Decisions and Orders Massachusetts Energy Facilities Siting Council

Volume 5

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In the Matter of:

DECISION and ORDER

In the Matter of the Nantucket Electric Company

Petition of the Nantucket Electric Company for Approval of the Third Annual Supplement to its Long Range Electric Forecast (Docket #79-28)

I. Introduction

This decision concerns Nantucket Electric Company's (hereafter Nantucket or Company) third annual supplement to its long range electric forecast submitted pursuant to M.G.L. c. 164, §69I and Chapter G of the EFSC Regulations. The supplement was reviewed by the Council's Staff.

It was suggested that no adjudicatory hearing be held unless so requested by the Company or an interested party as no new facilities within Council jurisdiction were proposed. The Company was so advised and was asked to publish notice of tentative APPROVAL and of the right to a public hearing in local newspapers as well as to post said notice in the Town Hall.

This decision will discuss Nantucket's forecast methodology, demand, supply and conservation. The Council's approval of the present Nantucket supplement is subject to the conditions stated in the Order set out in Section V below. The decision is as follows.

II. Methodology

A. The Council's Review Criteria

A forecast must satisfy the review criteria stated in Rule 62.9(2)(a), (b) and (c) as applied on a case-by-case basis by the Council. These criteria call for the use of accurate and complete historical data as a base for a reasonable statistical projection method.[1] A statistical projection method will be found to be reasonable if it is appropriate, reviewable and reliable.

A methodology is appropriate when it is technically suitable for the size and nature of the particular system. A methodology is reviewable when it has been presented in a manner such that the results can be evaluated and duplicated by another person given the same information. For a methodology to be capable of duplication it must be thoroughly and clearly described in the forecast documentation.[2] A methodology is reliable when it provides a measure of confidence that the assumptions, judgements and data which comprise it will forecast what is most likely to occur.

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1 Review criteria for all forecast methodologies and methodologies specializing in demand forecasting are stated in Rules 69.2 and 63.5, respectively.

2 The documentation must include a description of: any historical data used and its source, the significant determinants (e.g., population, government policies, availability of resources, conservation, see Rule 63.5(b)) and their effect on projected customer use factors (e.g., number of customers), any judgement incorporated into the decision, the assumption(s) upon which a judgement is based and the means by which it is incorporated into the forecast and the statistical projection method used.

III. Demand Forecast

The Nantucket Electric Company forecasts a 2.5% compound annual growth rate in system and peak sales over the 1979 to 1988 period. The forecast also shows a shift in 1978 from a winter to a summer peak which persists over the forecast period. For the residential class sales, the compound growth rate is 2.7% per year; for the commercial class, the compound annual growth rate is 1.7% per year (the Company has no Industrial class).

In its review of the present filing, the Council finds that the Company has made a good faith effort to meet the conditions imposed in last year's decision (EFSC No. 78-28). While the methodology employed by the Company is unchanged, the reviewability and hence the Council's understanding of and confidence in the forecast have improved due to the Company's efforts to provide information required by the conditions.

In preparing the forecast, the Company relied on historical data and on its judgements. Its judgements are based on the Company Staff's familiarity with its customers and Nantucket's economy, as well as on consultations by the Staff with local and state policy groups (Supplement, p. 4).

The Company expects the growth in residential class sales to be predominantly due to new, seasonal customers (Tr. 17). Average use per customer is expected to remain constant, reflecting an increase in sales to any new customers balanced out by decreasing sales to existing customers (Tr. 16-17). Witnesses for the Company testified that

current year-round electric heating residential customers have been conserving electricity by lowering their thermostats and by supplementing electric heat with wood stoves (Tr. 10,16).

In support of the above expectations and in response to the conditions set out in last year's decision, the Company provided an analysis of a sample of its electric space heating customers (Supplement, p. 9). The analysis shows that use per heating degree day has been declining over the last several years for these customers.

The Company examined, again complying with said conditions, the feasibility of disaggregating its residential customers into those with and without electric heating. The Company concluded that disaggregation would not be possible due to the nature of its rates and records[3] (Supplement, p. 8). Residential electric space heating customers may be served on either of two rates (E or R), neither of which serves these customers exclusively. Further, seasonal customers with electric space heating are also served by these rates. The Council would like to see the Company, in its next filing, pursue its examination of trends in the growth of electric space heating and seasonal customers by examining the changes in the numbers of customers served by each of the five residential rates.

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[3] The Council notes that the Company has limited computerized data processing capabilities (Tr. 8).

The Company's Table E-1 does not reflect the number of residential customers, but rather reflects the number of residential meters. Since a household may have more than one meter, this affects the accuracy of that table. In the case of rates E and J, for space and water heating, some commercial customers are also counted as residential and reflected in the current E-1 table, again affecting accuracy therein (Tr. 6-7). In future filings, the Company should address these inconsistencies in reporting its historical data and forecast.

The change in commercial class sales from 1978 to 1979 was also analyzed by the Company (Supplement, p. 12). It found that increased use from existing customers represented over half of the 1978 to 1979 growth in the Commercial class. The Commercial load is affected by tourism and concomitant uses such as lighting, cooking, and increasingly, air conditioning (Tr. 10, 12, 13). While the Company attempted to find an indicator relating commercial consumption to population and tourism, as directed to in EFSC No. 79-28, a lack of current and quality data impeded its efforts. As the growth in commercial class sales is predominantly related to tourism, the Company may need to study summer commercial sales separately from year round sales in order to find an indicator that can explain the fluctuations.

Both the winter and summer peak loads are projected to grow at a rate identical to system sales. The recent

trend towards a summer peak is expected to persist[4] due to the decrease in loads contributing to the winter peak from conservation and use of wood stoves by year-round customers (Tr. 9-10). Further, the summer peak, which occurs in the evenings, is growing as the tourism-related cooking and lighting loads grow.

IV. Supply Plan

The Company's power is generated by seven diesel generators ranging in size from 0.7 to 6.9 mw. Diesel fuel is barged to Nantucket from New York. There are 690,000 gallons of island storage available which will last for approximately 76 days in the fall and spring and 57 days in winter and summer (Tr. 24). At present projected growth rates, the Company does not expect to consider any additional capacity until 1985 (Tr. 21). The Company has experienced disruptions in service in the past during periods in which heavy load combined with an unscheduled outage of one of its larger units; the company was able to cope with such disruptions adequately.

The Company has been selected by the DOE for a wind power feasibility study. As soon as the environmental impact studies are completed, a 160' meteorological tower will be installed at a previously selected site. (Tr. 25).

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4 The system peak in 1979 also occurred in the summer. The winter 1980 peak was 7.5% lower than 1979 winter peak, supporting the increased penetration of conservation, but also suggesting that this conservation is more prevalent than the Supplement indicates in its projection of constant average use.

Two customers have installed 1500 watt wind machines and the Company is presently installing the necessary interconnection equipment and negotiating purchase power rates with these customers.

V. Order

The Council APPROVES Nantucket's 1979 Supplement subject to the following conditions:

1) That the Company inform the Council in its next filing of the buy-back rates it has negotiated with the wind-powered self-generators on the Island, and provide a summary of the performance of these and other self-generators.

2) That the Company provide data on its residential customers in the following manner:

   a) for 1970 and 1975-1980, the number of customers and average kwh use per customer for those on rates A, B, and R, including an estimate for each year of the number of these customers who pay a minimum monthly charge during the winter months.

   b) for 1970 and 1975-1980, the number of customers and average kwh use per customer for those on rates E and J, including an estimate for each year of the number and use of those customers who are in fact commercial customers.

   (Data used in Annual Reports to the Massachusetts Department of Public Utilities are acceptable.)

3) That the Company's Table E-1, which shows total residential sales, be modified as follows:

   a) data in the column "Number of Customers" should be computed by counting the number of A, B and R meters.

   b) data in the column "Average Use Per Customer" should be computed by dividing sales to all customers on rates A, B, R, E and J by the number of A, B and R meters.

   c) to the extent possible, commercial customers and use on rates E and J should be reported on Table E-3.

4) That the Company continue to monitor land use and growth policies, the use of wood stoves to supplement electric heating and other conservation, penetration of air conditioning into the commercial sector, self-generation, and tourism and relate these factors to the preparation of the sales and peak forecasts. The Council expects these relationships to be explained in the forecast narrative.

5) That the Company further study its seasonal commercial class sales in order to develop a relationship between the commercial class and tourism.

The Council thanks the Company, especially Mr. Wain and Mr. Roche, for their cooperation.

Energy Facilities Siting Council

by Robert D. Wilmot
Robert D. Wilmot, Esq.
Hearing Officer

Dated at Boston this 7th day of July, 1980.

The above decision was approved by unanimous vote of members present and voting at the meeting of July 21, 1980.

Joseph S. Fitzpatrick
Chairman

therein was received into evidence by the EFSC hearing officer at the September 26 hearing (Tr. 3-6) and has been reviewed by the Council as part of its deliberation in this case.

As stated, the EFSC hearing in this matter took place on September 26, 1980. The D.P.U. materials introduced were complemented by the direct testimony and cross-examination of a panel of EUA witnesses (John Gmeiner, John Marien and Lewis Bailey) as well as that of the Attorney General's witness (Paul Chernick). Several other documents pertinent to Council considerations were also introduced and accepted as exhibits (Tr. 2 for list). Finally, the parties' briefs were submitted on November 21, 1980.

II. ANALYSIS: INTRODUCTION

The Council's analysis of EUA's Third Annual Supplement in the following paragraphs is comprised of two main components: demand and supply. The Demand Analysis is further divided into the three customer classes: residential, commercial and industrial and examines the methodological approach to forecasting sales in each class. The Supply Analysis reviews and comments upon various aspects of the EUA supply plan by which the companies purport to meet their projected demand requirements for base, intermediate and peak power.

A. DEMAND

1. Residential

EUA's end-use approach to forecasting residential sales in the Third Supplement is an improvement over the previous

Supplement. However, while the end-use approach employed is, overall, theoretically sound, the Council questions whether the approach as utilized in this supplement yields reliable results when implemented with a limited database. The power of an end-use approach is in its ability to portray residential electricity use in a detailed manner which lends itself to categorizing and quantifying the many components and determinants of such use. Since an end-use methodology is data-intensive, its reliability is a function of the accuracy of each detail, as well as of the consistency of these details in the aggregate. In reviewing the manner in which EUA has implemented this methodology, the Council finds that the estimates of critical current and future parameters are often theoretically unsupported judgements, and are not based on reasonable statistical methods relative to the requirements of the selected methodology. While the Council recognizes that judgement will always be exercised in the development of a forecast, EUA is strongly urged to minimize the need for judgements by developing a methodology and data base based on empirical analysis, state-of-the-art forecasting techniques, and sound theory.

The comments in the preceding paragraph are further detailed in the following examination of the elements of an end-use approach as seen in the Supplement being reviewed. These elements are a) the number of residential customers; b) the number of appliances; and c) the levels of average use.

a. Number of Residential Customers

The EUA forecast of the number of residential customers is based on the projection of the ratio of population per customer. For Fall River and Blackstone,[3] EUA based its projections of population per customer on a time-trend analysis of the historical relationship between population and customer growth, and selected an algebraic form and time trend which statistically fit the data. (Ex. EUA-2, Response to Q 1&2). Modifications to this Fall River/Blackstone analysis were done for the Brockton service area.[4]

The Council finds that this projection of population per customer has an inadequate theoretical basis as EUA has shown only an empirical basis for the choice of this time-trend method. Further, EUA has not shown a theoretical basis for the selection of the particular time periods used, beyond its assertion that it expects the historical downward trend to continue at a declining rate (Ex. EUA-2, Q 1&2). It is noted that the critical assumption in the use of any time-trend analysis is

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[3] EUA has, effectively, three service areas for which it makes individual projections: Fall River, Blackstone and Brockton.

[4] The companies developed a ratio of growth in the number of Brockton customers relative to Fall River/Blackstone customers over the 1970-78 period; it then projected this ratio would continue over the forecast period, with some judgemental reduction.

that the passage of time will serve as a proxy for the many underlying causal factors, i.e., that history is an accurate barometer of the future. Yet in the EUA analysis it appears that by substituting different time periods in the regressions, results substantially different from the companies' are derived (See AG-4 at p. 6). Also the companies' inability to use their method directly in the Brockton service area[5] (EUA-2, Q 3&4) is a further implication of the theoretical weakness of this method.

The Council has previously commented on the requisite theoretical foundations for time-trend analysis. See In the Matter of Boston Edison, 2 DOMSC 43, at 54 and In the Matter of Massachusetts Municipal Wholesale Electric Company, 2 DOMSC 135, at 138. EUA is urged to examine its methodology for forecasting the number of residential customers, and to base its projections on service-area-specific demographic analysis. Indeed, EUA personnel have testified that they are attempting such modifications. (Tr. 19).

b. Number of Appliances

EUA's method of forecasting appliances is consistent among its three service territories. Its appliance forecast utilizes rates of saturation, penetration, conversion and replacement, applied to the customer forecasts in each territory to yield the number of appliances.

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5 See footnote 4. Aside from the discussed problems with time-trends which are also embedded in the Brockton method, this use of a ratio lacks both an empirical and theoretical basis.

Each year the appliance forecast is based on a distinction between new and existing customers. For new customers, penetration rates are determined and used to arrive at a forecast of new customers choosing each electrical appliance. For existing customers, the previous year's saturation rate, adjusted for current estimated conversions and replacements, is applied to forecast existing customers with each appliance. Thus, penetration, conversion and replacement rates are forecast for each year and combined with existing saturation rates, to derive the annual number of each appliance type. The forecast of these rates is generally increasing based on the assumption that electricity is becoming increasingly desirable as a residential fuel.

The Council has found that the initial (1978) and historical EUA appliance saturation levels are based on a number of sources, (Ex. EUA-1, p. II-7). Only the saturations of electric space heating and off-peak water heating are based on actual counts. The numbers of all other appliances (ranges, dryers, freezers, air conditioners and refrigerators) are based on a variety of data which are not necessarily timely nor service territory specific. Indeed, the companies cannot provide any empirical evidence of the reasonableness of these 1978 saturation estimates since it lacks a saturation survey of its customers. Thus, the Council cannot assess the reasonableness of these estimates.

Further, the forecast of the future number of appliances is derived from judgements and historical trends (D.P.U. Tr. Vol. XX at pp. 36, 44-46, 48-49), and a belief in an "increased

desirability of electric which we are forecasting in the third supplement" (D.P.U. Tr. XX at p. 49). Therefore, while EUA has adequately documented its development of historical trends for conversion rates for at least electric dryers and ranges (D.P.U. Ex. M-70), the problem is the leap from historical to future trends, given that the only support is the companies' belief in the increased desirability of electricity. The Council recalls that EUA was asked two years ago to document this belief in the future desirability of electricity as a residential fuel in a relative fuel price analysis. The need for such a reviewable basis for a forecast of appliance saturation levels is all the more telling in the present case. For example, the original need for the requested fuel price analysis was as a basis for projected electric space heating penetration rates. While EUA would have had the Council accept those rates on the basis of its judgement, less than a year later it revised its judgement: EUA halved the penetration rates in the Third Supplement and admitted they were too optimistic in the Second Supplement. (Tr. 67). Today, the Council finds itself asked to accept revised judgements, the basis of which cannot be reviewed and yet upon which the forecasts of all the changes in appliances stock over the ten-year forecast period are based. This the Council can not do. The companies are reminded of the Council's urging to minimize the need for judgements by developing a methodology and a database based on sound theory and empirical analysis.

c. Average Use

In EUA's residential sales methodology, current levels of average use for ranges, refrigerators, freezers, air conditioners and dryers are based on Edison Electric Institute estimates. Water heating average use is estimated from EUA data on off-peak water heating. These specified appliance uses are then multiplied by the estimated saturations for those appliances; the product is subtracted from the observed average use for non-space heating customers and the remainder is termed "Base Use". The process is similar for space heating customers: a parity with non-space heating customers is assumed for Base and specified appliance use; the remainder is the estimated current average use for space heating.

