RESEARCH TRIANGLE INSTITUTE

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Environmental Considerations Associated with Electric Industry Restructuring in North Carolina

Final Report

Prepared for

Legislative Study Commission on the Future of Electric Service in North Carolina
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Suite 545
Raleigh, NC 27603-5925

Prepared by

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Center for Economics Research
Research Triangle Park, NC 27709

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Acknowledgments

Several organizations and RTI staff members contributed to this report. ElectriCities, North Carolina Electric Membership Corporation, Carolina Power and Light, Duke Power, and North Carolina Power contributed recent data on conservation and load management programs, solar and renewable energy efforts, and qualifying facility (QF) contracts. The North Carolina Solar Energy Association, the North Carolina Solar Center at North Carolina State University, the Energy Division of the North Carolina Department of Commerce, and the Division of Air Quality of the North Carolina Department of Environment and Natural Resources contributed additional data and study reports. At RTI, Brad Eccles, Ryan Avent, and Steve Johnston were primary contributors. They were assisted by RTI environmental scientists and engineers in the preparation of the air quality section. Steven Rose, project manager for the Study Commission, and Esther Manheimer of the Commission staff provided valuable review comments.

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Executive Summary

This report discusses environmental considerations associated with a restructured electric utility industry in North Carolina. The material in this report was developed pursuant to Task Order Authorization #9 between Research Triangle Institute (RTI) and the Study Commission on the Future of Electric Service in North Carolina (the Commission). The Commission is investigating whether retail electric competition should be introduced in North Carolina and, if so, when and how.

The purpose of this report is to provide background information and an overview of potential policy options, not a comprehensive evaluation of these options. The background information is presented at an aggregate level and does not contain detailed cost, performance, and reliability data on the myriad solar and renewable technologies that are either currently available or becoming available in the marketplace. The potential policy options are ones that are typically being considered by several other states that are in the process of restructuring their retail electricity industry.

The environmental considerations addressed in this study include

- energy conservation and load management,
- solar and renewable energy, and
- air quality.

We conducted a survey of electric utilities to gather information on their energy conservation and load management and solar and renewable energy efforts during the past decade. We also collected information on their contracts with qualifying facilities (QFs, as defined in the Public Utility Regulatory Policies Act of 1978). The results of this survey were informative and are summarized in Sections 2 and 3.

Energy conservation and load management efforts have generally continued without diminution at rural electric cooperatives and municipal power agency member cities. The investor-owned utilities (IOUs) have reduced their energy conservation and load management program efforts considerably, although kW load and kWh energy savings from their earlier efforts continue.

Solar and renewable energy efforts, which enjoyed a modest level of IOU support in the 1980s, have also declined. One aspect of these efforts is the purchase of power by IOUs from QFs. Most of these power purchase contracts have involved generation from small hydropower and biomass resources and from cogeneration of steam and power by industry. Many of these power purchase contracts are no longer economically attractive from an IOU perspective, because the prices IOUs offer for this power, which are based on their avoided costs as set by the North Carolina Utilities Commission (NCUC), are lower now than when these QFs began operating.

IOUs' reduction in interest and effort in energy conservation and load management and in solar and renewable energy is primarily a reflection of a reduction in these programs' financial value to these utilities and their ratepayers as a group (i.e., the programs are not cost-effective from an IOU perspective). This reduction in value, in turn, is related to reductions in IOUs' need for new capacity and the lower cost of that capacity. Solar and renewable energy technologies are more expensive than conventional generation technologies, although their installed cost has been falling in the past decade, and their fuel cost is zero (solar) or low for many renewables. Conventional generating technologies themselves, especially gas technologies, have experienced efficiency improvements and, in some cases, fierce cost competition.

The discussion of air quality in Section 4 includes a synopsis of the current air quality situation in North Carolina, with special emphasis on the ground-level ozone problem and emissions of nitrogen oxides (NO_X) as a key precursor to this problem. It includes a discussion of recent efforts by the U.S. Environmental Protection Agency and North Carolina Department of Environment and Natural Resources (NCDENR) to address NO_X emissions. The main point of this discussion is that an air quality problem exists, it will exist regardless of whether the electricity utility industry is restructured, and it will be addressed (although the outcomes are uncertain at this time) by existing environmental protection agencies within their existing or expanded regulatory powers.

Although all the topics addressed in this report are related to environmental quality, whether restructuring the electric industry in North Carolina will result in changes in this quality is uncertain. This uncertainty is based on several considerations that are discussed in Section 5 and is primarily related to whether restructuring will lead to greater or lesser reliance on coal-fired generating units.

Section 5 also discusses policies that other states are considering or instituting as part of electric industry restructuring. These policies include

- environmental disclosure,
- net metering,
- green power,
- renewable portfolio standard,
- public benefits fund, and
- tax incentives.

In addition, at least one state (Texas) has included an explicit provision for the recovery of environmental compliance costs from ratepayers.

Some of these options are more controversial than others and may result in higher costs to customers to achieve the environmental and public health benefits they offer. Consideration of these options should include an evaluation of all the costs and benefits, including how the costs would be received and from where and who would receive the benefits.

Because the effect of electric industry restructuring on environmental quality is uncertain at this time, the discussion of policies in this section should not be construed as policy recommendations. Instead, the policies discussed should be viewed as ones the Commission or its designee could consider if restructuring does occur, and if it appears that environmental quality is likely to degrade as a result of this restructuring. Key state agencies that can help monitor this situation and help determine whether degradation is occurring as a result of restructuring include the NCDENR, the Energy Division in the North Carolina Department of Commerce, and the NCUC and Public Staff.

1 Introduction

This report on environmental considerations associated with electric industry restructuring in North Carolina is one in a series of studies being conducted by Research Triangle Institute (RTI) for the Commission on the Future of Electric Service in North Carolina (the Commission). These studies are all related to the overall topic of restructuring North Carolina's electric utility industry. They are designed to assist the Commission with decisions of whether to introduce electric retail competition into North Carolina and, if so, when and how.

The purpose of this report is to provide background information and an overview of potential policy options, not a comprehensive evaluation of these options. The material in this report was developed pursuant to Task Order Authorization #9 between RTI and the Commission. It includes a discussion of the following subjects:

- recent experience of North Carolina's electric utilities in the following areas:
  - ✓ energy conservation and load management programs (also called demand-side management, or DSM),
  - ✓ solar and renewable energy programs, and
  - ✓ qualifying facility (QF) contracts (as defined by the Public Utilities Regulatory Policies Act of 1978);
- energy program trends at the state agency level;
- recent air quality developments in North Carolina;
- the effect of restructuring the electric utility industry on the environment; and

- policy options that are being considered elsewhere to maintain environmental quality in a restructured electric utility industry.

DSM programs reduce electricity usage, which leads to a reduction in the amount of fuel used to generate electricity. By reducing fuel use, DSM programs also reduce pollutants that are a by-product of electricity generation from certain fuel types (e.g., the release of oxides of nitrogen, or NO_x, from the combustion of coal to generate electricity).

Solar and renewable energy resources are resources that are not in fixed supply and many are environmentally benign (with attendant public health benefits) when used to produce electricity. Examples of renewable energy sources other than solar include wind, biomass (e.g., trees and agricultural crops), and agricultural and municipal waste. Some of these resources (e.g., solar) are more environmentally benign that others (e.g., municipal waste) when used to produce electricity. The amount of electricity that can be produced from these resources depends on their availability and their energy content. As a result, they have traditionally been used in applications that are smaller than traditional utility-scale applications, in remote and resource-rich areas, and by electricity customers as well as utilities.

Solar and renewable energy for electricity generation can often promise lower fuel costs (especially solar), but the cost per unit of electric generation capacity is typically higher than for conventional power plants. This capacity cost differential has been declining with time, however. Other potential advantages of solar and renewable energy are presented in reports by the North Carolina Solar Energy Association and the North Carolina Solar Center (see NCSEA [1998]).

No policy prescriptions are offered in this report. Indeed, it is not clear at this time whether restructuring the utility industry in North Carolina will result in environmental quality changes. However, because of the importance of environmental quality to North Carolinians and the potential risk to it that any major change in industrial policy may have, it is advisable for the Commission to consider potential environmental risks with restructuring and policy options to address them. The information in this report should be viewed as background information on environmental issues and policies that can be used to inform policy discussions by the Commission and others.

2 Energy Conservation and Load Management

This section describes the recent experience in North Carolina with energy conservation and load management programs, also called demand-side management (DSM) programs. The first part describes the types and goals of utility and government DSM programs. The second part describes the recent history of DSM by North Carolina utilities and state agencies.

2.1 BACKGROUND

DSM programs have been supported by utilities, particularly during periods of rapidly escalating costs of generation. They have also been supported by state and federal agencies, particularly during periods of high oil prices.

2.1.1 Utility-Sponsored DSM Programs

This section discusses the types of utility-sponsored DSM programs. It follows a classification scheme developed by the Electric Power Research Institute (EPRI). The rationale for utility-sponsored DSM is presented at the end of the section.

Types of Programs

Utility DSM programs fall into five broad categories: conservation, load shifting, peak shaving, valley filling, and strategic growth. Each program has a unique objective and method for obtaining that objective. Some programs may exhibit characteristics that fall into several categories, but these categories serve as a general way of describing utility DSM programs.

Conservation. Conservation programs seek to lower the total amount of energy used systemwide. Conservation programs are often employed when utilities face high fuel costs and their rates do not reflect these costs. Because the utility's rates do not accurately reflect the marginal cost of the utility, the utility tries to reduce the amount of energy consumed. The utility may also offer conservation programs because customers request them and the programs help the utility reduce its emissions of pollutants into the environment.

Conservation programs reduce total energy consumed by encouraging consumers to install equipment that uses energy more efficiently. For instance, utilities may offer incentives for installing high-efficiency air conditioners, refrigerators, or heat pumps.

Load Shifting. Load shifting programs attempt to shift energy use from the utility's peak use period to off-peak periods. Utilities must build enough generation to serve their peak load. However, the generation that is built only to serve the peak period will often be idle, and the building cost of this generation will be spread over fewer kWhs. Because rates often do not reflect that on-peak consumption is more costly to the utility than off-peak consumption, the utility attempts to shift consumption from on-peak to off-peak periods. This is particularly true when the construction cost of new plants is high.

Load shifting programs involve either voluntary curtailment of certain energy use or utility-controlled shutdown of certain energy use. For instance, water-heating control is a common load-shifting program. A water heater can store hot water for several hours, so a person participating in a water heater control program will allow the heating element in the water heater to be shut off during the utility's peak demand period. The water is then re-heated during the off-peak period. Similar programs exist for air conditioning and heating. The consumer is given some kind of incentive on their rates for participating in the program.

Peak Shaving. Peak shaving attempts to lower the utility's overall peak demand. Peak shaving programs differ from load shifting programs in that the energy that is foregone during the peak period is not necessarily shifted to another time period. Therefore, there is not only a reduction in the system demand but also a small reduction in the energy consumed.

Peak shaving programs often involve industrial/commercial or residential customers voluntarily allowing the utility to shut down power to certain power uses during the utility's peak hours. Peak shaving allows the utility to limit the system peak and thus avoid construction costs associated with building generation to meet that peak.

Valley Filling. Valley filling is a DSM program that attempts to make better use of the current generation needed to meet peak demand by increasing usage during the off-peak periods. Valley filling offers incentives to customers to use more energy during the off-peak periods. This program allows the construction costs associated with building new plants to be spread over a greater number of kWhs, thus lowering the average cost per kWh that the utility has to charge.

One example of valley filling programs is the use of outdoor lighting. Utilities often offer incentives for customers to install outdoor lighting. Installation of outdoor lighting increases energy use in off-peak periods because the outdoor lights come on at night when energy use is low.

Strategic Growth. Strategic growth is not a conservation initiative, but it is aimed at reducing utility costs through DSM. The goal of strategic growth is to encourage "smart growth" in new loads that are added to the system. Smart growth will improve future system load factors and help to reduce the need for new generating capacity to serve new loads.

One example of strategic growth is incentive programs for the purchase of heat pumps. Heat pumps make the winter peak more in line with the summer peak. Thus, a plant that has to be built to meet a summer peak load is run at a higher capacity for a greater portion of the year.

Rationale

In North Carolina, the primary motivation for DSM has been to avoid utility cost and customer rate increases rather than to reduce environmental emissions. Utilities have traditionally offered DSM programs when regulated rates are substantially below their marginal cost of supplying additional energy. Because it is often difficult to bring rates in alignment with cost on a continuous basis, utilities use DSM to reduce demand during times that the utilities' costs are above what they are allowed to charge.

There is also the issue of whether costs should be measured from a private-sector perspective (private costs) or a public-sector perspective (social costs). Social costs include costs associated with pollution and are referred to as environmental externality costs. The costs of compliance with environmental laws and regulations are reflected in the prices charged for electricity. Including environmental externality costs beyond these compliance costs would increase electricity prices. The inclusion of environmental externality costs in electricity prices is a controversial topic and historically has not been accepted by the North Carolina Utilities Commission (NCUC).

Utilities have to build or buy enough generation to serve their maximum yearly demand and provide a reserve. If utilities choose to build generation to meet a demand that only occurs 10 percent of the time, then that generation will remain idle for 90 percent of the year. Thus, the building cost of that generation will only be spread across a few kWh, and the cost of power for the highest 10 percent of the time will be much higher than the system average. Similarly, if the utility buys generation to meet its peak load, it will likely be purchasing generation at the exact time that it is most expensive to buy. This is because demand is likely to be high for other utilities at the same time as demand is high for the purchasing utility. Because the utility has to charge a relatively constant rate over time of day and time of year, during high demand periods it is selling power below marginal cost. It is in the customer's and the utility's interest to have a more constant load over time of day and time of year so that the construction cost of generation built to serve peak demand can be spread over a larger number of kWhs. This can be achieved with DSM programs that reduce kWh usage during peak periods, increase off-peak kWh usage, or shift kWh usage from peak to off-peak periods.

A second reason for utilities to offer DSM programs is that, if the construction cost of plants is high, a utility would like to avoid building new plants until a time when the climate for building new plants is better. To do this, utilities may engage in DSM activities intended to slow load growth and, in particular, growth in peak demand.

A third reason that utilities may engage in DSM is if they face high fuel or energy costs. If they face these high costs without the ability to change their rates to reflect these costs, it may be in the utility's interest to offer incentives to get customers to consume less high-cost energy.

Investor-owned utilities' (IOUs') interest in DSM programs has waned in recent years primarily because the cost of supplying power has stabilized. From the IOU's perspective, the avoided energy and capacity costs attributable to DSM investments are no longer large enough to justify these investments. Interest in DSM programs by municipal electric companies and rural electric cooperatives has not waned, primarily because they are still able to use DSM to achieve reductions in the cost of the wholesale power they purchase from IOUs.

Evaluation of IOU DSM Programs: The RIM Test

In determining whether DSM program investments will be allowed in the rate base of an IOU, the NCUC uses the Ratepayer Impact Measure (RIM) test. The key feature of the RIM test is that it considers the impact of the DSM program on both customers participating in the program and nonparticipating customers. The RIM test measures the cost-effectiveness of DSM programs by evaluating the cost impact on all customers. According to the *Standard Practice Manual: Economic Analysis of Demand-Side Management Programs*, "The RIM test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program" (California Energy Commission, 1987). In addition, the EPRI (1992) End-Use Technical Assessment Guide notes that the RIM test is the only cost-effectiveness test that includes an assessment of the impact of a program on the nonparticipating customers. The RIM test evaluates a program's impact on rates charged to all customers. Programs that pass the RIM test result in rates being less than they would otherwise be. Conversely, a program that would result in higher rates will fail the RIM test.

Conservation programs tend to have a difficult time passing the RIM test because total kWh usage is reduced, and the utility's fixed costs are spread over fewer kWhs. Therefore, program nonparticipants have to pay a larger share of these fixed costs than they did before the program, and their rates will rise if this effect is not fully offset by a reduction in variable costs.

Relation of DSM Programs to Environmental Considerations

DSM programs can affect the environment in two ways. First, they can change the amount and type of generation that has to be built, thus reducing the environmental impact associated with generation from new capacity. Second, they can affect the amount and type of fuel used. A reduction in energy generation reduces the amount of fuel consumed. Reduced fuel consumption results in reduced air emissions, except for nuclear fuel, which has no air emissions.

2.1.2 Federal/State DSM Initiatives

This section presents the major types of government-based DSM initiatives that are targeted to the private sector. The rationale for these initiatives is presented at the end of the section.

The key reasons for federal/state support of DSM programs are cited below. The major types of support are also presented.

Types of Initiatives

Information Programs. Information programs inform the public about ways they can reduce their energy consumption. Many federal and state programs fund the dissemination of information on reducing energy consumption. Agencies may maintain web sites, distribute pamphlets or research reports, and conduct seminars and classes on energy efficiency.

Incentive Programs. To encourage people to install energy-efficient equipment, federal and state taxing authorities often offer incentive programs to people installing the equipment. Some programs allow customers to deduct the cost of the equipment or improvement from federal and state taxes; others offer a tax credit for installing the equipment. These incentive programs are often administered through the federal and state taxing authorities and are often supported by federal and state energy agencies.

Research Programs. Many state and federal agencies support research into ways to conserve energy. This support is often made in the form of grants to universities and nonprofit organizations. These groups research design changes in building codes and standards that can lead to more energy-efficient housing. They also research methods for reducing energy consumption by using solar or other energy sources.

Rationale

Reduce National Reliance on Energy. The energy crisis of the 1970s led federal and state governments to adopt programs aimed at reducing the nation's overall reliance on energy and, in particular, oil. Energy-efficiency programs encourage more efficient use of energy, which lowers the overall reliance of consumers and industry on electricity and the fuels necessary to create it.

Environmental Considerations. State and federal governments also promote energy-efficiency programs for environmental reasons. Energy-efficiency programs reduce the total amount of energy consumed, so emissions from plants that produce energy also fall.

Help in Reducing Bills for Citizens/Corporations. State and federal programs may promote energy efficiency to help consumers reduce their electric bills. In particular, initiatives aimed at reducing the electric bills of low-income consumers are often emphasized. They may also encourage industrial development by providing low-cost services (e.g., energy audits) to corporations locating in the state.

2.2 RECENT HISTORY AND TRENDS OF DSM PROGRAMS IN NORTH CAROLINA

RTI conducted a survey of utilities in North Carolina to identify recent (1990s) trends in DSM program experience. A copy of the data collection template is included in Appendix A. The result of that survey, and of discussions with state energy personnel, are included in this section.

2.2.1 Utilities

The primary emphasis of DSM programs for North Carolina utilities has been load management rather than conservation or energy efficiency. Load management primarily includes load shifting and peak shaving programs.

The 1980s were the peak period for DSM program activity; since then, DSM expenditures have declined because construction and fuel costs were not as high in the 1990s as they were in the 1980s. Consequently, DSM programs are not as cost-effective from the utility's perspective as they once were. The sharpest decline has occurred in recent years as North Carolina utilities have begun to prepare for a competitive market. In particular, conservation programs, which reduce demand, have declined the most.

Data Considerations

Before viewing the figures relative to individual utilities, we discuss the data on which these figures are based. The utilities do not follow a uniform reporting process that contains all the information reported for every year. The analysis presented here is based on data submitted individually from each of North Carolina's major electric utilities. Because recordkeeping requirements differ from utility to utility and year to year within a given utility, we were unable in some instances to make a straightforward comparison of utilities. In some cases, we were not able to look at the same time span for all utilities, and in some cases we were not able to show the same information categories for all utilities.

IOUs

IOUs have typically offered a wider variety of programs than the publicly (POUs) and customer-owned utilities (COUs). Over the last 6 years, IOU expenditures on DSM have decreased for both Duke and North Carolina Power. It appears that expenditures for CP&L have not decreased, possibly because of inconsistencies between the data available from CP&L and the data from the other IOUs (CP&L provided data through 1996, whereas Duke and North Carolina Power provided data through 1998). Also, conservation program expenditures have declined for both Duke and North Carolina Power over the last 6 years. CP&L conservation expenditures have not decreased, perhaps again because of differing time periods of data. All of the IOUs show a decrease in the total amount of *incremental* kWhs per year saved between 1992 and the latest year for which data were available.

Duke. As Figures 2-1 and 2-2 show, Duke Power's DSM expenditures dropped from approximately $43 million in 1992 to roughly $20 million in 1998. Along with the decrease in total expenditures, the composition of DSM expenditures also changed. In 1992, conservation activities, such as incentives encouraging the installation of high-efficiency equipment, represented 17 percent of Duke Power's total DSM expenditures. In 1998, Duke Power's only DSM expenditures were for peak shaving programs, such as interruptible service.

