

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of  
CONSUMERS POWER COMPANY  
(Midland Plant, Units 1 & 2)

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Docket Nos. 50-329  
50-330

NRC STAFF TESTIMONY OF SIDNEY E. FELD ON  
NEED FOR FACILITY

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This testimony addresses the need on the part of the Michigan Electric Coordinated System (MECS) for Midland, Units 1 and 2, in the 1981-1982 timeframe. The analysis will show that, based on Consumers Power's (CP) and Detroit Edison's (DE) latest forecasts and capacity plans, the reserve margin in the summer of 1981, with Midland units delayed one year, will fall below that deemed necessary by the MECS to maintain reliable service. Furthermore, the staff will demonstrate that based on CP's latest projection of KWh sales, there exists an affirmative indication for the addition of baseload capacity on the CP system.

Underlying these analyses is our ability to accept CP's and DE's forecasts as reasonable measures of future growth and inherent in this acceptance is a recognition that conservation has been given adequate weight in these forecasts. Based on a review of the assumptions embedded in the utilities' forecasts, a review of independent forecasts and studies of the MECS service area, and consideration of the Federal Energy Administration's (FEA) regional forecast, the staff concludes that the utilities' forecasts are reasonable representations of likely future growth and they do, in fact, factor in the impact of conservation. The following testimony provides support for this conclusion.

#### CONSUMERS POWER & DETROIT EDISON SERVICE AREAS

Consumers Power is one of two major electric utilities servicing the State of Michigan. As of 1975, it provided electricity to a population of approximately 3.3 million people extending over a wide geographic area (lower Peninsula of Michigan except Southeastern portion) consisting mainly of rural areas and dispersed urbanized centers. Major cities within the service area include Grand Rapids, Flint, Kalamazoo, Lansing, and Battle Creek. The industrial demand for electricity is concentrated in the automobile industry with General Motors alone accounting for about one-third the Company's total industrial electric energy sales. Other important industries in the service area include primary metals, pharmaceuticals, machinery, oil refining, paper and paper products, and food products.

The second major electric utility in Michigan is the Detroit Edison Company. Their service area extends over approximately 7600 square miles in the more urbanized and industrial area of southeast Michigan. Its customers number about 1.6 million, and the population served is about 5 million.

The two utilities comprise the Michigan Electric Coordinated System and jointly service approximately 90% of Michigan's electrical needs.<sup>1</sup> They constitute a highly integrated system and in addition to joint planning efforts, they actively coordinate their transmission and generating equipment to meet the electrical needs of Michigan's lower peninsula. Because Consumers Power is an integral part of this larger system, the staff concludes that a determination of need for Midland must be viewed in the context of the combined capacity and combined demands of both Detroit Edison and Consumers Power.

#### Forecasting Demand

The staff recognizes the uncertain nature of forecasting and that there is no standard forecasting methodology to which one can turn as a reliable guide for predicting the future. Prior to 1973 few envisioned the oil embargo and the succession of bewildering events aggravated by the embargo: fuel shortages; double-digit inflation; a prolonged economic recession; sharp rises in the price of electricity and alternate energy sources; and the implementation of conservation programs throughout the country. Yet, in the uncertain environment of 1971, the applicant prepared a forecast and the staff evaluated those projections of KWh sales and peakload demand and deemed them reasonable. Today, it is abundantly clear that those forecasts overstated future growth for the period 1971 through 1975.

<sup>1</sup> Governor's Advisory Commission on Electric Power Alternatives, Final Report.. Facts and Recommendations, Vol. IV, Lansing, Michigan, August, 1976, p.4.

In 1971, when the applicant submitted its ER for the Midland units, it was forecasting a growth rate in peak demand of about 7.6% per annum for the years 1970 thru 1980. Their KWh sales forecast was also about 7.6% per year over the same time period. These forecasts were strongly influenced by the actual growth experience in the previous decade in which total sales for Consumers Power grew at 7.6% per annum (1961-70), with residential sales growing at 6.4%, Commercial sales at 9.1%, and Industrial sales at 7.8%. Similarly, Detroit Edison was likewise forecasting a relatively high growth rate back in 1971 based on its historic growth pattern.

But because of the factors identified above, growth in the 1970's did not keep pace with historical levels. Between 1970 and 1975, Consumers Power's KWh sales grew at a rate of about 4% and peak demand at only 3.9% per annum. In addition, actual declines in sales were registered in 1974 and 1975, and a decline in peak demand occurred in 1974. Clearly, factors such as conservation, an economic recession, higher prices for electricity, and to some extent, more moderate weather, all contributed to this decline in growth.

However, it should be noted that the preliminary results for 1976 suggest that growth is once again on the increase among the nation's electric utilities. For example, over the first seven months of 1976, the production of electricity by all U.S. utilities has been 6.7% above the same period last year.<sup>2</sup> Similarly, over the first eight months of 1976, KWh sales on the CP system are up about 7.4% and for DE, sales are up 7.9%.<sup>3</sup>

In the midst of declining growth in the MECS the two utilities have over the last few years continually revised their forecasts downward. For example,

<sup>2</sup>Energy Resources Council, President's Energy Program, Monthly Progress Report, August, 1976.

<sup>3</sup>East Central Area Reliability Council (ECAR) - 1975-76 KWh Consumption by Ultimate Customer.

CP's latest forecasted growth rate is approximately 35% below that forecasted in 1972. The forecasts under consideration today, at this hearing, are CP's 1976 forecast of sales and peak demand of 4.9% per annum between 1975 and 1984, and DE's 1976 forecast of 4.8% growth in sales and 5.2% growth in peak demand between 1974 and 1984. It is the staff's belief that these moderate growth rates do in fact take conservation as well as other inhibiting factors on growth into account and reasonably reflect the likely growth over the time period under examination.

Clearly, adjustments to MECS's capacity plans were necessary to reflect the recent experience and these lower growth projections. In the last few years, the response to capacity planning has been rather dramatic. For example, in 1974, Consumers Power announced the deferral of 2773 MWe and the cancellation of 2300 MWe. Detroit Edison deferred 5779 MWe and cancelled 1150 MWe. Thus, the total amount of capacity either deferred or cancelled was 12,002 MWe, at a time when the two companies' total installed generating capacity was approximately 14,000 MWe. In addition, the Midland units themselves are now rescheduled to come on line about 4 years later (1981-82) than initially planned back in 1971 (1977-78).

