisions are made regarding which options to pursue. The questions in this section addressed the degree to which renewables are currently considered in utility resource planning.

Consideration of Renewables in Resource Planning

(2)(A) Do the utilities in your state actively consider renewable energy sources in their resource planning?

(2)(B) If you answered "Yes" in (A), please check which renewable energy sources are being considered.

More than two-thirds of the states responded that the utilities in their state currently include renewables in the consideration of resource options. Another 10 states answered that some of the state's utilities consider renewables. Only four states responded that their utilities do not consider renewables. Table 4-1 lists the specific renewable energy sources being considered by one or more utilities as identified by the respondents. As might be expected, the principal renewables being considered include hydropower, municipal solid waste (MSW), and wood, the more established renewables. However, utilities in many states also are considering wind and photovoltaics. State-specific responses are presented in Appendix E.

(2)(C) What, if any, policies has your state enacted that expressly encourage the consideration of renewable energy sources in energy resource planning or acquisition processes?

Utilities may be more inclined to consider renewables in their planning if the state has established rules or regulations that explicitly encourage or require it. Eighteen of the responding states (38%) have no such policies. Of the states that do, 15 states (32%) responded that they have instituted a least-cost planning (LCP) or integrated resource planning (IRP) process that explicitly considers the special attributes of renewables. Nine states require the valuation of environmental attributes, whereas eight states have standard offer contracts with special terms and conditions for renewables. Seven states responded that their competitive bidding process addresses renewables. Five states use adders to avoided cost to reflect the special attributes of renewables. Only two states currently provide utility incentives for renewables. These responses, along with other policies noted, are summarized in Table 4-2. State-specific responses are presented in Appendix F.

Table 4-1. Renewable Energy Sources Being Considered by Utilities in Resource Planning

Sources	Number Responding
Hydropower	31
Municipal Solid Waste	30
Wind	25
Wood	21
Photovoltaics	20
Other Biomass	18
Other Solar	13
Geothermal	10
Other Renewables*	5

*Other renewables includes methane, landfill gas, and tire-derived fuel.

Table 4-2. Policies Encouraging Consideration of Renewables in Resource Planning and Acquisition

Policy	Number Responding
States with None	18
LCP/IRP	15
Other*	12
Valuation of Environmental Attributes	9
Standard Offer Contracts — Special Terms	9
Competitive Bidding Rules	7
Special Adders to Utility Avoided Cost Rates	5
Utility Incentives	2

*_Other_ policies included

AZ Required to consider solar thermal; one utility must conduct feasibility study of photovoltaics as transmission system enhancement.

AR Energy Conservation Enforcement Act, which states that the Public Service Commission shall engage in energy conservation programs that encourage the use of renewable energy technologies or sources.

CA Renewable energy set-aside; consideration of fuel diversity values.

CO Public Utility Commission line extension rule requires utilities to provide comparative costs between photovoltaics and line extensions, under certain conditions.

FL Legislature intends that the use of resources such as solar energy and renewable energy sources be encouraged.

HI Statute with a stated long-term goal of encouraging the development of alternative sources of energy.

IN Each utility must annually file an avoided cost-based tariff for the purchase of energy and/or capacity from cogeneration and small power production facilities. In addition, utility companies must evaluate a range of resource options, both supply- and demand-side, before the commission approves the building of new generation facilities.

OR Solar access ordinances in 35 cities.

SC IRP filings must evaluate cost-effectiveness of each supply-side option.

TX Public Utility Regulatory Act requires commission to encourage qualifying cogenerators and small power producers.

VT Long-term, levelized rate contracts are available for renewable qualifying facilities.

WI Advance Plan Order 6 describes numerous actions taken by the commission on renewable energy.

Utility Avoided Cost Payments

(2)(D) What are the current avoided cost rates in your state?

(2)(E) Under what conditions are renewable energy projects not eligible for capacity payments?

The level and type of avoided cost payments are important for non-utility generators (NUGs), which were identified as the primary vehicle for renewables development during the 1980s. Also, the degree to which non-utility projects are eligible for capacity payments impacts a project's financial viability. Respondents were asked to provide the current avoided cost rates in their states, by utility, as well as a statewide average. They were also asked to identify conditions under which renewable energy projects would not be eligible for capacity payments.

The calculation and presentation of avoided cost is not straightforward. Avoided cost figures were provided based on a number of definitions. Some states provided short-term avoided costs; others provided long-term. Some states provided avoided cost as a stream of nominal dollars; others provided levelized constant dollar figures with different levelization periods (e.g., 10-, 15-, 25- or 30- year levelized streams). Since many of the responses were not directly comparable and utility avoided costs are available from other sources, such as the McGraw Hill *Independent Power Markets Quarterly*, we have chosen not to include the state responses on avoided cost in this report.

Valuable information was provided on the eligibility of renewables for capacity payments. Several responses noted that renewables are not treated differently from other NUGs in this area. However, many specific cases were cited in which renewables, or NUGs in general, are not eligible for capacity payments. Appendix G documents these responses.

5. Renewable Energy Resource Development

Several questions were posed regarding state resource assessment activities and the perception of obstacles to renewable energy resource development.

Renewable Energy Resource Assessment

(3)(A) Are you aware of any studies that have assessed the potential of renewable energy resources in your state?

(3)(B) If you answered "Yes" in (A), please list relevant studies.

An essential first step toward characterizing the potential of renewable energy in the states is resource assessment. Twenty-nine states (62%) reported the existence of at least one assessment of state renewable energy resources. Although many of these studies are resource-specific, several states have conducted studies that evaluate the aggregate potential for renewables. Nevertheless, 18 states, representing more than one-third of respondents, indicated that they knew of no renewable resource studies conducted for their particular state. The resource studies identified by the respondents are cataloged in Appendix H.

Renewable Energy Development Activity

(3)(C) Is the development of renewable energy resources being actively pursued in your state?

Sixteen states (34%) responded that the development of renewable energy resources is being actively pursued. Another 26 states (55%) responded that renewables were being "somewhat" actively pursued. Only 5 states (11%) responded that development of renewables was not being actively pursued.

Obstacles to Greater Renewable Energy Development

(3)(D) *What, in your opinion, are the primary <u>obstacles</u> to greater development of specific renewable energy resources in your state?*
[Refer to Figure 5-1 for matrix.]

One of the more important objectives of the questionnaire was to identify, in the view of state regulators, the most significant obstacles impeding greater development of renewable energy resources in the states. Twelve potential barriers were listed in the questionnaire focusing on cost, resource availability, reliability, and institutional issues. In addition, respondents were asked to specify any other obstacles deemed important.

Figure 5-1. Sample Matrix from Question (3)(D)

	Too Costly	Inadequate Resources	Resources Fully Developed	Immature Technology	Unreliable Technology	Operational Issues
Hydropower						
Wood						
Municipal Solid Waste						
Geothermal						
Wind						
Photovoltaics						
Solar Thermal Electric						
Other Solar/ Renewables						

	Utility Reluctance	Transmission Constraints	Institutional Resistance	Environmental Issues	Lack of Information	Other (please specify)
Hydropower						
Wood						
Municipal Solid Waste						
Geothermal						
Wind						
Photovoltaics						
Solar Thermal Electric						
Other Solar/ Renewables						

Table 5-1 summarizes the aggregate ranking of obstacles across all renewable energy resources and technologies. As the table illustrates, the most frequently cited obstacle for all technologies was cost. *Too costly* was the primary obstacle identified for four of the eight renewable energy resources and was one of the top three obstacles cited for seven of eight resources. The only resource in which cost was not indicated as a primary obstacle was hydropower. A summary of the perceived obstacles, by technology, is provided in Appendix I.

Table 5-1. Obstacles for All Renewables

Obstacle	Number of Responses
Too Costly	137
Inadequate Resources	105
Environmental Issues	82
Utility Reluctance	66
Other	62
Immature Technology	61
Lack of Information	60
Operational Issues	53
Institutional Resistance	39
Transmission Constraints	27
Resources Fully Developed	26
Unreliable Technology	20

Cost was cited most frequently as an obstacle for photovoltaics (by two-thirds of respondents), solar thermal electric (54%), and wind (42%); the so-called "emerging" renewable energy technologies (Table 5-2). The cost perception hierarchy implicit in this ranking is consistent with the current generation costs of renewable electric technologies, indicating a high degree of awareness in the regulatory community of the relative costs of

renewables.[2] One important point to make here is that even though photovoltaics (PV) today represent a high cost option for bulk power generation, many high-value, remote applications are being identified by the utility sector for which PV is currently a cost-effective technology option.[3]

Table 5-2. Ranking of Technologies by Barrier

TOO COSTLY

Technology	Number of Responses
Photovoltaics	32
Solar Thermal Electric	26
Wind	20
Municipal Solid Waste	15
Other Solar/Renewables	15
Wood	14
Hydropower	8
Geothermal	7

Ranking second of all obstacles was the availability of resources (Table 5-3). *Inadequate resources* was cited most frequently for geothermal (58%) and solar thermal electric (38%) resources. Again this indicates a fundamental awareness among regulators of generic resource

[2]For instance, a recent utility review of renewable energy noted the following ranges of generation costs for renewables technologies in favorable resource locations (in real levelized 1991 dollars):

Technology	¢/kWh
Photovoltaics	30-40
Solar Thermal	10
Wind	7-9
Geothermal	5-7
Biomass	5

Source: J. Douglas, "Renewables On the Rise," *EPRI Journal*, June 1991.

[3]See for example: J. Bigger and E. Kern, Jr., "Early, Cost-Effective Photovoltaic Applications for Electric Utilities," paper presented at *SOLTECH 90*, Electric Power Research Institute, March 1990; and C. Jennings, "PG&E's Cost-Effective Photovoltaic Installations," *Proceedings of Twenty First IEEE Photovoltaic Specialists Conference - 1990*, pp. 914-918.

availabilities; i.e., higher temperature geothermal resources are generally limited to the western United States and the direct beam solar resource necessary for concentrating solar technologies is limited to states in and around the Southwest.[4] However, wind, wood, and hydropower were not far behind solar thermal in the ranking of resource adequacy (33%, 31%, and 29% of respondents, respectively).

Table 5-3. Ranking of Technologies by Barrier

INADEQUATE RESOURCES

Technology	Number of Responses
Geothermal	28
Solar Thermal Electric	18
Wind	16
Wood	15
Hydropower	14
Photovoltaics	8
Other Solar/Renewables	3
Municipal Solid Waste	3

Identification of *environmental issues,* the third most frequently cited obstacle, was driven by concerns about development of MSW (54%), hydropower (46%), and wood (42%) resources (Table 5-4). No other renewable energy option received more than a 15% level of identification on environmental issues.