Figure 2-1. 1992 Duke DSM Expenditures by Type

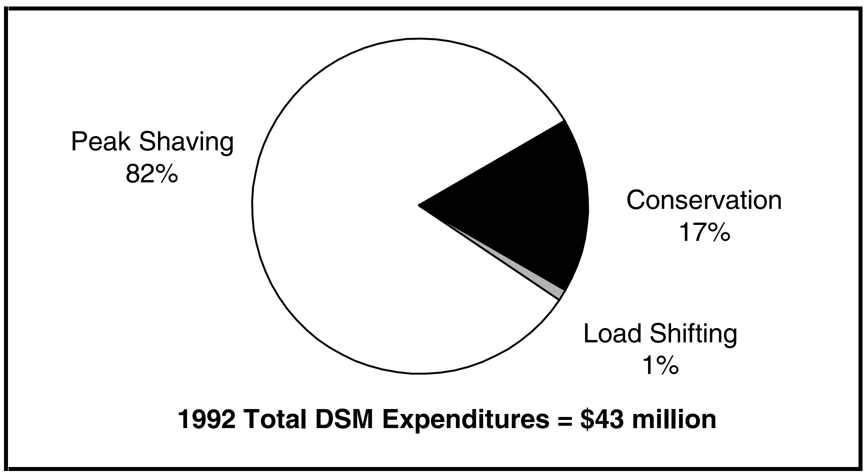
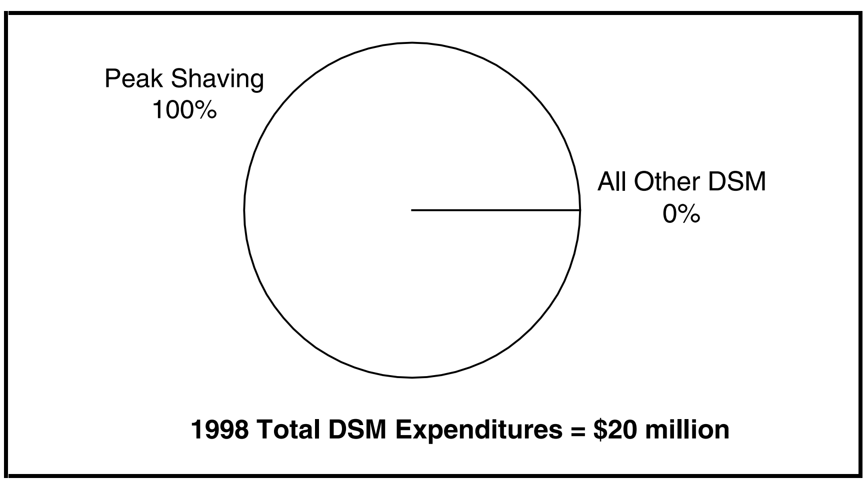
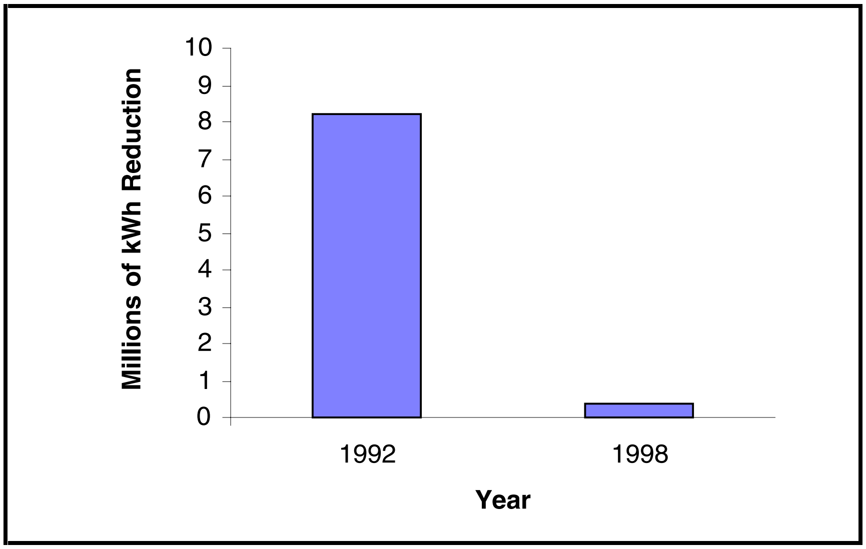


Figure 2-2. 1998 Duke DSM Expenditures by Type



Duke Power also saw a sharp decline in the total amount of kWhs saved between 1992 and 1998 (see Figure 2-3). Between 1992 and 1998, Duke Power's kWh reduction fell from roughly 8 million kWh to 400,000 kWh. The kWh reductions in 1998 reflect only reductions occurring as a side effect of peak shaving DSM, because Duke had no conservation programs in 1998.

Figure 2-3. Incremental kWh Reduction from DSM Programs: Duke



North Carolina Power. As Figures 2-4 and 2-5 illustrate, North Carolina Power's DSM expenditures fell sharply between 1992 and 1998. In 1992, North Carolina Power had DSM expenditures of approximately $28 million, and in 1998 total expenditures fell to approximately $12 million. Conservation activities represented 3 percent of total DSM expenditures in 1992, and in 1998 North Carolina Power had no expenditures on conservation activities. North Carolina Power's primary DSM activities in 1998 were load shifting activities, such as load control devices on water heaters, and valley filling activities, such as outdoor lighting.

The amount of kWhs saved by North Carolina Power's DSM programs fell from 1992 to 1998 (see Figure 2-6). In 1992, North Carolina Power saved approximately 20 million kWh. In 1998, North Carolina Power's DSM programs increased the amount of kWh consumed by 100 million kWh. This increase in kWhs is a result of North Carolina Power's emphasis on valley filling because

Figure 2-4. 1992 North Carolina Power DSM Expenditures by Type

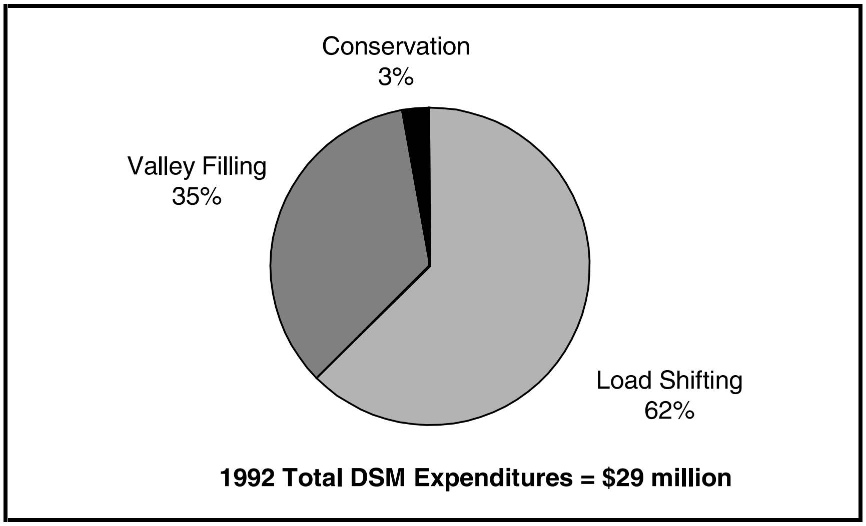


Figure 2-5. 1998 North Carolina Power DSM Expenditures by Type

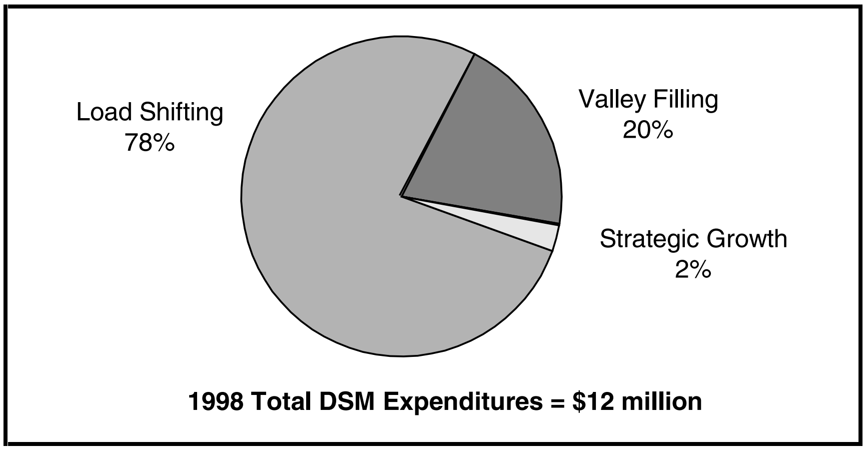
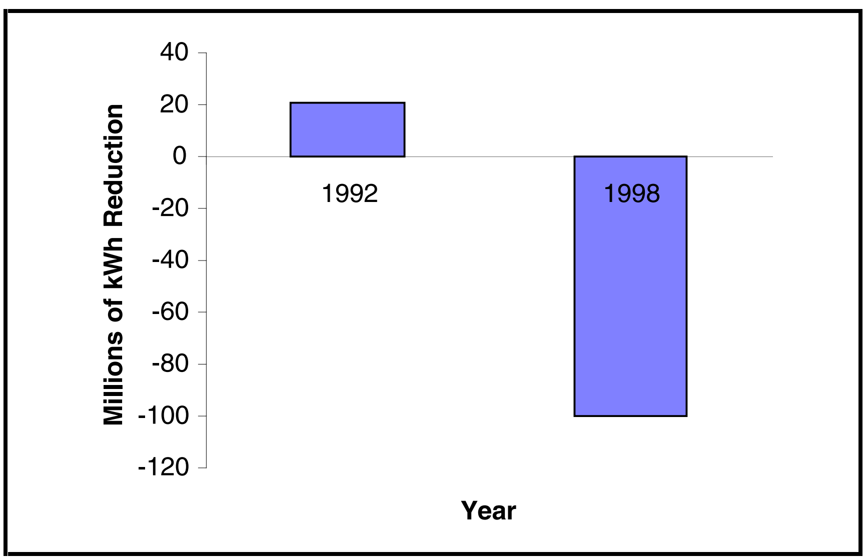


Figure 2-6. Incremental kWh Reduction from DSM Programs: North Carolina Power



this program leads to an increase in the total amount of kWh consumed. Since Figure 2-6 reflects reductions in kWh consumed, the increase in consumption from valley filling is represented as a negative reduction.

CP&L. Because complete data on kWh reductions through 1998 were not available for CP&L, Figures 2-7 and 2-8 focus on the period from 1992 through 1996. From 1992 to 1996, CP&L's total DSM expenditures increased from $30.9 million to $48.1 million. Conservation expenditures increased over the period from 42 percent to 52 percent of total DSM expenditures. This increase in spending from 1992 to 1996 was followed by decreases between 1996 and 1998. Also, many of CP&L's programs encompass several DSM objectives; for Figures 2-7 and 2-8, we counted only the objective listed first by CP&L when they provided the data to us. This could potentially over- or underestimate the true composition of CP&L's DSM expenditures.

Like other North Carolina IOUs, CP&L's kWh reductions per year fell sharply over the time period (see Figure 2-9). In 1992, CP&L had reductions of 594 million kWh, and in 1996 this number had fallen to 97,600 kWh. CP&L's number in 1996 is still significantly larger than other utilities, most likely because of CP&L's emphasis on energy-efficiency programs.

Publicly and Customer-Owned Utilities

POUs in North Carolina have tended to focus primarily on load control programs such as peak shaving. These programs tend to have minimal or no kWh reduction. COUs have focused on both load control and conservation programs, frequently through low-interest loan programs they provide. COUs have also tended to have high participation rates, reflecting the fact that their owners are also their customers.

POUs and COUs have not reduced their DSM activity to the same extent that IOUs have. In part, this continued interest in peak shaving by POUs and COUs is related to the substantial cost savings they can achieve under the Federal Energy Regulatory Commission (FERC)-regulated wholesale rates they are charged for

Figure 2-7. 1992 CP&L DSM Expenditures by Type

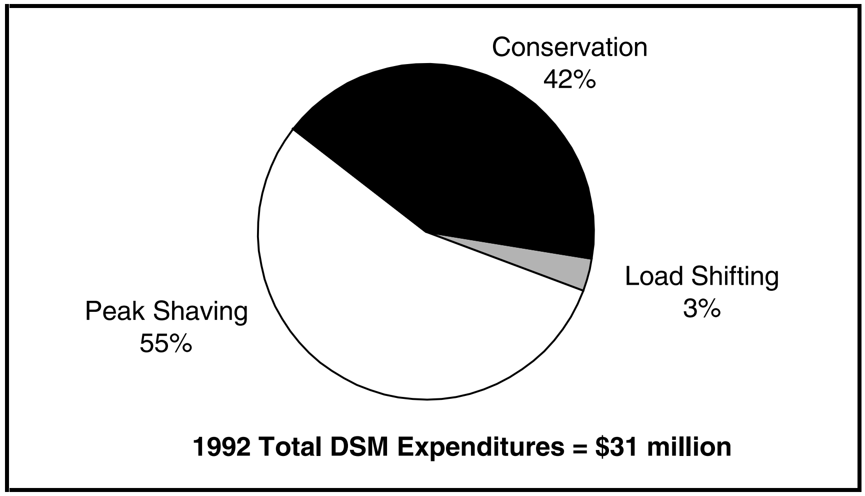


Figure 2-8. 1996 CP&L DSM Expenditures by Type

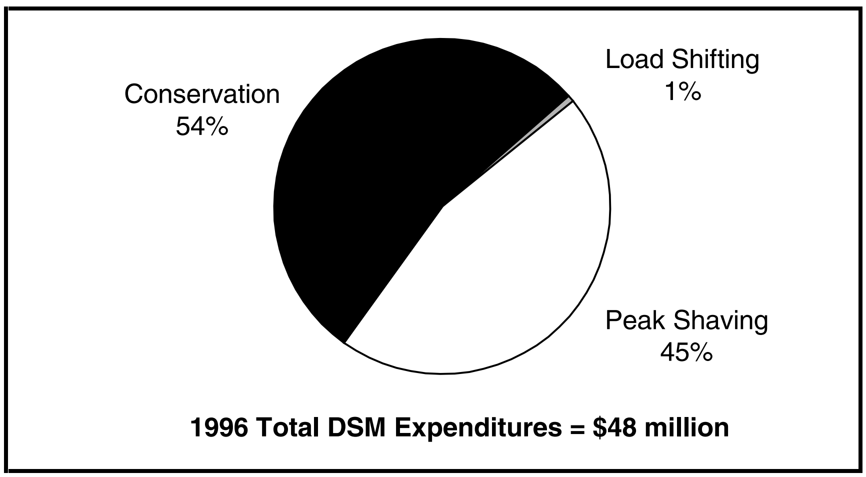
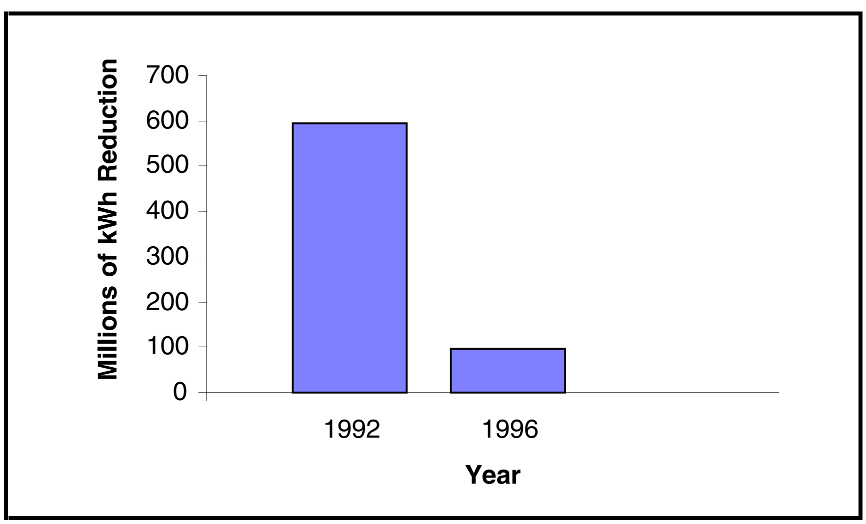


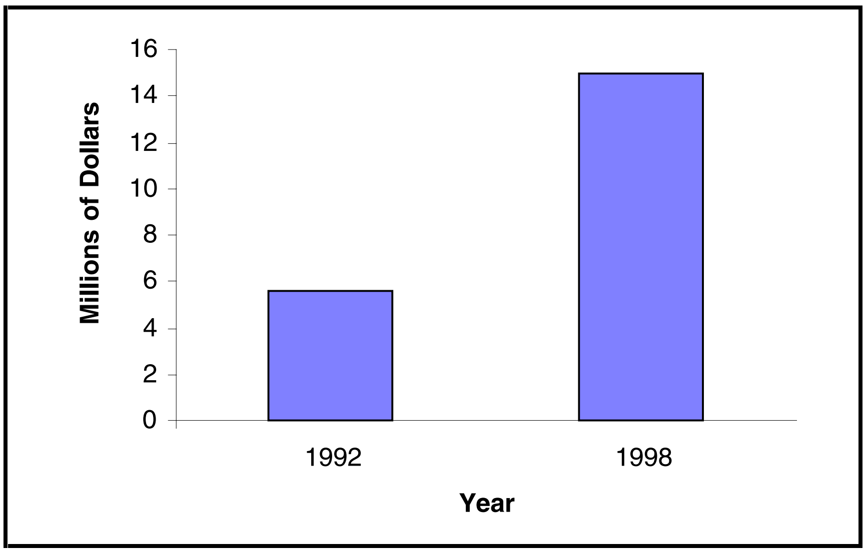
Figure 2-9. Incremental kWh Reduction from DSM Programs: CP&L



power purchases. Since POUs and COUs do not have to report to the NCUC, some of the data available for IOUs are not available for POUs and COUs.

NCEMC. As Figure 2-10 shows, since 1992 NCEMC's DSM expenditures increased from $5.5 million to $15 million in 1998. NCEMC's expenditures have been entirely in the area of peak shaving. NCEMC's peak shaving programs consist of direct load control programs for both industrial and residential customers. No kWh savings data were available for NCEMC. These data are for DSM programs that are offered to member co-ops through NCEMC, and all of the member co-ops participate. Individual co-ops may have separate DSM programs. Data from these programs were not included in NCEMC's submission however, because NCEMC does not keep records on them.

Figure 2-10. NCEMC DSM Program Expenditures



NCEMPA and NCMPA1. NCEMPA and NCMPA1 primarily focus on direct load control DSM. These programs control water heaters and air-conditioning units during peak demand periods. Data were not available on the expenditures for these programs because expenditures are made directly by the member municipalities.

NCEMPA and NCMPA1 also engage in conservation through audits performed on industrial customers to help them better use energy. Data were also not available on kWh savings from these programs.

2.2.2 State

The primary source for state conservation initiatives is the North Carolina Energy Division, which is a division within the Department of Commerce that provides programs supporting energy efficiency, conservation, and renewable energy in North Carolina. We describe the Energy Division's conservation programs and the funding sources.

Conservation Programs

Conservation programs sponsored by the Energy Division provide services in one of six major categories:

- ➤ education and training, such as workshops and publications on how to better conserve energy
- ➤ diagnostics, such as testing and analysis of energy-efficiency technologies
- ➤ demonstrations of energy-efficient equipment and processes
- ➤ financing that provides low-interest loans for the installation of energy-efficient equipment or insulation
- ➤ policy development, such as participating in the development of energy policies that encourage conservation
- ➤ energy technology development, such as supporting research on the creation of new technologies that help North Carolina consumers conserve energy

The conservation services listed above are primarily provided through the State Energy Plan (SEP). The SEP promotes the efficient use of energy resources to reduce energy consumption. Through the SEP, the North Carolina Energy Division provides technical assistance, public awareness programs, and energy-saving training to industry, government, and individuals. In addition to the SEP, the Energy Division also provides conservation services through the Weatherization Assistance Program (WAP). The WAP provides insulation and weather stripping to low-income consumers. Two other programs also provided conservation services prior to 1996: the Energy Extension Service, which provided conservation information to small energy users, and the Institutional Conservation Program, which provided matching funds for conservation in schools and not-for-profit hospitals. Both of these programs have depleted their funding; however, some of their activities have been moved into the SEP.

Funding

Funding for conservation programs primarily comes from two major sources: Petroleum Value Escrow (PVE) accounts and the U.S. Department of Energy (DOE):

- PVE accounts are funds allocated to the state treasury as part of a national settlement against several large petroleum companies. The North Carolina state treasury holds these funds in escrow and a portion is allocated yearly to the North Carolina Energy Division. As a consequence of the settlement agreement, the uses of these funds are limited. In particular, all of the funds must be used to meet some energy-related need that serves all the citizens of North Carolina. Some additional restrictions are also placed on some of the funds. For instance, only one account can be used to match federal funds.
- DOE funds are provided to the Energy Division as part of federal grants. Most of these funds require that the Energy Division match these funds. Matching requirements vary from 20 percent to 50 percent.

Recent Funding Trends

As Figure 2-11 shows, SEP funding dropped dramatically between 1997 and 1999 for two reasons. In 1998, DOE funds dropped and PVE funds stayed relatively constant. In 1999, PVE funds dropped dramatically, which offset the increase in DOE funds between 1998 and 1999 and reduced SEP funding to its 5-year low of $1.66 million.

