episodic acidic events associated with snowmelt or run-off and high flow conditions may not be treated completely with static stream mitigation techniques (e.g., limestone barriers).

G. Maryland Acid Deposition Research Programs

A number of research programs funded by both federal government and private sector have recently been initiated or completed that may be useful in assessing the effects of acid deposition on Maryland resources, particularly surface waters. Among these programs are four major research efforts being conducted by EPA through NAPAP: (1) the National Surface Water Survey (NSWS), (2) the Direct/Delayed Response Program (DDRP), (3) the Watershed Process/Manipulation Program (WP/MP), and (4) the Temporally Integrated Monitoring of Ecosystems (TIME) Program. Most of these studies have not yet been completed.

Efforts by the State to identify Maryland regions sensitive to acid deposition began in 1980, with the inception of a four-year study of Deep Creek Lake. Results of this study were outlined in annual reports (PPRP 1987, 1988; CBRM 1989a). Other relevant studies are summarized below.

- The Coastal Streams Pilot Survey was conducted in the spring of 1983 to provide an overview of the potential impact of stream acidification on the water quality of spawning areas for fish such as American shad, blueback herring, alewife, white perch, and yellow perch.

- The Coastal Streams Acidification Study was conducted in 1984 and 1985 in three Maryland Coastal Plain watersheds to evaluate the potential role of acid deposition on the occurrence of acidic conditions in the study streams (Lyons Creek -- Anne Arundel County; Morgan Creek -- Kent County; Granny Finley Branch -- Queen Anne's County). Acidic pulses of varying degrees occurred in all three streams during precipitation events with the greatest changes in pH and ANC occurring during periods of high surface water run-off. Modeling the responses in stream water chemistry during storm events suggested that higher precipitation acidity and lower residence time of rain water in and on the soil increased the occurrence and magnitude of acidic pulses.

- The Maryland Stream Chemistry Analysis, conducted in 1986, gathered stream chemistry data from a number of sources to characterize the sensitivity of surface waters in Maryland to acidification (Janicki and Greening 1987). Streams located in the Appalachian Plateau and Coastal Plain physiographic provinces were found to exhibit lower alkalinity and pH values. Conversely, the streams of the Valley and Ridge and Piedmont provinces generally exhibited conditions indicating their relative insensitivity to acidification. Close agreement between the cation exchange capacity of soils in Maryland and the ANC and pH of streams was observed. Overall, the results of this analysis agree with those of the Maryland Interagency Working Group on Acid Deposition (Harman 1984), which identified the Coastal Plain and Appalachian Plateau provinces as the areas in which acid deposition may adversely affect stream chemistry.

- The Maryland Synoptic Stream Chemistry Survey (MSSCS) was conducted in 1987 and was designed to provide statewide estimates of the number and extent of stream resources affected by or at risk from acidification (Knapp *et al.* 1988). Based on the results of the MSSCS and other existing data on watershed characteristics, a design for a long-term state stream chemistry monitoring program was developed to detect future changes in stream chemistry that may indicate either acidification or recovery of acidified streams throughout the state. Additionally, efforts were made to ensure data compatibility between this program and NAPAP's TIME project.

- The Maryland Doser Study was designed to test the ability of automated wet calcite slurry dosers to neutralize acidic episodes in two Coastal Plain streams that are used for spawning by several anadromous fish species. Over the first two years of the study, the wet-slurry dosers proved effective under most conditions.

- The Yellow Perch Spawning Stream Survey was conducted in spring 1989 to provide data on the geographical distribution of yellow perch spawning streams in the Maryland Coastal Plain and to provide water quality data from a number of streams sampled in the MSSCS. The data will be used to evaluate the current status of yellow perch spawning in Coastal Plain streams, to aid in determining probable sources of acidity in these streams, and to prioritize candidates for stream liming.

- Sources of Acidity to Coastal Plain Streams are being estimated using a variety of data including stream chemistry from the MSSCS; deposition chemistry; and land use, geology, and soils information. A model that grouped streams into three primary groups according to their conductivity and ANC was developed. Streams in the low ANC/low conductivity group were hypothesized to be relatively unaffected by agricultural or urban land use and sensitive to acid deposition and/or organic acidity. Streams in the high ANC/high conductivity group were hypothesized to be affected by urban land use. Streams in the low ANC/high conductivity group were hypothesized to be affected by agricultural development. Subsequent examination of land use within watersheds of these groups supported these hypotheses (Janicki *et al.* 1990).