The record in the instant case shows that only water heating use is based on actual service territory data. Estimates of space heating average use which are specific to each service territory depend on the accuracy of the initial (1978) saturation and average use estimates for the other specified appliances and assumed similarities in Base Use by non-heating and heating customers. The average use estimates for the specific appliances are based on Edison Electric Institute (EEI) data (D.P.U. Ex. M-29 Q/A-11A).

Again the difficulty here is one of weak base data. An examination of one EEI document in the record as to the annual energy requirements of electric household appliances (D.P.U. Ex. M-69) contains a salient caveat: "When using these figures for projections, such factors as the size of the specific appliance, the geographical area of use and individual usage

should be taken into consideration" (EEI-Pub #75-61). While the record is not clear on whether this specific EEI document was the source of the EEI based average use numbers, the record contains no indication that the types of information noted in the caveat have been developed for the EUA service territories nor, if they have been, how they are reflected in the average use numbers. EUA should show that the estimates of average use which it chooses to utilize, be they national, state, or some sample of customers, are representative of electricity use in its service areas. With no service area specific information about average use per appliance in EUA service territories, the Council has no basis for confidence that national numbers used can represent or capture particular local characteristics.

More particularly, the estimated initial level of Base Use clearly depends on the accuracy of estimates of saturation and average use for sepcified appliances since Base Use is the residual of average non-heating customer consumption. Base Use estimates are more accurately characterized as all other uses plus or minus all errors made in estimating specific appliance use. If saturations and average use estimates are in error for ranges, dryers, freezers, air conditioners, and refrigerators, then the Base Use estimate will include these errors.[6]

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6 The Council does note, however, that given the above limitations, the companies' change to estimating Base Use from non-electric heating customers' total average use is a relative improvement over the previous method of utilizing electric heating customers' total average use. The removal of refrigerators from Base Use is also a conceptual improvement.

refine the commercial models further by including the effects of income and a business cycle indicator (Ex. EUA-1 at II-25), the Council suggests that EUA continue to evaluate this year's approach and its implementation based on an analysis of the composition[8] and determinants of commercial growth and electricity use in its service territories.

Using the determinants of a) number of customers and b) their average use, commercial class sales are forecast by projecting these determinants, or elements, separately based on regression analysis for each service territory. The total forecast of commercial sales for each year is the product of the number of customers and average use, summed over all three service territories. The Council's analysis of this forecast looked at each of these elements.

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[8] A note on EUA data adjustments is appropriate here. It appears that when EUA reviewed its procedures of accounting for residential and commercial customers for 1978 data, adjustments to the data were made to remedy misclassified and overlooked groups of customers at varying rates to varying periods of historical data (DPU Ex. M-29, Q/A 15). The bases or principles which guided the companies' alterations to historic data were not clearly explained. As a result, these data alterations seem to be interpolations to arbitrarily selected periods at unspecified rates. For example, in Blackstone, the 1978 residential adjustment was interpolated back to 1970, while the commercial counts were adjusted by a factor of 7813 from 1960-77. A similar procedure was used in the Brockton residential customer adjustments. In Fall River, however, a constant adjustment was made due to the reclassification of churches. These adjustments, while probably well intended to improve the data, must be documented and explained as the quality of the data ultimately determines the quality of the regression results.

a. Number of Customers

Commercial customers are projected by EUA as a function of population and household size. The regression equations involved are derived from time series data (1960-1978), and used to predict future values of customer number only in the Blackstone and Brockton service territories. In Fall River, regression analysis was performed but not utilized for the forecast. The family size variable is the same variable employed in the residential portion of the forecast. The Council's concerns regarding EUA's commercial customer number model are twofold: theoretical and statistical. These two concerns are separate, yet inextricably linked.

Although EUA does discuss its theoretical basis for the inclusion of the particular variables of population and family size in the regressions (Ex. EUA-1 at II-21-22), its theory implies that the number of commercial customers in its service territories is determined solely by the demand for goods and services generated by the residents of those territories. There is no discussion of, nor variables which measure, the effects of such factors as the level of goods and services demanded, export-serving commercial activity, or changes in the diversity of commercial activity.

The inadequacy of the companies' theoretical basis is compounded and further confounded by weak statistical modelling results. First, the companies could not accept the results of the regression analysis for Fall River (Ex. DPU M-29, Q/A 13, 0.13) and thus did not use these results. Second, the

coefficients for the family size variable show opposite direction in the Blackstone and Brockton equations (Ex. DPU M-29, Q/A 13 at p. 1 and 7) indicating a spurious correlation on its face between family size and number of customers. Third, the statistics for the equations show evidence of both autocorrelation and multicollinearity. Lastly, EUA adjusted the regression predictions of customer number to ensure agreement with the companies' short-term customer projections (Ex. DPU M-29, Q 13, pp. 2, 8, fn. 1). All of the above points weaken the confidence of the Council in the projections of customer number and thus in the commercial forecast. The companies are encouraged to strengthen the commercial class forecast by attending to these points. As always, the Council Staff is prepared to answer any questions these comments may raise.

b. Average Use

EUA's forecasts of commercial average use were also based on regression analysis. The independent variables of the regression are population and the ratio of residential to commercial customers. Regression equations are again derived from time series data (1960-78 for Blackstone, 1961-78 for Brockton, and 1965-78 for Fall River), and used to predict values of average consumption for each year of the forecast.

Conservation is judgementally incorporated: 20% conservation for existing new customers and additional uses and 5% conservation for existing uses achieved gradually by 1988. Once more, the Council expresses theoretical and statistical concerns with the average use models.

EUA has presented a discussion of its theoretical bases for the inclusion of the population and ratio variables (Ex. EUA-1 at II-21). Similar to the concerns raised in discussing the customer number model, the theoretical discussion here is incomplete: e.g., the effect on average use of parameters such as type of commercial activity, price and weather are not explored. Further, the asserted relationship between population and average use is undercut by the rationale of the relationship between population and the number of commercial customers. While it is possible that growth in population drives the increase of commercial customers as well as an increase in the intensity of their electricity use, the rationale for the relationship between the ratio of residential and commercial customers average use is fairly convoluted. The customer ratio is hypothesized to represent a measure of competitiveness and this competition drives electrical use (Ex. EUA-1 at II-21). While the commercial sector has exhibited the characteristics described by the companies, it is not clear that competition is the best way to explain these changes or that the customer ratio would measure this phenomenon.

A review of the statistical aspects of the average use equations also raises some concerns with autocorrelation and multicollinearity. Further, the residential/commercial customer ratio variable shows opposite signs among the EUA service territories (Ex. D.P.U. M-29 Q/A 13).

EUA adjusts the resultant predicted average use values in several ways. In Blackstone, a level adjustment of 1983 KWH/year was subtracted from each year's predicted value. Brockton's forecast values were derived by actually altering the regression equation based on a short term average use forecast (1979). Finally, in Fall River, the estimated load of three known customer additions is added to the predicted values in the respective years of expansion. The argument that the adjustments "were performed so that the predicted values best matched the last historical year's data (1978) in order to get a smooth transaction from the historical to the forecast periods" (Ex. EUA-2, Q/A C-3), does not support the companies' adjustment of all predicted values of a regression. These adjustments effectively alter the entire equation rather than effect a mere transition form actual to forecasted values. Were the adjustments consistent among service territories, or merely short term adjustments, the forecast might appear more supportable. However, the adjustments are neither short term nor consistent and are inconsistent with the basic method of forecasting, i.e., regression analysis.

Again, these comments take further shape as conditions for the companies' consideration and implementation in the next filing. See Order below.

3. INDUSTRIAL

Industrial Sales are forecast with the same basic methodology and set of assumptions utilized in the previous EUA supplement. Historical data analysis is the basis of each service territory's forecast of large and small customer industrial

sales. While EUA has attempted to meet conditions on the second supplement pertaining to the residential and commercial forecasts, the industrial condition has not been addressed. In fact, the current industrial forecast relies to a greater degree on unexplained judgement that any other part of the companies' forecast impinging on the reliability and appropriateness of the method.

Historical compound annual growth rates (1970-79) are forecasted as "target rates" or simple rates of growth in the later years of the forecast, for each subclass.[9] The companies "believed these target rates, ranging from 1.14 to 4.58%, provided an adequate measure of industrial growth potential" (Ex. EUA-2, Q/A I-1&2). However, there is no analysis or theoretical argument to support the companies' belief that the historical growth rates are representative of the future. As stated in the analysis of the residential forecast above, forecasting by time-trend analysis requires the demonstration that underlying causal factors affecting the forecasted variable (industrial sales) will be the same in the future as in the historical period.

Since EUA has not identified these causal factors or hypothesized indicators of industrial activity, the Council must find that EUA has failed to present an adequate theoretical basis for its industrial forecast.

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[9] Interim growth rates were forecasted by interpolation of the 1978-79 estimated growth rate to the target rates.

Indeed, evidence in the record suggests that the time-trend method alone does not produce reliable results. In four of the six subclasses, EUA modified that method. For example, historical growth rates for Brockton and Fall River large customer classes are calculated from data that had been adjusted for the losses of a few large customers, (Ex. D.P.U. M-29, Q/A 22).[10] In addition, judgementally- determined constant annual rates of growth were forecasted for the small customer subclasses of Brockton and Fall River. The companies' judgement not to utilize the historical compound annual growth rates demonstrates the problems with its method. In Brockton the negative growth rate was "considered to be an unreasonable expectation of the future", while in Fall River the growth rate was considered high (5.66%) and "although not necessarily unreasonable, a lower growth rate was utilized ... ." (Ex. D.P.U. M-29, Q/A 22).

Thus does the Council find that EUA's industrial methodology has a weak theoretical basis due to its reliance on time-trend analysis and judgement. No attempt has been made to identify the indicators of industrial activity and electricity use.

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10 Little or no explanation is provided as to why these customer losses are not considered to be representative of the industrial activity in each territory.

In the future, EUA should attempt to further its understanding of industrial activity and its relationship to economic, demographic and physical variables. Through its knowledge of its service areas' industries, EUA should identify key variables affecting industrial activity and include these variables in its approach, as the first step in the development of a theoretical foundation in support of the forecast. Data collection and analysis should follow, with the specification of an appropriate method last. These points are again incorporated in the conditions of approval found below in the Council's ORDER.

B. SUPPLY

The focal point of the EUA system's supply planning efforts for its Third Annual Supplement to the Long-Range Forecast of Electric Power Needs and Requirements is the acquisition of additional ownership shares in the Seabrook Units 1 and 2 presently under construction in New Hampshire. This acquisition approximates 3.1% (72 MW) of the rated capacity of the Seabrook facility. EUA's wholesale subsidiary, the Montaup Electric Company, has proposed to acquire these shares as a result of transfers from the Connecticut Light and Power Company, the United Illuminating Company, and the Public Service Company of New Hampshire. Added to previously approved entitlements representing approximately 1.9% (44 MW) of Seabrook, the proposal increases EUA's total nuclear commitments from less that 20% of its existing load requirements to 35% of its needs in 1988, assuming, of course, that currently scheduled commercial operation dates for Pilgrim II and Millstone III are met. (Ex. EUA-1 at II-32).

TABLE I

Exhibit M-11
8/31/79

MONTAUP ELECTRIC COMPANY

Forecast of Load, Capability and Reserve Margins for
Various Ownership Shares in Seabrook 1 & 2 Units
(MW)

Year	EUA Adjusted Load	Estimated EUA Reserves Required in NEPOOL - %	Capability Responsibility	Forecasted Capability with Present Seabrook Ownership (1.89989%)	Reserve Margin with Varying Seabrook Acquisitions			
					Present Ownership only (1.89989%)	Additional CL&P Purchase (2.93531%)	Additional CL&P and PSNH Purchase (3.93531%)	Additional CL&P, PSNH, and UI Purchase (5.00000%)
1979/80	696	20	839	855	16	16	16	16
1980/81	719	19	856	863	7	7	7	7
1981/82	744	17	870	874	4	4	4	4
1982/83	749	17	876	869	-7	-7	-7	-7
1983/84	774	18	913	886	-27	-15	-3	9
1984/85	794	18	937	881	-56	-44	-32	-20
1985/86	821	21	993	923	-70	-46	-23	1
1986/87	845	22	1,031	953	-78	-54	-31	-7
1987/88	877	22	1,070	972	-98	-74	-51	-27
1988/89	905	22	1,104	962	-142	-118	-95	-71
1989/90	933	22	1,138	1,030	-108	-84	-61	-37
1990/91	962	22	1,174	1,028	-146	-122	-99	-75

potentially severe deficits in its required reserves (p. 8, Answers to Questions Directed to Montaup from the D.P.U. Staff, April 11, 1980).[11] These deficits have two undesirable impacts: (1) the companies will be forced to make costly short-term purchases of capacity from other utilities or install new gas turbines (peaking units), and (2) the companies' dependence on oil-based capacity is effectively increased. The Council believes that EUA could agressively pursue certain short-term options that may at least alleviate these impacts given the fact that "... Montaup is unable to acquire long term capacity to eliminate the deficits shown on M-11 ... ." (p. 8, Ibid,). These options are load management strategies that reduce daily loads throughout the year and the development (or redevelopment) of renewable energy resources, particularly small-scale hydro. Both options entail significantly less lead-times than required for planning new conventional faciltiies and both options are consistent with State and Federal oil backout policies. With respect to load management, the Council takes official notice of NEPOOL's Supplement to the Edison Electric Institute (EEI) Load Management Report, dated September, 1977, in which the NEPOOL Load Management Working Group concluded that "... load management techniques which reduce the load over a significant portion of the day throughout the year can be potentially beneficial to both the participant and the

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[11] See parties' Stipulation As To Documents (para. 5) dated July 7, 1980 in this EFSC proceeding.

pool." That substantial pecuniary benefits exist are also clearly demonstrated from EUA's Exhibit B-1(c) to the Gmeiner Deposition (Sept. 10, 1980). Using 1979 data, it is evident that average incremental on-peak fuel costs are at least 65% higher than average off-peak fuel costs, per KWH (See Table II). As an illustration of the potential for load management within the EUA service territory, the companies have projected that only 10% of its residential and commercial electric space heating load will be under some form of controls by 1988. (Ex. D.P.U. M-29, Q/A 26). Additionally, to the extent that EUA's marginal peaking capacity is oil-fired at relatively high heat rates and that off-peak capacity is predominantly non-oil or oil-fired at lower heat rates, load management will always save oil.

