THE PROCESS OF INTEGRATED RESOURCE PLANNING FOR ELECTRIC UTILITIES

Martin Schweitzer and Eric Hirst, Oak Ridge National Laboratory
Evelin Yourstone, Consultant

This paper identifies six key issues in utility integrated resource planning that are expected to influence a plan's societal value and discusses the first four, which are related to the planning *process*. They are: (1) the relative emphasis placed on supply- and demand-side resources throughout the planning process; (2) the breadth of inputs considered during plan preparation from various in-house departments and non-utility interests; (3) the criteria used to select options for resource plans; and (4) the uncertainty analyses used and their application to the resource selection process.

A number of opportunities exist for utilities and their regulators to improve the planning process in order to increase the value of the resource plans that are produced. Specifically, utilities and/or their state regulatory agencies can: (1) conduct comprehensive assessments of demand-side management (DSM) resources, avoid unduly restrictive screening methods, and expand data collection efforts concerning current energy-use patterns and existing DSM program performance; (2) increase the involvement of regulators and other interested non-utility parties in the resource planning process through mechanisms such as public meetings and the establishment of technical advisory boards; (3) when evaluating the cost-effectiveness of potential demand-side resources, use the Total Resource Cost Test or Societal Test instead of the more restrictive Ratepayer Impact Test, consider the environmental effects of the resources considered, and examine the effects of the entire mix of resource selection criteria used; and (4) focus uncertainty analysis on key uncertainties over the short-term time horizon and make sure that the results of this analysis are used in resource selection.

INTRODUCTION

Resource planning of various types has been performed by electric utilities for years. Recently, however, many utilities, often with the encouragement of their state public utility commission, have begun preparing least-cost plans. These documents differ from earlier resource plans in a number of ways, but perhaps most notable is their increased attention to demand-side (conservation and load management) programs. This paper presents findings from a study performed by Oak Ridge National Laboratory (ORNL) in which the least-cost plans and planning processes of 29 utilities and five nonutility government agencies (four state and one federal) throughout the United States were examined (Figure 1).

Key Issues

Through this study, ORNL researchers identified six key issues that are expected to be important in determining the societal value of a resource plan. The value of a plan is defined as its ability to guide utility actions so as to maximize benefits and minimize burdens for users of electricity and all those

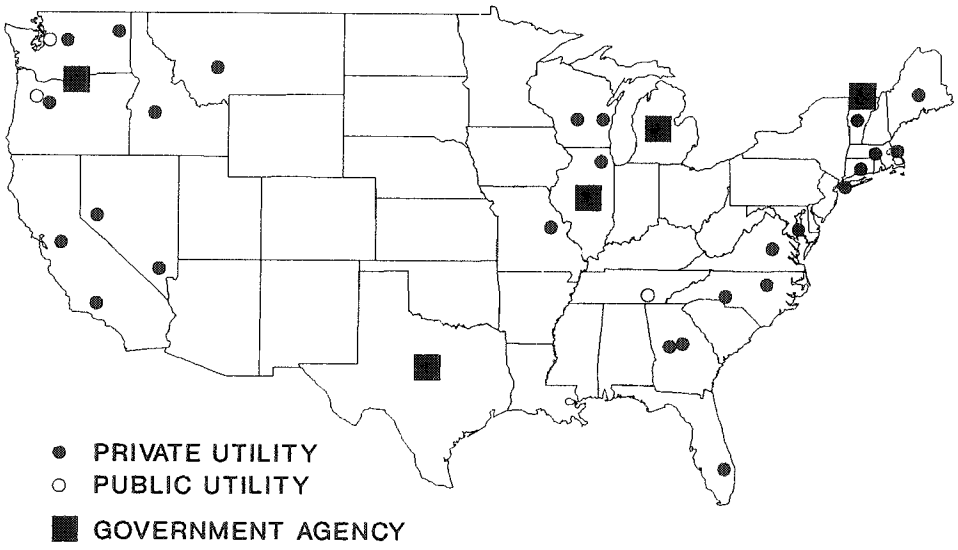

Figure 1. Location of Utilities and Government Agencies Providing Resource Plans and Related Documents for This Study

affected by its use. A plan's benefits include its ability to minimize total costs for present and future ratepayers and assure long-term availability of affordable electricity for all customers. Burdens to be avoided include excessive dependence on unstable resources and adverse effects on the natural environment.

