Appendix A
State Agency Guidelines for Evaluating Multiple Power Plants

State Agency Guidelines for Evaluating Multiple Power Plants

December 10, 2002

Mission

Develop a set of guidelines by which the agencies would develop recommendations to the Commission on power plant site suitability, particularly in situations where multiple power plants are proposed in close proximity to one another.

> *"Accordingly, we are proposing that the State agencies convene a Cabinet-level Task Force to undertake an immediate effort to enhance the State's current CPCN process in response to what we have seen in the newly deregulated market. This Task Force would develop a set of guidelines by which the agencies would develop recommendations to the Commission on power plant site suitability, particularly in situations where multiple power plants are proposed in close proximity to one another. This would also help guide developers in deciding where they should focus their efforts to license power plants in Maryland, including standards for greenfield development of new power plants."*

Approach

The approach is to identify issues for which multiple plants proposed in close proximity (a radius of 10 miles from a proposed power plant unless other factors dictate a greater or smaller distance is appropriate) may be assessed and compared to each other. Proposals would be rated more highly to the extent they have a higher degree of positive attributes. Staff will develop individual summaries for the factors described below and perform a comparative assessment of all proposals for each factor (using quantitative or qualitative methods as appropriate) and develop an overall assessment and comparison for consideration by the Cabinet.

Regardless of the assessment scheme used, any proposal would have to meet all environmental requirements. Based on a comprehensive environmental review coordinated by PPRP, requirements will have been determined that are necessary to meet any regulatory requirements and this would be the baseline from which the assessment process would proceed.

In addition to a comparative analysis, an analysis would be conducted assessing the cumulative impacts of multiple power plants applications. The cumulative analysis would be conducted assessing similar impacts from other facilities (including but not limited to power plants). It would be used to identify any additional licensing conditions necessary to preclude unacceptable impacts from multiple plants within close proximity.

Based on the results of both the cumulative and comparative analyses, the Cabinet would forward recommendations to the PSC in individual plant proceedings. These recommendations could find a plant unsuitable because of a flaw with that plant or could conclude that issuing CPCN's to one or more of multiple plants either exceeds the carrying capacity of one or more resources such as air, water or land, or is not in the best interests of the state.

Detailed Elements of the Guidelines

- *Cumulative Analysis — Prior to the application of the guidelines, a cumulative impact analysis would be performed. The cumulative analysis would compare cumulative air, water, terrestrial, land use and other impacts to any identified thresholds in a region where multiple plants are proposed. Additionally, the cumulative analysis would identify any additional licensing conditions needed to address cumulative impacts due to multiple plant applications.*

Included in the cumulative analysis would be:

- *Existing facilities (both power generation and industrial sources) impacting the region of interest*
- *Existing CPCN applications; filed proposals and self generation facilities that have filed for permits, as appropriate*
- *Expected applications*
- *Proposals expected to be filed*
- *Speculative plants*
- *Proposals expected in a 5-10 year window both within and outside the region of interest.*

The cumulative analysis would also include an assessment of the current and projected demand for electricity and the amount of electricity that could be generated by current and projected power plants in Maryland. This would provide insight into Maryland's share of the electricity supply to the PJM grid compared to the electricity Maryland uses from the grid.

- *Comparative Assessment — Evaluation of the impacts of siting multiple power plants in close proximity, based on an evaluation of four factors. Individual factors to be assessed are:*

1. **Adequacy and reliability of electric supply**
   A power plant proposal is more desirable:
   - *The more the plan contributes to MD's fuel mix diversity*

- *The higher the percentage of its electricity the developer guarantees will be supplied to MD customers*
- *If the proposed facility will be a capacity resource*
- *To the extent that it improves the stability and reliability of the electric power system, while helping to avoid or relieve overloads on key transmission facilities into or within Maryland*

2. **Environmental and Resource Issues**

   A power plant proposal is more desirable:

   - *The lower its consumptive use of groundwater or non-tidal off-site surface water*
   - *If it uses waste or other reclaimed water particularly if it is not expected to be returned to non-tidal rivers or creeks or is returned to tidal waters*
   - *If it provides for on-site water storage during periods of low flow*
   - *The higher the percentage of renewable fuel use*
   - *The higher its generation efficiency*
   - *The more local any* NO_x *offsets are*
   - *The more* NO_x *credits achieved through overcontrol of sources rather than through shutdown*
   - *The greater its reduction of greenhouse gases*
   - *If a plan is proposed providing for mitigation of greenhouse gases*
   - *The less it impacts visibility in a Class I area*
   - *The fewer hazardous pollutants that it emits*
   - *The greater its reduction of nitrogen loadings to the Chesapeake Bay*
   - *If a plan is proposed for mitigating nitrogen loadings to the Chesapeake Bay*
   - *The more it enhances habitat for living resources*
   - *The shorter the corridors needed to connect to fuel sources and the electric transmission line grid*
   - *If it is a coal-burning power plant proposal, the cleaner its coal combustion technology*

3. **Land Use and Smart Growth**

   A power plant proposal is more desirable

   - *The greater its compatibility with State land use policies including brownfield use, Rural Legacy, GreenPrint and agricultural land protection, protection of state-designated scenic byways*
   - *The fewer nearby land uses with which it is incompatible*
   - *The greater its compatibility with local land use planning and zoning; provided that a local government has designated, through its local zoning, appropriate land for power plant siting, with appropriate power plant infrastructure (e.g. access to electric transmission lines, fuel supply, and water)*