- The Western Maryland Stream Survey was performed in 1989 to investigate the relationship between acid-base chemistry and the presence and abundance of fishes in cold water streams in western Maryland. Water samples were collected under baseflow conditions in May 1989 from 80 streams in Garrett and Allegany Counties. Samples were analyzed for pH, ANC, sulfate, nitrate, monomeric aluminum, conductivity, and dissolved organic carbon. Fisheries samples were collected by electroshocking (Morgan *et al.* 1990).

- The Western Maryland Episodic Stream Acidification project was initiated in 1989. Changes in stream chemistry in response to hydrogeologic events such as rainfall and snow melt will be measured in the Big Run watershed, upstream of Savage River Reservoir. Sampling and analytical protocols are designed to be compatible with those used by the EPA's Episodic Response Project.

- Sources of Acidity in Mid-Atlantic Coastal Plain Streams are being determined in a project jointly sponsored by CBRM and the EPA. This project is designed to evaluate relationships between watershed characteristics and stream chemistry and to identify probable sources of acidity and ANC in Mid-Atlantic Coastal Plain streams. In addition, the feasibility of modeling future changes in stream water quality will also be examined. Through this study the results of the MSSCS and the National Stream Survey (NSS) will be compared to examine differences in estimated spatial patterns of stream acid-base chemistry as measured by the two surveys. MSSCS and NSS results will also be used to estimate the optimum sampling density in a stratified random stream chemistry survey.

- Critical Loads in Maryland. This study will be conducted using data on atmospheric deposition chemistry, stream chemistry, geology, soils, hydrology and land use from 70 watersheds in eight regions across Maryland. The data will be used as input to two critical load models. One was developed in Sweden (Sverdrup *et al.* 1989), while the other is the Model of Acidification of Groundwater in Catchments (MAGIC), developed at the University of Virginia (Cosby *et al.* 1985). These models will provide estimates of sulfur and nitrogen critical loads, which will then be used in a linear programming model to optimize sulfur and nitrogen oxides emissions reductions at national, regional, and state scales (Ellis 1988).

In addition, the Virginia Trout Stream Sensitivity Study, designed to provide a long-term monitoring of stream water chemistry in natural trout streams in the Blue Ridge and Appalachian regions of Virginia, is potentially applicable to geographic areas in western Maryland with similar soil types, geology, and stream characteristics (CBRM 1989a).

H. Recommendations of the Governor's Work Group on Acid Deposition

In November 1988, before passage of the recently enacted Clean Air Act Amendments of 1990, the Governor appointed a work group on acid deposition, which was tasked with addressing the following questions:

- Should Maryland develop an acid deposition control program independent of any federally-mandated requirements?

- If the program is determined to be appropriate for Maryland, what form should it take to be most effective?

- Given the Governor's position supporting national control legislation, are there actions that the state could take to complement a federal control program?

The findings and recommendations of the work group, published March 1989, are summarized below.

- **Continue to give strong support for passage of federal legislation for control of acid deposition, including controls on both sulfur and nitrogen oxides.**

  National reductions of sulfur and nitrogen oxide emissions from power plants, industrial sources, and motor vehicles are needed to prevent further damage to natural and cultural resources. It is estimated that most of the emissions causing acid deposition in Maryland originate from sources outside of the state.

- **Continue to support provisions of federal legislation that will reduce the overall costs of emissions reductions.**

  Such provisions include allowing emitters flexibility in selecting control technologies, intrastate emissions trading, and increased energy conservation. Increased federal gasoline taxes and stricter fuel economy standards for motor vehicles are among the options to be included in Congressional discussions of energy conservation. An additional approach that should be considered is to provide investments in pollution control equipment a tax-free status.

- **Begin immediately to explore, with neighboring states, a regional approach to reducing emissions, perhaps through the formation of an interstate compact.**

  A regional solution appears to have a greater likelihood of leading to reduced impacts to resources than does a Maryland-only approach. In addition, a regional approach is better tied to the interstate nature of power pools such as the Pennsylvania-New Jersey-Maryland grid.