The six key issues identified by ORNL researchers as likely to influence a plan's value are: (1) the relative emphasis placed on supply- and demand-side (DSM) resources throughout the planning process; (2) the breadth of inputs considered during plan preparation from various in-house departments as well as from outside interests; (3) the criteria used to select resource options for the plan; (4) the uncertainty analyses used to ensure that those options chosen will be appropriate for alternative futures; (5) the relationship between the long-term plan and action plans, or other short-term documents, that specify utility acquisitions; and (6) the balance between short- and long-term interests represented by the resource mix selected. These six issues are important determinants of a plan's value because of the opportunities offered for the consideration and balance of all major resource options and societal interests. The first four of these issues are primarily concerned with the *process* by which plans are prepared, which is the focus of this paper. The last two issues are more closely tied to plan contents. All six issues, along with substantially more detail on the plans reviewed and the methods by which they were prepared, are discussed in Schweitzer, Yourstone, and Hirst (1990).

METHODOLOGY

The 34 utilities and government agencies examined in this study were selected based on their reputation for competent least-cost planning among other utilities and researchers in this field. As shown in Figure 1, this process resulted in the selection of many subjects along the east and west coasts, with most of the remainder from the Great Lakes Region. This distribution accurately represents the current state of least-cost utility planning nationwide. A recent study by Mitchell and Wellinghoff (1989) ranked all 50 states in terms of their least-cost planning and found only 10 to have adopted and implemented "a full featured LCUP regulatory framework." Nine of these 10 states are represented in our sample. Our sample also includes eight of the ten utilities contained in another recent study (Donovan and Germer 1989) of the "latest practical planning methodologies."

Nearly all of the utilities studied were privately owned (26 of the 29), while four of the five government agencies were states. For all 34 subjects, least-cost plans and/or related documents were obtained and reviewed in detail. In addition, on-site interviews with staff from planning departments were conducted at six utilities. These utilities were selected because of their reputation as exemplary planners and because ORNL staff had previous contacts with key utility personnel from an earlier study. Finally, telephone interviews were conducted with a key planning staff member at each of 11 additional utilities and one government agency. These subjects were selected to achieve, in combination with the six case study sites, a balanced mix representing the larger sample in terms of geographic region, ownership (public/private), and location (urban/rural). Several utilities also were selected because a prior review had shown them to have a particularly interesting plan or planning process.

The review of plans and planning documents provided detailed information on the products generated by utilities and government agencies and some description of the planning process. The site visits and telephone interviews provided much additional data on the process by which resource plans are developed. In the following sections, information about a specific utility that is not followed by a citation indicates that the data come from a personal or telephone interview.

THE PLANNING PROCESS

Unless otherwise specified, the processes described in this section are those used to produce *long-term* resource plans. Long-term plans are emphasized for two reasons. First, action plans or other short-term planning documents, like budgets, often follow from long-term plans, meaning that much of the analysis and interaction that go into a short-term plan are actually performed during the long-term planning process. Second, much less descriptive information is provided in resource plans and related documents on the preparation of short-term plans than is presented on the long-term planning process.

Plan Development Procedures

Key Steps in Plan Development. While most utilities add their own unique touch to the plan development process, there are a number of common steps that are used by most of the utilities studied: (1) development of a load forecast or forecasts; (2) inventory of existing resources; (3) identification of future electricity needs that will not be met by existing resources; (4) identification of potential resource options; (5) screening of options to identify those that are feasible and economic; (6) performance of uncertainty analysis; and (7) selection of a preferred mix of resources. These elements were not used in *all* of the plans studied nor, where present, were they always used in the order listed here. Nevertheless, the majority of resource plans were developed through some combination of the above steps.

Uncertainty Analysis. Past experience in the electric utility industry has shown the future to be volatile and difficult to predict. Because of the potentially devastating results of committing resources to meet future conditions that do not materialize, the utility industry now avoids plans that are based on single, point predictions of future load growth or other key features of the electric system. Instead, alternative futures are explored, and resource options are selected that have the potential to meet a number of possible futures or that can be readily adapted in response to changing conditions.