4. **Socioeconomic Issues**

   A power plant proposal is more desirable:

   - *The higher the Local and State tax revenue it generates*
   - *The less it adversely affects transportation systems and traffic*
   - *The greater the benefits to the local community*
   - *The less visually obtrusive it is*

- *The quieter it is*
- *The more local jobs it creates*
- *The less it adversely affects historic and archaeological resources*
- *The more it has community support and addresses community concerns*
- *The less it raises environmental equity issues*

Appendix B
Determinants of Electricity Demand Growth in Maryland

Determinants of Electricity Demand Growth in Maryland

PPRP has historically conducted a program of independent electric load forecasts as part of its efforts to both monitor the adequacy of future power supplies and to independently evaluate the potential for excess generating capacity. With the restructuring of the retail electric industry in Maryland, brought about by the enactment of the Maryland Electric Customer Choice and Competitive Act of 1999 (the Act), the preparation of load forecasts (energy sales and peak demand) for the individual investor-owned electric utilities operating within Maryland would not provide the information required to assess the adequacy of planned supply.

Under restructuring, the primary issues relating to power supply affecting Maryland consumers are the adequacy of generating capacity and the adequacy of transmission system capacity. The issue of excess generating capacity was of extreme importance under the historical regulatory arrangements since captive ratepayers shouldered the cost burden of the excess generating capacity. Under restructuring, ratepayers no longer bear the cost of excess capacity, but certain non-monetary costs (e.g., socioeconomic and environmental impacts) are potentially imposed on Maryland from excess generating capacity. To assess and monitor the sufficiency of generating and transmission capacity, PPRP has modified its load forecasting program. Rather than focusing on the individual electric utilities serving consumers in the state, PPRP now forecasts energy requirements and peak demands for the state as a whole and for the various regions within the state.

The PPRP forecast studies, including those historically performed for the service areas of the individual utilities as well as the state-wide forecast, use economic theory as the organizing principle to model the demand for electricity, and rely on econometric methods for estimation and projection. The data that are used to run these models, both historical and projected, are comprised of variables assumed a priori to significantly affect the demand for electricity. Some of these variables are economic and some are non-economic in nature. Economic variables include income, the price of electricity, and employment; non-economic variables include population and weather. Historical information is required for estimation purposes, while projected data are necessary to forecast the demand for power econometrically.

This appendix provides an overview of the basic theoretical foundations upon which these forecast studies rest and an analysis of the trends of some of the economic and non-economic determinants of the demand for electricity. The Maryland data presented here have been obtained from the Maryland Department of Planning, the Bureau of Economic Analysis of the U.S. Department of Commerce, and the Bureau of Labor Statistics of the U.S. Department of Labor. For comparison, some national data are also included. The national data were obtained from the U.S. Departments of Commerce and Labor.

This appendix is composed of five sections. The following section presents a brief discussion of the theoretical foundations used for modeling the demand for electricity econometrically. This section sets the stage for the rest of the appendix, which examines economic and demographic trends for Maryland by region. For purposes of presentation, the state has been divided into five regions, as shown on Table B-1. These regions correspond to the regional definitions used in the PPRP state-wide forecast, but differ from those used by the Maryland Department of Planning.[1] The section covering the theoretical foundations is followed by a section discussing trends in per capita income which in turn is followed by a section discussing trends in employment. Trends in population and the number of households follow the employment section. A final section presents a brief summary.

Theoretical Foundations for Econometrically Modeling the Demand for Electricity

The PPRP forecast studies use the economic theory of demand as the organizing principle to econometrically model the demand for electricity. The total demand for any good or service, including electricity, is simply the sum of the demands of the individual consumers in the market. The portion of market demand for residential use of electricity is driven by factors to which individual residential consumers are sensitive. Similarly, for the commercial sector portion of the market demand for electricity, the factors affecting demand are those to which producers are sensitive. What these factors are and how they affect the demand for electricity is provided by well-established economic theory.

In the case of residential demand, electricity forms part of the basket of goods and services purchased by the consumer. The residential demand for electricity is assumed to result from the exercise of choice by which the consumer maximizes his welfare subject to a budget constraint. Consumer demand for a good or service is taken to be a function of its price, consumer income, weather, and the price of related commodities (i.e., substitutes and complements). It is important to note that electricity, in and of itself, conveys no benefits to the consumer. Rather, the consumer benefits from the services of the stock of appliances that require electricity. These services include space conditioning, refrigeration, cooking, clothes washing and drying, and numerous other services and functions. Consequently, the demand for electricity can be appropriately viewed as a derived demand; that is, it results from the demand for the services provided by electricity-consuming appliances.

For commercial and industrial customers, electricity is a factor of production, i.e., an input. In the PPRP forecast studies, the demand for electricity is assumed to result from decisions made by the producer to maximize profits. For the profit-maximizing producer, demand for a commodity (including electricity) is driven by its price, the price of related inputs, and the level of output. Producer demand is also driven by other factors, including weather.

[1] The Maryland Department of Planning divides the state into six regions (the Eastern Shore is separated into Upper and Lower Eastern Shore). Further, Frederick County is included in the Washington Suburban region whereas the state-wide forecasting methodology places Frederick County in the Baltimore region.