Utility reluctance was the next most frequently cited obstacle, in aggregate, and was indicated primarily as an obstacle for the emerging renewable energy technologies based on solar and wind resources (Table 5-5). This reluctance may stem from a lack of familiarity with these technologies and/or perceptions of higher costs and risks inherent in adopting new technologies.

[4]However, resource limits pose less of an issue for geothermal resources utilized in ground source heat pump technology.

Table 5-4. Ranking of Technologies by Barrier

ENVIRONMENTAL ISSUES

Technology	Number of Responses
Municipal Solid Waste	26
Hydropower	22
Wood	20
Wind	7
Geothermal	4
Solar Thermal Electric	2
Other Solar/Renewables	1
Photovoltaics	0

Table 5-5. Ranking of Technologies by Barrier

UTILITY RELUCTANCE

Technology	Number of Responses
Photovoltaics	14
Wind	13
Solar Thermal Electric	10
Other Solar/Renewables	9
Municipal Solid Waste	6
Wood	6
Geothermal	4
Hydropower	4

The *other* category was a "catch-all" for any perceived obstacles not specifically included in the matrix (Table 5-6). Among the most frequently mentioned obstacles were lack of financing and the absence of a tax structure that would encourage investment in renewables. Another barrier noted was that the pricing of electricity does not account for externalities. Other obstacles identified were utility overcapacity, inadequate sites, permitting issues, fuel quality problems, efficiency problems, geographic limits, R&D requirements, and limited resources.

Several other major obstacles were also noted. *Immature technology* was cited primarily for the emerging renewables, particularly the solar technologies (Table 5-7). *Lack of information* was mentioned across several technologies by 15% – 27% of the respondents (Table 5-8).

The remaining obstacles were identified less frequently (Tables 5-9 – 5-13). *Operational issues* were cited for MSW (29%), wind (21%), and wood (19%). Hydropower (38%) dominated concerns over *resources fully developed.* Of particular note is that *institutional resistance, transmission constraints,* and *unreliable technology* were not perceived to be major obstacles to the development of any of the renewable technologies.

Table 5-6. Ranking of Technologies by Barrier

OTHER

Technology	Number of Responses
Wind	11
Hydropower	9
Solar Thermal Electric	8
Photovoltaics	8
Geothermal	8
Wood	8
Municipal Solid Waste	6
Other Solar/Renewables	4

Table 5-7. Ranking of Technologies by Barrier

IMMATURE TECHNOLOGY

Technology	Number of Responses
Photovoltaics	21
Solar Thermal Electric	14
Other Solar/Renewables	9
Wind	8
Municipal Solid Waste	6
Geothermal	2
Wood	1
Hydropower	0

Table 5-8. Ranking of Technologies by Barrier

LACK OF INFORMATION

Technology	Number of Responses
Photovoltaics	13
Other Solar/Renewables	12
Wind	9
Municipal Solid Waste	8
Solar Thermal Electric	7
Geothermal	4
Wood	4
Hydropower	3

Table 5-9. Ranking of Technologies by Barrier

OPERATIONAL ISSUES

Technology	Number of Responses
Municipal Solid Waste	14
Wind	10
Wood	9
Photovoltaics	6
Solar Thermal Electric	5
Hydropower	4
Other Solar/Renewables	3
Geothermal	2

Table 5-10. Ranking of Technologies by Barrier

INSTITUTIONAL RESISTANCE

Technology	Number of Responses
Municipal Solid Waste	8
Wind	6
Photovoltaics	5
Hydropower	5
Other Solar/Renewables	5
Wood	5
Solar Thermal Electric	3
Geothermal	2

Table 5-11. Ranking of Technologies by Barrier

TRANSMISSION CONSTRAINTS

Technology	Number of Responses
Wind	7
Hydropower	5
Geothermal	4
Solar Thermal Electric	4
Photovoltaics	3
Wood	2
Other Solar/Renewables	1
Municipal Solid Waste	1

Table 5-12. Ranking of Technologies by Barrier

RESOURCES FULLY DEVELOPED

Technology	Number of Responses
Hydropower	18
Municipal Solid Waste	4
Wood	3
Solar Thermal Electric	1
Photovoltaics	0
Wind	0
Other Solar/Renewables	0
Geothermal	0

Table 5-13. Ranking of Technologies by Barrier

UNRELIABLE TECHNOLOGY

Technology	Number of Responses
Wind	6
Solar Thermal Electric	4
Photovoltaics	3
Other Solar/Renewables	3
Wood	2
Municipal Solid Waste	1
Geothermal	1
Hydropower	0

6. Renewable Energy Policies

Directed state policies can provide an important impetus for renewable energy development. Respondents were asked to identify and provide information on any policies instituted by the state to encourage the development of renewable energy resources and to estimate the amount of development that has resulted from these policies.

It was reported that some type of renewable energy policy is now (or has been) in place in 32 out of 48 states. These policies range in scope from generic policy statements encouraging the consideration of renewable energy to actual capacity set-asides for renewables. They may also include expired tax incentives for certain renewable energy systems. The remaining 16 states indicated that no specific renewable energy policies exist. Appendix J summarizes the various state policies reported.[5]

The amount of renewable energy resource development that has resulted directly from these policies is difficult to determine. Very few states were able to provide such an estimate. California indicated that the availability of standard offer contracts for qualifying facilities (QFs), along with federal and state tax credits, helped promote the development of 3,520 MW of renewable electric capacity. Illinois expects to realize 100 MW of waste-to-energy project development because of its incentive program. And in Utah, over 4,000 residential and commercial renewable resource systems have been installed, through 1990, as a result of a renewable energy tax credit available since 1980. Several other states indicated that their policies had stimulated development but could not offer specific estimates.

The types of state policies that have been enacted fall into three categories: (1) policies developed to implement the Public Utility Regulatory Policies Act (PURPA); (2) direct incentives or subsidies; and (3) utility-specific regulatory actions. Below we identify the different types of policies included in these categories.

PURPA-Related Policies

In many states, policies to encourage the deployment of renewable energy technologies have been a direct result of PURPA implementation. Some states, such as California, Maine and Texas, legislated state versions of PURPA. Other states, such as Connecticut, Iowa, and Vermont, have passed regulations that set forth avoided cost and contracting procedures for satisfying the federal PURPA requirements.

[5]In summarizing state-policies on renewables, we have relied solely on the information initially provided by the respondents or obtained through subsequent follow-up.

Direct Incentives or Subsidies

Economic incentives have been used by several states to stimulate and encourage the development of renewables. Various types of tax credits are currently in place in seven states: Illinois, Massachusetts, Michigan, Oklahoma, Oregon, Rhode Island, and Utah. Three other states had tax credit programs for solar and/or wind installations, which have expired.

Tax exemptions are another form of economic incentive currently offered in at least four states. In Massachusetts, residential solar, wind, and heat pump systems used in the principal residence are exempt from state sales tax. Wind machines and solar electric installations are currently exempt from both property and sales tax in Minnesota. In New Jersey, solar energy equipment is exempt from the 7% state sales tax. And Ohio allows a state tax exemption for ethanol-blended fuels similar to the federal tax exemption.

A third type of economic incentive is the availability of loans or grants. Alaska has a program that provides loans for the construction of renewable energy projects, although fossil fuel projects are also eligible. Oregon offers low interest loans (funded by tax-free state bonds) for renewable energy projects. Pennsylvania provides grants for solar power development but the same grants are also available for clean coal projects.

Other types of economic incentives have been instituted, such as higher than avoided cost utility buy-back rates for renewables developers. In Illinois, higher rates are offered to waste-to-energy projects. The purchasing utilities are subsequently granted a tax credit offset for the difference between avoided cost and the payment to the developer (plus other operational costs). Iowa also offers buy-back rates that are higher than avoided cost to encourage the development of renewable energy projects.

Several states, including North Dakota and Wisconsin, have established net energy billing policies in which small-scale generators are effectively paid retail utility rates through reverse metering.

Utility-Specific Regulatory Actions

A number of regulatory actions have been taken by utility commissions, which are either directly or indirectly favorable toward renewables. Subsumed within this category are actions and rulemakings on: the explicit consideration of renewable energy technologies in IRP; treatment of externalities; adders for renewables evaluation and acquisition; and other renewables-specific actions.

Integrated Resource Planning - The existence of an IRP (or least-cost planning) process provides a broader framework for the consideration of renewables in resource planning and

procurement. Fifteen states indicated that their IRP process explicitly encourages the consideration of renewable energy.

Externalities - The valuation of energy market externalities, including environmental impacts, and the inclusion of such costs in electricity pricing can enhance the economic competitiveness of "cleaner" renewable energy projects against those based on traditional fossil fuel resources. Several states, including California, Massachusetts, Nevada, and New York, have policies that require utilities to explicitly consider environmental externalities in the evaluation or acquisition of new generation resources.

Adders - In addition to environmental externalities, other adders may be included when valuing resource additions to account for such attributes as fuel diversity and resource flexibility. Again, these considerations would tend to favor renewables against more traditional resource options. California, for example, requires the consideration of fuel diversity in its resource planning process. Washington provides for a 10% price adder for renewables in the comparison of electricity supply projects in competitive bidding to reflect a number of beneficial attributes.

Renewables-Specific Legislation and Rulemakings - State legislation and rulemakings that explicitly call for special treatment of renewables may be one of the more effective ways to accelerate renewables development. Specific examples include the following:

California: Even before the passage of PURPA, state energy policy emphasized renewables. Most recently, a state law passed in 1991 mandates a 50% renewables set-aside to meet new electricity generating needs. This law was recently codified in the 1992 PUC decision implementing competitive bidding for the state's IOUs.

Kansas: A rate of return adder on power purchases from renewables is offered to utilities.

Minnesota: A state law enacted in 1991 requires the development of pilot renewable energy projects by utilities. So far, a pilot wind project has been developed.

New York: The 1992 State Energy Plan includes a goal of establishing a program by 1994 to procure 300 MW of new capacity from renewables, assuming that this capacity can be obtained "at an acceptable price premium."

Wisconsin: The Public Service Commission (PSC) in various utility planning decisions has required utilities to undertake a number of activities related to renewables. Recently adopted programs include establishment of a state renewables development goal of more than 800 MW by 2010 and the development of a utility-specific incentive program for renewables development.

In addition, several states offer front-loaded or levelized rates for power purchases from renewable energy projects.

Many states with longstanding regulatory orders or rules encouraging the development of renewables have achieved remarkable success in acquiring and integrating renewables into the state energy resource mix. California, for example, leads the nation in the amount of installed generating capacity from nonhydro renewables, having seven times more capacity than any other state (Rader 1990). Other states with established policy positions on renewables, such as Maine and Vermont, have also realized significant resource additions from renewables.

