CHAPTER VIII

ALTERNATIVE POWER SUPPLY TECHNOLOGIES

Since the late 1970s, there has been considerable interest in alternative power generation technologies, particularly technologies utilizing renewable energy resources. These power plants are generally customer-owned rather than utility-owned and are typically much smaller than utility power plants. It is the purpose of this chapter to describe the development of alternative power supply sources in Maryland. Six different energy sources are included in this chapter: municipal solid waste (MSW), small-scale hydroelectricity, industrial cogeneration, solar energy, wind energy and wood energy. This is not an exhaustive list of alternative or renewable power sources. However, other sources, which are important elsewhere in the U.S. (such as geothermal), are not being developed in Maryland and are therefore not discussed in this chapter.

The emergence of alternative power during the past several years has been encouraged by several factors including:

- the sharp increases in the costs of constructing, financing and operating new, conventional power plants;

- an assortment of subsidies, tax credits and other incentives introduced by federal, state, and in some cases local governments;

- regulatory reform which has created a "guaranteed market" for alternative energy at relatively favorable prices; and

- research and technological improvements in alternative energy sources.

The regulatory changes and tax incentives were introduced in the late 1970s in response to concerns over this nation's dependence on an insecure supply of foreign oil. Alternative energy received further stimulus from the large increases in world oil prices in 1979-1980 coinciding with the Iranian Revolution.

Despite these important developments, the vast majority of electricity in this country is still produced in conventional, central station power plants owned and operated by electric utilities. With a few exceptions, particularly industrial cogeneration in certain parts of the country and geothermal in California, the contribution of alternative energy has been modest. Within the past two to three years, this development has been slowed by stabilizing and even falling world oil prices, the emergence of chronic excess capacity in the electric utility industry and the expiration of the renewable energy tax credits at the end of 1985. These recent events tend to make alternative energy development considerably less economically and financially attractive then it was perceived to be in the early 1980s.

This somewhat diminished attractiveness of alternative energy is symptomatic of the worldwide energy "glut." It is a buyer's market for energy. However, many experts believe this situation to be temporary and expect sharply rising fossil fuel prices, dependency on oil imports and tight supplies of electric power to again emerge -- perhaps by the early 1990s. If that happens, then alternative energy will once again become a focus of attention and public policy.

A. Policy Actions

Federal and Maryland Initiatives

Federal tax legislation was passed in 1978 (under the umbrella of the National Energy Act) which provided tax credits and other measures as incentives to encourage private, non-utility investments in conservation and renewable energy resources. Developers in such renewable power technologies as photovoltaics, wind energy and geothermal were eligible for a 40 percent federal tax credit on their investments and in some cases additional tax credits from state governments. With the exception of alcohol fuels, all federal tax credits expired December 31, 1985, and it does not appear likely that Congress will renew them in the near future. The House of Representatives

Maryland has followed the federal lead in encouraging alternative energy development. In 1981, the Maryland General Assembly (Ch. 497) established the Maryland Energy Financing Administration (MEFA). This agency was created to mitigate the problems of high initial costs and unavailability of conventional financing for conservation and renewable resource investments. MEFA is a self-supporting unit within the Department of Economic and Community Development (DECD), and is authorized to issue industrial revenue bonds to finance low-interest loans for conservation, solar energy, alcohol fuel production, geothermal, hydroelectricity, cogeneration, synthetic fuel from coal, municipal solid waste, wood and wind energy projects (1). MEFA has recently approved a multimillion dollar project in Southern Maryland to recycle used rubber tires and to produce No. 6 fuel oil and carbon black. At present, there is no scheduled date of construction, and several modifications to existing plans may occur before construction actually begins.

The Role of PURPA

In addition to tax incentives, important regulatory changes also helped facilitate the growth of non-utility power. The Public Utility Regulatory Policies Act (PURPA) of 1978 and subsequent federal regulations issued in 1979 by the Federal Energy Regulatory Commission (FERC) were designed to encourage the development of cogeneration and small power production in three principal ways. First, the local utility must interconnect with any "qualifying facility" (QF) and stand ready to buy all electricity the QF is willing to sell. Second, the QF is exempted from the Public Utility Holding Company Act, the Federal Power Act and all state laws which treat sellers of power as "public utilities." This exempts the QF from cost-of-service ratemaking, i.e., basing rates paid to a QF on the QF's costs of production. Third, the utility purchasing must pay the QF rates that are based upon that utility's "avoided cost" as based on FERC rules or some other negotiated price. This means that the "buy-back" rates (i.e., the rates the utility pays to the facility) must reflect estimates of the additional costs the utility would incur if it generated the power itself rather than purchased it from the QF. Avoided cost is thus very similar to the economist's notion of marginal cost of supplying electric power. But it specifically relates to the utility's marginal cost, not the QF's marginal cost.[1] Although there is widespread agreement concerning the appropriateness of basing rates on avoided cost, there is disagreement over how it should be quantified. Federal regulations leave state commissions with considerable discretion concerning interpretation and quantification of avoided cost.

The FERC rules give the states both the responsibility and authority to establish "standard tariffs" that for most states, at a minimum, apply to QFs with generating capacity of 100 kilowatts or less. Rates for QFs above the 100-kilowatt threshold are usually based on negotiated contracts rather than on a tariff. The State of Maryland has adopted the FERC definition and criteria for avoided costs, interconnection, and buy-back rates. Other states have made modifications or exemptions to the FERC rules.

The PSC has been negotiating with the utilities for the purposes of establishing buy-back rates that accurately reflect avoided cost. The standard tariffs currently in effect in Maryland are shown on Table VIII-1 for BG&E, PE, PEPCO, DP&L, Conowingo and SMECO. The customer charges shown on that table are the monthly fees the QF pays to the utility. The rates for BG&E vary according to time of day and season, from approximately 72 cents to 6 cents per kWh, and capacity credits are generally not available.[2] PE offers the lowest buy-back rates, averaging 1.57 cents per kWh. There are only a small number of facilities in Maryland selling power under these tariffs or under negotiated contracts.

The passage of PURPA and implementation of the FERC rules have not slipped by unchallenged. Legal challenges to PURPA have been mounted at both the federal and state levels. Two cases have been litigated in federal courts. In the first instance, the State of Mississippi challenged the constitutionality of PURPA. In the second case, the American Electric Power Company and a group of other utilities filed suit against several of the FERC rules promulgated under PURPA. In both cases, the courts upheld the constitutionality of PURPA and the legality of the FERC rules.

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[1]The term "marginal cost" in this context is defined as the costs incurred in supplying an additional increment of electric service.

[2]Capacity credits refer to payments that the utility makes to the QF to reflect the fact that QF power enables the utility to avoid or postpone power plant construction. PEPCO and BG&E will make capacity credits available to customers willing to make long-term commitments and meeting certain other conditions. Potomac Edison will pay a credit of 0.5 cents per kWh during "system emergencies."

Table VIII-1. Buy-Back Rates Currently in Effect in Maryland(a) (in cents per kWh)

	June 1 - Sept. 30	Oct. 1 - May 31
<u>BG&E(b)</u>		
On Peak (weekdays, 10 AM - 8 PM)	4.725	3.565
Intermediate (weekdays, 7-10 AM, 8-11 PM)	3.455	3.565
Off Peak (weekends, holidays and weekdays, 11 PM - 7 AM)	1.985	1.830
<u>PEPCO(b)</u>		
Customer charge of $11.00 per month		
On Peak (weekdays, noon - 8 PM)	5.894	4.501
Intermediate (weekdays, 8 AM - noon, 8 PM - midnight)	4.917	3.823
Off Peak (weekends, holidays and weekdays, midnight - 8 AM)	2.872	2.376
<u>DPL</u>		
Customer charge of $3.02 per month(d)		
On Peak (weekdays, 8 AM - 9 PM)(e)	4.05	3.59
Off Peak (all other hours)	2.37	2.46
<u>Potomac Edison</u>		
On Peak (7 AM - 10 PM)	1.760	1.760
Off Peak (10 PM - 7 AM)	1.265	1.265
No Time of Day Metering	1.570	1.570

A 0.5¢/kWh capacity credit is available during system emergencies.

<u>Conowingo</u>

Energy payments shall be based on Conowingo's cost of purchased power from Philadelphia Electric and Susquehanna Electric. In 1984 those costs averaged 5.95¢/kWh and averaged 6.46¢/kWh in the first half of 1985.

<u>SMECO</u>

	June 1 - Sept. 30	Oct. 1 - May 31
	0.9654	0.6655

Above charge includes a monthly fuel factor from PEPCO which was 2.23¢/kWh in mid-1985.

(a) Sources: Standard cogeneration/small power producer tariffs on file with the Maryland Commission.

(b) Capacity credits are available for customers willing to enter into long-term power supply commitments.

Although there has been no successful litigation overriding PURPA or any of the FERC rules, various states have passed statutes referred to as "mini PURPAs" in an attempt to encourage cogeneration against possible successful challenges to PURPA in federal court. These mini PURPAs were designed to parallel the federal requirements of PURPA, and consequently, there have been several legal actions questioning the interpretation of these state laws (2). None of these state legal actions pose a challenge to federal laws or regulations, and none has occurred in Maryland.

Utility attitudes toward non-utility power sources and the FERC rules which require utilities to purchase that power are mixed. This new power source is useful to the utility in helping it to meet its power demands and potentially deferring construction of new plant. On the other hand, customer-owned power is in a sense a form of competition. Moreover, utilities may perceive a burden in the interpretation of and compliance with the complex set of rules, particularly those involving avoided cost and interconnection. Under these rules, the utility must purchase the power even if the utility already possesses excess capacity, and the purchase costs are then passed on to the ratepayers. There is also the concern that the FERC rules tend to skew the benefits disproportionately to the QF developers rather than to ratepayers and utility shareowners (3).

B. Alternative Energy Development -- U.S. and Maryland Compared

This section attempts to put the Maryland alternative energy development in perspective by comparing it to that occurring nationally. Unfortunately, such a comparison is difficult to perform quantitatively due to the lack of a good national data base on alternative energy. Thus, many of the observations in this section are qualitative and impressionistic. On the basis of the limited data that are available, it appears that Maryland has been less active in developing alternative energy power sources than the nation as a whole.

There is rather clear regional character to alternative energy development. New England, with its many streams and rivers (and high avoided costs), has been an active area of small-scale hydroelectric development. Electricity from geothermal energy has largely been confined to California and a few other sites in the far West. Very little electric energy has actually been produced from photovoltaics and solar energy. However, the most active areas of research and development have been in the sun-belt region, particularly the Southwest. Industrial cogeneration projects have been undertaken in virtually every major region of the U.S. However, regions that have large concentrations of certain industry have seen the largest amount of activity. Normally, these would be industries with extremely large electricity loads or large steam requirements such as paper, oil refining and chemicals. For this reason, the Gulf Coast region and California have experienced a disproportionate amount of the cogeneration activity.

