ENVIRONMENTAL REPORT

CHAPTER 8

NEED FOR POWER

8.0 NEED FOR POWER

This chapter provides an assessment of the need for electric power in support of the COL application for the proposed Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3. Also provided is a description of the existing regional electric power system, current and future demand for electricity, and present and planned power supplies.

The assessment of power needs is based on input provided by the Maryland Public Service Commission (PSC) on the need to sustain a safe and reliable electric system in the state and reduce the state's reliance on imported electric power. Maryland is one of several states that have restructured their regulatory programs for electric utilities. Restructuring has changed the PSC role relative to the pricing of electricity generation and establishes that retail electric choice will be available to all customers (MDPSC, 2006).

Effective July 2000, the Maryland Electric Customer Choice and Competition Act of 1999 restructured the electric utility industry in Maryland to allow electric retail customers to shop for power from various suppliers (MD, 1999). These retail suppliers can generally be grouped into two categories:

- Local Utility – Entity that supplies electricity as a regulated monopoly and is the current default provider of electricity supply for customers who do not choose an alternative competitive electricity supplier.

- Competitive Suppliers – Competing entities that began supplying electricity in the competitive marketplace when the market was restructured.

Prior to restructuring, the local electric utility operated as a regulated, franchised monopoly. It supplied all end-use customers within its franchised service area with the three principal components of electric power service: generation, transmission, and distribution. With the restructuring of the electric power industry in Maryland, generation of electricity is now provided in a competitive marketplace (transmission and distribution remain regulated monopolies). Prices for power supply are determined by a competitive electric power supply market rather than by the PSC in a regulated environment.

Retail customers of the investor-owned utilities in Maryland have been allowed to select their own electric supplier since 2000. Electric restructuring has been gradually implemented since then, but the PSC still monitors and reports on the adequacy and reliability of electric power supply in the state.

However, no new generating capacity has been built in Maryland for a number of years. The PSC role in licensing of new generation facilities is discussed in Section 8.1.

Additionally, to gain the efficiency and reliability benefits of interstate and intrastate power transactions, the Maryland utilities participate in multi-utility power markets called the PJM Interconnection LLC (PJM), which also includes all or part of 13 states, including most of Pennsylvania, New Jersey, Delaware and the District of Columbia. The PJM reliability planning process is discussed further in Section 8.1.

As noted in NUREG-1555, "Standard Review Plan for Environmental Reviews of Nuclear Power Plants" (ESRP) Section 8.1 (NRC, 1999):

> Affected States and/or regions are expected to prepare a need-for-power evaluation. NRC will review the evaluation and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found acceptable, no additional independent review by NRC is needed, and the analysis can be the basis for ESRPs 8.2 through 8.4 (NRC, 1999).

Additionally, the NRC recognizes that the "need for power" should be analyzed on an individualized basis:

> The guidance in [ESRP 8.0] is limited because changes in the regulatory structure are occurring as the guidance is being revised. Reviewers of issues related to the need for power should identify current NRC policy before beginning their review. Deregulation in the electricity market will have a significant impact on the analysis of the need for power. Applicants may be power generators rather than utilities; therefore, analysis of the need for power must be sufficiently flexible to accommodate the applicant type [emphasis added]. (NRC, 1999)

The following sections show that the licensing process and other regulatory reviews occurring in the restructured utility market in Maryland meet the characteristics of an acceptable analysis of the need for power that satisfies NUREG-1555.

8.0.1 REFERENCES

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NRC, 1999. Standard Review Plans for Environmental Reviews of Nuclear Power Plants, NUREG-1555, Nuclear Regulatory Commission, October 1999.

8.1 DESCRIPTION OF POWER SYSTEM

This section evaluates the following criteria described in NUREG-1555 (NRC, 1999):

> Affected States and/or regions are expected to prepare a need-for-power evaluation. NRC will review the evaluation and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found acceptable, no additional independent review by NRC is needed, and the analysis can be the basis for ESRPs 8.2 through 8.4.
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> As part of their analyses of the need for power, States and/or regional authorities are expected to describe and assess the regional power system. The reviewer should evaluate the description and determine if it is comprehensive and subject to confirmation. [emphasis added] If it is found acceptable, no additional data collection by NRC should usually be needed. These data may be supplemented by information sources such as the Energy Information Administration, FERC [Federal Energy Regulatory Commission], the North American Electric Reliability Council, and others. (NRC, 1999)

In 1999, the State of Maryland restructured the manner in which it regulates the state's utilities by allowing for customer choice of electricity suppliers and by deregulating the price of electric supply. In the Electric Customer and Competition Act of 1999, the Maryland state legislature outlined the goals of electric restructuring and the Maryland Public Service Commission's (PSC) role in its implementation under the new statute:

> In assessing and approving each electric company's restructuring plan, and overseeing the transition process and regulation of the restructured electric industry, the Commission shall provide that the transition to a competitive electricity supply and electricity supply services market shall be orderly, maintain electric system reliability, and ensure compliance with federal and State environmental regulations, be fair to customers, electric company investors, customers of municipal electric utilities, electric companies, and electricity suppliers, and provide economic benefits to all customer classes (MD, 1999).

Despite the deregulation of the price of electric supply and generation in Maryland, electric power generators must obtain a "Certificate of Public Convenience and Necessity" (CPCN) from the PSC to build or modify power plants and transmission lines in the state. The CPCN is a single, comprehensive licensing process for the State. The CPCN encompasses the requirements of the Clean Air Act (CAA), including the Prevention of Significant Deterioration (PSD) approval, which the PSC, on behalf of Maryland, has been authorized by the U.S. Environmental Protection Agency (USEPA) to issue to power developers.

For a CPCN to be approved, the applicant must submit an application that will be processed and reviewed under the regulations promulgated by the Maryland PSC (MD, 2007). The application must include descriptions of the site and existing power plant installations, all proposed changes or alterations of the site and plant, the new or altered associated facilities, the environmental and other impacts of the project, and the environmental and other benefits to be realized from the project.

The CPCN application is filed with the PSC pursuant to the PUC Article Section 7-207 (MD, 2007). The Power Plant Research Program (PPRP) of the Maryland Department of Natural

Resources (MDNR) coordinates and receives recommendations from various federal, state, and local agencies regarding the CPCN application with ultimate disposition of these recommendations and the application itself by the PSC.