The companies have shown on the record that renewable energy resources such as hydro, biomass, wind, refuse-fired facilities, and solar power, as well as cogeneration, are not in aggregate an alternative to the Seabrook shares (Ex. D.P.U. M-14, pp. 22-23). The Council agrees with this conclusion. However, as indicated above, renewable energy resources may serve a valuable supplementary purpose. The Commonwealth and the Nation's energy problems are complex and cannot be presumed to be resolved simply by purchasing available nuclear capacity from New Hampshire. It is noteworthy to the Council that EUA's consideration of renewable energy resources and cogeneration was strictly limited to its own territory; it was not so restrictive when considering and when seeking conventional power resources. The principles of power system

TABLE II

1979 EUA SYSTEM ENERGY COSTS

TOTAL ON-PEAK ENERGY (KWH)	$2,046,800,000	
TOTAL ON-PEAK FUEL COSTS	$43,414,352	
AVERAGE FUEL COST/ON-PEAK KWH		$0.0212
TOTAL OFF-PEAK ENERGY (KWH)	$1,617,600,000	
TOTAL OFF-PEAK FUEL COSTS	$30,200,163	
AVERAGE FUEL COST/OFF-PEAK KWH		$0.0187
TOTAL DIFFERENTIAL OFF/ON-PEAK ENERGY	$429,230,000	
TOTAL DIFFERENTIAL OFF/ON-PEAK FUEL COSTS	$13,212,467	
AVERAGE INCREMENTAL ON-PEAK FUEL COST		$0.031

interconnection make such a distinction a moot point. The Council would like to see a broader based effort and greater support for renewable energy resources and cogeneration in future EUA filings with the Council. The Attorney General has enumerated several specific oil backout strategies which may be worthy of consideration. (Ex. AG-4, pp. 19-22). The companies would be well advised to appraise the merits of each of these strategies and others. The Attorney General's point is well taken:

> It is important to realize that even if EUA obtains a 5% interest in the Seabrook plant, and even if all the planned nuclear units are completed on schedule, EUA's nuclear capacity will be only 324 MW, or, at a 65% capacity factor, 1845 GWH annually. This is only half of EUA's current annual energy output requirements, and 37% of EUA's projected 1988 requirements. EUA lists no other non-oil fired capacity, either existing or planned, in its current forecast.
>
> Therefore, EUA will remain primarily dependent on oil for the indefinite future, under its announced plans. It does not seem to be prudent to neglect so many promising alternatives for reducing oil use. (Ex. AG-4, pp. 21-22).

III. ORDER

The points discussed above are now incorporated in the following Council Order as conditions of approval of the Supplement reviewed. The companies are reminded that the Council Staff is prepared to assist with any questions which may arise as the companies seek to implement said conditions.

Therefore it is now ORDERED that the EUA Third Annual Supplement to its Long-Range Forecast of Electric Needs and Requirements be, and hereby is, APPROVED subject to the following conditions. These conditions are set out specifically for the DEMAND and SUPPLY sides of the filing.

DEMAND Conditions

1. Each use of time-trend analysis by the companies should be justified and explained. Such explanation should include:

   a. an identification of all causal factors;

   b. a discussion of the relationship of these causal factors to the historical as well as the projection periods;

   c. a discussion of the suitability of time-trend analysis relative to other statistical methods;

   d. a discussion of the suitability of the functional form.

2. All regression analyses are to comply with EFSC Rule 69.3, "Econometric Forecasting Models".

3. EUA's progress in implementing its residential methodology should emphasize development of timely and service-area specific estimates of initial appliance saturations, average appliance use, and base use. The companies should advise the Council in its next filing of the feasibility of conducting a saturation survey of its customers. Further, the companies are directed to examine the potential for data base improvements through its compliance with P.U.R.P.A. and R.C.S. requirements.

4. The bases for the companies' projections of future average use and numbers of appliances, including the "new developments" category, should be reexamined. Those appliance forecasts which rely on judgements about the future desirability of electricity must be supported by a fuels price analysis. This price analysis should also be applied to other classes of sales.

5. The companies should support the appropriateness of its approaches to projecting industrial and commercial sales by implementing a study of the composition and determinants of industrial and commercial growth and energy use. The companies are directed to report to the Council on its progress in addressing this and the other demand conditions in its next filing.

SUPPLY Conditions

1. The Council encourages EUA to appraise thoroughly the potential for direct control of major residential and commercial appliance loads for purposes of load factor improvement. This point should be specifically addressed by EUA in its next filing. The fact that these demand management activities are being aggressively pursued by other Massachusetts utilities suggests to the Council that this strategy may also be of value to EUA and its ratepayers.

2. The Council also encourages EUA to pursue actively and to support the promotion of renewable energy resources and cogeneration in Massachusetts. The next EUA filing should also address this point.

Energy Facilities Siting Council

by Dennis J. LaCroix

Dennis J. LaCroix, Esq.
Hearing Officer

Dated at Boston this 24th day of November, 1980.

Unanimously approved by Council members present and voting on December 1, 1980.

Joseph S. Fitzpatrick
Chairman

COMMONWEALTH OF MASSACHUSETTS
Energy Facilities Siting Council

In the Matter of the Petition of Fitchburg Gas and Electric Company for Approval of an Annual Supplement (1979-88) to the Long Range Forecast of Electric Power Needs and Requirements	)	EFSC No. 79-11B

DECISION and ORDER

The Energy Facilities Siting Council hereby APPROVES the Third Annual Supplement to a Long Range Forecast of Electric Power Needs and Requirements of the Fitchburg Gas and Electric Company ("Fitchburg" or "Company"), subject to certain conditions set out in the Order below.

I. HISTORY OF THE PROCEEDINGS

Fitchburg filed its Third Annual Supplement to its Long-Range Forecast of Electric Power Needs and Requirements on July 2, 1979.[1] After publication and posting of the notice of adjudicatory proceedings on this supplement, the initial prehearing conference in this matter was held on August 24, 1979 at Council offices. The Attorney General (AG) was the sole intervenor in these proceedings.

Between that initial prehearing conference and the Council hearing in this case on November 26, 1980, the parties carried out discovery in this matter and took part in ancillary proceedings at the

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1 The filing date was authorized by EFSC Memorandum and Order dated April 2, 1979 Docket Nos. 78-11B, 79-11B.

Department of Public Utilities (DPU) in D.P.U. 20055.[2] This was a joint proceeding on the petitions of several companies, including Fitchburg, for D.P.U. approval of their proposed purchase of shares of Seabrook Nuclear Units I and II. The Council accomodated the parties' involvement in the D.P.U. proceedings for the sake of regulatory efficiency; several of the issues and much of the evidence presented in D.P.U. 20055 were similar if not identical to those before the Council in this matter.[3] Although much time passed between the initial prehearing conference and the Council hearing, the parties were able to save time during the EFSC proceeding by the use and adoption of relevant material from D.P.U. 20055.

As stated, a Council hearing was held in this matter on November 26, 1980. The D.P.U. materials introduced were complemented by the direct testimony and cross examination of Mr. Bruce Garlick. Other pertinent documents also were introduced and accepted as exhibits (See Tr. 1 for list). A brief was filed by the Company on December 22, 1980; the Attorney General chose not to file a brief in this proceeding.

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2 This docket number is the common reference to this joint D.P.U. proceeding. The other docket numbers are D.P.U. 19738, 19734, 20109, and 72.

3 The EFSC hearing officer had offered to consolidate this EFSC matter with the D.P.U. cases if it would have been helpful and avoided duplication for Fitchburg. The Company appreciated the offer, but did not accept it.

II. ANALYSIS

As with other electric utilities, the Company's 1979 Supplement is subject to review criteria as stated in Rule 62.9(2)(a),(b)and(c), which call for the use of accurate and complete historical data and a reasonable statistical projection method. In its review of a forecast supplement, the Council determines whether a projection method is reasonable according to whether the methodology is (a) appropriate or technically suitable for the size and nature of the particular electric utility's system, (b) reviewable or presented in a way that results can be evaluated and duplicated by another person given the same information, and (c) reliable, that is, provides a measure of confidence that its assumptions, judgements and data will forecast what is most likely to occur. The Council applies these criteria on a case-by-case basis.

In the instant case, Fitchburg is a relatively small electric utility[4] that generates about one-third of its own power and purchases the rest from larger utilities. Given its size, the Company also notes that the size and nature of the Fitchburg system make the forecasting problem especially difficult.[5]

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4 The Company as of 1978 served 19423 residential customers, its total power requirements were 430,900 MWH and its total system load was 75.3 MW (Summer).

5 Predicting changes in population characteristics and changes in employment in business and industry would be difficult in a small territory like Fitchburg due to the ease and frequency of movements across the territory's boundaries. Fitchburg's problem is compounded by its large (58% of total system load) and growing industrial load. Industrial growth and change in Fitchburg are heavily influenced by economic conditions and changes in the state, region, and nation.

The Company has essentially used a "judgemental" approach to forecasting since its first long range forecast (1976). The Council suggested that the Company's judgemental approach in its 1978 Supplement was inadequate to meet its forecasting problem. Consequently, the adjudicatory proceeding in EFSC No. 78-11B was suspended by an EFSC Memorandum and Order dated April 2, 1979, to encourage the Company to work on improvements to be incorporated in its 1979 filing now being reviewed.

As a result of the Company's efforts, the 1979 Supplement contains a much improved methodology. The Company disaggregated its customer classes and systematically presented judgements regarding specific components of each customer class. The Company also plans to collect more information from its industrial and commercial customers, private developers, local public officials, state and regional agencies, and others (Ex. F-1, pp.4a-c).

The Company is to be praised for its improvements. The methodology is appropriate for its particular forecasting problems and is much more reviewable. Furthermore, the Company is demonstrating its familiarity with the determinants of energy sales in its service area and is developing a stronger basis for a reliable forecast methodology. However, this methodology still has some weaknesses which the Council urges the Company to correct in future filings. By critiquing the Company's methodology, the Council in no way denigrates the Company's efforts and improvements. Rather its comments are meant to be constructive and looking toward further improvements.

The Council's findings are discussed in detail in the following paragraphs. First, the Demand Analysis describes the method, strengths, weaknesses, and Council recommendations for electricity sales fore-

casts by customer class (residential, commercial and industrial) and the peak load forecast. Then, the Supply Analysis reviews the Company's plans for providing electricity to meet requirements.

B. Demand Analysis

1. Residential Forecast

The Company separately analyzed customers with and without electric space heating. First, for residential customers with electric space heating, the Company assumed a) a constant average use for a constant number of "existing" customers and b) ten "new" customers per year using the same constant average amount of electricity. Second, for residential customers without electric space heating, the Company assumed a) that "existing" customers would have a declining average use until 1984 and constant average use thereafter and b) that 200 "new" customers would have a lesser average use (based on 66% of the Company's new customers having gas ranges) which would also decline until 1984. For both "existing" and "new" customers, the Company based the estimates of declining average use (5% per year for four years) on the anticipated effects of appliance efficiency standards.

The separation of "heating" and "non-heating" customers and "existing" and "new" customers in each category is a reasonable approach. To use this approach more effectively, however, the Company needs to improve its documentaion, to explain the basis for its judgements, and to refine the use of available data to verify its judgements. Three specific examples follow.

First, the basis for the estimated increase in the number of residential customers without electric heat over the forecast period (200 per year) is not well documented.(Ex. F-2, Q/A3). In this instance, the Company could use the Montachusett Regional Planning Commission's

population projections to verify its own judgements. For example, the Commission's population projection divided by a projection of persons per household equals a projection of number of households. The Commission may also have information on population characteristics and housing characteristics as well as 1980 census data which may be available soon. These sources could be used to support Company judgements about numbers of customers and saturations of electric space heating and other appliances.

Second, the Company forecasted that average use by heating customers would be constant over the forecast period.(Ex. F-2, Q/A2). To make this judgement credible, the Company should show how it has considered and quantified effects of conservation in the base period (1975-1978) and over the forecast period.

Third, the Company's judgement about efficiency improvements needs a documented basis that shows consideration of new and replacement appliances, especially refrigerators (See Ex. AG-1, p.45; Ex. F-9, p.8). The Company should also support and verify its judgements about the effects of appliance replacement after 1984 and the extent and effects of customer conversions from electricity to gas.

2. Commercial Forecast

For the commercial class, which includes municipal services, the Company based 1979 and 1980 demand projections on known additions to load. For 1981-88, the Company assumed that the 1980 load would grow at a declining rate based on a reduction of the historic commercial rate (1974-1978) due to an assumption of future conservation and load management.

The strength of the commercial forecast is the Company's knowledge of likely additions to load during 1979 and 1980. For the years

1981-1988, however, the method of forecasting load needs more explanation and documentation. For example, nowhere is it evident that the Company considers possible load reductions due to commercial customer mortality (e.g. bankruptcy, loss of business, etc.) either in calculating a net load addition for 1979 and 1980 or in adjusting forecasted load for 1981-1988. More importantly, the reduction (100,000 kwh per year) in "normal growth allowance" due to conservation and load management was based only on judgement (DPU Tr. vol.28, at 136-137). Better use of existing customer data, further study of its commercial class or use of area planning studies prepared by others for its region may provide support material for the Company's judgements on commercial load growth. This and similar material should be used by the Company as part of its forecast explanation and documentation.

3. Industrial Forecast

Industrial sales, which accounted for 58% of Fitchburg's total sales in 1979, were expected to grow steadily over the forecast period. For "existing" customers, the Company assumed declining average use. For "new" customers, the forecast for 1979 and 1980 was based on known additions to load while for 1981-1988, the Company assumed growth rates based on historic loads and judgement.

The strengths of Fitchburg's industrial forecast are the known additions to load two years into the forecast period,[6] the breakdown

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[6] Although again, the method does not consider unkown load additions nor load reductions (customer mortality). See Commercial Forecast analysis supra.

by Standard Industrial Classification (SIC) for the largest industrial customers, and the use of industrial questionnaires. The basic weakness however, is the lack of documentation to support judgements about growth in the industrial class and about conservation by class customers. To address this, the Company could reassess its use of the questionnaire.

While the questionnaire covers important topics, some of the questions should be more specific to elicit responses that would be useful in documenting the forecast. For example, questions on anticipated load changes should request a best estimate in terms of a percentage. Then, the Company should report findings in terms of percentage changes in all or certain types of industries. Also, the question of time-of-use rates should give specific hours and rates for the respondents to consider; then, results could be expressed in numbers and if applicable, used to document judgement in the forecast. The Company could verify the reliablity of customer forecasts by comparing past questionnaires' predictions to actual experience.

Next, it can be seen that the growth in industrial sales for 1979-1988 is expected to occur mainly in two industrial parks (71%) and other small customers (18%) (See AG-1, at 46). The importance of these loads to the overall forecast calls for judgements with sound bases, especially since the projected system peak load and related reserve capacity are quite sensitive to the rate at which the industrial parks are occupied. For example, if only two lots were filled per year, total system peak load in 1988 could be 2.25 MW (or 2.3%) less then forecasted; this could increase reserves from 5.7 to 8.2%.

In this filing, there were no specific data to back up the Company's judgements about industrial parks or other small customers (DPU Tr. vol. 28, at 46,47). The Company could address this problem by using specific

data to calculate the rate at which new customers will occupy the industrial parks and the likely load factors of those customers. The Company states that it plans to contact possible sources for such data. (Ex. F-1, p.4a-c).