Figure 2-11. North Carolina State Energy Plan Funding History

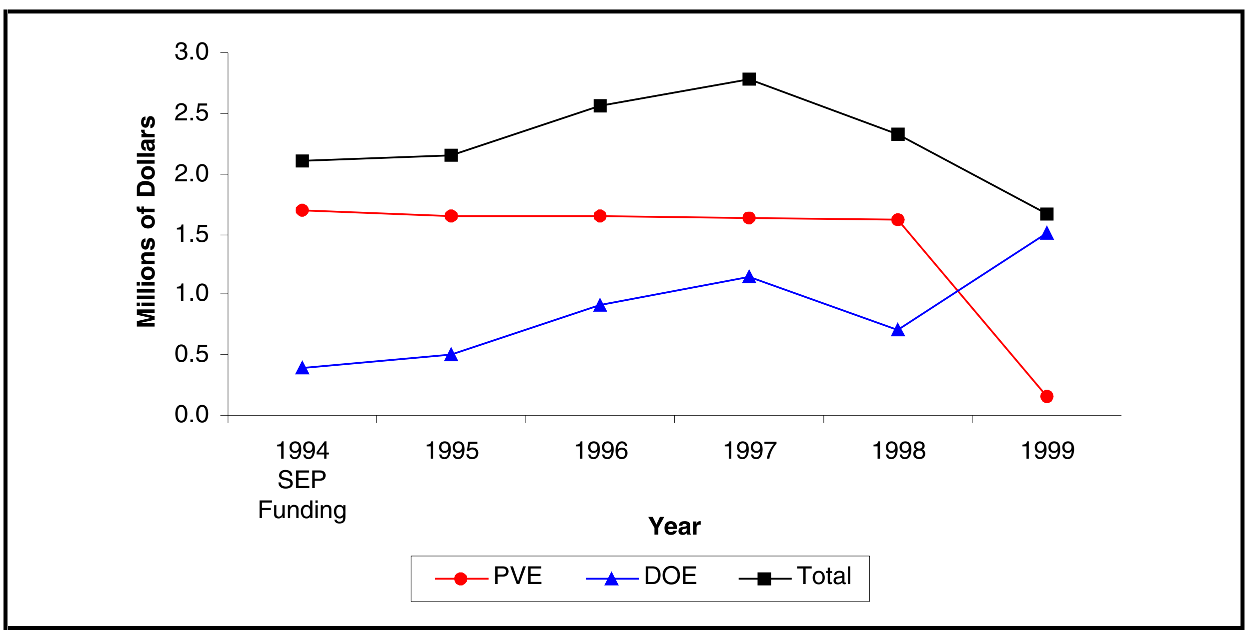
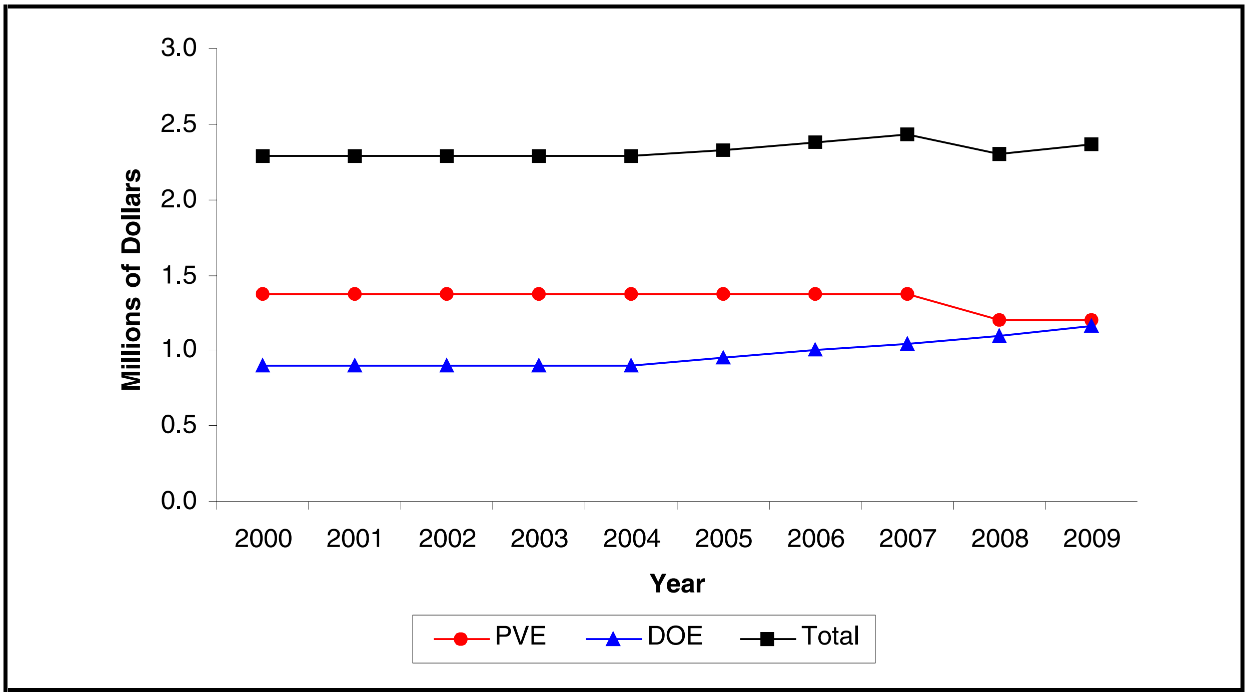


Figure 2-12 is based on an Energy Division 10-year forecast for their SEP programs. The Energy Division estimates that their funding will rebound from its 1999 value for the most part because of increased PVE funding. However, over the next 10 years the Energy Division estimates that SEP funding will not recover to its 1997 level of $2.78 million and will remain below $2.5 million for the next 10 years.

Figure 2-12. North Carolina State Energy Plan Funding Forecast



2.2.3 Advanced Energy

An additional source of DSM initiatives is Advanced Energy. The primary mission of Advanced Energy is to increase efficiency and productivity in industries, businesses, and homes as they transform energy into goods, services, and environmental conditioning.

Advanced Energy was originally known as the Alternative Energy Corporation and was established in 1980 by the NCUC. Advanced Energy receives the majority of its funding from its member electric utilities, which are Duke Power, CP&L, North Carolina Power, and NCEMC. These contributions are based on a charge per kWh to customers. Programs conducted by Advanced Energy include education of customers and providers in energy-efficient building design and industrial processes and research into alternative energy fuel and advanced energy technologies.

3 North Carolina Solar and Renewable Activity

In this section, we provide an overview of different kinds of solar and renewable programs in North Carolina. First, this section defines the different types of solar and renewable resources and discusses estimates of their energy production potential in North Carolina. Second, it describes the recent activity in the area of solar and renewable programs for North Carolina as a whole and by utility and nonutility sources.

The utility activities reflected in this section are based on a survey conducted by RTI. The data collection template used in the survey is included in Appendix B.

3.1 SOLAR AND RENEWABLE PROGRAMS

Solar and renewable programs and generation fall into five major categories:

- active solar,
- passive solar,
- biomass,
- wind, and
- small hydro.

We describe each category and provide previous estimates (where available) of their energy production potential (called “resource” estimates) in North Carolina.

3.1.1 Active Solar

Active solar equipment uses the sun's energy to directly produce energy. The energy can be used for hot water heating, space heating, or electricity. One type of active solar equipment is a solar hot water collector. These devices are mounted on the roofs of houses and buildings and use solar energy to heat water for occupant use. Another type of active solar equipment is photovoltaic units. These units convert the sun's rays directly into electricity to be used in a variety of applications in remote areas as well as in grid-connected applications.

Resource estimates for solar equipment are difficult to obtain because solar and renewable equipment is installed primarily on individual houses. However, some estimates for household savings from installing solar and renewable equipment are available. Table 3-1 shows the estimated cost and savings from the installation of solar space and water heating for a typical residential home. The cost and benefits of the equipment vary according to the exact type of equipment installed, so we provide ranges in this table. It can be assumed that the high cost and high savings per year are for the same device.

Table 3-1. Estimated Cost and Savings from the Installation of Solar Space and Water Heating for a Small Residential Home[a]

Solar Equipment Use	Cost after Existing Tax Credits	Yearly Energy Produced (Mbtus)	% of Total Demand	Energy Savings/Year
Space Heating	\$180 – \$1,800	3 – 17.9	10% – 60%	\$27 – \$210
Water Heating	\$340 – \$982	5.01 – 13.07	26% – 69%	\$77 – \$407

[a]Estimates are for a 1,030 square foot Habitat for Humanity house in Raleigh. Annual savings increase with larger houses.

Source: North Carolina Solar Center. <http://www.ncsc.ncsu.edu>. As obtained February 2000.

Photovoltaic systems are currently not economically justified for most grid-connected applications; the key exception is backup power (when storage is included in these systems). The cost of photovoltaic systems makes the cost per kWh over the lifetime of the system high, although some utility customers in North Carolina have installed or indicated interest in these systems. Tests conducted at the North Carolina Solar Center (NCSC) in Raleigh show that the cost per kWh of an installed 1 to 2 kW photovoltaic system over its 20-year life would be between 30 and 40 cents/kWh (NCSC, 2000). This is approximately four to five times the residential rate for Duke and CP&L customers in North Carolina currently.

One estimate of total North Carolina solar energy production from North Carolina Energy Division records indicates that, if solar energy were used to its full potential, in 1995 8.88×10^{13} Btus of energy could be generated (Brown and St. John, 1981). This estimate is difficult to translate into kWh because the conversion efficiencies (from Btu into kWh) vary widely by type of technology. Also, the availability of this energy within the year varies by season and time of day. This estimate is from an old (1981) study, and many of the assumptions about the future marketplace and technology may not apply in today's market.

3.1.2 Passive Solar

Passive solar involves building designs that use the sun's energy for heating purposes. A passive solar building is a building specially designed as a well-insulated, low-technology solar collector for winter heating or lighting and shading of windows for lower summer energy use. Passive solar buildings can be houses that use passive solar features primarily for heating, or commercial and institutional buildings that primarily use passive solar features for lighting (a feature called "daylighting"). Another example of a passive solar system is an attached greenhouse. The greenhouse collects solar heat, which can be used for space heating. Yet another passive solar design is the use of a sunspace. A sunspace is a room with well-insulated glass windows and floors and walls designed to capture solar heat.

As with active solar equipment, resource estimates of the potential for passive solar equipment for the state as a whole are difficult to obtain. The NCSC does, however, have estimates of cost and benefits from passive solar equipment. The ranges of cost and benefits are presented in Table 3-2.

Table 3-2. Costs and Benefit Ranges for Passive Solar Systems[a]

Solar Equipment Use	Cost after Existing Tax Credits	Yearly Energy Produced (Mbtus)	% of Total Demand	Energy Savings/Year
Passive Solar	$0 – 1,800	3 – 17.9	10% – 60%	$27 – $210

[a]Estimates are for a 1,030 square foot Habitat for Humanity house in Raleigh. Annual savings increase with larger houses.

Source: North Carolina Solar Center. <http://www.ncsc.ncsu.edu>. As obtained February 2000.

3.1.3 Biomass

Biomass is a broad category of renewable energy that covers all energy produced from organic materials. Currently, the most utilized biomass energy resource for electricity generation is wood; however, biomass energy can also be obtained from sources such as municipal solid waste, land fill gas, agricultural by-products, animal wastes, and energy crops (e.g., sawgrass, corn). These biomass fuels are usually burned to produce steam for generating electricity. Biomass energy is produced predominantly by industrial operations as a by-product. It is also produced on energy farms, which harvest trees that are used in wood-fired boilers to produce electricity.

Resource estimates for wood energy are available from a 1993 study for the North Carolina Division of Forest Resources, prepared by RTI (Cleland, Guessous, and Leary, 1993). The study shows that, given North Carolina’s current growing stock of wood, wood energy could contribute 1,017 MW per year. The study also shows that, given the optimal size of wood chips or debris, electricity from wood can be produced onsite (i.e., prior to transmission or distribution of the power to offsite customers) as low as 5.6 cents/kWh. This is approximately 1.4 times the annual average wholesale price of power in North Carolina currently. These estimates do not include the potential for electricity generation from industrial processes that produce biomass energy as a by-product to their production processes. They do not consider aesthetic, environmental, or other concerns that may limit public acceptance and lower this potential.

3.1.4 Wind

Wind energy is harnessed by windmills, which drive turbines to generate energy. These turbines generally require substantial amounts of wind on a consistent basis to be economically feasible. To capture enough wind, the turbines must be located in unobstructed areas such as mountain passes, near open water, or offshore.

A study done in 1987 by Gilbert/Commonwealth for the North Carolina Alternative Energy Corporation concluded that wind energy was not economically feasible in North Carolina. The study tested wind levels in the North Carolina mountains and beaches and found that, based on a conceptual design, the energy cost from wind was substantially higher than North Carolina utilities' avoided cost. A 1995 study by Public Citizen (Freedman, 1995) projected that maximum wind potential in North Carolina was 8 million kWh per year, enough to supply power to 667 typical households (assuming a typical household consumes 1,000 kWh per month). This wind potential represents less than 0.01 percent of the total kWh consumed in North Carolina currently and does not consider aesthetic or other concerns that may limit this potential.

3.1.5 Small Hydro Dams

Small hydropower dams are located primarily on small rivers and lakes. Most of these dams were built in the early 1900s for water supply or for industrial purposes (e.g., textiles). Power generation was added to supply local residents or industry.

After biomass, hydropower from river flow and dams of all sizes probably has the highest resource potential of all sources for North Carolina. Public Citizen estimates that North Carolina has 3,338 MW of potential hydro capacity and 8,591 million kWh per year of potential hydro energy. Of this potential, they estimate that 1,877 MW and 5,351 kWh are currently operating. Much of this potential includes large hydro electric units owned by investor-owned utilities (IOUs). Public Citizen did not estimate how aesthetic, environmental, or other concerns might limit this potential or how much of this potential is cost-effective. Also, as noted previously in this section, many small hydro units are no longer economical for IOUs in today's electric market because their production costs exceed the IOUs' avoided costs (i.e., what it would have cost the IOU to produce an equivalent amount of electricity).

3.2 RECENT HISTORY AND TRENDS IN SOLAR AND RENEWABLE PROGRAMS

This section presents the recent history of solar and renewables programs. Additional information is available in a recent report by the North Carolina Solar Energy Association (1998).

3.2.1 Overview

North Carolina is below the national average for solar and renewable energy as a percentage of generation. In part, this reflects resource availability and cost considerations.

As Table 3-3 shows, the national average for solar and renewable generation as a percentage of total generation is 12.3 percent, whereas 7.2 percent of North Carolina's generation is from solar and renewable resources, according to this source. The comparison may be misleading because the national average is dominated by a few states that consume a large portion of their generation from solar and renewable resources. Even though North Carolina ranks below the national average in the percentage of energy from solar and renewable resources, it is ranked 19th out of 50 states and the District of Columbia in the percentage of generation from solar and renewable resources. The category in which North Carolina ranked the highest (18th) was hydroelectric generation.

The primary form of solar and renewable generation in North Carolina is in the form of hydroelectric power (see Figure 3-1). In 1995, North Carolina had 1,877 MW of hydroelectric capacity, and this capacity generated 5,351 million kWh of electricity, which represented 89 percent of total renewable energy generation in North Carolina. The only other major source of renewable electricity generation was from biomass energy. Biomass was 10.8 percent of total renewable generation. Biomass generation accounted for 123.7 MW of capacity and 650.2 million kWh of energy.

Table 3-3. Percentage of Total Electric Generation by Fuel/Energy Source, 1995

Fuel/Energy Source	United States	North Carolina	National Rank (Rank/Out of[a])
Coal	53.8%	64.9%	
Oil	3.1%	0.2%	
Nuclear	20.9%	27.4%	
Natural Gas	9.2%	0.3%	
Municipal Solid Waste	0.6%	~0%	
Hydropower	10.4%	6.4%	18/48[b]
Biomass	1.2%	0.8%	21/43
Solar Thermal Electric	~0%	0%	—/2[c]
Photovoltaic	~0%	~0%[d]	25/36
Wind	0.1%	0	—/18[c]
Solar/Renewable Total	12.3%	7.2%	19/51

Note: National rankings by state for coal, natural gas, oil, nuclear, and municipal solid waste are not reported in this table because they were not available in the source document.

[a]"Out of" refers to the total number of states reporting generation in the fuel/energy source category.

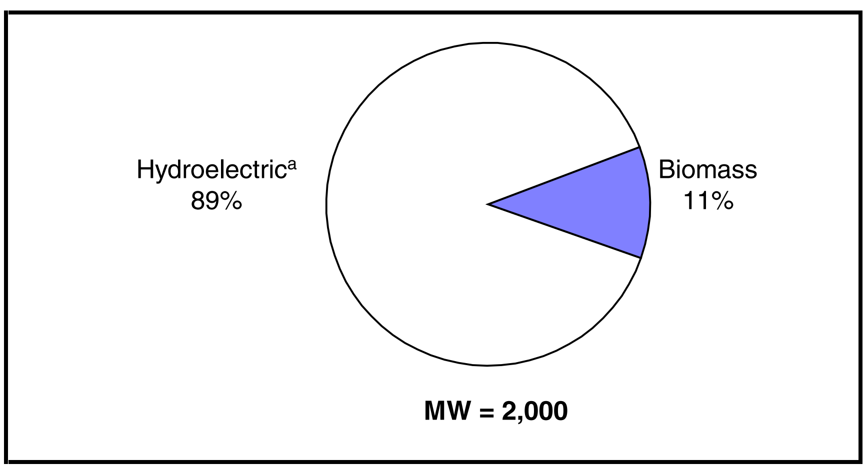
[b]Hydropower includes large utility-owned hydro.

[c]North Carolina does not have a ranking because no solar, thermal, or wind generation was reported.

[d]Photovoltaic represents less than 0.1 percent of total generation.

Source: Freedman, Matthew. 1995. *Renewable Energy Source Book: A Primer for Action*. Washington, DC: Public Citizen.

Figure 3-1. Composition of Renewables Capacity in North Carolina (1995)



[a]Includes large utility-owned hydro.

3.2.2 Utility Solar and Renewable Programs and Generation

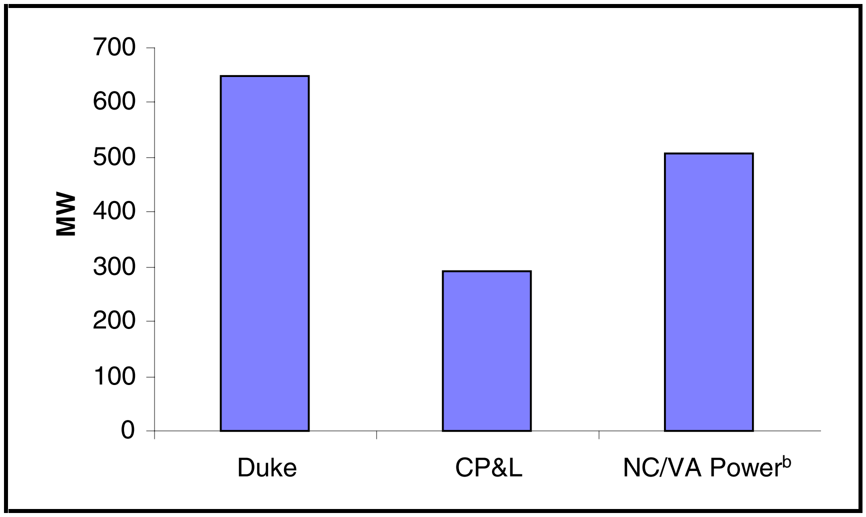
IOUs regularly evaluate the potential for various forms of power generation, including renewables, as part of their ongoing resource planning process. At the present time, the primary source of renewable energy for North Carolina utilities comes from hydroelectric plants and power purchased from qualifying facilities (QFs). QFs are generation facilities that qualify under Section 210 of the Public Utilities Regulatory Policy Act (PURPA) of 1978. PURPA requires that IOUs purchase power from generators that qualify under its regulations. IOUs are required to purchase power from these generation resources at a price equal to their avoided cost. The determination of avoided cost is under the jurisdiction of state utility commissions (e.g., the North Carolina Utilities Commission [NCUC]). Most QFs are hydroelectric, biomass, or cogeneration facilities. Cogeneration refers to industries that produce electricity as a by-product, use some or all of the electricity, and sell any remaining electricity back to the utility.

IOU power purchases from QFs have been declining recently as some of these contracts have expired and have not been renewed or replaced because IOU avoided costs (and thus the price of purchased power) have declined. This trend was most evident in the QF data provided to RTI by North Carolina and Virginia (NC/VA) Power, which submitted its data on the system level (rather than the North Carolina jurisdiction level).

As Figure 3-2 indicates, Duke has the largest amount of capacity in renewable resources with 532 MW in North Carolina. This total does not include pumped storage hydro capacity; Duke has pumped storage units in both North and South Carolina to help meet load fluctuations with their most cost-effective generation resources. NC/VA Power has 508 MW systemwide and CP&L has 293 MW of renewable capacity in North Carolina. These estimates do not include pumped storage hydro for NC/VA Power in Virginia, and they reflect the way the renewable energy data were provided to RTI—systemwide for NC/VA Power and North Carolina-wide for Duke and CP&L.

The majority of renewable electric generation is attributable to large IOU hydroelectric generation. Duke Power has 502 MW of large hydro generation in North Carolina (versus approximately

Figure 3-2. Renewable Energy by IOU (including large hydro but excluding pumped storage hydro)[a] (1998)



[a]NC/VA Power estimate is for the entire NC/VA service territory.

[b]Does not include cogeneration.

twice that systemwide), CP&L has 218 MW in North Carolina, and NC/VA Power has 321 MW systemwide. As a practical matter, there are few publicly acceptable sites for the development of hydroelectric resources in North Carolina, which limits the potential for large hydropower additions to North Carolina's generating mix.

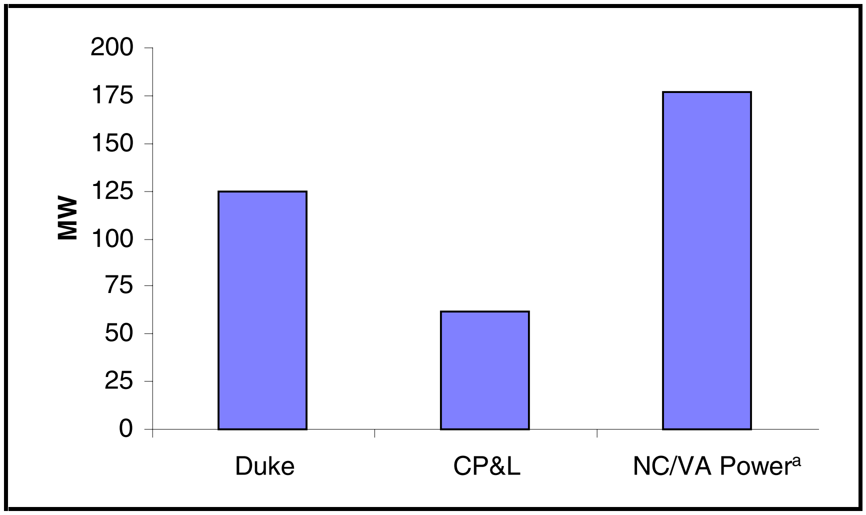
NCEMC and the municipal power agencies (MPAs) currently do not operate or purchase any renewable resources. However, as noted in a previous report for the Commission (RTI, 1999), purchase of hydropower from the Southeastern Power Administration (SEPA) in 1997 represented approximately 2.4 percent of NCEMC's kWh sales to its members and less than 0.7 percent of the two MPAs' kWh sales to their members.

After large hydro, biomass and small hydro represent the majority of the remaining renewable electricity purchased by North Carolina utilities. There is very little activity by North Carolina utilities in the areas of solar or wind energy.

Biomass

Biomass represents the largest category of renewable energy purchased by North Carolina utilities. North Carolina IOUs currently purchase 244 MW of biomass capacity (see Figure 3-3). NC/VA Power is the largest purchaser of biomass capacity: it has

Figure 3-3. Biomass by IOU (1998)



[a]NC/VA Power estimate is for the entire NC/VA service territory.

contracts for 176 MW of biomass capacity. The types of biomass purchased by North Carolina IOUs are primarily from wood, municipal solid waste, or landfill gas.