Table 1 (Hirst and Schweitzer 1988) shows four basic methods used to treat uncertainty, and the frequency of their use by the utilities and government agencies studied. Sensitivity analysis is the most favored method, being used nearly three times as much as its closest competitors. Those factors most often considered in sensitivity analysis are load growth, fuel prices, economic conditions, capital costs of generating facilities, and customer response to demand side programs. The lesser popularity of the other three methods may be due to the greater difficulty or complexity required to apply them. In several cases, more than one of the above

Table 1. Analytical Techniques Used to Treat Uncertainty[a]

Sensitivity analysis (17)	Preferred plan (combination of options) is first identified. Key factors are then varied to see how the plan responds to these variations.
Scenario analysis (6)	Alternative, internally consistent, futures are first constructed and then resource options are identified to meet each future. Best options can then be combined into a unified plan.
Portfolio analysis (6)	Multiple plans are developed, each of which meets different corporate goals. Often, these plans are then subjected to sensitivity analysis.
Probabilistic analysis (5)	Probabilities are assigned to different values of key uncertain variables, and outcomes are identified that are associated with the different values of the key factors in combination. Results include the expected outcome and cumulative probability distribution for key factors, such as electricity price and revenue requirements.

(a) Numbers in parentheses indicate the number of utilities from this study that utilize that technique. Information comes from 23 utilities and 2 state agencies; total exceeds 25 because many plans were prepared using more than one uncertainty analysis technique.

Source: Hirst and Schweitzer 1988.

techniques were used together in the preparation of a resource plan. Potomac Electric Power (1987), for instance, used portfolio and sensitivity analysis, while New England Electric (1988) used both sensitivity and probabilistic analysis techniques.

The utilities studied vary substantially in the importance they place on the results of their uncertainty analysis. Some utilities select resources for a long-term plan with scant consideration of the results of the uncertainty analysis that was performed. In contrast, other utilities attribute substantial importance to the results of this analysis when selecting resource options. Carolina Power and Light (1988), for instance, developed a number of candidate plans and then selected the best all-around approach based on the results of its probabilistic analysis.

Key Parties Involved in Plan Preparation

Utility Staff. Resource planning generally involves an interdepartmental effort, most frequently involving staff from supply-side planning and demand-side planning departments. Some utilities also use staff from load forecasting, financial planning, and marketing departments, or from a department specifically charged with resource planning (often focusing on supply-side resources or the integration of different resource options). Despite this multi-department involvement, and the occasional involvement of outside consultants, most utilities have a single department that is responsible for organizing and coordinating the planning effort. However, this lead department varies considerably among the utilities polled. Many utilities, including Sierra Pacific Power, Montana Power, and Idaho

Power, assign primary responsibility for long-term planning to their resource planning department. Supply-side and demand-side planning departments (among others) were also mentioned, but much less frequently. In a few cases, oversight of the planning process is provided not by a single department, but rather by an individual or an ad hoc group. An example of the latter situation is provided by Duke Power (1989), where planning is performed by a DSM team, a supply-side team, and an integration team, with the integration team responsible for coordinating the work of all participants.

Utility Management. While top utility management generally are not involved with day-to-day planning operations, they frequently play a key role at strategic points in the resource planning process. Almost all the utilities interviewed mention that senior management give final approval to the resource plan, and often periodically review the plan during its preparation. More specifically, many utilities describe a "senior management committee" or "executive committee" that reviews key planning assumptions (e.g., load growth rates, fuel prices), examines controversial issues (like the development of coal plants in the Northwest Power Planning Council's service area) and, in general, provides policy direction. These committees are typically composed of senior vice presidents from key departments and the company president. For example, Georgia Power Company's Management Council is composed of executive vice presidents from Power Generation and Administration, Marketing, External Affairs, and Finance, plus the president.

Non-Utility Interests. Nearly all of the utilities interviewed conducted some type of public involvement program. Public utility commission (PUC) staff are involved most frequently, followed by state energy office personnel. Residential and small commercial customers, conservation groups and other intervenors, large commercial and industrial customers, and outside experts were also mentioned as taking part in the planning process, but less frequently.

