BEFORE THE

Mississippi Public Service Commission

Docket No. 2008-AD-158

Proceeding to Review Statewide Electric Generation Needs

REPLY TESTIMONY OF

EZRA D. HAUSMAN, PH.D.

ON BEHALF OF THE SIERRA CLUB

July 31, 2008

Table of Contents

Exhibits

Exhibit EH-1:	Resume of Ezra D. Hausman
Exhibit EH-2:	Synapse Energy Economics, *Coal Fired Power Plant Construction Costs*, updated July 2008.
Exhibit EH-3:	Synapse Energy Economics, *Nuclear Power Plant Construction Costs*, updated July 2008.
Exhibit EH-4:	Synapse Energy Economics, *Synapse 2008 CO_2 Price Forecasts*, July 2008.
Exhibit EH-5:	U.S. Department of Energy State Energy Alternatives summary for Mississippi (Source: http://www.eere.energy.gov/states/alternatives/resources_ms.cfm)
Exhibit EH-6:	Archer, C.L., and M.Z. Jacobson, Journal of Geophysical Research, Vol. 108, No. D9, 4289, doi:10.1029/2002JD002076, May 16, 2003 (Available at: http://www.stanford.edu/group/efmh/winds/2002JD002076.pdf)
Exhibit EH-7:	Supporting and updated material for Attachment B. (Available at: http://www.stanford.edu/group/efmh/winds/us_winds.html)

Q. Please state your name, title and business address.

A. My name is Ezra D. Hausman, Ph.D., and I am a Senior Associate with Synapse Energy Economics (Synapse). My business address is 22 Pearl Street, Cambridge, Massachusetts, 02466.

Q. Please describe Synapse Energy Economics.

A. Synapse Energy Economics ("Synapse") is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, market power, electricity market prices, stranded costs, calculation of avoided costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities Commission staff, attorneys general, environmental organizations, federal government and utilities. A complete description of Synapse is available at our website, www.synapse-energy.com.

Q. Please summarize your relevant work experience and your educational background.

A. I have been employed by Synapse since July of 2005. In this position I have served as an analyst and provided expert testimony in numerous cases involving electricity and ancillary service market design and analysis, electricity price forecasting, resource planning, and economic analysis. I have also prepared reports on these and other related topics for clients including the American Public Power Association and the U.S. Environmental Protection Agency. I have also facilitated and served as an expert analyst for state-level stakeholder processes aimed at mitigating greenhouse gas emissions associated with the electricity sector.

From 1997 until 2005, I was employed as a Senior Associate with Tabors Caramanis & Associates (TCA), now part of CRA International, performing a

wide range of electricity market and economic analyses and price forecast modeling studies, including asset valuation studies, market transition cost/benefit studies, market power analyses, and litigation support studies. I have extensive personal experience with market simulation, production cost modeling, and resource planning methodologies and software.

I hold a B.A. from Wesleyan University, a M.S. in civil engineering from Tufts University, an S.M. in applied physics from Harvard University and a Ph.D. in atmospheric chemistry from Harvard University.

A copy of my current resume is attached as Exhibit EH-1 to this testimony.

Q. Have you previously provided testimony in this proceeding?

A. No. However my colleague at Synapse, Dr. William Steinhurst, did file preliminary testimony in this proceeding on behalf of the Sierra Club. He indicated (page 4) that I was likely to file rebuttal testimony once we and the Sierra Club had an opportunity to review the direct testimony of the other parties to this proceeding.

Q. Have you reviewed the testimony and discovery responses submitted in association with this docket?

A. Yes.

Q. On whose behalf are you appearing in this proceeding?

A. I am appearing on behalf of the Sierra Club.

I. Overview and Recommendations

Q. What is the purpose of your testimony?

A. Entergy Mississippi, Inc. ("Entergy") and Mississippi Power company ("MPC") (together, "the companies" or "the utilities") have submitted resource plans to the Commission in accordance with Miss. Code Ann §77-3-14 (Revised 2000) so that the Commission may

> …develop, publicize and keep current an analysis of the long-range needs for expansion of facilities for the generation of electricity in Mississippi, including its estimate of the probable future growth of the use of electricity, the probable needed generation reserves, the extent, size, mix and general location of generating plants and arrangements for pooling power to the extent not regulated by the Federal Energy Regulatory Commission and other arrangements with other utilities and energy suppliers to achieve maximum efficiencies for the benefit of the people of Mississippi. [MCA 77-3-14 (2)]

Specifically, the utilities are required to

> …submit to the commission its forecasts and plans for the addition of generating capacity planned by the utility for an ensuing five-year period and shall furnish to the commission such documents and proof with respect to the need therefor as the commission may reasonably require. [MCA 77-3-14 (2)]

I have been asked to review these "forecasts and plans" along with the supporting materials submitted by the utilities, as well as their responses to data requests in this proceeding, and to examine the modeling assumptions, approaches, results, and background materials supporting. In this testimony I discuss the adequacy of these assumptions, approaches, results, and background materials as bases for the companies' forecasts and plans.

Q. Please summarize your conclusions.

A. In general, I conclude that the companies have not provided sufficient information for the Commission to make a finding on the adequacy of their plans to provided for a least-cost, reliable, and robust electricity resource mix, which would

"achieve maximum efficiencies for the benefit of the people of Mississippi." [MCA 77-3-14 (2)] To the contrary, the companies' plans as filed are lacking in both specificity and economic analysis, and are unlikely to yield "maximum efficiencies" or reasonable cost for ratepayers. During discovery, the companies either failed or refused to provide the documentation and work papers necessary for the Commission to make findings regarding the adequacy of the companies' plans, or else the documentation and work papers simply do not exist.