Alternative, non-utility power sources operating in Maryland (or expected on-line in the near future) are summarized on Table VIII-2.[1] Generating capacity is estimated to be approximately 162 megawatts, which compares with an estimated 1984 peak demand in the State of over 8,000 megawatts. However, nearly two-thirds of that 162 megawatts is derived from two facilities, a 47-megawatt municipal solid waste facility near Baltimore and a 50-megawatt cogeneration unit operated by the Westvaco Corporation, a paper manufacturer in Western Maryland.

Table VIII-3 presents a rough comparison between alternative electric power capacity in the U.S. and Maryland. This is a very "rough" analysis because the U.S. figures are based upon applications for "qualifying facilities" status and notifications with FERC, not installed capacity. Since a potential developer is likely to obtain FERC certification at the initial planning stage, prior to construction, it is difficult to judge how accurately these figures reflect actual, installed capacity or capacity likely to be constructed in the near term. It is possible that many of these proposed facilities may never be built. To facilitate this comparison, the second column of the table includes alternative power capacity from the previous table, and the third column includes lists of QF applications filed with FERC, between January 1, 1980 and December 31, 1984, for facilities to be located in Maryland.

This table indicates that applications have been filed with FERC for more than 21,600 megawatts of capacity, the vast majority of that capacity (nearly 16,500 megawatts) classified as cogeneration. Maryland's 162 megawatts is only 0.7 percent of that total, or using the data on applications filed at FERC, only 0.4 percent of the U.S. total. By way of comparison, in 1983 Maryland accounted for 1.7 percent of total U.S. electricity consumption. It would therefore appear that Maryland has been lagging the rest of the U.S. in alternative electric power development.

The national outlook for alternative electric power sources is uncertain and depends upon numerous factors including future avoided costs, industrial mix, availability of tax credits and financing. The Energy Information Administration (EIA) estimates that these sources may possibly account for anywhere from 5 to 20 percent of U.S. electricity consumption by the year 2000 (9).

C. Energy Sources

Cogeneration

On a nationwide basis, industrial cogeneration has grown very rapidly during the past several years and is far and away the dominant form of non-utility power. Because of its efficiencies, proponents believe that there is potential to expand its usage even further.

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[1] This table excludes the power plant operated by Bethlehem Steel at its Sparrows Point facility because that plant is not considered to be a cogeneration facility.

Table VIII-2. Cogeneration and Renewable Resource Power Facilities in Maryland - by Utility Service Area(a)

	Capacity (Megawatts)
Baltimore Gas & Electric Company	
. Amstar (alternate-gas or oil)	12.5
. Alternate Energy Associates (Brighton Dam)	0.4
. American Hydro Power Company (Rocky Gorge) projected	0.125
. Elvin Sprouse (small hydro)	0.008
. Baltimore Refuse Energy Systems Company (municipal solid waste)	47.0
. Union (small-scale hydro)	0.6
. Gores Mill (small-scale hydro)	0.01
Delmarva Power & Light Company	
. Copley Photovoltaics	0.015
. Curtis Windmill (2 units)	0.008
. Parker Pond (small-scale hydro)	0.04
Potomac Electric Power Company	
. Gude Landfill (municipal solid waste)	3.0
. Lathrop Environmental (windmill)	0.02
. Oxon Cove Landfill (municipal solid waste)	0.2
. Prince George's County Detention Center - projected 1986 (methane gas)	1.7
Potomac Edison Company	
. Bloomington Lake Dam - projected	13.8
. Savage River Dam	2.0
. Self-Use Cogenerators(b)	
Avtex Fibers	24.0
Halltown Paperboard	3.0
Kelly Springfield	2.5
Mack Truck	0.24
Westvaco	50.0
Conowingo Power Company	
. Gilpin Falls (small-scale hydro)	0.4
. Wilson Mill Dam (small-scale hydro)	0.02
TOTAL	161.546

(a) Sources: (4,5,6,7,25). Projects listed exclude utility-owned facilities. The utility-owned facilities include 22.7 megawattts of small-scale hydro.

(b) These customers generate electricity principally for their own use. Avtex and Westvaco occasionally sell excess power to Potomac Edison.

Table VIII-3. Cogeneration and Small Power Production Capacity in the U.S. and Maryland - by Energy Source (Megawatts)

	U.S.(a)	Maryland PPSP Estimate(b)	Maryland From FERC Filings(c)
Cogeneration(d)	16,461.291	79.740	--
Hydro	1,054.072	17.363	20.721
Wind	924.781	.028	--
Biomass/Waste(e)	2,401.143	51.900	72.000
Geothermal	539.170	--	--
Solar	186.533	0.015	0.065
Other	80.800	12.5	--
TOTAL	21,647.790	161.546	92.786

(a) Ref. 8. Includes only owners or operators of facilities who claim qualifying status for PURPA benefits, and may include facilities currently in operation and facilities that may never be constructed.

(b) Derived from Table VIII-2.

(c) Based upon applications and notifications filed with the FERC between January 1, 1980 and December 31, 1984. Ref. 8.

(d) Includes cogeneration facilities using coal, natural gas, biomass, waste, fuel oil, nuclear and solar.

(e) Includes wood waste, municipal solid waste, biomethane.

The term cogeneration has been used by engineers to describe the dual production of electric and thermal energy, usually process steam. It may arise from a situation where the primary purpose of consuming energy is to produce electricity, and in the process, waste heat is also produced. The firm may then find a productive use for that waste heat by recapturing and using some thermal energy that is normally discharged. Alternatively, an industrial or commercial firm may use energy primarily to obtain process steam, and in doing so it finds it can also produce electricity relatively inexpensively. As a result of jointly producing both types of energy (e.g., steam and electricity), total energy requirements may be reduced by as much as 10 to 30 percent (2,10). Although there is potential for exploiting cogeneration from commercial and residential heating systems, the bulk of the cogeneration comes from industrial applications.

It is widely believed that cogeneration, particularly coal-fired steam, is capable of producing relatively inexpensive energy (10). The cost tends to be competitive with both the short-run marginal costs of existing electric systems and the long-run marginal (and average) cost of a new baseload coal facility.

Unfortunately, the contribution of cogenerators to electric service reliability is not well documented and therefore a matter of possible disagreement. There is no question that power supplied to the utility from a cogenerator will enable a utility to save on boiler fuel costs as the utility runs its own plants correspondingly less. The more controversial issue is whether cogeneration enables the utility to reduce or defer its power plant construction and thereby save on capital costs. The answer to this question depends upon several factors and circumstances. For example, most utilities are currently experiencing excess capacity. Therefore, the cogenerator will not save the utility (and its customers) any power plant capacity costs until the in-service date of the next unit, which in many cases may be five to ten years from now.

Utilities often find it difficult to integrate cogeneration with their capacity planning process. In most cases, cogeneration facilities are much smaller than generating units typically constructed by a utility. The cogeneration capacity, according to this view, is not useful in reducing capital costs unless it reaches a certain minimum size. That minimum size is the magnitude of one year of projected load growth so as to permit a one-year deferral in the construction of the utility's next power plant.

Another question raised in this regard is the reliability of the individual cogeneration units. Specifically, will the capacity be available to service the power grid when needed? Utilities normally schedule maintenance on their units in such a manner as to ensure that their units are available during times of system peak demand. Unless it is written into the power purchase contract, the utility cannot control the maintenance schedule of the cogeneration facility or the quality of the maintenance. Even if the utility has no concerns regarding the cogenerator's reliability in the near term, it may have concerns in the long term. The utility's time horizon is typically quite long, at least 15 to 20 years, and the utility often has little assurance that the cogeneration facility will be available and reliable over that time period.

Table VIII-2 lists the cogeneration projects located in Maryland, either currently operating or planned, and the installed capacity of each facility. There is a significant amount of cogeneration capacity in Western Maryland, but virtually all of it is consumed on site rather than being sold to Potomac Edison. There is no cogeneration in the PEPCO and Delmarva Maryland service areas. In the case of PEPCO, this is not surprising since the Company has virtually no industrial base. DP&L serves some industry in Maryland, but it is largely food processing or other light manufacturing rather than the heavy industry which typically invests in cogeneration. The relative lack of cogeneration in the Baltimore area, a region with considerable heavy industry, cannot be explained as easily.[1]

Municipal Solid Waste and Refuse Derived Fuel

The generation of electricity from municipal solid waste (MSW) performs two vital public services. First, it supplies electricity to the utility power grid using a boiler fuel that is, in essence, a renewable resource. Second, the generation of power from an MSW plant will reduce the need of a community to site and construct new landfill facilities. In Maryland, this activity has taken the form of using MSW, or its derivative, refuse derived fuel (RDF) in a utility boiler, as well as constructing non-utility power plants burning MSW.

Processing of MSW and production of RDF is taking place at the Maryland Environmental Service (MES)/Baltimore County Resource Recovery Facility on a commercial basis. There are several advantages to utilizing MSW as a fuel source for power production. It has been estimated that approximately 75 percent (net weight) of MSW consists of combustible material (11,12) with about 8 percent consisting of metal and 10 percent glass (11). RDF generally has a significantly lower sulfur content than coal[2] and can be co-fired with higher sulfur content coal in order to produce less sulfur dioxide than results from burning coal alone. Finally, production of RDF in conjunction with other recycling processes allows recovery of recyclable material such as metals and glass (13). Recycling can provide significant energy savings over producing these products from raw materials. The Maryland Environmental Service has estimated that about 3.5 million tons of MSW is produced annually in the State, with an energy content equivalent to approximately 1.3 million tons of coal (14).

BG&E has been co-firing fluff RDF at its C.P. Crane plant in a 192 MW cyclone furnace since February 1984. The RDF is burned in one of two identical furnaces with the RDF comprising 3 to 5 percent of the total heat input for the RDF test boiler (Crane Unit 2).[3] Favorable test results have prompted BG&E to

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[1]Bethlehem Steel operates 140 megawatts of generating capacity. Since its load frequently exceeds that capacity, it purchases the excess from BG&E.

[2]MSW sulfur content generally ranges from 0.1-0.2 percent by weight compared to 1.0-3.0 percent for most coals (24).

[3]In CEIR IV, Tables II-5 through II-8 provided specific information on recovered materials from burning MSW, the problems associates with co-firing RDF, and analyses of the physical properties of ash and trace elements of the RDF used in the 1980 BG&E Crane plant test burns.

negotiate a 10 year contract with MES to burn RDF in Crane Unit 2. The long-term effects of RDF on boiler operation will be assessed. It is estimated that over $100,000 in fuel costs will be saved annually by co-firing Crane Unit 2 with RDF.

