GAO

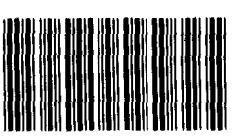
United States General Accounting Office

Report to the Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives

September 1990

# ELECTRICITY SUPPLY

# Older Plants' Impact on Reliability and Air Quality



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GAO
**United States**
**General Accounting Office**
**Washington, D.C. 20548**

**Resources, Community, and**
**Economic Development Division**

B-240541

September 10, 1990

The Honorable John D. Dingell
Chairman, Subcommittee on Oversight
and Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

As you requested, we reviewed electric utilities' plans for extending the useful life of older fossil fuel power plants and examined the effects of life extension on the reliability of the nation's power supply and on air quality.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of this report to the Secretary of Energy and the Administrator, Environmental Protection Agency. We will also make copies available to others upon request.

This work was performed under the direction of Victor S. Rezendes, Director, Energy Issues, (202) 275-1441. Major contributors to this report are listed in appendix III.

Sincerely yours,

J. Dexter Peach
Assistant Comptroller General

# Executive Summary

## Purpose

To help meet America's growing demand for electricity, electric utilities plan to extend the service life of many fossil fuel power plants. Accounting for some 70 percent of the nation's generating capacity, such plants, particularly older plants exempted from the Clean Air Amendments of 1970 (commonly referred to as the Clean Air Act) are major sources of air pollution. The Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, asked GAO to evaluate

- the reliability of plants with an extended service life and their current and projected contributions to electricity supply and
- the impact of current and proposed air quality requirements on plant emissions and utilities' decisions to extend the service life of older plants.

## Background

Fossil fuel power plants traditionally were expected to have an operating service life of about 30 to 40 years, after which they would be replaced with new plants. However, in part to avoid the financial risks of constructing new plants, utilities increasingly are looking to extend the service life of older plants well past their assumed retirement age. Utilities' life extension projects encompass a variety of activities, including maintenance, repair, and replacement of equipment.

Fossil fuel power plants are major sources of sulfur dioxide and nitrogen oxides, pollutants that adversely affect health and the environment, the latter by forming acid rain. The Clean Air Amendments of 1970 established emission standards for these and other pollutants emitted from power plants constructed after 1971. Plants built before that are exempt so long as they are not (1) modified so that their emissions increase or (2) reconstructed so that the cost exceeds 50 percent of the cost of a new plant. In 1985 these exempt plants emitted 88 percent of the sulfur dioxide and 79 percent of the nitrogen oxides emitted from all fossil fuel plants. The Environmental Protection Agency (EPA) is responsible for enforcing emission requirements, while the Department of Energy (DOE) aims to ensure an adequate national energy supply at reasonable rates.

In doing this work, GAO spoke with federal, utility industry organization, state public utility commission, and state environmental officials and reviewed available studies. GAO also contacted officials at nine utilities that rely on older fossil fuel plants.

## Results in Brief

Life extension of fossil fuel plants is a relatively recent phenomenon; thus, utilities have little experience to demonstrate the longer-term operating reliability of plants with an extended service life. While utility industry officials and government and industry studies express optimism that these plants will continue to operate reliably, the officials and the studies also caution that it is too soon to determine how pursuing life extension will affect the reliability of the nation's electricity supply. According to DOE, the number of fossil fuel generating units[1] 30 years old or older is expected to increase from about 2,500 in 1989 to roughly 3,700 in 1998, increasing such plants' share of overall generating capacity from 13 percent in 1989 to 27 percent in 1998.[2]

EPA estimates that with existing air quality requirements, fossil fuel plant emissions will increase steadily during the coming decade. Proposed acid rain control legislation—which would affect many plants that may have their service life extended—would require utilities to significantly reduce emissions by the year 2000 but would allow utilities flexibility in deciding how and where to achieve the reductions. If such legislation is enacted, utilities generally are expected to find reducing emissions from existing plants more cost-effective than replacing them and to continue extending plants' service life.