No Policy

Sixteen states reported that they have no specific renewable energy-related policies in place at this time. In many of these states, excess capacity and low avoided costs have worked against the development of such policies. In general, the states with no policies or statutes have had very limited success with the development of renewable energy technologies. Twelve of these states reported that they have added virtually no new renewables-based capacity since 1980.

7. Renewable Energy Information Needs

As previously noted, the lack of current information on renewables has been identified in past studies as a "significant impediment" to development. Furthermore, *lack of information* was identified as a barrier to several renewables technologies by 15%–27% of the questionnaire respondents (see Section 5). This section summarizes the responses received on renewable energy information needs.

Existing Information Base

(5)(A) Do you feel that you have adequate information and knowledge concerning the resource base and the technical and economic status of renewable energy technologies to make decisions regarding renewable energy development in your state?

Nineteen states (40%) responded that they had adequate knowledge and information on renewable energy technologies to make regulatory decisions. (However, three of these states did indicate that additional information would be valuable.) Several of these responses came from states that are leaders in renewable energy development. The remaining 28 states (60%) noted that the level of knowledge and information at the regulatory commission is not adequate.

Information Needs

(5)(B) If you answered "No" in (A), what types of information would be important to you?

The questionnaire provided a list of six information categories for respondents to indicate what types of information would be important to the commission. Respondents were also asked to identify other important types of information not covered in the list. The responses are summarized in Table 7-1.

More than one-half of the respondents indicated that *economic evaluations* of renewables are needed. Rated nearly as important were *operational characteristics* of renewable energy technologies and *resource studies*. The remaining information categories were selected at a rate of about 30%–40%. Several states indicated a need for information across all categories.

Table 7-1. State Information Needs

Information Needs	Number of Responses
Economic Evaluations	27
Operational Characteristics	22
Resource Studies	21
Technology Descriptions	18
Regulatory Analyses	18
Workshops/Conferences	13
Other*	3

**Other* responses included complete information regarding what other commissions are doing to encourage the development of renewable energy sources and local case studies and demonstrations.

8. Analysis and Discussion of Responses

Several summary observations can be made from a detailed analysis of the state responses to the NARUC renewable energy questionnaire.

- ***Renewable energy development has occurred only slowly over the last decade, and a small number of states account for the bulk of development. The development that has occurred has been limited to non-utility entities.***

  During the decade of the 1980s, the U.S. electric utility industry, including non-utility generators (NUGs), added nearly 150,000 MW of capacity. Renewables represent an estimated 23,000 MW (or 15%) of this total.[6] However, when utility hydro additions are removed, renewables account for only about 12,000 MW (or 8%) of capacity additions over this period. Eight states account for more than two-thirds of this development, and California alone accounts for about 40%.

  State respondents indicated more than two to one that NUGs were the primary vehicle for the development of renewable energy sources. In fact, nearly four-fifths of the nonhydro renewables capacity added since 1980 has come from NUGs.[7] This has occurred for several reasons. First, PURPA regulations provided market parity for qualifying facilities (which include renewables) and at the same time restricted utility ownership of these facilities. The federal tax incentives that were available to renewable energy developers during much of the 1980s also were restricted to non-utility entities. Finally, many utilities were in the midst of construction programs involving large coal and nuclear projects and, with the overcapacity that resulted, had less interest in renewables development. Those utilities that were involved with renewables were focused primarily on the expansion of hydropower resources or construction of large pumped storage hydro facilities.

  Although a large majority of states indicated that utilities consider renewables in their resource planning, this has not translated into significant utility development. The lack of incentives, comparable to those that have been available to non-utility developers, may at least be partially responsible for the lack of utility development activity.

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[6]As noted in Section 3, analysis of the generation capacity data received from the states was problematic, and thus we have utilized other published data sources here. These sources include B. Swezey and K. Porter (1990); Rader (1990); and Edison Electric Institute, *Statistical Yearbook of the Electric Utility Industry* and *Capacity and Generation of Non-Utility Sources of Energy*, various issues.

[7]Ibid.

Several ideas have recently been proposed to encourage greater utility involvement in renewables development (Moskovitz 1992).

- ***Directed state policies have been a key driver in renewable energy development.***

  The questionnaire responses indicate that those states that have had active policies toward implementing PURPA have experienced the greatest level of renewables development. Market conditions have also played an important role. Some renewables development has occurred in states in which new capacity needs were projected or utility petroleum consumption was being reduced. On the other hand, in states with excess capacity, and thus low avoided costs, renewables have generally not been developed. Several states in this latter category are now attempting to "jump start" development with renewables-specific mandates.

  Such directed policies may be necessary because renewables possess many attributes that have not been recognized under traditional electricity planning methods. The consideration of the environmental externalities associated with energy resources and technologies is one example. Many states indicated that their IRP (or least-cost planning) rules require utilities to consider renewables. Although IRP offers one mechanism for realizing greater *consideration* of renewables, greater actual *development* may not be realized unless IRP policies are reinforced with renewables-specific incentives or implementation measures.

- ***Those states not currently addressing renewables may need more data and information before they proceed with directed policies.***

  About one-third of the states noted that they have no established policies toward renewables. In many of these states, past market conditions have been unfavorable for renewables development. Also, utility decision making has been more conservative in addressing issues of resource diversity and new technology development.

  Several states noted the need for information "across the board." However, the need for information goes beyond those states that have not been active in renewables development; 60% of all respondents noted that the current level of information is not adequate. A concerted effort must be developed and maintained to provide information on renewable energy resources, technologies, and economics, as well as implementation issues and strategies, to the state utility regulatory community on a continuing basis.

Beyond these more general findings, a number of other important observations can be made from the questionnaire responses:

- ***The cost of renewables is an overriding concern.***

  Cost concerns were particularly evident for the "emerging" renewable energy technologies (solar and wind). If renewables are more costly than traditional resource choices, this will have a negative impact on rates. Also, renewables tend to be capital intensive, which has implications for near-term rate impacts.

  Although these cost concerns indicate a need to continue research and development activities on renewables, there is also a need to communicate cost developments, along with technology improvements, to state regulators. *Economic evaluations* were cited as the number one information need among respondents. In addition, a need exists to articulate other values that renewables may bring to utility operations. Several activities are already under way to communicate renewable energy technology and cost developments to the utility sector.[8]

- ***Regulators distinguish between "emerging" and "established" renewable energy technologies.***

  The *emerging* renewable energy technologies face perceptions of high cost, immature technology, and utility reluctance. The *established* technologies (hydropower and biomass) generally face more typical project development concerns such as environmental and operational issues (and to a lesser extent resource availability). These different perceptions of the technologies suggest that different approaches may need to be developed for information communication. However, it can probably be expected that as the emerging technologies become more broadly competitive, the more traditional development concerns will also surface for these technologies.

- ***Specific data are lacking on state-level renewable energy development.***

  We found that data on renewables development in the states are not easily obtained. Some states have efforts in place to collect this data but most do not. The data that does exist are generally not comprehensive; coverage is often limited by regulatory jurisdiction. Furthermore, many respondents indicated that they do not know where to get this data within the state, even if data do exist.

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[8]The utility industry has recently formed a *Utility PhotoVoltaic Group (UPVG)* "to accelerate the use of cost-effective and emerging high-value applications of photovoltaics for the benefit of electric utilities and their customers." And two groups have been formed to communicate developments in wind technology and economics. The *Utility Wind Interest Group (UWIG)* supports the appropriate integration of wind technology for utility applications and the *Advisory Council for Wind Energy* endeavors to build utility sector alliances for evaluating opportunities in wind power.

The poor condition of state renewables data suggests that a greater effort is needed in this area. Since many states may lack the resources to undertake data collection, the federal government could play a role in supporting these efforts. Such an effort could be coordinated with existing federal data reporting requirements for the electric utility industry. However, any new programs of this type should draw as much as possible from existing sources of data to avoid placing new reporting burdens on the industry.

- ***Detailed renewable resource assessments have yet to be performed in many states.***

  Inadequate resources was noted as a development obstacle for a number of renewable energy technologies. However, we found that very few states have performed comprehensive resource assessments; the resource assessments that have been performed have generally been directed to one particular resource.

  The need for *resource studies* was identified as one of the more important information needs of the respondents. This suggests that comprehensive resource assessment programs need to be developed. Again, there may be a role for the federal government in providing directed grants to the states for renewable energy resource assessments.

9. References

J. Douglas, "Renewables on the Rise," *EPRI Journal*, June 1991.

D. Moskovitz, *Renewable Energy: Barriers and Opportunities, Walls and Bridges*, A paper for the World Resources Institute, Regulatory Assistance Project, Gardiner, ME, July 1992.

National Association of Regulatory Utility Commissioners, *Renewable Energy and Utility Regulation*, Committee on Energy Conservation, Subcommittee on Renewable Energy, Washington, D.C., April 10, 1991.

N. Rader, *The Power of the States: A Fifty-State Survey of Renewable Energy*, Public Citizen, Washington, D.C., June 1990.

B. Swezey and K. Porter, *REPiS: The Renewable Electric Project Information System*, Solar Energy Research Institute, Golden, CO, SERI/MP-260-4080, December 1990.