The Northeast Maryland Waste Disposal Authority (NMWDA), in cooperation with the Baltimore City and State agencies and Signal Environmental Systems, Inc. has completed construction of the Baltimore Refuse Energy Systems Company (RESCO) waste-to-energy plant in Southwest Baltimore. The plant, which began commercial operations May 21, 1985, is designed to burn 2,250 tons of unsorted and unshredded residential and commercial refuse per day. Forty percent of the State's population resides in the plant's service area (Baltimore City and County and northern Anne Arundel County), and the plant is designed to process much of the "acceptable waste" generated by this population (estimated at over 1.3 million tons in 1985). Electricity (up to 50 MW) is sold to BG&E, and steam will be supplied to the downtown heating loop that serves some 500 customers (15). The Harford County Waste to Energy Facility is currently in the development stage. Commercial operation is anticipated to begin in late 1986 or early 1987. The facility will burn a maximum of 300 tons per day of MSW (annual average of 250 tons per day) to be supplied from Harford County's residential and light commercial wastes. Steam will be produced at the facility and sold to Aberdeen Proving Grounds (16). Montgomery County government officials are also currently investigating options for energy recovery from MSW.

The Maryland Environmental Service, in conjunction with the Maryland counties of Caroline, Dorchester, Queen Anne's and Talbot and the Delaware Solid Waste Authority have also been examining the feasibility of using MSW from this region of the Eastern Shore to produce steam and/or electricity (17). The first phase of the study addressed the technical, legal, and financial feasibility of the concept. It is estimated that this region of the Eastern Shore will produce approximately 260 tons of MSW per day in 1985, increasing to 298 tons per day in 2005. The study concluded that three potential projects are technically and economically feasible and that two of these are capable of near-term implementation (18).

Unlike industrial cogenerators, MSW plants are usually initiated by state or local governmental agencies. These agencies are usually able to finance these projects by issuing tax exempt municipal bonds, which enables them to obtain funds to finance the plant at a relatively low cost. The relatively favorable financing terms and the need to dispose of growing volumes of solid waste will continue to make this form of energy production attractive compared to other forms of renewable energy.

Solar Energy

Solar energy is for all practical purposes inexhaustible. The problem is one of developing technologies and practices to make cost-effective use of it. The most common applications of solar energy are home heating and domestic hot water, either through hot water systems or through building structure designs that make effective use of sunlight for heating purposes. In these applications solar energy displaces conventional energy sources, including electricity, and may properly be thought of as a form of conservation. A second type of solar energy application is photovoltaics, whereby sunlight is converted directly to electricity. In this form, solar energy can be viewed as a type of alternative power supply.

In heating applications, solar energy systems are generally classified as either passive or active. Passive systems use the structure and design of the building for solar energy collection and storage and would include such devices as shutters, certain types of windows, window shades and southern exposures. Strictly speaking, a passive system would not include the use of mechanical equipment. Active systems generally capture the solar energy in some sort of storage medium (usually water) and circulate it through the building's heating system. Because sunlight is not available at night and during periods of inclement weather, active solar systems are generally accompanied by back-up thermal systems.

The greatest area of activity for solar energy has been in the residential sector. Installations of solar systems grew extremely rapidly in the 1970s but leveled off in the early 1980s. EIA data for the U.S. indicate that installation of solar collectors has been declining over the past few years (19). With the expiration of federal solar tax credits at the end of 1985, the installation of solar units is likely to decline further.

EIA data also indicate that in 1983 70 percent of the new solar collectors were utilized in the residential sector. More than half of the new installations were domestic hot water systems and 29 percent were for swimming pool heating (19). Since approximately 80 percent of the collectors were delivered to residential customers in 1979, this indicates that commercial/industrial usage is gradually becoming relatively more important.

The costs and productivity of solar units vary widely and depend upon the geographic area, the type of solar system used, and the housing structure to which the system is affixed. Combined active space heating and hot water systems range in price from $10,000 to upwards of $20,000. Domestic hot water systems alone price between $3,000 and $6,000 in the northern climates, and $2,000 to $5,000 in the Sunbelt regions of the U.S. It is estimated that incorporating passive features for space heating and cooling will add between 5 and 10 percent to the cost of a new house. Adding a greenhouse or other passive system to an existing house will cost between $5,000 and $10,000. Passive water features retail for between $800 and $3,000. Do-it-yourself systems can be built for under $650 (28).

State and local governments in Maryland have taken a variety of measures to encourage solar energy. The Community Development Administration (CDA) administers a residential energy conservation program throughout Maryland. The purpose of the program is to provide low interest rate financing to all residential property owners investing in energy conservation and solar utilization improvements. The program began as a pilot program with $1million in funding. Maryland legislation specifies that solar units cannot be used as a basis for increasing property assessments and allows local municipalities to grant tax credits for solar equipment. Harford and Anne Arundel Counties have established such property tax credits for installed solar systems.

The discussion thus far has emphasized solar energy as a method of reducing the demand for electricity and other conventional energy forms. There is also commercial interest in photovoltaics, a solar technology that directly converts sunlight into electricity using semiconductor material (20). Copley Engineering, Inc. began generating a nominal 15.8 kW of electricity in December 1982 at its Denton, Maryland photovoltaic array facility. This power is currently being sold to DP&L. The facility operates completely automatically (21).

Currently, there is only a modest degree of utility involvement in solar energy. Each of the major utilities has conducted or funded research on small demonstration projects involving solar hot water applications. PE had announced plans to build a 30-kW photovoltaic solar collection system near its Hagerstown, Maryland corporate offices in 1985. This system was to be constructed for the purpose of identifying potential problems in generating large amounts of power with such equipment. PE has delayed and will redesign the project sometime in 1986 due to the fact that several other utilities, including Virginia Power, are currently constructing or planning to construct a similar system.

Wind Energy

To date, no large scale efforts have been undertaken in Maryland to generate electricity from wind machines. Part of the reason for this lack of development is that wind speeds in most areas of Maryland average only 8 to 10 mph, which is typical of much of the U.S. To effectively exploit wind energy would normally require average wind speeds of more than 12 mph, so that the turbines can operate efficiently.

Some areas of Western Maryland, however, may have a potential for use of wind energy because the high elevation/high relief in this area results in considerably higher average wind speeds than in other locations (22). Many of the sites that appear to have potential for wind energy are found at the highest levels of sharp ridge lines, and these sites will normally be accessible only to utilities or to very energy-intensive industrial establishments, due to the high cost of land acquisition and power line construction. Few Maryland homeowners are likely to find wind energy to be competitive with utility-supplied power (22).

A wind measurement program was conducted by PPSP at three locations in Western Maryland (Dan's Rock, Savage Mountain and the Garrett County Airport). Mean monthly wind velocities taken from August 1982 to January 1983 indicate that values greater than 12 mph exist at the 50-foot level at Dan's Rock and Garrett County Airport. The study, released in early 1984, suggests that: 1) wind power may be used for heating purposes in certain carefully chosen sites; 2) mean wind speeds are not high enough or persistent enough to justify the installation of megawatt size turbines or wind farms in the region; and 3) any assessment of wind power potential in Western Maryland must take into account the specific geographical location (23).

In late 1984, BG&E concluded a wind measurement study similar to the study described above which assessed the potential for generating commercial amounts of electricity in the Central Maryland region (24). Sites in Baltimore, Howard, Carroll, Harford and Anne Arundel counties were monitored and it was concluded that: 1) small wind energy generators are not economically feasible in the BG&E service area and will have a negligible impact on future BG&E load shapes; and 2) the costs of installing such systems far outweigh the dollar savings realized from the customers reduced bill.

Small-Scale Hydroelectricity

Small-scale hydroelectricity[1] is a much more established renewable energy source than wind energy or photovoltaics. Some development has already occurred in Maryland, and there appears to be a potential for significant expansion. PPSP has estimated that the total small-scale hydroelectric potential statewide, developed plus undeveloped, is 160,000 MWh per year, with a primary energy equivalence of about 1.6 trillion BTU per year (25). The 160,000 MWh is approximately 0.4 percent of total electricity consumption in Maryland in 1984.

Table VIII-4 lists current and potential small-scale hydroelectric capacity and annual energy in Maryland, by county. The table excludes Conowingo since it is not considered small-scale, but it includes the 20-megawatt Deep Creek Lake facility. As this table indicates, the vast majority of the State's existing and potential small-scale hydro is located in the Western Maryland counties. Very little of this resource is found in either Southern Maryland or the Eastern Shore.

Under the Federal Power Act, the FERC retains licensing jurisdiction for virtually all non-federal hydroelectric projects. Construction and operation of hydropower projects require either a license or license exemption from FERC. Normally, the first step in the licensing process is to obtain a preliminary permit which is routinely granted to the applicant for an 18-month to 3-year period. The permit allows the applicant the time to perform the necessary feasibility and environmental studies and during that time to maintain exclusive rights to the site. Upon completion of the studies, the permit holder may apply for a license or license exemption which will allow project construction and operation.

One of the disadvantages of small-scale hydro compared to conventional power plants (or even cogeneration) is the problem of reliability. Power output depends upon streamflow which can vary significantly from one year to

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[1]Under PURPA, a small-scale hydro facility is defined to be less than 30 megawatts of installed capacity.

Table VIII-4. Small-Scale Hydroelectricity in Maryland Installed Capacity and Annual Generation(a) (kW and MWh)

County	Developed(b)		Potential(c)		Total	
	Capacity	Generation	Capacity	Generation	Capacity	Generation
Garrett	20,000	29,000	15,885	64,842	35,885	93,842
Allegany	0	0	1,616	7,270	1,616	7,270
Washington	2,720	12,777	3,500	17,308	6,220	30,085
Frederick	0	0	744	3,517	744	3,517
Montgomery	480	2,685	130	577	610	3,262
Carroll	0	0	93	501	93	501
Baltimore	10	NA	3,569	14,351	3,579	14,351
Anne Arundel	0	0	79	450	79	450
Prince George's	0	0	125	1,090	125	1,090
Harford	23	NA	435	2,629	458	2,629
Cecil	396	2,700	0	0	396	2,700
Caroline	0	0	68	344	68	344
Wicomico	40	NA	36	149	76	149
Total	23,669	47,162	26,280	113,028	49,949	160,190

(a) Source: (25)

(b) Includes only those facilities generating as of January 1986.

(c) Generation estimates are not available for all potential facilities. Thus for some counties the indicated energy totals are biased downward by a small amount.

the next depending upon climatic conditions. Moreover, the low streamflow period is frequently during late summer, a time when most of Maryland's utilities experience their annual peak demands. Thus the extent to which small-scale hydro can reduce utility capacity needs is unclear. At a minimum, however, such facilities will enable utilities to reduce their consumption of boiler fuel. The amount of this reduction, however, is quite modest. Table VIII-5 shows that the energy available at potentially developable dams would displace only 2.8 percent of the oil or 0.7 percent of the coal consumed in Maryland power plants in 1983.