Small Hydro

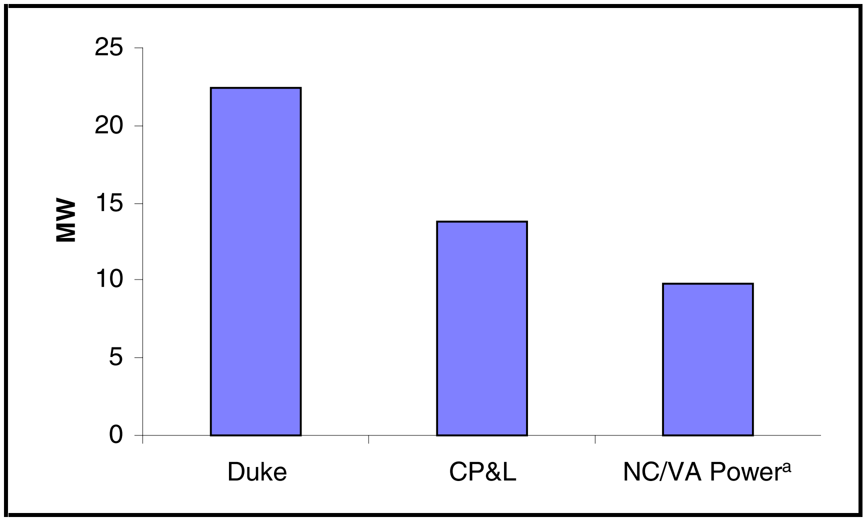
North Carolina's utilities purchase small hydro through QF contracts. North Carolina utilities currently purchase 48 MW of small hydro capacity primarily from small dams owned by cities and businesses. As Figure 3-4 shows, the largest purchaser of small hydro is Duke Power, which currently has contracts for 24 MW of capacity. CP&L currently has contracts for 15 MW of small hydro capacity. Duke and CP&L purchase all of their small hydro generation from QFs.

NC/VA Power has a total of 10 MW of small hydro capacity. It owns one small hydroelectric plant that represents 1 MW of capacity and purchases the remaining 9 MW through QF contracts.

Active Solar

NC/VA Power is the only North Carolina utility that currently has active solar generation. NC/VA Power has 75 kW of photovoltaic generation at its North Anna nuclear site in Virginia. No North Carolina utility currently has any programs encouraging the installation of active solar equipment for its ratepayers.

Figure 3-4. Small Hydro by IOU (1998)



[a]NC/VA Power estimate is for the entire NC/VA service territory.

Wind

No North Carolina utility currently uses power from wind resources.

Passive Solar

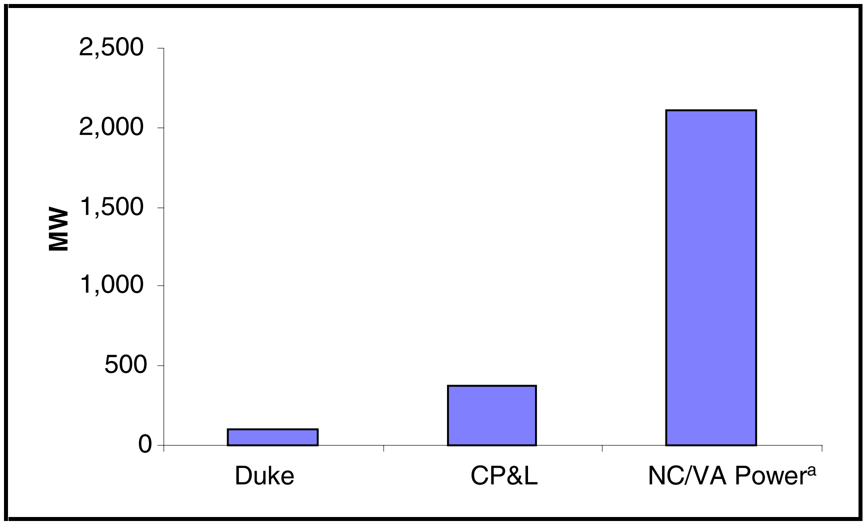
No North Carolina utility currently has any programs promoting the installation of passive solar equipment or designs.

Cogeneration

Cogeneration is not classified here as a renewable energy resource because cogeneration facilities often use fossil fuels to generate energy. However, cogeneration can have conservation and environmental benefits. Because cogeneration is the generation of electricity as a by-product to some industrial process, it leads

to more efficient use of energy. As Figure 3-5 indicates, NC/VA Power, with 2,108 MW, currently has the largest amount of cogeneration resources under contract.

Figure 3-5. Cogeneration by IOU (1998)



[a]NC/VA Power estimate is for the entire NC/VA service territory.

3.2.3 Nonutility Solar and Renewable Activity

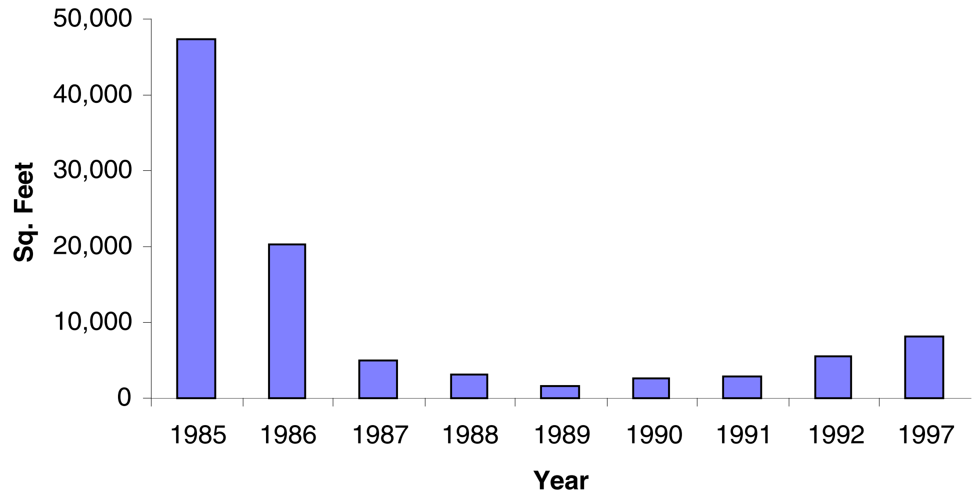
Household Solar and Renewable Activity

The primary use of solar and renewable equipment in individual households is the installation of active or passive solar systems. Measurement of active solar activity in North Carolina can best be accomplished by looking at the shipments of active solar equipment to North Carolina. The U.S. Energy Information Administration keeps records on the number of solar devices imported into each state.

As Figure 3-6 shows, North Carolina had a peak in solar equipment installation in 1985. This peak was followed by a rapid decline in the number of solar devices imported into the state, which ended in a low point in 1989. Since 1989, the number of solar devices imported into the state has gradually increased. In 1997, 8,194 square feet of solar collectors were imported into the state.

Passive solar energy is more difficult to measure because it more often is implemented through building design rather than the installation of equipment. A 1992 estimate by the NCSC indicates that 27,515 homes in North Carolina had either new or retrofitted passive solar designs.

Figure 3-6. North Carolina Imports of Solar Equipment by Year



Sources: North Carolina Energy Division. 2000. Personal communication with Research Triangle Institute.
U.S. Energy Information Administration. <http://www.eia.doe.gov>.

Public Solar and Renewable Activity

The North Carolina Energy Division is the primary source of solar and renewable activity in state government. The Energy Division funds research and information activities designed to promote solar and renewable resources. The Energy Division's solar and renewable activities fall into five major categories.

- ➤ education and training, such as workshops and publications on solar energy, geothermal energy, electric vehicles, and industrial extension
- ➤ diagnostics, such as testing and analysis of solar renewable technology
- ➤ demonstrations of solar and renewable resources, like the Solar House at North Carolina State University, which is operated by the NCSC, and photovoltaics, bio-gas fuel cells, and solar car races
- ➤ policy development, such as participating in the development of energy policies that encourage the use of solar and renewable resources
- ➤ energy technology development, such as supporting research into the creation of new technology that helps North Carolina consumers better use solar and renewable energy

One of the main ways that the Energy Division accomplishes its solar and renewable activities is through the NCSC. The NCSC operates the Solar House in which it tests solar equipment and designs for economic and technical feasibility. The NCSC then makes this information available to North Carolina citizens for use in installing active and passive solar equipment. The Solar House is open to the public 6 days a week and is a frequent host to visiting school groups.

Funding for the North Carolina Energy Division's solar and renewable activities is described in the State Energy Plan. This plan is developed by the North Carolina Energy Policy Council, and staff support is provided by the Energy Division.

4 Air Quality Issues

This section provides recent background information on power plant air emissions and current policy developments related to these emissions. It includes major federal and state policies that target power plant emissions. This section does not address the question of whether electric industry restructuring will affect air quality. That topic is discussed in Section 5.

4.1 INDUSTRY PROFILE

The North Carolina Utilities Commission (NCUC) lists 46 major electric generation sources in the state. Fourteen sources or "plants" are owned and operated by CP&L, 31 by Duke Power, and three by North Carolina Power. Fuel sources include nuclear, coal, natural gas, oil, and water (hydro power).

Environmentally, the most challenging fuel source to manage today is coal because of the air pollutants generated from burning coal: particulate matter (PM), sulfur oxides, nitrogen oxides (NO_X), and toxic substances such as mercury and cadmium. Six CP&L plants and seven Duke Energy plants have generating units that use coal as fuel. Five of CP&L's six plants and three of Duke's seven plants include combustion turbines that burn oil or natural gas.

4.2 AIR POLLUTANTS

Air pollutants are classified into two categories for regulatory purposes by the U.S. Environmental Protection Agency (EPA): criteria pollutants and toxic air pollutants. It is important to understand the legal difference between air toxics, or hazardous air pollutants (HAPs), and criteria air pollutants. For criteria air pollutants, health-protective ambient air concentrations are established under Title I of the Clean Air Act. While criteria pollutants can cause adverse health and environmental effects, they are not included under the Clean Air Act, Title III, HAP program.

4.2.1 Criteria Air Pollutants

The Clean Air Act, which was last amended in 1990, requires EPA to set **National Ambient Air Quality Standards** (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards. ***Primary standards*** set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. ***Secondary standards*** set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA Office of Air Quality Planning and Standards (OAQPS) has set National Ambient Air Quality Standards for six principal pollutants, which are called criteria pollutants. The criteria pollutants are carbon monoxide (CO), lead (Pb), NO_x, ozone (O_3), PM, and sulfur oxides (SO_x).

4.2.2 Toxic Air Pollutants

Toxic air pollutants are also referred to as air toxics or hazardous air pollutants (HAPs). They are generally defined as those pollutants that are known or suspected to cause serious health problems. The emission of toxic substances into the air can be damaging to human health and to the environment. Human exposure to these pollutants at sufficient concentrations and durations can result in cancer, poisoning, rapid onset of sickness (such as nausea), or difficulty breathing. Pollutants deposited onto soil or into lakes and streams affect ecological systems and eventually human health through consumption of contaminated food.

"Routine" toxic air pollutants are emitted by a variety of industrial sources and motor vehicles. In addition to routine releases, sudden accidental air releases of toxics potentially threaten many Americans.

Toxic air pollutants may exist as PM or as vapors (gases). Toxic air pollutants include metals, other particles, gases adsorbed onto particles, and certain vapors from fuels and other sources. An example of such a pollutant is the chemical benzene, which is in gasoline. Inhaling fumes that contain benzene could increase a person's chances of getting cancer. Many state and local agencies, including North Carolina, have excellent programs to reduce HAPs.

The many sources of air pollution emissions have been grouped into four categories:

- Point sources include sources like factories and electric power utilities.
- Mobile sources include cars and trucks but also lawn mowers, airplanes, and anything else that moves and puts pollution into the air, such as off-road equipment.
- Biogenic sources include trees and vegetation, gas seeps, and microbial activity.
- Area sources consist of smaller stationary sources such as dry cleaners and degreasing operations.

Emissions of all of the criteria pollutants, except for NO_2, have decreased significantly since passage of the Clean Air Act in 1970, even while electric generation has increased to meet growing load.

Ozone is a focal point of controlling certain criteria pollutants. Ozone is a colorless, odorless gas and the principal component of smog. It is a secondary pollutant, not directly emitted through a stack or vent. Ozone formation in the lower atmosphere occurs by chemical reactions between two pollutants—volatile organic compounds (VOCs) and NO_x in the presence of sunlight. Both stationary and mobile sources generate VOCs and NO_x. VOCs are

- "volatile" because the chemicals vaporize readily in the open air and
- "organic" because the chemicals are composed of some form of carbon-based molecules.

The ozone formed in the lower atmosphere (i.e., at ground level) should not be confused with the beneficial upper atmosphere's ozone (6 to 30 miles above the earth), which shields us from the ultraviolet rays of the sun (North Carolina Department of Environment and Natural Resources [NCDENR], 1999c).

In 1999, North Carolina experienced a record high number of high-level ozone days, referencing the federal 8-hour ozone standard (stayed in 1999 by the federal courts) as well as the 8-hour ozone standard adopted by North Carolina in 1999 (see "Federal Ozone and Particulate Matter Standards.") This is due to our rapidly growing population, the number of automobiles, energy consumption, and our increasing manufacturing base. It is estimated that 30 percent of North Carolina's NO_x emissions (an ozone precursor) are generated from on-road mobile transportation sources. Forty-four percent are generated from utilities, and 24 percent from a combination of other sources, such as industry and off-road mobile sources (e.g., construction vehicles) (NCDENR, 1999a). North Carolina is taking steps to reduce ground-level ozone. Recognizing the increasing role of mobile sources, the 1999 North Carolina General Assembly passed the Ambient Air Quality Improvement Act (North Carolina General Assembly, 1999) to reduce air pollutants from automobiles, trucks, and mass transit vehicles. This effort falls within the Governor's Clean Air Plan—a three-phase plan to improve North Carolina's air quality. This plan was introduced in December 1999. A copy of this plan is available at <http://daq.state.nc.us/News/cleanairplan6.pdf> and is included in Appendix C. Phase I comprised activities from the mid-1990s to 2000 to initially reduce ozone-forming pollutants from mobile and stationary sources. The second phase of the Governor's plan also addresses stationary sources that contribute to ozone, in particular, electric utilities burning coal as fuel. Since NO_X—a precursor to ozone formation—is emitted from both mobile and stationary sources, Phase II is designed to reduce NO_x emissions from both sources. Phase III will consist of additional actions to further reduce emissions from mobile and stationary sources.

As noted earlier, NO_x contributes to ground-level ozone formation when heated by the summer sun. NO_x is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen. Many of the NO_x are colorless and odorless. However, one common pollutant, NO_2, along with particles in the air, can be seen as a reddish-brown layer over many urban areas.

NO_x is the focus of much environmental policy attention currently because it

- is one of the main ingredients involved in the formation of ground-level ozone, which can trigger respiratory problems;
- reacts to form nitrate particles (NO_2 and other acid aerosols), which also cause respiratory problems;
- contributes to the formation of acid rain;
- deposits on land and water and, in turn, contributes to nutrient overload that deteriorates water quality;
- contributes to atmospheric particles that cause visibility impairment, which is most noticeable for many people in national parks;
- reacts to form toxic chemicals; and
- contributes to global warming (EPA, 1998).

NO_x and the pollutants formed by NO_x can be transported over long distances, following the pattern of prevailing winds in the U.S. Tall stacks at utility or identical facilities contribute to the transport and dispersion of NO_x over large areas. To resolve differing viewpoints on the extent of regional transport, studies are underway at the North Carolina Department of Environment and Natural Resources (NCDENR); the Ozone Transport Assessment Group (OTAG), which is a working group of eastern states; and the EPA to estimate the extent of pollutant transport. This modeling effort is very complex and controversial.

Thus, problems associated with NO_x are not confined to areas where NO_x is emitted. Therefore, controlling NO_x is often most effective if done from a regional perspective, rather than focusing on sources in one local area.

From 1970 to 1995, North Carolina's population grew by about 40 percent, while miles driven increased by about 150 percent. Because of the rapid increase in driving, motor vehicles account for up to 90 percent of NO_x emissions in North Carolina's urban areas (NCDENR, 1999a).

In 1995, 51 percent of the NO_x emissions in North Carolina came from stationary sources (e.g., power plants and individual boilers), and the remainder (49 percent) came from mobile sources. North Carolina utilities represented over 85 percent of the total stationary source NO_x emissions.

In December 1999, the NCDENR drafted tighter NO_x emission regulations for coal-fired utilities. These are reflected in Phase II of the Governor's Clean Air Plan. This plan is presented in Appendix C. The material in this plan includes figures that depict the contribution of each North Carolina power plant to North Carolina's NO_X emissions. The draft regulations in the Governor's Clean Air Plan were proposed by the North Carolina Environmental Management Commission in March 2000 and are undergoing public comment at the present time.

These draft regulations in the Governor's Clean Air Plan target the five largest coal-fired power plants in North Carolina. These five power plants are CP&L's Roxboro and Mayo plants and Duke's Belew's Creek, Marshall, and Allen plants. The plan also provides Duke and CP&L an option to distribute emissions reductions across all their fossil-fueled plants.

This option, which is a variant of the "bubble" approach to emissions reduction, provides Duke and CP&L flexibility to meet a systemwide target by making emissions reductions at plants where they are most cost-effective. This option stops short of a "cap and trade" approach, in which permits are issued and traded among utilities. Cap and trade approaches offer even more flexibility to utilities in meeting overall emissions reduction targets and are widely supported by economists.

4.3 FEDERAL AND STATE POLICIES AND REGULATIONS

The federal Clean Air Act Amendments of 1990 built on the significant progress made by the original federal Clean Air Act of 1970 and its 1977 amendments in improving the nation's air quality. The amendments used the existing structure of the Clean Air Act but strengthened those requirements to tighten and clarify implementation goals and timing, increase stringency of some requirements, revamp the HAP regulatory program, refine and streamline permitting requirements, and introduce new programs for controlling acid rain precursors and stratospheric ozone-depleting substances.

4.3.1 Highlights of the Clean Air Act Amendments

The 1990 Clean Air Act Amendments contain 11 titles. It is estimated that it will take the regulated community 20 to 30 years to implement all of the Amendments' provisions. The statute provides federal and state air quality control agencies with increased authority to implement these provisions. Selected titles are highlighted below.

Title I: Attainment and Maintenance of the National Ambient Air Quality Standards (NAAQS)

NAAQS are standards for criteria pollutants (e.g., CO, NO_x, SO_2, PM). Under the 1977 Clean Air Act Amendments, the U.S. was to attain compliance with these numeric standards by 1987. However, geographic areas of "nonattainment" exist throughout the U.S. for ozone, CO, and PM. North Carolina has previously had nonattainment areas for ozone, primarily in metropolitan areas such as Raleigh-Durham, Greensboro-Winston-Salem, and the Charlotte/Mecklenburg-Gaston County areas. North Carolina is currently in "attainment" or compliance with the 1-hour ozone standard, but application of the 8-hour standard resulted in 69 unhealthy, Code Orange days between April and October of 1999 (NCDENR, 1999d). (In spring 1999, the District of Columbia Circuit Court of Appeals remanded the 8-hour standard to the EPA for further consideration, and its status is "in limbo" at the present time.)

Title II: Mobile Sources

Designed to reduce emissions from cars and other on- and off-road vehicles, the 1990 Clean Air Act Amendments call for further emissions reductions through stronger tailpipe standards and cleaner fuels. North Carolina's Ambient Air Quality Improvement Act of 1999 addresses mobile sources through

- expansion of auto inspection and maintenance (I/M) programs to 48 counties (the I/M program contains air pollution evaluations of cars' tailpipe emissions),
- introduction of low-sulfur fuels into North Carolina's gasoline supplier market,
- mandates and incentives to expand auto fleets that run on alternative fuels such as natural gas and electricity, and
- expansion of North Carolina's mass transit program.

North Carolina's on-road NO_x emissions comprise about two-thirds of NO_x emissions from all mobile sources in North Carolina.

Title III: The Air Toxics Program

Toxic air pollutants are those emissions that are hazardous to human health or the environment but are not specifically covered in the Clean Air Act's criteria pollutants. In response to this Title, the EPA promulgated National Emission Standards for Hazardous Air Pollutants (NESHAP)—standards for 189 HAPs that are being addressed by industry category in the NESHAP program. In 1997, the EPA released its Report to Congress on HAP emissions from utilities (EPA, 1997). In it, the EPA identified HAPs of concern such as mercury, cadmium, and Pb. The EPA is continuing its research on the need to regulate HAP emissions from utilities, including its current call for emissions data from the industry.

Title IV: Acid Rain

This Title was established to reduce emissions of SO_2 and NO_x—pollutants that upon entering the atmosphere form acidic compounds that deposit on plants and in water. These acidic droplets also impair visibility and degrade man-made structures. Burning fossil fuels produces the greatest amount of SO_2 and NO_x emissions. Thus, utilities are the focus of Title IV regulations. Title IV is designed with two phases of implementation. Phase I reductions (effective 1995) are in place, and Phase II reductions (effective 2000) will strive to further reduce NO_x emissions. A total of 16 power plants in North Carolina are included in the Title IV program.

Title V: Permitting

Under Title V, the EPA and authorized states established a permitting program for all major sources that emit regulated pollutants to ensure that the emission source is in compliance with all applicable Clean Air Act regulations. Major emission sources are defined as follows:

- sources with the potential to emit 10 tons per year or more of any one HAP, 25 tons per year or more of a combination of HAPs;
- sources with the potential to emit 100 tons per year or more of any pollutant; and
- sources subject to the nonattainment area provisions of Title I.

North Carolina's Title V program is in place and functioning. It should be noted that the EPA has authority to review and override a Title V permit if deemed appropriate.

Federal Ozone and Particulate Matter Standards

Triggered by concern that the health and ecology of our nation were suffering from exposure to ground-level ozone and fine particulates generated by automobiles, utilities, and factories, the EPA promulgated a tighter 8-hour ozone standard in July 1997, along with a standard for fine PM (2.5 micron diameter). A standard for PM greater than 10 micron diameter (PM10) is already in effect. Ozone is a highly reactive form of oxygen that is the primary contributor to smog. Particulates are very fine dust and other particles either emitted directly from a stack or formed by chemical reactions in the air. Both ozone and particulates can be unhealthy to breathe, particularly for children, the elderly, and people with asthma or other respiratory problems. High ozone levels can also damage crops and forests. The new standards were aimed at reducing public and ecological exposure to the pollutants and are likely to result in stricter controls on industries, motor vehicles, and other sources of emissions.

