UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 4 1980

MEMORANDUM FOR: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

FROM: Robert J. Budnitz, Director
Office of Nuclear Regulatory Research

SUBJECT: RESEARCH INFORMATION LETTER # 87 - "ECONOMETRIC MODEL FOR THE DISAGGREGATION OF STATE-LEVEL ELECTRICITY DEMAND FORECASTS TO THE SERVICE AREA"

Introduction and Summary

This memorandum transmits the results of completed research to develop a modeling capability for independent assessment of need for power estimates for utility service areas as required by NEPA in the licensing process for nuclear power stations. The work was performed by Oak Ridge National Laboratory under the direction of the Environmental Effects Research Branch of the Office of Nuclear Regulatory Research (RES) in response to a request from your office.

The purpose of this research effort was to develop a method for disaggregating state-level electricity demand forecasts to forecasts for utility service areas. Since independent forecasts of electricity demand for individual utility service areas were generally unavailable, it has been customary to use more readily available state or regional level estimates of the future level of electricity demand as a proxy for forecasts of electricity demand for a utility service area. In some instances where the service area generally corresponds to a state or where the service area is similar to the state as a whole, this procedure has been acceptable. However, in many cases the characteristics of a utility service area differ considerably from those of the state as a whole. The objective of this research project was to develop an econometric modeling technique for forecasting utility service area demand using forecasts for state-level demand as a base. The technique could then be applied to particular utility service areas on a case-by-case basis as needs arose in the licensing process.

Methodology

The SLED (State-Level Electricity Demand) Model, developed by Oak Ridge National Laboratories, was used as the base for obtaining projections of state level electricity demand. The SLED model is a three sector (residential, commercial, industrial) modeling system in which demand for electricity is defined as a function of electricity price, prices of alternative fuels, income, number of electricity customers, and heating and cooling degree days in the case of the residential sector; electricity price, prices of alternative fuels, income, population, and heating and cooling degree days in the case of the commercial sector; and value added in manufacturing,

the price of electricity, and prices of alternative fuels in the case of the industrial sector. The model has been used to produce forecasts for 48 states through the year 2000. It has received favorable academic review, and has performed relatively well in limited out-of-sample period forecasting.

For this project an additional model was constructed to explain the share of state-level demand which could be accounted for by a particular utility service area within the state. In this model, the utility service area share of total state demand is a function of differences in levels of independent variables; i.e., income, heating and cooling degree days, etc., between the state and the utility service area, as well as differences in the responsiveness of electricity demand to changes in levels of independent variables (the demand elasticities of the independent variables).

Results

The model was estimated and used to forecast electricity demand for six service areas; Consolidated Edison, Central Hudson Gas and Electric (New York), Commonwealth Edison (Illinois), San Diego Gas and Electric (California), Carolina Power and Light (North Carolina), and Detroit Edison (Michigan) in five states. The estimation period was 1960-1974 for most service areas with annual data being used. The performance of the model using data from the estimation period was good. Root mean squared percentage errors are shown in Table 1; in only 5 out of 18 possible instances do they exceed 1 percent. Results for the residential sectors were much better than those for the commercial or industrial sectors. In no case did the error exceed 1 percent for the residential sector; and for the commercial sector, the maximum error was less than 3 percent. Future work will track the model's performance using data from later periods.

SLED model forecasts for the state as a whole and forecasts given by the disaggregated model for individual utility service areas are given in Table 2. As is evident from the table, for some service areas significant differences in forecasts of annual growth rates of electricity demand exist, while for others little difference is apparent.

Conclusions and Recommendations

As a result of this study, an effective method of disaggregating state-level electricity demand forecasts to utility service area forecasts has been developed. This capability will enable NRC to make an independent evaluation of other forecasts of utility service area electricity demand. We recommend that your staff use this method as part of its assessment of the need for power requirements called for by NEPA as part of the licensing process.

For further information on this study, please contact Dr. Clark Prichard (427-4358).

Robert J. Budnitz, Director
Office of Nuclear Regulatory Research

Enclosures:
1. Table 1
2. Table 2
3. NUREG/CR-1147

Table 1. RMSPE in estimation period (percent)

	Residential	Commercial	Industrial
Consolidated Edison	.66	.83	2.0
Central Hudson	.57	1.57	3.15
Commonwealth Edison	.75	.78	.75
San Diego Gas & Electric	.93	2.79	4.34
Carolina Power & Light	.66	.77	.94
Detroit Edison	.29	.39	.94

Table 2. Forecasted annual growth rates of electricity demand of service areas and their corresponding state for 1974-1990 (percent)

Area	Customer class			
	Residential	Commercial	Industrial	Total
New York State	2.9	5.0	4.2	4.1
Consolidated Edison Co. of New York, Inc.	2.3	4.0	-0.4	3.3
Central Hudson Gas and Electric Corp.	2.4	7.9	2.7	4.1
Illinois	3.0	4.5	3.4	3.6
Commonwealth Edison Co.	2.9	3.6	4.8	3.9
California	4.1	4.9	3.0	4.0
San Diego Gas and Electric Co.	5.4	5.9	0.4	3.9
North Carolina	2.4	2.2	2.9	2.6
Carolina Power and Light Co.	1.7	0.2	4.5	2.9
Michigan	2.3	5.0	4.7	4.0
Detroit Edison	1.7	3.9	5.0	4.0

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