#### Need for Additional Capacity

Table 1 presents the utilities latest summer peak demand forecasts and capacity plans for the years 1981 thru 1983. The table identifies two cases: Midland units on-line as scheduled (available for summer of '81 and '82); and Midland units delayed one year (available for summer of '82 and '83). In the event Midland is not delayed, the reserve margin (net capability as a percentage of peak demand) is projected to be approximately 20% over all three years, however with a one year delay, the reserve falls to 14.2 and 18.1 percent in 1981 and 1982 respectively. It should be noted that based on the applicant's reliability analysis a reserve margin of about 20% is needed on the MECS to maintain a reliability criterion of one day in ten years loss of load which is a recognized standard throughout the electric utility industry.

TABLE 1 Michigan Electric Coordinated System (C.P. and D.E.)  
Summer Peak, Capacity and Reserve Margins  
1981 thru 1983

Y E A R	Peak Demand <sup>a</sup> (MWe)	Net Capability (MWe) <sup>b</sup>		Reserve Margin as % of peak demand	
		Midland on-line as scheduled	Midland delayed one year	Midland on-line as scheduled	Midland delayed one-year
1981	15127	18084	17273	19.5	14.2
1982	15891	19220	18760	20.9	18.1
1983	16653	19896	19896	19.5	19.5

<sup>a</sup>SOURCE: Consumers Power Company Environmental Report Supplement, October 26, 1976, Table 1.1-1.

<sup>b</sup>SOURCE: Consumers Power Company Environmental Report Supplement, October 26, 1976, Tables 1.1-6 and 1.1-7.

Note: Staff accepted the data presented in these tables with the following exceptions:

- 1 - we assume Palisades will not be out during the 1981-82 period.
- 2 - the only sales of capacity that the staff has taken account of are the Luddington sale to Consolidated Edison of 624 MWe and the sale of 220 MWe of Fermi 2 to municipalities. Although other sales are projected by the Applicant and may well materialize, no deduction from capacity has been made for them.
- 3 - The staff has taken account of a 147 MWe derating of capacity for (CP) and 143 MWe for (DE) during summer peak load due to higher cooling medium temperatures in summer. See ER Supplement, p. 1.1-20.

### Need for Baseload Capacity

The staff also evaluated the need for baseload capacity on the CP system. Essentially, this consisted of a quantitative comparison of projected baseload demand and baseload capacity for the years 1981 thru 1983.

All units designed and operating as baseload units were identified by the applicant. For example, in 1981, with Midland 2 in service, the CP system will have 7682 MWe of capacity of which 4698 MWe will be baseload for a percentage share of total capacity of about 61%. Without Midland 2 on-line, the baseload portion would approximate 57%. As of September 30, 1976, CP's baseload portion approximated 59% which suggests that the addition of Midland 2 would not alter significantly CP's historic relative dependence on baseload capacity.

Baseload demand has been estimated by the staff as a function of forecasted KWh sales. It may be noted that nationally approximately 85 to 90% of the KWh's generated during the year are at loads equal to or less than the average load. For CP the staff has estimated that 88.2% of its KWh sales occur over this range of their load duration curve.<sup>4</sup> The staff assumes that these KWh's will be generated by those units in the system that are the most economical to operate, usually the large units. The remainder of the electrical energy will be generated by peaking or cycling units. Taking 1981, the year the first unit is expected to go on-line, the applicant forecasts an energy level of 29,835,000 MWh. 87.5% (midrange between 85 and 90) of this is about 26,106,000 MWh. At a capacity factor of 65% for baseload units, this would require 4585 MWe in baseload capacity.

<sup>4</sup>That load equal to or less than the average load for the CP system is a function of its load duration curve which can be approximated by a fifth degree polynomial whose coefficients are closely related to just two quantities--the ratio of the minimum load to the maximum load during the period, and the ratio of the average load to the maximum load. The preceding method is discussed in International Atomic Energy Agency, "Market Survey for Nuclear Power in Developing Countries," September, 1973, and comments to that article, Nuclear Technology, "Letters to the Editor," letter by Artha Jean Snyder, Vol. 24, November, 1974, p. 260. These ratios were calculated for the CP system based on 1975 results as reported in CP's FPC Annual Report, Form No. 12, Schedules 12 and 13. The results indicate that 88.2% of the total KWh's generated occur at loads at least equal to the average load.

Table 2 presents the baseload capacity and demand estimates for CP for the years 1981 thru 1983. Based on this analysis, a delay of one year will result in shortages in baseload capacity of about 700 MWe and 125 MWe in 1981 and 1982 respectively. With Midland on-line as scheduled, surpluses of between 84 and 335 MWe will occur in the 1981 to 1983 period.

Y E A R	BASELOAD CAPACITY		BASELOAD DEMAND	BASELOAD MARGIN-EXCESS OR (DEFICIT)	
	With Midland on line as scheduled	With Midland delayed 1 year		With Midland on line as scheduled	With Midland delayed 1 ye
1981	4698	3887	4585	113	(698)
1982	5158	4698	4823	335	(125)
1983	5158	5158	5074	84	84



A third factor which is relatively important in considering the applicant's need to add the proposed nuclear plant to its system is the desirability of adding non-fossil capacity to reduce fuel consumed by gas- and oil-fired units now forming about 27% of CP's total system capacity. To the extent that this substitution can occur, it will increase the availability of these more versatile fuel resources for other uses for which there is no available substitute. Shifts of this nature are consistent with national energy objectives as set forth by the Federal Energy Administration and the Federal Power Commission, and are also beneficial in reducing our nation's balance of payment deficit.

The foregoing analyses suggest that the Midland units are needed as scheduled to maintain reliable service for the MECS customers, to meet the need for baseload capacity on the CP system, and to permit CP to limit its dependence on scarce fossil fuels in accordance with national energy policy. However, for the most part, these analyses are dependent on two important assumptions:

- 1) that the capacity estimates in the 1981-83 time frame will materialize; and
- 2) that the growth forecasts envisioned by CP and DE will likewise materialize and are reasonable in light of the potential for conservation savings.