Under the previous (1-hour) standard, ozone levels exceeded the standard when ozone concentrations averaged 0.124 parts per million (ppm) or higher over any 1-hour period. A violation occurred if ozone levels exceeded the standard for 4 days within any 3-year period. The EPA then could designate such areas as "nonattainment," a designation that required stricter controls on emissions from industries, motor vehicles, and other sources.

Under the new 8-hour standard, which was stayed by the District of Columbia Circuit Court of Appeals in early 1999, ozone is regulated to 0.08 ppm averaged over an 8-hour period. Violations occur when ozone levels reach or exceed the standard—based on a 3-year average of the fourth highest ozone readings at each monitor in an area. It is useful to note that a single exceedance does not constitute a violation.

The promulgation of the new 8-hour ozone and fine particulates standards, in combination with positions taken by OTAG member states on modeling studies of ozone transport, triggered a series of legal and regulatory actions among the EPA, North Carolina, other states, and private parties (see Table 4-1).

Table 4-1. Legal and Regulatory Actions

Date	Action
September 1998	The EPA issues the Regional Transport of Ozone rule (also known as the NO_X State Implementation Plan [SIP] Call). This rule required 22 eastern states (including North Carolina) and the District of Columbia to submit SIPs designed to reduce NO_X. Northeastern states also filed petitions under Section 126 of the Clean Air Act to reduce pollutants in southern states, which they believe are transported to the Northeast and cause those states to exceed the old 1-hour ozone standard.
December 1998	North Carolina and seven other states listed in the SIP Call file suit opposing the EPA's SIP Call. North Carolina's rationale for filing suit is that the EPA's order of an accelerated timetable for NO_X reduction "ignores pollution from motor vehicles and forces the state to spend hundreds of millions of dollars with minimal environmental benefit to North Carolina" (NCDENR, 1998). North Carolina announces a new strategy to reduce NO_X from utilities and a series of measures to reduce pollution from motor vehicles, the largest source of ozone-forming pollution in North Carolina.
April 1999	North Carolina adopts the new 8-hour ozone and fine particulates standards.
Spring 1999	The District of Columbia Circuit Court of Appeals decides two to one to deny the EPA the ability to set the 1997 PM2.5 and 8-hour ozone standards. The Court's decision was not based on the science of the new health-based standards but rather on the constitutionality of the primary health provisions of the Clean Air Act.
May 25, 1999	The District of Columbia Circuit Court of Appeals stays the EPA's NO_X SIP Call to allow parties to argue cases in the fall.
June 11, 1999	The EPA temporarily stays the effectiveness of its final action on the Section 126 petitions (which are directed to businesses, including utilities), separating the petitions from the NO_X SIP Call (which is directed to state environmental agencies).
June 14, 1999	The EPA issues a final rule extending time to act on Section 126 petitions (which are based on the 1-hour ozone rule). The EPA also proposes to indefinitely stay the determinations of technical merit based on the new 8-hour ozone standards.
July 1999	The North Carolina General Assembly enacts the Ambient Air Quality Improvement Act—legislation aimed at reducing car and truck emissions, a major contributor to ozone smog. It requires the use of low-sulfur gasoline statewide by January 2004, requires the purchase of alternative fuel vehicles by state fleets, and expands the motor vehicle emissions testing program from nine counties now to 48 counties by July 2006. The statewide goals of the legislation were to "reduce emissions of [NO_X] from all sources by at least 25 percent" by 2009, and to "reduce the growth of vehicle miles traveled in the State by at least [25 percent] of that growth that would otherwise occur" by 2009 (North Carolina General Assembly, 1999, Part I, Section 1.1).
October 1999	The EPA requests Duke and CP&L to supply records on maintenance and changes made at coal-fired plants over the past two decades.
October 1999	The EPA announces it intends to reinstate the 1-hour ozone standard that it had revoked in June 1998, following the adoption of a new, 8-hour ozone standard in 1997. The EPA is bringing back the 1-hour standard because of a spring 1999 District of Columbia Circuit Court of Appeals decision that set aside the 8-hour standard, leaving many parts of the nation without an ozone standard (NCDENR, 1999b).

(continued)

Table 4-1. Legal and Regulatory Actions (continued)

Date	Action
November 1999	The EPA and the Department of Justice sue 17 utilities' 32 coal-fired plants for unauthorized major modifications. No utilities in North Carolina were named in this lawsuit, although the EPA has requested information on plant expenditure histories from Duke and CP&L.
December 8, 1999	NCDENR presents draft regulations aimed at reducing NO_X emissions from coal-fired utilities consistent with the 8-hour ozone standard the North Carolina Environmental Management Commission adopted in April 1999.
December 17, 1999	The EPA approves Clean Air Act Section 126 petitions by Connecticut, Massachusetts, New York, and Pennsylvania against NO_X emitters in several southern states, including North Carolina. The EPA is considering approving Section 126 petitions for District of Columbia, Maryland, New Jersey, and Delaware.
December 1999	Duke and CP&L file a petition for rulemaking to reinstate the 1-hour ozone standard and remove the 8-hour standard in North Carolina.
February 9, 2000	The Air Quality Committee of North Carolina's Environmental Management Commission voted to recommend that the Governor's Clean Air Plan be taken to public hearing.
March 3, 2000	The District of Columbia Circuit Court of Appeals upheld the EPA's authority to issue NO_X SIP Calls to North Carolina and 18 other states. However, no action was taken on the 8-hour standard.
March 9, 2000	The North Carolina Environmental Management Commission voted to conduct hearings to reduce NO_X emissions from 14 power plants to 0.25 lb/MMBtu generated, but it postponed setting hearing dates until the impacts of the March 3 Appellate Court decision could be assessed.
March 20, 2000	North Carolina filed a legal petition opposing the EPA's approval of the northeastern states' Section 126 petition to require specific pollution controls for utilities and other industries. The northeastern states' petition would ultimately reduce NO_X emissions to 0.15 lb/MMBtu.
March 2000	Duke Power and CP&L announced their commitment to reduce NO_X emissions 35 to 40 percent to about 0.3 lb/MMBtu over the next 5 years. The companies also announced they would withdraw their petition for rulemaking they filed in December 1999 challenging North Carolina's new 8-hour ozone standard.
April 11, 2000	The EPA asked the District of Columbia Circuit Court of Appeals to formally remove the May 25, 1999 stay.
April 13, 2000	The North Carolina Environmental Management Commission set public hearings in July for their proposed NO_X rules. The state's proposed rules would reduce power plant NO_X emissions by approximately 50 percent between 2000 and 2007, with a daily site-specific cap on NO_X emissions computed based on each power plant's seasonal generating capacity. The proposed package included two alternative proposals for comment: (1) the utility companies' proposal that would reduce NO_X emissions by about 35 percent (seasonal caps of about 38,300 tons in 2005), and (2) a proposal by a coalition of environmental interest groups that would reduce NO_X emissions by about 70 to 80 percent (seasonal emission cap of 23,000 tons in 2007).

(continued)

Table 4-1. Legal and Regulatory Actions (continued)

Date	Action
June 23, 2000	The District of Columbia Circuit Court of Appeals responded to the EPA's April 11, 2000, request and lifted the May 25, 1999, stay, thereby allowing the EPA to proceed with implementation of the SIP Call. This decision will allow the EPA to require SIPs from 19 states, including North Carolina, by October 29, 2000. This SIP Call must address attaining a NO_X budget that includes emissions from power plants, other industrial sources, and mobile sources comparable to power plants achieving 0.15 lb/MMBtu in NO_X emissions.
October 12, 2000	The North Carolina Environmental Management Commission will vote on whether to adopt the proposed NO_X reduction power plant rules or one of the two alternative proposals. The Environmental Management Commission is also working with NCDENR and key stakeholders to develop a SIP and NO_X reduction rules that respond to the NO_X SIP Call.
October 29, 2000	North Carolina's revised NO_X SIP is tentatively due to the EPA. The plan must address reductions in selected stationary sources comparable to power plants achieving 0.15 lb/MMBtu.

4.3.2 Compliance Considerations

Actions utilities can take to comply with emission control requirements (whether the EPA's or the North Carolina Environmental Management Commission's) include the following:

- For SO_2:
  - ✓ Improve the performance of existing scrubber units and scrubbers that facilities will build on new units under existing regulatory programs such as the New Source Performance Standards
  - ✓ Add scrubbers on existing boiler units
  - ✓ Switch to lower sulfur coals
  - ✓ Switch from coal-fired to gas-fired units
- For NO_X:
  - ✓ Place federally established "reasonably available control technology" (RACT) on existing electric generation units
  - ✓ Build new generation units to meet federally established "best available to control technology" (BACT) standards
  - ✓ Replace coal with natural gas as a fuel source

The EPA research has estimated that reducing 1 ton of NO_X from coal-fired utility plants costs about $1,500 on average (EPA, 1998). This estimate is a capital cost estimate that is based on using the Selective Catalytic Reduction (SCR) technology to reduce NO_X. A similar estimate ($1,503/ton of NO_x removed) was used by the NCDENR in the Governor's Clean Air Plan as the capital cost to achieve a 0.15 lb/MMBtu standard (for the five coal plants cited in the plan), and an estimate of $1,143/ton of NO_x removed was used as the capital cost to achieve a 0.25 lb/MMBtu standard (on a systemwide basis). The Governor's Clean Air Plan is included in Appendix C.

The NCDENR, the North Carolina Environmental Management Commission, Duke, and CP&L are continuously working to clarify and resolve the differences in their cost estimates and to resolve the NO_x emissions issue with regulations that address public health concerns with ground-level ozone in a scientifically supportable and cost-effective way.

This section has focused on two regulatory programs intended to reduce NO_x and SO_x (for SO_x, both Phase I and the upcoming Phase II expansion). In addition, fine particulate standards are undergoing federal court review and EPA studies of heavy metal emissions (such as mercury) are nearing conclusion. Mercury study findings may potentially result in regulatory action to reduce mercury emissions.

Given the number of imminent emissions reduction programs, the potential exists for many different pollutant-specific control technologies to be required. This could lead to substantial utility cost impacts and implementation difficulties and complicate the work of state utility and environmental regulators.

5 Potential Environmental Effects of Restructuring and Review of Policies

This section discusses how restructuring might affect environmental quality. It also discusses various policies that are being considered or instituted in other states to help maintain environmental quality, even if the effects of restructuring on environmental quality are uncertain.

5.1 POTENTIAL EFFECTS

Whether restructuring the electric industry in North Carolina will result in changes in environmental quality is uncertain at this time. Some forces associated with restructuring may tend to reduce environmental quality, while others may tend to improve it, relative to the current situation.

First, there is no unanimity of opinions or predictions on the effect of restructuring on energy conservation activities. On the one hand, if restructuring brings lower electricity prices, then the demand for energy conservation will likely decrease and budgets to support energy conservation activities will likely be reduced also. On the other hand, restructuring may bring more robust competition in the market for energy conservation services, particularly if utilities become even more involved in this market (e.g., via formation of energy service companies, or ESCOs) in attempts to attract new customers and retain existing ones.

Second, it is unclear whether restructuring will result in increased use of coal. Indeed, robust competition in a restructured industry may reinforce trends in generating capacity that are currently underway (e.g., the strong preference for gas-fired units for capacity additions) and the growing interest in extending the life of existing nuclear units. The effect on the operation of existing coal units is unclear: older units may tend to be less efficient, but the primary determinant of whether such plants will be competitive in a restructured market is fuel cost, not age. These older units may continue to be relied on to help meet the predictable component of the time-varying demand for electricity (i.e., in the jargon of the industry, to serve as cycling or load following generating units) rather than base load or peaking units. Their output may also expand to meet an increased demand for energy if new generation is not built. Output from coal units in North Carolina increased almost 20 percent per year during the 1992 to 1998 period (versus kWh sales growth of approximately 2.5 percent per year over this same period) to meet this growing demand. This growth in coal-fired generation was primarily related to the lack of new capacity additions and low coal costs, not to restructuring. Restructuring of wholesale markets began in 1996 when FERC issued Order 888.

Third, it is unlikely that restructuring the North Carolina electric industry will affect nuclear waste volumes either. Nuclear units typically operate every hour they are available, so it is unlikely that their output will increase after restructuring. Similarly, since their operating costs are low, it is unlikely that their output will decrease after restructuring.

Fourth, a restructured utility industry may result in more diverse product and service offerings, and these can include "environmentally friendly" sources of power (e.g., through "green power" offerings). If the market demand for environmentally friendly offerings is strong, it can lead to additional research and development in environmentally friendly technologies. It may also lead to cost reductions for those technologies that benefit from economies of scale.

Fifth, a restructured utility industry will likely lead to more diverse rate offerings, including more time-differentiated rates (e.g., time-of-use rates and real-time pricing) and curtailable rate offerings for larger customers. These offerings will tend to reduce the use of electricity during peak periods and increase the use of electricity during nonpeak periods. The effect may be to reduce the use of peaking units, which tend to be gas-fired and increase the use of either existing units or power from the emerging competitive generation market. To the extent that the use of existing coal units is expanded relative to the use of gas-fired units, environmental quality may fall if this shift results in an increase in NO_x and sulfur emissions and other air pollutants. Any expanded use of existing coal units will ultimately depend on their marginal cost of operation relative to the cost of procuring similar amounts of power from the emerging competitive generation market.

The North Carolina Utilities Commission (NCUC) currently plays a supportive role, albeit not a primary role, in helping to ensure environmental quality. The NCUC examines environmental issues in considerable detail in the siting of transmission facilities. In approving the construction of new transmission facilities, the NCUC issues a Certificate of Environmental Compatibility and Public Convenience and Necessity. In the case of generation, the NCUC issues a Certificate of Public Convenience and Necessity based on a demonstration of need and economic viability. The NCUC also sees that the appropriate environmental permits are issued by other state agencies before transmission and generation facilities are constructed. This is how the NCUC currently interprets its mandate to "promote harmony between the public utilities, their customers, and the environment…" in N.C.G.S. § 62-2(a)(5).

5.2 SELECTED POLICY OPTIONS

As the Commission considers the possibility of electric industry restructuring, certain policy options may be considered to help ensure that current environmental standards are maintained and improved. While all the policy options presented here will promote the use of renewable resources in some way, they vary considerably in the efficiency with which they do so. Most of these policy options are also discussed and promoted in the North

Carolina Solar Energy Association's (NCSEA's) (1998) "Comments of the North Carolina Solar Energy Association." These options vary in their complexity and the degree of controversy they engender. The discussion below summarizes these policy options and their respective strengths and weaknesses.

It should be noted that, of these policy options, the only one currently in use is North Carolina's program of tax incentives. All the other options have been used in some form in other states but have not been enacted in North Carolina. For several of the options, implementing them would first require substantial deregulation. For others, certain institutions must be created to verify and distribute information. Background information on these policies is available from the Database of State Incentives for Renewable Energy (DSIRE), a national database that the North Carolina Solar Center (NCSC) at North Carolina State University maintains for the U.S. Department of Energy.

We describe the following policy options in this section:

- environmental disclosure
- net metering
- green power
- renewable portfolio standards (RPS)
- public benefits fund (PBF)
- tax incentives

Table 5-1 summarizes the potential advantages and disadvantages of each option.

5.2.1 Environmental Disclosure

Environmental disclosure is an option characterized by its low costs, both monetary and political. An environmental disclosure policy generally requires power providers to publish information regarding how they generate power. This information can and has included fuel-mix used, percentage of generation that is green, plant emissions data, or the environmental consequences of using certain types of fuel sources (Larson, Rogers, and Shirley, 1998).

The most frequently cited reason for choosing such a policy is that it improves the consumer's ability to make a decision about power consumption. The more a consumer knows about a product, the

Table 5-1. Policy Summary Table

Policy Option	*Potential* Advantages	*Potential* Disadvantages/Issues
Environmental Disclosure	More information helps markets run more efficiently Customer surveys indicate desire for publication of such information Little required regulation or expenditure	Mechanism required to collect/verify data Unclear how information will make its way to consumers Recovery of additional costs
Net Metering	Once set up, little regulation required No public investment required Encourages private investment Eases utility load during peak periods	"Buyback" price (credit for displaced power) must be provided Meter ownership issues Generation type/size issues Complicates load-profiling Recovery of additional costs Cross-subsidies from nonparticipants to participants
Green Power	Nonregulatory—market driven Voluntary Increases choice while encouraging renewable development	Requires a restructured market Requires disclosure/verification mechanism Recovery of additional costs Cross-subsidies from nonparticipants to participants
Renewable Portfolio Standards	Supports renewables and the formation of green markets Helps commercialize and lower prices of renewable generation (e.g., through economies of scale) Encourages research to lower renewables costs	Regulatory May differ from efficient market outcomes Could suppress investment in promising renewables technologies that are expensive currently Recovery of additional costs Cross-subsidies from nonrenewables to renewables
Public Benefits Fund	Allows public to choose how to invest in renewables Can leverage other investments Can be used to protect low-income ratepayers from higher rates or rate volatility	Regulatory May differ from efficient market outcomes Could suppress investment in promising renewables technologies that are expensive currently Recovery of additional costs Cross-subsidies from nonrenewables to renewables and from large to small users
Tax Incentives	Does not require additional regulation Does not require additional expenditure Helps commercialize and lower prices of renewable generation May have positive net impact on jobs by strengthening domestic renewable industry	Effectiveness may be small Recovery of additional costs May be difficult to comprehend cross-subsidies from taxpayers to participants

more efficient the market will be for that product. Therefore, if a consumer finds the disclosed information from his electric utility to be unacceptable, he may either adjust his consumption patterns (self-generate or use less power), or, if the opportunity is available, change power providers.

Another reason for using the environmental disclosure option is its low implementation cost. This type of policy can be legislated or ordered and then left to the utilities for execution. Providing this information on customer bills is not costly either. Without a restructured market, however, consumers are limited in their ability to use the disclosed information.

Some problems exist regarding implementation of the policy. When California adopted an environmental disclosure policy, problems arose over who would collect the information and who would verify that it was, in fact, correct. In addition, distribution of information has been an issue whenever this type of

policy has been adopted. For example, questions have been raised over whether the disclosed data should be included in the customer's bill, posted on the Internet, or simply placed on public file. If information is disclosed but inaccessible, the policy might be considered a failure (Rogers et al., 1999).

An environmental disclosure policy is another form of regulation. As with any form of regulation, it requires allocation of financial and staff resources for monitoring and enforcement.

5.2.2 Net Metering

In 1978 Congress passed the Public Utilities Regulatory Policies Act (PURPA), which requires utilities to purchase power from qualifying facilities (QFs). These facilities include QFs owned by utility customers that have installed qualifying distributed generation and cogeneration facilities. The price QFs receive from IOUs for this power is regulated by state utility commissions. Generally, QFs receive a price that represents the purchasing utility's avoided cost of generation. This purchase involves installing two meters, one that meters power coming in at the retail rate and one that measures power purchased by the utility at its avoided cost (Larson, 1999a).

Net metering creates a change in this system so that all power is metered on one, bi-directional meter. Thus, net metering represents an implicit "buyback" of outgoing power by the utility at its retail rate, which is a higher rate than has been used for buyback in the past. In essence, the utility is buying back power at a price (its retail rate) that includes transmission and distribution costs that are not incurred by the customer who sells the power back to the utility. The power that the utility purchases from the customer may also be intermittent (or "as available") power, which is of less value than "firm" power. Both situations result in a subsidy from existing ratepayers to the customer. To offset this subsidy in part and to keep administrative costs down, NCSEA's recommendation on net metering stipulates that any surplus power supplied by the customer beyond a contracted amount be provided free of charge to the utility for resale to its other customers. In this way, no check is ever written from the utility to the consumer (NCSEA, 1998).

Several reasons cited for legislating net metering consistently stand out. First, net metering encourages private investment in renewable resources. By increasing compensation for net surplus power, this policy subsidizes private investment and makes it cheaper and, therefore, more likely to be undertaken widely. This policy assumes that only renewable distributed generation and cogeneration sources are allowed to take advantage of net metering.

Second, net metering improves the diversity of a locality's power portfolio. For example, the hog farmer may choose biomass, and the streamside homeowner may choose micro-hydro, and the power portfolio will become more diverse. Improved diversity has the benefit that, by allowing demand to flourish for several sources of generation, technological development will also flourish for those sources and will not be limited to a small number of energy sources.

Claims are also made that net metering

- results in an uneconomic subsidy,
- reduces utility profits, and
- is unsafe.

If net metering programs are improperly designed, they can result in uneconomic subsidies. As to lost profits, a study conducted by

Pacific Energy Group has noted that losses due to net metering are minimal, and if the policy is crafted so that it eliminates payments to customers, then these losses may be largely offset by gains in economic efficiency. Similarly, technical experts across the country agree that safety should not be an issue with this policy. New York Governor George Pataki arrived at this conclusion when he reintroduced a net metering bill after vetoing it because of safety concerns (NCSEA, 1998). New technology (e.g., from the Potomac Electric Power Company) is being introduced to address the safety issue, and national safety standards are continually being introduced.

Adopting net metering could raise additional issues. Public officials typically would have to set upper limits on the amount of power from distributed generation and cogeneration and must decide which renewables technologies qualify for net metering. At some point, questions may also arise regarding meter ownership. These issues are not prohibitive, however.

The NCUC has an open proceeding on net metering (Docket No E-100, Sub 83). Several parties, including NCSEA and the utilities, are parties to this proceeding. The NCUC is considering the NCSEA proposal. Technical and economic issues such as interconnection standards and costs, standardized application forms, and metering requirements and costs are being addressed that will significantly reduce the overall costs of solar systems being connected and operated in parallel with the utilities.

5.2.3 Green Power

Green power refers to electricity generated by renewable resources. Green power programs fall into two general categories:

- ➤ green power pricing: Customers can choose to pay a special rate or monthly premium to have some of their energy come from renewables or to invest in development of renewables technology.
- ➤ green power marketing: With open access, customers can choose a power provider that specializes in providing green power (Rogers et al., 1999).

From an economist's perspective, green power programs hold promise. As a general rule, green power programs are not legislated or ordered; rather, legislatures or commissions provide retail access, and the programs arise from customer demand. This type of market-determined action will have some advantages. First, renewables technology will be developed based on future expected profits, which are largely dependent on the future cost of generation. Thus, technology will develop based on market expectations without the influence of mandatory public actions. That is, the market, rather than public officials, decides what technologies should be supported. Second, under retail competition green power suppliers will respond to the demand for that power.