Officials of DOE and utility organizations expressed concern, however, that EPA could decide, as it did for one plant in 1988, that alterations made in extending the service life of plants exempted from the Clean Air Act would result in increased emissions and thus cause the altered plants to lose their exemption. According to the officials, the additional costs of achieving the Clean Air Act's standards could discourage some life extension projects. However, such decisions by EPA could also reduce the nation's total power plant emissions by eliminating an existing incentive to retain exempt plants. Because uncertainty exists about the emission standards applicable to altered plants, EPA is taking steps to clarify the standards.

[1] A power plant may contain several generating units.

[2] Because data on electric generating capacity and power plant emissions are not available specifically for plants with an extended service life, GAO collected data on plants 30 years old or older. When a plant is at about this age, utilities generally decide whether to extend its service life.

# GAO's Analysis

## Reliability of Plants With an Extended Service Life

Life extension, a generic term, covers a variety of activities, including maintaining, restoring, and repairing power plant components. As plants age, critical components degrade because of fatigue, erosion, and corrosion. For plants over 30 years old, breakdowns are more frequent than for newer plants, and the time needed to repair the older plants increases. The general goal of life extension projects is to keep plants operating at acceptable levels of availability[3] and, in some cases, to return the plants to their original operating efficiency and maintain that status for an additional 30 years beyond their originally estimated service life.

DOE estimates that plants accounting for about one-third of the current total generating capacity of the nation's fossil fuel plants may undergo life extension by the year 2000. However, no consensus has emerged among utility industry experts on the degree of reliable performance that can be expected from these renovated plants. While officials at the nine utilities GAO contacted, as well as government and industry studies, are generally optimistic about the success of life extension, they also are cautious because of the lack of operating experience with these plants.

## Effects of Air Quality Requirements

Under current air quality requirements, fossil fuel plant emissions will increase steadily during the next decade, according to EPA's estimates. Proposed acid rain control legislation would require utilities to reduce these emissions significantly by the year 2000. This legislation targets many of the same power plants that are candidates for life extension. The legislation would require utilities to reduce their aggregate emissions of sulfur dioxide and nitrogen oxides by the year 2000, but would establish an allowance trading system whereby utilities could choose how and where they can achieve the most cost-effective emission reductions. If such legislation is enacted, utilities probably would continue operating existing plants and extending the service life of older plants, rather than build replacement plants.

However, officials at DOE and utility organizations expressed concern that power plants currently exempt from the Clean Air Act that have their service life extended would be required to meet the act's emission

[3]Availability refers to the percentage of time that a power plant could be used to generate electricity.

standards if EPA decides that the alteration would result in increased emissions. EPA's decisions are made case by case and usually after a state agency—authorized by EPA to enforce the Clean Air Act—has determined that a project will result in increased emissions. In 1988 EPA determined that the Wisconsin Electric Power Company's (WEPCO) proposed life extension project would constitute a "modification" under the act, necessitating that the plant meet the act's standards. WEPCO unsuccessfully argued that the project was the routine replacement of existing equipment and thus the plant should remain exempt from the standards. WEPCO also argued that EPA's method of estimating the resulting increase in emissions was not reasonable.

According to officials of DOE and the utility industry, the additional costs for emission control equipment incurred in complying with such a decision by EPA may cause utilities to defer or abandon some life extension projects. EPA policy officials maintain that the WEPCO life extension project is not typical and that many projects do not result in increased emissions and many are routine alterations, which would not make the plants subject to the standards.

EPA regulations implementing the act, however, do not explicitly address life extension projects, but rather (1) physical and operational changes made at power plants that result in increased emissions and (2) substantial reconstruction. However, EPA plans to develop additional policy guidance to address the majority of plant alterations the agency expects will occur in the near future as more plants have their service life extended and/or are altered to achieve emission reductions required under proposed amendments to the Clean Air Act. Also, in May 1990, EPA agreed to draft an amendment clarifying the applicability of current emission standards.

## Agency Comments

As requested, GAO did not obtain written comments on this report but discussed it with officials of DOE and EPA, who generally agreed with its content. Their comments have been incorporated where appropriate.