Several different institutional arrangements have been used to involve the public in resource planning. For those utilities providing data on this subject, by far the most widely used public involvement mechanism is the advisory group or task force, which was used by over half the utilities polled. An example of such an arrangement is the Electric Least-Cost Planning Working Group that was formed to allow interested parties to provide input into Potomac Electric Power's 1990 resource plan during its development. Other mechanisms for gaining public involvement, each used by about one third as many utilities as used an advisory group, are surveys, focus groups, and workshops. Often, surveys and focus groups are used to solicit input from residential and small commercial customers on specific demand-side programs rather than on the entire resource plan.

Interactions Among Key Parties. The ultimate task of the department or committee with primary responsibility for plan preparation is to develop a complete resource plan and get it officially approved by top management. To do this, information and ideas must be solicited and integrated, often over a period of many months, from those departments charged with forecasting and planning, those departments involved in system operations, and those key management officials with responsibility for setting policy directions and approving major acquisitions.

In addition to interactions among key actors *within* utilities, the manner in which utilities interact with non-utility interests can be very important. The amount of interaction between utilities and other interested parties varied widely among the organizations studied. On one end of the scale is the collaborative planning effort run by Northeast Utilities, in which the utility worked closely with the Conservation Law Foundation of New England and other potential intervenors under binding agreements to produce a mutually acceptable DSM plan that is different from what the utility would have produced if it had acted alone (Ellis 1989). Similar collaborative efforts are being undertaken by a number of other New England utilities. On the other end of the scale are utilities with little or no formal mechanism for receiving public input prior to PUC review of their plan.

The development of short-term plans, whereby specific steps are identified to allow implementation of

preferred actions during the next two to five years, often involves less interaction with non-utility interests. This is particularly true where there is no formal action plan and the short-term plan consists of budgets or similar internal documents, and where action-oriented collaborative planning procedures are not in place. Within the utility, operating departments assume a key role in identifying the specific steps and associated costs necessary to build, buy, or otherwise acquire resources. These suggested actions must then be reviewed, revised if necessary, and approved by utility management.

Integration of Supply and Demand-Side Resources

The opportunity to effectively integrate supply- and demand-side resources begins with data collection. If one class of resources is more familiar to resource planners than are other types of resource, the resulting plan is likely to be skewed in the direction of the known, rather than the unfamiliar. Achieving equality among resources in the area of data collection can encourage a more balanced treatment in subsequent stages of the planning process.

When screening resource options, most utilities exclude certain options entirely, due to lack of familiarity or implicit judgments regarding cost or feasibility. Then, utilities rank the remaining options based on their costs and, in some cases, on other characteristics as well, such as technical feasibility, customer acceptance, environmental impact, and effect on load factor. Equal treatment of supply- and demand-side options requires that a full range of reasonable options of both types be considered. If one type of resource is disproportionately eliminated before the comparison with other options takes place, a balanced integration of resources cannot occur. Also, if the estimated costs attributed to one set of resources are systematically high (or low), an optimum mix of resources will not be selected. Once the initial elimination of options is completed, most of the utilities interviewed seem to use the same criteria to screen supply-side and DSM options. In several cases, however, demand-side resources were subjected to different economic tests, such as the examination of their effect on non-participants. Such a test could not be applied to supply-side options, since all customers are considered participants in these programs.

Those resource options that survive the screening process are subjected to further analysis, culminating in the selection of options for the long-term plan. The order in which different types of options are analyzed fell into three distinct categories for the utilities studied. Of the 27 organizations providing data on this subject, 15 considered supply- and demand-side resources at the same time. Central Maine Power, for example, developed an optimal supply-and demand-side plan with a linear programming model. Simultaneous consideration of supply and DSM resources provides a direct comparison of different types of options, and allows all analyses, including examination of the effects of alternative futures on resource effectiveness, to be performed on all the options. In seven cases, demand-side resources were selected first, and the amount of electricity to be saved through these options was subtracted from projected load. The remaining need for power was then met with supply-side resources; subsequent analyses did *not* consider demand-side options. Georgia Power (1988) and Virginia Electric Power (1988) are two of the utilities that operate in this fashion. In the remaining (5) cases, a base-case supply-side plan was developed initially, and then alternative plans containing DSM options were considered as substitutions for the base-case. Northeast Utilities (1989) followed this model, developing a supply-side "reference" plan, followed by the creation of a number of alternative plans tailored to different "themes," such as reducing oil dependence and capturing lost opportunities. This study did not reveal any relationship between the method of integration used and the importance of DSM options to the overall resource mix that was selected.