The information in the CPCN application presents the scope and impacts of the project and contains the information required by Maryland regulations (COMAR, 2007). It addresses the environmental and socioeconomic aspects of the project by presenting information on the existing natural and human environment, the facilities proposed to be constructed and operated, and the impacts of those new facilities on the environment. The MDNR, through the PPRP, also monitors construction of new power plants.

As part of the review, the PPRP performs the following functions:

- Consolidates issue analysis involving the MDNR, Environment, Agriculture, Business and Employment Development, and Transportation; the Office of Planning; and the Energy Administration. The PPRP usually represents those agencies in the PSC CPCN hearing process.

- Evaluates potential impacts of the proposed facility on environmental resources, including air, surface water and groundwater, terrestrial resources, and cultural and historic resources, while assessing overall site suitability.

- Manages the development of a consolidated set of recommendations to be included as conditions within the CPCN.

In addition, the PPRP provides a Cumulative Environmental Impact Report, which provides biennial information about potential environmental impacts of existing plants and power transmission on Maryland natural resources, cultural foundation, and economic situation, including power demand forecasts and growth factors.

Figure 8.1-1 provides an overview of the power plant construction approval process in Maryland.

8.1.1 Systematic Process

In Maryland, two state agencies are primarily responsible for the review and approval of applications to build new electric generating facilities in the state. Public concern about potential environmental damage to Chesapeake Bay prompted the creation of the PPRP (within the MDNR) to ensure a comprehensive, objective evaluation, based on sound science, to resolve environmental and economic issues before decisions were made regarding whether and where to build additional power-generating facilities. The PPRP, as noted above, coordinates the analysis of new generating plants by the various state agencies and the recommendations made by those agencies concerning the conditions to be imposed by the PSC upon the authorization of the new generating plants. The PSC approves the construction of the new facilities by issuing the necessary CPCN license after conducting hearings on each CPCN application. The PSC also provides an annual report to the MDNR describing the composition, fuel type, and adequacy of Maryland's existing electric generation facilities as well as proposed generation resources planned for construction in the state.

The PPRP coordinates the comprehensive review of all proposed power generation and transmission facilities and develops technically based licensing recommendations. The PPRP evaluates impacts to Maryland surface water, groundwater, air, land, and socioeconomics for

all proposed power facilities, including new plants, expansions of existing plants, and transmission lines.

Within the CPCN process, PPRP facilitates extensive interagency cooperation and planning. The PPRP may meet with representatives of potential applicants who are considering new generating station or transmission line projects to discuss whether and how all relevant concerns will be addressed and to ensure that the applicant understands the PSC regulations and procedures. Once the applicant submits an application to the PSC, the PPRP prepares a project description and summary of key issues to inform the other state agencies and the public at large. This discussion includes a review of power and reliability reports developed by the PSC and PPRP. (PPRP, 2006a)

The adjudicatory process starts with the filing of the CPCN application, summarizing the impact analyses that have been performed and discussing the mitigation that the applicant has proposed to undertake to address environmental concerns. The applicant prepares prefiled testimony that addresses the criteria established by Maryland law and regulation for the issuance of a CPCN and then responds to discovery requests from intervenors. Thereafter, the PPRP and any other parties that have intervened in the process may cross examine this testimony and present their own analyses in direct testimony. The PPRP testimony, presented on behalf of the various state agencies, presents initial recommended licensing conditions.

Other intervening parties, including the PSC staff, Office of People's Counsel (a state agency charged with protecting the interests of electricity ratepayers), and citizen's groups, can prepare and submit direct testimony. The Commission, a panel of Commissioners, or a Hearing Examiner (appointed by the PSC) takes into consideration the recommended license conditions, testimony, and briefs filed by the PPRP, the applicant, and any other parties, and issues a decision in the form of a proposed order on whether the CPCN should be granted and any associated conditions. Where a Hearing Examiner is utilized, after a period during which an appeal can be made to the full Commission, a final order is released granting or denying the application.

PJM Interconnection, LLC (PJM) also performs systematic reliability planning (PJM 2007a). The PJM Capacity Adequacy Planning (CAP) Department is responsible for determining and monitoring the generation reliability requirements of PJM. This includes analyzing the growth of electrical peak load within the region (Brattle, 2006). As part of its reliability planning obligations as a Regional Transmission Organization (RTO), PJM also focuses on planning the enhancement and expansion of transmission capability on a regional basis.

PJM has recently developed independent load forecasting procedures to enhance reliability planning and transmission expansion. For example, reliability planning was previously based on individual reports from each transmission zone within the PJM. Each submitting entity produced its forecast based on its own methodology, though it was common that the energy forecast was derived from the company's retail sales forecast and the energy forecast was then used to derive the peak load forecast. After receiving these individual forecasts, PJM would then prepare a report showing the aggregate coincident and non-coincident peak reports and release these to the public (PJM, 2007a).

With the advent of electric industry restructuring, PJM, as the RTO, determined that a single independent forecast should replace the diversified "sum of zones" report. In 2004, PJM began developing its forecast model and framework. PJM still relies on data from its members, but performs an independent forecast to determine the need for transmission improvements and

expansion. The latest transmission expansion report notes plans for new capacity as well as dynamic growth forecasts (PJM, 2007b).

In order to reliably and cost efficiently operate the region's electricity grid, PJM employs an operating procedure known as security constrained economic dispatch. With security constrained economic dispatch, PJM maximizes the use of its lowest cost generating units (coal and nuclear plants) and only uses more expensive units (oil or gas-fired units) when the lower cost units are already running at their maximum levels.

Additionally, the mission of the North American Electric Reliability Corporation (NERC), the "electric reliability organization" as certified by the FERC, is to improve the reliability and security of the bulk power system in North America. To achieve that, NERC develops and enforces reliability standards; monitors the bulk power system; assesses future adequacy; audits owners, operators, and users for preparedness; and educates and trains industry personnel.

NERC develops and publishes long-term reliability assessment reports annually to assess the adequacy of the bulk electric system in the U.S. and Canada over a 10 year period, including summer and winter assessments, and special regional, interregional, or interconnection assessment as needed. These reports project electricity supply and demand, evaluates transmission system adequacy, and discusses key issues and trends that could affect reliability (NERC, 2007).

These processes provide the necessary regulatory reviews and approvals to ensure that proposed power plants can be built to provide reliable, reasonably priced electricity without improperly harming the state's natural resources.