In fact, I conclude that the companies have not even provided the Commission with resource plans in any meaningful sense. Entergy has provided the Commission with a "Reference Planning Scenario" [Exhibit APW-1, p. II-93] which is extremely lacking in details regarding the types and locations of resources to be built, the capital and operating costs of those resources, or any indication of whether this plan represents the least-cost among possible alternative plans. MPC has provided even less information, presenting only two reference cases, with and without coal plant retirements [Exhibit MPC-6] that only suggest the need for new capacity without any indication of how this need would be met. This approach may serve as an indication that MPC foresees a problem meeting their customers' electricity needs in the coming decade and beyond, but it gives exceedingly little indication of how they plan to address those needs at reasonable cost to their ratepayers.

Finally, I conclude that the companies are not adequately pursuing all potential resource options, in particular demand side resources and renewable resources, which could provide substantial economic, risk management, and environmental benefits for their ratepayers and the for the state of Mississippi.

Q. What are your recommendations for the Commission in this case?

A. I recommend that the Commission refuse to accept either Entergy's or MPC's resource plans, or the information they submitted in support of these plans, as sufficient to guide their long-term resource planning. The Commission should

order the companies to produce detailed planning studies that investigate all resource options for meeting the needs of Mississippi's ratepayers, including fossil generation; renewable generation; nuclear generation; demand side management; transmission enhancement; and purchased power, and to file detailed information supporting their modeling and analysis of each of these resources individually and in portfolios. The completion of comprehensive DSM assessments is an essential element of this process.

The companies should also be ordered to present and analyze alternative resource plans before the Commission in a public and transparent manner. The companies should assess the costs and benefits of each of these plans under a range of realistic forecast assumptions regarding, at a minimum, economic growth; capital costs; fuel costs; and emissions costs including carbon dioxide (CO_2) emissions costs. In addition, these resource plans should treat load not as a fixed value to be forecast but as an economic variable which can be managed, and which is responsive to electricity price in a realistic manner.

In addition, I make the following specific recommendations:

Load Forecasts

I recommend that the Commission require both companies to provide complete explanations of their load forecasting approaches, including a full and transparent accounting of their input assumptions and forecasting methodologies. In the case of Mississippi Power Company, I further recommend that the Commission direct the company to discard their current overly-simplistic approach and replace it with an industry-standard, objective, econometric demand forecasting approach.

I recommend that both companies' forecasts be audited and verified by an independent third party, selected by the Commission but at the companies' expense, and that this third party produce a report affirming the validity of the

companies' load forecasts. Finally, the Commission should provide for a period of public review and comment on these forecasts before they are relied upon for any construction permit proceedings.

Capital and Operating Costs

I recommend that the Commission order both companies to produce their estimates of capital and operating costs for generating resource alternatives in detail, and backed up by appropriate and comprehensive engineering studies. I recommend that both companies' estimates be audited and verified by an independent third party, selected by the Commission but at the companies' expense, and that this third party produce a report affirming the reasonableness of the companies' capital and operating cost estimates. Finally, the Commission should provide for a period of public review and comment on these estimates before they are relied upon for any construction permit proceedings.

CO_2 Emissions Costs

I recommend that the Commission adopt, after a period of public review and comment, a range of reasonable future CO_2 emissions price scenarios. These scenarios should be based on a thorough analysis of the bills introduced in the US Congress and the likely cost of emissions mitigation, similar to the Synapse analysis presented as Exhibit EH-4. The Commission should order the companies to use these CO_2 price forecast trajectories in analyzing the economics of all potential generating resource investments, analyzing how the proposed investments perform under "high", "mid", and "low" CO_2 emissions price scenarios.

If the companies build uneconomic resources because they have ignored foreseeable CO_2 emissions costs in the planning process, ratepayers should not bear the cost of extra emissions allowances incurred because of this imprudent

planning. Ratepayers should not bear the burden of poor decisions when the utility should have known better.

Energy Efficiency and Demand Response

I defer to Sierra Club witnesses Hale Powell and Carl Pechman to make specific recommendations for goals and implementation details that would be most appropriate and effective for Mississippi. However, I do conclude that neither MPC nor Entergy has treated demand resources as a coequal alternative to supply resources, to be compared and selected or rejected on the basis of cost and operational characteristics. By failing to do so they are likely to miss the opportunity to provide Mississippi ratepayers with the least-cost, least-risk and most environmentally-benign resource alternative available for meeting a significant portion of their energy needs.

Renewable Energy Resources

The Commission should either direct the companies to commission, or should commission a study itself at the companies' expense, a thorough investigation of the potential for harnessing all types of renewable energy in Mississippi and the surrounding region. This study should investigate at a minimum the technical and economic potential for biomass energy (both co-firing and direct-firing,) agricultural waste gasification, landfill gas, solar photovoltaic, and off-shore wind. The economic potential analysis for these resources should be undertaken assuming a range of plausible avoided cost levels, and should assume CO_2 emissions costs for displaced fossil resources as described above.

Once this study is complete, the Commission should determine an appropriate means of fostering renewable energy development in Mississippi, in recognition of their societal value over and above their direct avoided fuel and emissions costs benefits. There are a number of options available to the Commission and the Legislature to assist and encourage the utilities in developing

these resources. These options include net metering, feed-in tariffs, and renewable portfolio standards (RPS). Variants on these approaches are used in numerous states to foster the development of renewable resources. Ideally, the Commission could foster a collaborative process including utilities, renewable energy developers, environmental advocates, ratepayer advocates, and other interested parties to develop such a policy. Failing that, the Commission could open a Docket on the issue, hold a period of public comment, and issue an order to take best advantage of the renewable resource potential in the state.