Table VIII-5. Percentage of Actual 1983 Fuel Usage at Power Plants Located in Maryland that Could Be Displaced by Generation at Small-Scale Hydro Plant

	Percent of 1983 Fuel Consumption Displaced(a)	
	Oil	Coal
Developed(b)	1.2%	0.3%
Potential(b)	2.8	0.7
Total	4.0%	1.0

(a) 1983 fuel usage from Ref.

(b) Energy values from Table VIII-4.

Twelve dams in Maryland currently produce or are licensed to produce hydroelectricity. These facilities have a combined capacity of 550 megawatts, which is approximately 6 percent of the total installed capacity in Maryland. However, approximately 90 percent of that total is accounted for by one facility, the Conowingo plant, which is owned and operated by a subsidiary of the Philadelphia Electric Company. Another utility-owned facility at Deep Creek Lake in Garrett County is operated by Pennsylvania Electric Company. In addition to this existing capacity, 36 dams in Maryland were identified as having potential for hydroelectric development, with a total capacity of 26.3 megawatts (25).

Wood Energy

In past years, the potential impact of wood energy on Maryland's power supply has not been addresse-d. While available data are limited, it can be estimated that Maryland has the potential of generating almost 11.5 trillion[1] BTUs of energy annually without any degradation to the State's forest resource. It is estimated that each year Maryland loggers leave 2 million tons of residues behind after harvesting (45 to 50 tons per acre). This forest by-product is usually piled and burned. Much of this residue could be used for residential, commercial and industrial energy generation. It is also estimated that about 9,000 tons of mill wood residues go unused each year in the State (27).

Under a subgrant from the U.S. Department of Energy (DOE), through the Coalition of Northeastern Governors, the MEA/Alternative Energy Sources Program (AESP) and the Forest, Park & Wildlife Resource utilization section have begun assessing the potential of industrial and commercial wood energy in Maryland. The Program further seeks to promote expanded use of wood energy by commercial and industrial firms in the State (26).

There are currently 12 companies in Maryland which supply all or part of their energy needs by burning wood. In-depth engineering studies are currently being performed on four other industrial firms and one federal government facility which have exhibited great potential for utilizing wood energy. Results of the studies are to be released in early 1986 (27).

The Proctor and Gamble production facility located near Baltimore has recently installed a 75 million BTU per hour wood fuel combustor system to provide 65 to 70 thousand pounds of process steam per hour (29). The State Department of General Services has recently approved the construction of a 1500 bed detention center on Maryland's Eastern Shore. Space heat and hot water will be supplied by two 25,000 pound per hour wood combustion boilers with two 2 MW turbine generators to cogenerate electricity for the facility. The center, the State's first complex to utilize wood energy, is due for completion in June.

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[1]This estimate was found by multiplying Maryland's annual residue (2 million tons) by the "standard heating value" of 5.738 x 106 (BTUs per ton). The standard heating value is based upon the use of green wood and the use of conventional wood combustion technologies.

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APPENDIX A

ECONOMIC AND DEMOGRAPHIC GROWTH IN MARYLAND

Long-range load forecasts play a central role in the planning of new power generation facilities. (See Chapter II.) For this reason, the Power Plant Siting Program (PPSP), in conjunction with the Maryland Department of State Planning (DSP), has conducted a program of independent load forecasts since the mid-1970s. Reliable load forecasts will help to ensure that future power supplies are adequate while mitigating excess capacity.

The PPSP/DSP forecasts, as well as those prepared by the Maryland utilities, are based upon sets of econometric models of the demand for electricity. These models (described in the 1982 CEIR) quantify the effects of various economic, demographic and other factors upon the demand for electricity. In order to forecast future power demands with these models, it is necessary to formulate assumptions concerning the future values of those explanatory variables. Two of the most important of these variables are employment and population. For local areas, such as utility service territories, employment is probably the best available measure of the level (and structure) of economic activity. Population is a measure which can be used to track changes in the number of residential electric customers.

DSP periodically prepares and publishes long-range projections of employment and population for all Maryland counties (and Baltimore City), and these projections have been incorporated into the PPSP/DSP forecasts of power demands. This appendix examines the economic/demographic historical trends in the State and DSP's outlook through the year 2000.[1] To put these historical trends and projections in perspective, Maryland data are compared to the performance and projected outlook for the U.S.

It is important to understand that the Maryland utilities plan all generating capacity additions on the basis of total system load growth, including their non-Maryland portions. Three of the four major electric utilities in the State have substantial amounts of non-Maryland service area. However, the State's largest electric utility, BG&E, is entirely within Maryland, and slightly more than half of PEPCo, the second largest electric utility, is in Maryland. Only approximately 20 percent of APS and 25 percent of DP&L are in Maryland. Thus projections of economic/demographic trends in Maryland are only part of the information needed for all but BG&E.

DSP develops its projections of Maryland employment and demographic variables at the county level. This is particularly useful for utility planners because investments in distribution plant (such as substations) and certain kinds of transmission capacity are based upon small area growth prospects.

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[1]Appendix A of the previous edition of the CEIR includes a brief overview of the methods and models employed by DSP to forecast employment and population (Ref. 1).

Maryland's economy and population have increased moderately but steadily over the past decade and a half reflecting the trends for the U.S. A major exception has been manufacturing, which has declined sharply since the early 1970s. Employment growth was interrupted during the sharp economic downturn of 1981-1982 but has resumed since then. These trends, however, have not been uniform throughout the State. Some regions within Maryland have expanded rapidly in recent years, while others have expanded only very slowly or even stagnated.

The sections which follow examine the aggregate historic and projected trends for the State and breaks down those trends to the principal regions within the State. For perspective, Maryland growth patterns are compared to those of the U.S. This appendix identifies five distinct regions within Maryland, as indicated on Table A-1, rather than the seven regions employed by DSP. Whereas DSP lists Frederick County as a separate region, it is included in our definition of Western Maryland. In addition, a single Eastern Shore region is utilized in this appendix instead of the "Upper" and "Lower" Eastern Region regions utilized by DSP. These changes have been made for simplicity and to make the regional definitions conform more closely with electric utility service territories.

A. Employment Trends

The trend in total civilian employment for Maryland and the U.S. is shown on Table A-2 for the time period 1967 to 1985. Over this 18-year period, Maryland has slightly outpaced the U.S., with annual growth of 2.1 percent compared to a U.S. average rate of 2.0 percent. However, these statistics are somewhat misleading. As the right hand column on Table A-2 indicates, Maryland's share of national employment declined from 2.06 percent in 1970 to 1.96 percent in 1983. However, between 1983 and mid-1985 Maryland experienced employment growth of 10.3 percent compared to a 6.1 percent increase nationwide.[1] As of mid-1985, the State's unemployment rate stood at 4.4 percent which is far stronger than the national average of 7.2 percent. Thus, over most of the historical period Maryland's employment growth has lagged the nation, and only in recent years has it outpaced the rest of the U.S.

The breakdown of total employment into major sectors is shown on Table A-3 for 1970 and 1983, the latter being the most recent year such data are available on a consistent basis. Employment structure in 1983 is fairly similar for the U.S. and Maryland except that Maryland has somewhat more government and less manufacturing than the rest of the nation. The most dramatic change on the table is the precipitous decline in manufacturing's share in Maryland from 17.7 to 10.5 percent of total employment. This was principally offset by gains in the service sector (in 1983 the largest sector), from 19.2 percent in 1970 to 25.7 percent in 1983. The decline in manufacturing has been a nationwide trend falling from 24.5 percent in 1970 to 18.1 percent in 1983.

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[1]The reader is cautioned that this finding is based on preliminary data for May 1985.

Table A-1. Principal Regions in Maryland

Region	Counties	Electric Utility
(1) Baltimore	Baltimore City Baltimore County Anne Arundel Harford Howard Carroll	BG&E
(2) Washington Suburban	Montgomery Prince George's	PEPCo
(3) Eastern Shore	Cecil[(a)] Caroline Kent Queen Anne's Talbot Dorchester Somerset Wicomico Worcester	DP&L (and Choptank)
(4) Southern Maryland	Calvert Charles St. Mary's	SMECo (and PEPCo)
(5) Western Maryland	Allegheny Frederick Garrett Washington	PE

[(a)] Most of Cecil County is served at retail by Conowingo Power Company.

Table A-2. Total Employment in the U.S. and Maryland 1967-1985[a] (Thousands)

Year	Maryland	U.S.	Maryland as a % of U.S.
1967	1,501.6	74,372	2.02%
1970	1,623.8	78,678	2.06
1975	1,745.0	85,846	2.03
1976	1,762.7	88,752	1.99
1977	1,816.8	92,017	1.97
1978	1,911.0	96,048	1.99
1979	1,966.8	98,824	1.99
1980	1,975.0	99,303	1.99
1981	1,986.0	100,397	1.98
1982	1,959.6	99,526	1.97
1983	1,974.6	100,834	1.96
1984	2,080.8[c]	105,005	1.98
1985[b]	2,178.5[c]	106,960	2.04
	Annual Rates of Growth		
1967-1985	2.1%	2.0%	-
1975-1985	2.2	2.2	-
1980-1985	2.0	1.5	-

(a) Data from Ref. 2 and 3.

(b) Data are for the month of May 1985, (Ref. 4).

(c) Estimates based upon May figures published in Employment and Earnings (July 1985).

Table A-3. Employment Structure in Maryland and the United States, 1970 and 1983[a]

Sector	Maryland		United States	
	1970	1983	1970	1983
Agriculture	2.6%	2.4%	5.8%	4.5%
Mining	0.1	0.1	0.8	0.9
Construction	6.6	6.1	5.2	4.9
Manufacturing	17.7	10.5	24.5	18.1
Transportation, Communications & Utilities	5.6	4.8	5.5	5.1
Trade	21.5	23.4	19.9	22.0
FIRE[b]	4.9	5.7	4.6	5.9
Services	19.2	25.7	18.6	23.2
Civilian Government	21.8	21.3	15.1	15.4
TOTAL	100.0%	100.0%	100.0%	100.0%

(a) Data from Ref. 4 and 5.

(b) Finance, insurance and real estate.

With the decline of manufacturing, Maryland's economy is now dominated by its commercial sector. Based on 1983 data, trade, services and government account for over 70 percent of total civilian employment. The comparable figure for the U.S. is 60.6percent.