For a utility's planning process to be truly integrated, equal treatment of supply- and demand-side resources must apply not only to the selection of options for the long-term plan, but also to the design of the action plan or other short-term document. If one type of resource is systematically excluded or minimized in the short-term plan, the final result of the planning process will be skewed. Finally, an integrated planning process requires that, once programs are adopted and implemented, supply- and demand-side programs be evaluated with equal rigor, so that sufficient data will be

available for selecting among all available options when preparing the next resource plan.

Resource Selection Criteria

Most of the utilities and government agencies studied use more than one criterion to select options for their resource plans, reflecting the fact that resource plans often are designed to meet multiple organizational objectives. Despite the variety of criteria used, however, there are some marked areas of agreement. All the utilities and practically all of the government agencies use cost as a key factor in comparing the desirability of potential resource options. A substantial number also consider an option's environmental consequences (Montana Power 1988, Pacific Power and Utah Power 1989), flexibility (Southern California Edison 1989, Union Electric 1988), reliability (Nevada Power 1988, Southern Electric 1989), and effects on electricity rates (Northeast Utilities 1989, Wisconsin Electric Power 1989). It is likely that many more utilities use these non-cost criteria, particularly rates and flexibility, than indicated by this study, because these considerations are often an *implicit* part of the decision-making process. Also, an increasing number of PUCs (e.g., New York) require the consideration of environmental effects in resource planning. Many of the remaining factors (e.g., diversity, financial health of utility) are closely related to the more widely used criteria. An interesting way of classifying the different selection criteria is provided by Boston Edison, which distinguishes between *externalities*, such as environmental concerns, and *internalities*, which include factors such as security, flexibility, and site availability. The use of multiple selection criteria allows the satisfaction of different objectives and offers the opportunity to serve a variety of societal interests.

The non-economic criteria listed above are generally used to evaluate all types of resource options. Costs, however, are sometimes evaluated differently for supply- and demand-side resources. More important than the fact that different economic criteria may be used for different types of resources is the fact that different DSM tests can result in markedly different conclusions concerning the desirability of any given demand-side option. The *Participant Test*, as the name implies, looks at DSM options from the perspective of those customers that participate in these programs, comparing the direct costs and value received by these customers. The *Ratepayer Impact Test* (also known as the *Nonparticipants* or *No Losers Test*) is relatively restrictive, finding DSM programs to be cost-effective only if they do not result in the need for increased electricity rates, which would result in negative impacts for nonparticipants. The *Total Resource Cost Test* (or *All Ratepayers Test*) looks at total costs and benefits, independent of their allocation to utilities, participants, or nonparticipants. Accordingly, DSM programs that would not be considered cost-effective under the Ratepayer Impact Test might be accepted using the Total Resource Cost Test. The *Societal Test* is very similar to the Total Resource Cost Test, except that it considers externalities (e.g., acid rain). Finally, the *Utility Cost Test* (or *Utility Revenue Requirements Test*) focuses on the difference between utility avoided costs and the costs involved in program implementation (California PUC and Energy Commission 1987; NARUC 1988).

Among the utilities interviewed, the two most commonly used cost-effectiveness tests for demand side options were the Total Resource Cost Test and the Ratepayer Impact Test. As described above, whether or not a given demand-side option is found to be cost-effective could depend on which of these tests is used. It is important for utilities and regulators to understand the potential biases inherent in each of the available cost-effectiveness tests, and to carefully consider the effects of these tests on the resource mix selected as well as on realizing the broader goals and objectives of the appropriate utilities and regulatory agencies. A discussion of the policy implications of using the various cost-effectiveness tests is provided in the NARUC report referenced above (1988).