APPENDIX A

STATE RENEWABLE ENERGY CONTACTS

Table A-1. State Renewable Energy Contacts

State	Contact	Telephone/Fax Number
Alabama	Ralph Stanford (1)	(205) 242-5283/Fax 242-5515
Alaska	Penny Haldane Rick Rogers	(907) 561-7877/Fax 561-8584
Arizona	David Berry	(602) 542-5517/Fax 542-2129
Arkansas	Jana Lierly	(501) 682-5829/Fax 682-5731
California	Tom Thompson	(415) 703-2881/Fax 703-1965
Colorado	Saeed G. Barhaghi Morey Wolfson	(303) 894-2000 Ext 369/Fax 894-2065 (303) 894-2000 Ext 306
Connecticut	Mark Quinlan	(203) 827-1553 Ext 2129/Fax 827-2613
Delaware	Craig McDonnell	(302) 739-3227/Fax 739-4849
District of Columbia	Dr. Grace Hu	(202) 626-5148/Fax 638-2330
Florida	Roland Floyd	(904) 488-8501/Fax 487-0509
Georgia	James Cole	(404) 656-6790/Fax 656-0980
Hawaii	Norman Lee	(808) 586-2033/Fax 586-2066
Idaho	Bill Eastlake	(208) 334-0359/Fax 334-3762
Illinois	A. M. Visnesky, Jr.	(217) 524-5040/Fax 782-1042
Indiana	Bradley K. Borum	(317) 232-2304/Fax 232-6758
Iowa	John J. Pearce	(515) 281-5679/Fax 281-5320
Kansas	Robert D. Elliott	(913) 271-3222/Fax 271-3354
Kentucky	Michael D. Alexander	(502) 564-2982/Fax 564-7279
Maine	Richard Parker	(207) 287-3831/Fax 287-1039

Table A-1. State Renewable Energy Contacts (continued)

State	Contact	Telephone/Fax Number
Maryland	Dr. Barbara Black	(410) 333-2877/Fax 333-6086
Massachusetts	Michael Mendelsohn	(617) 727-0089/Fax 723-8812
Michigan	Charles Millar	(517) 334-6432/Fax 882-4640
Minnesota	Paul Helgeson (2) David Jacobson	(612) 297-3067/Fax 297-1959 (612) 297-4562/Fax 297-7073
Mississippi	C. Keith Howle	(601) 961-5476/Fax 961-5804
Missouri	Bill Washburn	(314) 751-7505/Fax 751-1847
Montana	Paul Cartwright (3) Dan Elliot	(406) 444-6761 (406) 444-6188/Fax 444-7618
Nevada	Tom Henderson	(702) 687-6048/Fax 687-6120
New Hampshire	Paula M. Lebrocquy Janet Gail Besser	(603) 271-2431/Fax 271-3878
New Jersey	Cameron Johnson	(609) 777-1501/Fax 292-1074
New Mexico	Prasad Potturi	(505) 298-4081/Fax 827-6973
New York	John McLaughlin (4)	(518) 486-2883
North Carolina	David F. Creasy	(919) 733-3979/Fax 733-7300
North Dakota	Jerry Lein	(701) 224-4080/Fax 224-2410
Ohio	Carl R. Tucker Claude W. Eggleton	(614) 644-8935 (614) 466-7707/Fax 752-8353
Oklahoma	Ken Zimmerman	(405) 521-3593/Fax 521-6045
Oregon	Roger Colburn Dr. Phil Carver (5)	(503) 378-6894/Fax 373-7752 (503) 378-6874
Pennsylvania	John Miller (6)	(717) 783-1546/Fax 783-3458

Table A-1. State Renewable Energy Contacts (concluded)

State	Contact	Telephone/Fax Number
Rhode Island	Mary Kilmarx	(401) 277-3500/Fax 277-6805
South Carolina	A. R. Watts	(803) 737-5115/Fax 737-5119
South Dakota	Steven M. Wegman	(605) 773-3201/Fax 773-3809
Texas	Nat Treadway	(512) 458-0310/Fax 458-8340
Utah	Rebecca Wilson/ Jim Wingerden/ Britt Reed (7)	(801) 538-5428/Fax 521-0657
Vermont	Paul R. Peterson	(802) 828-2358/Fax 828-3351
Virginia	Catharine M. Lacy	(804) 786-4314/Fax 786-4550
Washington	Bruce Folsom	(206) 586-1132/Fax 586-1150
West Virginia	David J. Ellis	(304) 340-0348
Wisconsin	Terri K. Kosobucki	(608) 267-3595/Fax 266-3957
Wyoming	Steve Oxley	(307) 777-7427/Fax 777-5700

Note: Unless otherwise indicated, contacts are in the state utility regulatory agency.

(1) Alabama Department of Economic and Community Affairs
(2) Department of Public Service
(3) Department of Natural Resources and Conservation
(4) NYS Department of Public Service
(5) Oregon Department of Energy
(6) Bureau of Conservation, Economics, & Energy Planning
(7) Department of Natural Resources, Utah Division of Energy

Two states, Nebraska and Tennessee, did not complete the questionnaire but sent a letter explaining why. The Nebraska utility commission does not regulate natural gas or electric companies. In Tennessee, virtually all generation of electric power is handled by the TVA, therefore, the commission does not address matters contained in the questionnaire.

Louisiana did not respond to the questionnaire.

APPENDIX B

NARUC COVER LETTER/QUESTIONNAIRE ON RENEWABLE ENERGY

National Association of Regulatory Utility Commissioners

Incorporated

KENNETH GORDON, *President*
Maine Public Utilities Commission
242 State Street
State House Station 18
Augusta, Maine 04333

DENNIS J. NAGEL, *First Vice President*
Iowa Utilities Board
Lucas State Office Building
Des Moines, Iowa 50319

KEITH BISSELL, *Second Vice President*
Tennessee Public Service Commission
460 James Robertson Parkway
Nashville, Tennessee 37243-0505

1102 Interstate Commerce Commission Building
Constitution Avenue and Twelfth Street, N.W.
Washington, D. C. 20423

Mailing Address: Post Office Box 684
Washington, D. C. 20044-0684

Telephone: 202-898-2200
Facsimile: 202-898-2213

PAUL RODGERS
Administrative Director
General Counsel

GAILE ARGIRO
Treasurer

April 3, 1992

Dear ,

As Chairman of the NARUC Subcommittee on Renewable Energy, I am requesting the participation of your Commission in a very important activity to help identify and address the needs of state regulatory commissions in developing a better understanding of the role that renewable energy sources can play in the state energy mix. Enclosed you will find a copy of a short questionnaire seeking information on the deployment and regulatory status of renewable energy in your state.

We plan to use this information in several ways. First, the Subcommittee has commissioned a *White Paper on Renewable Energy in State Regulatory Processes* with the objective of identifying and illuminating key barriers to and opportunities for greater consideration and selection of renewable energy technologies in state resource planning and acquisition processes. Information obtained from the questionnaire responses will be used in support of this white paper. Second, the Subcommittee has recently introduced a newsletter, *State Renewable Energy News*, which reports on state-level renewable energy activities. I have enclosed a copy of the first issue for your examination and circulation. Through this questionnaire, we hope that we will uncover additional activities that we can share in the newsletter with other states. Finally, a formal report will be prepared, based on the questionnaire responses, identifying key information needs on renewable energy that the Subcommittee will use to help guide its future activities.

I would be most grateful if you would direct this questionnaire to the person on the Commission staff with the most knowledge and experience in addressing renewable energy. Please have the questionnaire returned to: Mr. Blair Swezey; National Renewable Energy Laboratory; 1617 Cole Blvd.; Golden, Colorado 80401. In case of questions, Mr. Swezey's telephone number is (303) 231-7014. We would like to have the responses back to NREL by April 27. Thank you and your Commission staff for your attention in this important matter.

Sincerely,

Renz D. Jennings
Chairman, Subcommittee on Renewable Energy

NARUC Questionnaire on Renewable Energy
State of Arizona

(1) - Renewables Data

The following estimates of line-connected renewable electricity generating installations in your state have been published by the National Renewable Energy Laboratory (formerly the Solar Energy Research Institute) for 1989:

Hydropower - Total	**3642.1 MW**
Large Hydro	3420.7 MW
Small Hydro	73.1 MW
Pumped Storage	148.3 MW
Combined/Pumped Storage	
Biomass - Total	**.4 MW**
Agricultural Waste	.3 MW
Methane	.1 MW
Municipal Solid Waste	
Wood/Wood Waste	
Geothermal	
Photovoltaics	.4 MW
Solar Thermal Electric	
Wind	38 kW

The following estimates of renewable energy thermal applications in your state were made in 1990 by Public Citizen:

Industrial Wood	
Residential Wood	5,150 billion Btu
Alcohol Fuels	
Direct Heat Geothermal	233 billion Btu
Active Solar Collection Systems	
Domestic Hot Water	176,787 systems
Pool Heating	5,380 systems
Space Heating	873 systems

NARUC Questionnaire on Renewable Energy
State of Arizona

(1) - Renewables Data (cont.)

(A) Does your state prepare similar estimates of renewable energy use?

_____ Yes
_____ No
_____ Don't Know

(B) If you answered "Yes" in (A), do your state's estimates differ and/or do you have more recent data? (If so, please note on previous page or below)

(C) What are the best sources for renewable energy data in your state?

(D) How much total generating capacity (in MW) has been installed in your state since 1980?

_____

(E) What fraction of this capacity is renewables-based?

_____

(F) What has been the primary vehicle for acquiring this renewables capacity?

_____ Utility constructed and operated
_____ Non-utility entities through standard offer contracting
_____ Non-utility entities through competitive bidding
_____ Other (please specify) _____
_____ N/A

NARUC Questionnaire on Renewable Energy
State of Arizona

(2) - Renewable Energy in Resource Planning and Acquisition

(A) Do the utilities in your state actively consider renewable energy sources in their resource planning?

_____ Yes
_____ No
_____ Some do
_____ Don't know

(B) If you answered "Yes" in (A), please check which renewable energy sources are being considered:

_____ Hydropower
_____ Wood
_____ Municipal Solid Waste
_____ Other Biomass
_____ Geothermal
_____ Wind
_____ Photovoltaics
_____ Other Solar
_____ Other Renewables (please specify)

(C) What, if any, policies has your state enacted that expressly encourage the consideration of renewable energy sources in energy resource planning or acquisition processes? (Please expand where warranted)

_____ LCP/IRP reflecting special attributes of renewables
_____ Competitive bidding rules reflecting special attributes of renewables
_____ Standard offer contracts (special terms and conditions)
_____ Special adders to utility avoided cost rates
_____ Utility incentives (please specify)
_____ Valuation of environmental attributes
_____ Other (please specify)

(2) - Renewable Energy In Resource Planning and Acquisition (cont.)

(D) What are the current avoided cost rates in your state?

State	Utility:_____	Utility:_____	Utility:_____
_____ Energy	_____ Energy	_____ Energy	_____ Energy
_____ Capacity	_____ Capacity	_____ Capacity	_____ Capacity
_____ Total	_____ Total	_____ Total	_____ Total

(E) Under what conditions are renewable energy projects not eligible for capacity payments?

NARUC Questionnaire on Renewable Energy
State of Arizona

(3) - Renewable Resource Development

(A) Are you aware of any studies that have assessed the potential of renewable energy resources in your state?

_____ Yes
_____ No

(B) If you answered "Yes" in (A), please list relevant studies:

(C) Is the development of renewable energy resources being actively pursued in your state?

_____ Yes
_____ No
_____ Somewhat

(D) What, in your opinion, are the primary obstacles to greater development of specific renewable energy resources in your state? (Using the matrix on the next page, please check the appropriate boxes for each resource/technology listed.)

NARUC Questionnaire on Renewable Energy
State of Arizona

(3) - Renewable Resource Development (cont.)