Then again, the industrial forecast does not reflect the relationship between local industries and state, regional and national economies. The Company could supplement the industrial customer interviews with a brief discussion of regional and state employment trends for major industries (by SIC) found in the Fitchburg territory.[7]

And the Company did not base its estimate of the reduction in annual kwh consumption on specific calculations (DPU Tr. vol.28, at 114). The importance of the industrial load indicates a need for the Company's judgements about industrial conservation to be specified and well documented rather than mere conclusory estimates with no apparent explanation or basis.

4. Peak Load Forecast

The Company forecasted peak load by adding the new loads in each sector to current peaks and adding in projected NEPOOL transmission losses at peaks. Information about load shapes in each sector was incorporated in the calculations.

The record shows that the Company assumed no specific relationship between peak growth and total energy growth.(DPU Tr. vol.29 at 29).

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7 Possible sources include: U.S. Bureau of Labor Statistics, Projections of Industrial Employment in New England to 1985, Boston U.S. Bureau of Labor Regional Report #77-4, 1977. U.S. Department of Commerce, U.S. Industrial Outlook, annual.

The Company could better document its judgements about peak load by comparing forecasted load factors to historical load factors and, while EFSC Rule 63.6 does not call for load factors by customer class, the Company should continue to give special attention to the industrial sector's effect on the system load factor and discuss the results of such comparisons.

5. Summary: Demand Analysis

The Company filed a much improved forecast in 1979 and plans further improvements in data collection for the next filing.(EFSC Tr. 10,11). While all of the points and suggestions in the above analysis are important, the Company could benefit most from improving the industrial forecast methodology and better documenting judgements about conservation in all classes. Sound bases for judgements in those areas would make the demand forecast methodology much more reliable.

As a final note to the demand analysis, the Council reminds the Company that uncertainty in the demand forecast can be reduced through conservation and load management (discussed below in the Supply Analysis). For example, the Company could be more confident in its peak load forecast if much of the system load is controlled under potential peak conditions. As can be seen from the supply analysis, the Council encourages the use of load management.

C. Supply Analysis

Fitchburg's immediate supply planning efforts concern the acquisition of approximately 16 megawatts of the combined capability of the Seabrook Units 1 and 2. As stated in the record (DPU Tr. vol.28 at 104):

> Fitchburg faces a long-term shortage of baseload capacity. Seabrook is the only available source of generating capacity which can fill that shortage. In addition, Seabrook is the cheapest available source of baseload capacity.
>
> Even with the purchase of this additional

> Seabrook capacity, Fitchburg still faces generating deficiencies. To meet our customers' needs, we are presently exploring low-head hydro, biomass, and load management.

The Council supports this statement and hereby recognizes Fitchburg's urgent need for baseload capacity. The urgency of Fitchburg's needs was clearly demonstrated by the Company for the following reasons:

1. Fitchburg owns no baseload capacity (Ex. F-1, Table E-12);
2. The proposed Charlestown (Rhode Island) nuclear units (NEP 1 & 2) have been cancelled and Fitchburg had been seeking a 26 MW entitlement to that facility (Ex. F-9, p.1);
3. Fitchburg's primary source of baseload power (40 MW) is a purchase agreement with Boston Edison which is contingent on the availability of the Pilgrim I nuclear unit (See Ex. F-4, Q/A35);
4. Fitchburg's efforts to secure 3 MW of hydro capacity in New Hampshire may be fruitless for reasons beyond its immediate control (See Ex. F-3, Q/A19).

Given the timely completion of the Seabrook units, Fitchburg is still likely to experience chronic capability deficiencies and will be frequently forced to seek expensive, and typically oil-fired deficiency service from the Pool. While recognizing the limitations of small utilities in initiating new facilities (See In Re Eastern Utilities Associates System, 4 DOMSC__, December 1, 1980)[8] the Council is obligated to warn the Company that its 1979-1988 supply plan is tentative The Council, by approving the purchase of the proposed Seabrook shares,

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[8] at page 22 of the final decision in EFSC No. 79-33.

cannot guarantee the timely completion of those units. The Company must immediately act to mitigate this risk and to minimize expected deficiencies. The Council encourages Fitchburg to expeditiously implement new rates for controlled electric hot water heating[9] and related load management initiatives. In particular, efforts to improve the residential and commercial class load factors should be pursued where they are demonstrated to be cost effective to the system and its customers. The Company should continue, and perhaps expand its search for and development of potential low-head hydro sites. The Council also encourages Fitchburg to actively and aggressively support and encourage interested developers of cogeneration and other small-power producers within its service territory.(See DPU Tr. vol.28, p.103) And finally, the Council urges the Company to seriously consider the merits of conservation initiatives as an integral part of its supply planning efforts. The record is replete with ideas and suggestions by the Intervenors in this regard.

III. ORDER

In light of the considerations set out in the above decision, it is now ORDERED that the Third Annual Forecast Supplement of the Fitchburg Gas and Electric Company be, and hereby is, APPROVED subject to the following conditions:

1. That the Company expand explantion and documentation of and strengthen the bases for judgements in the demand

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9 The Company has noted in the record that it has begun an evaluation of a rate for controlled water heaters (p.103, vol.28, DPU Trans.)

forecast methodology. The most important judgements are related to new industrial customers, consumption by existing industrial customers, average use by commercial customers, number of new residential customers, and average use in the residential class. This condition includes verifying judgements about conservation in all customer classes.

2. That the Company compare historical and forecasted system load factors to check the reasonableness of projections of peak growth and total energy growth.

3. That the Company carry out the data collection program outlined in the forecast methodology (Ex. F-1, pp.4a-c) and, where applicable, incorporate findings as documentation in all future EFSC filings.

4. That the Company expand its load management programs, where cost effective, as a means of reducing expected capability deficiencies in its forecast Supply Plan. The Company's efforts, and the estimated impacts on the system's load characteristics, are to be discussed in its next EFSC filing.

5. That the Company expand its search for suitable low-head hydro sites and demonstrate, in its next filing, its support for the development of cogeneration and other small-power producers.

Energy Facilities Siting Council

by Dennis J. LaCroix
Dennis J. LaCroix, Esq.
Hearing Officer

Dated at Boston this 12th day of January, 1981.

The above Decision and Order was unanimously approved by the Council members present and voting at the Council meeting of January 20, 1981.

Joseph S. Fitzpatrick
Chairman

COMMONWEALTH OF MASSACHUSETTS
Energy Facilities Siting Council

In the Matter of a Petition of the Massachusetts Municipal Wholesale Electric Company (MMWEC) for Approval of an Annual Supplement (1979-88) to the Long Range Forecast of Electric Power Needs and Requirements	)	EFSC No. 79-1

DECISION and ORDER

The Massachusetts Energy Facilities Siting Council hereby APPROVES the Annual Supplement (1979-88) to the Long Range Forecast of Electric Power Needs and Requirements of the Massachusetts Municipal Wholesale Electric Company (MMWEC or Company), subject to a number of conditions set out below at the conclusion of this decision.

I. HISTORY OF THE PROCEEDINGS

MMWEC filed its Annual Supplement on July 2, 1979. Additional revised pages to this supplement were filed on September 10, 1979. Certain testimony concerning and exhibits to the supplement were filed on January 25, 1980. After publication and posting of the notice of adjudicatory proceedings on this filing by MMWEC, the initial prehearing conference herein was held at Council offices on August 27, 1979.

At that conference, potential intervenors were identified and asked to file petitions to intervene with the Hearing Officer. Petitions were received from the Attorney General (AG), the Town

of Marblehead, the Municipal Power Advocacy Coalition (MPAC)[1] and the Energy Development Caucus (EDC)[2]. After some discussion among the interested parties about whether and how intervenors would participate in this proceeding, MMWEC basically did not press any objections to any of the petitions. Thus, by an Order dated September 27, 1979, the petitions to intervene of the AG, MPAC, EDC and Town of Marblehead were allowed.

At the same time its case was proceeding before the Council, MMWEC was also before the Department of Public Utilities (DPU) seeking approval of the financing for proposed purchase of shares of the Seabrook Nuclear Power Plant, a proposal referred to generally as "Project 6". This DPU proceeding (DPU No. 20248) involved the same parties and substantially similar issues. Thus, on December 21, 1979, MMWEC filed motions for joint DPU and EFSC hearings in an attempt to avoid a duplicative presentation of essentially the same case to each agency. The intervenors opposed this motion in writing and orally before the Hearing Officer at a motion hearing on January 9, 1980. By a Memorandum and Order dated January 21, 1980, the Hearing Officer granted the motion for joint hearings subject to a DPU decision on the same motion before it. Sometime

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1 An unincorporated association of citizen and consumer groups from MMWEC towns essentially and primarily interested in Project 6.

2 A bipartisan coalition of 54 state senators and representatives interested in energy issues, especially the development of alternative energy sources.

later, the DPU denied that motion and no joint hearings were held[3].

On February 5, 1980, the Attorney General filed a Motion For Declaration of the Filing Date, which was opposed by MMWEC. With this motion, the Attorney General sought a ruling from the Hearing Officer which declared January 25, 1980 as the date for the filing of the MMWEC supplement under review. This had in mind the Council's statutory one year time frame in which it should render a decision on a forecast or annual supplement. G.L. c. 164, sec. 69J. The Attorney General contended that MMWEC had not filed its 1979 supplement completely until it had submitted the testimony and exhibits filed on January 25, 1980. This motion was granted in a Memorandum and Order dated March 11, 1980.

Other motions were filed by the parties and ruled upon by the Hearing Officer as discovery herein proceeded. Council hearings in this case were finally conducted on December 3, 10, 11 and 18, 1980. Of the intervenors, only the Attorney General appeared to present a case; the Town of Marblehead, MPAC and EDC had not been formally heard from for some time. (See EFSC Tr. vol. I at 2-3). At these hearings, much testimonial and evidentiary material from DPU No. 20248 which proved relevant to Council considerations in the instant case was incorporated in this record

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[3] Viewed with the keen vision allowed by hindsight, it is unfortunate that no joint hearings were held, at least with respect to intervenor participation in this Council proceeding. It appears that intervenors MPAC and EDC depleted all their resources with their role in DPU No. 20248 and had nothing left for the Council. While these intervenors were active during the discovery proceedings in this case, nothing more was heard from them after that discovery and the DPU proceeding was completed. (See EFSC Tr. vol. I at 2-3). Hindsight causes one to wonder why participants with such restricted resources would oppose joint hearings.

depict the state's energy situation from demand and supply viewpoints. The Council annually reviews these documents to ensure that the conclusions it may draw from them about the state's energy situation are true ones, based as they should be on accurate historical data and reasonable statistical methods. In its review of each utility's forecast, the Council must critique the filings where appropriate and advise the companies to improve as necessary. Overall, the Council has found it more beneficial to encourage the companies rather than discourage them by regulating affirmatively rather than punitively. While the Council is not reluctant to reject a filing - and has done so in the past: see 2 DOMSC 156 (Nov. 15, 1978) - rejection is, as the Attorney General concedes (AG Brief at 3), a harsh recommendation for the Staff to make and for the Council to follow. For the most part, an approval with the imposition of stringent conditions calling for and geared to the particular company's making progress in its forecasting methodology has been most productive for the Council in carrying out its mandate.

And conditions have never been imposed simply for the sake of imposing conditions. It is of no benefit to anyone, to the Council, the companies, nor the energy consumer/customer to labor to achieve the unachievable. Conditions on Council approvals have been drawn with consideration for what the particular company, with its particular system and personnel characteristics, can do in a very practical sense. To do this, the Council must be aware of those characteristics, must be attuned to them. More often than not, this awareness comes simply from listening to the companies' staff.

Which is exactly what the January 8 session in the instant case allowed the Council, through its Staff, to do: to listen to MMWEC so that realistic, achievable conditions could be drawn and imposed. In a sense, "settlement" is an unfortunate description of the January 8 session. In reality, there was nothing to settle: the hearings were finished, the record was complete. Viewing that record, all interested could see that MMWEC's forecast methodology, despite the company's prodigious efforts of last year, would still need substantial improvement. The company could see this, the Staff could see this and from his brief, it is clear that the Attorney General could see this. Thus, all that remained was to encourage and direct the company toward those improvements through, again, realistic and achievable conditions. The discussion of January 8 was geared to that end. There was no discussion of the substantive reasoning behind the conditions suggested by the Staff: the record speaks to that. Indeed, by agreeing to Conditions 1 through 9 as attainable improvements, MMWEC does not necessarily agree (and may yet disagree) with the Council's rationale for their imposition. Instead, the Company continued to show its good faith in its efforts to improve its demand forecast by recognizing the need to improve further and asking the parties' help in so doing. More active participation in this session by the Attorney General would certainly have been as asset, had he been able to work it out.[4]

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[4] The Council is genuinely disappointed at the posture of the Attorney General with respect to this session. The Council feels that the AG, in this instance, is unduly elevating procedural form over substance at the expense of a chance to have some beneficial input to the forecasting methodology of a company which is a major component of the Commonwealth's energy situation. The Attorney General, along with the Company, was advised at the close of the

(footnote continued on next page)

Next, a final procedural note should be made concerning the status of the intervenors who were present at the outset of this case but who, good intentions notwithstanding, have not been active in this case for some time. (See EFSC Tr. vol. I at 2-3.) To clarify the record at this point, the Council makes a specific finding that these intervenors, namely, the Town of Marblehead, MPAC and EDC, are not parties in interest who may claim to be aggrieved by this Council decision. What this finding essentially does is preclude these parties from seeking judicial review of (i.e., appealing) this decision, a result dictated by the failure of these parties to present a case in this Council proceeding.

Here follows the Council's Demand and Supply Analyses of the MMWEC 1979 Supplement which underlie the conditions set out below in the Council's Order. Again, the Council states that, while the Company agreed to Conditions 1 through 9 as realistically imposed and achievable, it has had no input in the supporting analyses. What follows are the Council's findings and reasonings based on the record before it in this case.

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[4](continued from previous page)
hearings on December 18, that any such "settlement" discussions would be quick and to the point. (See EFSC Tr. vol. IV at 134-139.) Indeed, the Attorney General attended the session without specific objection and without requesting any accomodation for his schedule other than an earlier starting time. On the following day, he even submitted a draft set of conditions in response to those which were the focus of the session. Those have been considered and addressed herein, it is hoped to his satisfaction. In the end, the Council fails to see what the Attorney General gains, for himself or for his client (the ubiquitous consumer), by taking such an adversarial position. MMWEC will continue to improve its forecasting along the lines set out in the conditions below which are not substantially different from those suggested by the Attorney General.

II. DEMAND ANALYSIS

1. Description of the Methodology

MMWEC's 1979 forecast supplement represents the Company's efforts to comply with Council forecasting requirements and with the conditions imposed in the 1978 decision. See 2 DOMSC 135 (Oct. 18, 1978). In particular, MMWEC's preparation and submittal of individual forecasts for each of its members (see EX. MMWEC-21, p. 1), as well as a MMWEC system forecast (total of its 31 members), is a positive step towards compliance with EFSC rules and towards development of an appropriate forecasting methodology. MMWEC's reorganization of its forecasting department is further evidence of its commitment to improving its forecasting capabilities (see EX. MMWEC-21, pp. 13-14). The Council also notes that the forecast methodology currently before it is a "new"methodology, evidencing MMWEC's affirmative response to the intent of the previous decision.