SUMMARY AND RECOMMENDATIONS

Utility resource planning has changed significantly in recent years. The process has been expanded considerably, with more emphasis placed on preparing for uncertain future conditions, considering criteria other than utility costs when choosing resources, bringing new participants into the planning process, and adding demand-side programs

and alternative energy sources to the traditional mix of supply-side options. Utilities and regulators alike have played active roles in bringing about the substantial changes that have occurred. The findings of this study suggest some ways in which the planning process might continue to be improved to increase the value of the resource plans that are produced. This section summarizes our findings in each of the four key issue areas related to the planning process and recommends further improvements.

Relative Emphasis on Supply- and Demand-Side Options

The relative emphasis placed on supply- and demand-side options during the planning process is expected to have a significant impact on the mix of resources selected for the resource plan. In turn, this mix of resources can have a substantial effect on present and future customers, the natural environment, and other important constituencies. A majority of the utilities and government agencies studied consider both types of options at the same time, comparing one against the other, when selecting resources for the long-term plan. However, such equality of treatment may not apply at other important stages of the planning process, like initial screening of options and evaluation of program performance. The contribution of demand-side programs has increased substantially over time, accounting, on average, for approximately one-fifth of new resources projected for the year 2000. This level of demand-side activity is not uniform across the utility industry, however, with several utilities showing a much smaller role for DSM in their resource plans. This may indicate that, for the industry as a whole, full integration of supply and DSM resources has not yet occurred.

We recommend that utilities conduct comprehensive assessments of the DSM resources in their service area, to identify the full range of current and emerging technologies and their costs (both to the utility and to adopting customers). The screening methods used by utilities should allow some DSM programs and supply options to enter the integration stage even if they appear cost-ineffective at the screening stage. Subsequent uncertainty analysis may render these options attractive. In addition, utilities should expand their efforts to collect data on their customers and how they currently use electricity. Combining this data with data from evaluations of existing DSM programs and market research should lead to designs of effective programs.

Breadth of Inputs Received During Plan Preparation

The broader the range of inputs received during plan preparation from interested parties within and outside the utility, the greater the opportunity for consideration and possible adoption of resource options that serve a variety of interests. Nearly all the utilities studied involve staff from several departments as well as key management personnel in the plan development process. The non-utility interests most frequently represented during plan preparation are PUC staff and state energy offices, and the mechanism most frequently used to gain public input is the advisory group or task force.

Utilities should actively seek the participation of customers and nonutility energy experts during the development of their plan, and inform regulatory staff concerning their progress. This public involvement process could involve public meetings throughout the utility service area, establishment of customer panels, and creation of a technical advisory board. Entry into the type of collaborative process employed by Northeast Utilities and other New England utilities also is worthy of consideration. It is not sufficient, in our view, to allow public comment only after the plan is formally submitted to the PUC.

Criteria Used to Select Resource Options

The criteria used to evaluate available options is likely to influence the contents of the resource plan. Virtually all of the utilities and government agencies in this study evaluated potential options based on their costs to the utility, but most used additional criteria as well. Environmental concerns, flexibility, reliability, and electricity rates were all used by a number of utilities. Consideration of environmental effects may be related to greater use of DSM resources, and utilities employing the Total Resource Cost Test may choose more DSM options than those that evaluate demand-side resources with the Ratepayer Impact (No Losers) Test.

In light of the potential positive effect on the selection of demand-side options, utilities are encouraged to use the Total Resource Cost Test or Societal Test instead of the more restrictive Ratepayer Impact Test and to consider environmental effects of the resources considered. However, it is recognized that utilities, their regulators, and their customers have valid objectives in addition (or even in opposition) to the goal of increasing the use of DSM. All these objectives must be balanced when choosing the entire mix of resource selection criteria to use. Resource plans should clearly show which criteria are used, how they are weighted, and how different resources are ranked according to different criteria.