- **Make a serious attempt to limit increases in Maryland's sulfur dioxide and nitrogen oxide emissions during the interim period before a federal or state emission reduction program is adopted.**

- **Continue to support the comprehensive research and monitoring efforts underway by the Departments of Natural Resources and Environment. Accelerate research in the areas of sources of acid deposition in Maryland,**

stream acidification, and effects on organisms that inhabit sensitive Maryland streams.

Work in progress includes evaluation of the Maryland precipitation monitoring network, pilot studies of Coastal Plain stream liming, determination of acidification effects on fish that spawn in Coastal Plain streams, evaluation of Coastal Plain streams that might benefit from liming, and identification of sources of acidity in small Maryland streams. The Departments plan to begin long-term stream chemistry monitoring, studies of acidification in western Maryland streams, and a biological survey of small streams in the near future. Expanded precipitation and stream chemistry monitoring is crucial to determining the effectiveness of future emissions reductions.

- **Analyze the feasibility and potential effectiveness of mobile source testing of NO_x and develop possible options for program implementation.**

  Maryland is committed to reducing nutrient inputs to Chesapeake Bay by 40 percent. Recent studies suggest that atmospheric deposition may be a significant nitrogen source to the Bay. About 45 percent of the nitrogen oxide emissions in Maryland are from mobile sources. If such a testing program proves feasible and desirable, it would provide baseline data upon which future evaluation of mobile source NO_x reductions could be based.

- **Immediately evaluate, in cooperation with other mid-Atlantic states, the feasibility, air quality benefits, and costs of adopting the California mobile source nitrogen oxide control program.**

  The California program required substantially more stringent control of nitrogen oxide from light duty vehicles (0.4 gram per mile) than does the federal standard (1.0 gram per mile). Eight northeastern states have recently adopted such an evaluation as policy. Maryland's evaluation should include controls on heavy-duty vehicles.

- **Begin discussions with neighboring states on possible interstate agreements to allow coordinated development of implementation plans to comply with federal legislation when it is enacted.**

- **Implement policies and programs to promote energy conservation.**

  A range of options was submitted for group consideration by the Chesapeake Bay Foundation. Several Work Group members oppose the use of gasoline tax revenues for any purpose other than transportation.

- **Begin to expand pilot studies of stream liming.**

  Stream liming, while not a substitute for national emissions reductions, may be an interim method of protecting sensitive populations of fish such as herring, perch, striped bass, and trout. Careful monitoring of the effects of stream liming should continue to ensure that stream liming technologies are implemented cost-effectively. Stream liming can treat only individual streams and, once instituted, may need to continue for a long period to provide benefits to fish until stream chemistry improves as a result of emissions reductions.

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J. Glossary

Aerosols. A suspension of liquids in air; a mist.

Allowance. A federal permit to emit one ton of sulfur dioxide.

Ambient. Typical of natural conditions.

Ameliorate. To reduce the severity of.

Anadromous. Returning from the sea to spawn in fresh water rivers and streams.

Benthic. Of, relating to, or occurring at the bottom of a body of water.

Buffering. The process of neutralizing acidity, serving to slow the response of a system to acidic pulses.

Bioaccumulation. Accumulating in biological organisms over time.

Canopy. Relating to the leaf cover of a forested area.

Chronic. Occurring over a period of time, not acute.

Cistern. A water storage container that collects rainwater to be used as drinking water.

Conductivity. A water quality parameter used for measuring the ionic concentration in water.

Eutrophication. The over enrichment of water bodies resulting from excessive nutrient inputs. Leads to the uncontrollable growth of algae.

Foliar. Relating to the leaves of a plant.

Ions. A positively charged atom. Hydrogen ions are responsible for acidification.

Larvae. The early form of an animal.

Leaching. To dissolve out through the action of percolating liquid.

Littoral zone. The shallow, near-shore region of a lake that is an interface zone between the shoreline and the open water region.

Macroinvertebrates. Organisms lacking backbones found on stream bottoms.

Mitigation. As related to acid deposition, processes which reduce the effects of acidity on surface waters and watersheds.

Nitrogen oxides. The principal form of nitrogen emitted from coal fired power plants.

Oxidized. A chemical transformation of a compound in which an oxygen is gained and/or a hydrogen ion is lost.

Ozone. A triatomic form of nitrogen which is a major agent in the formation of smog.

pH. A measure of acidity of water.

Precursor. A substance from which another substance is formed.

Respiratory. Relating to the lungs.