A further understanding of economic trends in Maryland can be obtained from an examination of regional trends. Table A-4 presents manufacturing, nonmanufacturing and total employment for each of the five regions for 1970 and 1982. Manufacturing employment is listed on this table because it tends to be the most unstable sector and the one which has changed the most over time. The right hand column lists the annual average rate of growth for all of these employment measures over this period.

The most rapidly growing region has been Suburban Washington (Montgomery and Prince George's counties) which now account for nearly 30 percent of total State employment. One of the reasons this region has been able to grow as rapidly as it has is its lack of a manufacturing base. In contrast, the Baltimore region lost over 50,000 manufacturing jobs during this period, or an annual decline of 2.6 percent. However, that region's nonmanufacturing sector grew at a healthy 1.8 percent annual rate, outpacing every other region in the State except the Washington Suburban. Western Maryland and the Eastern Shore, with their substantial manufacturing sectors and lack of substantial commercial centers, were the slowest growing regions in Maryland. Despite the decline in manufacturing, however, all regions in Maryland have exhibited at least modest employment growth since 1970.

The outlook for growth in total employment in Maryland (by region) and the U.S. is shown on Table A-5. The Maryland projections on that table were prepared by DSP, while the U.S. projections were prepared by BEA. Both projections indicate relatively slow growth -- 1.0 percent per year for Maryland and 1.4 percent per year for the U.S.

Over the next 15 years, DSP projects that the Maryland economy will create approximately 319,000 additional jobs, or a 15.6 percent increase. The breakdown of these new jobs into major sectors is shown on the bottom panel ofTable A-5. As this table indicates, employment gains are expected in almost every major sector. However, nearly 65 percent of the additional jobs are projected to emerge in two sectors -- trade and services. Manufacturing, historically a declining sector, is expected to remain roughly stable, contributing about 17,000 additional jobs. This is not enough of a gain, however, to prevent manufacturing from declining as a percentage of total employment.

B. Population and Household Trends

On a year-to-year basis, population tends to be far more stable than employment. However, over longer periods of time, significant changes do occur in both the total amount and composition of population within a region. Moreover, for small geographic areas (e.g., counties) large and important changes can occur even within the period of a few years.

Table A-4. Employment and Employment Shares by Region[a]

Region	1970 Number	1970 % of Region	1982 Number	1982 % of Region	Annual Rate of Growth in Number Employed 1970-1982
Baltimore					
Total	951.4	-	1,077.1	-	1.0%
Manufacturing	197.1	20.7%	144.1	13.4%	-2.6
Nonmanufacturing	754.3	79.3	933.0	86.6	1.8
Washington Suburban					
Total	401.7	-	575.6	-	3.0
Manufacturing	16.2	4.0	24.5	4.3	3.5
Nonmanufacturing	385.5	96.0	551.1	95.7	3.0
Western Maryland					
Total	115.8	-	130.9	-	1.0
Manufacturing	31.9	27.6	24.8	19.0	-2.1
Nonmanufacturing	83.9	72.4	106.1	81.0	2.0
Southern Maryland					
Total	39.6	-	48.1	-	1.6
Manufacturing	1.1	2.8	0.9	1.9	-1.7
Nonmanufacturing	38.5	97.2	47.3	98.1	1.7
Eastern Shore					
Total	115.3	-	125.0	-	0.8
Manufacturing	27.0	23.4	24.1	19.2	-0.8
Nonmanufacturing	88.5	76.6	100.7	80.8	1.3
Maryland					
Total	1,623.8	-	1,956.9	-	1.6
Manufacturing	273.3	16.8	218.5	11.2	-1.8
Nonmanufacturing	1,350.5	83.2	1,738.4	88.8	2.1

(a) Data from Ref. 1 and 6.

Table A-5. Employment Projections for Maryland and the U.S. (Thousands)

Region	1985	1990	2000	Rate of Growth 1985-2000
Baltimore	1,111	1,164	1,245	0.8%
Washington Suburban	644	692	780	1.3
Southern Maryland	50	55	62	1.4
Western Maryland	132	143	151	0.9
Eastern Shore	132	143	153	1.0
Total State	2,068	2,196	2,391	1.0
United States	112,600	120,378	135,645	1.4

Employment Gain in Maryland (1985-2000)

Sector	Jobs (in Thousands)	
Construction	14	4.4%
Manufacturing	17	5.3
Transport, etc.	22	6.9
Trade	88	27.6
FIRE	21	6.6
Services	112	35.1
Other	49	14.1
Total State	319	100.0%

(a) Data from Ref. 6.

(a) Excluding military employment.

Table A-6 presents total population for Maryland and the U.S. since 1960. Over the entire period 1960-1984, population in Maryland increased at a slightly more rapid rate than for the nation as a whole, 1.4 percent versus a 1.1 percent annual rate for the U.S. However, Maryland's more rapid growth was entirely confined to the 1960s. Since 1970, Maryland's population growth has slowed to 0.7 percent per year compared to a 1.0 percent U.S. annual growth rate.

Table A-6. Maryland and United States Population, 1960-1984(a) (Thousands)

Year	Maryland	U.S.	Maryland as a % of U.S.
1960	3,113	180,671	1.72%
1970	3,924	205,052	1.91
1980	4,217	227,738	1.85
1981	4,258	230,019	1.85
1982	4,270	232,309	1.84
1983	4,304	234,496	1.84
1984	4,349	236,634	1.84
	Annual Rates of Growth		
1960-1984	1.4%	1.1%	-
1970-1984	0.7	1.0	-
1980-1984	0.8	1.0	-

(a) Data from Ref. 2 and 6.

Historic population growth in Maryland is presented by region on Table A-7. The State's population is primarily concentrated into two regions, the Baltimore and Washington Suburban regions, which together in 1984 accounted for approximately 81 percent of the total. The rates of population growth among the various regions in the State have been fairly similar with one exception. Growth in the Southern Maryland region has been 3.4 percent per year compared to a Statewide average of 0.7 percent per year. However, even with this very rapid growth that region accounts for less than 5 percent of the State's population.

Table A-7. Population in Maryland
By Region, 1970-1984[a]
(Thousands)

Year	Baltimore	Washington Suburban	Southern Maryland	Western Maryland	Eastern Shore
1970	2,071	1,185	116	294	258
1980	2,174	1,244	167	335	297
1981	2,189	1,260	172	337	299
1982	2,194	1,263	175	337	301
1983	2,205	1,278	179	338	304
1984	2,217	1,300	185	340	308
% of Total MD -- 1984	51.0%	29.9%	4.3%	7.8%	7.1%
		Annual Rates of Growth			
1970-1984	0.5%	0.7%	3.4%	1.0%	1.3%
1980-1984	0.5	1.1	2.6	0.4	0.9

(a) Data from Ref. 6.

The regional aggregations can sometimes mask important demographic trends which occur at the county level. The most important example of this may be found in the Baltimore region. The annual rates of growth of total population for the City and five surrounding counties for the period 1970-1984 are as follows:

Baltimore City	-1.3%
Anne Arundel	2.0
Baltimore County	0.6
Carroll County	3.1
Harford County	2.0
Howard County	5.8
Region	0.5%

The newer, suburban counties have been increasing at a rate of 2 to 5.8 percent per year compared to the considerably slower 0.6 percent per year rate for Baltimore County and the 1.3 percent per year decline for Baltimore City. The overall regional growth rate of only 0.5 percent per year reflects the fact that Baltimore City and County contain the majority of the region's population. A similar situation arises in the Washington Suburban region. Montgomery County's population has been growing by 1.3 percent per year compared to almost no growth over the last decade and a half in Prince George's County. The two counties are roughly equal in size.

Table A-8 presents DSP's population projections for the State and the five regions through the year 2000. That table also includes the Bureau of Economic Analysis' (BEA) latest projection of U.S. population for purposes of comparison. DSP expects Maryland's population growth rate to approximate the actual rate of growth over the historical period 1970-1984. It holds the same basic outlook for each of the five regions except for Southern Maryland which it expects to slow somewhat from its very rapid growth rate over the last 15 years. BEA projects a nationwide population growth rate of 0.8 percent per year, nearly identical to DSP's 0.7 percent annual rate of growth.

Table A-8. Projections of Total Population for Maryland Regions and the U.S., 1984-2000[a] (Thousands)

Region	1984	1990	1995	2000	Rate of Growth 1984-2000 (%)
Baltimore	2,217	2,288	2,341	2,398	0.5%
Washington Suburban	1,300	1,365	1,421	1,482	0.8
Southern Maryland	185	212	234	253	2.0
Western Maryland	340	365	379	390	0.9
Eastern Shore	308	328	340	351	0.8
Total State	4,349	4,557	4,715	4,874	0.7
United States[b]	236,634	249,203	259,085	267,464	0.8

(a) Data from Ref. 6.

(b) Projections for U.S. are from BEA. (Ref. 5.) All others are DSP.

The projected pace of growth within regions, however, is not uniform. Baltimore City's population decline is expected to continue though at a diminishing rate. Over the 1984 to 2000 period, the City is projected to experience a population decline of about 30,000 compared to a loss of nearly 150,000 during the 1970-1984 period. The majority (nearly three-fourths) of the population growth in Western Maryland is expected to occur in one county, Frederick County.

In addition to population, DSP projects the number of households. This variable is particularly important to utility planners since the number of residential customers is likely to be very closely related to the number of households.[1] Those projections along with historic data are presented on Table A-9. The top portion of the table presents the number of households (by region) for 1970, 1985, 1990 and 2000, and the bottom portion of the table indicates the corresponding average household size.

Table A-9 reveals several interesting patterns. In every region the number of households is expected to increase more rapidly than population which simply reflects a declining average size of household. This is a very long-term trend that was rather clearly present during the 1970-1985 period. In each region DSP projects household rate of growth to exceed that of population by about 0.3 to 0.5 percentage points. The tendency toward smaller household size may be due to a variety of factors including the overall aging of the population, more single-parent households, the decision on the part of parents to have fewer children, and so forth. It also should be noted, however, that this phenomena is gradually becoming less important. For example, during the 15-year period 1970 to 1985, average household size in Maryland declined from 3.25 to 2.70, or an annual rate of decline of 1.3 percent. Over the next 15 years, DSP expects average households to decline in size from 2.70 to 2.50, or an annual rate of decline of only 0.5 percent. There also appears to be a fairly uniform average household size behavior across regions in Maryland. In the year 2000, DSP projects average household size in four of the five regions to range from 2.46 to 2.58 persons. Southern Maryland is the exception with a projected average household size of 2.76 persons.

C. Population and Employment Interactions

Population and employment interact in a complex manner. Increases in population tend to increase labor supply, and thus ultimately total employment as businesses make use of the increased pool of labor. Moreover, population increases tend to increase the demand for goods and services. Since some of these goods and services may be locally produced, that will also increase employment. Alternatively, increased employment opportunities in the State (for example, from new investment) tend to attract an in-migration of job seekers. These job seekers and their families add to the State's population.