Use of Uncertainty Analysis

The type of uncertainty analysis technique used during plan preparation, and the way in which the results of this analysis are used, are expected to help determine the nature of the plan that is developed. Virtually all utilities conducted some type of uncertainty analysis. Sensitivity analysis was the most widely used technique, with scenario analysis, portfolio analysis, and probabilistic analysis all having approximately the same number of adherents. The utilities and government agencies studied showed substantial variation in how they performed these analyses and the extent to which the results influenced resource selection decisions.

We believe that uncertainty analysis should be focused more sharply on the decisions that the utility must make during the next two to three years (the time horizon for the short-term plan), emphasizing those factors most likely to have substantial impacts on costs, reliability, and other important criteria used to select the preferred resource portfolio. A two-stage analysis of uncertainty might be worthwhile, with the first stage examining many factors in a search for those that are most important, and the second stage focusing on how these few key factors affect resource decisions. Regardless of the techniques used, uncertainty analysis will have little value unless the results influence resource selection decisions.

As shown above, the process by which a resource plan is developed can have an important influence on the value of the document that is produced. As more attention is paid to this topic, old planning methods will undoubtedly be improved and new ones will be developed. It is hoped that the recommendations made here will stimulate further improvement in utility resource planning and in the actions that result from these endeavors.

REFERENCES

Carolina Power and Light Company. 1988. *Integrated Resource Plan Summary*, Raleigh, North Carolina, December.

California Public Utilities Commission and California Energy Commission. 1987. *Standard Practice Manual, Economic Analysis of Demand-Side Management Programs*, P-400-87-006, San Francisco and Sacramento, California, December.

Donovan, D. J., and M. F. Germer. 1989. "Integrated Utility Resource Planning in Practice." *Public Utilities Fortnightly*, 15-21, August 17.

Duke Power Company. 1989. *Least-Cost Integrated Resource Plan*, Charlotte, North Carolina.

Ellis, W. B. 1989. "The Collaborative Process in Utility Resource Planning." *Public Utilities Fortnightly* 123 (13), 9-12, June 22.

Georgia Power Company. 1988. *Integrated Energy Planning*, Atlanta, Georgia, December.

Hirst, Eric, and M. Schweitzer. 1988. *Uncertainty in Long-Term Resource Planning for Electric Utilities*. ORNL/CON-272, Oak Ridge, Tennessee, December.

Mitchell, C., and J. Wellinghoff. 1989. *Status of Least-Cost Utility Planning in the United States*, Draft, Attorney General's Office of Advocate for Customers of Public Utilities, Carson City, Nevada, October.

Montana Power Company. 1988. *Projection of Electric Loads and Resources, 1988-2011*, Butte, Montana, June.

National Association of Regulatory Utility Commissioners. 1988. *Least-Cost Utility Planning, a Handbook for Utility Commissioners*, Vol. 2, Washington, D.C., December.

Nevada Power Company. 1988. *1988 Resource Plan, 1988-2007*, 8 volumes, Las Vegas, Nevada.

New England Electric System. 1988. *NEESPLAN II: 1989, A Framework for Energy Choices*, 2 volumes, Westborough, Massachusetts, November.

Northeast Utilities. 1989. *The Northeast Utilities System: 1989 Forecast of Loads and Resources for 1989-1998*, Hartford, Connecticut.

Pacific Power and Utah Power Company. 1989. *Planning For Stable Growth: The Pacific Power and Utah Power Resource and Marketing Planning Program*, 2 volumes, Portland, Oregon, November.

Potomac Electric Power Company. 1987. *The 1987 Energy Plan*, 3 volumes, Washington, D.C.

Schweitzer, M., E. Yourstone, and E. Hirst. 1990. *Key Issues in Electric-Utility Integrated Resource Planning: Findings from a Nationwide Study*, ORNL/CON-300, Oak Ridge National Laboratory, Oak Ridge, Tennessee, April.

Southern California Edison Company. 1989. *Least-Cost Resource Planning*, Rosemead, California, March.

Southern Electric System. 1989. *1989 Planning Hearing: Generation Expansion Planning Document*, Atlanta, Georgia.

Union Electric Company. 1988. *Emergency Resource Plan*, St. Louis, Missouri, August.

Wisconsin Electric Power Company. 1989. *Integrated Resource Plan in Support of the Concord Generating Station*, Milwaukee, Wisconsin, May.