8.1.2 Comprehensive Process

The PSC performs an assessment of the generating or transmission capacity in Maryland. The Maryland Power Plant Research Act (MD, 2006) provides the process for analyzing forecasted energy consumption and peak demand in the restructured Maryland electricity marketplace.

The PSC is required to "assess the amount of electricity generated in Maryland as well as the amount of electricity imported from other states in order to determine whether a sufficient supply of electricity is available to customers in the State" (MD, 2006). Within the PSC, the Energy Resources and Markets Division (ERMD) is responsible for monitoring developments in the energy markets as they affect Maryland, and promoting PSC policies that accomplish more-robust and competitive energy markets, including at PJM, the RTO for the region that includes Maryland. Because retail electricity customers in Maryland either obtain electricity supply from a competitive retail supplier or from their distribution utility acting as the default supplier who purchases electricity through competitive auctions, the ERMD does not "plan" what is the best mix of energy supplies and method of delivery.

ERMD (formerly known as the Integrated Resource Planning (IRP) Division) was established in March 1993 to assess the capability for reliably meeting Maryland customers' electricity and natural gas energy demands. Division members have analytical and/or oversight responsibilities on a wide range of subjects, including regional power supply and transmission planning; applications for construction of major electric facilities; oversight of the Standard Offer Service competitive solicitations; developments in the wholesale energy markets, focusing on prices and availability; air emission compliance plans and emission monitoring as they affect the availability of power supplies; Maryland renewable portfolio standard; load

management and conservation programs; and certification of natural gas and electricity suppliers.

During 2006, ERMD performed the following activities:

- Prepared the 10 Year Plan (2006 through 2015) of Electric Companies in Maryland (MDPSC, 2006). In this report, the ERMD notes that Maryland imports over 27% of its electricity from other states over the transmission grid. The report also outlines the PSC efforts to evaluate the status of restructuring in the state. The report notes the PSC reliability concerns and congestion issues. Further, it highlights an overall concern in the state and region over the predicted decline in capacity margins, volatility in the price of electricity, and the lack of in-state generation capacity in Maryland.

- Prepared the Electric Supply Adequacy Report of 2007 (MDPSC, 2007). This report is required by Section 7-505 of Maryland Code Annotated, and describes the amount of electricity generated in Maryland, as well as the amount of electricity imported from other states. This assessment determines whether there is a sufficient, reliable supply of electricity to customers as part of electric market restructuring in Maryland. The report concludes that Maryland's electric supply has become "uncertain, if not precarious." In addition, the in-state electricity supply is inadequate to meet current demand. If new generating capacity is not built and/or upgrades to the transmission system are not made, the likelihood of a reliability crisis in Maryland will increase and may become unavoidable. This report is discussed further, along with its relationship to regional reliability planning efforts, in Section 8.3.

- Monitored wholesale electricity prices in Maryland, including spot prices as measured by locational marginal prices.

- Participated in the PJM planning processes to put in place a new long-term transmission planning protocol addressing both reliability and market efficiency. PJM manages price and transmission reliability, and operates a centrally dispatched wholesale market within the region (PJM, 2007a).

- Actively participated in several PJM committees and working groups, including the Transmission Expansion Advisory Committee, the Markets and Reliability Committee, the Planning Committee, the Market Implementation Committee, the Members Committee, the Demand Response Working Group, and the Regional Planning Process Working Group (PJM, 2007b).

- The PPRP is authorized by the Maryland Power Plant Research Act to prepare a Cumulative Environmental Impact Report (CEIR) each biennium. The intent of the CEIR is to assemble and summarize information regarding the impacts of electric power generation and transmission on Maryland's natural resources, cultural foundations, and economic situation. The CEIR report provides analysis of resource impacts and provides a topical discussion of current trends in the electricity industry (PPRP, 2006).

- The PPRP also provides the PSC with energy consumption forecasts. PPRP provides statewide and regional energy consumption forecasts within the state based on multiple scenarios with low and high case alternatives (PPRP, 2006).

Accordingly, both the PPRP and the PSC, work to monitor the conditions supporting sufficient energy supply to serve Maryland electricity customers. As a result, the process is comprehensive.

8.1.3 Confirmation Process

Consolidated review of power plants and transmission lines by the State of Maryland provides an important opportunity for coordination and confirmation within state government. The PPRP serves as a central point of contact for input from various state agencies. PPRP staff members communicate with other agencies to ensure that all issues are identified, and the program undertakes impact evaluations with input and involvement of those agencies. The PPRP represents seven state agencies before the PSC during the licensing process. Through the development of a consolidated set of recommended licensing conditions, the CPCN process is a valuable tool for bringing together the perspectives of various government bodies and evaluating them within a common framework.

The PPRP has historically conducted a program of independent electric load forecasts as part of its responsibility to 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 preparation of load forecasts (energy sales and peak demands) for the individual investor-owned electric utilities operating within Maryland is not sufficient to provide the information required for the PPRP 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. These assessments remain the responsibility of the PPRP, using the 10 year plans developed by ERMD. To assess and monitor the sufficiency of generating and transmission capacity, the 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 to significantly affect the demand for electricity. Economic variables include income, the price of electricity, and employment; non-economic variables include population and weather. Historical information is required for estimating purposes, while projected data are necessary to forecast the demand for power econometrically. The uncertainty associated with these predictions is discussed in Section 8.1.4.

The PSC reviews certain of these assessments and market demand forecasts in Commission proceedings. The agency also provides the PPRP and the legislature with assessments of transmission reliability and demand projections. Further, the PSC is in the process of conducting a major policy review covering the provision of electricity to retail customers.

8.1.4 Consideration of Uncertainty

In its annual reliability report, the PSC notes the basic uncertainties of forecasting electricity consumption on a long-term basis and that actual demand could vary significantly, particularly in the years calculated for the end of the 10 year analysis period. A number of Maryland-specific factors add to this unpredictability. For example, the elasticity of consumer response to sharply higher electricity prices, on both a short-term and long-term basis, is very difficult to forecast.

Customers might not reduce demand for electricity as much as one might otherwise expect in the face of higher prices and widespread availability of demand-reduction programs. On the other hand, these price signals could help force demand response and energy efficiency programs and ultimately cause consumer demand to fall short of levels projected by PJM reliability studies and the utilities. Given the long lead times required to plan and construct generation and transmission facilities, and current shortages of both forms of infrastructure in Maryland, the PSC recognizes that it needs to assess the extent to which it can rely on the most optimistic and most pessimistic of the load forecasts.