Both the residential and non-residential demand for electric power is discussed above in terms of the individual consumer or producer. The market demand for electric power, for example, in Maryland or within regions in Maryland, is also dependent on the number of consumers (households) and the level of goods and services produced in the region. Residential demand is therefore forecasted on a per-customer basis which, when multiplied by the projected number of residential customers, provides a forecast of total residential demand. Commercial and industrial electric sales are projected per employee, which are then multiplied by the number of forecasted employees to project total commercial and industrial demand for electricity. Employment is used in lieu of, and as a proxy for, output since no satisfactory time series of output data is available at a suitably disaggregated level.

Per Capita Income Trends

Income is an important determinant of the residential demand for electricity and changes in income will affect the quantity of electricity purchased. Changes in income affect electric power consumption in two ways. First, a change in income will induce a change in the intensity of use of the existing stock of electricity-consuming appliances. Second, an income change will induce changes in the stock of electricity-consuming appliances. As income changes, therefore, the demand for electricity will rise or fall. The PPRP forecast studies demonstrate a positive and, typically, statistically significant relationship between income and the residential demand for electricity.

The PPRP forecast studies (the historical service area forecasts as well as the state-wide forecasts conducted following industry restructuring) use real (i.e., inflation adjusted) per capita income as an explanatory variable. Real per capita income figures are reported in Table B-2 for the Maryland regions defined in Table B-1. Table B-2 summarizes historical and projected data as well as average annual growth rates for the period 1980 through 2010. As shown by the historical data, all regions within the state, with the exception of Western Maryland, experienced a substantial slowing in the growth of real per capita income during the 1990 to 2000 period in comparison to the 1980 to 1990 period. For the state as a whole, growth in real per capita income declined to 1.63% per year between 1990 and 2000 compared to an average annual growth rate of 2.84% between 1980 and 1990.

The projections for growth in real per capital income for the 2000 to 2010 period are lower than the growth rates experienced during both the 1980s and the 1990s. Between 2000 and 2010, real per capita income is expected to increase at an average annual rate of 0.93% for the state as a whole, compared to the 2.84% growth rate experienced in the 1980s. The most rapid increase in real per capita income is expected in the Southern Maryland region (1.38% per year), with the slowest growth over the 2000 to 2010 period projected for the Baltimore region (0.96% per year).

Employment Trends

The non-residential demand for electricity is largely driven by the level of output. The PPRP forecast studies, however, do not use output as an explanatory variable because quarterly output data at the county level are not available on a consistent basis. Hence, a proxy for output must be used. Non-farm employment has typically been relied upon for this purpose. It is a sound alternative and it is not subject to data consistency problems. Employment data by major employment sector are reported in Tables B-3 and B-4.

Table B-3 reports sectoral shares for Maryland and the United States for 1990 and 2000. Sectoral distribution within Maryland has been subject to important changes over time. This is particularly so for the shares reported for government, services, and manufacturing. These changes are consistent in both the local and the national economy. Government, for example, has become a less significant source of employment largely as a result of downsizing at the federal level. Services have become the largest source of employment, as the local economy continues to move away from manufacturing and heavy industry. Manufacturing employment as a proportion of total employment declined in Maryland, mirroring the decline nationally, which reflects movement towards a service-based economy.

Sectoral changes are expected to continue as a result of not only a horizontal migration of workers across sectors, but also as a result of increases in the workforce. As shown in Table B-4, every region of the state is expected to experience employment growth. Growth is projected to be most rapid in the Southern Maryland region and slowest in Western Maryland and Baltimore. For the state as a whole, average annual growth in employment for the 2000 to 2010 period is expected to be slightly lower than the growth over the 1990 to 2000 period (1.14% per year compared to 1.21%). Growth in employment for all of the regions in Maryland during the 2000 to 2010 period, with the exception of the Suburban Washington region, is projected to be below the rate of growth experienced between 1990 and 2000.

Population Trends

Population is an important causal variable in the PPRP electricity consumption forecast models because population trends are used to project the number of residential customers. Two demographic concepts closely related to population are the number of households and average household size. These concepts can be important since the number of households affects the number of residential customers purchasing electricity and changes in average household size can affect usage per customer. Population growth and the rate of household formation are closely related, and both affect the residential use of electricity. Increases in population lead to increases in the number of households (and hence residential customers) although rates of change need not coincide due to changes in the size of households. Population and household data are reported in Tables B-5 and B-6.

Population data at regional and state levels are reported in Table B-5. The table summarizes historical and projected data, as well as average rates of growth for the period 1980 through 2010. The rates of growth in population have been positive since 1980 for every region of Maryland. Between 1990 and 2000, population growth in Maryland has been about 1% per year on average. The growth in population for the state is projected to slow to approximately 0.82% between 2000 and 2010. The pattern of slowing growth for the state as a whole also characterizes the expected pattern of growth in most of the five separate regions. The exception is Western Maryland. In Western Maryland, growth in population increased at an average annual rate of 0.53% between 1990 and 2000 compared to average annual growth of 0.20% between 1980 and 1990. Forecasted population is expected to grow at an average annual rate of 0.34% between 2000 and 2010. Western Maryland population represents about 4% of total state population. Consequently, the population growth rate trend for this region does not significantly affect the trend expected for the state as a whole.