# Contents

## Abbreviations

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|---|---|
| DOE | Department of Energy |
| ECAR | East Central Area Reliability Coordination Agreement |
| EEI | Edison Electric Institute |
| EPA | Environmental Protection Agency |
| EPRI | Electric Power Research Institute |
| ERCOT | Electric Reliability Council of Texas |
| FGD | flue gas desulfurization |
| MAAC | Mid-Atlantic Area Council |
| MAIN | Mid-America Interconnected Network |
| MAPP | Mid-Continent Area Power Pool |
| MW | megawatt |
| NAPAP | National Acid Precipitation Assessment Program |
| NERC | North American Electric Reliability Council |
| NPCC | Northeast Power Coordinating Council |
| NSPS | New Source Performance Standards |
| PSD | Prevention of Significant Deterioration |
| SERC | Southeastern Electric Reliability Council |
| SPP | Southwest Power Pool |
| UARG | Utility Air Regulatory Group |
| WEPCO | Wisconsin Electric Power Company |
| WSCC | Western Systems Coordinating Council |

# Introduction

Electric utilities are responsible for supplying the nation with electric power in a reliable and environmentally acceptable manner. To accomplish their mission, they traditionally have retired older power plants and have replaced them with new plants. In recent years, however, increased financial risks, uncertainties about future demand, and other factors associated with constructing new plants have led utilities away from readily building new plants. Instead, utilities plan to rely increasingly on other options to meet demand, including purchasing power from other utilities and nonutility sources, pursuing conservation and demand management programs, and extending the service life of existing fossil fuel power plants beyond the previously anticipated 30 to 40 years.

## Utilities' Plans for Meeting Future Electricity Demand Are Not Complete

The Department of Energy (DOE) and industry experts predict that demand for electricity will increase through the 1990s, outstripping planned additions to generating capacity. In 1989 the nation's total electric generating capacity was about 684,000 megawatts (MW).[1] DOE projects a need for an additional 102,000 MW of capacity by the year 2000, and utilities have made plans to construct plants that will produce only about one-third of this additional amount. Also, in 1989 the North American Electric Reliability Council (NERC)[2] projected that utilities' planned additions would be insufficient by 1998. Moreover, according to NERC, some areas of the eastern United States will be at serious risk of supply disruptions in the early 1990s if the demand for electricity reaches the high end of the organization's forecast.

Utilities' are planning to meet future demand in part by extending the service life of fossil fuel plants beyond their originally anticipated retirement date. Fossil fuel power plants are the nation's primary electric generating source and, according to NERC, accounted for more than 70 percent of U.S. generating capacity in 1989. According to DOE's and NERC's projections, such plants will continue as the primary source of electricity during the next decade.

[1] A megawatt is 1 million watts, a watt being the basic unit of measurement of electricity production.

[2] NERC was formed by the electric utility industry in 1968 to promote the reliability and adequacy of the electric power supply in North America.

## Utilities' Options Are Subject to Regulatory Constraints

Electric utilities are subject to a variety of federal, state, and local regulations that affect the construction and operation of power plants, as well as the rates charged to customers. The regulatory focus of DOE and state public utility commissions is to ensure an adequate energy supply at reasonable rates. DOE's activities include (1) collecting, analyzing, and reporting information regarding energy production, consumption, distribution; (2) reporting on related economic issues; and (3) forecasting about these issues. State utility commissions have a regulatory role in ensuring system reliability and in setting rates charged to retail customers.

Because burning fossil fuels produces harmful air pollutants, federal, state, and local environmental agencies also regulate utilities. Among the pollutants these plants emit are sulfur dioxide and nitrogen oxides, which can adversely affect human health and the environment, the latter by forming acid rain. The Environmental Protection Agency (EPA) and state environmental agencies are charged with enforcing compliance with environmental laws.

One of the most important environmental laws affecting electric utilities is the Clean Air Act, as amended in 1970, which was enacted to promote public health and welfare by protecting the quality of the nation's air. The act established air quality requirements that limit the quantity of pollutants electric power plants may emit. It was amended in 1977 to further restrict power plant emissions, and Congressional debate has begun on additional amendments. EPA has delegated most of the enforcement responsibility under the act to state environmental agencies, but retains an oversight role, which it fulfills by performing various activities, such as auditing state agencies, inspecting power plants periodically, and providing policy guidance.