Two main complications stand in the way of effective green power programs. First, electricity markets must be restructured before such programs become possible. Second, the programs require some verification measure for green sources. These concerns must be addressed to prevent marketing claims that are false. Furthermore, if little demand exists for green programs, little investment will be made in renewables.

Given that green power would involve competition in the electricity market, utility profit margins could be affected. However, incumbent utilities would also be eligible to offer green power programs. It is likely that the pressure from green competition will be concentrated on utilities serving areas with higher-income customers, where disposable income exists among consumers to support green providers and green power.

5.2.4 Renewable Portfolio Standards

The RPS is a policy measure requiring that a certain percentage of a utility's generation come from renewable power sources. A variant of this policy measure is the set-aside, which requires that a percentage of new generation come from renewables.

Some reasons are commonly given to encourage the use of the RPS as a policy option to support renewables:

- As a public good, the social benefits are higher than the private benefits (which are based on market prices), so there is likely to be an underinvestment in green power if these decisions are left totally to private markets.
- Renewables are an "infant industry" with high initial costs, and the industry will not survive if not supported by public officials during its early years.

These explanations tend to be weak. Demand does exist for green power in private markets, and a flexible price will help ensure that demand is met.

This type of policy, which is mandatory rather than voluntary, will have certain foreseeable consequences. If an RPS is adopted, there will be little place for market-driven green power because it will become harder for green firms to differentiate themselves from standard utilities. Thus, an RPS may preempt the natural development of green power. Also, utilities will tend to use the lowest cost renewables available to them that meet availability, reliability, quality, and other requirements, so power sources that are expensive now but may be more desirable in the long run could be ignored. Public officials could counter this tendency by requiring the use of a diverse array of green sources. This requirement, however, creates a potential economic efficiency issue by having public officials, rather than the market, choose which technologies to support.

5.2.5 Public Benefits Fund

The PBF is generated by a charge to all electric customers regardless of their power provider. This is referred to as a "nonbypassable" systems benefits charge (SBC) to consumers. Under an SBC, all electricity consumers, regardless of their power provider or power use, pay the same per kWh fee. The proceeds from this fee are then allocated toward those expenditures deemed appropriate by public officials for the advancement of renewables technology and use, energy efficiency, and low-income assistance. The charge typically resembles monthly stranded cost surcharges or a tax on electricity consumed.

This policy is similar to the RPS in its immediate and definite effect on renewables use and investment in renewables technology. Upon collection of the first fund receipts, the collection agent can immediately channel the money into renewables R&D. This type of program may encourage utilities to develop plans for expansion into renewable sources of generation, because they would have the ability to claim environmentally friendly policies without having to divert resources toward that end. Additionally, PBF supporters assert that fund money could be used to leverage procurement of other, private forms of capital, increasing the investment in renewables. Moreover, PBF supporters claim that a uniformly administered charge would be competitively neutral, which would allow for its successful use in an open-access environment (Larson, 1999b).

A PBF is based on the notion that electricity market imperfections exist and that public redirections of fund resources can help resolve these imperfections. It is also based on the notion that renewables, energy efficiency, low-income customers, and the environment and public health should obtain some benefit from restructuring. But there are problems with such a fund, including overinvestment in certain projects and neglect of other projects that could be more promising. In addition, such a policy necessitates the creation of a mechanism to review proposals, administer funds, and verify their appropriate usage. This aspect could offset some of the gains from quick investment that the PBF provides.

PBFs are becoming increasingly popular among states that are restructuring. Appendix D contains more information on PBFs and their prominence from state to state. These funds are often extended to include support for low-income programs. Table D-1 compares state funding from SBCs in the areas of research and development (R&D), energy efficiency (EE), renewable energy (RE), and low-income programs (LI), and gives information on the status of PBFs, RPSs, and environmental disclosure legislation for each state (ACEEE, 2000).

5.2.6 Tax Incentives

Tax incentives are simply any number of tax credits, deductions, and exemptions designed to modify behavior in a way that supports renewables technologies. These incentives can apply to residential, commercial, or industrial electricity consumers and have been enacted on property, sales, and income taxes. Policies under this heading can also include accelerated depreciation of assets and other policies that affect asset prices.

As Table 5-2 indicates, North Carolina currently uses tax credit policies to support private, residential renewables use. Items covered by these credits include small biomass, hydroelectric, and wind units, as well as a number of solar units for power generation,

Table 5-2. North Carolina Residential Renewable Energy Tax Credits

Tax Credit	Percent and Limit	Eligible Expenditures
Biomass	35% $10,500 per installation	100% of the cost of equipment that uses renewable biomass resources to produce liquid fuels, gas, thermal or electric energy, including related devices to convert, condition, or store these products, including installation cost
Hydroelectric	35% $10,500 per installation	100% of the cost of equipment to generate electricity at an existing dam or free-flowing waterway, including related devices to convert, condition, or store the electricity, including installation cost
Solar energy equipment for domestic water heating	35% $1,400 per dwelling unit	100% of the cost of collectors, storage, controls and heat exchangers used for solar system only, including installation cost
Solar energy equipment for active space heating	35% $3,500 per dwelling unit	100% of the cost of collectors, storage, controls, and heat exchangers used for solar system only, including installation cost
Solar energy equipment for combined active space and domestic hot water systems	35% $3,500 per dwelling unit	100% of the cost of collectors, storage, controls, and heat exchangers used for solar system only, including installation cost
Solar energy equipment for passive space heating	35% $3,500 per dwelling unit	Passive systems must use passive system worksheet to calculate percentage
Solar energy (systems not covered by the $1,400 and $3,500 credit)	35% $10,500 per installation	100% of the cost of equipment to generate electricity from solar energy, including related devices for collecting, storing, exchange conditioning or converting solar energy, including installation cost
Wind	35% $10,500 per installation	100% of the cost of equipment to generate electricity or mechanical power from wind energy, including related devices for converting, conditioning, and storing the electricity produced, including installation cost

Source: North Carolina Solar Energy Association (NCSEA). 1999. "North Carolina Residential Renewable Energy Tax Credits." Table provided to RTI.

Note: Expenditures that may accompany renewable energy investments but that are not eligible for these tax credits include the following: wood-burning stoves and furnaces; oil and gas furnaces, including replacement burners and ignition systems labeled as "energy efficient"; automatic set back thermostats; heat pumps, including both air and water-source units; evaporative cooling systems; Insulation (except where otherwise noted in these guidelines); and storm windows and storm doors.

water heating, and space heating. Table 5-3 presents a companion table of tax credits available to private nonresidential customers in North Carolina.

In addition to the information in these tables, the 2000 session of the 1999 General Assembly passed House Bill 1473, which extends the current corporate tax credit for a corporation that constructs a facility for the production of photovoltaic (PV) equipment. The credit is now extended to include the construction of a facility for the production of other types of renewable energy equipment. The bill provides that the credit must be taken in five equal installments and extends the carry forward from 5 years to 10 years. There is a limit in that the cumulative amount of the credit may not exceed 50 percent of the tax imposed for the taxable year. Costs incurred during taxable years beginning on or after January 1, 2000, are not eligible for the credit.

The primary benefit of such tax incentives is to lower the relative cost of qualifying generation facilities and uses. By allowing a residential PV unit to be exempt from property value assessments, for example, the real cost of the PV unit is decreased, and the unit is thus more likely to be installed. Such incentives, if exploited, could encourage increased private investment in renewables technology.

These policies, however, tend to have problems too. Often, savings from tax incentives are generally relatively small compared to the costs of installing a system. Moreover, these tax programs are often unknown to the average electricity consumer, negating their possible positive effects. Furthermore, tax incentives are often in direct conflict with other government incentive programs, such as oil and gas subsidies, which make conventional energy cheaper. This is a very complicated subject and one that has generated much debate.

In addition, public officials must decide which technologies to reward with tax incentives and how much incentive to give. This is another complicated subject and one that has also generated much debate. As with some of the other policy options, public officials, rather than the market, are attempting to determine the most promising renewables technologies.

Table 5-3. North Carolina Nonresidential Renewable Energy Tax Credits

Tax Credit	Percent and Limit	Eligible Expenditures
Biomass	35% to $250,000 per installation Note 1	100% of the cost of equipment that uses renewable biomass resources to produce liquid fuels, gas, thermal or electrical energy, including related devices to convert condition or store these products, including installation cost.
Hydroelectric	35% to $250,000 per installation Note 1	100% of the cost of equipment to generate electricity at an existing dam or free-flowing waterway, including related devices to convert, condition or store the electricity, including installation cost.
Solar energy equipment for domestic water heating	35% to $250,000 per installation Note 1	100% of the cost of collectors, storage, controls and heat exchangers used for solar system only, including installation cost.
Solar energy equipment for active space heating	35% to $250,000 per installation Note 1	100% of the cost of collectors, storage, controls and heat exchangers used for active systems only, including installation cost.
Solar energy equipment for combined active space and domestic hot water systems	35% to $250,000 per installation Note 1	100% of the cost of collectors, storage, controls and heat exchangers used for active systems only, including installation cost.
Solar energy equipment for daylighting	35% to $250,000 per installation Note 1	100% of the cost of lighting controls, vertical roof monitors, baffles, lightshelves, lightshelf glazing, advanced daylighting glazing, roof monitor glazing and daylighting transport systems, including installation cost.
Solar energy equipment for solar electric or other solar thermal applications	35% to $250,000 per installation Note 1	100% of the cost of equipment to generate electricity from solar energy, including related devices for collecting, storing, exchanging conditioning or converting solar energy. 100% of the cost of equipment for distillation, desalination, detoxification or industrial or commercial process heat from solar energy including related devices to convert, condition or store thermal energy, including installation cost.
Wind	35% to $250,000 per installation Note 1	100% of the cost of equipment to generate electricity or mechanical power from wind energy, including related devices for converting, conditioning, and storing the electricity produced, including installation cost.

Note: Nonresidential credits must be taken in five equal installments over 5 years. Residential credits must be taken first year. All credits cannot exceed 50 percent of the tax due. All credits can be carried over 5 years. Taxpayer cannot take two credits for the same renewable energy property. If a renewable energy property is taken out of service or relocated out of state, no remaining installments or carry-overs may be taken. Excess energy storage will not qualify for credit.

Expenditures that may accompany renewable energy investments but that are not eligible for these tax credits include the following: wood burning stoves and furnaces; oil and gas furnaces, including replacement burners and ignition systems labeled as "energy efficient"; automatic set back thermostats; heat pumps, including both air and water-source units; evaporative cooling systems; skylights; and windows.

5.3 CONCLUSIONS

The discussion of policies in this section should not be construed as policy recommendations. Because the effect of industry restructuring on environmental quality is uncertain at this time, these policies are ones that should be explored more comprehensively prior to the onset of retail competition.

Although the policies discussed in this section will support future renewables use in some way, each one varies significantly in the means used to achieve such an end. Policy analysts must carefully consider the need for market intervention, whether the policies will be mandatory or voluntary in nature, the effectiveness of these policies, and their cost-effectiveness in achieving the desired outcomes.

Certain policies (e.g., an RPS) may increase an incumbent utility's stranded costs, in the sense that some portion of prior investments in conventional generation may be impaired if the renewables generation replaces conventional generation as a result of these policies. If this were to occur, appropriate recovery mechanisms for these costs should be considered, as should any stranded costs that result from incumbent utility compliance with environmental regulations mandated by the U.S. Environmental Protection Agency (EPA) prior to retail competition in North Carolina.

Given recent oil and gas price increases, our smaller reserve margins and increased reliance on coal units that has developed over the last decade, and the uncertainties associated with the environmental effects of electric industry restructuring, none of these policies, especially the voluntary ones, should be removed from the table at this time. Whatever happens with these policies, support should continue to be offered for public education and outreach (including residential and business/industry energy extension activities), building codes, housing codes, and similar programs and standards to foster cost-effective energy conservation and public awareness of the public and private benefits and costs of solar and renewable energy.

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Appendix A: Utility Conservation and DSM Programs Questionnaire

To get data on utility conservation and DSM programs, we sent questionnaires to the six major utilities in North Carolina: Duke, CP&L, NC Power, NCEMC, NCEMPA, and NCMPA1. These questionnaires are provided in this appendix. The responses to the questionnaires varied from utility to utility. Some utilities were able to provide us with almost complete data on their DSM programs; others were not. For the most part, recordkeeping tended to vary between years, so often information on DSM programs was missing. This appendix is intended to give the reader an idea of the data that were available. It should be noted, however, that no utility provided a complete set of data.

DSM Experience: Industrial DSM

Program Name: ____________________

Calendar Year	Participation (# of Customers)	Participation Rate (Participation/ Eligible Customers)	Savings		$ Spent ($000)	Load Shape Objective
			kW	kWh		
1998						
1997						
1996						
1995						
1994						
1993						
1992						
1991						
1990						
1989						

DSM Experience: Residential DSM

Program Name: ______________________________

Calendar Year	Participation (# of Customers)	Participation Rate (Participation/ Eligible Customers)	Savings kW	Savings kWh	$ Spent ($000)	Load Shape Objective
1998						
1997						
1996						
1995						
1994						
1993						
1992						
1991						
1990						

DSM Experience: Residential DSM

Program Name: ____________________

Calendar Year	Participation (# of Customers)	Participation Rate (Participation/ Eligible Customers)	Savings kW	Savings kWh	$ Spent ($000)	Load Shape Objective
1998						
1997						
1996						
1995						
1994						
1993						
1992						
1991						
1990						
1989						

Appendix B: Utility Environmental and Qualifying Facilities Programs Questionnaire

To get data on utility environmental and qualifying facilities programs, we sent questionnaires to the six major utilities in North Carolina: Duke, CP&L, NC Power, NCEMC, NCEMPA, and NCMPA1. These questionnaires are provided in this appendix. Utilities provided very detailed and complete data for their qualifying facilities contracts. Very little data were available for solar and renewable programs, because most of the utilities did not have solar and renewable generation or programs.

Qualifying Facilities Contracts

	QF Name	Length of Contract Start Date–End Date	kW	kWh	Type of QF	Type of Contract	Purchase Price: Capacity Payment ($/kW)	Purchase Price: Energy Payment (Cents/kWh)
1)								
2)								
3)								
4)								
5)								
6)								
7)								
8)								

Active Solar **Program Name:** ______________________

Calendar Year	kW	kWh	$/year
1998			
1997			
1996			
1995			
1994			
1993			
1992			
1991			
1990			
1989			

Passive Solar **Program Name:** ______________________

Calendar Year	kW	kWh	$/year
1998			
1997			
1996			
1995			
1994			
1993			
1992			
1991			
1990			
1989			

Biomass **Program Name:** ____________________

Calendar Year	kW	kWh	$/year
1998			
1997			
1996			
1995			
1994			
1993			
1992			
1991			
1990			
1989			

Wind **Program Name:** ____________________

Calendar Year	kW	kWh	$/year
1998			
1997			
1996			
1995			
1994			
1993			
1992			
1991			
1990			
1989			

Small Hydro **Program Name:** ____________________

Calendar Year	kW	kWh	$/year
1998			
1997			
1996			
1995			
1994			
1993			
1992			
1991			
1990			
1989			

Appendix C: Governor Hunt's Clean Air Plan for North Carolina

DRAFT – January 14, 2000

Governor Hunt's Clean Air Plan for North Carolina

A Strategy for
Reducing Ground-Level Ozone
by the Year 2007

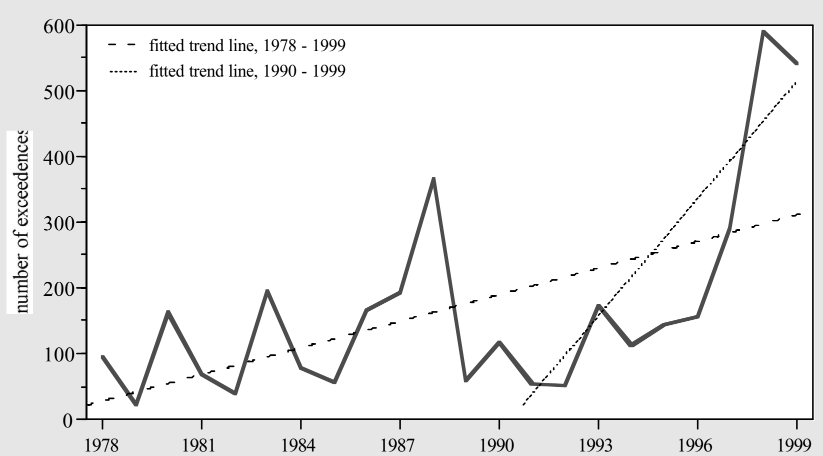
2000

Executive Summary of the North Carolina Clean Air Plan

Governor Hunt proposes this Clean Air Plan in an effort to move North Carolina towards a day when all citizens can breath healthy air every day and the good quality of our air enhances tourism and strengthens our economy. Reducing ground-level ozone concentrations in North Carolina would provide the following benefits:

- ♦ Protect public health, especially for children, the elderly and asthmatics.
- ♦ Improve visibility and reduce environmental damage to plant life and ecosystems.
- ♦ Provide economic benefits through reduced health care costs, reduced agriculture and forestry yield losses, improved economic development opportunities in non-attainment areas, and enhanced tourism.

Nitrogen oxides (NO_x) are converted into ozone through complex atmospheric chemical reactions. As shown in the graph below, exceedances of the 8-hour standard for ozone raise concern about the healthiness of North Carolina's air. Due to this trend and the length of the rule making process in North Carolina, it is critical to act now to develop rules for reducing coal-fired power plant NO_x emissions as an interim step toward improving air quality.



Trends in Exceedances of the 8-Hour Ozone Standard in North Carolina
(number of exceedances for all NC ambient monitoring locations)
April through October, 1978 to 1999

This Plan is divided into three phases. Phase I NO_x reductions from coal-fired power plants are in the process of being implemented. Phase II reductions from mobile sources were set by the 1999 General Assembly.

Phase II NO_x reductions from coal-fired power plants would be achieved through the development of rules by the Environmental Management Commission. These rules would provide utilities two options to reduce their NO_x emissions:

- **Option A:** Reduce the rates of emissions from the largest five emitters to 0.15 lbs NO_x/ million BTU by 2003. The largest 5 plants produce 74 percent of the NO_x from the utility sector.
- **Option B:** Reduce the rates of emissions from all Carolina Power & Light and Duke Energy facilities to a system wide average of 0.25 lbs. NO_x/ million BTU by 2005.

Phases I and II together would reduce total NO_x emission by 42 to 44 percent over uncontrolled levels. As additional scientific modeling becomes available and uncertainty over national standards is resolved, a more comprehensive reduction strategy will be developed in a Phase III.

Governor Hunt's Clean Air Plan
for North Carolina

Table of Contents

I. Background

Ozone and Nitrogen Oxide

Ozone[1] is the prime ingredient in smog. It harms public health, the environment, and the economy. Ozone is formed by the chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight on hot summer days. Although many VOC emissions are generated from industrial processes and finishing operations, the vast majority comes from natural or biogenic sources in North Carolina. NO_x on the other hand is generated almost exclusively from the combustion of fossil fuels (e.g., coal and oil). North Carolina's significant ozone problem is becoming more serious due to this State's high growth rates in population along with the accompanying increased energy demands, sprawl, and vehicle miles traveled (VMT). North Carolina population is projected to grow by 15 percent from 1995 to 2007, the time horizon of this plan. Vehicle miles traveled are projected to grow 43 percent over this same period, and energy demand is projected to grow 44 percent from 1995 to 2005. Although ozone can be transported regionally, the vast majority of North Carolina's ozone problems are caused from its own emission sources. Figure 2 shows the sources of NO_x emissions in North Carolina. As VOCs are abundant in North Carolina and as most of them are uncontrollable, the most effective way to reduce ozone and smog is to reduce NO_x. Nationally, since 1970, emissions of four out of the five major air pollutants have decreased significantly, while NO_x has increased about 10 percent.

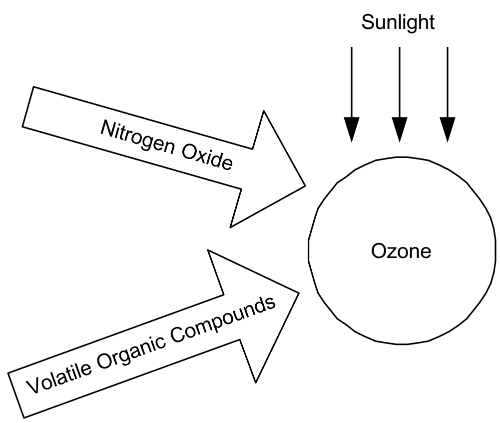


Figure 1. Formation of Ozone

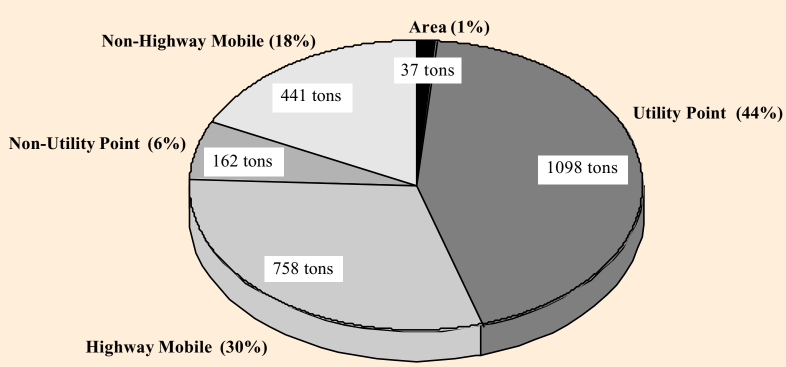


Figure 2. North Carolina 1995 Statewide Daily Ozone NOx Emissions

Ozone Standards

Previously, the federal Environmental Protection Agency (EPA) regulated ozone based on an ambient air quality standard of 0.12 part per million (ppm) measured over a 1-hour period. Subsequent data showed that ozone impacts on humans are most significant over periods of exposure longer than the 1-hour standard. In response to that problem, the EPA promulgated rules to regulate ozone over an 8-hour period and to lower the standard to 0.08 ppm in 1997, a level more protective of public health. The North Carolina Environmental

[1] Smog forming ozone is often referred to as "ground-level" or "tropospheric" ozone to differentiate it from the ozone that forms the protective layer around the earth high up in the stratosphere.