#### System Capability - 1981-83

Capacity planning on the CP and DE systems has undergone dramatic revisions in the last few years in response to changing demand and financial conditions. The capacity data appearing in Tables 1 and 2 represent the latest plans (as of mid-1976) available to the staff. The staff believes that the estimates used herein are conservative because the potential for future delays and deferrals in capacity are ignored even though they are very much a reality whereas the addition of capacity not planned for at this time is highly unlikely because of the large lead time typically required.

For example, the capacity plan presented here assumes that six units, excluding Midland 1 and 2, with a total net summer capacity of 4459 MWe will come on-line between 1977 and 1983 as scheduled. Given the frequency with which construction has been delayed in recent years, this must be characterized as a very optimistic assumption. Furthermore, it does not take into account the possible repairs to Palisades which represent a potential derating of CP's capacity of approximately 680 MWe during the 1981-82 period. Also, it assumes that gas and oil supplies will be adequate to allow CP to meet the future demands that will be placed on its gas- and oil-fired capacity. Out of a total capacity of 7682 MWe in 1981, oil- and gas-fired units will account for about 1800 and 400 MWe's respectively. And finally, it does not reflect CP's present plans to sell portions of Midland 1 and 2, and Campbell 3 which, if consumated, would further reduce CP's net system capability in 1981 and 1982.

#### Independent Assessment of Demand

The staff has had an opportunity to review two independent forecasting analyses that project growth in electricity demand on the MECS. Since they are solely concerned with growth in the CP and DE service areas and because they are the products of analyses performed under the auspices of the government of the state of Michigan, their inclusion here appears warranted. In addition, the staff has also considered the FEA's latest forecast for the east north central region. Although this forecast is not as precise geographically (evaluates growth in a five state region), it is included here as a secondary reference check on the preceding analyses. Each of the analyses will be discussed and their results will be compared with those made by CP and DE.

MICHIGAN PUBLIC SERVICE COMMISSION

In December of 1974 the Michigan Public Service Commission (MPSC) released a report entitled Evaluation of the Consumers Power and Detroit Edison 1974 Load Growth Forecasts. The document prepared by a project team within the MPSC, responded to a request by the Commissioner to:

Provide an independent evaluation of the electric demand load factors and forecasts for the Commission's use in evaluating electric demand requirements.<sup>5</sup>

The thrust of the report is a detailed evaluation of the 1974 forecasts prepared by CP and DE. After a careful analysis of each of the assumptions underlying growth in the residential, commercial, and industrial sectors, as well as a detailed investigation of the impact of conservation, substitution, growth in the economy, and the future behavior of the load factor, the report concludes that:

- 1) The forecasting methodologies used by both CP and DE seemed reasonable and were consistent with generally accepted approaches used by utilities across the country. Furthermore, they were depicted as containing a high degree of analysis and statistical support although specific areas of improvement were identified;<sup>6</sup> and
- 2) In the opinion of the PSC project team, the CP and DE 1974 forecasts underestimated future peak demand. This conclusion was based primarily on the project team's belief that the utilities overstated conservation savings and understated growth in the Michigan economy.<sup>7</sup>

<sup>5</sup>Michigan Public Service Commission, Evaluation of the Consumers Power and Detroit Edison 1974 Load Growth Forecasts, Staff Study 1974-4, December, 1974, p. 1-9.

<sup>6</sup>Ibid., p. 2-1<sup>a</sup>, 2-2 and 3-7.

<sup>7</sup>Ibid., p. 2-1, 2-11.

Although the project team did not develop an independent forecast per se, they did produce a reforecast range by substituting alternative assumptions within the Companies' forecast methodologies. It should be emphasized that this is not to say that the Companies' forecasts are necessarily incorrect, or that the project team's are correct. Rather, they indicate the general direction in which the project team believes the actual values may be relative to the Company estimates.

The key parameters used in CP's and DE's 1974 forecast methodologies are depicted in Tables 3 and 4 respectively. For each parameter, three estimates are presented. The first is the company's own estimate which was used to generate their 1974 forecasted growth rate in electricity demand. The latter two values represent the high and low values that the project team assigned to the same parameters based on their research and knowledge. These estimates were then incorporated into the forecasting model to derive high and low estimates of electrical growth in the CP and DE systems. It is interesting to note, that in several instances, CP's value for a particular parameter was even less than the MPSC's low value for the same parameter. For example, whereas in 1974 the applicant assumed an average use per residential domestic customer of 7800 KWh by 1982 and a rate of growth in GNP of 2.3%, the MPSC's low estimates were 8100 KWh's and 3% respectively. The project team's estimates for electrical growth for the year 1982 appear in Table 5. Represented are projected KWh sales and peak demand for CP, DE, and for the MECS (CP and DE combined). In each instance, high and low values are depicted. These estimates are contrasted with the Companies' latest (1976) forecasted results.

Table 5 suggests that CP's forecasts are consistently conservative, even when contrasted to the MPSC's low forecast. For DE, the Company's forecasts are consistently below the high-end of the project team, however, are apparently not as conservative as the project team's low forecast with respect to peak demand. Here, the Company's own forecast is about 700 MWe greater than the project team's low value. With respect to the MECS, the

TABLE 3  
 MPSC SUPPORTING ASSUMPTIONS FOR REFORECAST  
 Based on Projections by 1982  
 Consumers Power

FORECAST CATEGORY	1974 FORECAST	MPSC HIGH ESTIMATE	MPSC LOW ESTIMATE
- Residential Sales			
. Number of Customers	1,275,500	1,304,600	1,265,000
. Marginal Space Heating Saturations	40%	50%	70%
. Average Use Per Residential Domestic Customer	7,800 KWH	8,700 KWH	8,100
. Average Use Per Space Heating Customer	19,200 KWH	19,900 KWH	18,900
-Commercial Sales	6.05%	7.37%	5.17%
-Industrial Sales			
. Sales to GM	1%	2.2%	1.5%
. Sales to Other Industrial			
.. Rate of Growth in GNP	2.3%	4.0%	3.0%
.. Rate of Growth in Usage Per Unit FRB	0%	1.9%	1.1%
-Load Factors			
. Space Heating Load Factor	45%	45%	45%
. Net System Load Factor	65%	63%	67%

SOURCE: Chart 4.26 C, MPSC Study.