## Objectives, Scope, and Methodology

The Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, asked GAO to evaluate

- the reliability of plants with an extended service life and their current and projected contributions to electricity supply and
- the impact of current and proposed air quality requirements on plant emissions and utilities' decisions to extend the service life of older plants.

In studying the reliability of plants with an extended service life, we examined various studies and reports issued by DOE and utility industry

organizations, including the Electric Power Research Institute (EPRI),[3] NERC, and the Edison Electric Institute (EEI).[4] We discussed the issue with representatives of utility industry organizations and state public utility commissions. We also contacted utility companies with experience operating older plants to obtain details on their life extension activities. The utilities were selected judgmentally on the basis of their reliance on older fossil fuel power plants, as reported to DOE. In 1988 these utilities' plants accounted for roughly 6 percent of the total number of fossil fuel generating units in the United States and approximately 12 percent of the total generating capacity of the nation's fossil fuel plants. Appendix I provides a complete list of the utilities and the other organizations we contacted.

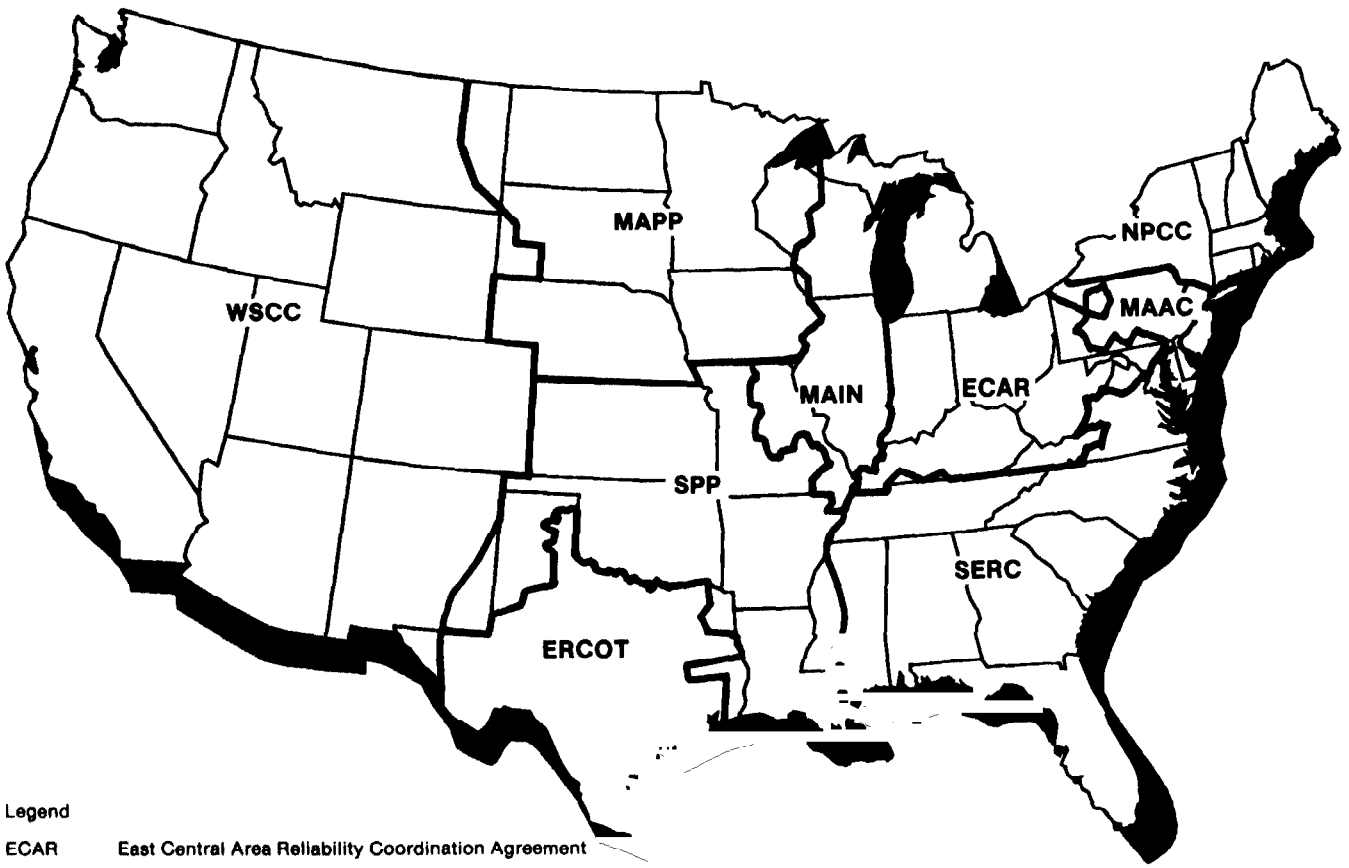
Because data on electric generating capacity and air pollution emissions are not available specifically for plants with an extended service life, GAO collected data on plants 30 years old or older. When a plant is at about that age, utilities generally decide whether to extend its service life. To determine the current and projected contributions of older power plants to the nation's electricity supply, we obtained data, both national and regional, from DOE's Energy Information Administration on power plant generating capacity and electricity production. Regional data are for the nine reliability council areas of NERC, as shown in figure 1.1. DOE compiled this data from annual reports of the nation's utilities. The electricity production data reflect electricity generated at fossil fuel steam plants only; however, these plants accounted for more than 99 percent of the electricity generated by fossil fuel plants during the time period in which the data were collected. While we did not verify the data on generating capacity and electricity production, we assured ourselves that DOE subjected the data to extensive quality control procedures to ensure accuracy.