Management Commission (EMC) adopted this 0.08 ppm, 8-hour standard for ozone levels. A federal district appeals court on a 2-1 decision has remanded the 8-hour standard to EPA due to legal procedural issues. The EPA's petition to the Supreme Court for review of that decision is anticipated. Also, the EPA has recently indicated that it will attempt to regulate NO_x sources directly instead of through State Air Quality programs. North Carolina remains committed to the 8-hour standard as an appropriate response to the heath problems confronting our state.

Governor Hunt's Efforts
In December 1998, Governor Hunt outlined a comprehensive plan to fight ozone pollution, addressing both mobile and stationary sources. In order to protect public health and the environment and improve the quality of North Carolina's air, in April 1999, the Governor announced his legislative package at a multi-state regional Summit on Mountain Air Quality in Asheville. Governor Hunt pushed for the passage of Senate Bill 953, the Air Quality Improvement Act, to reduce mobile source emissions (see Section IV, Phase II for a description of the elements in SB 953). Unlike mobile sources, new statutory authority is not needed for stationary sources, and Governor Hunt will rely on the EMC to address emissions from the utility sector.

II. Vision

Governor Hunt proposes this Clean Air Plan in an effort to move North Carolina towards a day when all citizens can breathe healthy air every day and the good quality of our air enhances tourism and strengthens our economy.

III. Rationale

Ground-level ozone is one of North Carolina's most serious environmental problems as more North Carolinians are exposed to ozone than any other pollutant. It poses serious risks to the health of North Carolina's citizens, and ozone adversely impacts both the environment and economy of this State. It is neither normal nor acceptable that North Carolina citizens are subject to the high ozone levels seen today, and air pollution is not the unavoidable price of modernization. It is important to take an interim step now due to the risks posed by the number of unhealthy air quality days per year in North Carolina and due to the length of the rule making process. The need for a comprehensive clean air strategy to minimize ground-level ozone is as follows:

- **Public Health.** Code orange and red days that jeopardize public health will become more prevalent as our air quality worsens. Ground-level ozone causes acute respiratory problems, especially for children, the elderly, and asthmatics. Fourteen Americans die every day from asthma, a rate three times greater than just 20 years ago, and ground-level exacerbates the severity and frequency of asthma cases. A report generated for a consortium of environmental groups found that bad ozone days in North Carolina were responsible for 1,900 respiratory hospital emissions, 630 asthma emergency room visits, and 240,000 asthma attacks for the summer months of 1997 (Abt Associates for the Clean Air Task Force, 1999). Additionally, ozone also causes inflammation of lung tissue and respiratory illness, such as bronchitis and pneumonia, for all populations. Those who exercise or work outdoors in the summer, such as construction workers, can experience a 15 percent reduction in lung function from exposure to low levels of ozone over several hours (EPA).

- **Visibility and Tourism.** Tourism is a 10-billion dollar industry in North Carolina supporting 170,000 jobs, and tourism depends on clean air, beautiful scenery, and healthy forests. NO_x, along with ozone and especially sulfur dioxide (SO_x), causes haze and reduces visibility. Smokey Mountain National Park officials estimate that pristine visibility should be approximately 60 miles in the summer time. Today, average summer visibility is only 15 miles. Loss of visibility directly threatens tourism, a vital sector of North Carolina's economy.

- **Environmental Damage.** In addition to poor air quality, ground-level ozone interferes with the ability of plants to produce and store food, so growth, reproduction, and overall plant health are compromised. Ozone can kill or damage plant leaves and make them more susceptible to disease. In addition to being a precursor to ozone, NO_x can be converted to nitric acid in the presence of water, which acidifies both rain and soils. Acid rain, a year round problem, threatens North Carolina's ecosystems especially in the mountains. The acidification of streams due to NO_x and other sources may damage both recreational and commercial fishing.

- **Ozone Levels Are High in North Carolina.** Of the 32 counties monitored for ozone by the North Carolina Division of Air Quality, 24 are out of compliance with the 8-hour standard. Despite improvement early in the 1990s, Figure 3 reveals a trend of increasing ozone levels, which is manifested by increasing violations of the 8-hour standards.[2] The map on the Page 8 shows the major NO_x point sources in North Carolina.

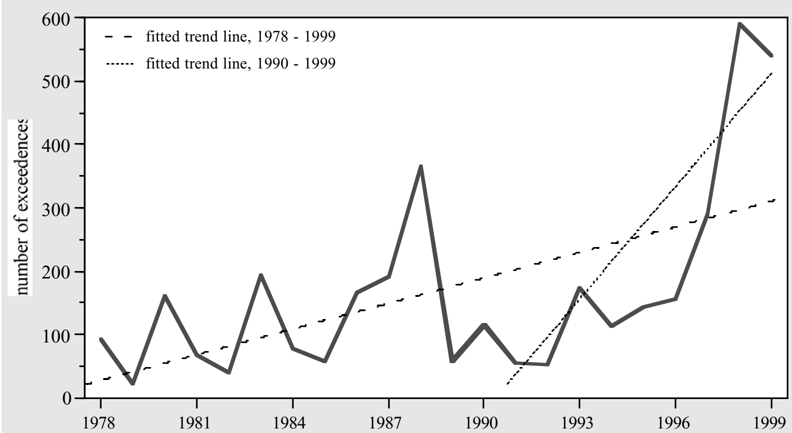


Figure 3. Trends in Exceedances of the 8-Hour Ozone Standard in North Carolina
(number of exceedances for all NC ambient monitoring locations)
April through October, 1978 to 1999

- **Economic Impacts.** Ground-level ozone adversely impacts the economic health of North Carolina due to the public health and tourism costs, which are discussed above. For example, lifetime chronic asthma costs on average \$25,000 per case, and hospital admissions due to respiratory illness costs on average \$6,900 per case (EPA, 1999). In addition to health costs, North Carolina study shows that ozone exposure can cause crop losses between seven and nine percent for soybeans, cotton, and peanuts (NCSU, 1988). Southeastern pine forests may suffer

[2] Although there were some improvements in ozone concentrations in the early nineties, the overall trend has been an increase in exceedances of the 8-hour standard and unhealthy air days.

$110 million per year in yield loss due to ozone exposure (EPA, 1999). The results of a cost-benefit analysis for various regulatory scenarios for North Carolina NO_x emissions is presented in Section IV of this Plan. In addition to these many direct costs of ozone, non-attainment for a county impedes economic development.

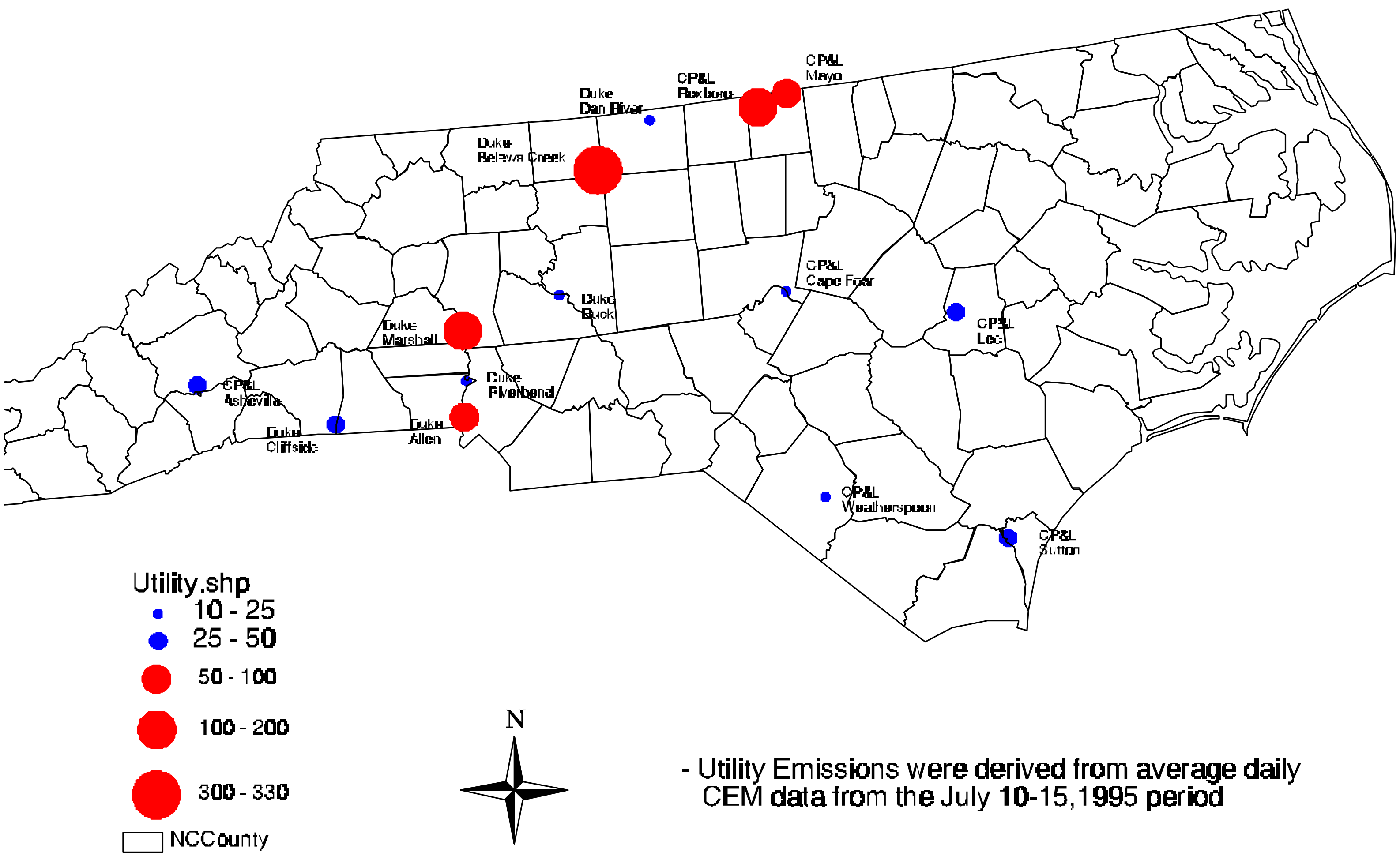
- **Lawsuit against EPA's 110 SIP Call[3].** In December 1998, North Carolina – as well as seven other states – sued the EPA regarding the 110 SIP call with the understanding that the utility companies would be receptive to making reasonable reductions in their NO_x emissions. This Plan presents a sound alternative to the EPA SIP call, and Governor Hunt feels that the major North Carolina utilities have the responsibility to accept and meet the proposed reductions.

- **Regional Cooperation**. Ozone does not honor the boundaries between states. Just as North Carolina contributes to some of Virginia's ozone problems, North Carolina is the recipient of ozone transported from Tennessee, Georgia, Ohio, West Virginia, and South Carolina. Action by North Carolina to address its ozone problems will provide leverage in negotiating with other states to encourage regional reductions in ozone producing pollutants.

- **Energy Conservation.** As North Carolina's population and vehicle miles traveled both grow, the need for energy conservation and pollution prevention become increasingly important. Conservation tends to be the most cost-effective way to reduce ozone pollution, and it also reduces other pollutants, such as greenhouse gasses, which contribute to climate change.

[3] Transportation of ground-level ozone across state boundaries is a concern as states develop individual ozone reduction strategies. Ozone generated in North Carolina impacts areas of Virginia. The northeastern corridor states also claim that North Carolina ozone impacts them as well, even though North Carolina does not believe its impact is significant in these areas. Based on ozone transport issues, the EPA required North Carolina to submit a State Implementation Plan known as the 110 SIP Call as it was derived from Section 110 of the Clean Air Act (CAA). This 110 SIP Call required reductions in coal-fired power plant emissions down to 0.15 pounds NO_x per million BTUs. North Carolina is suing as these emission reduction requirements are based on false assumptions regarding North Carolina's contribution to Northeast NO_x pollution, and they ignore ozone caused by mobile sources (e.g., automobiles). Federal courts are expected to rule on this suit in the summer of 2000. Additionally, in response to petitions led by northeastern states (known as 126 Petitions) the EPA has ordered the 27 largest North Carolina NO_x emitters to comply with the EPA-mandated NO_x contols that were uniformly applied to all sources affecting the Northeast corridor. Most recently, EPA has begun enforcement actions against large power plants, including those in North Carolina, to require them to install control technologies, which may result in implementation of further controls of NO_x at these plants.

North Carolina Utility Sources - 1995 NOx Emissions



- Utility Emissions were derived from average daily CEM data from the July 10-15,1995 period

IV. Ozone Reduction Strategy

Ground-level ozone levels are best controlled in North Carolina by the reduction of NO_x. The strategy to reduce NO_x is divided into to three phases, which are discussed below and summarized in Table 1. Phase I is already underway. Phase II represents an interim step with refinements to be identified in the comprehensive strategy developed in Phase III. Note that all reductions listed are compared to total NO_x emissions from all sectors.

Table 1: Summary of Ozone Reduction Strategies

Phase	Source	Expected Emission Rate (pounds / Million BTUs[4])	Reduction[5] of Total NO_x by 2007 (%)
Phase I mid-1990's - 2000	Mobile Sources (e.g., tailpipe standards)		
	Coal-Fired Electric Utility Boilers (Title IV)	0.40 – 0.68	20%
Phase II 1999 – 2003 for Option A or 2005 for Option B	Mobile Sources • low sulfur gasoline • inspection and maintenance programs • alternative fuel vehicles • telecommuting • transportation planning		8%
	Coal-Fired Electric Utility Boilers	**Option A** - 0.15 for "Big 5" **Option B** - 0.25 average	14% - 16%
			42% - 44%
Phase III	Coal-Fired Electric Utility Boilers	*To be determined*	
	Mobile Sources		
	Industrial Sources		

[4] BTU stands for British Thermal Unit. It represents the amount of energy in a fuel source. For example, typical BTU content of common fuels are as follows: coal – 11,000 BTU per lb., fuel oil – 18,300 BTU/lb., and natural gas – 22,300 BTU per pound

[5] All reductions presented in this plan are compared to total NO_x generation in North Carolina. Percent reductions compared against a single sector are higher than compared to total NO_x. For example, the utility reductions compared to total NO_x is about 36 percent (20 + 16 from table), while their reductions compared to only utility emissions represents about a 68 percent reduction.

Phase I.
Title IV of the federal Clean Air Act requires reductions to national specific emission rates of NO_x from coal-fired electric utility boilers by 2000 as a part of the strategy to reduce acid rain. These rates are between 0.40 and 0.68 lbs. of NO_x per every million BTU. Carolina Power and Light (CP&L) and Duke Energy have largely met these emission rates through combustion modifications. The emission rates are expected to reduce total North Carolina emissions of NO_x by 20 percent by 2007. In other words, emissions would likely be 20 percent lower in the year 2007 than they would have been without such reductions.

Phase II.
North Carolina believes that this State's ozone problems can only be solved through a comprehensive approach that addresses ozone pollution caused by NO_x emission from both mobile and stationary sources. The 1999 General Assembly committed North Carolina to the mobile source reductions of Phase II though Senate Bill 953.[6] The utility industry's contribution to Phase II NO_x reduction would be established through the rule making process, with proposed rules to be approved for notice in March 2000 in preparation for action by the EMC by September 2000. Important ozone modeling, expected to be completed by mid-year 2000, will be available before final emission rate commitments would be put into rule. Phase II reductions represent an interim step to reduce NO_x emissions and ozone pollution, and the modeling will shed light on possible future additional reductions needed from all source sectors. The Phase II strategy is as follows:

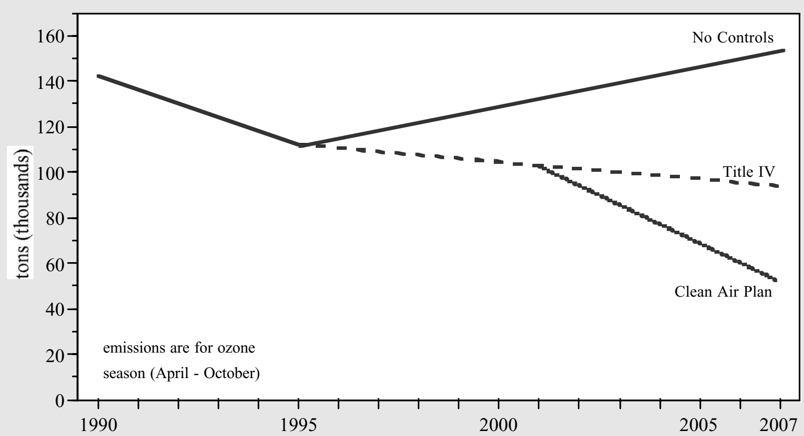


Figure 4. Utility NOx Emissions in North Carolina
Proposed Reductions by the Year 2007

- **Significant Mobile Sources (8% reduction).** Mobile sources emit 49 percent of the State's NO_x emissions. Most reductions in mobile source emissions will be achieved through implementation of Senate Bill 953 enacted by the General Assembly in 1999, and the federal Motor Vehicle Control Program along with some additional initiatives. The mobile source strategy is as follows:

[6] Senate Bill 953, the Ambient Air Quality Improvement Act of 1999 was sponsored by Representative Joe Hackney and Senator Brad Miller.

- **Low Sulfur Gasoline (4.8% reduction).** This limits the average sulfur content of gasoline that can be sold in North Carolina to 30 parts per million.
- **Expanded and Enhanced Inspection and Maintenance Program (2.0% reduction).** Senate Bill 953 expands the inspection program from 9 to 48 counties and requires testing for NO_x in addition to carbon monoxide and hydrocarbons.
- **Alternative fuel vehicles (0.3 – 0 .7% reduction).** Senate Bill 953 require that by 2004 50 percent of new purchases of State fleets and school busses be alternative vehicles. Private fleets are also encouraged to use alternative vehicles.
- **Telecommuting (0.3% reduction).** State government should decrease the vehicles miles traveled by its employees by 20 percent. Telecommuting will be key strategy to meet this goal.
- **Transit (0.3 – 0.7% reduction).** The Department of Transportation will continue to follow through on public transportation (train and bus) as Governor Hunt outlined in the Transit 2001 report.

♦ **Coal-fired Electric Utility Boilers (14% – 16% reduction).** Coal-fired power plants offer a cost-effective option for North Carolina to reduce NO_x emissions. To implement Phase II of the Clean Air Plan, the North Carolina Environmental Management Commission needs to adopt rules to reduce NO_x emissions at the major coal-fired utilities. DENR proposes that these rules should allow the utilities one of two options to make their reductions. Both options would place caps on total NO_x emissions so that reductions in emission rates cannot be offset by increases in levels of combustion.

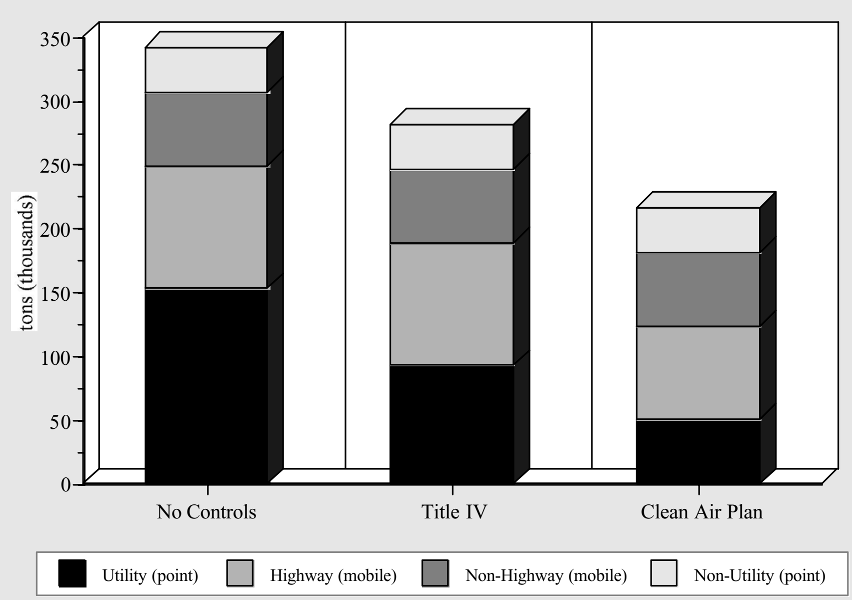


Figure 5. Emissions Scenarios for NOx in the Year 2007
(based on estimates for ozone season: April through October)

- **Option A:** Reduce the rates of emissions from the largest five[7] emitters to 0.15 lbs NO_x/ million BTU by 2003. The largest 5 plants produce 74 percent of the NO_x from the utility sector. This option would represent an additional 16 percent reduction in total NO_x emissions in North Carolina.

- **Option B:** Reduce the rates of emissions from all Carolina Power & Light and Duke Energy facilities to a system wide average of 0.25 lbs. NO_x/ million BTU by 2005. The additional two years beyond the Option A timeframe is needed since the controls would be spread among more plants. This option would represent an additional 14% reduction in total NO_x emissions in North Carolina.