TABLE 4  
 MPSC SUPPORTING ASSUMPTIONS FOR REFORECAST RANGES  
 Detroit Edison

FORECAST CATEGORY	1974 FORECAST	MPSC HIGH ESTIMATE	MPSC LOW ESTIMATE
<b>Residential Maximum Demand</b>			
.Number of Customers	1,759,000	1,759,000	1,700,000
<b>Air Conditioning Saturations</b>			
..Room	46%	50%	42%
..Central	23%	25%	21%
.Marginal Space Heating Saturations	63.5%	80%	80%
<b>Average Use Per Customer Temperature Sensitive Load</b>			
..Room Air Conditioning	500	600	400
..Central Air Conditioning	3,200	3,200	2,800
..Electric Space Heating	14,000	14,000	12,000
.Average Use Per Customer Non-Temperature Sensitive Load	6,804	7,600	6,600
.Residential Load Factor	54.4%	50%	50%
<b>Commercial Maximum Demand</b>			
.Commercial Growth Rate	4.6%	5.0%	4.2%
..Commercial Load Factor	46.6%	44%	47%
<b>Industrial Maximum Demand</b>			
.Rate of Growth in GNP	3.5%	4.0%	3.0%
..Industrial Load Factor	77.5%	72.5%	77.5%

SOURCE: Chart 4.15 C, MPSC Study

Table 5 - 1982 KWh Sales and Peak Demand for CP, DE, and MECS--  
Companies' Forecasts vs. MPSC Range

1982 KWh SALES			
	Company Forecast (1976) MKWh	MPSC RANGE MKWh	
		HIGH	LOW
Consumers Power	31386 <sup>a</sup>	38737 <sup>b</sup>	34494 <sup>b</sup>
Detroit Edison	48423 <sup>c</sup>	57443 <sup>d</sup>	49937 <sup>d</sup>
MECS (CP & DE)	79809	96180	84431

  

1982 PEAK DEMAND			
	Company Forecast (1976) MWe	MPSC RANGE MWe	
		HIGH	LOW
Consumers Power	5840 <sup>a</sup>	6734 <sup>b</sup>	6354 <sup>b</sup>
Detroit Edison	10051 <sup>c</sup>	11222 <sup>d</sup>	9337 <sup>d</sup>
MECS (CP & DE)	15891	17956	15691

a - Consumers Power Company Environmental Report Supplement, October 26, 1976, Tables 1.1-1 and 1.1-3

b - MPSC Study, Chart 4.26B, p. 4-79

c - Latest forecast submitted 10/18/76 by CP on behalf of DE - Note, since DE only forecasts total output, 1982 sales were estimated by applying growth rate in total output (1975-82) to actual sales in 1975.  
1975 sales = 32,419 MKWh and 1975-82 growth = 1.49

d - MPSC Study, Chart 4.15B, p. 4-42

Companies' combined peak demand is approximately 2000 MWe below the commission's high forecast and about 200 MWe above their low forecast. On balance, one must conclude that relative to the MPSC forecast range, the Companies' combined 1976 forecasts are a conservative reflection of likely electric growth in its region.

Governor's Advisory Commission on Electric Power Alternatives (GACEPA)

In August, 1976 the GACEPA released a study which, among other things, provided the state with an econometric model to forecast electricity demand in the CP and DE systems.<sup>8</sup> The model utilized quarterly data over a ten year period (1965-74) with the exception of the industrial sectors which were developed on 19 years of annual data. Using this data base and regression analysis it derived estimating coefficients for key explanatory variables. The model was fairly disaggregated in that it forecasted sales by major customer class (residential, commercial, and industrial) and within the industrial sector attempted to forecast by the Department of Commerce's Standard Industrial Classification Code (SIC). This attempt at further disaggregation was statistically effective with respect to the CP forecasting model but produced excessively downward biased forecasts for the DE model.<sup>9</sup> Consequently, the forecast for the DE industrial class was ultimately performed on an aggregated basis.

Once the causal variables and estimating coefficients were defined, the Advisory Commission Staff postulated future levels for all causal variables. Three distinct scenarios for the growth levels of causal variables were developed.<sup>10</sup>

<sup>8</sup>Governor's Advisory Commission on Electric Power Alternatives, Final Report...Facts and Recommendations, (Vol IV) Lansing, Michigan, August 1976.

<sup>9</sup>Governor's Advisory Commission on Electric Power Alternatives, Forecasting Electric Energy Demand in Michigan, Vol II, Lansing, Michigan, February, 1976, p. 29.

<sup>10</sup>Advisory Commissions Final Report, pp. 14-15.



The high-growth case assumes that causal variables will grow at the same annual average growth rate which obtained in Michigan during the period 1969-73, a period of strong economic growth.

The medium-growth case assumes that the levels of causal variables will grow at the annual average rate that obtained in Michigan during the period 1965-74, a period which saw both high and low cycles of economic activity in the state.

The low-growth case assumes that Michigan causal variables will move at the same rate forecast for the nation by Chase Econometrics (this forecast includes a recession in 1977-78).

Given these postulated levels, the model forecasts the following average annual growth rates in sales and demand through 1985 (see Table 6).

TABLE 6  
GACEPA' FORECASTED GROWTH RATES IN SALES AND PEAK DEMAND  
1975-1985

	High	Medium	Low
Consumers Power	7.54%	5.26%	3.70%
Detroit Edison	5.49%	4.17%	3.33%
MECS (CP & DE) weighted average	6.29%	4.59%	3.47%

The Advisory Commission adopted its staff's medium forecasts. When weighted by the size of the two companies 1975 peak demand, the MECS average annual compound growth rate in peak demand is 4.59 percent, unless vigorous conservation measures are taken. However, the Commission noted that shortages

of basic fuels that are readily transportable to end users (natural gas, fuel oil, propane) could result in a shift to greater expansion of electricity use and thus they recommend using the staff's medium rate of growth with allowance for minor upward adjustment in case of error.<sup>11</sup>

Addressing the question of need for new capacity on the CP and DE systems by 1985 the Advisory Commission concludes that:<sup>12</sup>

The national recession which hit Michigan's economy with the force of a depression in 1974 and 1975 did have the effect of providing a "breather" in the state's growing electric needs. Also, this Commission's forecast at present projects a lowered rate of growth in demand through 1985.