Consideration of Alternative Plans

The Commission should direct the companies to develop and evaluate a number of alternative resource plans, using an industry-standard planning optimization model such as EGEAS or Strategist. It is important that the plans themselves be substantially varied in terms of their resource choices, and not be merely minor variants on the companies' preferred plans. The companies should investigate how each of the plans performs over a range of plausible future scenarios. The development and evaluation of the plans must consider all available resources, including demand resources, renewable resources, and conventional generation, on an equal footing.

The companies should identify their preferred plan to propose to the Commission, but they should also present the results of their modeling exercise showing the results for all of the alternative plans, the input assumptions, and the performance of all plans for each scenario considered. Only then will the Commission have a basis for determining whether the companies' plans are optimal, least-cost plans for serving Mississippi ratepayers.

II. Entergy and MPC Resource Plans

Q. You mentioned that the companies have not provided the Commission with sufficient information on which to base a finding that their resource plans are adequate or least cost. Can you specify what information is missing or inadequate?

A. The following types of information, crucial to understanding and evaluating a utility's resource plans, have not been provided to the Commission in the companies' filings or to the interveners in discovery process:

- Detailed information on the basis of the companies' load forecasts
- Capital and operating cost estimates for new or existing generating resources
- Completed assessments of the magnitude of DSM resource potential in their service territories
- Detailed studies of renewable energy potential in Mississippi or in the surrounding region
- Basic planning inputs, such as fuel price forecasts, forecasts of emissions costs, and forecasts of other operating costs, and the analytical bases for these inputs
- Forecasts of likely future CO_2 emissions costs, and of the impact of these costs on the economics of alternative electricity generating technologies and resource plans
- Alternative plans for meeting customers' electricity needs with varying types of resources, and under various planning scenarios and sensitivity cases, and thorough analyses of the total cost and revenue requirements for serving load under each plan
- Uncertainty and risk analysis supporting the selection of a preferred plan from among the options presented and analyzed.

In the absence of such essential information, I have nonetheless reviewed the materials the companies have provided in direct testimony and in response to discovery questions, and I have done my best to evaluate and comment upon their performance in each of these areas in this prefiled testimony.

Q. If the companies present more detailed information, workpapers, and analysis in these areas later in this proceeding, are you prepared to review these materials, revisit your comments, and revise your recommendations to the Commission, as appropriate?

A. Yes. I understand that some arrangements may be made during this proceeding to make more confidential information available to interveners, and I am prepared to review that information and revisit my comments, conclusions, and recommendations as appropriate. Further, if it is brought to my attention that any of the information lacking in this Docket has been filed under some other proceeding with the Commission, I would be prepared to review that information and revisit my testimony accordingly.

Load Forecasts

Q. With regard to load forecasts, Entergy has provided load forecasts in Exhibit APW-1, and MPC has provided load forecasts in MPC Exhibit A of the Mississippi Power Company Response to the Commission in this Docket. Why do you find this information insufficient?

A. The companies have provided only the most minimal form of a load forecast, namely, an estimate of expected peak demand and annual energy sales over the course of the planning period. This sort of information should be the end result of applying some sort of sophisticated model, which reflects a wide range of inputs and assumptions about economic growth, consumer behavior, replacement rates of appliances and equipment, responses to energy prices, and other variables. The simplest model of load growth is to just calculate the average rate of growth over a historical period and extend that growth rate into the future. A more complex model might take into account (among other factors) factors such as the continuing regional recovery from Hurricanes Katrina and Rita in 2005, trends in industrial development, changes in appliance standards, and econometric factors.

While both companies have provided load forecasts, neither has provided sufficient detail to assist the Commission in understanding the underlying models, or in assessing whether their underlying assumptions and input data were reasonable, or even if they have made simple arithmetic errors in forecasting their load.

Q. Is your primary concern with the accuracy of the load forecasts?

A. Only partly. I do have concerns about accuracy and potential bias; that is, as I will discuss, I am concerned that the companies' approaches may lead to unrealistically high forecasts. However, I am also concerned that if they are using less sophisticated approaches to forecasting, the companies are missing opportunities to understand and learn how to manage their load. If they had performed detailed, disaggregated, and econometrically-based load forecasting exercises, the companies would have gained insight into opportunities for low-cost demand side management that would likely save their ratepayers money, reduce company emissions, and may well obviate or defer the need for investments in costly new generation.

Finally, I am concerned that the companies have produced load forecasts assuming only continuation of their current, quite modest DSM efforts, as discussed in the testimony of Sierra Club witness Hale Powell. This, combined with their failure to fully incorporate DSM into their resource options as discussed below, could result in needless and avoidable construction of costly generating resources at ratepayer expense.

Q. Please provide a summary of MPC's approach to load forecasting.

A. According to MPC Exhibit A [p. 8], MPC uses two approaches to forecasting load growth for the company's five-year planning process. First, MPC's "marketing segment managers" call on their approximately 180 largest customers "who use over 500 KW per month, by month for 5 years for both energy usage (kWh) and

peak month by demand (kVa or kW)."[1] [MPC Exhibit A, 8 at 19] According to MPC, these customers to account for just over half of MPC's total retail sales. The marketing segment managers apparently compile forecasts based on these direct customer contacts; there is no evidence indicating whether or not there is any validation or screening of the results, much less a consistent methodology applied by all MPC staff.

Next, MPC forecasts the remaining system load (just under half) using "a combination of trend analysis and experienced judgment." [MPC Exhibit A, 8 at 27] Other than "variances from the previous forecast and information provided by marketing personnel," [MPC Exhibit A, 8 at 28] there is no indication of exactly how this forecast is made.

MPC does use a model (identified as ICF's Hourly Electric Load Model, or HELM) to forecast loads beyond the five-year time horizon. While this approach appears to be more sophisticated than that used for the near-term period, very little information has been provided about this model and no input or output files or technical specifications have been provided. In any case, as the company is only providing generation addition plans for the first five years (years for which it does not utilize the model), it is hard to see the relevance of this model.