We also contacted utilities, state public utility commissions, and state environmental agencies, all within the geographic areas of two of NERC's nine regional reliability councils. The two councils—the Mid-America Interconnected Network (MAIN) and the East Central Area Reliability

[3]EPRI was founded in 1972 by the nation's electric utilities to develop and manage a technology program for improving the production, distribution, and utilization of electric power.

[4]EEI is the national association of America's investor-owned electric utilities, which supply about 70 percent of the nation's electricity.

**Figure 1.1: NERC Region Map for the Contiguous United States**




Legend

| | |
|---|---|
| ECAR | East Central Area Reliability Coordination Agreement |
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Source: Prepared by GAO from NERC data.

Coordination Agreement (ECAR)—covering all or part of 12 states,[5] include utilities that are expected to depend increasingly on older fossil

[5]Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Missouri, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin.

fuel power plants during the next 10 to 20 years. The two councils provided us with copies of their 1989 electricity reliability reports to DOE, which included individual utilities' forecasts of supply and demand for the next 10 years. Several utilities provided us with specific information on how intensively they plan to use their plants during that period.

To address the effects of emission requirements on life extension programs, we interviewed EPA policy and compliance officials at EPA's headquarters, in Washington, D.C.; Research Triangle Park, in North Carolina; and Region 5 offices, in Chicago. We also reviewed various regulations, analyses, and policy memorandums by EPA regarding life extension and air quality. In addition, we obtained views from officials of state environmental agencies, environmental advocacy groups, utility industry organizations, and utility companies. To determine the contribution older plants make to power plant emissions, we obtained from EPA national and regional data—contained in the National Utility Reference File, developed for the National Acid Precipitation Assessment Program—as of 1985 on estimated sulfur dioxide and nitrogen oxide emissions from utility power plants. Data contained in EPA's system were also used to calculate emission restrictions in the acid rain control proposal sponsored by the Bush administration, and, according to EPA, were the latest, most accurate, and most comprehensive available at the time of our work. Finally, because proposed Clean Air Act amendments would impose acid rain control restrictions on existing power plants, we studied various analyses of the administration's proposal to determine the effect on utilities' life extension plans, electricity supply, and power plant emissions.[6] We also discussed these issues with officials from EPA, DOE, utility companies, state regulatory agencies, environmental groups, utility industry associations, and other private organizations.