Projected growth in the Baltimore region shows a different pattern of expected change. Between 1990 and 2000, population in the Baltimore region grew at an average annual rate of 0.81%; the growth rate is projected to decline over the 2000 to 2010 period to about 0.65% per year.

As suggested by the discussion of population growth in Western Maryland and the Baltimore region, the rates of growth in population are uneven across the state. Historically, the largest growth rates are reported for Southern Maryland and the smallest rates for Western Maryland. In the 1980s, the population growth rate for Southern Maryland was approximately 16 times that of Western Maryland. While disparities are expected to continue, it is anticipated that there will be a narrowing of the growth rate differentials over the 2000 to 2010 period compared to the 1980s.

Household data for the state and for regions within the state are shown in Table B-6. The table shows a summary of historical and projected data, as well as average rates of growth for the period 1980 through 2010. Average annual growth in the number of households was 1.82% during the 1980s, declined to 1.25% between 1990 and 2000, and is expected to further decline to approximately 1.1% through 2010. The pattern of slowing growth in the number of households for the state also characterizes the pattern of growth in each of the five regions of Maryland. As was the case for population, growth in the number of households is projected to be most rapid in Southern Maryland and least rapid in Western Maryland.

Since 1980, household size in each of the five Maryland regions has been declining, and the rate of decline is forecasted to increase slightly. For the state, the average household size was 2.82 people in 1980, declined to 2.67 in 1990 (representing an average rate of decline of about 0.56% per year) and further declined to 2.61 in 2000 (a decline of 0.24% per year, on average, compared to 1990). The rate of decline is expected to be approximately 0.31% per year between 2000 and 2010. The largest declines in household size are projected for Southern Maryland and the smallest for Western Maryland.

Summary

This appendix provides a review of the theoretical foundations used for modeling the demand for electricity econometrically in the PPRP forecast studies. In doing so, emphasis is placed on some of the key determinants of the demand for electric power. The determinants of demand are classified into residential and non-residential, as well as into economic and non-economic for purposes of exposition. Per capita income is an explanatory economic variable that influences the residential demand for electricity; population, the number of households, and average household size are non-economic explanatory variables affecting residential electricity consumption. This appendix also shows trends in employment, which affect the non-residential demand for electricity. Selected data on these determinants of demand are reported and trend analyses presented. The broad conclusion to emerge from these trends is that the demand for electricity should continue to grow in Maryland.

Table B-1 Principal Regions in Maryland

Region	Counties	Predominant Electric Distribution Utility
Baltimore	Anne Arundel Baltimore City Baltimore County Carroll Frederick Harford Howard	Baltimore Gas and Electric Company
Southern Maryland	Calvert Charles St. Mary's	Southern Maryland Electric Cooperative
Eastern Shore	Caroline Cecil Dorchester Kent Queen Anne's Somerset Talbot Wicomico Worcester	Conectiv and Choptank Electric
Washington, D.C.	Montgomery Prince George's	Potomac Electric Power Company
Western Maryland	Allegany Garrett Washington	Potomac Edison Company

Table B-2 Historical and Projected Per Capita Income for Maryland, 1980-2010 (1996 Dollars)

Region	Census 1980	Census 1990	Census 2000	2010	Annual Rate of Growth (%) 1980-1990	1990-2000	2000-2010
Maryland	20,391	26,980	31,708	34,797	2.84	1.63	0.93
Baltimore	20,030	25,660	30,520	33,594	2.51	1.75	0.96
Washington Suburban	23,570	32,306	37,285	40,262	3.20	1.44	0.77
Southern Maryland	16,981	23,683	28,482	32,662	3.38	1.86	1.38
Western Maryland	15,687	18,340	21,481	23,503	1.57	1.59	0.90
Eastern Shore	15,260	21,391	24,650	27,599	3.44	1.43	1.14

Prepared by the Maryland Department of Planning, Planning Data Services, October 2002.
Historical data, 1980 - 2000 from the U.S. BEA.

Table B-3 Structure of Non-Agricultural Employment in Maryland and the U.S., 1990 and 2000 (Percentages)*

	Maryland		United States	
Sector	**1990**	**2000**	**1990**	**2000**
Mining	0.14	0.09	0.77	0.48
Construction	7.31	6.86	5.39	5.88
Manufacturing	7.87	3.96	14.61	11.79
Transportation and Public Utilities	4.37	4.60	4.87	5.10
Wholesale Trade	4.33	4.14	4.98	4.68
Retail Trade	17.56	17.07	17.00	16.90
Finance, Insurance, and Real Estate	8.55	8.70	7.95	8.15
Services	31.27	37.22	28.71	32.98
Government	18.61	17.35	15.72	14.03

*Totals may not sum to 100 due to independent rounding.

Source: Maryland data prepared by the Maryland Department of Planning, Planning Data Services, and the U.S. BEA, Table C-25.