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[1]A factor that often obscures this relationship, particularly in highly urbanized areas, is the master metered apartments. These facilities are generally classified as commercial even though the end-use is entirely residential.

Table A-9. Historic and Projected Number of Households and Average Size of Households in Maryland By Region, 1970-2000[a] (Thousands and Percentages)

Region	1970	1985	1990	2000	Annual Rate of Growth 1970-1985	Annual Rate of Growth 1985-2000
Baltimore	624	807	859	932	1.7%	1.0%
Washington Suburban	350	473	520	593	2.0	1.5
Southern Maryland	30	60	72	91	4.7	2.8
Western Maryland	92	126	135	149	2.1	1.1
Eastern Shore	80	115	125	139	2.4	1.3
Total State	1,175	1,580	1,710	1,904	2.0%	1.3%
Average Household Size						
Baltimore	3.22%	2.69%	2.60%	2.51%	-1.2%	-0.5%
Washington Suburban	3.32	2.70	2.58	2.46	-1.4	-0.6
Southern Maryland	3.77	3.07	2.92	2.76	-1.4	-0.7
Western Maryland	3.16	2.74	2.67	2.58	-0.9	-0.4
Eastern Shore	3.12	2.64	2.55	2.49	-1.1	-0.4
Total State	3.25%	2.70%	2.60%	2.50%	-1.2%	-0.5%

(a) Data from Ref. 6.

For these reasons, we would expect to find a direct relationship between population and employment, and in general that is the case. However, there are some important differences over time and geographic areas which require explanation. The most prominent change is the tendency over time for employment to grow more rapidly than population. This has been due primarily to two factors. The first is the fact that a larger percentage of the population is of working age (i.e., 16-64) than in the past; and second, there has been an increased tendency for women to enter the work force. Nationwide, the "working age" percentage increased from 60.0 percent in 1970 to 64.8 percent in 1983. In 1970, women accounted for 37.7 percent of total civilian employment in the U.S. compared to 43.7 percent in 1984. Over this 14-year period, female civilian employment in the U.S. has increased by 3.2 percent per year.

Table A-10 summarizes historic employment/population trends and projections for the U.S., Maryland and regions within Maryland, with the Maryland projections prepared by DSP and the U.S. projections prepared by BEA. For the U.S., BEA projects that 50.7 percent of the population will be employed in the year 2000 compared to 38.4 percent in 1970. That is an increase of 32 percent.

Table A-10. Historic and Projected Employment/Population Ratios for the U.S. and Maryland, 1970-2000[a]
(Percentages)

Region	1970	1980	1990	2000
Baltimore	43.7%	49.0%	50.1%	51.1%
Washington Suburban	32.3	44.5	48.8	50.7
Southern Maryland	27.7	25.6	24.2	21.4
Western Maryland	38.2	39.7	40.2	39.4
Eastern Shore	42.3	42.5	43.2	42.3
Total State	39.3	45.5	46.8	46.3
United States	38.4	43.6	48.3	50.7

(a) Data from Ref. 3, 5 and 6. Excludes military employment.

(b) Projections prepared by BEA.

The State of Maryland and most of the regions in the State also show a clear trend toward a higher employment/population ratio although somewhat less pronounced than for the U.S. The State's ratio in the year 2000 exceeds its 1970 ratio by only 17.8 percent. Moreover, the ratio appears to peak near the year 1990. After that year, DSP projects employment and population to increase at approximately the same rate, and thus the ratio after 1990 remains approximately stable and even declines slightly.

This same basic pattern is exhibited by all regions in the State except Southern Maryland. That region displays a noticeable downward trend on both an historic and projected basis. From a purely mechanical standpoint, this is because the region's population has been growing and is expected to continue to grow rapidly, while employment has been increasing much more gradually. This reflects the fact that the Southern Maryland counties (and Charles County in particular) have been undergoing rapid suburbanization with the region's residents commuting to employment centers in the Washington and Baltimore areas. This pattern of development makes Southern Maryland an exception to the Statewide trend.

D. Personal Income Growth

Personal income is an economic measure which utility forecasters track carefully because it is believed to play an important role in determining the demand for electricity. Increases in personal income induce consumers to purchase more electricity-using appliances and to utilize their existing stock of appliances more intensively. Moreover, consumers tend to spend at least a portion of their incomes on locally produced goods and services which stimulates greater nonresidential electricity demand.

On a per capita and inflation adjusted basis, growth in personal income in Maryland has managed to slightly outpace that of the U.S. as a whole. Over the period 1969-1983, real per capita income in the State increased by 2.1 percent per year compared to a nationwide 1.9 percent per year. In 1983, per capita income in Maryland was $6,116 compared to the U.S. average of $5,470 (1972 dollars).

At the present time, DSP does no public projections of personal income. However, BEA does publish such projections for the U.S. and all 50 states, including Maryland. Over the period 1983-2000, BEA projects an increase in per capita income for the U.S. of 1.8 percent per year, a rate of growth virtually identical to that which occurred from 1969 to 1983. Per capita income for Maryland is projected by BEA to increase by 1.7 percent per year. Whereas Maryland had previously slightly outperformed the U.S., BEA expects Maryland to slightly underperform the U.S. in the future.

APPENDIX A - REFERENCES

(1) Power Plant Cumulative Environmental Impact Report. Maryland Power Plant Siting Program, Annapolis, Maryland, PPSP-CEIR-4, February 1984.

(2) Economic Report of the President. Council of Economic Advisory February 1985.

(3) Employment in Maryland. Maryland Department of State Planning, July 1982.

(4) Employment and Earnings. U.S. Department of Labor, July 1985.

(5) 1985 OBERS BEA Regional Projections. Volume 1. U.S. Department of Commerce, 1985.

(6) Unpublished DSP data, November, 1985.

APPENDIX B

A. Introduction

The following is an abstract of the Public Service Commission 1985 Ten-Year Plan (1985-1994) of electric utilities operating in Maryland. The entire Report consists of three parts:

Part I, Maryland's Electric Needs and Utility Generation Planning, presents projections of the electric power needs in Maryland to 1999 (which includes an additional 5-year horizon) and the utilities' plans to meet those needs through new power generating stations and other means. The primary thrust of Part I concerns the four major electric utilities operating in Maryland, namely, Baltimore Gas and Electric, Delmarva Power and Light, Potomac Edison and Potomac Electric Power Company. Possible and proposed generating sites within Maryland, including associated transmission lines, are listed.

Part II, Energy Conservation and Alternative Energy Sources, presents information on both current and planned efforts by Maryland electric utilities regarding energy conservation programs and the development of alternative energy sources. Part II focuses on present and future efforts to moderate the peak demand for electricity in Maryland.

Part III, Summary of Recommendations, summarized the recommendations made in Parts I and II of the Report and highlights suggestions for future Ten Year Reports.

This abstract includes portions of Part I, Utility Generation Planning in order to compare utility forecasts to those of PPSP presented in the body of the text. The abstract also includes Part III, Summary of Recommendations.

B. 1985 Fifteen-Year Generation Plants of Each Utility

1. Baltimore Gas and Electric

Peak Load and Energy Forecast Methodolgy

BG&E's methodology for forecasting peak loads and energy sales, as stated in its filing, is as follows:

> Forecasting activities at the Baltimore Gas and Electric Company (BG&E) are detailed and subject to continuous study and review. Methodology improvements are largely evolutionary. Extensive judgement is utilized, along with historical load analysis and mathematical sales and load modeling (econometric, engineering end-use, load shape, etc.). However, the application of each of these techniques is directly related to the availability of specific tools and the appropriate data. In most cases, data availability is as important as methodology development. Where it is possible, historical structural relationships (economical or physical) are determined and models are developed, which are used to test scenarios and assumptions and to reinforce experienced judgements. Results from models are useful and provide additional

information for analysis, but in the final forecast development, individual judgement prevails. For whatever value it may serve, at the desired time, pertinent modeling information can be made available for discussion and review.

Extensive disaggregation of data into like categories in relation to rate groups, weather sensitivity, industrial activity or energy end-use supports a more complete analysis of history and enables us to improve our understanding of customer use. Current information on areas of new customer growth as well as periodic load research studies, appliance surveys, and conservation surveys provide essential forecasting support. Conservation and load management impacts are reflected in both the sales and peak forecasts. The estimates are based on empirical analyses of efficiency improvements in appliances and equipment and of price and income effects on usage.

As stated above, the impacts of load management programs have been incorporated into the Company forecasts. Peak load impacts of curtailable and interruptible loads are expected to grow from 23 MW in 1985 to 51 MW in 1999, according to Company estimates.

Peak Load Projections

BG&E is presently a summer peaking utility. However, it expects to become a winter peaking system by 1994, with its 1994/95 winter peak exceeding the previous summer's estimated peak.

Actual and projected BG&E summer and winter peak loads are listed on Attachment 1 for the period 1980-2000. Average compound growth rates in peak load (summer) for 1985-2000 are estimated to be 1.6% per year, only slightly over half of the actual growth in load over the 1974-1985 decade. Both the actual and estimated winter peak load growth rates are significantly higher than their corresponding summer peak growth rates.

It should be noted that BG&E issues two kinds of peak load forecasts. One set of estimates, known as Group Load, is furnished to the PJM Interconnection and is a basis for the allocation of PJM forecast capacity obligations. BG&E files with the Public Service Commission, in its Annual Ten-Year Plans, a second set of projections known as Contract Load, which includes only BG&E firm sales to the Bethlehem Steel Plant and The Maryland component of the Con Rail Corporation. Group Load includes the total load of the Bethlehem Steel Company plant, some of which has been provided by customer-owned generation. Contract Load figures are used in this Report.

Comments

BG&E, with its 620 MW Brandon Shores Unit 2 already certificated by the Public Service Commission and one-third complete, appears to have considerable flexibility to either accelerate or further delay the on-line date of this unit, should expected peak loads deviate from their current estimates. As stated above, however, further examination of this issue is warranted to insure the adequacy of BG&E contingency planning. In particular, the Staff is interested in reviewing the Company's projection of lead times that would occur should an early resumption of construction be necessary.

The projected impacts of curtailable and interuptible loads on the otherwise "normal" loads are not expected to be large (51 MW by 1999, less than 1% of the peak load). Of greater importance would be a significant increase in the growth of the economy of central Maryland. In the 1974-84 decade, the actual growth rate in electric peak demand was 2.9% per year. If an average annual growth rate of 2.5% is assumed for 1985-2000, and Brandon Shores 2 comes on-line by the fall of 1988 (as in the original plan filed in December 1984), a scenario develops wherein reserve margins dip below 15% in the winter of 1996/97 and thereafter.