Sulfur oxides. The principal form of sulfur emitted from coal fired power plants.

Volatile organic compounds. Chemical compounds are easily transformed into a gaseous state.

CHAPTER 9

THE CHANGING UTILITY OPERATING AND REGULATORY ENVIRONMENT

A. Introduction

Important changes are taking place in the electric utility industry, and many observers believe the industry is in transition to an entirely new or very different form. Proponents of change argue that the generation (and possibly the transmission) of electric power should not be viewed as "monopoly utility" functions. During the past several years regulatory and institutional forces have been at work introducing more competition into electric power supply.

This chapter explores this emerging institutional environment and the initiatives undertaken to date. Much of this change is occurring at the national level; its implications for Maryland utilities are considered here. The objective is to gain an understanding of the forces at work and their implications for the ways in which load demands will be met in the future. This "restructuring" of the industry has important implications for reliability, resource planning, environmental impacts, and utility system operations.

B. The Forces for Change

Before identifying the forces for change, it is first worth considering what is meant by the "traditional" electric utility industry as it has existed in Maryland and in most of the country. The electric utility industry nationwide has been dominated by approximately 100 large investor-owned electric utility companies (IOUs), some of which are public utility holding companies like the Allegheny Power System. These 100 IOUs provide about 75 to 80 percent of the electricity supply in the U.S. They have two major characteristics. First, they function as regulated monopolies, in most cases serving a franchised service territory, whose terms of service are strictly regulated by state public service commissions. The state commissions often regulate other aspects of their operations such as construction of facilities. Second, the large IOUs are in almost all cases vertically integrated systems: they own and operate the generation, transmission, and distribution segments of the business.

This institutional structure functioned relatively effectively for many decades. It was established in the 1930s with the enactment of two key pieces of federal legislation, the Federal Power Act and the Public Utility Holding Company Act (PUHCA). The half century that followed was a period of growth, progress, and financial stability. For the most part, electric rates remained stable or even declined as economies of scale (particularly from larger generating plants) and technological progress provided efficiency and cost savings. Rate cases were rare and typically resulted in rate decreases. System reliability was continually enhanced through the construction of high-voltage transmission grids and the formation of power pools (or reliability councils) in the 1960s.

The traditional structure worked very smoothly until the "energy crises" and attendant inflationary problems of the 1970s, when nearly a half century of declining electric rates, impressive efficiency gains, and financial strength came to a halt. Some experts believe that by the 1970s economies of scale had been largely fully exploited: that utilities and new generating units were already so large that efficiency gains from further size increases at that point could not be achieved. The industry was hard hit by the combination of rapid inflation (particularly for fuel) and a recessionary economy. These conditions led to an interruption of the steady, predictable growth in demand for electricity that had been occurring for decades. Moreover, many utilities were slow to recognize these fundamental changes.

Part of the industry's response to the "energy crises" of the 1970s was to seek an alternative to insecure and unstable natural gas- and oil-fired generation -- nuclear power. By the end of the 1970s, and particularly after the Three Mile Island accident, it had become clear that nuclear plants were far more costly than previously believed. Moreover, with unstable and slowing demand for electricity, the anticipated customer demand for this new power was in many cases failing to emerge. The results became apparent in the early 1980s -- cost overruns, excess capacity, and canceled plants. For some utilities this translated into rate shock, incomplete cost recovery, and severe financial distress.

The early 1980s saw widespread dissatisfaction on the part of ratepayers, regulators, and utility investors. In many areas, rate increases met with considerable consumer (and political) resistance. Regulators were forced to deal with many difficult and protracted issues, such as management prudence and excess capacity. Many utilities concluded that the regulatory framework did not fairly compensate for the risks they incurred in constructing expensive central station power plants.

The contentiousness and dissatisfaction that arose in the 1970s and 1980s have given rise to two seemingly contradictory but related trends. The first is the introduction of competition for bulk power supply. This requires both institutional change to remove the present barriers to competition and a relaxation or "streamlining" of regulation; in other words, competition reduces the need for regulation. Ironically, the second discernible trend is increased regulatory oversight, in the form of least-cost planning review procedures in many states, including Maryland.