Table B-4 Regional Non-Agricultural Employment for Maryland and the U.S. 1980-2010 (Thousands)

					Annual Rate of Growth (%)		
Region	**1980**	**1990**	**2000**	**2010**	**1980-1990**	**1990-2000**	**2000-2010**
Maryland	2,030.2	2,712.8	3,060.4	3,426.2	2.94	1.21	1.14
Baltimore	1,161.2	1,455.8	1,616.3	1,778.9	2.29	1.05	0.96
Washington Suburban	608.5	886.2	991.8	1,136.9	3.83	1.13	1.37
Southern Maryland	46.8	90.3	122.6	143.7	6.79	3.11	1.60
Western Maryland	93.4	113.7	129.8	141.0	1.99	1.33	0.83
Eastern Shore	120.3	166.8	199.9	225.7	3.32	1.83	1.22
United States	109,524.2	134,820.9	162,032.7	189,079.9	2.10	1.86	1.56

Prepared by the Maryland Department of Planning, Planning Data Services, October 2002.
Historical data, 1980-2000 from the U.S. BEA.
Notes: 2000 Data include estimates of Agricultural Services and Mining employment U.S. 2010 Forecast developed by applying a U.S. BLS projection growth rate to U.S. BEA 2000 data.

Table B-5 Historical and Projected Population for Maryland 1980-2010 (Thousands)

					Annual Rate of Growth (%)		
Region	**Census 1980**	**Census 1990**	**Census 2000**	**2010**	**1980-1990**	**1990-2000**	**2000-2010**
Maryland	4,217	4,780.8	5,296	5,747	1.26	1.03	0.82
Baltimore	2,289	2,498	2,708	2,889	0.88	0.81	0.65
Washington Suburban	1,244	1,486	1,675	1,844	1.79	1.21	0.97
Southern Maryland	167	229	281	335	3.17	2.10	1.76
Western Maryland	220	224	237	245	0.20	0.53	0.34
Eastern Shore	297	344	396	434	1.49	1.42	0.92

Prepared by the Maryland Department of Planning, Planning Data Services, October 2002. Year 2005-2025 for Baltimore and Washington metropolitan jurisdictions based on Rnd 5d (Baltimore) and Preliminary Rnd 6.3 (Washington) projections of the Cooperative Forecasting Groups.

Table B-6 Historical and Projected Number of Households and Average Size of Households in Maryland, 1980-2010

Region	1980	1990	2000	2010	Annual Rate of Growth (%) 1980-1990	1990-2000	2000-2010
Number of Households (thousands)							
Maryland	1,461	1,749	1,981	2,211	1.82	1.25	1.11
Baltimore	794	920	1,029	1,135	1.48	1.12	0.98
Washington Suburban	432	540	611	689	2.26	1.24	1.20
Southern Maryland	5	75	98	121	4.01	2.63	2.17
Western Maryland	78	85	91	96	0.75	0.69	0.54
Eastern Shore	105	129	153	171	2.04	1.73	1.16
Average Household Size							
Maryland	2.82	2.67	2.61	2.53	-0.56	-0.24	-0.31
Baltimore	2.81	2.65	2.56	2.47	-0.60	-0.33	-0.36
Washington Suburban	2.83	2.71	2.70	2.63	-0.46	-0.03	-0.26
Southern Maryland	3.24	2.97	2.83	2.71	-0.85	-0.50	-0.41
Western Maryland	2.70	2.52	2.44	2.37	-0.70	-0.34	-0.26
Eastern Shore	2.75	2.58	2.51	2.44	-0.64	-0.29	-0.27

Prepared by the Maryland Department of Planning, Planning Data Services, October, 2002. Year 2005-2025 for Baltimore and Washington metropolitan jurisdictions based on Rnd 5d (Baltimore) and Preliminary Rnd 6.3 (Washington) projections of the Cooperative Forecasting Groups.

Appendix C
State-Wide Forecast of Electricity Consumption and Peak Demands in Maryland

State-Wide Forecast of Electricity Consumption and Peak Demands in Maryland

Introduction

This appendix presents the results of a long-range forecast of electric energy consumption in the state of Maryland as well as projected peak demand in the state. Aggregate forecasted state electric energy use and peak demand is also disaggregated to five regions that comprise the state: the Baltimore region, the Washington Suburban region, Southern Maryland, Western Maryland, and the Eastern Shore.

Forecast results for three scenarios were developed: a base case, a case resting on assumptions of rapid economic growth and relatively low electricity prices, and a case based on assumptions of slow economic growth and relatively high electricity prices. The base case represents our assessment of the most reasonable set of forecasting assumptions over the 10-year forecasting period (2000 to 2010). The high case and low case scenarios were developed by modifying the base case assumptions such that the assumptions for these alternative scenarios, though reasonable, are more extreme than those of the base case. The alternative scenarios define the likely range of growth in energy consumption and peak demand over the forecast period. In addition to these scenarios, an alternative scenario relying on the base case assumptions with modified electricity prices (relative to the base case) was also run to address the high degree of uncertainty surrounding future use electricity prices.

The remainder of this appendix provides an overview of the methodology and a summary of the forecast results.