Q. Is MPC's approach to load forecasting, and the information they have provided to the Commission, adequate for resource planning purposes?

A. No. MPC's approach has no apparent analytical foundation, and as a result is opaque to review or auditing by the Commission or interveners. It relies on the judgment of a large number of unspecified personnel whose qualifications are invisible to the Commission. Further, there is evidence that the results may well be biased upward, perhaps because MPC's large customers would be more

[1] MPC appears to mean that these customers must have both a peak usage of over 500 kW, and a total monthly usage of over 500 kWh, but it is not entirely clear from the quoted text.

inclined to overestimate their future energy needs than to underestimate, or at least to make optimistic projections regarding their own facility growth.

If MPC's load forecasts do have a reasonable analytical basis, it is not in evidence in this proceeding. Although the Sierra Club requested that MPC provide work papers underlying their forecasts [SC MPC 1-37], MPC declined to produce any such materials.[2] Further, MPC indicated in response to DR SC MPC 1-16 that their large customer forecasts, that represent more than half of their load, reflect no analysis of macroeconomic variables and no impacts from price elasticity. In many cases industrial DSM is the most readily available and cost effective load reduction opportunity for a utility. MPC's failure to address industrial load in a sophisticated and consistent manner may cause them to overlook such opportunities. Similarly, in response to data request MPUS 1-2, MPC confirms that the five-year forecast for their entire load "is not developed using models."

Because load forecasts form the most fundamental basis on which resource plans are built and very large capital investments justified, it is imperative that they be objective, analytically-based, sensitive to macroeconomic factors, transparent, auditable and reproducible. MPC's process does not satisfy any of these criteria. Thus I conclude that MPC's forecasts are wholly inadequate for resource planning purposes.

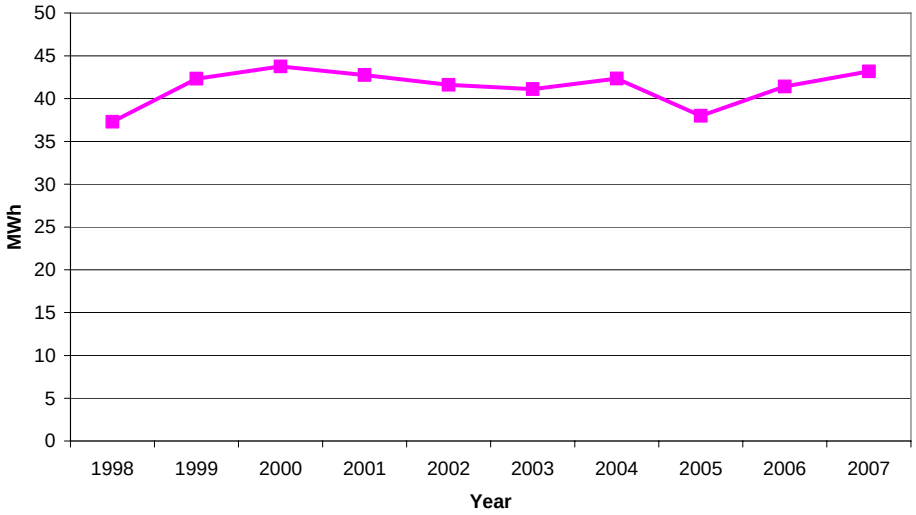
Q. What is your evidence that MPC's industrial load forecasting approach may be biased upward, and what is the significance of this bias?

MPC's industrial load (representing more than half of MPC's total retail sales) appears to be somewhat variable from year to year without displaying any

[2] As noted earlier, I am prepared to review this information and revisit my testimony if it is provided later in this proceeding.

overall trend, other than the impact of Hurricane Katrina, as shown in Figure 1 based on data from data response SC MPC 1-16.

Figure 1: MPC Historical Industrial Load
Source: Data response SC MPC 1-16



At the same time, MPC has assumed *annually increasing* industrial load in their forecasts every year since at least 2001. [SC MPC 1-16, Attachment A] The high volume and the variability of these loads together underline the importance of a realistic, careful, and transparent analysis of industrial demand, which MPC has failed to present. Since industrial load factors are typically very high, estimates of load growth in this sector will be critical to determining the need for new baseload capacity. The results of this bias could, unfortunately, lead to unnecessary or inappropriately large investments in new generation.

Q. Do you have any other concerns regarding MPCs load forecasts?

A. Yes. In response to DR AGO MPC 1-24, MPC reported that more than half of their load growth annually is to support wholesale sales for almost every year from 2011 through 2022. Presumably, this refers to the sales to "six electric power associations and one municipal customer" referenced in MPC Exhibit A [8 at 18]. However, there is no analysis or methodology provided to account for the

growth in these sales, nor is there any indication of whether the anticipation of these sales is based on contractual agreements, or is merely speculative. The Commission should be wary of allowing the company to invest ratepayer money to support these future sales without first reviewing these underlying details.

Q. How does Entergy describe their load forecasting approach?

A. Entergy's load forecast is presented beginning on page II-44 of Exhibit APW-1 in this Docket. Entergy asserts that their load forecast is "developed using econometric forecasting techniques." [APW-1, p.II-45] However, the company provides no details regarding the input assumptions or the structure of this model.

Q. Did the additional information provided by Entergy in response to Data Request MPUS 1-4 alleviate these concerns?

A. Entergy did provide more detail on their load forecasting approach in response to DR MPUS 1-4, and provided a comparison of their model to the U.S. Energy Information Administrations (EIA) published in EIA's Annual Energy Outlook for 2007 and 2008. Although I am not personally familiar with the proprietary models they employed, I have no reason to doubt that they are legitimate and sophisticated econometric models, leveraging off of some of the EIA's "efficiency indices" as described on page MPUS 1-4 SS213.