Both the PPRP and the PSC recognize that uncertainties in market trends, income, rapid increase in population and demand, and fuel supply diversity will remain significant uncertainties in forecast methodology.

8.1.5 References

Brattle, 2006. An Evaluation of PJM's Peak Demand Forecasting Process, The Brattle Group, December 2006, Website: http://www.pjm.com/planning/resadequacy/downloads/brattle-final-report.pdf, Date accessed: June 1, 2007.

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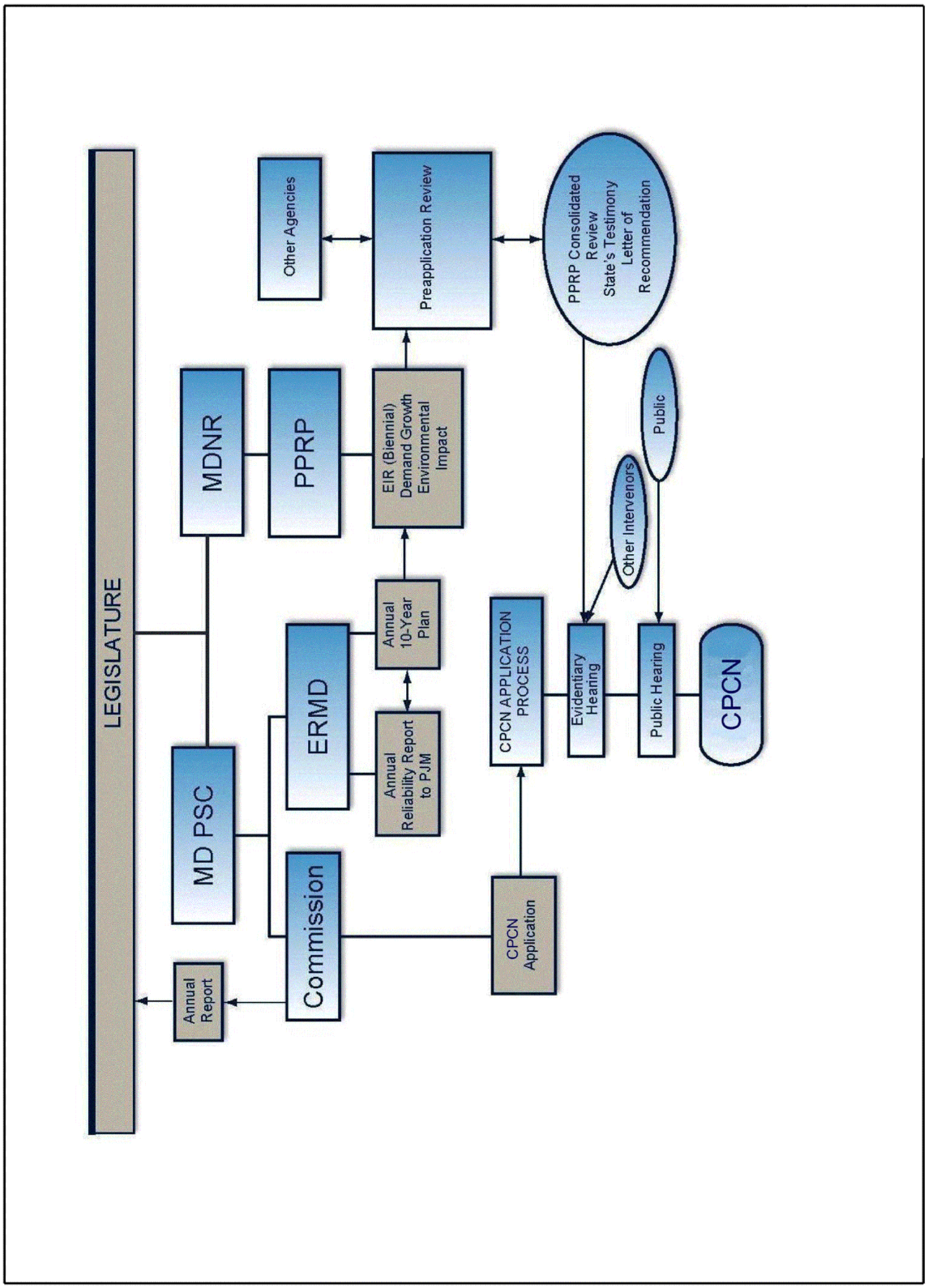

Figure 8.1-1— Power Planning and Plant Construction Approval – Maryland

8.2 POWER DEMAND

The guidance in NUREG-1555, "Standard Review Plan for Environmental Reviews of Nuclear Power Plants" (ESRP) 8.2 (NRC, 1999), allows that a state program describing current power demand and forecasts may support the need for power described in this chapter. This section describes the power resource adequacy review performed by the Maryland Public Service Commission (PSC) and the Power Plant Research Program (PPRP) of the Maryland Department of Natural Resources (MDNR).

8.2.1 Power And Energy Requirements

NUREG-1555 (NRC, 1999) provides the following guidance in ESRP 8.2.1:

> Affected States and/or regions continue to prepare need-for-power evaluations for proposed energy facilities. The NRC will review the evaluation and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the need for power evaluation is found acceptable, no additional independent review by the NRC is needed, and the analysis can be the basis for ESRPs 8.2 through 8.4 (NRC, 1999).

In Maryland's restructured marketplace, power and energy requirements are defined by customer demand (energy consumption), supply adequacy, and reliability. Section 7-505(e)(1) of the Public Utility Companies (PUC) Article (MD, 1999) requires the PSC to "assess the amount of electricity generated in Maryland as well as the amount of electricity imported from other states in order to determine whether a sufficient supply of electricity is available to customers in the State." The report on supply adequacy was filed with the General Assembly every two years beginning January 2001 until January 2007. In its 2007 report (MDPSC, 2007), the PSC noted:

> Maryland imports over 25% of its electric energy needs. On an absolute basis, Maryland is the fifth largest electric energy importer in the U.S. Virginia and New Jersey are in a comparable situation, being respectively the third and fourth largest energy importers in the country. Delaware and the District of Columbia, neighboring jurisdictions, are also large electricity importers, particularly given their relative small size. Thus, not only is Maryland a large importer of electricity, but so are states to the south, east and north of it as well. This makes much of the mid-Atlantic region deficient in generating capacity or, in industry parlance, a "load sink." Of states in the surrounding area, Maryland can import electricity in appreciable amounts only from West Virginia and Pennsylvania, and is competing with Delaware, Virginia, New Jersey, and the District of Columbia for the available exports from those states.
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> Exacerbating this situation is that Maryland's dependence on out of state electricity supplies will likely increase over the next several years. On the supply side, little new in-state electric generation is scheduled to be built in the next five years. Additionally, some fossil-fired generating capacity may be de-rated or retired in order to comply with both federal and State air emission requirements, including the sulfur dioxide and mercury provisions of Maryland's Healthy Air Act. On the demand side, Maryland's electric utilities and PJM forecast that electricity demand will continue to rise, albeit at a modest pace of between 1% and 2% per year, further increasing Maryland's need for additional electricity supplies.