Methodological Overview

The forecast of energy consumption was predominantly developed using econometric techniques. For certain portions of the forecast, such as consumption by several large individual users (e.g., Eastalco Aluminum), non-econometric techniques were used. To prepare the econometric portions of the forecast, the following general steps were taken:

(1) *Formulate theoretical models of electricity consumption for each customer class or sector for which energy use is to be projected. The models express the hypothesized relationships between the causal variables (e.g., income, employment, price, weather) and the variable to be forecasted (e.g., electricity use per residential customer).*

(2) *Collect data on all variables for the historical period. (The historical data relied upon for this forecast cover the period from the first quarter of 1985 through the first quarter of 2000).*

(3) *Estimate the values of the parameters on the causal (or independent) variables using a statistical technique called regression analysis. The estimated parameters relate changes in the values of the causal variables over the historical estimation period to changes in the value of the dependent variable (e.g., electricity use per residential customer).*

(4) *Develop assumptions regarding the growth in the values of the causal variables over the forecast period.*

(5) *Insert the assumed future values of the causal variables into the estimated forecasting equations which, when solved, will provide the forecasted values of the dependent variables.*

Econometric forecasting models were developed for the following categories of electric energy consumption in Maryland:

(1) *Residential;*

(2) *Commercial;*

(3) *Industrial; and*

(4) *Streetlighting.*

This study relied upon historical megawatt-hour electricity usage data from Baltimore Gas and Electric Company (BG&E), Delmarva Power and Light Company (DP&L),[1] Potomac Electric Power Company (PEPCO), Potomac Edison (PE), and the Southern Maryland Electric Cooperative (SMECO). Electricity usage was disaggregated by major customer class to capture important differences in the causal factors affecting the demand for electricity among the various customer classes. For example, per capita personal income influences residential usage but it does not directly influence the consumption of electricity by commercial and industrial users. By disaggregating the forecast of energy consumption, these differences can be reflected in the estimated parameters. The electricity usage data therefore, were broken into end-user categories, i.e., residential, commercial, industrial, and streetlighting.

There are several small electric power providers in the state: five municipally owned electric systems (Berlin Municipal Electric Plant, the Easton Utilities Commission, City of Hagerstown Light Department, Thurmont Municipal Light Company and Williamsport Municipal Electric Light System) and three cooperative systems (A&N Electric Cooperative, Choptank Electric Cooperative, Inc. and Somerset Rural Electric Cooperative). The total electric consumption of these small providers represents less than four percent of electricity usage in the state as a whole. The econometric equations were estimated using the electricity consumption data from the four investor-owned utilities operating in Maryland and SMECO. The base year and forecasted values were then adjusted upwards to reflect the electricity consumption in the areas served by the small electricity providers. Separate add-factors were applied to the estimation results of the

[1]Delmarva Power and Light acquired Conowingo in 1996. DP&L data prior to that date were adjusted by adding in the Conowingo customer and usage data to create a consistent series.

residential, commercial, and industrial equations; no add-factor was used for the streetlighting consumption because no data were available regarding that segment of usage for the municipal utilities and electric cooperatives.

Non-econometric techniques were used to develop forecasts of consumption for Baltimore Gas and Electric's interdepartmental usage, the Sparrows Point steel plant, Amtrak, Eastalco Aluminum, and company use and losses for all utilities in the state.[2]

This forecast also includes a regional analysis of electricity usage in Maryland in order to capture the diverse electric energy consumption patterns within the state. Five regional models were developed to accommodate the projections of regional consumption. The five regions defined for this analysis are: the Baltimore region, the Washington Suburban region, Southern Maryland, Western Maryland, and the Eastern Shore. Each regional model contained the electricity usage data from the corresponding utility responsible for providing service and region-specific demographic, weather, and economic data of the counties that comprise the regions. The counties contained in each region are listed below in Table C-1.

Table C-1 Regional County and Usage Data Definitions

Baltimore Region:	***Western Maryland:***
Baltimore Gas & Electric	**Potomac Edison**
Anne Arundel County	Allegany County
Baltimore City	Garrett County
Baltimore County	Washington County
Carroll County	
Frederick County	***Eastern Shore:***
Harford County	**Delmarva Power & Light**
Howard County	Caroline County
Cecil County	Dorchester County
Washington Suburban:	Kent County
Potomac Electric Power Company	Queen Anne's County
Montgomery County	Somerset County
Prince George's County	Wicomico County
Talbot County	Worcester County
Southern Maryland:	
Southern Maryland Electric Cooperative	
Calvert County	
Charles County	
St. Mary's County	

[2] Sparrows Point consumption and BG&E interdepartmental use were held constant throughout the forecast period. Amtrak usage was assumed to grow three percent a year based on historical trends. Eastalco usage was forecasted based on projections developed by Potomac Edison and are projected to decline at a rate of -0.03 percent per year. Company use and losses were assumed to be 4.5 percent of net system usage (pro-rated for the Maryland portion of the service areas) in 2010. This approach for projecting company use and losses was adopted because econometric projections yielded unrealistically low values of company use and losses for the last few years of the forecast period.

The regional definitions provided in Table C-1 were based on geographical location and usage patterns of the regions. The statewide equations, discussed above, were used to forecast the regional electricity usage of each customer class within each of the five regions. Regional projections (rather that state-level projections) of demographic and economic indicators, such as population and employment, were inserted into the statewide equations to generate the regional forecasts. The regional forecast model results were then adjusted such that the sum of the regional projections equaled the state-wide projection in each year of the forecast period; that is, the state-wide projections were used as a control total for the sum of the regional projections.