	Too Costly	Inadequate Resources	Resources Fully Developed	Immature Technology	Unreliable Technology	Operational Issues
Hydropower						
Wood						
Municipal Solid Waste						
Geothermal						
Wind						
Photovoltaics						
Solar Thermal Electric						
Other Solar/ Renewables						

	Utility Reluctance	Transmission Constraints	Institutional Resistance	Environmental Issues	Lack of Information	Other (please specify)
Hydropower						
Wood						
Municipal Solid Waste						
Geothermal						
Wind						
Photovoltaics						
Solar Thermal Electric						
Other Solar/ Renewables						

NARUC Questionnaire on Renewable Energy
State of Arizona

(4) - Renewable Energy Policies

(A) To help address energy market inequities, some states have instituted specific policies targeted toward encouraging greater development of renewable energy sources (e.g., tax credits or exemptions, preferred status in planning, etc.). What, if any, renewables-related policies has your state instituted and how much development has resulted?

NARUC Questionnaire on Renewable Energy
State of Arizona

(5) - Renewable Energy Information Needs

(A) Do you feel that you have adequate information and knowledge concerning the resource base and the technical and economic status of renewable energy technologies to make decisions regarding renewable energy development in your state?

_____ Yes
_____ No

(B) If you answered "No" in (A), what types of information would be important to you? (Check as many answers as may apply)

_____ Resource studies
_____ Economic evaluations
_____ Operational characteristics
_____ Technology descriptions
_____ Regulatory analyses
_____ Workshops/Conferences on the status of renewables
_____ Other (please list below)

Please provide the name of the person who completed this questionnaire to facilitate follow-up and for future state regulatory contact on renewable energy.

_____ phone _____
fax _____

If possible, please send a copy of the relevant portions of any reports or rulemakings concerning renewables referred to in your responses.

Thank you for your help in providing the NARUC Subcommittee on Renewable Energy with key insights and information on the development of renewable energy in your state.

APPENDIX C

STATE SOURCES OF RENEWABLE ENERGY DATA AND INFORMATION

Table C-1. State Sources of Renewable Energy Data and Information

State	Source of Renewable Data
Alabama	No sources listed
Alaska	Alaska Natural Energy Institute
Arizona	No sources listed
Arkansas	Arkansas Power & Light Co.; Oklahoma Gas & Electric Co.; Southwestern Electric Power Co.; The Empire District Electric Co.; Arkansas Electric Cooperative Corp.
California	Utility quarterly reports on QFs (submitted to Public Utilities Commission); Electricity Reports (California Energy Commission)
Colorado	Office of Energy Conservation; Public Utilities Commission
Connecticut	Utility forecast of loads and resources
Delaware	State Energy Office
District of Columbia	DC Energy Office
Florida	Energy Office, Department of Community Affairs
Georgia	Public Service Commission (James Cole); Georgia Forestry Commission (J. Fred Allen)
Hawaii	Energy Division, Department of Business and Economic Development
Idaho	Utilities; State Energy Office; Public Utilities Commission
Illinois	Illinois Department of Energy and Natural Resources; Utilities
Indiana	No sources listed
Iowa	Department of Natural Resources, Energy Bureau
Kansas	Kansas Corporation Commission
Kentucky	Biennial Integrated Resource Plans filed by utilities
Louisiana	Did not respond to questionnaire

Table C-1. State Sources of Renewable Energy Data and Information (continued)

State	Source of Renewable Data
Maine	Public Utilities Commission; State Planning Office
Maryland	Maryland Energy Administration; Maryland Department of the Environment
Massachusetts	Department of Energy Resources; New England Power Pool
Michigan	Wood Energy: Michigan DNR Forest Management Division Waste to Energy: Michigan Utility Companies Solar: Michigan Public Service Commission, Solar Tax Credit Program.
Minnesota	The *Energy Data Book* published biennially by the Minnesota Department of Public Service
Mississippi	TVA - Southwest Region Biomass Energy Program
Missouri	Division of Energy, Department of Natural Resources
Montana	Department of Natural Resources and Conservation
Nebraska	Utility commission does not regulate natural gas or electric companies and thus did not prepare a formal response to the questionnaire.
Nevada	U.S Bureau of Reclamation, Boulder City, NV (large hydro) Sierra Pacific Power Co (small hydro, geothermal) Direct use: Wood - Sierra Pacific Power Co, home energy survey Direct use: Geothermal - Geo Heat Center, Klamath Falls, OR
New Hampshire	Governor's Office of Energy and Community Services
New Jersey	New Jersey Department of Environmental Protection and Energy
New Mexico	Department of Energy, Minerals and Natural Resources
New York	Division of Policy Analysis & Planning, NY State Energy Office Office of Energy Efficiency and Environment, NY State Department of Public Service
North Carolina	Utilities

Table C-1. State Sources of Renewable Energy Data and Information (continued)

State	Source of Renewable Data
North Dakota	Each utility or rural electric cooperative
Ohio	No good source, however, Ohio Biomass Energy Program within PUCO is a good start.
Oklahoma	Solar: Mr. Craig Christensen, Omniplex Science Museum Dr. John Fagen, University of Oklahoma Wind: Dr. Carl Berge, University of Oklahoma Biomass: Mr. Richard Smith, Weyerhaeuser Paper Company General: Dr. Gene Tyner, Gene Tyner & Associates
Oregon	Department of Energy (tax credit information)
Pennsylvania	Pennsylvania Energy Office
Rhode Island	New England Power Pool's 'CERT' report issued annually in April. List compiled by each state for New England Governor's Conference.
South Carolina	Governor's Office - Office of Energy Programs
South Dakota	No sources listed
Tennessee	Virtually all generation of electric power is handled by TVA. The commission thus did not prepare a formal response to the questionnaire.
Texas	*Cogeneration and Small Power Production in Texas*, the commission staff report updated annually; Utilities' "Load and Capacity Resource Forecast filings", biennial filing with the commission.
Utah	Utah Division of Energy
Vermont	Department of Public Service
Virginia	Virginia Department of Mines, Minerals & Energy, Division of Energy; Virginia State Corporation Commission, Division of Energy Regulation
Washington	State Energy Office
West Virginia	No sources listed

Table C-1. State Sources of Renewable Energy Data and Information (concluded)

State	Source of Renewable Data
Wisconsin	Utilities; State Department of Natural Resources; RENEW (renewable energy advocacy group)
Wyoming	State Energy Office

APPENDIX D

VEHICLES FOR ACQUIRING RENEWABLE ENERGY RESOURCES

(By state response)

Table D-1. Vehicles for Acquiring Renewable Energy Resources

State	Non-Utility Standard Offer Contracts	Non-Utility Competitive Bidding	Utility Constructed	Other	N/A
Alabama				✓	
Alaska				✓	
Arizona			✓		
Arkansas			✓		
California	✓		✓		
Colorado	✓			✓	
Connecticut	✓				
Delaware					✓
District of Columbia	✓	✓			
Florida	✓			✓	
Georgia				✓	
Hawaii	✓				
Idaho	✓				
Illinois				✓	
Indiana	✓				
Iowa				✓	
Kansas					✓
Kentucky			✓		
Louisiana[a]					
Maine		✓			
Maryland	✓		✓		
Massachusetts	✓		✓		
Michigan	✓	✓			
Minnesota	✓		✓		
Mississippi				✓	
Missouri					✓
Montana	✓				
Nebraska[b]					

Table D-1. Vehicles for Acquiring Renewable Energy Resources (concluded)

State	Non-Utility Standard Offer Contracts	Non-Utility Competitive Bidding	Utility Constructed	Other	N/A
Nevada				✓	
New Hampshire				✓	
New Jersey				✓	
New Mexico				✓	
New York	✓				
North Carolina	✓		✓		
North Dakota				✓	
Ohio				✓	
Oklahoma[c]					
Oregon	✓				
Pennsylvania				✓	
Rhode Island	✓			✓	
South Carolina			✓		
South Dakota					✓
Tennessee[d]					
Texas	✓			✓	
Utah			✓		
Vermont	✓		✓		
Virginia	✓		✓		
Washington		✓	✓		
West Virginia[c]					
Wisconsin			✓		
Wyoming	✓				
Totals	21	4	14	17	4

[a] No questionnaire response received.
[b] Commission does not regulate electric utilities.
[c] Did not respond to this question.
[d] Bulk of generation comes from TVA which is not regulated by the Commission.

APPENDIX E

RENEWABLE ENERGY RESOURCES BEING CONSIDERED BY UTILITIES IN RESOURCE PLANNING

(By state response)

Table E-1. Renewable Energy Resources Being Considered by Utilities in Resource Planning

State	Hydro	MSW	Wind	Wood	PV	Other Biomass	Other Solar	Geothermal	Other RETs
Alabama[a]									
Alaska	✓	✓	✓	✓				✓	
Arizona					✓		✓		
Arkansas[a]									
California			✓					✓	
Colorado	✓	✓			✓	✓			
Connecticut	✓	✓	✓	✓	✓	✓	✓		✓
Delaware		✓							
District of Columbia					✓	✓			
Florida		✓		✓	✓	✓	✓		
Georgia	✓	✓		✓		✓			
Hawaii	✓	✓	✓			✓		✓	
Idaho	✓			✓					
Illinois	✓	✓				✓			
Indiana	✓	✓							
Iowa[a]									
Kansas[a]									
Kentucky	✓	✓	✓	✓	✓	✓	✓	✓	
Louisiana[b]									
Maine	✓	✓	✓	✓		✓			
Maryland		✓							
Massachusetts	✓								
Michigan	✓	✓		✓					
Minnesota	✓	✓	✓	✓	✓	✓			
Mississippi				✓					
Missouri		✓	✓		✓				
Montana	✓	✓	✓	✓	✓	✓			
Nebraska[c]									

Table E-1. Renewable Energy Resources Being Considered by Utilities in Resource Planning (concluded)

State	Hydro	MSW	Wind	Wood	PV	Other Biomass	Other Solar	Geothermal	Other RETs
Nevada	✓	✓	✓		✓		✓	✓	
New Hampshire	✓	✓	✓	✓		✓			
New Jersey[a]									
New Mexico[a]									
New York	✓	✓	✓	✓	✓	✓	✓		✓
North Carolina	✓	✓	✓	✓	✓	✓	✓		
North Dakota	✓		✓			✓			
Ohio[a]									
Oklahoma[a]									
Oregon	✓		✓		✓		✓	✓	
Pennsylvania	✓	✓	✓	✓					
Rhode Island	✓	✓	✓		✓				✓
South Carolina	✓	✓	✓		✓		✓		
South Dakota	✓	✓							
Tennessee[d]									
Texas	✓	✓	✓	✓	✓	✓	✓	✓	
Utah	✓		✓		✓		✓	✓	
Vermont	✓	✓	✓	✓					
Virginia	✓	✓	✓	✓	✓	✓			
Washington	✓	✓	✓	✓				✓	✓
West Virginia[a]									
Wisconsin	✓	✓	✓	✓	✓		✓		✓
Wyoming	✓	✓	✓	✓	✓	✓	✓	✓	
Totals	31	30	25	21	20	18	13	10	5

[a] Did not respond to this question (see Q. 2A & 2B in Appendix B).
[b] No questionnaire response received.
[c] Commission does not regulate electric utilities.
[d] Bulk of generation comes from TVA, which in not regulated by the commission.