> Maryland's position as a large net importer and the fact many other jurisdictions in PJM are in a similar situation gives the State little margin for error in ensuring electric reliability. Significantly, Maryland has no in-state reserve margin. Existing in-state generating capacity would have to be increased by over 4,000 MW to bring load and electric supply into balance if Maryland was forced to rely on in-state resources alone. De-rating or retiring any existing instate generation would further increase this need. Maryland has been relying on the bulk electric transmission grid to make up the difference between available in-State supply and demand. However, Maryland's ability to import additional electricity over that grid, particularly during times of peak demand, is limited at best. This is because the current transmission facilities that allow the importation of electricity into the State is operating at peak capacity during peak load periods. In other words, even though generators in Pennsylvania, West Virginia and states farther west may have excess generation to sell to Maryland, the transmission network is unable to deliver that power during times of peak demand.

Additionally, the PPRP recently noted that base demand will continue to rise through 2015 (PPRP, 2006a). However, the PPRP also predicts that consumption may slow because of increases in the real price of electricity over the forecast period, resulting from the expiration of fixed prices for power purchased from the local investor-owned distribution utilities that prevailed following implementation of restructuring.

The expiration of fixed prices, combined with market factors that cause increases in wholesale electricity prices (such as fuel price increases), have resulted in significant increases in electricity prices for the latest customer base (created when the latest price restrictions were lifted in Maryland). Additional price increases will be borne by those customers that continue to be served under the frozen rates – the last of which are set to expire shortly.

To prevent long-term reliability issues, Maryland requires the adoption of long-term energy policies that encourage:

- The construction of generation capacity in-state;
- Siting and building of new transmission facilities that give increased access to out-of-state generation; and
- Energy conservation and demand management programs that will reduce the need for new electric supplies, and make more efficient use of both existing and planned electric infrastructure.

8.2.2 Factors Affecting Growth and Demand

The PPRP has historically conducted a program of independent electric load forecasts as part of its effort to monitor the adequacy of future power supplies. Due to 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 preparation of load forecasts (energy sales and peak demands) for the individual investor-owned electric utilities operating within Maryland no longer provides sufficient information for the PPRP to assess the adequacy of planned supply.

Peak demand occurs when consumers in aggregate use the greatest amount of electricity. Over the course of a year, peak demand usually occurs on hot summer afternoons and cold

winter evenings. The load profile diagram presented in Figure 8.2-1 shows how electricity demand within a region changes during a typical summer day.

Virtually all power plants operate by using some form of energy to drive a generator to produce electricity. The needed energy can come in the form of steam created from coal, oil, natural gas, or nuclear fission. Gas turbines and internal combustion engines can also be used to drive generators directly. Hydroelectric plants use moving water to spin generators, while wind turbines use wind. Each of these technologies has different performance characteristics, entails different capital costs, and carries different operation and maintenance costs.

The power plants that are least expensive to run operate almost continuously to meet the minimum level of electricity that is demanded by a system (the base load). Also, known as baseload facilities, these continually running generators are predominantly coal-fired and nuclear plants. During periods when consumers demand more electricity, the power plants that can be quickly fired up to meet the peak load are put into operation. These "peaking plants," while expensive to operate due to fuel costs (typically oil or natural gas), are relatively inexpensive to construct (PPRP, 2006b).

Based on the projected load forecasts, both the PSC and the PPRP review the adequacy of generating capacity and the adequacy of transmission system capacity. The PPRP has modified its load forecasting program. Rather than focusing on the individual electric utilities serving consumers in the state, the PPRP now forecasts energy requirements and peak demands for the state as a whole and for the various regions within the state. The PPRP notes (PPRP, 2006a):

> 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 and industrial sectors of the market demand for electricity, the factors affecting demand are those to which producers are sensitive.
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> 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 electricity 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 factors, the PPRP assumes that the decisions about consumption are made by the consumer to maximize profits. Thus, the demand for power will be driven by price, the price of related inputs, and the level of output, and other factors – including weather. The PPRP also looks at the following in predicting demand: per capita income trends, employment trends, and population trends.

These three trends all show increases in the 10 year analysis period, with a predicted annual growth rate in demand of about 1.5% through the year 2015. Similar predictions of load growth were provided by the PJM in their 2007 Strategic Report (PJM, 2007).

8.2.3 Energy Efficiency and Substitution

Energy efficiency and demand side management (DSM) programs result in estimated load drops that reduce the demand for energy. There has been a substantial increase in DSM programs in recent years. While beneficial, these programs do not meaningfully affect the supply or demand side of the market and cannot be reasonably expected to substitute for necessary power upgrade projects. The DSM program measures are generally considered the cheapest possible compliance option and are often projected to provide a positive cash flow to the customer or utility implementing those measures. These measures can include rebates or other incentives for residential customers to update inefficient appliances with Energy Star® replacements. Customers can also receive credits on their bills for allowing a utility to control, or intermittently turn off their central air conditioning or heat pumps when wholesale electricity prices are high.

Recent legislation passage positions the State of Maryland as one of the leaders in energy efficiency and climate policy. On the energy efficiency side, the state recently launched the EmPOWER Maryland Initiative, which establishes a state goal of achieving a 15 percent reduction in per capita electricity use and peak demand by the end of 2015. This requires the state's utilities to implement energy efficiency programs and tasks the MDPSC with tracking progress toward that goal. This energy efficiency initiative, unlike energy conservation, which is based on changing behaviors and lifestyles, is technology-based.