As noted above, following completion of the econometric estimations, assumptions regarding the future values of the causal variables were developed. The most important causal variables include the number of residential customers, real electricity prices, real per capita personal income, total employment and weather. Weather in the future period is assumed to equal long-run historical average weather. Projections on the growth in employment and population (which determines growth in the number of residential customers) and real per capita personal income were obtained from the Maryland Department of Planning. The projections for the real price of electricity were developed by Exeter Associates, Inc. and are based on existing price freeze arrangements (which vary by service area and customer class) and end-user electricity cost projections for the Mid-Atlantic Area Council (MAAC) developed by the U.S. Department of Energy, Energy Information Administration.

Summary of Results

Table C-2 is a summary of the forecast of total electric energy consumption for Maryland and regions using the base case set of forecasting assumptions. The base case assumptions are those judged to represent the most reasonable path of growth for the driving variables over the 2000 to 2010 forecast horizon.

Table C-2 Maryland and Regional Electric Energy Consumption—Base Case (thousands of MWh)

	Maryland	Baltimore Region	Washington Suburban	Southern Maryland	Western Maryland	Eastern Shore
1999*	62,353	33,514	14,694	2,767	6,376	5,002
2003	68,496	36,719	15,834	3,199	7,078	5,667
2005	71,937	38,340	16,740	3,433	7,388	6,036
2007	75,702	40,127	17,768	3,668	7,727	6,412
2010	82,317	43,275	19,633	4,058	8,316	7,035
Average Annual Growth Rates (percent)						
1999-2003	2.38	2.31	1.88	3.69	3.81	3.17
2003-2005	2.48	2.18	2.82	3.60	2.19	3.21
2005-2007	2.58	2.30	3.03	3.36	1.99	3.06
2007-2010	2.83	2.55	3.38	3.43	1.97	3.14
1999-2005	2.41	2.27	2.20	3.66	3.00	3.18
2005-2010	2.73	2.45	3.24	3.41	1.98	3.11
1999-2010	2.56	2.35	2.67	3.54	2.49	3.15

*Actual.

As shown in Table C-2, electric energy consumption in Maryland is projected to increase at an average annual rate of 2.56 percent between 1999 and 2010. Over the forecasting period, total electric energy consumption in the Southern Maryland region is projected to grow more rapidly (3.54 percent per year) than consumption in the other four regions. This result largely reflects relatively high demographic and economic projections for this region when compared to the rest of the state. At a rate of 2.35 percent, the Baltimore region has the slowest average annual growth rate of total electric energy consumption.

Table C-3 summarizes the base case peak demand forecast (summer and winter seasons) for Maryland and the regions. Summer peak demand in the state is projected to increase at an average annual rate of 2.3 percent per year between 1999 and 2010 while winter season peak demand is projected to increase at an average annual rate of 2.9 percent over the same period. Annual peak demands (summer) are projected to increase most rapidly in Southern Maryland and the Eastern Shore.

Table C-3 Regional Summer and Winter Peak Demand Forecasts (MW)

BASE CASE

	1999 Summer (MW)	2010 Summer (MW)	Average Annual Growth Rate (%)	1998/1999 Winter (MW)	2009/2010 Winter (MW)	Average Annual Growth Rate (%)
Baltimore Region	6,681	8,690	2.42	5,747	7,475	2.42
Washington Suburban	3,183	3,832	1.70	2,451	3,767	3.99
Southern Maryland	566	808	3.29	504	742	3.59
Western Maryland	1,193	1,474	1.94	1,187	1,576	2.62
Eastern Shore	1,045	1,484	3.24	914	1,241	2.82
Maryland*	12,445	16,000	2.31	10,610	14,540	2.91

*Maryland's total peak is less than the sum of the regions by 1.8 percent to reflect diversity in peak demands.

Table C-4 presents the results of the total electricity consumption forecast for the state of Maryland under the base, low, high and base case/alternative price case scenarios. Total electricity consumption in the state is projected to grow at an average annual rate of 2.56 percent between 1999 and 2010 under the base case scenario. The low case scenario forecasts a 1.63 percent average annual growth rate, which is 0.93 percentage points less than the base case. Under the high case assumptions, total electric energy consumption in Maryland is projected to grow at an average annual rate of 3.50 percent, or 0.94 percentage points higher than the base case. Electricity consumption is expected to grow by 1.84 percent per year, on average, under the base case/alternative price scenario, which is 0.72 percentage points less than the base case.

Table C-4 Total Maryland Electric Energy Consumption—Base, Low, High and Base Case/Alternative Price Scenarios (thousands of MWh)

	Base Case	Low Case	High Case	Base Case/Alternative Price Scenario
1999*	62,353	62,353	62,353	62,353
2003	68,496	66,923	70,096	68,496
2005	71,937	38,862	75,139	71,506
2007	75,702	70,894	80,852	73,628
2010	82,317	74,465	90,911	76,241
Average Annual Growth Rates (percent)				
1999-2003	2.38	1.78	2.97	2.38
2003-2005	2.48	1.44	3.53	2.17
2005-2007	2.58	1.46	3.71	1.47
2007-2010	2.83	1.65	4.03	1.17
1999-2005	2.41	1.67	3.16	2.31
2005-2010	2.73	1.58	3.90	1.29
1999-2010	2.56	1.63	3.50	1.84

* Actual

Table C-5 Maryland Forecasted Summer Peak Demand (MW)

	Base Case Peak Demand	Low Case Peak Demand	High Case Peak Demand	Base Case/Alternative Price Scenario Peak Demand
Base Year 1999	**12,445**	**12,445**	**12,445**	**12,445**
2001	12,894	12,812	12,976	12,894
2002	13,113	12,926	13,301	13,113
2003	13,372	13,062	13,687	13,372
2004	13,656	13,208	14,118	13,656
2005	13,999	13,395	14,627	13,914
2006	14,341	13,574	15,150	14,118
2007	14,714	13,773	15,719	14,306
2008	15,115	13,988	16,332	14,480
2009	15,544	14,218	16,992	14,645
2010	16,000	14,464	17,699	14,804
Average Annual Growth Rates (percent)				
1999-2005	1.98	1.23	2.73	1.88
2005-2010	2.71	1.55	3.89	1.25
1999-2010	2.31	1.38	3.25	1.59

*Year indicated is the end of the winter period, for example, the year 2001 represents the 2000-2001 winter season.