Efforts to introduce competition into electric power supply are part of the broader trend toward deregulation of the traditional utility and transportation sectors. The airline industry was deregulated and its regulatory agency (the Civil Aviation Board) dismantled under the Carter Administration in the 1970s. The railroads also have been substantially deregulated. In 1983, AT&T was divested of its local telephone operations as a settlement of an antitrust suit. Partly as a result of divestiture, competition in telecommunications has increased substantially. Although telephone companies are still regulated monopolies, rate regulation has become considerably more flexible. Deregulation has also extended into the energy field, most notably for the natural gas industry. The Natural Gas Policy

Act of 1978 mandated a phased decontrol of gas field prices. The Federal Energy Regulatory Commission (FERC) has encouraged the interstate pipelines under its jurisdiction to take on "common carrier" status, i.e., offer their customers transportation services. This permits local distribution companies and other large purchasers to acquire their own supplies of gas from producers in a highly competitive market.

Proponents of competition in the electric utility industry argue that the generation of electricity is not a natural monopoly and therefore should not be treated as a regulated utility. They suggest that introducing competition will lead to efficient generation sector and will eventually permit deregulation of new sources of supply. Some argue that if competition is to be truly effective, then potential participants in the bulk power supply market must have access to the regional transmission grid, which is now privately owned by the IOUs. This "transmission access" issue is discussed later in this chapter.

The other major response to the severe planning problems of the late 1970s and early 1980s has been direct government participation in "least-cost planning." Highly formalized systems for periodically reviewing utility planning were implemented by state commissions in California, Nevada, and Wisconsin; several other states have introduced their own, typically less formalized programs. Traditionally, electric utilities undertook capacity expansion with minimal regulatory supervision. The utility sought cost recovery in a rate case when the new facility entered service. During the 1980s, this "after-the-fact" method of review culminated in rate case disallowances for prudence and excess capacity. Both the utilities and commissions found that the traditional approach no longer worked very well. Rate case disallowances did not adequately protect consumers from serious planning mistakes, and utilities discovered that after-the-fact reviews entailed unacceptable risks. In contrast, least-cost planning reviews the critical planning decisions <u>before</u> resource commitments are made. This has the advantage of focusing more public attention on these major decisions and providing the utility with feedback from its regulators on a "before-the-fact" basis.

The forces discussed in this section have led to important changes in the planning for new electric power resources. Maryland utilities have responded to these forces in the following ways:

- <u>Reliance on integrated resource planning</u>: There is a growing consensus that planning for new electric power resources should give heavy emphasis to purchased power and demand-side management (DSM) options along with utility power plant construction. Life extension of existing units is also being undertaken in order to defer construction of new capacity.

- <u>Emphasis on smaller power plants with short lead times</u>: To the extent capacity is needed, the utilities are presently emphasizing planning flexibility and the avoidance of large capital commitments. They favor plants which can be constructed quickly with relatively low construction costs per kW, such as combustion turbines and combined cycle units. This planning approach results in capacity increments that coincide with load growth to avoid excess capacity.

° The emergence of non-utility generation: Maryland utilities are beginning to factor in non-utility generation (NUG) in their planning. These supplies are exempt from traditional cost--of-service rate regulation and operate in competitive markets.

° Consideration of fuel use flexibility in planning: In selecting generation technology, utilities are attempting to avoid overreliance on any one particular type of fuel. This is in response to the enormous uncertainty regarding fuel prices and security of fuel supply, and to changing environmental requirements.

These four responses to the changing environment and their consequences are outlined on Table 9-1. The remaining sections of this chapter discuss these subjects, including the implications for environmental impacts.

C. Integrated Resource Planning in Maryland

Public Service Commission (PSC) oversight of planning for new power plant capacity changed considerably during the past decade. During the early 1980s, the utilities over the entire region had excess generating capacity and therefore were not actively planning for new generation facilities. With accelerating demand growth in the latter part of the decade, planning for new resources again became a focus of attention. During the late 1980s, two major changes were introduced to achieve more effective PSC oversight of resource planning. New and more comprehensive regulations became effective in 1986 regarding the "need-for-power" aspects of a Certificate of Public Convenience and Necessity (CPCN). A utility seeking authority to construct a power plant in Maryland must now present extensive information regarding its entire resource planning process, including feasible alternatives. The second change, introduced in 1988, established least-cost planning review by the PSC staff.