Nevertheless, we forecast the need for 5077 MWe of new construction in the combined Consumers Power-Detroit Edison service area by 1985, assuming only a 15% installed reserve capacity. If the reserve is 20% (which both Detroit Edison and Consumers Power assert is necessary to maintain bulk power reliability), then the necessary construction by 1985 would be 5908 MWe.

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The present expressed plans of both companies provide for 7231 MWe construction by 1985, which would more than meet the needs which we forecast. However, construction has not yet resumed on enough capacity to warrant certainty that Michigan's needs will be met. If additional delays of one to two years are incurred on plants now tentatively scheduled for completion in 1983 and 1984, then the state's 1985 needs at 20% reserve would not be met.

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<sup>11</sup> Ibid. pp. 20-22.

<sup>12</sup> Ibid. pg. 9.

Table 7 contrasts the companies' and the GACEPA' peak demand projections for the year 1982. The GACEPA medium forecast, which was identified by the Advisory Commission as probably being slightly biased downward, is accepted by the staff as a basis for comparison. The Advisory Commission's peak demand growth rates are applied to the 1975 peak for CP and DE in order to obtain projected peak demands in 1982 and the comparison is performed for CP, DE, and the MECS (CP & DE).

TABLE 7  
1982 PEAK DEMAND FOR CP, DE, AND MECS - COMPANIES'  
FORECASTS VS. GACEPA'S MEDIUM FORECAST

	1982 PEAK DEMAND Company Forecast (1976) MWe	GACEPA Medium Forecast MWe
Consumers Power	5840	6004
Detroit Edison	10051	9609
MECS (CP & DE)	15891	15613

Relative to the Commission's medium forecast, CP's own forecast is conservative by about 165 MWe, whereas DE's own forecast is overstated by about 440 MWe. In total, the MECS forecast is about 280 MWe greater than that forecast by the Commission's econometric model. Recognizing that this is only a 1.8 percent discrepancy in estimated 1982 peak demand and that the Commission acknowledges that their medium forecast may understate growth, one must conclude that relative to the Advisory Commission's findings, the companies' forecasts are reasonable measures of future growth.

#### FEDERAL ENERGY ADMINISTRATION REGIONAL MODEL

The most comprehensive attempt at an econometric model concerned with future energy growth was presented about a year ago by the U.S. Federal Energy Administration (FEA) in their "Project Independence Report."<sup>13</sup> More recently, a refinement of the FEA model was reported in "National Energy Outlook (February, 1976)."<sup>14</sup> One impact of this refinement was a reduction in FEA's projections. Furthermore, this report provided results on a regional basis. In all, the model provides three projections of future national electric energy consumption: 1) the reference case, which does not assume passage of any energy conservation actions but does include the conservation effect of higher energy prices; 2) the conservation case, which represents the reference case as modified by conservation actions and load management programs; and 3) the electrification case, which incorporates into the reference case certain measures aimed at substituting coal and electricity in place of oil and natural gas in the commercial, industrial, and residential sectors. Under the reference case, with oil at \$13/barrel, electricity consumption is projected to grow nationally at 5.4 percent per year between 1974 and 1985. Under the conservation and electrification cases, electricity consumption is projected to grow at 4.9 percent and 6.4 percent, respectively.

<sup>13</sup>"Project Independence Report," Federal Energy Administration, Superintendent of Documents, U.S. Gov't Printing Office, Washington, D.C., Stock Number 4118-00029.

<sup>14</sup>"National Energy Outlook," Federal Energy Administration, FEA-N-75/713, February 1976.

These national results simply constitute an aggregation of estimates prepared on a regional basis and in actuality elasticities and projected changes in the independent variables exist for each of the nine census regions in the U.S. In addition, for each region, electricity consumption is forecasted by major customer class: residential, commercial, and industrial. Consequently, based on the distribution of sales among major customer classes, one can use the regional results to estimate growth in electricity consumption in a specific service area. This procedure requires one to accept the assumption that the structural coefficients and their projected growth rates that were developed on a regional basis are representative of specific service areas within the region.

The FEA forecasts energy sales for the time period 1974-85 by major Census Region. The relevant geographic area is the East North Central Region which encompasses the States of Michigan, Wisconsin, Illinois, Indiana, and Ohio. The forecasted growth rates for this region under the reference scenario are 8.15 percent for the residential sector, 3.90 percent for the commercial sector, and 2.65 percent for the industrial sector.<sup>15</sup> Sales to others will be assumed to grow at the same rate as the average of the three major classes. The staff assigned weights to each of the growth rates based on the present distribution of electricity by customer class in the system. This assumes that these proportions will remain relatively unchanged over the forecast period. This approach produces an annual compound growth rate in electricity sales through 1985 of 4.79 percent for CP, 4.55 percent for DE, and 4.66 percent for MECS. The calculations appear in table 8.

<sup>15</sup>ibid., page C-28, Table 13a.

TABLE 8

DERIVATION OF CP'S, DE'S, AND MECS' GROWTH RATE IN ELECTRICITY SALES, 1974-1985, USING REGIONAL FEA MODEL

Customer Class	Percent of Total Sales <sup>a</sup>	Forecasted Growth Rate (%) <sup>b</sup>	Contribution to Service Area Growth Rate
<u>Consumers Power</u>			
Residential	31.7	8.15	2.59
Commercial	22.3	3.90	0.87
Industrial	40.9	2.65	1.08
Other	5.1	4.90	0.25
Total	100.0		4.79
<u>Detroit Edison</u>			
Residential	29.8	8.15	2.43
Commercial	17.3	3.90	0.68
Industrial	51.0	2.65	1.35
Other	1.9	4.90	0.09
Total	100.0		4.55
<u>Michigan Electric Coordinated System (CP &amp; DE)</u>			
Total			4.65 <sup>c</sup>

a - 1975 sales distribution as reported to ECAR

b - National Energy Outlook, p. C-28, Table 13a, Residential, Commercial, and Industrial forecasts for East North Central region. Other is the average of the above three.

c - average of total growth rate for CP and DE weighted by total 1975 sales.