Table C-6 Maryland Forecasted Winter Peak Demand (MW)

	Base Case Peak Demand	Low Case Peak Demand	High Case Peak Demand	Base Case/Alternative Price Scenario Peak Demand
Base Year 1999	10,610	10,610	10,610	10,610
2001*	11,424	11,350	11,497	11,424
2002	11,727	11,559	11,895	11,727
2003	12,037	11,757	12,322	12,037
2004	12,349	11,943	12,767	12,349
2005	12,697	12,148	13,268	12,623
2006	13,030	12,333	13,765	12,838
2007	13,379	12,525	14,291	13,029
2008	13,747	12,725	14,850	13,203
2009	14,134	12,935	15,443	13,364
2010	14,540	13,153	16,073	13,515
Average Annual Growth Rates (percent)				
1999-2005	3.04	2.28	3.80	2.94
2005-2010	2.75	1.60	3.91	1.38
1999-2010	2.91	1.97	3.85	2.22

The winter peak, as indicated above, is projected to grow more rapidly than the summer — 2.91 percent per year compared to 2.31 percent per year, respectively, under the base case assumptions. The state, however, is projected to remain summer-peaking throughout the forecast period under the base case set of assumptions as well as under the three alternative sets of assumptions.

Appendix D
Internet Resources

Internet Resources

Federal Agencies

- *Department of Energy (DOE): http://www.energy.gov/*
  - *Data & Prices: http://www.energy.gov/dataandprices/*
  - *Office of Scientific and Technical Information (OSTI) Library: http://www.osti.gov/*
  - *National Renewable Energy Laboratory (NREL): http://www.nrel.gov/*
- *Energy Information Agency (EIA), DOE: http://www.eia.doe.gov/*
  - *The Changing Structure of the Electric Power Industry 2000: An Update: http://www.eia.doe.gov/cneaf/electricity/chg_stru_update/toc.html*
  - *Electric Power Industry Restructuring and Deregulation: http://www.eia.doe.gov/cneaf/electricity/page/restructure.html*
  - *Electricity Statistics: http://www.eia.doe.gov/fuelelectric.html*
- *Environmental Protection Agency (EPA): http://www.epa.gov/*
  - *Toxic Release Inventory: http://www.epa.gov/tri/*
- *Federal Energy Regulatory Commission: http://www.ferc.fed.us/*
- *Nuclear Regulatory Commission: http://www.nrc.gov/*

Maryland Agencies

- *Maryland Department of the Environment: http://www.mde.state.md.us/*
- *Maryland Energy Administration: http://www.energy.state.md.us/*
- *Maryland Power Plant Research Program: http://www.dnr.state.md.us/bay/pprp/*
- *Maryland Public Service Commission: http://www.psc.state.md.us/psc/home.htm*
  - *Electric Choice Information: http://www.md-electric-info.com*

(continued on next page)

National & Regional Associations

- *American Nuclear Society: http://www.ans.org/*
- *National Association of Regulatory Utility Commissioners (NARUC): http://www.naruc.org/*
- *National Rural Electric Cooperative Association: http://www.nreca.org/*
- *North American Electric Reliability Council: http://www.nerc.com/*
- *Nuclear Energy Institute: http://www.nei.org/*
- *PJM Interconnection: http://www.pjm.com/*

Research

- *Electric Power Research Institute (EPRI): http://www.epri.com/*
- *National Regulatory Research Institute (NRRI), NARUC: http://www.nrri.ohio-state.edu/*

Power Industry

- *Allegheny Energy: http://www.alleghenyenergy.com/*
  - *Allegheny Energy Supply: http://www.alleghenyenergysupply.com/*
  - *Allegheny Power: http://www.alleghenypower.com/*
- *Constellation Energy: http://www.constellation.com/*
  - *Constellation Generation Group: http://www.constellation.com/generation*
  - *BGE: http://www.bge.com/*
- *Pepco Holdings, Inc.: http://www.pepcoholdings.com/*
  - *Pepco: http://www.pepco.com/*
  - *Conectiv Power Delivery: http://www.conectiv.com/cpd*
- *AES: http://www.aesc.com/index.asp*
- *BRESCO: http://www.baltimoreresco.com/*
- *Exelon: http://www.exeloncorp.com/*
- *Mirant: http://www.mirant.com/*
- *Panda: http://www.pandaenergy.com/*
- *Easton: http://www.eastonutilities.com/*
- *Old Dominion Electric Cooperative: http://www.odec.com/*
- *Southern Maryland Electric Cooperative: http://www.smeco.com/*