However, Entergy did not provide any of their input assumptions or work papers associated with this modeling exercise in response to the data request, and even the best model is only as good as the input assumptions applied. Thus I still conclude that the record in this case is insufficient for the Commission to fully understand, evaluate, or accept Entergy's load forecasting results.

Q. Do you have any reason to question the validity of Entergy's input assumptions, and therefore of Entergy's results, in this area?

A. Yes. The comparison of Entergy's load forecasts with EIA's suggests that Entergy used overly optimistic assumptions about economic growth, or overly pessimistic

assumptions about increased efficiency. Although Entergy suggests (MPUS 1-4 SS213) that their average forecasted growth rate of 1.1% annually (2013 to 2018) is "quite close" to EIA's regional average growth rate of 0.8% annually, I disagree strongly with this characterization.[3] Given the nature of compound growth, the amount of load added to the system after ten years of 1.1% annual growth would be almost 40% greater than the amount added given 0.8% annual growth, obviously not a trivial difference. Even Entergy's "low" case is higher than EIA's 2008 projected rate of growth for the region. Thus it appears that Entergy is projecting anomalously high load growth in their service territory, relative to the US Government projections for the region. This anomaly should receive careful review by the Commission.

Q. What is your recommendation to this Commission regarding the companies' filed load forecasts?

A. I recommend that the Commission require both companies to provide complete explanations of their load forecasting approaches, including a full and transparent accounting of their input assumptions and forecasting methodologies and presentation of their workpapers. In the case of Mississippi Power Company, I further recommend that the Commission direct the company to discard their current overly-simplistic approach and replace it with an industry-standard, objective, econometric demand forecasting approach.

I recommend that both companies' forecasts be audited and verified by an independent third party, selected by the Commission but at the companies' expense, and that this third party produce a report affirming the validity of the companies' load forecasts. Finally, the Commission should provide for a period of

[3] Note that in the data tables provided by Entergy accompanying DR MPUS 1-4, in the section entitled "Percentage Annual Increases" the growth rates for the East South Central region (which includes Mississippi) are erroneously labeled "EIA West South Central". In addition, the data rows labeled "EIA West South Central" do not appear to correspond to the EIA 2008 data for the West South Central region. The EIA 2008 regional demand forecast data may be found at http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html.

public review and comment on these forecasts before they are relied upon for any construction permit proceedings.

Capital and Operating Costs

Q. Has Synapse recently investigated trends in the capital costs of new baseload electricity generating resources?

A. Yes. A copy of Synapse' report entitled *Coal Fired Power Plant Construction Costs* may be found as Exhibit EH-2, and our report entitled *Nuclear Power Plant Construction Costs* may be found as Exhibit EH-3. Both of these reports have been updated as of July, 2008.

Q. Have you reviewed MPC's assumptions regarding the capital and operating costs of various alternative electricity generating technologies?

A. No. MPC provided no such information in their filing in this docket.

Q. Did the Sierra Club request that MPC provide capital and operating cost forecasts for their generating resource alternatives?

A. Yes. Sierra Club data request SC MPC 1-56 requested MPC's estimates of the capital costs of natural gas and coal-fired generating facilities, along with work papers and source documents. Data request SC MPC 1-57 requested the same information for nuclear facilities. Data request SC MPC 1-77 requested fuel price forecasts prepared by or for the company, along with related work papers. In each case MPC failed to provide the requested information, objecting that such data are proprietary, beyond the scope of the docket, irrelevant, and not reasonably calculated to lead to the discovery of admissible evidence.

Q. Do you agree that MPC's capital and fuel data are beyond the scope of this docket and irrelevant?

A. No. It is hard to see how interveners or the Commission can reach conclusions on the prudence of MPC's assessment of generating alternatives if the company doesn't provide such basic data for review.

Q. Have you reviewed Entergy's assumptions regarding the capital and operating costs of various alternative electricity generating technologies?

A. No. Entergy provided no specific estimates of either capital or operating costs for generating resource alternatives. The only information in this regard provided in Exhibit APW-1 consists of the charts, on pages II-79 and II-80, which compare the 30-year levelized cost of electricity for various types of resources under a variety of scenarios. However, these charts raise many more questions than they answer, including the financial model used and the breakdown of costs leading to the levelized costs estimates shown. In fact, the vertical axes on these charts are unlabeled, so even the estimated levelized costs can only be interpreted on a relative basis.

Q. Did the Sierra Club request that Entergy provide capital and operating cost forecasts for their generating resource alternatives?

A. Yes. Sierra Club data request to Entergy SC 1-31 requested Entergy's estimates of the capital costs of natural gas and coal-fired generating facilities, along with work papers and source documents. Data request SC 1-32 requested the same information for nuclear facilities. In addition, Data requests SC 1-41 through SC 1-48 requested various types of materials that the company may have which would reflect the Entergy's projections for such capital and operating costs. In each case, Entergy refused to provide the information on the grounds that it would comprise highly sensitive confidential and commercial information.

Q. Do you think it is reasonable for Entergy to withhold such information from interveners and from the Commission?

A. No. Entergy is a regulated company and a vertically integrated monopoly. In order for the regulatory Commission to do its job it must have the opportunity to review the capital and operating costs underlying Entergy's resource plans.

Q. Has Synapse regularly received this information in other resource planning proceedings?

A. Yes. Synapse regularly requests and receives information regarding utilities' estimates of power plant capital costs, operating costs, and performance when we serve as experts in utility resource planning proceedings.

Q. What is your recommendation for this Commission regarding the companies' capital and operating cost estimates?

A. I recommend that the Commission order both companies to produce their estimates of capital and operating costs for generating resource alternatives in detail, backed up by current and comprehensive engineering studies. I recommend that both companies' estimates be audited and verified by an independent third party, selected by the Commission but at the companies' expense, and that this third party produce a report evaluating the reasonableness of the companies' capital and operating cost estimates. Finally, the Commission should provide for a period of public review and comment on these estimates before they are relied upon for any construction permit proceedings.