The forecasts of electricity sales become the basis on which peak load demand is projected. That is, once electrical energy growth is projected, the analyst must make a determination as to the likelihood of whether peak load will grow faster or slower. In most instances, utilities are forecasting faster growth for peak load than for electricity consumption. This is true for DE, although CP assumes equal growth between sales and peak demand. Historically, peak load has grown considerably faster than energy sales. For example, for all U.S. utilities, between 1963 and 1973 electrical energy consumption grew at 6.9 percent per year and non-coincident peak load grew at 8 percent per year.

The FEA regional results cited above reflect the FEA's reference scenario. Presently, this is the only scenario for which results are reported on a regional basis. An important assumption underlying the reference case is the continued deterioration of the load factor with peak load growing a modest one-half percent faster than electrical consumption.<sup>16</sup> Thus, the FEA regional forecast indicates that peak load in the relevant service areas will grow at approximately 5.29 percent, 5.05 percent, and 5.15 percent for CP, DE, and the MECS respectively (or one-half percent faster than the growth in energy sales). Applying these growth rates to the appropriate 1974 peak demands enables one to obtain estimated 1982 peak demands which are based on the FEA's regional model. These values are presented in Table 9 and contrasted with the companies' own latest forecasted values.

TABLE 9  
1982 PEAK DEMAND FOR CP, DE, AND MECS - COMPANIES' FORECASTS  
VS. FEA'S EAST NORTH CENTRAL FORECAST-REFERENCE SCENARIO

	1982 Peak Demand	
	Company Forecast (1976) MWe	FEA East North Central Forecast-Reference Case MWe
CONSUMERS POWER	5840	6206
DETROIT EDISON	10051	9809
MICHIGAN ELECTRIC CO- ORDINATED SYSTEM	15891	16015

<sup>16</sup>Ibid. page 239

Once again, the company forecasts appear reasonable. Relative to the FEA forecast, CP's 1982 estimate understates peak demand in 1982 by about 360 MWe and DE overstates growth by about 240 MWe. More importantly, the net effect for the coordinated system (MECS) is an understatement on the part of the companies by about 100 MWe.

Thus, based on the three independent analyses reviewed by the staff, we conclude that the Companies' forecasts provide reasonable estimates of projected growth in the MECS service area. In the remaining sections of this testimony the staff will attempt to determine whether or not these forecasts give adequate weight to future conservation savings in the service area.

#### CONSERVATION

Since late 1973, this country has developed numerous programs in an effort to conserve our scarce energy resources. The conservation of electric energy has been an integral part of this endeavor. All levels of government, as well as the electric utilities themselves, have initiated policies encouraging the "wise use" of electricity. Essentially, these programs are designed to discourage physical and economic waste in order to reduce current use rates.

The applicant is actively involved in promoting conservation measures among its customers. For example, as of 1970, promotional advertising was abolished and advertising campaigns and educational programs were limited almost exclusively to encouraging conservation. In addition, the applicant discontinued the sale of electric appliances in 1972.<sup>17</sup> To a large extent, a utility's conservation program -- as it relates to consumers -- can be little more than informational in nature. Once the consumer is made aware of the seriousness of the problem and the means to correct wasteful use, it is up to the consumer to effect a change. However, a utility can also practice conservation within its own operations and CP has done this. The applicant's internal uses of electricity have been cut by almost 30 percent.<sup>18</sup>

<sup>17</sup>C.P.'s Environmental Report Supplement, October, 1976, p. 1.1-2.

<sup>18</sup>Ibid., p. 1.1-5



Our ability to separate out and quantify conservation's impact relative to higher prices, a sluggish economy, and various other factors is very difficult. Technically, conservation--that is, conservation apart from any response to changes in relative prices of electricity and other goods and services--represents a shift in consumer demand curves rather than a movement along the demand curve. The shift would be due to changes attributable to taste preference factors such as a new conservation ethic rather than real income effects. In explaining the absence of significant growth in KWh sales since 1974, we cannot at present resolve the relative role of nonprice-related conservation because so many other factors were changing rapidly during this time period. And even if data problems were surmountable, semantic differences would remain. At one extreme, some would probably argue that all savings in KWh of electricity would have been realized even in the absence of rising real electricity prices, the economic slump, and mild weather, as consumers became aware of the potentials for such savings. At the other extreme, some would argue that all savings are economically motivated. The truth, as it often does, probably lies somewhere in between these two extreme viewpoints.

The applicant has made several attempts to identify the conservation response that has already occurred between 1973 and 1976. In a 1976 survey of commercial and industrial firms, ordered by the Michigan Public Service Commission, the company has ascertained that most firms have reduced lighting levels, that about 20 percent have reduced ventilation energy, and that, in certain instances, electric water heater temperatures have been lowered, equipment has been shut down during work breaks, and thermostats have been lowered in winter and raised in summer.<sup>19</sup>

The applicant's analysis of conservation savings among residential and commercial customers in its service area generally indicates a diminished response over time. In the winter following the energy crisis these

<sup>19</sup>Ibid., p. 1.1-8.

customers reduced consumption by about 4.5 percent. However, in subsequent heating seasons, absolute increases were registered. One exception to this pattern is energy use among residential electric space heating customers. Here, declines in winter energy use have persisted each year, although at a decreasing rate.<sup>20</sup>

The applicant states that these conservation responses have been factored into its latest forecast via the inclusion of the slow down in growth experienced over these latest years. More specifically, the applicant has identified several parameters, used in its forecast, that have been adjusted to reflect future conservation savings. For example, in the residential sector, the growth in average use of electricity by residential domestic customers is now projected at one-half the rate that occurred during the 1960s. The present forecast also assumes that 10 percent of new, electrically heated homes will have heat pumps by 1980. In the industrial sector, conservation is reflected by the assumption that the ratio of electricity sales per unit of the forecasted Federal Reserve Bank (FRB) Manufactures Index will level off in contrast to the historical experience in which this ratio has increased at about 4.6 percent per year. In the commercial sector, the applicant simply states that conservation will contribute to a significant reduction in growth from historic levels but does not identify how this has been factored into its model.