APPENDIX F

POLICIES ENCOURAGING CONSIDERATION OF RENEWABLES

(By state response)

Table F-1. Policies Encouraging Consideration of Renewables

State	LCP/IRP	Standard Offer Contracts	Competitive Bidding	Avoided Cost Adders	Utility Incentives	Environmental Valuation	Other	None
Alabama								✓
Alaska								✓
Arizona							✓	
Arkansas							✓	
California	✓	✓	✓	✓		✓	✓	
Colorado			✓				✓	
Connecticut		✓	✓					
Delaware								✓
District of Columbia								✓
Florida							✓	
Georgia								✓
Hawaii							✓	
Idaho								✓
Illinois	✓			✓				
Indiana		✓					✓	
Iowa		✓						
Kansas								✓
Kentucky								✓
Louisiana[a]								
Maine	✓	✓	✓					
Maryland								✓
Massachusetts	✓					✓		
Michigan								✓
Minnesota	✓					✓		
Mississippi								✓
Missouri	✓							
Montana								✓
Nebraska[b]								

Table F-1. Policies Encouraging Consideration of Renewables (concluded)

State	LCP/IRP	Standard Offer Contracts	Competitive Bidding	Avoided Cost Adders	Utility Incentives	Environmental Valuation	Other	None
Nevada	✓					✓		
New Hampshire	✓	✓						
New Jersey	✓					✓		
New Mexico		✓						
New York	✓			✓	✓	✓		
North Carolina								✓
North Dakota								✓
Ohio								✓
Oklahoma[c]								
Oregon	✓		✓			✓	✓	
Pennsylvania				✓				
Rhode Island		✓						
South Carolina							✓	
South Dakota	✓							
Tennessee[d]								
Texas							✓	
Utah	✓		✓			✓		
Vermont						✓	✓	
Virginia								✓
Washington	✓		✓	✓				
West Virginia								✓
Wisconsin	✓	✓			✓		✓	
Wyoming								✓
Totals	15	9	7	5	2	9	12	18

[a] No questionnaire response received.
[b] Commission does not regulate electric utilities.
[c] Did not respond to this question.
[d] Bulk of generation comes from TVA, which in not regulated by the commission.

APPENDIX G

CONDITIONS UNDER WHICH NON-UTILITY PROJECTS ARE NOT ELIGIBLE FOR CAPACITY PAYMENTS

(As stated in the questionnaire responses)

Conditions Under Which Non-Utility Projects Are Not Eligible for Capacity Payments

- Heavily penalized if independent power producer (IPP) or cogenerator goes off line. (AL)
- When utility does not forecast need for capacity in the next year cycle. (AK)
- Where projects can only provide nonfirm energy. (AK)
- No payments have been allowed in the past. (AR)
- Failure to meet performance obligations. (CA)
- Qualifying facilities over 100 kW and not obtained through the bidding process. (CO)
- Renewable projects above 5 MW cannot get a contract with a capacity payment if the year of capacity need is not within 10 years. (CT)
- When contract is less than 3 years in duration. Capacity payments vary according to contract. (DE)
- State has no renewable energy projects. (DC)
- When they do not meet minimum on-peak and overall capacity factors for each utility. (FL)
- Currently only pay avoided fuel costs; no capacity payments available. (GA)
- Capacity cost is negotiated based on avoided capacity cost at the time. Not eligible when qualifying facility (QF) does not sign an agreement to provide firm capacity with legally enforceable obligation provision; also, when utility does not need firm capacity. (HI)
- State has excess capacity; therefore no payments are provided. (IL, SD)
- If project does not derive at least 75% of its energy input from renewable energy. (IA)
- If utility has excess capacity, according to outcome of court case. (KS)
- For contracts of less than 5 years, QF gets avoided energy costs only. (ME)
- Eligible only if installed capacity of QF is 1000 kW or less and QF agrees to provide power under a 5-, 10-, 15-, or 18-year contract. (ME)
- QFs larger than 1000 kW must negotiate for capacity payment with utility; may petition Public Utility Commission to set contract price terms if they fail to reach an agreement with utility. (ME)

- If utility does not need capacity within a reasonable time frame. (MA)
- If supply source does not have capacity benefits. (MA)
- Only if capacity itself is not needed. (MI)
- For facilities rated from 40-100 kW, a time of day purchase rate has an on-peak and off-peak rate. The off-peak rate does not have a capacity component. For facilities rated below 40 kW, the QF has an option of taking a net energy billing rate, which is the average electric utility rate for the customer class. Those who do not take net energy rate may accept a simultaneous purchase and sale rate, which does not include capacity payment. (MN)
- Utilities file tariffs for 100 kW or below. (MO)
- When energy is not produced during peak hours. (NV)
- If less than 100 kW and do not provide firm capacity. (NH)
- If no capacity addition planned by utility. (NM)
- IPPs more than 2 MW capacity may not receive capacity payments unless qualified through a bidding process. (NY)
- When they operate off peak. (NC)
- Not eligible unless facility enters into a contract that extends into the time period when capacity deficits are projected. (ND)
- Small QFs may opt for net energy billing. (ND)
- Only if they do not meet the requirements of the Public Utility Regulatory Policies Act (PURPA). (OH)
- Noncontract facilities. (RI)
- Subject to PURPA regulations. (SC)
- During parallel operation; if QF cannot operate at certain periods, such as peaking periods, a credit may not be available. (SD)
- None for nonfirm capacity. (TX)
- QFs larger than 1 MW are eligible for avoided cost rates filed on a year-to-year basis. Until 1995, no capacity payments would be automatically provided to such facilities. QFs

smaller than 1 MW can obtain levelized payment contracts that provide capacity compensation today for the value of future capacity avoided. (UT)

- If larger than 3 MW and not selected as the winning project in a competitive bidding process. (VA)

- All projects are pay-for-performance. (WA)

APPENDIX H

STUDIES ASSESSING STATE RENEWABLE ENERGY POTENTIAL

(As reported in the questionnaire responses)

Table H-1. Studies Assessing State Renewable Energy Potential

State	Study
Alabama	Southeastern Regional Biomass Energy Program funded studies.
	Numerous "case specific" studies.
Alaska	Map of *Alaska's Renewable Energy Potential*, Alaska Energy Institute, October 28, 1991.
Arizona	*The Power of The States*, Nancy Rader, Public Citizen, June 1990.
	Current study by PacifiCorp regarding capacity to be built in Arizona
Arkansas	None identified.
California	*Electricity Report*, California Energy Commission.
	Energy Development Report, California Energy Commission.
Colorado	Conservation and Renewable Energy Wind Prospecting Program, conducted by NEOS Corp. for the Western Area Power Administration (WAPA), January 1985.
	Wind Energy Resource Atlas, Vol 8. The Southern Rocky Mountain Region. Pacific Northwest Labs. PNC 319SWERA8 1981 UC-60.
	Biomass Resource Assessment in the State of Colorado. Western Regional Biomass Energy Program, 1991.
	Geothermal Energy Development in Colorado: Processes, Promises, and Problems. Colorado Geological Survey, 1978.
	Energy Potential through Bio-conversion of Agricultural Wastes. Four Corners Regional Commission, 1978.
	Colorado Solar Radiation Data. Colorado Office of Energy Conservation, 1979.
Connecticut	None identified.
Delaware	None identified.

Table H-1. Studies Assessing State Renewable Energy Potential (continued)

State	Study
District of Columbia	*Solar Energy and Natural Gas Conservation. Engineering and Economic Options for the District of Columbia.* Glakpe, Emmanuel K., Carsie A. Hall, and Linus J. Thomas. School of Engineering, Department of Mechanical Engineering, Howard University, Washington, D.C., February 7, 1992.
Florida	None identified.
Georgia	Georgia Forestry Commission wood study. Public Citizen studies. Georgia Public Service Commission 1986 report.
Hawaii	Assessment currently being done by the Department of Business and Economic Development; not yet completed.
Idaho	*Evaluation and Ranking of Geothermal Resource for Electrical Generation or Offset in Idaho, Montana, Oregon, and Washington*; Bloomquist, R.G., et. al., Bonneville Power Administration, Portland, 1985. *Idaho Hydroelectric Potential*, Gladwell, J.S., Idaho Water Resources Research Institute, Moscow, 1980. *Pacific Northwest Regional Hydroelectric Power Potential*, Pacific Northwest Utilities Conference Committee, Portland, 1983. *Western States Inventory of Low Head Electricity Sites*, Tudor Engineering, San Francisco, 1980. *National Hydroelectric Power Resources Study*, US Army Corps of Engineers, Portland, 1981. *Evaluation of Potential for Electric Generation in the Pacific Northwest*, Gershman, B. and Bratton, Inc., Washington, D.C., June, 1983. *Assessment of Biomass Resources for Electric Generation in the Pacific Northwest*, Report prepared for the Northwest Power Planning Council, Washington State Energy Office, Olympia, WA, 1989.

Table H-1. Studies Assessing State Renewable Energy Potential (continued)

State	Study
	1991 Northwest Conservation and Electric Power Plant, Volume II, Part II, Northwest Power Planning Council, Portland, OR.
Illinois	Department of Energy and Natural Resources Study, 1987.
Indiana	None identified.
Iowa	None identified.
Kansas	Studies sponsored by the Kansas Electric Utility Research Program included investigations on wind and solar potential in Kansas.
Kentucky	None identified.
Maine	*Final Report of the Commission on Comprehensive Energy Planning*, May 1992.
Maryland	None identified.
Massachusetts	Salisbury Beach State Reservation; Halibut Point State Park in Rockport; Town of Fairhaven DPW/Wastewater Treatment Plant.
Michigan	*Michigan Electricity Options Study*, 1987.
	ICF CO_2--Photovoltaics, (Draft).
	Michigan State University Wind Studies, 1978-81.
	Michigan Department of Natural Resources Wood Energy Plan, 1986.
	Jordon Energy Institute: Analysis of PV for Lime Island State Park, 1991.
Minnesota	*Minnesota Wind Resource Assessment Program Report #10*, Minnesota Department of Public Service, April, 1991.
Mississippi	None identified.
Missouri	None identified.
Montana	*Montana Wind Energy Atlas*, 1987.