CO_2 Emissions Costs

Q. Is there any indication that MPC perceives CO_2 emissions costs to be an important factor affecting the economics of their generating resource portfolio in the future?

A. Yes. For example, in Attachment A to MPC's Response, page 6, MPC writes,

> An additional uncertainty is the anticipated legislation and/or regulation designed to address the climate change issue through the reduction of so-called greenhouse gas emissions which primarily consist of carbon dioxide (CO2). Although no legislation of regulation has been passed, the potential impact on our customers could be significant, depending on the timing and the requirements of the legislation. Whether legislation seeks CO2 reductions through a carbon tax or through a cap and trade program, the result for our customers will be a substantial increase in the cost of electricity.

Q. Has MPC taken CO_2 costs into account in their planning process?

A. It is unclear whether MPC has taken CO_2 costs into account in its planning process. In response to data request SC MPC 1-58, the MPC writes, "The company has not projected CO2 allowance prices. However, for planning purposes, we model various price ranges for allowances that were chosen to span the likely outcome range of carbon legislation." It is hard to imagine how they model "various price ranges" without making any such projections.

Q. Have you reviewed the "various price ranges for allowances" to which MPC refers, and their impact on the company's generation portfolio?

A. No. The price ranges were not provided with the discovery response. In addition, although Sierra Club requested analyses and work papers on the impact of CO_2 allowance prices on the company's generation fleet, dispatch, and resource plans, MPC refused to provide this information on the basis that it is confidential and proprietary.

Q. Is there any indication that Entergy perceives CO_2 emissions costs to be an important factor affecting the economics of their generating resource portfolio in the future?

A. Entergy has offered an ambiguous statement in this area on page I-12 of Exhibit APW-1. While they note that "the prospect for CO_2 regulation in the future continues to increase," they emphasize the uncertainty in the timing, form, and impact of this legislation. While they note that "solid carbon-based technologies would be negatively affected relative to nuclear and gas", they seem to imply that this could just push up the price of gas, and thus have a more muted impact on resource choices.

Finally, on page II-5, Entergy offer their strongest acknowledgement that this is an important factor for resource planning: "Because alternative technologies emit different levels of CO2 per MWh of generation, CO2 legislation would likely change the relative economics of supply alternatives."

Q. Do you agree that CO_2 legislation is likely to "change the relative economics of supply alternatives?"

A. It is inevitable. In fact, this would be the primary practical result of CO_2 legislation affecting the power industry. The only way that the power industry is going to reduce its contribution to CO_2 emissions, and thus to global warming, is to significantly reduce the consumption of coal unless and until it is possible to generate electricity from coal without releasing the CO_2 produced into the atmosphere. This means that any effective CO_2 legislation would of necessity render coal resources less economic relative to lower-carbon alternatives, or require carbon capture technology which would itself significantly increase the costs of coal-fired generation per MWh produced.

Q. Has Entergy taken CO_2 costs into account in their planning process?

A. It appears not. In response to data request SC 1-33, Entergy stated that the company has performed an analysis of "potential ranges of outcomes for future carbon dioxide allowance prices," apparently through a contract with the consulting firm ICF.

However, in data request SC 1-34, and again in SC 1-41 through 1-45, the company was asked to provide copies of various types of analyses, assessments or studies, and related work papers, on (among other things) the impact of potential regulation of greenhouse gases on the company's generating resources and purchased power. In each case, the company either provided a nonresponsive answer or declined to answer on the grounds that the request seeks "highly confidential commercial and financial information."

Q. Have you reviewed the "potential ranges of outcomes for future carbon dioxide allowance prices" developed by Entergy and/or by ICF on behalf of Entergy?

A. No. These were not provided with the data response.

Q. Has Synapse regularly received utilities analyses of expected CO_2 costs in its resource planning reviews?

A. Yes. Synapse regularly requests and receives utilities' forecasts of expected CO_2 costs when we serve as experts in utility resource planning proceedings.

Q. Given the uncertainty as to the timing and form of future federal carbon legislation, what is your recommendation for how MPC, Entergy, and other utilities should project carbon prices?

A. While significant uncertainties remain, a large number of studies by US government laboratories and various universities have analyzed likely future carbon emissions prices, based on various legislative proposals before Congress

and the economics of emissions mitigation. Moreover, numerous states and regulatory authorities have ordered that utilities apply certain carbon price trajectories for various planning purposes, and these may serve as a guide to expected prices. Synapse Energy Economics has prepared and regularly updated a meta-analysis of these studies, in which we provide our recommendations for how to take carbon emissions prices into account for resource planning purposes. We also provide our recommended low, mid, and high carbon price scenarios for use in resource planning models. The most recent version of the report and forecasts as of this writing is included as Exhibit EH-4 to this testimony.

Q. What is your recommendation to the Commission regarding MPC's and Entergy's treatment of CO_2 emission costs in their planning processes?

A. I recommend that the Commission adopt, after a period of public review and comment, a range of reasonable future CO_2 emissions price scenarios. These scenarios should be based on a thorough analysis of the bills introduced in the US Congress and the likely cost of emissions mitigation, similar to the Synapse analysis presented as Exhibit EH-4. The Commission should order the companies to use these CO_2 price forecast trajectories in analyzing the economics of all potential generating resource investments, analyzing how the proposed investments perform under "high", "mid", and "low" CO_2 emissions price scenarios.