Unless peak demand grows substantially more than anticipated over the next 15 years, Staff would conclude that from an engineering standpoint, BG&E is well-postured to meet its anticipated loads to 2000. This adequate supply of electric power bodes well for the future economic growth of central Maryland.

As noted above, BG&E issues two sets of peak load projections called Group and Contract Load figures. Staff has difficulty in understanding the rationale for this policy, particularly in view of the fact when it is noted that the Bethlehem Steel generating plant has not operated for several years. Use of the two sets of peak load estimates causes confusion and difficulty when making comparisons. It is recommended that BG&E hence forth file <u>one</u> set of peak load estimates, group load, with both the PJM and the Public Service Commission.

2. Delmarva Power and Light

<u>Peak Load Forecasting Methodology</u>

The initial step used to determine the peak load forecast is to adjust the actual system peak for the particular summer/winter season to reflect a more normal weather pattern. The normalized system peak is then incorporated into the historical series and forecasted using regression analysis. In this analysis, the relationship of certain variables to the base and weather sensitive components of the system peak is established. For the summer season, the regression analysis examines the relationship of the weighted average of a consolidated production index, a consolidated price of electricity, and the estimated number of air conditioners to the system peak. The net system peak is finally derived by adding the following components to the forecasted system peaks:

a) interruptible customer load;
b) peak sharing of municipal customers;
c) wheeling activities of DEMEC;[1]
d) additional Getty refinery GS load; and
e) additional load supplied to Easton by a limited term agreement.

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[1]Delaware Municipal Electric Corporation, an association of six municipal electric utilities in Delaware.

Peak Load Projections

The Delmarva projections of both system-wide and Maryland peak loads are listed on Attachment 2. Because only firm peak demands are listed there, Delmarva's interruptible load of 74 MW has been excluded from the listing. Growth rates over the fifteen year period were estimated to be 1.2% per year (system) and 1.1% per year (Maryland). Over the ten year period 1985-1994, growth rates are estimated to be somewhat higher. Delmarva expects that its peak load will drop from 1,851 MW in 1995 to 1,828 MW in 1996. The Old Dominion Cooperative plans to buy 50 MW of Nanticoke Unit No. 1's 400 MW capacity beginning in 1995, thus reducing Delmarva's load projections by this amount.

Although Delmarva is a summer-peaking utility, its winter peaks are pronounced, reflecting the growing importance of electric space heating on the Eastern Shore. Recent winter peaks have been within 6% to 7% of the summer peaks. If this trend continues, the winter peak may exceed the summer peak before 1990.

Load Management

In October 1982, Delmarva concluded a two-year study of direct load control of residential space heating water heating units and central air conditioning in selected households in Delaware. On the basis of this and other programs, Delmarva expects that load management will reduce its peak load by 2 MW in 1988 and 100 MW by the mid-nineties. After that the impact may level out at 100 MW for the rest of the decade. A recent Delmarva report[1] states:

> Although more planning and investigation will be required, DP&L believes that the technology for peak load management is sound and commercially available, and preliminary experience indicates that it is applicable on the DP&L system.

In its current projections of peak demands, Delmarva has not included any reductions from such load management strategies. A more detailed discussion of Delmarva's load management activities appears in Part II.

Comments

The Delmarva generation plan provides for adequate capacity over the next 15 years to meet the peak loads as anticipated by the Company. In fact, Delmarva reserves are considerably above the 16% minimum reserve margin for the rest of the 1980 decade and again beyond 1996.

Although no construction has begun on the 400 MW Nanticoke 1 at Vienna, Delmarva received a Certificate for its construction from the Public Service Commission in 1982. Delmarva has also received one 18-month renewal of an

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[1]Report to the Public Service Commission Pursuant to Condition 23 of the Certificate of Public Convenience and Necessity, filed by Delmarva on December 30, 1982, as part of Case No. 7222, pages 12 and 13.

environmental permit relating to air quality, which is one of the conditions of the Certificate. Approvals of other environmental permits by the Department of Health and Mental Hygiene may require some time.

Should significantly improved economic conditions on the Delmarva Peninsula increase the demand for electricity, the status of the Nanticoke 1 unit is such that Delmarva has the flexibility to put it on-line sooner than presently anticipated. With a total construction time of seven to eight years from start, Nanticoke 1's on-line date could be advanced to as early as 1992 or 1993, thus covering the more critical years of lower reserve, 1993-1995. On the other hand, if the need for Nanticoke 1 does not materialize by this time, its deferral would give Delmarva the opportunity to more aggressively address the potentials of new boiler technology for Nanticoke 1, particularly in view of the impact that pending acid rain legislation may impose on coal-fired generation. The commission would recommend such action by Delmarva.

3. The Potomac Edison Company

Peak Load Forecasting Methodology

APS uses both econometric and end-use models to predict peak loads and energy sales. These models are organized into four categories:

a) Macroeconomic model of the U.S. economy, developed by Data Resources, Inc.;

b) Economic models of the three APS operating company service areas, with input from (a);

c) Operating company peak load models.

The service area economic models yield population, income and employment estimates as inputs to the sales models. The peak load models use average demand by customer class, separated as appropriate into base and weather-sensitive components, to produce a load forecast at the hour of the day in each season when historical peaks have occurred most often. Finally, the separate operating company forecasts are summed to produce an APS aggregate forecast.

To derive the peak forecast for Potomac Edison's Maryland component, the known historical load factor in Maryland and net power supply derived by the energy allocation factor are both used.

Further details on the forecasting methodology are outlined in Part I of Potomac Edison's Fifteen-Year Plan.

Peak Load Projections

Estimates made by APS and Potomac Edison of their expected peak loads beginning with the 1984/85 winter and yearly thereafter to 1999/2000 are shown on Attachment 3. Both APS and Potomac Edison are presently winter-peaking and expect to remain so through at least the year 2000. These forecasts assume normal weather patterns at the time of peak load.

Average growth rates in peak load over the next fifteen years (1984/85 to 1999/2000) are presently estimated at 1.7% and 1.8% per year for APS and Potomac Edison, respectively. Over the ten year interval 1984/85 to 1993/94, these rates are somewhat greater (2.0%) for both companies. The actual rate observed by APS for its winter-time peak between 1973 and 1983 was 2.7% per year.

As a point of interest, the actual 1983/84 winter peak was 5,508 MW. The all-time record of 5,720 MW set in January 1983 is expected to be exceeded during the 1984/85 winter.

A detailed summary report of the loads and energy for the APS system and its component companies, "Forecast of Peak Loads and Net Power Supply to 2009," was prepared by the APS Planning Group in October 1984.

Comments

APS has stated that a reserve margin in the range of 25% to 30% appears reasonable for planning purposes. A much larger pool, the PJM Interconnection, has selected 22% as its overall margin.

Under the assumptions made by APS with reference to its growth is peak load and anticipated new generating, purchases from the outside, and reactivation of units now in cold reserve, it can be concluded that the APS system can reliably meet its requirements to 1999.

APS has been, and continues to be, a heavy exporter of power to eastern utilities with its low-priced coal generation displacing the costly oil-fired generation of these utilities. In view of the large reserves which APS presently has, this trend is expected to continue. Such transactions appear to be limited only by inter-pool transmission line capacities.

The present status of the 1,500 MW new coal generation discussed above is in the conceptual stage. In view of the time requirements for engineering and design, regulatory approval, bidding, equipment procurement, and actual construction, the time schedule for commercial operation of the first unit by 1992 appears short.

Reserve margins that would result if the first coal unit does not come on line until 1995 will drop below 25% beginning in the 1993/94 winter, a situation that may not be acceptable.

The winter-time peak demands listed in Attachment 3 are estimates and should be regarded as such. That they will be actually recorded is highly unlikely. These demands correspond to an average rate of growth of 1.7% per year. While Staff would suggest that these estimates and this rate of growth appear reasonable, it is interesting to postulate a somewhat higher growth rate of 2.2% and view the results. This 2.2% value is reasonable in light of APS' historical peak demand growth since about 1973.

Reserve margins expected to result form an assumed 2.2% annual growth rate to 1999 remain above 25% through the 1994/95 winter, but dip below 24% beyond that point. This again may not be acceptable.

The peak load estimates provided include the anticipated impact of load management techniques in moderating the growth of peak demand. As indicated earlier, APS expects such techniques to reduce peak loads by 448 MW by 1992/93. The resulting margins of peak loads without load management programs, might drop below 25% beginning with the 1988-89 winter.

It can be questioned whether these anticipated reductions in peak load will be achieved by the magnitude assumed. Staff has seen little hard evidence, to date, from experimental programs in load control that might justify these figures. The reserve margins anticipated by APS should be regarded in that light.

4. Potomac Electric Power Company

<u>Projections of Peak Loads and Energy Methodology</u>

PEPCO uses an econometric end-use model to forecast peak demands and energy sales. The current forecast was performed in detail to 1992, and extended to 1999 by extrapolating the 1992 growth rates. See Attachment 4.

Conservation effects due to price changes are incorporated in the forecast. However, they reflect no external conservation effects such as direct load control, general time-of-use, and the D.C. time-of-use rates for large commercial customers. The forecast to be completed in 1985 will incorporate the effects of PEPCO's Energy Use Management Plan.

<u>Load Control Programs</u>

PEPCO expects to achieve significant reductions in future peak loads through its Energy Use Management (EUM) load control programs. The Company estimates the following reductions by the early 1900's:

	Amount of Peak Load Reduction
Time-of-Use (Commercial and Residential)	115 MW
Curtailable (Commercial and Governmental)	205 MW
Residentail Load Control (A/C and Water Heaters)	120 MW
Total:	440 MW

PEPCO has recently requested authority from the Public Service Commission for approval of rates intended to implement energy use management strategies in Maryland in three areas:

a) voluntary commercial/government curtailable rates for general service customers;

b) voluntary residential load control of air conditioners and water heaters; and

c) mandatory time-of-use rates for medium-sized general service customers and the metro Rapid Transit customer.

A more detailed discussion of PEPCO's load control programs is presented in Part II.

Peak Load Projections

PEPCO is a summer peaking utility and is expected to remain in this category for the remainder of the century.

A comparison of PEPCO's current peak load forecasts with those provided in last year's plan reveals the figures to be identical. Upon reviewing last year's figures, PEPCO determined that the 1983 estimates were still valid for this year's forecast.

The projected peak loads of both the PEPCO system and its Maryland component are listed in Attachment 4. The peak load of the PEPCO review, including the Southern Maryland Electric Cooperative load, is estimated to grow at a compound rate of 1.5% per year, while the Maryland component rate of growth is estimated to be 2.1%.