After the 1978 decision, MMWEC hired Mr. Richard K. Byrne to supervise the preparation of its long range forecast. Mr. Byrne was previously employed by NEGEA, where he had prepared that system's forecasts before the EFSC for four years (see 1 DOMSC 221 (Aug. 6, 1976), 2 DOMSC 66 (Jan. 26, 1978) and 3 DOMSC ___ (Dec. 6, 1978) and current proceedings in EFSC No. 79-4). Mr. Byrne prepared the forecast for each MMWEC member "by employing nearly the same methodology" as was used in producing NEGEA forecasts (EX. MMWEC-21, p. 4). This methodology, which includes as one of its methods what the Council terms the "survey-interview technique", and which was last conditionally approved in EFSC No. 78-4, (see 3 DOMSC 37 (Dec. 6, 1978)), is now before

the Council as applied to the MMWEC system and its members. Therefore, while in the present proceeding we are reviewing a new methodology - in that this is the first time that the survey-interview technique (and other techniques which comprise the present MMWEC methodology) has been applied to the MMWEC forecast - the Council has long been familiar with this particular technique and its implementation. This current proceeding should thus demonstrate the progress made with improving the reviewability and reliability of the survey-interview technique consistent with applicable Council decisions.

In this decision, the Council will recognize and applaud MMWEC for those improvements in forecasting as enumerated above. At the same time, the Council wishes to provide MMWEC with specific guidance as to the appropriateness of its selected methodology before irrevocable resource commitments are made. This, then, being the first formal review of MMWEC's current methodology, is a critical moment for the Company's forecasting techniques.

In reviewing the MMWEC forecast, the Council has weighed heavily the particular difficulties MMWEC experienced in preparing this third supplement (see EX. MMWEC-21, pp. 13-15), as well as the unique forecasting problems posed by the dispersed and diverse nature of the system's service areas. Despite the weight given by the Council to these considerations, it must find the MMWEC forecast methodology fundamentally weak at this point in its development. It is the Council's intent, by imposing the conditions herein, to provide specific guidelines for any further efforts on the part of MMWEC in enhancing or modifying its methodology. Since there are no facilities before

the Council in this proceeding that would necessitate a determination of need, the Council seizes this opportunity to assist MMWEC in submitting a forecast based on an acceptable methodology and to curtail the expenditure of resources in non-productive directions.

The Council again recognizes that forecasting for MMWEC poses unique problems, given that the MMWEC system encompasses 31 separate service areas (municipal light departments, hereafter "MLD") throughout the Commonwealth. Just as the forecasting methodology must be designed to reflect the unique composition of the system, so must the review of the forecast consider the system's unique character.

The MMWEC forecast consists of the aggregation of 31 separate forecasts for each of the municipal systems. Each of these municipal system forecasts should be reviewed, it might be argued, by the same standards of review the Council exercises in reviewing the forecasts of the other independent municipal departments (such as Norwood and Wellesley), all of which are all-requirements customers of another EFSC regulated company. However, it might also be argued, and so the Council finds, that a stricter standard of review applies because of the role of MMWEC as a "broker" in the supply of electric energy to its member systems. The Council, in order to fulfill its statutory mandate, feels that it is imperative that the MMWEC system develop a reliable forecasting methodology that is appropriate to its responsibilities as the forecaster and planner for many municipal systems. Such a methodology must go beyond mere judgement and extrapolation of historical

relationships.

The methodology utilized for the preparation of each MMWEC member's forecast is described by Mr. Byrne as follows:

> MMWEC's methodology consists of synthesizing information gathered during interviews of local sources and analysis of historical data in order to reach quantitative and qualitative judgement necessary to produce a forecast. (EX. MMWEC-21, p. 17).

From this description, it can be seen that the methodology consists of three components: interviews, historical data, and judgements[5]. The Council finds this methodology weak in its design, and further, finds each of the three components weak in their implementation. The major weakness in the design of the methodology is that it relies too heavily on past trends and judgement. The Council's major concerns with the design and implementation of the methodology for the Residential, Commercial and Industrial forecasts will be addressed separately below. Then, certain important aspects of the demand forecast which are common to all sectors and integral to the methodology will be separately highlighted, including: the survey-interview technique, conservation and load management, and methodology development.

2. Residential

The MMWEC residential forecasting methodology is described as a single approach, applied to the 31 separate members, with some variations (EX. MMWEC-21, p. 17). The major data components of the forecast are the number of customers and average electricity

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5 The Council would add that some verification is also part of MMWEC's methodology, as in the comparison of customer number projections to Regional Planning Commission population projections.

use, by customer type. EFSC Rule 63.7 requires disaggregation of residential customers by: (1) those with electric space heating and (2) those without electric space heating. In addition to these categories, for most of its members, MMWEC further disaggregated customers into those with and without electric water heating, yet inexplicably and inconsistently, did not so disaggregate electric space heating customers in other cases (see, for example, Reading MLD and Belmont MLD).

Also, the judgements of the member system managers/staffs along with interviews with "local interests" and analysis of historical trends were considered by MMWEC before making its judgement regarding the forecast of total new customers (Id., p. 18). Average annual Kwh use for each customer type was forecast based on the parameters and judgements outlined in the Residential Energy Consumption Discussion (RECD). The RECD, "prepared to summarize the thought process used by MMWEC when making judgements concerning the use of electricity by residential customers" (Id., EX. B, p. D1) is a 13 page narrative which is attached to each member system Narrative (DPU EX. M-16) as Appendix D.

Generally, the residential forecast methodology is simple and straight forward. The problems are encountered in the application of this simple methodology to a diverse set of service areas. The methodology that guides the judgements in each forecast is non-specific, and there are as many variances and contortions of the general methodological rules as there are municipalities. The result is a system-wide methodology that lacks consistency, is burdensome to review, and is predominantly based on judgements.

The first problem encountered in the application of this methodology is one of data. Historic data on the number and consumption of customers by type is not consistent among the 31 member systems. For example, not all members offer a separate rate to electric space heating customers, making the identification of customers with space heating difficult.[6]

Two concerns arise because of the inconsistent data bases. The first is with the techniques employed by MMWEC to estimate customer disaggregations. The second is with the application of the methodology to inconsistently defined base estimates.

For example, in developing estimated customer disaggregations in Reading and Marblehead, neither of which offer electric space heating rates, MMWEC applied two different techniques. In Reading, all customers using 4,000 Kwh or more in any one month over a 4 month period were identified as potential electric space heating customers (DPU EX. M-16, Reading Narrative, p. 12). Of the 176 identified accounts, only 22 were verified as actually having electric heat. Based on this analysis, it was decided to "ignore" electric space heating customers in the Reading area. Alternatively, in Marblehead, all customers with consumption of 3,000 Kwh or more in the month of December, 1978, were assumed to have electric space heating (DPU EX. M-16, Marblehead Narrative, p. 12).

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[6] The most straight forward way to enumerate customer types and average use is by examining billing data, which are tied to rates. Where a system offers only one rate to its residential customers for all types of service, it cannot be assumed that there are necessarily no electric space heating or water heating customers. MMWEC has begun a saturation survey of its customers, which should assist in accurate enumeration of customer types (EX. MMWEC-21, p. 14).

Several problems are apparent in these methods of identifying electric space heating customers. First, the bases for selecting either the 4,000 or 3,000 Kwh values or the time periods were not established. The use of a substantially different Kwh amount as a criterion in each municipality was not explained. Further, there appear to be different decision rules for the determination of who does or does not have electric space heating even with the differing criteria: viz., the decision to ignore all of the identified Reading customers and to count all of the identified Marblehead customers. Lastly, there is no attempt to explain the high consumption of the identified Reading customers that were dismissed as non-space heating customers. (The average basic use for Reading customers is estimated to be about 533 Kwh per month.)

The second Council concern which arises from data inconsistencies can be illustrated again with the above examples. This concern goes to the application of the methodology to incongruous base estimates. In Reading, residential sales were disaggregated into Hot Water Heating Use and Basic Use (DPU EX. M-16, Reading Narrative, p. 23). In Marblehead, residential sales were disaggregated into Hot Water Heating Use, Basic Use, and Space Heating Use (DPU EX. M-16, Marblehead Narrative, p. 11).

First, note that in Reading space heating sales, by definition, will be included in either Hot Water Heating or Basic Use, whereas the Marblehead Hot Water Heating and Basic Use categories, by definition, will not include Space Heating sales. Yet, the same parameters and judgements are considered in forecasting average use for these two member systems, as discussed in the

RECD, which is identical for both systems. Further, the Hot Water Heating and Basic Use categories contain additional inconsistencies. The Marblehead estimates of Hot Water Heating use are based on average Kwh use for Hot Water Heating in Reading (DPU EX. M-16, Marblehead Narrative, p. 12), despite the fact that Reading offers no special rates for hot water heating (DPU EX. M-16, Reading Narrative, p. 12), and despite the fact that Marblehead offers differential rates for on- and off-peak hot water heating use to its customers (DPU EX. M-16, Marblehead Narrative, p. 10). Although these differences in rates might be postulated to substantially impact average use in these member systems, MMWEC has not addressed this difference. Rather, it has assumed that there is no difference by applying the same hot water heating average use to both member systems. The Council finds this conclusion highly unlikely.[7]

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[7] The documentation of the Reading MLD study of average hot water heating use is cryptic (EX. AG-37, Q/A AG-PR-1 with attached letter). Since the Reading MLD does not offer a hot water heating rate, it is unclear how customers with electric hot water heating were identified or how Kwhs used for water heating were segregated from Kwhs used for other appliances (lighting, refrigerators, etc.). MMWEC's basis for extrapolating the results of this study to other members is:

> "MMWEC also believes that the residential areas served by RMLD are not unlike the residential areas served by other MMWEC systems..." (Id.)

In addition to rates, hot water heating average use may be affected by family size (and tank size), income, price presence of dishwashers and washing machines, and temperature, none of which have been demonstrated by MMWEC to be the same in Reading as elsewhere. Similar concerns extend to MMWEC's use of the Holden electric space heating study (See EFSC Record Request, EFSC Tr. vol.IV, p.130).

The above examples only highlight a few of the inconsistencies which pervade the MMWEC forecast. Addressing these data problems should be a priority for MMWEC in improving its forecast. Customers should be disaggregated in a consistent manner (particularly if the methodology requires their consistent definition), and in accordance with specified classification criteria. Estimation techniques, when necessary and used in the forecast, should be theoretically based and fully documented. If study results from one member system are to be extrapolated to other member systems, the representativeness of the study system to other systems must be demonstrated.

The second major problem with the residential forecast is with certain aspects of the methodology itself. Both the forecasts of customer number and of average use are based largely on judgement and analysis of historical data. The forecasts are not based on any objective analysis; that is to say, no quantitative analysis of the effects of conservation, price, behavioral changes, load management, appliance efficiency standards, or socio-economic effects are provided.

Mr. Byrne assures the Council that his judgements are conservative ones, (EX. MMWEC-21, p. 24), yet the Council would prefer that the forecast be accurate, not simply conservative. Further, the Council cannot evaluate whether or not the judgements made were conservative as it has not established criteria for ascertaining the "conservativeness" of growth rates and judgements. Yet, this assertion of conservativeness is the only evidence of the reasonableness of the residential forecast MMWEC has provided.

Nor does MMWEC apply the first method in a consistent manner. For example, in Marblehead, the ratio of Commercial to Residential sales for each year between 1974 and 1978 was averaged, and then extrapolated over the forecast period (DPU EX. M-16, Marblehead Narrative, p. 21). In Shrewsbury, the 1978 ratio was projected to persist over the forecast period (DPU EX. M-16, Shrewsbury Narrative, p. 21). In neither case does MMWEC explain or provide a basis for its choice of base years. In no case has MMWEC defined the term "stable relationship". Again, for example, in Middleton, MMWEC projected that the 1978 ratio would persist over the forecast period, despite the fact that the 1978 ratio was 15.5% lower than the 1974 ratio, and 13.3% lower than the 1977 ratio (DPU EX. M-16, Middleton Narrative, p. 21). The Middleton ratio of Commercial to Residential sales can certainly not be seen as stable.

The second method, applied to communities experiencing exceptional growth, based the commercial sales forecast on known load additions. Here, MMWEC failed to define its criteria for determining systems where exceptional growth might occur. Further, the known load additions method raises the related concerns of comprehensiveness and the possibility of double-counting when combined with the ratio method.

The known load additions method requires a showing that all identified new loads will occur and that all new loads have been identified. MMWEC has not done this. Also, the method does not accomodate the possibility that existing commercial sales may be reduced due to conservation or customer closings. Further, when known load additions were combined with the ratio method,

MMWEC did not demonstrate that trends in the historic data to be extrapolated did not already include the effects of the identified new load additions (double-counting). (The method by which MMWEC identified known load additions as subject to the concerns raised elsewhere herein regarding the use of interviews).

Also, like the residential class, the commercial class forecast suffers from data problems. (EX. MMWEC-21, pp. 14 and 20.) The current sales to commercial customers figure may include some small industrial customers and may exclude some large commercial customers. The lack of a well-defined data base on the number of customers and sales to the commercial class leads the Council to suspect, if not doubt, the extrapolations, ratios and judgements which form the forecast.

The Council finds MMWEC's methodology for forecasting commercial sales to be theoretically weak, and applied inconsistently to an ill-defined historical data base. Condition 4 below orders a reevaluation of the methodology. The Council implicitly recognizes, in stating these criticisms, the difficulties that MMWEC, as well as other electric companies, face in developing appropriate and reliable commercial forecasting methodologies.

The first priority for MMWEC in reevaluating its commercial methodology must be to correctly disaggregate sales to commercial customers (see Condition 1, below). A parallel effort should be undertaken to understand and describe the nature of MMWEC member's commercial sales.[9] Documentation should be provided

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[9] Most commercial forecasting methodologies reviewed to date by the Council suffer from a common weakness: the limited analyses made of the diverse nature of sales to this class cannot theoretically support the selected methodology, which is often too generalized due to the limited information.

these aspects was done unsystematically and was influenced far too heavily by judgement.

First, MMWEC did not select the industrial customers to be interviewed according to any sort of selection criteria which would assure the forecast reviewers of the comprehensiveness of the resulting data. If the goal was to interview customers in "those municipal systems with the greatest potential for industrial growth" (EX. MMWEC-21, p. 21), then MMWEC should have, but did not, develop criteria by which those systems could be identified. It is insufficient to state that the goal of capturing growth potential was met by focusing the interviews "on eight systems whose total industrial sales represent 48.9 percent of the total MMWEC industrial sales" (Ibid.). For example, had the South Hadley Electric Light Department been considered for interviews as the ninth system, 53% of the total MMWEC industrial sales would be represented.[11] MMWEC did not distinguish the importance of representing 48.9% rather than 53% of industrial sales. Further, MMWEC did not explain why six customers, representing 48.2% of the Reading Municipal Light Department 1978 industrial sales (DPU EX. M-16, Reading Narrative, p. 34) were interviewed while none were interviewed in South Hadley, where three customers represent over 82% of that member's 1978 industrial sales (DPU EX. M-16, South Hadley Narrative, p. 22).