The first major application of the new PSC regulations regarding need for power occurred in Case No. 8063, Phase II, PEPCO's CPCN application for Station H at the Dickerson plant. This phase was filed and hearings held during 1988. In this case, PEPCO's entire planning process was evaluated, including fundamental planning methodologies, planning assumptions, commitment to DSM programs, and the possible role of NUG. Evidence was also taken on the relative environmental merits of the resource options. This comprehensive review of PEPCO's planning process contrasted with earlier CPCN proceedings (e.g., DP&L in 1981, Case No. 7222), in which the principal focus was whether the load forecast justified a new power plant. In the Station H proceedings, the Hearing Examiner (subsequently affirmed by the PSC) found that Station H is needed and that coal gasification combined cycle is the least-cost configuration for the plant. The PSC also made a number of findings regarding planning methodology and criteria for implementing DSM programs (PSC 1989a).

Table 9-1

Utility responses to the changing environment

Criterion Emphasized	Consequence
(1) Reliance on Integrated Resource Planning	-Formal PSC review of the planning process
	-Maximum cost-effective use of DSM, purchased power, life extension
(2) Construct small units with short lead times	-Reduces capital risk
	-Avoids excess capacity and allows quick adjustment to changes in load forecast
	-Results in combustion turbines, combined cycle capacity
(3) Emergence of nonutility generation	-Long-term contracts at generation
	-Introduction of competitive bidding for power supplies
	-Reliability concerns
(4) Fuel use flexibility	-Natural gas a primary fuel, but dual fuel capability
	-Maintain coal gasification as a future option
	-For baseload coal plants consider fluidized bed combustion

Although comprehensive in scope, the CPCN need-for-power review occurs only when the utility seeks to construct a power plant in Maryland. To ensure more effective oversight, the PSC established an ongoing program of least-cost planning reviews, to be conducted by the PSC staff in consultation with PPER. Unlike the CPCN proceeding, this process is intended to be informal. The resource plans of each of the four major utilities are to be evaluated in depth every other year (i.e., two per year), and the plans of the smaller utilities are monitored annually. Staff findings are published in the PSC's annual Ten-Year Plan report, and the utilities are provided an opportunity to respond.

The goals of least-cost planning are identified in the PSC's 1989 Ten-Year Plan report:

> The Commission's immediate goal is to influence the planning process at an early stage so as to encourage use of demand-side management and other least-cost options, and thereby avoid or delay construction of new generating stations when appropriate from a cost and reliability standpoint. The overall function of the Commission's long-range plan review process is to evaluate whether utility plans minimize the total cost to society of providing electric service, through consideration of all feasible options. (page XII)

This process will also assist the utility by providing valuable feedback on its planning process before the utility submits a CPCN application.

D. The Role of NUG in Maryland

Competition is beginning to emerge in the area of bulk power supply, an area that has traditionally been dominated by regulated utilities. Competition may come partly from utilities themselves (e.g., utilities with excess capacity competing for wholesale purchasers), but it will be mostly in the form of non-utility generation sources. NUG falls into two categories: 1) qualifying facilities (QFs), certified under FERC rules; and 2) independent power producers (IPPs). All of the NUG in Maryland and nearly all NUG nationwide at this time is in the QF category. IPPs are discussed briefly in the next section, but for the most part the terms NUG and QF are used interchangeably here.

QFs, in the form of cogeneration and small power production, provide approximately three percent of total generating capacity in Maryland. Cogeneration is the simultaneous production of electricity and thermal energy, typically steam, which can be used in an industrial process. The use of a single fuel to produce two useful forms of energy results in a highly efficient process. Cogeneration has been introduced at highly energy-intensive industrial installations (e.g., petrochemical plants and paper mills) that have large process steam needs. A small power production facility is a power plant that produces electricity using biomass, wastes, or renewable resources.

The emergence of NUG is primarily attributable to the Public Utility Regulatory Policies Act of 1978 (PURPA) and the rules implementing it promulgated by FERC in 1980. This legislation was prompted by the "energy crisis" of the 1970s in order to encourage efficient new sources of energy. NUG facilities (i.e., cogenerators or small power producers) meeting certain efficiency, fuel use, and legal standards are entitled under the Act to receive QF status. The QF is then exempt from traditional regulation, has a "guaranteed market" for all power it produces, and is entitled to be paid rates for its power at the purchasing utility's "full avoided cost." This means that the local utility must purchase the power supplied to it and pay rates that reflect the power supply costs that the purchasing utility avoids as a result of acquiring the NUG power. As a practical matter, this is normally accomplished through long-term contracts for the mutual convenience of the NUG and the utility.