Importantly, these CO_2 emissions costs should be understood to be direct operating costs which, to the extent that they have been incurred prudently and anticipated reasonably in the companies' resource plans, will be recoverable in rate base. If the companies build uneconomic resources because they have ignored or unreasonably underestimated these foreseeable costs in the planning process, ratepayers should not bear the cost of extra emissions allowances incurred because of this imprudent planning. For example, coal-fired generating resources may, at present, appear to be inexpensive options, but once likely carbon

emissions costs are properly and reasonably taken into account they are generally revealed as economically poor choices. Ratepayers should not bear the burden of poor decisions when the utility should have known better.

Energy Efficiency and Demand Response

Q. Have you reviewed the companies' activities and plans in the use of energy efficiency and demand response resources?

A. Yes, but I am not the Sierra Club's primary witness in these areas. These areas are discussed primarily by Sierra Club witness Hale Powell. However, I have reviewed the companies' testimony in this area from the perspective of their treatment of demand resources in their overall resource planning.

Q. What do you conclude in this area?

A. I conclude that neither MPC nor Entergy has treated demand side resources as a coequal alternative to supply resources, to be compared and selected or rejected on the basis of cost and operational characteristics. By failing to do so they are likely to miss the opportunity to provide Mississippi ratepayers with the least-cost, least-risk and most environmentally-benign resource alternative available for meeting a significant portion of their energy needs.

Renewable Energy Resources

Q. Have you reviewed MPC's treatment of renewable resources in the company's resource plan?

A. Yes. MPC provides a brief discussion of renewable alternatives on Page 21 of the company's direct testimony, lines 5-17.

Q. Do you find this discussion to be comprehensive, supported by documentation and evidence, and compelling?

A. No. MPC essentially rejects all renewable resources out of hand with the statement that they are not "economic" choices, but then provides no evidence or comparative data to support these statements. MPC concludes with the intriguing statement that "the total amount of economic renewable resource capacity that can be added is inadequate to fully meet the projected load requirements of MPC's customers." It is not clear whether this means that it can only meet a part of their projected load requirements or none at all.

Q. Did MPC elaborate on their renewable resource potential in response to discovery questions?

A. To a very limited degree. In response to data request AGO MPC 1-42, MPC reproduced maps of wind and solar energy potential from the National Renewable Energy Laboratory of the U.S. Department of Energy. In addition, in response to data request AGO MPC 1-43, MPC cited (but did not provide) a number of studies performed by the Southern Company on the viability of biomass generation in their generation fleet.

Q. Do you find this MCP's response to discovery in this area to be comprehensive, supported by documentation and evidence, and compelling?

A. No. I find it cursory at best, and lacking in the detailed studies and economic analyses that would allow either MPC or the Commission to make a reasoned judgment on the appropriate role for renewable energy in MPC's generation mix.

Q. Have you reviewed Entergy's treatment of renewable resources in the company's resource plan?

A. Yes. Entergy's filing devotes a single page of their SSRP, Exhibit APW-1 p. II-70, to outlining the reasons that Entergy does not consider renewable resources to be viable alternatives for their region. However, there is no indication that they

have performed any credible technical or economic feasibility analysis to support these conclusions.

Q. Did Entergy elaborate on their renewable resource potential in response to discovery questions?

A. In response to Sierra Club's discovery questions on Entergy's renewable energy efforts, questions SC 1-26 and 1-27, Entergy provided a reproduction of a report from the Electric Power Research Institute (EPRI) entitled, "Role of Renewable Energy in a Sustainable Generation Portfolio: Modeling and Analysis of Climate Policy Scenarios." Entergy also made reference to a second report, a joint EPRI-ESI study entitled, "Regional Portfolio standard – A Study of Implications of the Entergy Utility System," but they did not provide a copy of this report. (ESI may refer to Energy Services International, but this was not defined in their response.)

Q. Do these reports support Entergy's position that there are limited renewable energy opportunities in the region?

A. The EPRI report does not. As detailed in the testimony of Sierra Club witness Carl Pechman, the EPRI report details significant opportunities for harnessing both biomass energy and landfill gas. I cannot comment on the EPRI-ESI report as it has not been made available in this proceeding.

Q. Is it your opinion that Mississippi has promising renewable energy resources that MPC and Entergy should pursue?

A. Synapse has not investigated the technical or economic potential for renewable energy resources in Mississippi. However, in addition to the evidence in the EPRI report provided by Entergy, a number of other studies suggest that there may be a significant amount of technically and economically feasible renewable resources in the state. For example, according to a 2005 study by the US Department of Energy (included as Exhibit EH-5 to this testimony,) Mississippi is endowed with "excellent" biomass energy potential, and "good" solar photovoltaic potential.

While the DOE study finds that on-shore wind potential is limited, studies by Professors Cristina L. Archer and Mark Z. Jacobson of Stanford University, included as Exhibit EH-6 and Exhibit EH-7, suggests that Mississippi may have strong off-shore wind energy potential. Certainly, these studies are promising enough that MPC and Entergy do their ratepayers and the environment a disservice by failing to even investigate the potential to harness renewable energy resources in Mississippi.

Q. What is your recommendation for this Commission on how to improve the development and utilization of renewable energy by the utilities?

A. The Commission should either direct the companies to commission a study, or should commission a study itself at the companies' expense, comprised of a thorough investigation of the potential for harnessing all types of renewable energy in Mississippi and the surrounding region. This study should investigate at a minimum the technical and economic potential for biomass energy (both co-firing and direct-firing,) agricultural waste gasification, landfill gas, solar photovoltaic, and off-shore wind. The economic potential analysis for these resources should be undertaken assuming a range of plausible avoided cost levels, and should assume CO_2 emissions costs for displaced fossil resources as described above.

Once this study is complete, the Commission should determine an appropriate means of fostering renewable energy development in Mississippi, in recognition of their societal value over and above their direct avoided fuel and emissions costs benefits. There are a number of options available to the Commission and the Legislature to assist and encourage the utilities in developing these resources. These options include net metering, feed-in tariffs, and renewable portfolio standards (RPS). Variants on these approaches are used in numerous states to foster the development of renewable resources.