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[11] South Hadley's industrial sales represent an additional 4.1% of MMWEC's industrial sales (53% = 4.1% + 48.9%).

The second element of the interview methodology is the structure of the interview including the nature of the questions and the manner in which they were administered. MMWEC does not use a questionnaire when conducting the interviews, although each interview covered certain topics (EX. AG-38, Q/A AG-F-13) related to the interviewee's energy forecast. While some of the discussion covered during an interview (See summaries of interviews provided in EX. HO-1, Q/A AG-F-1A) might arguably have not occurred in a structured situation, the potential for reducing interview bias through the administration of a precise questionnaire negates the interest in free-form discussion. Further, Mr. Byrne, himself, did not conduct all of the interviews (DPU Tr. 22, p. 38), introducing further bias potential. The absence of a standardized questionnaire has its greatest consequences when the next interview methodology element of data interpretation is considered.

Given the lack of a standard questionnaire, and the open-ended structure of the interviews described above, the third element of the interview methodology - that of data interpretation - must be discussed. At the outset of this discussion, the Council notes the difficulties presented in reviewing the use and interpretation of MMWEC interview data, given MMWEC's claims of confidentiality (DPU EX. AG-42, pp. 8-10). It is difficult, if not impossible, to review data whose source cannot be examined. Interviewees were promised that "any information which they would give me (Mr. Byrne) I would keep confidential and make available only to a Hearings Officer." (DPU Tr. 22, p. 24). As is addressed later in this analysis and in Condition 2, it is the Council's

hope that MMWEC, should it continue to use interviews in any manner in forecasting, will make every effort to provide the results of interviews in a manner such that they may be more easily and readily reviewed.[12]

In addition to the issue of reviewability of interviews, the Council is concerned with the use of data from interviews. Simply, the concern is that a substantial portion of MMWEC's forecast of sales relies far too much on judgements, either the judgements of the interviewees or the judgements of the interviewer.

The primary purpose of the industrial customer interviews, was to "receive from each customer an unbiased forecast of their electric energy requirements". (EX. MMWEC-21, p. A-2). Yet, since MMWEC did not provide these customers with a standard set of methods and assumptions with which to prepare these forecasts, it is entirely likely that each industrial customer prepared its forecast using its own and unique set of methods and assumptions. While it is indeed possible that each customer prepared a forecast using his/her own best judgements, the methodology does not guarantee a consistency among these judgements. Further, the methodology is not conducive to identifying nor controlling potential sources of inconsistency and bias.

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12 Council concern with the reviewability of the survey-interview technique was also a major factor in the Conditions of approval in EFSC No. 78-4 (3 DOMSC ___ (Dec. 6, 1978)).

The forecasts of sales to the 40 individual industrial customers interviewed represent 33% of MMWEC's 1988 industrial sales, and 11.7% of MMWEC's 1988 total sales (sum of 40 individual 1988 forecasts from EX. HO-1, Q/A EJM-B-11(b)). This significant portion of the MMWEC forecast is based solely on the judgements of the interviewees and MMWEC. The concern of the Council goes not to the expertise which underlies these judgements, but rather to the presumption that underlies MMWEC's interpretation and/use of these judgements: that the interviewees have perfect business acumen and that such perspicacity is equally reliable for ten years into the future.

Another concern of the Council is that the judgements may not have been reliable in all instances. One example in the record is that of an interview conducted for the Reading MLD forecast with Analog Devices (See EX. HO-1, Q/A AG-RI-2, AG-RI-4 and attached letter from Analog Devices). In summarizing the results of the Analog interview, MMWEC stated that because of Alalog's requirements for "precise temperature and air-circulation control ... (Analog) does not expect to implement any further conservation efforts than already accomplished." (DPU EX. M-16, Reading Narrative, pp. 31 and 32). When asked to further explain this statement (EX. HO-1, Q/A AG-RI-4), MMWEC stated that "Analog's requirements are what MMWEC reported - what it was told - that Analog considers further conservation efforts impossible". However, in Analog's letter of June 26, 1980 (Id., attachment), Analog, itself, clearly states the opposite of MMWEC's summary:

> "Mike Cerat (the interviewee) was correct in stating our process area has a rigid temperature, humidity and circulation control. This process area though covers approximately one eighth of the building leaving us seven eighths of the building to be constantly looking for better ways of energy conservation."

For that portion of the industrial sales forecast which does not rely on interviews, the Council would again note its concern with MMWEC's reliance on judgement and historical trends.[13] The known load addition method is subject to the same concerns raised in the analysis of its use in forecasting commercial sales.

In addition, it is not clear what distinguishes a known load addition from an interview, given the fact that the results are weighted the same in the methodology. For example, in South Hadley, the forecast relies on the expert judgement of the MLD manager, who is in "regular contact with these large customers" (DPU EX. M-16, South Hadley Narrative, p. 19). Despite the absence of a formal interview, South Hadley's forecast includes the known plans of one customer (representing 16-17% of the class sales), to "increase consumption in 1979 by about one-fifth of 1978 consumption, and by the approximately same amount again in 1980" (Ibid.). This customer forecast was apparently given the same weight with the MMWEC methodology as a customer forecast provided during an interview, where customers were instructed to consider in their forecasts the impacts of such factors as conservation, price, capital expansion and alternative energy sources.

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[13] MMWEC's selection of a "3.8% growth rate based on the NEPOOL model forecast" (DPU EX. M-16, Reading Narrative, p. 34) also causes the Council concern. Until MMWEC disaggregates its industrial sales on an SIC basis, it cannot demonstrate the applicability of portions of the NEPOOL forecast to its members.

MMWEC has provided information which indicates that many of its members already have in-place load management or conservation programs (See MMWEC Response to Council Information Request). That this information had to be compiled subsequent to the supplement's preparation is evidence of the lack of its consideration in preparing the supplement. In meeting the conditions below, particularly Conditions 3, 4, 5 and 6, MMWEC is directed to design a methodology that explicitly considers conservation and load management in its member systems' service areas.

6. The Survey-Interview Technique

MMWEC's current forecasting methodology has as its cornerstone the survey-interview technique. The Council has recognized the potential of this technique in past decisions, but has expressed its reservations through conditional approvals[15]. It is not the Council's practice to prescribe for a utility the use of specific methodologies for forecasting demand; however, it does from time to time, prohibit the use of certain methodologies. The Council, after careful review of the use of the survey-interview technique in the instant case, must now prohibit further dependence on this technique as the cornerstone of MMWEC's forecasting methodology. MMWEC's methodology, by design and application, is primarily dependent on the survey-interview technique; the Council finds this technique too subjective, too judgemental, and too burdensome to review to be considered a reasonable statistical projection method.

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15 In addition to the NEGEA decisions cited earlier above, a history of the use of interviews, for a smaller utility, may be found in the Fitchburg decisions (1 DOMSC 287 (May 11, 1977), Memorandum and Order of April 2, 1979 in EFSC No. 78-11B, and the current proceeding in EFSC No. 79-11B).

The Council does not prohibit the use of interviews in some manner in the MMWEC forecasting methodology; the value of these interviews in reinforcing the familiarity of MMWEC Staff with the member systems' service areas is apparent. Should MMWEC attempt to combine interviewing effectively with other methodologies (other than judgement and mere trend analysis), the Council would not object - provided that the interviews are conducted according to certain standards as enumerated in Condition 2 below. These standards, developed to address the many shortcomings of the current survey-interview technique, should, if carried out conscientiously, at least ensure that the interviews are comprehensive, systematic and subject to review.

7. Methodology Development

The Council wishes to make it clear now that it will not approve MMWEC's next forecast filing unless it is accompanied by an analytical presentation of the process by which MMWEC designed the forecasting methodology used therein. The Council recognizes that the current forecast was prepared in a relatively short time period and with limited resources, but trusts that these difficulties have been obviated. MMWEC is directed to carefully consider the pros and cons of the many alternative methodologies available, in light of the diverse nature of its service areas, the foregoing Council analysis and the conditions imposed herein.

As was discussed in the commercial analysis above, MMWEC's historical data on industrial sales excludes small industrial customers and includes large commercial customers. Development of a well-defined and consistent data base is imperative. Further, industrial sales should be disaggregated by SIC code before a meaningful methodology can truly be developed.

Conditions for the use of interviews are further discussed below and are subject to Condition 2. The industrial sales forecast is further subject to Conditions 1, 3 and 6. The intent of these conditions is to ensure the development of an industrial forecasting methodology that is well-founded theoretically, and incorporates objective and comprehensive measures of growth.

5. Conservation and Load Management

Given the Council's review of MMWEC's supply plan, discussed later in this decision, and particularly the Council's interest in reducing the members' peak and energy requirements through conservation and load management, it is important that the MMWEC demand forecast methodology allow the explicit quantification of in-place and projected conservation and load management in all sectors.[14] The current methodology is not designed to explicitly consider or identify the impacts of conservation and load management.

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[14] The peak forecast methodology should also be designed to include effects of conservation and load management on peak; the present method which extrapolates the lowest historical load factor over the forecast period, ensures the projection ofa declining load factor.

Thus, as appropriately described in Condition 6 of this decision, MMWEC should prepare and submit a methodology development plan. It is hoped that the quarterly meetings required by Condition 8 will serve as a forum for discussing the development of this plan (among other topics), and will thereby result in the choice of a forecasting methodology for and by MMWEC which represents the most appropriate, reviewable, and reliable forecasting methodology for its system and system members.

III. SUPPLY ANALYSIS

1. Introduction

MMWEC's supply plan has undergone substantial change since its last Supplement was filed with the Council. The New England Power Company has cancelled its proposed Charlestown, Rhode Island, nuclear units NEP1 and 2 in which MMWEC members had planned for a 138 MW entitlement. Northeast Utilities had also indefinitely deferred construction of its proposed Montague units 1 and 2[16]; MMWEC members were seeking capacity totalling 33.35 MW from these units. Also, the status of the Sears Island Coal unit, sponsored by Central Maine Power, is in doubt due to a negative decision from the state utility commission in Maine. MMWEC owns a 79 MW share of that facility.

To partially compensate for these actual and potential reductions in their planned resources, MMWEC is seeking approval to acquire an additional share in Seabrook units 1 and 2 totalling

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16 Northeast Utilities has since cancelled these units as well.

approximately 138 MW (6.0091% of the combined rated capacity of the twin units). That facility is presently under construction in New Hampshire and has been designated "Project 6" in MMWEC's "Power Supply Program". It is an addition to 129 MW of Seabrook presently owned by MMWEC which has already been approved by both the EFSC and the DPU. To finance this additional purchase, (EX. MMWEC-4, p. 13), MMWEC would require bonding worth approximately $ 325,000,000.

Specifically, Project 6 is a Power Sales Agreement between MMWEC and 20 of its member cities and towns and 10 non-member municipals in Vermont, Rhode Island, and Maine. (See EX. MMWEC-1B, BS-2.) Approximately 110.4 MW or 4.80073% of the Seabrook units are allocated to the 20 MMWEC participants out of the 138 MW which comprises Project 6. (EX. MMWEC-1, p. 11.) The other 12 MMWEC members rejected participation.

The MMWEC "Power Supply Program" has as a stated goal, the phasing out of wholesale power purchases[17] from investor-owned utilities and substituting capacity from shares in units jointly-owned and financed by MMWEC. The program, itself, is being financed with tax-free revenue bonds, with the corresponding

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17 Most of MMWEC cities and towns have traditionally been all-requirements customers of investor-owned utilities. (EX. MMWEC-1, p. 4.) A drawback of these power agreements was that the capacity was originally financed at the higher investor-owned utility cost of capital rather than the lower municipal bond costs. MMWEC secured the authority to issue such bonds in 1975 under M.G.L. c. 164, Appendix, the same statutory legislation which created MMWEC as a public corporation.

lower cost of capital[18] directly benefiting the rate payers within the service territories of the member municipalities. (See EX. MMWEC-1, pp. 4-9.) The Power Supply Program also emphasizes a commitment toward non-oil based generation. (EX. MMWEC-1, p. 9.)

In addition to Project 6, MMWEC's development of its Power Supply Program includes on-going efforts to secure capacity from Canadian sources (New Brunswick[19], Quebec, and Ontario), potential resource recovery facilities, the Niagara Project of PASNY, and a very ambitious hydro development program. Yet none of these efforts can be considered an alternative to Project 6, either in part or in aggregate. For example, low-head hydro facilities will typically have low capacity factors (less than 60%) and would thus serve only peaking or cycling capacity needs. (EX. MMWEC-1, p. 57.)

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18 It is also unique to this acquisition, that MMWEC will not have to pay Public Service of New Hampshire for allowance for funds used during construction (AFUDC) accumulated during construction on this share of the project, a further cost savings to the rate payers. (EX. MMWEC-1, p. 16.) A second feature of the agreement with PSNH is a pair of sell-back provisions. At any time prior to November 1, 1982, MMWEC can notify PSNH that it desires to sell capacity in amounts not exceeding 100 MW in power years 1986/87, 1987/88, and 1988/89. Alternatively, PSNH has agreed to purchase up to 2.5% of the capacity in each unit (approximately 57.5 MW total) beginning with the commercial operating date of the second unit and ending after 7 years or the end of the power year 1995/96, whichever comes later. (See EX. MMWEC-1, pp. 17, 18 and EX. MMWEC-1B, BS-3 and BS-4.) Hence, subject to certain constraints, participants of Project 6 are afforded an opportunity to withdraw from participation should circumstances warrant such a decision.

19 Since the commencement of these proceedings, MMWEC has successfully negotiated an agreement with the New Brunswick Power Commission for 100 MW of capacity from the Pt. Le Preau nuclear station (EFSC Tr. vol.II, p.15).

2. Alternatives to Project 6

MMWEC and its consultants, Mr. Roger M. Cotte of R. W. Beck and Associates, and Dr. Ian Forbes, of Energy Research Group, Incorporated, have exhaustively analyzed a broad spectrum of alternative sources of power to Project 6.

Mr. Cotte has compared the relative cost effectiveness of Project 6 with a conventional coal-fired facility (EX. MMWEC-4, p. 221), low-head hydro (EX. MMWEC-2, p. 28), wood-fired units (EX. MMWEC-4, p. 29), and refuse-burning plants (EX. MMWEC-4, p. 30). Save for a new coal facility, the Council cannot and does not recognize these options as meaningful sources of cheap and reliable base-load capacity in quantities sufficient for MMWEC's projected needs. However, the Council does strongly endorse the promotion and development of these so-called renewable energy resources, and commends MMWEC for the initiatives it has taken and continues to take with regard to inclusion of these initiatives in MMWEC's long-term supply planning efforts. A balanced, diversified generation mix must include indigenous resources. The Council does consider coal-based generation as a viable alternative to nuclear capacity and anticipates a greater role for this fuel in future pool-planned facilities. However, the Council agrees with MMWEC that it would not be prudent to attempt to build a new coal facility as a substitute for Project 6. Under ideal[20] circumstances, Mr. Cotte has shown that power

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[20] Cotte bases his analysis on a hypothetical 340 MW coal unit built at an "ideal site". The analysis makes use of assumptions that explicitly favor the coal option over nuclear. (EX. MMWEC-4, pp. 22, 23.)

from a coal unit would be at least twice as costly, per KWH, as that from Project 6[21]. This results primarily from the fact that Seabrook is presently under construction and a comparable coal facility is not[22]. (EFSC Tr. vol. 2, p. 11; EX. MMWEC-1A, p. 38.)