Table H-1. Studies Assessing State Renewable Energy Potential (continued)

State	Study
	Montana Solar Data Manual, 1985.
	Evaluation and Ranking of Geothermal Resources for Electrical Generation or Electrical Offset in Idaho, Montana, Oregon, and Washington, Bonneville Power Administration, 1985.
Nevada	*Capital and Operating Costs for Geothermal Power in Nevada*, Prepared for Sierra Pacific Power Company by GeothermEx, Inc. and The Ben Holt Company, May 1991.
	Geothermal Energy in the Western U.S. and Hawaii: Resources and Projected Electricity Generation Supplies, Energy Information Administration, DOE/EIA-0544, September 1991, Appendix B.
New Hampshire	None identified.
New Jersey	*New Jersey Energy Master Plan*, November 1991.
New Mexico	*New Mexico State Energy Policy*, Energy, Minerals and Natural Resources Department.
New York	*New York State Energy Plan, Biennial Update*, Draft.
	Renewable Technology Assessments on Wind Energy, Wood Energy, and Photovoltaics, New York State Energy Research and Development Authority.
	Upcoming report by NYSEO on the need for, and environmental effects of, "HydroQuebec," Canadian hydropower, including New York State alternatives.
North Carolina	None identified.
North Dakota	Department of Energy study of wind energy potential for each of the 50 states (Pacific Northwest Laboratories report).
Ohio	*Ohio Biomass for Energy Annual Potential by County.* Ohio State University. Columbus, OH: OSU, April 1982.
Oregon	*Oregon Department of Energy 4th Biennial Plan.*

Table H-1. Studies Assessing State Renewable Energy Potential (concluded)

State	Study
Pennsylvania	PA Energy Office Study is in progress.
Rhode Island	None identified.
South Carolina	None identified.
South Dakota	WAPA study.
Texas	None identified.
Utah	Utah Division of Energy Studies: Biomass, funded by the Western Regional Biomass Energy Program (WERBEP); Wind, in conjunction with WAPA. Utah Geological Survey Study: Low Temperature Geothermal.
Vermont	None identified.
Virginia	*Virginia Energy Patterns and Trends. Virginia Energy Profiles: 1960 to 1990.* Virginia Department of Mines, Minerals, and Energy. Division of Energy. 1991.
Washington	None identified.
West Virginia	None identified.
Wisconsin	*Advance Plan 6 - Technical Support Documents D17-D21* - Commission requires utilities to conduct studies of long-range potential for and cost of renewable energy. D17 - Wind; D18 - Photovoltaics; D19 - Small hydro; D20 -Wood/Wood Waste; D21 - Solid Waste-to-Energy.
Wyoming	U.S. Windpower studies.

APPENDIX I

RENEWABLE ENERGY DEVELOPMENT OBSTACLES BY TECHNOLOGY

Table I-1. Hydropower

Development Obstacle	Number of Respondents
Environmental Issues	22
Resources Fully Developed	18
Inadequate Resources	14
Other*	9
Too Costly	8
Transmission Constraints	5
Institutional Resistance	5
Utility Reluctance	4
Operational Issues	4
Lack of Information	3
Immature Technology	0
Unreliable Technology	0

* Included are Federal Energy Regulatory Commission relicensing, current over-capacity, public unacceptance, inadequate financial resources, inadequate sites, no sources, and permitting issues.

Table I-2. Wood

Development Obstacle	Number of Respondents
Environmental Issues	20
Inadequate Resources	15
Too Costly	14
Operational Issues	9
Other*	8
Utility Reluctance	6
Institutional Resistance	5
Lack of Information	4
Resources Fully Developed	3
Transmission Constraints	2
Unreliable Technology	2
Immature Technology	1

* Included are volatility of industrial waste wood supply, wood waste used by NUGs, financing, other uses for wood, air quality concerns, and safety.

Table I-3. Municipal Solid Waste

Development Obstacle	Number of Respondents
Environmental Issues	26
Too Costly	15
Operational Issues	14
Institutional Resistance	8
Lack of Information	8
Utility Reluctance	6
Other*	6
Immature Technology	6
Resources Fully Developed	4
Inadequate Resources	3
Transmission Constraints	1
Unreliable Technology	1

* Included are financing, fuel quality problems, and recycling, a low-cost alternative.

Table I-4. Geothermal

Development Obstacle	Number of Respondents
Inadequate Resources	28
Other*	8
Too Costly	7
Environmental Issues	4
Transmission Constraints	4
Utility Reluctance	4
Lack of Information	4
Immature Technology	2
Operational Issues	2
Institutional Resistance	2
Unreliable Technology	1
Resources Fully Developed	0

* Included are financing, no source, efficiency problems; more R&D is needed; tax structure does not encourage investment in renewable energy; pricing structure for energy does not account for externalities; and there is a lack of incentives for utilities to invest (both financial and regulatory).

Table I-5. Wind

Development Obstacle	Number of Respondents
Too Costly	20
Inadequate Resources	16
Utility Reluctance	13
Other*	11
Operational Issues	10
Lack of Information	9
Immature Technology	8
Environmental Issues	7
Transmission Constraints	7
Institutional Reluctance	6
Unreliable Technology	6
Resources Fully Developed	0

* Included are inaccessible sites, no source, financing, geographic limits, R&D needed, best sites are far from need, quality of power, space restrictions, output hard to forecast, tax structure does not encourage investment in renewable energy, pricing structure for energy does not account for externalities, and there is a lack of incentives for utilities to invest (both financial and regulatory).

Table I-6. Photovoltaics

Development Obstacle	Number of Respondents
Too Costly	32
Immature Technology	21
Utility Reluctance	14
Lack of Information	13
Other*	8
Inadequate Resources	8
Operational Issues	6
Institutional Resistance	5
Unreliable Technology	3
Transmission Constraints	3
Environmental Issues	0
Resources Fully Developed	0

* Included are cost, financing, for remote installations due to cost, PV planning at inappropriate scale and quality, R&D is needed, tax structure does not encourage investment in renewable energy, pricing structure for energy does not account for externalities, and there is a lack of incentives for utilities to invest (both financial and regulatory).

Table I-7. Solar Thermal Electric

Development Obstacle	Number of Respondents
Too Costly	26
Inadequate Resources	18
Immature Technology	14
Utility Reluctance	10
Other*	8
Lack of Information	7
Operational Issues	5
Transmission Constraints	4
Unreliable Technology	4
Institutional Resistance	3
Environmental Issues	2
Resources Fully Developed	1

* Included are cost, efficiency problems, limited applications, R&D is needed, financing, tax structure does not encourage investment in renewable energy, pricing structure for energy does not account for externalities, and there is a lack of incentives for utilities to invest (both financial and regulatory).

Table I-8. Other Solar/Renewables

Development Obstacle	Number of Respondents
Too Costly	15
Lack of Information	12
Utility Reluctance	9
Immature Technology	9
Institutional Resistance	5
Other*	4
Inadequate Resources	3
Operational Issues	3
Unreliable Technology	3
Transmission Constraints	1
Environmental Issues	1
Resources Fully Developed	0

* Included are limited resources; tax structure does not encourage investment in renewable energy, pricing structure for energy does not account for externalities, and there is a lack of incentives for utilities to invest (both financial and regulatory).

APPENDIX J

STATE RENEWABLE ENERGY POLICIES

(Contains only policies reported by respondents)

Table J-1. State Renewable Energy Policies

State	Renewable Energy Policy
Alabama	Solar tax credits (now expired).
Alaska	Article 5 - Power Project Fund. This fund provides for loans to pay the costs of: A. Reconnaissance studies, feasibility studies, license and permit applications, preconstruction engineering, and design of power projects; B. Constructing, equipping, modifying, improving, and expanding small-scale power production facilities, conservation facilities, bulk fuel storage facilities, and transmission and distribution facilities, including energy production, transmission and distribution, and waste energy conservation facilities that depend on fossil fuel, wind power, tidal, geothermal, biomass, hydroelectric, solar or other non-nuclear energy sources.
Arizona	Decision 57589, Docket U-0000-90-088, ordered: 1. Solar thermal plants must be included as a possible alternative for the future construction of intermediate and peaking power plants. 2. Utilities shall provide information to potential line extension customers in remote areas based on staff guidelines regarding possible use of stand-alone photovoltaics that are cost competitive. 3. One utility to study the cost-effectiveness of using photovoltaics in transmission and distribution systems.
Arkansas	Energy Conservation Endorsement Act, which states, "It shall be considered a proper and essential function of public utilities regulated by the Arkansas Public Service Commission to engage in energy conservation programs, projects, and practices which conserve, as well as distribute, electrical energy and supplies of natural gas, oil, and other fuels." Energy conservation programs are defined, in part, as "programs which encourage the use of renewable energy technologies or sources, including solar energy, wind power, geothermal energy, biomass conversion, or the energy available from municipal, industrial, silvicultural, or agricultural wastes."

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
California	Public Utility Code 701.1 - One of the stated purposes of the code is "that a principal goal of electric and natural gas utilities' resource planning and investment shall be to encourage the diversity of energy sources through improvements in energy efficiency and development of renewable energy resources, such as wind, solar, and geothermal energy." It further states, "in calculating the cost effectiveness of energy resources...the commission shall include a value for any costs and benefits to the environment, including air quality." Order Instituting Rulemaking No. 2 (OIR2), initiated in 1980, established standards governing the prices, terms, and conditions of electric utility purchases from cogenerators and small power facilities as defined under PURPA. Decision 91-06-022 made several changes to the final Standard Offer 4, including incorporating the consideration of nonprice factors such as environmental impacts, in determining appropriate levels of QF development. Decision 92-04-045, which mandates a 50% renewables set-aside to meet new electric generating needs.
Colorado	Public Utility Commission line extension rule (31) requires utilities to provide comparative costs between photovoltaics and line extensions, under certain conditions. Colorado Office of Energy Conservation's Renewable Energy Program, which has a current focus on: implementation of photovoltaics for small, remote loads through education and demonstration, and maintenance of existing solar space and water systems through surveys, inspections, publications, and education. CRS 38-30-168 prohibits covenants or other restrictions on solar energy devices. Western Area Power Administration requires customers who purchase long-term firm power to develop a conservation and renewable energy program (Title II of the Hoover Power Act).