Ideally, the Commission could initiate a collaborative process including utilities, renewable energy developers, environmental advocates, ratepayer advocates, Commission staff, and other interested and knowledgeable parties to develop such a policy. The Commission should then hold a period of public review and comment, and issue an order to take best advantage of the renewable resource potential in the state.

Consideration of Alternative Plans

Q. Do you consider it an important element of long-range resource planning to develop and evaluate alternative resource plans in addition to a company's preferred plans?

A. Yes. As Sierra Club witness William Steinhurst noted in his prefiled preliminary testimony, "The resource portfolio that is projected to have the lowest life cycle cost under one set of assumptions about the future, may or may not also be the best under another set of assumptions." [9 at 19] Dr. Steinhurst goes on to list a number of factors that can affect the outcome of the analysis of alternative portfolios. If the company presents only a single preferred plan, there is no comparative basis for the Commission to form an opinion on how that plan performs over a range of assumptions about future conditions.

Q. Has MPC filed alternative resource plans for the Commission to consider in this docket?

A. No.

Q. Has Entergy filed alternative resource plans for the Commission to consider in this docket?

A. No.

Q. What is your recommendation to the Commission in this area?

A. The Commission should direct the companies to develop and evaluate a number of alternative resource plans, using an industry-standard planning optimization model such as EGEAS or Strategist. It is important that the plans themselves be substantially varied in terms of their resource choices, and not be merely minor variants on the companies' preferred plans. The companies should investigate how each of the plans performs over a range of plausible future scenarios. The development and evaluation of the plans must consider all available resources, including demand side resources, renewable resources, and conventional generation, on an equal footing.

The companies should identify their preferred plan to propose to the Commission, but they should also present the results of their modeling exercise showing the results for all of the alternative plans, the input assumptions, and the performance of all plans for each scenario considered. Only then will the Commission have a basis for determining whether the companies' plans are optimal, least-cost integrated resource plans for serving Mississippi ratepayers.

III. Entergy and MPC Planning Goals

Q. How does Entergy witness Anthony Walz describe the objective of Entergy's planning process?

A. In Mr. Walz direct testimony, p. 3, he describes the "overarching objective" of Entergy's SSRP process as "to provide a portfolio of generation supply resources that will enable the System to meet the needs of the Operating companies' customers at the lowest reasonable cost." [3 at 8] He goes on to predict that "…implementation of the SSRP will result in a portfolio of generation resources that are better matched to customer load shape requirements at the System and individual Operating company levels." [3 at 13]

Q. Should the Commission accept these as reasonable goals, and conclude that Entergy's SSRP is likely to achieve them?

A. These goals raise more questions than they answer. In the first place, Mr. Walz' emphasis on providing a portfolio of *generation supply resources* completely misses the point of resource planning, which is to determine the best mix of resources of all types including demand side resources. It simply makes no sense to leave the least-risk, least-cost resources off of the table, or to relegate them to second-class status when, on the basis of cost, they really should be the first options considered. Secondly, Mr. Walz seems to seek a portfolio (again of generating resources only) that is *better matched* to customer needs, but he neither provides a standard for judging the "match" nor does he specify to what alternatives he might be making this comparison.

In fact, there is no comparison among resource plans in Entergy's SSRP, nor is there sufficient information for the Commission, interveners, or anyone else to make a comparison among plans. Therefore there is no reason that the Commission should expect that Entergy's SSRP will result in a least-cost plan for meeting ratepayer needs, or that it will be "better matched" to these needs than any other plan that might be considered.

Q. How does MPC describe the objective of that company's planning process?

A. In Exhibit A to MPC's response to the Commission in this Docket, page 1, MPC writes, "[MPC] has an obligation under the Mississippi Public Utility Act to provide reliable electric service to its customers at the lowest reasonable price. Planning for load growth, including new generation requirements, is an essential part of fulfilling that obligation."

Q. Should the Commission accept these as reasonable goals, and conclude that MPC's plan is likely to achieve them?

A. These are reasonable goals as far as they go. "Planning for load growth" could and should be taken to imply that demand side *management* is an integral part of resource planning, not just demand *projection*. However, there is no evidence in this docket that leads me to believe that MPC's plan will result in "reliable electric service…at the lowest reasonable price." As detailed earlier, MPC has provided no economic analysis of their plan, no comparison among alternative plans, no evidence of aggressively pursuing demand side resources or renewable energy, and almost no information to help the Commission form an opinion as to the costs or benefits of their plan. Thus the Commission cannot conclude that MPC has produced a plan which meets the company's stated goals without receiving and reviewing considerably more evidence and analysis.

Q. What are your overall recommendations for this Commission in this case?

A. I recommend that the Commission refuse to accept either Entergy's or MPC's resource plans, or the information they submitted in support of these plans, as sufficient to guide their long-term resource planning. The Commission should order the companies to produce detailed planning studies that investigate all resource options for meeting the needs of Mississippi's ratepayers, including fossil generation; renewable generation; nuclear generation; demand side management; transmission enhancement; and purchased power, and to file detailed information supporting their modeling and analysis of each of these resources individually and in portfolios. The completion of comprehensive DSM assessments is an essential element of this process.

The companies should also be ordered to present and analyze alternative resource plans before the Commission in a public and transparent manner. The companies should assess the costs and benefits of each of these plans under a range of realistic forecast assumptions regarding, at a minimum, economic

growth; capital costs; fuel costs; and emissions costs including carbon dioxide (CO_2) emissions costs. In addition, these resource plans should treat load not as a fixed value to be forecast but as an economic variable which can be managed, and which is responsive to electricity price in a realistic manner.

Q. Does this complete your testimony?

A. Yes.