Nationwide, NUG is only a small portion of total power supply, but it is growing rapidly. The U.S. Department of Energy estimates that NUG accounted for only 3.8 percent of total generation in 1985 and expects this share to increase to 7.4 percent by the year 2000 (EIA 1989). Although this is still a modest percentage of the total generation, NUG is an important incremental resource. The North American Electric Reliability Council estimates that NUG facilities will provide about 22 percent of the total planned capacity additions over the next ten years. The percentage in the mid-Atlantic region is expected to be even greater (NERC 1988). According to U.S. Energy Information Administration projections, more than half of the new NUG facilities will be fueled by natural gas. The emergence of natural gas as the "fuel of choice" is attributable to the favorable price and availability conditions arising from natural gas deregulation and other FERC regulatory reforms.

Table 9-2 lists NUG facilities now operating in Maryland, indicating the owner, location, fuel type and rated capacity size. These facilities supply a total of 297 MW, roughly equivalent to one utility-size generating unit; all have QF status. This table does not include portable generators (sometimes used at construction sites) and backup generators operated by hospitals, military bases, etc., since they would not be eligible for QF status. Three projects -- Bethlehem Steel, Westvaco, and the BRESCO solid waste incinerator -- account for 93 percent of the total. The Bethlehem Steel and Westvaco units are older facilities (pre-PURPA) and operate primarily in a "self generation" mode, i.e., supplying most of their electrical output to the on-site industrial complex.

Although QF development in Maryland in response to PURPA so far has been modest, this may be changing. Many NUG developers have changed from adapting power generation facilities to existing steam hosts to developing "stand-alone" cogeneration facilities supplying both the electric supply and steam host in a package. There are several planned and proposed new projects of this type in Maryland. Applied Energy Services (AES) plans to construct a 180 MW coal-fired cogeneration project near Cumberland, Maryland, to enter service in 1995. The power will be sold to Potomac Edison under a long-term contract, which was recently approved by the PSC (Order No. 68345). AES also proposed a similar size plant at a site in Anne Arundel County, but this project has been suspended.

Table 9-2

Non-utility generating facilities currently installed in Maryland

Owner	Location	Fuel Type	Size (MW)
E.L. Copley III	Denton	Solar	0.015
Pacific Lighting Energy Systems	Gude Landfill Rockville	Biomethane	3.0
American Hydro Power Company	Gilpin Falls Cecil County	Hydro	0.396
Baltimore Refuse Energy Systems Company	Baltimore	Municipal Solid Waste	57.0
Prince George's County Government	Prince George's County	Biomethane	2.55
Alternative Energy Associates	Brighton Dam Montgomery Cty	Hydro	0.40
American Sugar Division of Amstar Corporation	Baltimore	Oil/Natural Gas	10.0
Bethlehem Steel Corporation	Sparrow's Point	Coke Oven Gas/ Natural Gas	169.0
Dorchester Lumber Co.	Linkwood	Wood Chips	0.65
Maryland State Department of Public Safety and Correctional Services	Somerset County	Wood Chips	4.4
Westvaco Corporation	Luke	Coal/Spent Pulping Liquor	50.0
Paul Curtis	Bozman	Wind	N/A
Wilson's Mill Ltd.	Wilson's Mill	Hydro	0.02
TOTAL MW			297

Source: FERC's annual READ I II SYSTEM listing of Qualifying Facility applications by state: utility response to PSC data requests for the PSC's annual Ten-Year Plan report; and telephone contacts with facility owners.

Montgomery County has approved plans to construct a solid waste burning plant with a capacity rating of 60 MW. The plant will be located at PEPCO's Dickerson power station and the power sold to PEPCO. In early 1990, Advanced Power Systems entered into a long-term contract with SMECO to supply approximately 100 MW from a natural gas-fired cogeneration plant to be constructed in Charles County. This contract has not yet been approved by the Maryland PSC. There are other potential projects in the discussion or planning stage, but there is little public information available concerning them.

In addition to these projects, DP&L has proposed a competitive bid solicitation for 150 MW of NUG to enter service in 1996. Although this is likely to elicit substantial NUG offers, it is not clear how much power would be generated in Maryland. The majority of DP&L's service area is in Delaware. Competitive bidding is discussed further in the next section.