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
Connecticut	Contract Procedures for Private Power Producers and Providers - Purpose is to stimulate the production and provision of private power by encouraging least-cost supply alternatives and to integrate the availability of resources from private power producers and providers into the overall utility planning process.
Delaware	No policies reported.
District of Columbia	No policies reported.
Florida	Florida Statute 366.81 states, in part, "Since solutions to our energy problems are complex, the Legislature intends that the use of solar energy, renewable energy sources, highly efficient systems, cogeneration, and load-control systems be encouraged."
Georgia	No policies reported but incentives under consideration.
Hawaii	Revised Statutes 269-27.2, with a stated "long term goal of encouraging, to the greatest extent practicable, the development of alternative sources of energy." In determining utility payments for nonfossil fuel generated electricity, the Commission shall consider "the minimum floor a utility should pay." The statute furthers states that "payments made by the public utility to the nonfossil fuel producers for firm capacity shall be recovered by the public utility through an interim increase in rates."
Idaho	No policies reported.
Illinois	State Public Utilities Act of 1987 is a state policy to "encourage the development of alternative energy production facilities for the disposal of solid waste in order to conserve our energy resources and to provide for their most efficient use." The act was amended to offer higher than avoided cost payments to waste-to-energy projects and to provide utilities with restitution through tax credits for the amount of payment above avoided costs plus operational costs (i.e., redispatch and transmission costs, etc.).
Indiana	No specific policies, however, I.C. 8-1-8.5 requires utilities to evaluate a range of resource options, both supply-side and demand-side, before the commission will approve the building of a new generation facility.

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
Iowa	Public Utility Regulation 476.43 states that "rates for electricity purchased... from alternative energy production facilities or small hydro facilities located in the utility's service area...shall be established at levels sufficient to stimulate development of alternate energy production and small hydro facilities." IAC 199-15 states that each utility can purchase up to 15 MW from a qualifying facility (QF) in a given year. Under Board rules, a QF can sign a long-term contract for a maximum term of 33 years. The capacity rate varies with the length of the contract, up to a maximum of 3.44¢/kWh. The energy rate, currently at 2.57¢/kWh, does not vary. The maximum combined capacity/energy payment is 6.01¢/kWh.
Kansas	Statute 66-117 states that the commission may allow a return on investment to utilities investing in projects or systems reasonably expected to produce energy from a renewable resource other than nuclear equal to an increment of from 1/2% to 2% plus an amount equal to the rate of return fixed for the utility's other investments approved by the commission.
Kentucky	No specific regulatory policies, however, the Commission Integrated Resource Planning regulation (807KAR5:058) requires utilities to *consider* renewable resources in their resource assessment and acquisition plan.
Maine	The Maine Energy Policy Act of 1988 requires utilities to give preference to conservation and demand-side management and then to power purchased from qualifying facilities "when choosing among equivalent resources." It also includes comprehensive least-cost planning requirements. The Electric Rate Reform Act (1977), Statute 3152, is legislation encouraging the commission to set electric rates to promote the maximum efficient utilization of natural energy resources existing in the state in order to promote the use of indigenous energy resources to the extent that this will reduce overall electric costs. Regulatory rules and policies encouraging competitive, all-source bidding.

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
Maryland	No policies reported.
Massachusetts	State income tax credit for individuals who install solar or wind-powered systems in their residences. State sales tax exemption for sales of residential solar, wind, or heat pump systems used as a primary or auxiliary power system to principal residence. Exemption from local property tax for a period of twenty years for the installation of solar or wind-powered systems heating or otherwise supplying the energy needs of a residence or business. Energy systems installed on business property subject to state excise tax will be exempt from tax for the length of its depreciation period. Business purchasing qualifying solar or wind-powered "climatic control unit" or "water heating unit" may deduct from its income for state tax purposes any costs incurred for the installation of the unit. Residents holding patents for alternative energy or energy conservation system or device may petition the Commissioner of Energy Resources for a determination on the system or device. If the commissioner determines it is "...of economic value, practicable, and necessary for the convenience and welfare of the Commonwealth" then any income received from the device is exempt from state personal income tax or corporate excise tax for five years. Hydropower facilities that commenced construction after January 1, 1979, are exempt from local property tax for twenty years. The owners, however, must agree to pay the host community at least 5% of the gross income of the facility for the preceding calendar year. The commission issued rules governing the sale of electricity by small power producers and cogenerators to utilities that included a provision for the valuation of environmental externalities and how they should be included in the resource bidding process.

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
Michigan	Public Act 323 of 1990, amending Public Act 2 of 1989, allows public utilities with more than 500,000 customers to enter power purchase agreements for capacity and energy from resource recovery facilities that process solid waste. Each eligible utility can purchase up to 120 MW of capacity and energy. Michigan renewable resource income tax credits are provided to qualifying individuals for solar, wind, or water energy conversion equipment.
Minnesota	The Omnibus Energy Bill of 1991 states, "the Commission shall require at least one public utility to establish a pilot program to make investments in and expenditures for energy from renewable resources such as solar, wind, or biomass...." Minnesota PURPA law requires utilities to purchase electric power from small power producers with less than 40 kW capacity at average retail rates. Wind machines and solar electric installations installed after January 1, 1992, are exempt from both property tax and sales tax.
Mississippi	No policies reported but State Energy Plan includes recommendations to survey those industrial streams of biomass waste or scrap by-products that could be cost-effective fuels.
Missouri	No policies reported but tax credits being considered.
Montana	No policies reported.
Nevada	Final Rule for Docket 89-752 (January 22, 1991) reads, in part, "The environmental costs to the state associated with operating and maintaining a (resource) plan for supply or demand must be quantified for air emissions, water and land use." (Section 7).
New Hampshire	Least-cost planning order (DE 90-072, p. 15) states that "...the Commission's policy preference for QFs using renewable and indigenous fuels, including municipal solid waste, and cogeneration based on existing industrial use of fossil fuels, over technologies that increase the dependence of New Hampshire on fossil fuels."

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
New Jersey	Solar energy equipment is exempt from the 7% state sales tax. Municipal solid waste is exempt from the first three years of bidding (instituted in 1988). The New Jersey Energy Plan includes policies to: encourage the use of cost-effective passive solar energy; work aggressively to develop methane recovery systems because of their potential to produce energy and reduce methane releases; encourage private sector development of photovoltaic projects. The plan also directs the Department of Community Affairs to consider the promulgation of technical specifications for the installation of solar domestic hot water systems.
New Mexico	NMPSC Rule 420 - stated purpose is to assure that utilities identify viable alternatives available to them, including energy conservation. Energy conservation is defined, in part, as the promotion and development of alternative renewable energy resources. Tax credits for solar applications from 1981-1989.
New York	NY State Energy Plan includes, as one of its goals, the establishment of a program to procure 300 MW of new capacity from renewables by January 1, 1994 (to be in-service by 1998), assuming that such capacity can be obtained at an acceptable price premium. In supply-side bidding, renewables receive full "environmental credit" and have, on occasion, received special credits in bidding situations. 15-year Real Property Tax Credit for solar and wind systems installed from 1978 through 1988. NY Supplemental Federal Tax Credits for solar and wind installations offered from 1978 through 1986.
North Carolina	No policies reported.
North Dakota	Recently established net energy billing for small QFs on investor-owned utility systems.

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
Ohio	Ethanol fuels tax exemption for 10% ethanol blended fuels similar to the federal program. The tax exemption represents 1.5 cents per gallon of ethanol and expires in 1993.
Oklahoma	1992 Oklahoma Renewable Energy Initiative established a temporary tax credit for the purchase of wind and solar equipment. The investment tax credit would be applicable for residential and business property. Wind farms are not eligible for the credit. Commission order 327883 provides for payment of 1.5¢/kWh, up to a maximum of 10,500 kWh for waste-to-energy projects. Policy views municipal solid waste combustion as a necessary alternative to landfills. Electricity is sold to utilities and displaces energy from fossil fuel sources.
Oregon	Pacific Northwest Electric Power Planning and Conservation Act mandates that renewable energy resources be given preference over nonrenewable resources. Order 89-507. Least-Cost Planning order, which requires utilities to consider externalities, such as environmental impacts. Order 91-1383. Competitive bidding order, which requires bid evaluation to give specific weights to environmental factors. Also directs each electric utility to obtain at least a portion of its new power resources through the competitive bidding process. Up to $40 million per year of projects can receive a 35% tax credit (mostly conservation and recycling). A tax credit of 50 cents per kWh saved in the first year of operation is available for specific types of residential solar and geothermal (ground source heat pump) projects. Low interest loans for renewable projects (funded with tax-free state bonds).

Table J-1. State Renewable Energy Policies (continued)

State	Renewable Energy Policy
Pennsylvania	The Pennsylvania Energy Development Authority (PEDA) was created to encourage greater development of renewable energy sources and other technologies. PEDA provides grants to entities pursuing energy projects utilizing clean coal technology, energy efficiency, and solar power.
Rhode Island	Tax credits; reversible meters for wind turbines of 25 kvA or less; small power and cogeneration facilities of 5 MW or less receive full avoided cost with standard contract available. Other independent sources must compete with each other and utility-built resources; support of utility R&D on renewables (i.e., photovoltaic); support of New England Electric System's request for proposals for renewables.
South Carolina	No policies reported but Integrated Resource Planning order requires consideration of environmental costs (Order 91-1002).
South Dakota	No policies reported.
Texas	Substantive Rule 23.66 (1) (f) requires that a utility shall purchase capacity from qualifying facilities on the basis of avoided cost adjusted for the quality of firmness of such capacity. If more capacity is offered than needed, purchases will be prioritized such that QFs offering power produced by municipal solid waste or renewable fuel sources shall be purchased first, followed by all other sources. Public Utility Regulatory Act requires commission to encourage qualifying cogenerators and small power producers.
Utah	Energy Saving Systems Tax Credit allows both individuals and businesses to claim tax credits against any income tax liability, provided that the alternative energy system meets stated rule requirements. *Draft* IRP guidelines require consideration of environmental externalities and attendant costs be included in IRP analysis. This may affect ranking of resource alternatives. IRP must evaluate supply-side and demand-side resources on a consistent and comparable basis.

Table J-1. State Renewable Energy Policies (concluded)

State	Renewable Energy Policy
Vermont	Board Rule 4.100 - Purpose is to encourage development of electricity through use of biomass, other renewable resources, waste, and cogeneration. Offers levelized rates (up to 30 years) for small power renewable producers (80 MW maximum) and for cogenerators.
Virginia	No policies reported.
Washington	Utilities and Transportation Commission ruling that renewable electricity supply projects receive a 10% price advantage over other resource projects in competitive bidding. This advantage is used for *ranking purposes only.*
West Virginia	No policies reported.
Wisconsin	Advance Plan Orders 1 (1978) through 6 (1991) requirements describe numerous actions taken by the commission on renewable energy. Recently adopted programs include net energy billing; standard long-term levelized contracts; wind farm implementation plan; utility testing of state-of-the-art wind machine; and, incentive programs for utilities and NUGs to develop renewable energy.
Wyoming	No policies reported.