In 1974 the Michigan Public Service Commission carefully examined the CP and DE forecasting methodologies and assumptions. An important conclusion of this report was that the companies did factor conservation into their forecasts and in the opinion of the MPSC staff, did so in such a way as to overstate its likely impact on future growth. After reviewing the forecast assumptions made by both utilities, it was the project team's opinion that:

....the impact of the energy crisis and projections of slow economic growth on future demands for electricity have been overstated. As a result, both utilities' forecasts of

<sup>20</sup>Ibid., p. 1.1-7.

maximum demands are lower than what might be reasonably projected if the potential impact of these factors were assessed differently.<sup>21</sup>

With respect to residential demand, the opinion of the project team was that:

"...the impact of conservation pressures on residential customers to cut back on their electric usage would not be as significant as both Detroit Edison and Consumers Power assumed in the 1974 forecasts."<sup>22</sup>

Specifically, the project team questions..."...the drastic decrease in the growth of average use..."<sup>23</sup> which CP has since identified as reflecting conservation savings. The project team felt that..."...less of a reduction seems warranted"<sup>24</sup> based upon the following reasons:

- Voluntary conservation will not continue at 1974 levels for the duration of the forecast period. The Company's recent monthly reports support this.
- Appliance efficiencies increased as a result of the energy crisis will not immediately affect average use because of the comparatively long term turnover for major appliances.<sup>25</sup>

With respect to industrial growth and the specific conservation assumption that the ratio of sales to unit of FRB index would level off; the project team concluded that: "Growth in sales per unit of output is, for similar reasons, unlikely to cease."<sup>26</sup> The team reasoned that:

<sup>21</sup>MPSC Study, p. 2-4.

<sup>22</sup>Ibid., p. 2-11.

<sup>23</sup>Ibid., p. 4-73.

<sup>24</sup>Ibid.

<sup>25</sup>Ibid.

<sup>26</sup>Ibid., p. 4-76.

"Efficiencies of operations will be offset by environmental requirements as is the case in sales to General Motors. From this analysis, it is the project team's opinion that the company's forecast of sales to other industrial customers is very low."<sup>27</sup>

With respect to commercial growth, the project team acknowledged consideration of conservation within the applicant's forecast and found its commercial projection reasonable.<sup>28</sup>

In the aggregate, the MPSC project team repeatedly reached the opinion that the companies are understating future growth because they are giving too much weight to conservation savings over the forecast period. Yet, in spite of this criticism, the applicant's present forecasted growth rate in peak demand is even less than that being forecasted in 1974.

The staff believes that much uncertainty surrounds estimates of future conservation savings. We recognize that several existing studies indicate that the technical potential of electric energy conservation is indeed considerable. However, one must distinguish between potential energy savings and achievable savings. The staff believes that in order for important gains to occur, government sponsored incentives, mandates, and legislation must be forthcoming, and in their absence, the impact of conservation on future electrical use and demand will likely be considerably less than the maximum technical potential.

<sup>26</sup> Ibid., p. 4-76

<sup>27</sup> Ibid.

<sup>28</sup> Ibid., p. 4-74, 75.

However, one study suggests that even with important technological breakthroughs, government subsidies, and large conservation investment, the more dramatic forecasted conservation savings may not be realized. The FEA has projected annual kWh growth through 1985 under a conservation scenario which includes: thermal efficiency standards for new buildings, appliance standards and labeling, an insulation tax credit, an industrial energy conservation program, and increased dispersed solar equipment. The program has been characterized as an aggressive one, with the commitment of \$250 billion over a ten year period in conservation investments in all energy markets. The difference in the results generated through this scenario vs. the FEA reference case is a reduction in the growth rate of electric utility output of 0.5 percent per year over the period 1974-85. Thus, given government incentives, and the expenditures of high sums of money for technological developments, growth in kWh sales is not eliminated, but simply lowered by one-half a percentage point a year, which results in a fall-off in sales of about 9 percent relative to the FEA reference case.

In the opinion of the staff, the foregoing discussion provides support for the applicant's position that conservation is adequately accounted for in its present forecast. And in the event savings should exceed present estimates, the staff feels that countervailing forces exist which may offset an increased conservation response.

### SUBSTITUTION

Since the new emphasis on energy conservation has resulted principally from the energy crisis, it is equally important to inquire as to what extent will the future substitution of electrical energy for fuels in short supply -- namely, oil and natural gas -- tend to increase the demand for electrical power and thus offset the impacts of conservation measures.

Recognition of this positive stimulus to future electrical demand has been frequently noted in the literature. Preliminary data already indicate shifts by consumer groups due to price and supply considerations associated with natural gas. For example, for the residential sector, for the first six months of 1973, the sale of gas ranges was down 0.6 percent from the year before while electric ranges were up 12.6 percent over the same time period. Water heater sales suggest a similar trend; gas water heater sales up 1.2 percent versus electric water heater sales up 18.4 percent. For gas and electric dryers, sales of electric models increased 17.5 percent versus an increase of 5.5 percent for gas units. And in the spaceheating category, gas fired units were down 9.3 percent versus a 15 percent increase for electric models. In 1974, the Electric Energy Association predicted that for the first time more than half the newly built homes in the United States would be heated electrically.<sup>29</sup>

Recently, the 50th American Assembly held a symposium attended by 62 experts from government, industry, and the academic community where the following general consensus was reached:

For U.S. electric power demand, it was felt that although growth would probably be less than the historic growth rate, it was unlikely to be less than 5 to 5.5 percent in view of the need to substitute electrical energy for some present uses of oil and gas.<sup>30</sup>

<sup>29</sup> See for example, "Energy Crisis Alters Power-Use Pattern," Electric World, January 1, 1974 and Sanford Jacobs, "More Homes are Using Electric Heat," Wall Street Journal, February 18, 1974.

<sup>30</sup> The American Assembly, Columbia University, Report of the Fiftieth American Assembly, April 22-25, 1976, Arden House, Harriman, New York.