NUG development in Maryland has been significantly less than in the surrounding states of Pennsylvania, Virginia, and West Virginia, for a number of reasons. Perhaps the most important of all is Maryland's "resource endowment." States surrounding Maryland have large heavy industry sectors (suitable for cogeneration), abundant and low-cost energy supplies (including waste coal), and available cogeneration sites. These underlying conditions strongly influence the relative pace of development. Also, utilities in Virginia and Pennsylvania have been very active in encouraging NUG development. The avoided cost rates available to NUG developers by Maryland utilities have been relatively low, discouraging development.

The emergence of NUG as an important resource raises questions of reliability of supply. NUG facilities do not have the same obligation to provide reliable service that Maryland's electric utilities have as part of their franchises. NUG facilities are typically commercial enterprises and can be expected to provide electric service and remain in business as long as it is profitable to do so. As mentioned earlier, many NUG facilities are natural gas-fired. Considering some projections of natural gas prices, there is concern that some non-utility generators may find it too expensive to operate in the future. If that were to happen, the utility would then have to take over the plant or replace the capacity. Other NUG facilities may enter into supply contracts with the utility, but then find that they cannot complete their projects. For example, much of the capacity contracted for by Allegheny Power System is currently facing legal challenges and may never be constructed.

Increased reliance upon NUG may also impact the operation of the transmission system. While the utilities normally plan and construct their intra- and interstate transmission networks to accommodate their own generation and load patterns, NUG facilities tend to site units in accordance with their own needs and opportunities. This may not always coincide with the existing transmission configuration and could give rise to local imbalances and stability problems.

Increased reliance on NUG resources in Maryland introduces new complexities and challenges in the utility planning process but, if properly managed, will not necessarily cause a degradation in reliability of service. Although the NUG facilities do not have the same reliability-of-service obligations as the utility, they have a strong business incentive to operate reliably and to meet contract obligations. There is much the utility and the PSC can do to ensure success. This would include establishing and ensuring conformance with appropriate engineering standards for construction, maintenance, operation, and interconnection; discouraging projects that may be unsound or flawed; informing potential developers of transmission limitations; and including appropriate contract provisions to encourage reliability and protect the utility's retail customers. These issues can be addressed cooperatively by the utilities, NUG developers, and the PSC to ensure that NUG is viable and reliable.

Projects owned, constructed, and operated by NUG developers are not subject to comprehensive or consolidated environmental review provided by the Power Plant Research Act under the PSC's jurisdiction. These projects are required, however, to obtain permits and approvals that address specific impacts on environmental media. Unlike the comprehensive plant licensing process for utilities, the permitting process for NUG facilities is not capable of addressing the relative impacts of installing several small NUG projects rather than a single large utility project to satisfy generation requirements. Further, dispersed siting of smaller NUG generating capacity can have a total environmental impact greater than that of the consolidated siting of typical utility power plants. At present, the State has no formal mechanism to look at the combined environmental impact of multiple, below-threshold sources.

E. Toward a Competitive Market for Bulk Power Supply

Important initiatives have been taken or are currently being considered that may alter in a fundamental way the manner in which the electric utility industry is organized and electric power is supplied. Efforts are underway to remove barriers to competition, and some observers foresee the electric utility industry evolving in a manner analogous to the gas industry. The impact of these changes on Maryland to date (and probably in the near term) is slight; but in the long run, Maryland can be expected to reflect the national trends.

Competition was introduced indirectly in the early 1980s with federal and state implementation of PURPA. The primary purpose of the cogeneration/small power sections of PURPA was to enhance supplies of efficient energy, not to make the utility industry more competitive. Indeed, the FERC avoided-cost rules created the framework for administratively determined prices, not competitively established prices. Nonetheless, during the late 1980s, the nonregulated NUG industry emerged, ready to challenge the traditional utility industry. Ironically, some of the most active participants in the NUG industry are the unregulated subsidiaries of the large electric utilities (including Maryland electrics).

The experience with PURPA during the 1980s was very uneven; some states (e.g., California) encouraged far too much development and aggravated excess capacity problems, while in other states little development occurred. Some states, notably in New England, began to experiment with competitive bidding arrangements as an alternative to the FERC framework of administratively determined avoided-