Baltimore Gas & Electric Company (BGE), a Constellation Energy Group company, has recently taken steps to initiate DSM efforts through its Smart Energy Savers Program™, BGE recognizes that it relies heavily on electricity generated outside its market area, that there are higher costs resulting from market-based generation, and that customers expect them to promote energy efficiency. As a result, the BGE proposes to develop innovative programs promoting energy efficiency for its customers. These programs include: demand response infrastructure (DRI), energy efficiency/conservation, and advanced metering infrastructure (AMI) (BGE, 2007).

DRI is an effort to achieve customer benefits by reducing customer demand during periods of tight or peak supply. This can be accomplished technology-based measures such as programmable communicating thermostats and advanced air conditioning control switches. These technologies allow the BGE to regulate the demand and operation during periods of very high electricity use (that is, peak demand times). As part of the energy efficiency/ conservation efforts, the BGE is proposing to offer rebates or incentives to customers to purchase high efficiency products, such as Energy Star®; expand the current low-income gas Comprehensive Home Improvement Program (CHIP); and encourage homebuilders to build homes that meet Energy Star® standards. Through these efforts, the BGE hopes to reduce gas consumption by about 10 percent over the first 10 years of the program and reduce greenhouse gas emissions by an average of 2 billion pounds of carbon dioxide ($C0_2$) per year (BGE, 2007).

AMI, also referred to as "smart meters" is a state-of-the-art technology to read gas and electric meters. Simply put, AMI provide a two-way communication between the BGE and a customer's meter. The MDPSC approved the BGE AMI pilot in 2007 and the BGE proposes to provide about 9,000 meters to 5,000 customers in early 2008. BGE anticipates the complete AMI rollout to start in late 2008 and take 3 years to complete (BGE, 2007).

In addition, there are a number of state, regional, and national initiatives that promote both energy efficiency and climate policy. National concern for developing adequate supplies of electric power in an environmentally sound manner has led to state consideration of renewable minimum percentage of their power from renewable energy resources by a certain date. As of June 2007, there were 24 states, plus the District of Columbia, that have RPS policies in place Together these states account for more than half of the electricity sales in the United States (PJM, 2008).

In Maryland, the Governor recently set new renewable energy requirements for the state. These requirements propose to more than double the state's requirements for renewable energy by 2022. This new law proposes to slow the growth of the RPS over the next several years but then accelerates it starting in 2011. It still maintains a requirement for 2 percent of the state's power to come from solar energy by 2011 (MEA, 2008).

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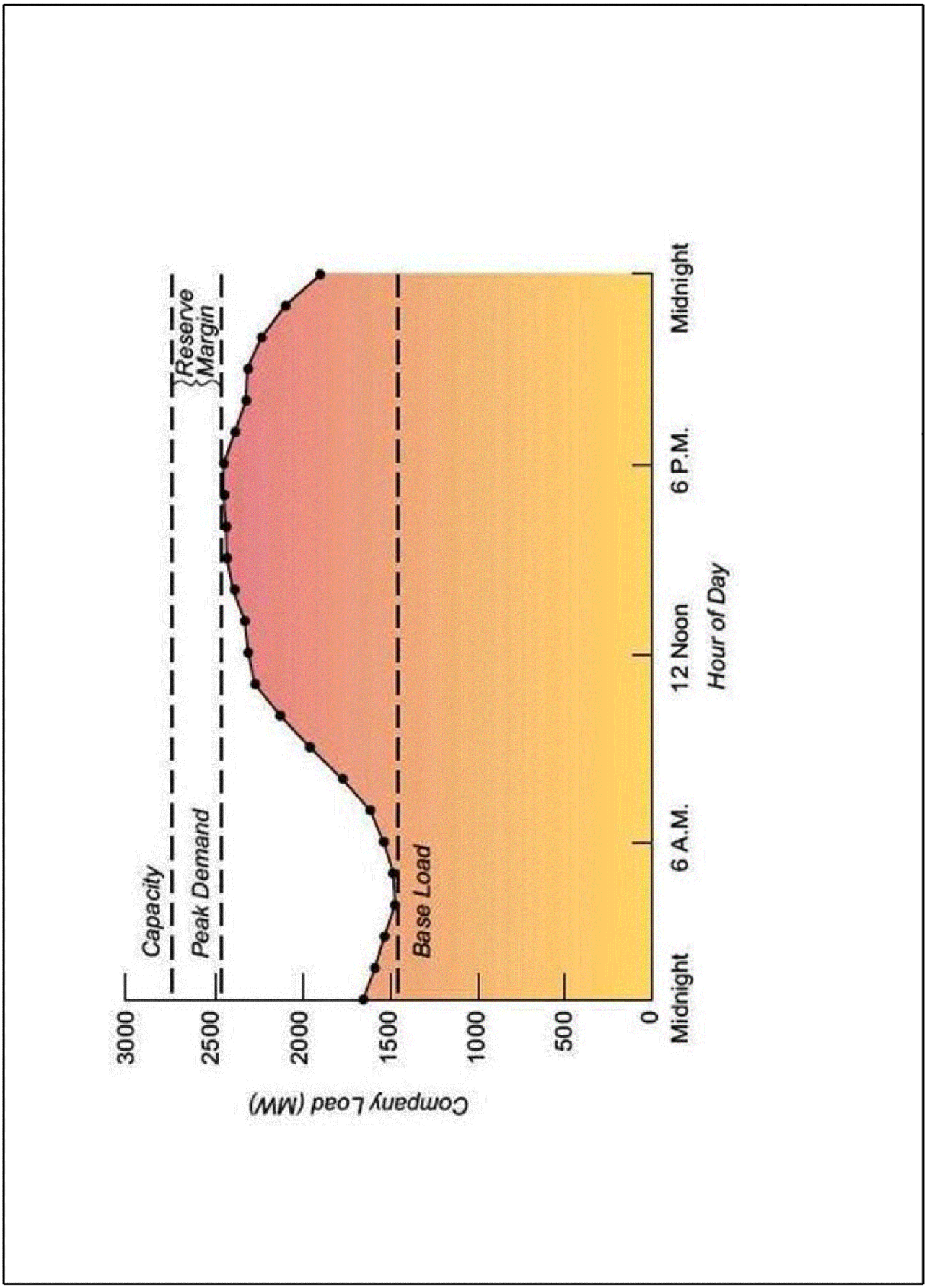

Figure 8.2-1— Summer Power Demand

8.3 POWER SUPPLY

In Maryland, the Public Service Commission (PSC) is tasked with assessing and reporting on the adequacy of the power supply in the region to meet the state's forecasted demand. The legislature has required the PSC to report its assessments of the reliability of the power supply and transmission to the Maryland marketplace.