In his direct testimony (EX. MMWEC-3), Dr. Forbes has very capably analyzed the availability of a number of "alternate" energy resources. He has discussed the present commercial status of each technology, its cost, and the potential for its implementation by MMWEC. Specifically, Dr. Forbes has researched geothermal, ocean thermal, wave power, fusion, magnetohydrodynamics (MHD), fuel cells, fluidized bed combustion, solar thermal electric, solar photovoltaics, wind, tidal, wood, solid wastes and hydro-electric. The Council agrees with Dr. Forbes' conclusion that these technologies are not now viable alternatives to Project 6 (EX. MMWEC-3, pp. 80 and 84). While several of these options i.e., wind, wood, hydro and solid waste) are certainly commercially feasible, for reasons of cost as well as lead-time considerations, they cannot be responsibly proffered as a substitute for Project 6.

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[21] Cotte estimates energy to cost 98.30 mills/Kwh from such a coal unit in 1990 (EX. MMWEC-4, RMC-17). This compares with Project 6's estimated cost of 47 mills/Kwh in the 1988/89 power year (EX. MMWEC-1C, BS-7).

[22] As of September 30, 1980, 40 percent of Unit #1 was completed and 29 percent of the total project was estimated to be complete. (Update of DPU EX. AG-24.)

3. MMWEC's Need for Capacity Such as Project 6

The Council recognizes five major justifications for the need for capacity: (1) capacity for system growth; (2) replacement capacity (i.e., due to unit retirements); (3) oil displacement capacity; (4) capacity that improves economic mix (where it can be reasonably shown that a new facility will result in appreciably lower costs accruing to the system's rate payers); and (5) capacity for reliability maintenance. The Council hereby APPROVES MMWEC's inclusion of Project 6 in its Supply Plan for reasons of oil displacement and economic mix. Mr. Stein, in his prepared testimony, states: "The addition of a resource such as Project 6 acts to reduce the overall cost of power to a system by reducing the fuel oil assumed burned on the own load dispatch, substituting less expensive nuclear fuel. The difference between these two fuel costs is substantial enough that the fixed costs of Project 6 can be justified on the fuel savings alone." (EX. MMWEC-1, p. 26.) The record shows quite clearly that each participant will benefit in every year. (See DPU EX. M-3; EX. MMWEC-1C, BS-6 (Rev. 2); EX. MMWEC -2, p. 25.)

4. Contingencies and Demand-side Supply Considerations

MMWEC had a system load factor equal to 56.4% in 1978 and is projecting a value of 55% in 1988 (EX. MMWEC-20A, p. 33). The Council believes that this load factor is unnecessarily low and that MMWEC's members should be concerned about it. Low load factors have costs associated with them such as a greater reliance on oil-fired peaking and cycling capacity in the system's generation mix. (Low load factors indicate a high system peak

load relative to average load.) If MMWEC's chief service to its member municipalities is the planning and acquisition of low cost and reliable bulk power supplies, it is consistent with those goals that the system load factor be brought under control. A significant benefit of restraining peak (KW) growth relative to energy (KWH) growth is that the system's long range planning efforts can emphasize more efficient baseload capacity, particularly non-oil fired generation. The Council believes that MMWEC members should be implementing load management initiatives at a faster pace than is evident from the record.

Some MMWEC members already recognize the merits of load management. Many cities and towns have off-peak hot water heating rates, controlled hot water rates, and storage electric space heating rates. However, many do not. Only 1 town has implemented interruptible rates; 4 towns offer time-of-use rates; 1 town has an off-peak back-up power rate for solar hot water; and 1 town has yet to implement a back-up rate for customers who self-generate some of their electricity needs. (MMWEC Response to EFSC Information Request.) MMWEC represents 32 cities and towns.

The Council expects MMWEC and its members to make greater efforts toward controlling its peak requirements. Where cost effective and oil conserving, load management programs employing innovative rate structures and appliance controls should be expeditiously implemented. As a condition to the Council's approval of MMWEC's Supply Plan, each member is to fully cooperate with MMWEC in the development of these initiatives, as described below in the itemized conditions to this decision. With respect to the actual implementation of these programs, MMWEC members have con-

siderable discretion. They may choose to work with MMWEC's planning staff, they may choose some other forum or organizational structure, or they may do it alone. All the members are, however, responsible for communicating the impacts of their activities to MMWEC such that appropriate adjustments can be made to future demand forecasts and to insure that the membership's supply planning goals are met.

Such is the thrust of Condition 10. Unlike the other nine Conditions, it goes directly to each and every member system, rather that through MMWEC. Counsel for MMWEC has advised that the Company cannot require its members to adopt any load management programs, but can only suggest their adoption. Condition 10 is addressed directly to each member system to emphasize the Council's interest in load management programs. The anticipated cooperation of the member municipals is greatly appreciated by the Council.

IV. ORDER and CONDITIONS

It is now ORDERED that, given the points and considerations set out above, the Annual Supplement (1979-88) of the Massachusetts Municipal Wholesale Electric Company be, and hereby is, APPROVED, subject to the following conditions:

1. That MMWEC's efforts to standardize data collected by its member systems, and its efforts to disaggregate this data to comply with EFSC Rule 63.7, shall be continued. Further, inconsistencies such as the following in customer classification should be eliminated to the extent possible:

a. commercial customers classified as industrial customers and the reverse;

b. hot water heating;

c. saturation of electric space heating;

d. seasonal residential and commercial customers.

2. That MMWEC's approach to forecasting number of residential customers and industrial sales shall be reevaluated, particularly the manner in which interviews are used. MMWEC may choose to continue a process of regular interviews in order to reinforce its familiarity with its service areas; however, interviews conducted for the purposes of gathering data for the forecast must meet the following standards:

a. For each type of interview, a detailed statement of the purpose must be developed, which identifies the types of data to be collected.

b. Based on the stated purpose, selection criteria must be developed and applied in identifying interviewees. Efforts to ensure representativeness and comprehensiveness must be made.

c. All interviewees shall be identified, including a description of the individual's specific area of expertise.

d. A standard interview format shall be administered to each individual, using a written questionnaire.

e. Where forecasts are requested as part of the interview, a consistent set of questions about methodology and assumptions shall be asked of each interviewee.

f. Results of the interviews shall be quantified and summarized.

g. Confidentiality may be discussed with interviewees, but promised only when requested. The items to be kept confidential shall be specifically designated, and protective orders may be granted by the EFSC when appropriate.

3. That MMWEC shall reevaluate its industrial sales forecasting approach and continue development of a methodology which incorporates quantitative measures of industrial growth and provides a basis for judgements exercised.

4. That MMWEC shall reevaluate its commercial sales forecasting methodology, in order to develop a stronger theoretical basis and more direct measures of commercial sales.

5. That Company plans to evaluate and use its saturation survey, RCS program data, and current Census data shall continue in order to provide a quantitative basis for the residential sales forecast.

6. That, given the diversity of the MMWEC member systems and the availability of existing individual data bases, attention shall be given to other data such as sales-mix, geographic location, weather, income and industry mix. MMWEC shall evaluate the collection and use of such data and shall prepare a methodology development plan based on this type of analysis

of its members, as well as incorporating the preceeding conditions, for submission in its next forecast.

7. That MMWEC shall examine the feasibility of studying the implementation of direct and indirect load management initiatives by the MMWEC member systems. The results of this study should be communicated to the member towns for their consideration. Town responses to this study, as well as documented evidence of similar initiatives which may exist or be proposed, shall be submitted to the Council. (See also Condition 10 below.) The study design shall include at a minimum:

I. RATE STRUCTURES THAT CONTROL DEMAND

(Primarily Efforts to shift load from peak to off-peak or to constrain on-peak load growth)

1. Interruptible rates to commercial and industrial customers;
2. Peak control rates to commercial and industrial customers;
3. Off-peak rates for all classes of hot water heating;
4. Storage electric heat rates;
5. Controlled air conditioning rates;
6. Time-of-use rates.

II. DIRECT, REMOTE CONTROL LOAD MANAGEMENT INITIATIVES

1. Hot water heating;
2. Air conditioning.

8. That MMWEC shall report to the Council on its progress in implementing the above conditions at meetings to take place at intervals of or about three, six and nine months from the date of this decision. These meetings shall take place at Council offices or at MMWEC offices as MMWEC shall designate. The Attorney General or his designee may attend these meetings if he wishes. The first such meeting shall be held on April 15, 1981.

If it should arise during these meetings that MMWEC and any attending party are involved on the opposite sides of a judicial or administrative proceeding before any court or agency, MMWEC may act accordingly and reasonably to protect its legal rights if communication of information by it at such meetings would jeopardize or adversely affect such rights.

9. That the next forecast filing from MMWEC be submitted on December 1, 1981. Actual MMWEC system data for the year 1980 shall be submitted to the Council as soon as possible in an appropriate form, i.e., MMWEC's annual DPU filings.

And it is further ORDERED:

10. That each and every MMWEC member system study and initiate load management programs employing innovative rate structures and appliance controls, where such programs are cost effective and oil conserving. For load management initiatives to be considered at a minimum, see Condition 7 above.

Each member shall also cooperate fully with MMWEC in the development of these initiatives and shall communicate the impacts of their load management activities to MMWEC.

Energy Facilities Siting Council

by Dennis J. LaCroix

Dennis J. LaCroix, Esq.
Hearing Officer

Dated at Boston this 13th day of January, 1981.

The above Decision and Order was unanimously approved by the Council members present and voting at the Council meeting of January 20, 1981. Chairman Fitzpatrick did not participate in the consideration of or vote on this case.

Joseph S. Fitzpatrick
Chairman

COMMONWEALTH OF MASSACHUSETTS
Energy Facilities Siting Council

In the Matter of the Petition of the Massachusetts Electric, New England Power, Yankee Atomic Electric and Manchester Electric Companies for Approval of an Annual Supplement (1980-89) to the Long Range Forecast of Electric Power Needs and Requirements	)	EFSC No. 80-24

DECISION and ORDER

The Energy Facilities Siting Council hereby APPROVES the Annual Supplement (1980-89) to the Long Range Forecast of Electric Power Needs and Requirements (Supplement 1D) as submitted jointly by the Massachusetts Electric, New England Power, Yankee Atomic Electric and Manchester Electric Companies (hereinafter "Companies" or "NEES").[1]

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1 For convenience, the petitioning Companies are referred to throughout this decision as the "Companies" or "NEES". For reference and the sake of clarity, the following paragraphs describe each company and its relationship to NEES.

Massachusetts Electric Company provides retail service for customers in Massachusetts only and is a wholly-owned subsidiary of New England Electric System (NEES). All of Massachusetts Electric Company's bulk power needs are provided by New England Power Company (NEPCo), which is also a wholly-owned subsidiary of NEES.

NEPCo is a bulk power supply company and provides generation and most of the major transmission facilities for all the NEES retail companies. These companies include, besides Massachusetts Electric Company, the Narragansett Electric Company in Rhode Island and the Granite State Electric Company in New Hampshire. NEPCo also serves, at wholesale, a number of municipal and other small utility systems, plus a few large industrial customers.

(Footnote 1 continued on next page.)

I. INTRODUCTION

In its 1980 filing, the Companies present a substantially improved forecast methodology. Since Council rejection of their 1978 Supplement (see 2 DOMSC 156, 163 (December 15, 1978)), the Companies have developed an appropriate and non-traditional approach which has produced a much more reviewable and reliable forecast methodology. This non-traditional approach, as described

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[1] (continued)

Yankee Atomic Electric Company (YAEC) owns and operates a nuclear generating plant in Rowe, Massachusetts. It has no other operating facilities and no plans for expansion. Its output is purchased by its stockholders in proportion to their ownership. NEPCo owns 30% of the stock of YAEC and receives 30% of its output. The plant in Rowe is a base-load unit which is run at practically constant power level, depending on the unit's ability. Information provided by YAEC is Total Electric Energy Requirements (EX. NEES-1, at II-167), and Agreements for Electric Service (EX. NEES-1, at V-85). The Rowe plant is included in the list of existing generating units (EX. NEES-1A, at III-4).

Manchester Electric Company is an independent company which services the town of Manchester, Massachusetts. Manchester Electric Company receives all of its bulk power needs from New England Power Company and thus makes its Council filings jointly with Massachusetts Electric Company. (See Section V infra.).

All the NEES Companies are members of the New England Power Pool (NEPOOL). As such, the planning of their bulk generation and transmission facilities is done within the framework of an overall NEPOOL regional plan which is described in the NEPOOL Forecast for New England 1976-1985, and supplements thereto, as filed with the Council by the NEPOOL planning staff. (See EX. NEES-1A, Appendix). The operation of these facilities, once placed in service, is placed under the control of the NEPOOL dispatch center, the New England Power Exchange (NEPEX).

by witness Robert O. Bigelow (Tr. 7-21), forecasts the "natural growth" of the service area, sets goals for electricity demand growth and controls that growth to achieve those goals. Moreover, the Companies recognize a degree of uncertainty in their forecasting and account for this uncertainty by setting out contingency plans to meet their power needs, should such uncertainty mean some forecast inaccuracy.

The Council is impressed with and supports this non-traditional approach and feels that the Companies' overall direction and anticipated further improvements in its forecast methodology are worthy of special note. Thus, the Council wishes to make clear at the outset of this decision its appreciation of the Companies' fine effort and work product. The critique of and comments on this methodology contained in the analysis below should be taken as suggestions for continued improvement and an exhortation to keep up the good work. The Council also appreciates the willing cooperation of the Companies' personnel during technical sessions held as part of this proceeding as well as their prompt and thorough response to information requests from the Attorney General as intervenor and the EFSC Staff.

In the following paragraphs, the Council analyzes the demand and supply forecasts of the Companies' 1980 Supplement. The Demand Analysis comments on the forecast methodology for total power requirements in three customer classes (residential, commercial and industrial) and peak load on the system. The Supply Analysis addressed the Companies' plans for supplying electricity to meet their projected needs for power. The joint

III. DEMAND ANALYSIS

A. Residential Forecast

The Companies used an end use methodology to forecast residential electricity demand. First, they projected the number of residential customers by dividing a population forecast by projections of household size for respective years during the forecast period. Then, the forecasts of appliance saturations[2] and average use (Kwh) per appliance were applied to the customer forecasts to produce a projection of residential electricity requirements. The paragraphs below discuss the NEES methods of forecasting (1) number of customers, (2) appliance saturations, and (3) average use of appliances.

1. Number of Customers

The NEES forecast of number of customers is based on the mean of population forecasts from two sources: Chase Econometrics, Inc. (Chase) and National Planning Associates (NPA). It is noted that NEES adjusted the Chase data after deciding that the Chase projections underestimated population (Tr. I, at 106-108).[3] This approach presents two slight difficulties which should be pointed out.

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[2] Saturation = percent of customers (dwelling units) that use a major appliance at a given time.

[3] The Companies stated that the econometrically driven Chase model predicts too much net out migration and does not account for "structural changes in the Massachusetts economy that had taken place post the period of time over which they had estimated that relationship." (Tr. 107).