### Natural Gas - National Perspective

As early as 1969, it was recognized by the Federal Power Commission's (FPC) Bureau of Natural Gas that the nation would be facing difficulties of supply emerging during the period 1969-73.<sup>31</sup> The shortage indeed appeared such that by 1971-72 the major pipeline companies and distributors in most parts of the country were forced to refuse requests for additional gas service from large industrial customers and many new customers. By 1970, ninety-five percent of the proven reserve inventory was already committed to gas sales contracts and was therefore unavailable for sales to new customers or for increased volumes to old customers. Availability had decreased to such an extent that it became necessary for the FPC to curtail service on interstate pipelines and to issue guidelines and priorities in meeting commitments to gas customers.<sup>32</sup>

### Natural Gas - State of Michigan

In 1970, gas requirements in the state of Michigan were approaching one trillion CF. Today, because of curtailments on the major interstate pipelines servicing Michigan, the available supply approximates 900 billion CF, or a short-fall from 1970 requirements of about 10 percent. As a result of this shortage most Michigan gas distributors have not hooked up new commercial and industrial customers since 1970. Today, only one distributor continues to service new non-residential customers but does so on a selective basis. Thus, the 10 percent short-fall in supply may be misleading because it does not take into account most of the growth in gas requirements that would have occurred in the commercial and industrial sectors between 1970 and 1976.

In recent years, the applicant has observed some minor conversions to electricity on the part of CP customers.<sup>33</sup> For example, in the industrial sector during the last 6 to 8 years conversions to electric furnaces have

<sup>31</sup> Federal Power Commission, "National Gas Supply and Demand 1971-1990," Staff Report No. 2, Bureau of Natural Gas, Washington, D.C., February 1972.

<sup>32</sup> 38 F.R. 1503 (January 15, 22, 1973).

<sup>33</sup> Consumer Power Company, Environmental Report Supplement, October 26, 1976, pp. 1.1-14 & 15.

resulted in the addition of about 200 MWe. Recently, a natural gas pipeline company replaced gas engines with electric motors resulting in a small electric load of about 2200 KWe. In addition, CP has received numerous inquiries from industry, including one from one of its largest customers, to discuss contingency plans calling for conversions to electricity. New commercial and industrial buildings and private residences are also installing electric heat with much greater frequency. For example, since 1970, the number of homes heated with electricity has more than doubled (18.6 thousand vs. 39.4 thousand) on the CP system.

The results to date indicate that although electricity is increasing its market share relative to other energy sources, the transition is slow in coming. The Governor's Advisory Commission on Electric Power Alternatives acknowledges that the substitution stimulus in Michigan is really not effective at the present time and attributes this to the fact that increases in the price of natural gas have not yet matched those of other fuels. However, they conclude that shifts out of natural gas should pick up momentum in the next decade and ultimately predominate over those factors such as conservation which tend to reduce growth in electricity demand.<sup>34</sup>

Specifically, they identify the following substitution factors as items that will increase the future demand for electricity in Michigan.<sup>35</sup>

- . Natural gas, historically the space-heating fuel of choice, will become, less available and/or much more expensive in real dollars. As natural gas becomes less available and/or more expensive, space-heating installations will turn to oil and electricity.
- . New and more efficient forms of electric heating and cooling, such as the heat pump, are being developed and put into widespread commercial and residential use. As such developments make electric heating and cooling more

<sup>34</sup> Governor's Advisory Commission on Electric Power Alternatives, Final Report--Facts and Recommendations, State of Michigan, Lansing, Michigan, August, 1976, pp. 19-22.

<sup>35</sup> Ibid., pp. 19-20.



desirable, they will increase its use in new and, to some extent, replacement applications.

- The low capital cost of electric resistance heating makes it attractive to builders of both single-family and multiple dwellings. (Over 50% of dwelling units completed in recent years contain electric heating.)
- Uncertainty of future price and availability of natural gas and petroleum-based fuels has led to increased experimentation and commercial development of devices which run on electric power.

Another study<sup>36</sup> also acknowledges the importance of substitution on future electric demand and identifies these shifts as being long-term in nature. The authors of this study conducted a survey of the major energy consuming manufacturing industries in the United States to determine the effect of potential short-falls of fossil fuels on future industrial electric energy requirements.

The 15 most energy intensive manufacturing groups were selected, representing over 90 percent of the energy consumed by the industrial sector in the United States. Ten companies from each of these groups were selected for interviews and in all, 142 companies and approximately 25 trade associations, electrical equipment manufacturers, and electric utility industry representatives were contacted.

Of the 142 companies surveyed, 80 percent indicated that they expect a short-fall of certain types of fossil energy and 61 percent plan significant changes in their energy mix during the next ten years and have developed contingency plans. Of those companies expecting to make energy use changes in the immediate future, most anticipate greater reliance on oil, apparently due to the ease of conversion. However, although

<sup>36</sup>Potential Fuels Shift--A Survey of Contingency Planning by Manufacturing Industries in the United States, A Report by Stone & Webster Manufacturing Consultants, Inc., for the Edison Electric Institute, May, 1976.

oil will remain the dominant alternate fuel for the two to five year immediate period, increased shifts to electricity and to new coal applications are anticipated. This study concluded that...."over the long term, the number of companies using coal and electricity is expected to increase significantly.<sup>37</sup>

Industrial activity in the state of Michigan is concentrated in the lower peninsula where CP's and DE's service areas are located. According to the Census of Manufactures, the 1972 manufacturing activity in those counties serviced by MECS accounted for over 95 percent of total manufacturing payrolls and value added. Furthermore, those manufacturing activities that predominate in Michigan also happen to be the most energy intensive. For example, the 15 most energy intensive industries, as identified in the preceding survey, account for over 95 percent of Michigan's manufactures value added.

The staff has attempted to calculate the potential level of conversions and translate this to its effect on the growth in electricity in the MECS's service area. The FPC's Bureau of Natural Gas has adopted a policy which includes reallocation of available natural gas away from low priority use together with conversions to alternate fuels for all interstate gas supplies. Industrial use, of which manufacturing is a subset, has been designated a low priority by the FPC. Approximately 90 percent of the natural gas consumed in Michigan enters the interstate supply system and thus comes under the authority of the FPC. Just viewing manufacturing activity, one can demonstrate that electricity growth, via natural gas substitution, can be significantly expanded.

<sup>37</sup> Ibid., p.4.

In summary, the staff believes that the existing shortage of natural gas in the state of Michigan and the uncertainty of future supply offers significant growth potential in new electric loads in the MECS service area over the forecast period and beyond. However, it must be emphasized that just as with conservation savings, there is no guarantee that substitution's full potential will be realized. Rather, its inclusion here appears warranted to simply identify a potential off-setting influence to conservation.