The PSC describes a challenging power outlook in Maryland (MDPSC, 2007), despite increases in energy efficiency and voluntary conservation measures from consumers:

> If new generating capacity is not built, and/or upgrades to the transmission system are not made, the likelihood of a reliability crisis in Maryland, and eastern PJM generally, will increase, and may become unavoidable. As shown in earlier sections, not only will Maryland likely become more capacity deficient in the near-term but PJM is also projecting that capacity reserve margins will decline throughout the system. By the middle of the next decade, reserve margins in PJM may decline below the levels generally associated with ensuring reliable service. Maryland is in a large capacity deficit position, with little new capacity likely to be added and some older generating units possibly being de-rated or retired. Maryland will likely be confronted with a large and growing capacity deficiency unless transmission upgrades are made that will provide increased access to generating resources in western PJM.
>
> Renewables do not appear to be a substitute for traditional enhancements to the electric generation and transmission network. Renewable sources (excepting large hydroelectric projects) supply less than one percent of Maryland's and PJM's energy and capacity. This contribution may grow somewhat with time, but not by enough to meet electric load growth or replace older fossil units that may be de-rated or retired. Siting renewable resources can also be controversial (e.g., siting wind generation in Maryland is opposed by elements of the environmental community).
>
> In closing, Maryland faces major challenges in securing reliable and economic electricity supplies that will support its economy. The Commission recognizes that a balanced approach is required to ensure adequate electricity supplies, including adding new generation, upgrading the transmission system, preserving existing generation resources, and encouraging cost-effective conservation and demand response actions on the part of energy consumers. The Commission has been proactive in each of these areas and is committed to sustaining its efforts. The Commission is also committed to working with Maryland utilities, energy suppliers, and consumers; PJM and its stakeholders; and Maryland policymakers in moving initiatives forward in each of these areas.

The outlook for the adequacy of Maryland's electricity supply can perhaps be best characterized as fragile. Greater reliability depends on several electric grid infrastructure additions and upgrades whose timing may be problematic.

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8.4 ASSESSMENT OF NEED FOR POWER

In assessing the costs and benefits of the project, NUREG-1555, "Standard Review Plan for Environmental Reviews of Nuclear Power Plants" (ESRP) 8.4 (NRC, 1999), provides the following review criterion:

> If a need-for-power analysis conducted by or for one or more relevant regions affected by the proposed plant concludes there is a need for new generating capacity, that finding should be given great weight provided that the analysis was systematic, comprehensive, subject to confirmation, and responsive to forecast uncertainty.
>
> Although this criterion does not show a need for baseload capacity, it does demonstrate a need for new capacity that is independent of type. This criterion, coupled with an affirmative indication that there is a need for baseload capacity, justifies a baseload addition within the time span determined by the … forecast analysis.

8.4.1 Assessment of the Need for New Capacity

As the Maryland Public Service Commission (PSC) noted in its latest adequacy supply report (MDPSC, 2007), the need for in-state generating capacity is increasing rapidly. The PSC assessed the following factors as contributing to its growing concern about reliability and power supply:

- Maryland's growing reliance on imported electricity.
- Need for infrastructure additions and new transmission.
- Energy efficiency, wholesale, and retail opportunities.

Maryland's Growing Reliance on Imported Electricity

Maryland's dependence on out-of-state generation resources will likely increase over the next 5 to 10 years because of both growth in electricity demand and the possible de-rating or retirement of existing generating units. Both Maryland utilities and PJM are forecasting electricity demand to grow by between 1% and 2% per year. Military base realignments, proximity to the national capital, Maryland's attractive port facilities, its central location in the Atlantic economic corridor, and Maryland's attractiveness as a recreational destination lends credence to these forecasts.

Need for Infrastructure Additions and New Transmission

Further contributing to uncertainty in the power supply adequacy outlook is that over the next 10 years only a small number of new electricity generators will likely be built in Maryland. In 2003 the PSC granted a CPCN for a new 640 MWe generating unit to be built at the Doubs substation near Frederick, Maryland; however, the site developer has taken no action to initiate construction, and no prospective action appears to be likely.

As described in Section 2.8.6, the only other significant baseload generation plants in the PJM generation project queue are the addition of two combustion turbine generating units at an existing power plant near Easton, Maryland, and the addition of four combustion turbine generating units at an existing power plant near Eagle Harbor, Maryland. These units, even if built, would not provide sufficient baseload generating capacity to alleviate current generating capacity shortfalls in the region and future demand growth without reliance on

additional new baseload generating capacity. The proposed CCNPP Unit 3, if licensed and built in a timely fashion, would enter service in 2015 at the earliest.

In addition, federal and Maryland regulations require sharp reductions in sulfur dioxide, nitrous oxide, and mercury emissions from fossil-fired generating plants. Some of the older generating units may have difficulty in satisfying the stricter emission limits, or may be unable to satisfy them at all. If they are unable to comply, it is possible they would discontinue operations.

Even units that achieve compliance may see net energy output reduced because of parasitic losses associated with operation of the emission control equipment. Other states in PJM have also put in place strict air emission requirements, with similar potential effects on fossil-fired generating units. Maryland has also joined the Regional Greenhouse Gas Initiative (RGGI), which will place further limitations on fossil-fueled generation.

Energy Efficiency, Wholesale, and Retail Opportunities

More efficient use of electricity is occurring in Maryland. Electricity demand growth has been moderate despite strong economic growth. Since restructuring legislation was implemented, electric consumption in Maryland has increased at an average annual rate of 2.5%. The recent increase in wholesale electricity rates will likely reduce this rate of electric load growth. Both the Maryland utilities and PJM are forecasting that, over the next 10 years, electricity demand growth will be about 1.5% per year. Regional efforts under PJM, such as load response programs to encourage consumers to voluntarily reduce consumption, also contribute to efficiency. The long-term objective of these efficiency programs is to establish market conditions so that demand response and generation are, in effect, competing with one another (MDPSC, 2007).