Economic Analysis of Phase II Coal-fired Utility Boiler Strategy

Although the goal of the Governor's Clean Air Plan is to improve public health and protect the environment, the economics of the Plan must be considered as decisions are made. The total charges for asthma hospitalizations in North Carolina are about $50 million per year, and a portion of these asthma hospitalizations are cause by high ozone concentrations. The North Carolina Department of Health and Human Services (DHHS) estimates that 2.1 percent[8] of respiratory-related (more than just asthma) hospital admissions from April to October 1997 may be due to ozone. Based on total numbers and average costs of respiratory hospital admissions, DHHS estimates the quantifiable costs of ozone on public health to be between $8.7 million and $19.1 million. These estimates do not include the costs to asthmatics that are treated outside the hospital, which represent the majority of

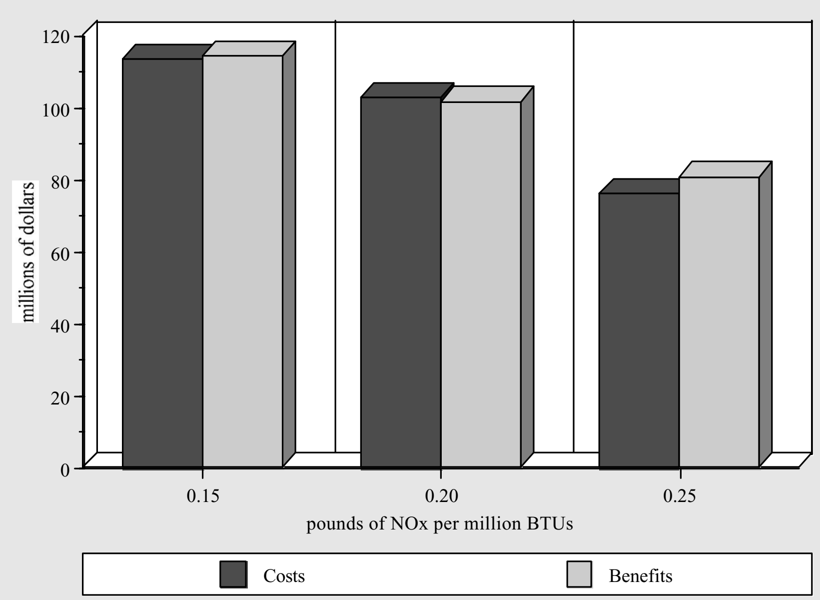


Figure 6. Cost/Benefit Analysis of Phase II of Clean Air Plan (utilities only)

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[7] The top five facilities in terms of NO_x emissions are as follows: Belews Creek, Duke Energy –329 tons per day; Roxboro, CP&L – 194 tons per day; Marshall, Duke Energy –164 tons per day; Allen, Duke Energy – 59 tons per day; Mayo, CP&L – 55 tons per day. Sutton, CP&L – 55 tons per day – was excluded from the top five list as its NO_x emissions are transported out to the Atlantic Ocean and do not impact North Carolina's non-attainment areas (though nitrogen loading impacts in the ocean may be a concern.)

[8] Percentage based on Abt Associates study for the Clean Air Task Force, 1999.

the cases, nor do they include other health, environmental, or social costs.

In addition to the estimates calculated by DHHS above, DENR has extrapolated EPA's economic data on ozone reduction strategies to North Carolina to provide an approximate sense of the costs and benefits of Phase II of this Clean Air Plan. The results of this analysis, presented in Figure 6, show that for various reduction scenarios at all utilities (0.15, 0.20 and 0.25 pounds NO_x per million BTUs) the cost of compliance is approximately equal to those benefits that can be quantified in dollars values. The benefits evaluated in this analysis include reductions of short-term mortality, hospital admissions, acute respiratory symptoms, work productivity, commodity crops and commercial forests. (Division of Air Quality, 2000).

In addition to the cost quantified by the EPA data, there are many societal benefits or avoided costs associated with ozone reduction that are not easily quantified. For example, the benefits of North Carolina's clean air to tourism cannot easily be put into monetary terms. Avoided costs of reduced ozone concentrations include: pulmonary inflammation, chronic respiratory damage, damage to urban ornamentals (grass, flowers, shrubs), loss of fruit, vegetable, and tree seeding yields, and damage to ecosystems.

<u>Additional Issues Associated with Coal-fired Electric Utility Boilers</u>

- **Early Reductions.** Early reductions provide benefits sooner to the citizens of North Carolina. As an incentive, significant early reductions can extend a utility's timeframe for two ozone seasons for complying with the Phase II reduction requirements
- **Utility Restructuring.** Restructuring presents both environmental opportunities and threats. For example, deregulation may promote cogeneration facilities, which extract more useful energy per BTU of fuel than conventional power generation facilities. At the same time, deregulation may prompt increased consumption of electricity. As utility restructuring has the potential to reduce residential electric rates by 20 to 30 percent (EPA, 1998, document #456/F-98-006), restructuring provides an opportunity for North Carolina to absorb the modest increases in costs of 1 to 2 percent from NO_x reductions. As North Carolina considers deregulation of its energy production sector, it is critical that pollution, conservation, and renewable energy issues are integral to deregulation decisions. For example, Texas integrated ozone strategies and NO_x reductions into its process of restructuring its utility industry. Along with deregulation, Texas law aims to reduce emissions by 50 percent through a standard of 0.14 pounds NO_x per million BTU for old plants predating permitting requirements. Texas law also provides that cleanup costs like control equipment can be included in the stranded cost recovery process of utility deregulation.
- **Cost Recovery.** Governor Hunt and DENR recognize that installing controls to reduce emissions of NO_x at power plants will increase capital treatment costs for electric utilities.

Phase III.

Detailed modeling of ozone production in North Carolina should be completed by September 2000. Modeling results will be the point of departure for Phase III of the strategy to reduce ground-level ozone in North Carolina. The modeling results will indicate what additional reduction in NO_x may be needed by all sectors to achieve the 8-hour standard and significantly improve the air quality in North Carolina. The Southern Appalachian Mountain Initiative is performing additional modeling that will help in the development of a multi-state strategy to improve the visibility in those mountains by one deciview by 2008 as called for in the DENR strategic plan. Also, Phase III may provide an opportunity to look at all aspects of clean air beyond just ozone. Phase III will be developed with the following goals in mind:

- **Equity.** Emission reduction requirements should be distributed fairly among utilities, manufacturing facilities, and mobile sources.

- **Incentive Tools.** Strategies should stress early reductions, set caps, and allow for emission offsets. Emission trading should also be explored.

- **Pollution Prevention and Conservation.** Pollution prevention and energy conservation should be emphasized in reducing ground-level ozone concentrations and other air pollution.

- **Tier II automobile Standards.** North Carolina will need to factor in the benefits of the federal Tier II automobile standards recently announced by the Clinton Administration.

- **Low Sulfur Gasoline.** The EPA has recently required the sale of cleaner, low sulfur gasoline and North Carolina must determine how it will implement this standard.

- **Energy Output Standards.** North Carolina should explore emissions rate standards based on energy output, which may provide greater incentive for energy efficiency.

- **Integrated Clean Air Strategies.** Strategies to reduce ozone concentrations should be interwoven with efforts to reduce acid rain, fine particulates, mercury, and greenhouse gasses.

- **Smart Growth.** Smart growth principles should be incorporated in ozone reduction strategies. For example, leadership of the NC Department of Transportation will help North Carolina to moving forward with the following smart growth initiatives: (1) development and adoption of Project Selection Criteria, (2) consolidation of Metropolitan Planning Organizations, and (3) linking of local land use, transportation, and air quality planning, such as management of access to major highways.

- **Clean Air Trust Fund.** North Carolina should create a Clean Air Trust Fund to facilitate the transition to cleaner technologies and management systems. The trust could fund conversion to alternative fuels, innovative transportation projects, energy efficiency, and other innovative efforts.

V. Timeline for Near Term Actions

December
- Draft clean air rules are introduced to the EMC, Air Quality Committee.

January 2000
- Stakeholder input gathered.
- EMC Clean Air Workshop held.

February
- Clean Air Plan finalized.
- EMC Air Quality Committee acts on draft rules and forwards them to the full Commission.

March
- EMC initiates public hearing process on the draft rules.

April – August
- Public hearings on draft rules are held.
- General Assembly acts on any pertinent issues.
- Division of Air Quality comprehensive ozone Phase III modeling is completed.

September
- EMC approves temporary and permanent rules.
- The Department of Environment and Natural Resources begins development of Phase III strategies based on latest modeling data.

Appendix D: A Summary of Public Benefit Programs in the Electric Utility Industry

Executive Summary

This table provides an overview of the results of an American Council for an Energy Efficient Economy (ACEEE) review of the nature and scope of public benefits programs being developed under electric utility restructuring. For those states that have acted on restructuring, the report presents information on policy decisions regarding each of five policy areas: public benefit energy R&D; energy efficiency; renewable energy; low- income programs; and disclosure of energy sources and environmental emissions.

This table was posted on the ACEEE website in December 1999.

Table D-1. A Summary of Public Benefit Programs in the Electric Utility Industry

			Details of SBC Funding					Renewables Portfolio Standard	Generation Disclosure
			R&D	EE	LI	RE	Total		
Arizona	In Dec96, the ACC ordered retail competition beginning in Jan99 and completed by Jan03. Later updated to Jan01. But, in Jan. 99 a new Commission stayed the rules. Utilities have filed indiv. plans. A new rule is under development, including support for EE and LI. Also a separate rulemaking for RE.	**million $**	TBD	TBD	TBD	TBD	TBD	An RPS rule is under development at the ACC.	Under discussion.
		mills/ kWh	TBD	TBD	TBD	TBD	TBD		
		% rev.	TBD	TBD	TBD	TBD	TBD		
		admin.	TBD	TBD	TBD	TBD			
California	In Sept96, AB1890 was signed into law. Full retail access for all customer types began Apr98. Funding is through a nonbypassable wires charge. EE total is just the 3 large IOUs. Small IOUs and muni' s are additional. Table shows annual average over 4 year authorization in the legislation (1998- 2002).	**million $**	62.0	218+	81.0	135.0	496+	None.	Developing a label standard to cover gen mix, emissions, price, price volatility.
		mills/ kWh	0.4	1.3	0.5	0.8	3.0		
		% rev.	0.4	1.3	0.5	0.8	3.0		
		admin.	CEC	CBEE	CPUC	CEC			
Connecticut	In April 1998 Public Act 98- 28 was signed into law. Phases in retail access during 2000. It funds EE, RE, and LI. RE ramps up over time, average is in table. Support for R& D is imbedded in the RE programs. Funds would be collected through a nonbypassable wires charge.	**million $**	in RE	87.0	TBD	22.0	109+	Two tier, limits hydro starting at 6% and escalating to 13% by the year 2009.	Included in bill without specifics.
		mills/ kWh	in RE	3.0	TBD	0.75	TBD		
		% rev.	in RE	3.0	TBD	0.75	TBD		
		admin.	EE & RE	collab.	TBD	St. Auth.			
Delaware	Restructuring Act signed in March 1999. Has two SBCs: 0.178 mills/ kWh for EE "incentive" programs, overseen by DE Economic Dev. Office, 0.095 mills/kWh for LI bill asst. & EE, overseen by Dept. of Health & Soc. Services. An additional $ 250,000 from rates is to go to customer education, esp. regarding RE.	**million $**		1.5	0.8	0.3	2.6	None.	Not required. Law says Commission "may" promulgate rules.
		mills/ kWh		0.18	0.1	0.03	0.3		
		% rev.		0.3	0.15	0.05	0.5		
		admin.		state	state	state			
Illinois	In Dec97, PA 90- 561 was signed. It provides funding for EE, RE and LI (although EE and RE are at low levels), using nonbypassable flat monthly charges on customer bills. ("mills/kWh" equiv. includes $ from gas & electric.) Also, one- time ComEd $ 250 million Clean Energy Trust fund ok' d by legis. May 99 (not in table).	**million $**		3.0	75.0	5.0	83.0	None.	All electricity retailers would be required to disclose generation mix and emissions.
		mills/ kWh		0.03	0.6	0.04	0.7		
		% rev.		0.04	0.8	0.05	0.9		
		admin.	Dept of Cmrce. & Comm. Affairs						

(continued)

Table D-1. A Summary of Public Benefit Programs in the Electric Utility Industry (continued)

			Details of SBC Funding					Renewables Portfolio Standard	Generation Disclosure
			R&D	EE	LI	RE	Total		
Maine	In May97, a state restructuring law was passed. The PUC has proposed, and legislature has authorized, up to approx. $ 17 million/ yr. for EE via statewide charge in distribution rates (equiv. to max. of 1.5 mills/ kWh). State Planning Office will oversee. Original law also requires LI asst. funding as shown. R& D is voluntary funding.	**million $**		17.2	5.5		22.7	30% starting Mar00. Limited to facilities of 100-MW or less.	Yes. Fuel mix and emissions disclosure is required.
		mills/ kWh		1.5	0.8		2.3		
		% rev.		1.5	0.5		2.0		
		admin.	TBD	state	utility				
Maryland	Restructuring Law signed in April 1999. Includes $34 million/yr. tax funded "Universal Service Fund" for bill assist. and EE for LI customers. (Table shows mills/ kWh and % rev. equiv.) In addition, 2 of state's 3 largest utilities have 1 mill/ kWh residential only SBC for EE ok'd thru settlements. (EE in table just for those)	**million $**		13.0	34.0		47.0	PSC to conduct a feasibility study of an RPS and report by 2/1/2000.	Yes. Fuel mix and emissions disclosure is required.
		mills/ kWh		1.00	0.6		0.6+		
		% rev.		0.4	0.9		0.9+		
		admin.		TBD	state				
Massachusetts	In Dec96,the DPU issued Model Rules. In Nov97 comprehensive legislation was signed bringing retail access to all customers in 1998.Includes a nonbypassable wires charge for EE,RE and LI. Amounts ramp up for RE and down for EE. Averages shown in table. (Note: RE excludes .25 mills/kWh for MSW)	**million $**		130.0	current	30.0	LI +160	Requires a new 1% increment by 2003, 4%more by 2009, 1%/yr.thereafter.	Fuel mix and emissions disclosure is required. Member N.E. Disclosure Proj.
		mills/ kWh		3.0	levels	0.7	LI +3.7		
		% rev.		3.0		0.7	LI+3.7		
		admin.		DOER	DOER	MTPC			
Montana	In May97,electric utility restructuring was signed into law. Retail access begins July98 and is scheduled to be completed by July02.Using EE and RE funds for R&D is approved by the new statute. Funds will be collected using a "universal system benefit charge." LI must be at least 17%of total.	**million $**		TBD	TBD	TBD	14.0	None.	The Transition Advisory Committee will address the issue.
		mills/ kWh		TBD	TBD	TBD	1.1		
		% rev.		TBD	TBD	TBD	2.4		
		admin.	Utility programs +						
Nevada	In July97,electric utility restructuring was signed into law. Subject to PUC review, retail access is scheduled for Dec99. Public benefit programs, including R&D, are specifically encouraged but funding is not provided by the statute. PUC is working on rules to implement the law, EE not addressed yet.	**million $**	TBD	TBD	TBD	TBD	TBD	By Jan01 to be 0.2%. Add 0.2%bienially until 1%total in 2009, 1/2 to be new solar.	Bills must contain price variability, and generation mix.
		mills/ kWh	TBD	TBD	TBD	TBD	TBD		
		% rev.	TBD	TBD	TBD	TBD	TBD		
		admin.							

(continued)

Table D-1. A Summary of Public Benefit Programs in the Electric Utility Industry (continued)

			Details of SBC Funding					Renewables Portfolio Standard	Generation Disclosure
			R&D	EE	LI	RE	Total		
New Hampshire	In May97,NHRSA was signed into law. Full retail access was to be implemented in Jan98,but conflicts over stranded costs have delayed the process. The statute authorizes funding for R&D,EE,RE and LI but initial PUC plan only funded LI.PUC is considering funding some EE as a result of a rehearing.	**million $**		TBD	13.0		TBD	None.	Participants in the New England Disclosure Project.
		mills/ kWh		TBD	1.5		TBD		
		% rev.		TBD	1.3		TBD		
		admin.		TBD	county				
New Jersey	Restructuring law passed in Jan.99.Requires SBC funding for EE/RE at same level as existing DSM costs (approx.$235 million/yr.). Full SBC is 3.4 mills. Half would pay for costs from prior years, half for new programs.25%of new must be RE. Numbers in table are new $only.. LI sep. funded at prior levels.	**million $**		87.5	10.1	30.0	127+	By Jan01 to be 0.5%. from "Class 1",by Jan.06 1.0%.Ramps up to 4%by 2012.	Required for fuel mix and emissions.
		mills/ kWh		1.35	0.16	0.45	1.96		
		% rev.		1.35	0.15	0.45	1.95		
		admin.		Utility	Utility	Utility			
New Mexico	Legislation to restructure (SB 428) was signed in April 1999.An SBC of 0.3 mills/kWh is required, which goes to fund consumer educ., LI energy efficiency, and renewable energy promotion. Numbers in table are specified min. or max. figures. Funds to be administered by the state Dept. of Environment.	**million $**			0.5+	4.0	5.0+	Suppliers required to offer renewables, but no portfolio std. is required.	Required for fuel mix and emissions.
		mills/ kWh			incl.	incl.	0.3		
		% rev.			0.1	0.4	0.5		
		admin.			state	state			
New York	In May96,the PSC issued Order 96-12.All state IOUs filed rate and restructuring plans. A July98 Order identified $78 million per year for an SBC to fund EE,LI and R&D, administered by NYSERDA. R&D includes $4 million for solar &wind. (EE in table doesn't incl.Approx.$100 million/yr. by power author.)	**million $**	14.0	54.0	10.0	in R&D	78.0	None.	Required by PSC Order dated 12/15/98. Working on design to start in 2000.
		mills/ kWh	0.1	0.6	0.1		0.8		
		% rev.	0.1	0.5	0.1		0.7		
		admin.	state	state	state				
Ohio	Restructuring Law (SB3) signed in July 1999.Includes an SBC for up to $15 million/yr. for an "Energy Eff. Revolving Loan Fund" admin. by the state, plus a "Universal Service Rider" for LI bill asst. and efficiency. LI in table based on recent historical spending. (EE does not incl. addtl. agreements by indiv. utilities.)	**million $**		15.0	100.0		115.0	None.	Yes. Fuel mix and emissions disclosure is required.
		mills/ kWh		0.1	0.7		0.8		
		% rev.		0.15	1.1		1.25		
		admin.		state	state				

(continued)

Table D-1. A Summary of Public Benefit Programs in the Electric Utility Industry (continued)

			Details of SBC Funding						
			R&D	**EE**	**LI**	**RE**	**Total**	**Renewables Portfolio Standard**	**Generation Disclosure**
Oregon	Law passed in July 1999.Includes a "public purpose charge" to fund EE,RI and LI, equiv. to 3%of total IOU revenues (approx.$50 million). Requires 63%of funds for EE (incl. MT) and 19%to RE.PUC to develop rules. LI gets 18%of PPC for weatherization, plus extra $10 million for bill payment assistance (incl. in table totals).	**million $**		31.5	19.0	9.5	60.0	None. (a "green rate" option is required, however)	Yes. Fuel mix and emissions disclosure is required.
		mills/ kWh		1.0	0.6	0.30	1.9		
		% rev.		1.9	1.1	0.60	3.6		
		admin.		TBD	state	TBD			
Pacific Northwest: Idaho, Wash. (Oregon & Montana) see above)	In Dec96 the NWPPC, made up of Governor's appointees from all 4 Northwest states, issued a Comprehensive Review and restructuring plan. A regional nonprofit would receive up to 33%of funds for regionally focused EE, RE, and R&D programs. A wires charge was recommended at 3%of revenues.	**million $**	TBD	TBD	TBD	TBD	TBD	None.	Not discussed.
		mills/ kWh					n/a		
		% rev.					3.0		
		admin.	mix	mix	state	mix			
Pennsylvania	In Dec96,a restructuring law was signed. Retail access to be phased-in over 2 yrs. starting Jan99.Law requires EE and LI minimum funding at existing levels (10m and 26m). Exact levels determined in indiv. utility cases have been higher than minimum. EE includes some renewables. LI includes 20%for efficiency.	**million $**		11.0	85.0	2.0	98.0	Being addressed in individual utility restructuring cases.	Yes. Fuel mix is required. (but not emissions data.)
		mills/ kWh		0.1	0.7	0.02	0.8		
		% rev.		0.1	0.9	0.02	1.0		
		admin.		Utility	Utility	Utility			
Rhode Island	Retail competition phased in by Jan98.Final spending plans exceeded the legislated minimum of 2.3 mills per kWh. Some funding on R&D for "near commercialization" renewables. Funds collected through a nonbypassable wires charge, except low-income efficiency and rate discounts which are funded in rates, not the SBC.	**million $**		14.0	in rates	2.5	16.5	None.	Participant of NE Disclosure Project.
		mills/ kWh		2.1	in rates	0.5	2.6		
		% rev.		2.1	in rates	0.4	2.5		
		admin.		Collab.	utility	Collab.			
Texas	Restructuring Law signed in June 1999.Requires utilities to administer EE programs to achieve savings equiv. to 10%of annual load growth by 2004.PUC to establish rates and procedures. Also a small SBC for customer educ. and LI assistance &10%LI rate discount. (SBC not to exceed .065 mills/kWh.)	**million $**		TBD	15.0		15+	Requires 2000 MW of new renewables by 2009. (Phase-in, 450 MW by 2003.)	PUC required to develop rules to disclose enviro. impacts.
		mills/ kWh		TBD	0.065		0.065+		
		% rev.		TBD	0.1		0.1+		
		admin.		utility					

(continued)

Table D-1. A Summary of Public Benefit Programs in the Electric Utility Industry (continued)

			Details of SBC Funding					Renewables Portfolio Standard	Generation Disclosure
			R&D	EE	LI	RE	Total		
Vermont	VT has not yet restructured*, but in June 1999 S.137 passed, giving PSB the authority to establish an SBC to fund statewide EE thru a nonutility entity, in place of utility programs.$17.5 million/yr maximum.5-year ramp-up budget was set in settlement, averages shown in table.* (in 1997,S.62 passed Senate but not House.)	**million $**		13.1	TBD	TBD	TBD	S62 required 2-tier, existing (up to 15%) &emerging (up to 4%) by 2007.	S62 required price, mix, pollutants, EE notices, and terms. NE Disclosure Proj.
		mills/ kWh		2.5	TBD	TBD	TBD		
		% rev.		2.6	TBD	TBD	TBD		
		admin.		contract	TBD	TBD			
Wisconsin	Act 9 of 1999 passed Sept.99 includes elec. Reliability provisions which designate the WI Dept. of Admin. as the state agency to design and implement public benefit programs. Industry restructuring has not yet been addressed. Totals in the table reflect best current estimate of funding levels when fully in place.	**million $**	1.5	78.3	64.2	3.8	147.8	Requires 0.5 %by 12/31/2001. Increases biennially to 2.2% by 12/31/2011.	Not addressed.
		mills/ kWh	0.0	1.5	1.3	0.1	2.9		
		% rev.	0.05	2.9	2.4	0.15	5.5		
		admin.	DOA	DOA	DOA	DOA			