The actual peak load as recorded by PEPCO for 1984 was 4,490 MW, which is greater than the projected peak for 1988. There is probably a large, weather-related component in this peak. With regard to this recorded peak, PEPCO Witness Mitchell stated (page 5 of his prefiled testimony in Cast No. 7874):

> The significance of this experience will be considered carefully by the Company as it updates its forecasts of load growth in 1985.

The year-by-year reductions in peak load expected to result from PEPCO's load control and management strategies are listed in Attachment 5. The resulting peak loads also shown on this Attachment, are expected to decrease for a brief period in the early 1990's when the impact of these load control programs begins to outweigh the "normal" growth pattern. With load control, peak load growth rates of 0.9% per year are expected.

Comments

If EUM develops as expected, PEPCO will need new generation capacity beginning around 1997. With EUM in place and new generation coming on line as presently planned, PEPCO reserves appear ample to provide satisfactory reliability to at least 2000.

If the expected impact of load control programs does not occur, however, PEPCO could face a reserve problem as early as 1991 which would extend through the remainder of the decade, even with new coal-fired units now planned for the latter half of this decade.

All of these scenarios assume a peak demand growth of about 1.5% per year (without EUM). Many people are now suggesting that in the years ahead the role of electricity, as part of the total energy picture, will increase. This prospect, coupled with greater than expected growth in the region's economy, may well portend a peak load growth rate that surpasses the 1.5% estimate.

The Commission is concerned about PEPCO's reliance on its energy management strategies. Figures cited above for the expected impact of these methods may be optimistically high. These anticipated impacts are only projections and need to be viewed in that light. As of now, there is a lack of hard experimental data on which to base these estimates. While there will undoubtedly be some impact, the amount that PEPCO anticipates could well be too high.

For this reason, we believe that PEPCO should more seriously pursue its planning for new generating, recognizing that EUM may not develop to the extent anticipated and that long lead times are required for conventional, yet proven, coal-fired generation. Such planning appears to be both prudent and necessary to allow for any uncertainties within the next few years.

C. Summary of Projected Growth Rates in Peak Demand

Attachment 6 lists the average annual rates of growth in peak demand over the next ten years as now projected by the principal Maryland electric utilities. For purposes of comparison, last year's projections and those of the previous year are also shown. Anticipated growth rates in the Maryland load are also shown for multi-jurisdictional utilities.

These figures reflect rates of average growth per year. They are derived by taking the ninth root of the ratio of the tenth year peak load to the first year peak load to capture the effect of compounding.

Of the four major utilities, Potomac Edison projects the highest growth rate, 2.1% per year, down from both last year's estimate (2.5%), and its estimate of two years ago (3.0%). Maryland's rate of load growth (1.4%) is expected to be substantially less than the system figure.

This situation is reversed in the PEPCO territory. PEPCO's more effluent Maryland customers are expected to cause a 2.1% annual demand growth, in comparison to 1.5% for the entire system. This year's estimates are substantially unchanged form last year's figures.

Delmarva's projections have trended downward to the current estimate of 1.4% per year. The corresponding figure for Delmarva's Maryland load is 1.5% per year.

BG&E has lowered its expected rate of growth from 2.0% in the previous year's Plan to 1.7% in this year's Plan.

D. Summary of Recommendations

The following section summarized the recommendations made in Parts I and II of the Report and highlights suggestions for future Ten Year reports.

With regard to generation and capacity planning, the Commission recommends that future Ten Year Plan submissions by utilities include high, low and intermediate forecasts of peak demand growth, on which contingency planning can be based. Considering that forecasting is, at best, an inexact science, a range of probable estimates would allow the Commission to test the sensitivity of future generating capacity requirements and reserve margins to each level of forecast demands. The adequacy of lead times for constructing new power plants and the estimated impacts of load reduction programs could be more accurately assessed in the light of varying forecasts. For instance, BG&E's Brandon Shores Unit No. 2 may be needed prior to 1992 if peak load growth exceeds the Company's expectations. Thus, BG&E should more critically examine its projection of lead times should an early resumption of construction be necessary. A similar situation exists with regard to Delmarva's Nanticoke 1 plant.

The Commission also recognizes the need for more hard data to support the estimated load reductions expected to result from demand management activities. The load management programs of both Potomac Edison and PEPCO, though ambitious in scope, are susceptible to a variety of factors that could lessen their overall impact. Again, a range of probable estimates would provide a means for analyzing the effects of various outcomes on projected reserve margins and generating capacity requirements.

Therefore, the Commission will require that future Ten Year Plans include high, low and intermediate estimates of both peak load growth and the load reductions expected to result from demand management programs.

With regard to demand management activities, the Commission recognizes the need for all utilities to provide more concrete data to support load reduction estimates. The Commission further recommends that each utility adopt a cost-effectiveness evaluation methodology and begin to collect data so that the cost effectiveness of all programs can be determined.

ATTACHMENT 1

ACTUAL AND PROJECTED ANNUAL PEAK LOADS
(1980-2000)
(MW)

Baltimore Gas and Electric Company
(Contract Load)

Year	Summer Actual	Summer Projected	Winter* Actual	Winter* Projected
1980	3,969		3,176	
1981	3,871		3,351	
1982	3,924		3,093	
1983	4,079		3,410	
1984	4,230			3,600
1985		4,300		3,740
1986		4,370		3,880
1987		4,440		4,020
1988		4,510		4,160
1989		4,580		4,300
1990		4,640		4,450
1991		4,730		4,600
1992		4,830		4,750
1993		4,920		4,900
1994		5,010		5,040
1995		5,100		5,180
1996		5,180		5,300
1997		5,250		5,420
1998		5,320		5,540
1999		5,390		5,660
2000		5,470		5,780
Average Annual Growth Rate (%)				
1974-84		2.9		4.1
1985-94		1.6		3.5
1985-2000		1.6		3.0

*The winter period is that following the indicated year, i.e., for 1985, the winter is the 1985-86 season.

ATTACHMENT 2

PROJECTIONS OF PEAK LOAD

DELMARVA POWER AND LIGHT COMPANY

	Peak Load (MW)	
Year	System	Maryland
1985	1,610	404
1986	1,643	412
1987	1,637	413
1988	1,664	420
1989	1,693	427
1990	1,721	434
1991	1,747	441
1992	1,774	447
1993	1,799	454
1994	1,825	460
1995	1,851	467
1996	1,828	452
1997	1,851	457
1998	1,876	464
1999	1,897	469
Average annual rate of growth (%)		
(1985-1999)	1.2	1.1
(1985-1994)	1.4	1.5

NOTES:

(1) Getty Refinery load served by Delaware City Units #1 and #2 and dedicated portion of Unit #3 excluded through 1986.

(2) All Refinery loads excluded after 1986.

(3) No interruptible load is included in above estimates. Total interruptible load is 74 MW

ATTACHMENT 3

PROJECTIONS OF PEAK LOADS,

THE ALLEGHENY POWER SYSTEM AND POTOMAC EDISON CO.

(MW)
(50% Probability Due to Weather)*

Year (Winter)	APS	Potomac Edison System	Potomac Edison Maryland Component
1984/85	5,773	1,657	N/A
1985/86	5,887	1,692	1,128
1986/87	6,004	1,730	1,146
1987/88	6,129	1,773	1,167
1988/89	6,282	1,814	1,187
1989/90	6,417	1,852	1,205
1990/91	6,553	1,891	1,223
1991/92	6,669	1,928	1,240
1992/93	6,796	1,960	1,255
1993/94	6,906	1,992	1,268
1994/95	7,015	2,022	1,281
1995/96	7,103	2,052	1,294
1996/97	7,210	2,079	1,308
1997/98	7,296	2,103	1,320
1998/99	7,376	2,125	1,333
1999/2000	7,459	2,153	1,348
Average Annual Growth Rates			
(1985/86-1999/00)			1.3 %
(1984/85-1999/2000)	1.7%	1.8%	
(1984/85-1993/94)	2.0%	2.0%	

*Actual peaks are equally probable to be over or under these forecasted values due to weather variations.

NOTE: These are projections made by APS and Potomac Edison.

ATTACHMENT 4

PROJECTED PEAK LOADS, SYSTEM AND MD ONLY

Potomac Electric Power Company

(MW)

YEAR	SYSTEM	MARYLAND COMPONENT
1985	4,302	2,451
1986	4,361	2,505
1987	4,416	2,554
1988	4,473	2,605
1989	4,571	2,654
1990	4,608	2,705
1991	4,680	2,769
1992	4,754	2,829
1993	4,837	2,888
1994	4,914	2,956
1995	4,994	3,020
1996	5,074	3,085
1997	5,156	3,151
1998	5,239	3,219
1999	5,323	3,287
Average Growth Rate, % per year (1985-1999)	1.5	2.1

NOTE: No contribution from Energy Use Management program assumed

ATTACHMENT 5

PROJECTED PEAK LOADS WITH AND WITHOUT EUM

Potomac Electric Power Company

Year	Peak Load (MW) Without EUM *	With EUM *	Difference
1985	4,302	4,302	0
1986	4,361	4,354	7
1987	4,416	4,401	15
1988	4,473	4,438	35
1989	4,541	4,445	96
1990	4,608	4,427	181
1991	4,680	4,414	266
1992	4,754	4,403	351
1993	4,837	4,419	418
1994	4,914	4,468	446
1995	4,994	4,545	449
1996	5,074	4,621	453
1997	5,156	4,699	457
1998	5,239	4,779	460
1999	5,323	4,859	464
Average compound growth rate, % per year (1975-1888)	1.5%	0.9%	

*EUM is Energy Use Management programs.

ATTACHMENT 6

COMPARISONS OF PROJECTED AVERAGE ANNUAL GROWTH RATES IN PEAK DEMAND (%)

Utility Projections

Region	1983 Plan (1983-1992)	1984 Plan (1984-1993)	1985 Plan* (1985-1994)
Baltimore Metro			
Baltimore Gas & Electric Co.	2.0%	2.0%	1.7%
Washington Metro			
Potomac Electric Power Co.			
System	1.2	1.4	1.5
Md. only	1.0	2.0	2.1
Western Maryland			
Potomac Edison Co.			
System	3.0	2.5	2.1
Md. only	3.0	1.9	1.4
Southern Maryland			
Southern Maryland Electric	3.1	2.7	3.2
Eastern Shore			
Conowingo Power Co.	2.6	2.5	1.9
Delmarva Power & Light Co.			
System	1.9	1.6	1.4
Md. only	3.1	1.7	1.5
Easton Utilities Commission	2.3	2.7	4.1

*The 1985 Plan covers the fifteen year period 1985-1999. However, the 1983 and 1984 Plans were both ten-year planning documents, so in the interest of uniformity, the growth rates were taken over the ten years 1985-1994.