8.4.2 Other Benefits of New Nuclear Capacity

The guidance in NUREG-1555 (NRC, 1999) allows for an applicant to assess the need for the proposed facility on other grounds. The following criteria suggest the continuing benefits of, and the need for, a new nuclear baseload generating facility in the state independent of the need for power:

- The relevant region's need to diversify sources of energy (e.g., using a mix of nuclear fuel and coal for baseload generation).

  Although new generation should be sufficient to meet established reliability criteria within the region, the PSC is concerned about the lack of fuel diversity exhibited by generation additions. Combustion turbine capacity in eastern PJM is expected to remain the predominant source of quickly built generation for at least the next 5 years. Natural gas prices have of course risen sharply in recent years and remain volatile.

  In the PJM region, many projects have been withdrawn because of unsatisfactory profit forecasts, general financial market instability, and, more recently, the much higher fuel costs for gas-fired plants, making them less economical to operate (MDPSC, 2002). The addition of new nuclear would help diversify the fuel mix and reduce dependence on gas-fired plants.

- The potential to reduce the average cost of electricity to consumers.

  The PSC and the Power Plant Research Program (PPRP) of the Maryland Department of Natural Resources (MDNR) note that the potential for new power generation to

increase availability to in-state consumers is essential to ensure reliability and a robust competitive market. The addition of a new nuclear plant to Maryland's electricity supply would provide an additional source of baseload power that would help stabilize the cost of electricity for consumers.

- The national need to reduce reliance on fossil fuels generally and increase energy security.

The current national policy is to develop ways to reduce dependence on fossil fuels. New baseload nuclear generating capacity is required to enhance U.S. energy supply diversity and energy security, a key National Energy Policy (NEP) objective (WH, 2001). The national policy in support of new nuclear is also apparent in Nuclear Power 2010, which is a joint government/industry cost-shared effort to identify sites for new nuclear plants, develop and bring to market advanced nuclear plant technologies, evaluate the business case for building new nuclear power plants, and demonstrate untested regulatory processes (DOE, 2007). The Energy Policy Act of 2005 (PL, 2005) also encourages needed investment in the national energy infrastructure, helps boost electric reliability, and promotes a diverse mix of fuels, including nuclear, to generate electricity. The Energy Policy Act of 2005 includes a number of provisions that directly encourage the development of new nuclear facilities, including the following:

- Authorizes construction cost-overrun support of up to $2 billion total for up to six new nuclear power plants;
- Authorizes a production tax credit of up to $125 million total per year, estimated at 1.8 US¢/kWh during the first eight years of operation for the first 6000 MW of new nuclear capacity;
- Authorizes a loan guarantee program to support advanced nuclear energy facilities.

The addition of nuclear baseload power to the nation's electricity supply supports national policy objectives and increases energy security.

Other recent national policy statements assert the benefits of baseload capacity that reduces GHG, including nuclear power. The concern over GHG, and the resulting climate change, has triggered a number of policy trends:

- During the 109th Congress, both houses of the U.S. Congress introduced resolutions calling for a national program of carbon reduction (USC, 2006) (USS, 2006).
- Several states, including Maryland, have joined regional GHG initiatives (MD, 2007). In addition to the RGGI, several western states have likewise joined the trend (WCGGWI, 2004). California has recently passed stringent requirements in order to curtail GHG (CAB, 2007).
- The 110th Congress continues its exploration of legislation that would limit carbon emissions in the U.S. Known as "cap and trade" legislation, the legislation seeks to bring carbon emissions down through a series of industry caps and trading strategies (USS, 2007b).

Costs of climate change have also triggered concerns about the economic effects of continuing carbon emission growth. The following examples highlight the growing concern in the U.S.:

- A British study reviewed by the U.S. Senate notes that unabated climate change will sharply affect economic systems globally, ultimately costing more than 20 percent annually of gross domestic product by the year 2050 (USS, 2007a).
- U.S. economic reviews of the British study support it with "high confidence" (Yohe, 2007)."

Because nuclear power plants do not produce significant GHG emissions, the addition of nuclear baseload power to the nation's electricity supply supports national policy objectives and furthers national efforts to reduce GHG emissions.

- The Maryland need to reduce reliance on fossil fuels generally.

The state recently placed drastic limits on emissions from coal- and natural gas-fired plants. The Maryland Healthy Air Act (MDE, 2006) will provide larger reductions in NOx, SO2, and mercury in a faster timeframe than the federal Clean Air Interstate Rule (CAIR) and Clean Air Mercury Rule (CAMR). The Maryland Healthy Air Act prohibits Maryland power plants from acquiring out-of-state emissions allowances (trading credits) in lieu of adding pollution controls locally.

Maryland has also recently joined RGGI to combat state reliance on fossil fuels, as well as to reduce greenhouse gases (GHG). RGGI is a cap-and-trade program to control carbon dioxide emissions and is aimed primarily at reducing carbon dioxide pollution through a mandatory emissions cap on the electric generating sector, coupled with a market-based trading program (MD, 2007).

Because nuclear power plants do not produce significant GHG emissions, new nuclear plants provide the benefits of baseload power without the environmental costs of other fossil-fueled facilities. The addition of nuclear baseload power to Maryland's electricity supply supports state policy objectives and furthers state programs that aim to reduce GHG emissions.

8.4.3 Summary of Need for Power

In summary:

- The State of Maryland has a well-defined, systematic, and comprehensive resource monitoring, assessment, and reporting process that reviews the State's resources and growing demand for additional baseload capacity, eliminating the need for additional NRC review.
- The Maryland PSC has concluded that there is a need for new baseload capacity, and this conclusion has been given "great weight," herein as allowed for by the guidance in NUREG-1555 (NRC, 1999).
- The Maryland PSC/PPRP/CPCN process gives NRC assurance that construction would not proceed without the State's due consideration of the project's impact on supply adequacy and on the stability and reliability of the electric system in the state.
- The growing demand for new capacity shows benefits to be derived from CCNPP Unit 3.
- Given State concerns about climate change and carbon emissions, CCNPP Unit 3 serves another important need by reducing carbon emissions in Maryland. The new

plant will offset significant amounts of carbon, as compared to a coal-fired generating plant.

- Decreased reliance on fossil fuels.
- The potential to reduce the average cost of electricity to consumers by increasing availability of low cost power generation to in-state consumers through the competitive marketplace.
- Improved diversity of the sources of energy relied upon for baseload generation.

Section 9.2 discusses the viability of various baseload energy alternatives. Section 10.4 further reviews the costs and benefits of CCNPP Unit 3.

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