First, the population adjustment lessens the internal consistency of the Supplement since the same Chase model is used without the population adjustment for the employment forecasts on which NEES bases its commercial and industrial forecasts. Since population and employment in the NEES territory are necessarily interrelated to similar assumptions about migration, households, and labor force, a prima facie inconsistency arises. The forecast methodology should be based on the consistent use of similar assumptions as much as possible.

The second concern here goes to the fact that the Chase and NPA projections reflect national and regional trends; as such, these may not be applicable to the NEES service territory. For example, the NEES area's net migration is apt to vary from national, regional, and even state averages.[4] The record in this case does not indicate that characteristics of the NEES territory are sufficiently similar to those of the nation and the region so as to allow confident use of those national and regional trends in NEES's population and employment forecasts.

With respect to these two concerns, the Council notes that the Companies intend to address the internal inconsistency by using only the Chase population forecast (i.e., without the

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[4] The most important characteristics of an area in terms of migration would be age distribution, labor force participation, employment opportunities, degree of urbanization, and various amenities. The differences in these characteristics for an area of a certain size (national, regional, state or local) could be significant and should be considered.

NPA forecast), but with alterations to incorporate the Companies' judgements about net migration in its service territory (Tr. 108). The Companies could address and account for the second concern by using more territory-specific data in their population and employment projections. While such data may be scarce, its incorporation in these projections could increase the reliability of and confidence in the forecast of number of customers. The Companies should investigate what can be done with the collection and use of territory-specific data.

2. Appliance Saturations

The Companies based appliance saturation forecasts on results from a 1978 survey of their service area, on assumptions about the characteristics of appliances, and on functional relationships between saturation and variables such as income and fuel prices. The appliances were classified and analyzed by four types[5], and saturations were either fixed at levels

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[5] (1) Necessities which are competitive in terms of fuel type in the residential market,

(2) Necessities which are non-competitive,

(3) Luxuries which are competitive, and

(4) Non-Competitive luxuries.

based on survey data[6] or specified in functions based on survey data[7], the relative prices of oil and gas[8], NEPOOL model results[9], and income[10].

The Companies' division of appliances into four types strengthened the theoretical basis for their saturation models as compared to last year's method. There remains, however, some weakness in the specifications of the models, namely, (1) the use of income as the sole explanatory variable for dishwashers and freezers and (2) the lack of basis for judgements on customers' likely substitution of gas for electricity in ranges and dryers.

As to the first, the Companies themselves note that other factors affect dishwasher and freezer ownership (EX. NEES-1, at II-18, II-20) and demonstrated in their workpapers that housing mix and age of housing stock are significant variables in explaining dishwasher saturations (EX. NEES-5; Q/A 1).

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6 Refrigerators, lighting and washers.

7 Dryers, air conditioners, water heaters and space heating.

8 Electric ranges, space heating and dryers.

9 Televisions and microwave ovens.

10 Dishwashers and freezers.

These other factors deserve attention since income, by itself, may not be a reliable predictor; the saturation of dishwashers and freezers are sensitive, but inconsistently so, to changes in personal income projections (EX. NEES-5; Q/A 9). A reliable model should be consistently insensitive to small changes in the values of predictors. Independent variables other than or in addition to income could be useful and reliable predictors.

As to the second, the Companies' approach to projecting consumers' likely substitution of gas for electricity in ranges and dryers[11] needs a documented, quantified basis. The effects of gas vs. electric competition are important enough for the Companies to support their judgements with facts and figures from applicable studies or Companies' data. The bases for such judgements need be set out so that the reliability of the Companies' projections on this point can be more easily seen.

Thus, the Council recommends that the Companies make important improvements in saturation projections by (1) further testing multiple variables in specifying the equations for saturation of dishwashers and freezers, and (2) continuing to develop and refine their method for incorporating the effects of gas vs. electric price competition in dryer and range saturation forecasts.

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[11] The Companies developed cross-elasticity equations and exercised judgement about the short term and long term competition between gas and electricity (EX. NEES-5; Q/A 2). The effects of the judgements were: reduced market shares for electric dryers and ranges through 1985 and increasing shares thereafter.

3. Average Use

The Companies utilized the NEPOOL model in forecasting average use (Kwh per appliance) for ten major appliances[12]. Included in NEPOOL's Massachusetts model were the effects of higher prices, efficiency trends, and family size. For devices in the NEES model which were not recognized in the NEPOOL model, the Companies assumed that usages would be fixed percentages of the usage for other appliances (EX. NEES-1, at II-28)[13].

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[12] Dryers, dishwashers, air conditioning, freezers, water heating, home heating, ranges, microwave ovens, lighting, televisions, washers.

[13] The Company estimated average use for these devices as follows:

a. Solar assisted electric water heaters were assumed to use 50 percent of usage estimated for controlled water heaters.

b. Wood stoves were assumed to contribute one-half of the heat in an electrically-heated home.

c. Solar space heating systems were assumed to provide one-half of a home's heat. A wood stove was assumed to save an additional 22 percent in a solar-heated home.

d. Miscellaneous use was estimated as a fixed percentage of the total of all other uses.

The Council offers a comment on the solar estimates: the assumptions that solar water heating would save 50 percent of the usage estimated for controlled water heaters may understate the most likely solar contribution over the forecast period (See EX. AG-1, at 7). Potential improvements in solar units during the forecast period could increase the level of savings. The Council notes that the Companies are conducting a solar water heating test program (EX. NEES-4) and encourages the Companies to incorporate those results or similar data in solar assumptions in future filings.

The Companies consider the NEPOOL model estimates of appliance average use to be the "best data available" (Tr. 115). The Companies' judge that the estimates adequately represent appliance average use in their service territory; this judgement was confirmed by a "reasonable correlation" to historical sales (Tr. I, p. 116). However, this limited analysis of the representativeness of the data begs certain fundamental questions.

While the Companies have not demonstrated that these estimates of appliance average use adequately represent present or future appliance average use in their service territory, the Council does recognize the paucity of territory-, state-, or even New England-specific data on average appliance use and the difficulties that NEES, as well as other companies, face in implementing an end-use methodology given this data constraint. Nevertheless, it still remains that the connected load data which form the initial basis for the estimates were collected during a period from 1955 to 1974 as part of various studies in regions of the country other than New England (EX. NEES-8, at G-22 - G-25). The appropriateness of such data is difficult to ascertain given the lack of comparable and timely local data. The Council notes that the Companies are planning improvements to their data base through an experiment in monitoring appliance average use, coding of customer accounts by housing type, and data collection related to the Public Utilities Regulatory Policies Act (PURPA) (Tr. 38-39). The

Council wholeheartedly encourages the Companies to pursue these improvements.[14]

B. Commercial Forecast

The NEES Companies are the first in the Commonwealth to disaggregate sub-categories of customers in a commercial forecast. In this revised methodology, the Companies identified seven commercial sub-categories for which data could be separated from the total commercial load information.[15] The Companies projected that the number of customers in those sub-categories, accounting for 15 percent of the total commercial load, would remain constant at the 1979 level.[16] Then, the Companies projected a "natural load growth" in each of these subcategories by multiplying the number of customers by an assumed constant base use.

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[14] Statistical approaches to estimating service territory appliance use also might be explored as the Companies have the ability to match individual saturation survey responses to customer billing data. For a discussion of this approach, see M. Parti and C. Parti, "The Total and Appliance-Specific Conditional Demand for Electricity, in the Household Sector", Bell Journal of Economics, Spring 1980, Vol. II, No. 1, pp. 309-321.

[15] The seven sub-categories were: churches, all-electric schools, all-electric nursing homes, commercial electric space heating, large non-electrically heated schools, large hospitals, and the Massachusetts Bay Transit Authority.

[16] The one exception is supplemental space heating which the Companies assumed would nearly double from 1979 to 1990. (Ex. NEES-1, Figure C-7).

mation and specifying models based on 3-digit forecasts would increase the reliability of the industrial forecast considerably. Such is the value of the Companies' growing familiarity with its industrial customers. Additionally, the Companies plan to concentrate data collection efforts on price and conservation adjustments to specifically account for technological change and conservation practices in the industrial sector (Tr. 45, 46).

The Council is aware that the basic structure of the industrial model will remain the same (Tr. I, p. 46), but that the Companies are moving to strengthen their industrial forecast methodology. The Council recommends that (a) the Companies expand their documentation of the specification and selection of regression equations to meet the requirements of Rule 69.3 fully, and (b) continue to analyze industries at the 3-digit level and to collect data on price and conservation adjustments, and then incorporate the appropriate findings in future Supplements.

D. Peak Load Forecast

The Companies projected their peak load forecast in two parts. First, the "natural" peak load[21] was estimated using the energy forecast for each sector with service area weather data and coincident load factors extracted from the NEPOOL model. Second, the companies estimated reductions to the natural peak

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[21] The "natural" peak is the coincident load in Kw of all customers at the NEES typical peak hour (based on historical system data).

load due to load management.[22]

With respect to the peak load forecast, the Council is constrained to express its concern about the use of the coincident load factors extracted from the NEPOOL model. Insertion of the Companies' service area weather data alone does not ensure that load factors derived from the NEPOOL model adequately represent NEES load factors. Difficulties with the residential data base (and thus, with the residential load factors) are discussed above in the analysis of average use. The commercial sector load factors are based on data from a sample which has no demonstrated relationship to the Companies' commercial customers (EX. NEES-9). That sample consists of a number of all-electric commercial buildings in various parts of New England in 1969. The Companies' service area's mix of stores, office buildings, schools, and motels and their characteristics have not been shown to be the same as those in the NEPOOL model are based on small samples from each two-digit SIC group that are likely to apply to the NEES industrial sector (NEES-9).

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[22] Load management would include increased storage heating, controlled water heating, time-of-use rates, peak control rates, interruptible rates, cogeneration, and air conditioner control. One example of the importance of load management to forecasting is the Companies' control of electric space and water heating. Uncontrolled space and water heating would have uncertain affects on peak load over the forecast period because competition with gas, solar, and wood systems makes the saturation of electric systems uncertain. If the Companies control electric units to shut off during peak periods, then the impacts of saturation forecasting error on the peak forecast are reduced.

meeting supply needs from the demand-side of the energy equation. The advantages of this approach extend beyond the number of barrels of oil saved. The potential minimization of capital investment by actively adjusting the system's load characteristics results from the fact that by directly controlling demand, NEES is effectively reducing the uncertainty in its demand forecast. Other companies which are only passively interested in customer end-use behavior must, of necessity, rely on very sophisticated empirical methods for minimizing forecast uncertainty - methods, which, as frequently seen by the Council, are beyond their expertise and data resources.

The specific load management strategies to be employed are storage heating systems; controlled water heaters; peak control, time-of-use, and interruptible rates; controlled air conditioning and storage cooling (EX. NEES-1, at II-73 to II-84).

NEES' promotion of storage heating systems is two-pronged. First, NEES is "offering a cost justified rate incentive for those customers who have storage heat under utility control to recognize their contribution in reducing the utility's operating costs and need for future generating facilities" (EX. NEES-1, at II-73). And, secondly, NEES is proposing a prohibition on new conventional baseboard electric heating customers, i.e., NEES is not allowing builders within their service territories the option to install electric heating systems with low capital costs but at appreciably higher life-cycle costs. Additionally, NEES does not presume that

all potential baseboard heating applications will be substituted with storage heating systems, if in fact, gas, wood or solar systems are cheaper, as the case may be. The Council applauds this economic pragmatism and hopes and suggests that NEES expand its research efforts and monitor such circumstances where extensive conversions or retrofits of existing baseboard systems may be equally cost justified and oil conserving.

NEES' initiatives with controlled water heating is an on-going program dating back almost a half-century (EX. NEES-1, at II-76). NEES is continuing its efforts to have controls on all electric water heaters within its service territories, but the Council is somewhat disappointed that this is currently being implemented by means of appliance attrition only (EX. NEES-1, at II-76 to II-77).

Three types of rates are integral to NEES' load management program: time-of-use rates (TOUR), peak control rates, and interruptible rates. The purpose of TOUR is to map more accurately the system's rates to the actual cost of service, which varies temporally. NEES hopes that the relative levels of its time-of-use rates will act as an incentive for some customers to shift load from peak to off-peak periods. They acknowledge, however, that if these rates "do not offer sufficient incentives, (NEES) will incrementally modify their design until they do." (EX. NEES-1, at II-80). NEES also recognizes the need to educate its customers with respect to their adaptation to TOUR and "in effect modify rate structures

to reflect customer price elasticities." (Ex. NEES-1, at II-80). The Companies' interruptible rates and peak control rates are being expressly designed to control seasonal peak periods and times of system emergencies. The Council supports these rate initiatives as a vital contribution to the Companies' long-range supply planning efforts and encourages NEES to expedite their implementation quickly with the appropriate guidance from the Massachusetts Department of Public Utilities and the Federal Energy Regulatory Commission.

Controls on air conditioning usage is another major feature of NEES' load management program. Such controls will be attempted with a combination of time-of-use and peak control rates, remote cycling of units for peak clipping, and storage cooling (as this emerging technology develops).

Finally, NEES considers "... load management as a continuously evolving area, dependent on customer reaction and participation, regulatory concurrence, load research results and future cost trends. Therefore, while our goals are to keep electricity costs down and to minimize the need for new generating facilities, the programs to achieve these goals will remain flexible." (Ex. NEES-1, at II-73). The Council endorses this conclusion and hereby enthusiastically approves the NEES Supply Plan on the assumption that the Companies will act to implement the load managment and conservation proposals contained in the Plan. In addition, the Council expects that the Companies will demonstrate actual load management and conservation improvements in future filings.

V. Manchester Electric Company

As in past years, Manchester Electric Company filed jointly

with Massachusetts Electric Company, et al, in the 1980 Supplement. In order to comply with EFSC Rule 61.5(3),[24] the Supplement should either (a) contain separate data for Manchester Electric Company for Tables E-1 through E-11 or (b) aggregate Manchester Electric Company data with data for the NEES service territory. The Council would accept either method in future filings as opposed to the manner of reporting in the present filing (Tr. 108-112).

VI. ORDER

Given the Companies' commitment to addressing the considerations raised herein, the Council ORDERS that Annual Supplement 1D (1980-89) filed jointly by the Massachusetts Electric Company et al. be, and hereby is, APPROVED. This approval is given with the expectation that the refinements of forecasting methodology and NEESPLAN implementation discussed above will be pursued by the Companies.

Energy Facilities Siting Council

by Dennis J. LaCroix

Dennis J. LaCroix, Esq.
Hearing Officer

Dated at Boston this 13th day of February, 1981

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24 EFSC Rule 61.5(3):

Companies may file joint forecasts or supplements, using the same or comparable methodologies and assumptions. Even so, all historical sales and demand or sendout data and forecast levels must be stated separately for each company whose wholesale and retail sales exceed two percent (2%) of total retail sales in the Commonwealth. Any company whose wholesale and retail sales do not exceed two percent (2%) need not file such data separately if it participates in a joint forecast or supplement. In the event of a joint forecast or supplement, the Council may conduct a joint adjudicatory proceeding concerning the forecasts or supplement. In such a proceeding the Council may render separate and different decisions for different companies.

Unanimously approved by Council members present and voting on February 26, 1981.

Joseph S. Fitzpatrick
Chairman