As requested by the Chairman's office, we did not obtain official agency comments on this report. However, we discussed the factual information in this report with officials from EPA and DOE. We conducted our work between July 1989 and March 1990 in accordance with generally accepted government auditing standards.

[6]Although our study focused on the administration's proposed Clean Air Act Amendments of 1989, the recently approved congressional bills contain many features similar to those of the administration's proposal.

# Life Extension May Be Important for Meeting Future Demand but Reliability Is Unproven

Utilities estimate that extending the service life of their fossil fuel power plants, which entails a variety of activities, including maintaining, repairing, and replacing equipment, will be a cost-effective alternative to constructing new plants. While utility officials and others are generally optimistic about the ability of plants with an extended service life to provide a reliable electricity supply, such an ability has not been demonstrated. Thus, the long-term success of life extension is uncertain.

Due to the increased financial risks of constructing new plants, fewer new plants are being constructed than in the past, and older plants (those 30 years old or older), including those with an extended service life, are expected to provide an increasing share of electricity during the next decade. This probably will be true even if the Clean Air Act is amended to require additional emission reductions from existing plants. Consequently, the operating success of plants with an extended service life may be important to the continued reliability of the nation's electricity supply.

## Power Plant Life Extension Projects Take Many Forms

In recent years, electric utilities have initiated programs to extend the service life of their fossil fuel power plants. The nature and extent of life extension efforts depend on how the plants were maintained and used since they were put in service and on how they will be used in the future. DOE estimates that plants accounting for about 70 percent of the nation's 1989 total generating capacity represented by fossil fuel plants may undergo life extension by the year 2010.

Historically, older power plants have tended to develop operational problems and require increased maintenance. As plants age, critical components degrade due to factors such as fatigue, erosion, and corrosion. Plants over 30 years old break down more frequently than do newer plants, and the time it takes to repair the older plants increases. According to a DOE official, an ongoing study conducted for the agency shows that generally the efficiency and availability of older plants tend to decrease and the costs for operation and maintenance tend to increase. In addition, according to data compiled by NERC, coal-fired plants with a generating capacity of between 50 MW and 200 MW begin to become less reliable after 20 years of service (fossil fuel generating units range in generating capacity from 1 MW to over 1,000 MW).

The general goal of life extension projects is to keep plants operating at acceptable levels of availability,[1] and, in some cases, to return the plants to their original operating efficiency and maintain that status for an additional 30 years beyond the originally estimated service life. Typically, extending the life of an existing plant costs considerably less than building a new one and does not involve the licensing and permitting requirements of constructing a new plant. According to estimates by DOE, the cost of extending the service life of a coal-fired plant ranges from $89 to $230 per kilowatt[2] of generating capacity compared to a range of $1,294 to $1,378 per kilowatt of generating capacity for building a new coal-fired plant.

Utilities have taken different approaches to life extension:

- The Cincinnati Gas and Electric Company used a "front-end" approach to refurbish several fossil fuel power plants at its Beckjord station. For example, refurbishment of Beckjord plant number 3 included replacing worn-out turbine-generator components. Using this approach, the company performed a major portion of the life extension work during a single planned shutdown of 13 weeks. After the renovation, the utility estimated that the 32-year-old plant, producing 125 megawatts, could operate at an acceptable level of availability for another 25 years. Duke Power has also used the "front-end" approach.
- Pennsylvania Power and Light is using a "phased approach" to life extension. Under this approach, life extension is done over several years, during normal maintenance shutdowns. Pennsylvania Power and Light's program has included rehabilitating boilers, replacing control systems, and repairing generators. The program's goal is to extend the service life of the utility's plants so that they can operate safely, reliably, and cost-effectively for the indefinite future. Other utilities using the "phased approach" include Potomac Electric Power Company and Utah Power and Light Company.
- Detroit Edison and Ohio Valley Electric have programs, similar to the phased approach, under which they gradually have increased their annual operating, maintenance, and capital investment expenditures to maintain the performance of their existing plants. Although not normally considered life extension, such maintenance practices have the same outcome: allowing fossil fuel plants to operate beyond their normal 30- to 40-year service life. At the time of our review, these two utilities

[1]Availability refers to the percentage of time a power plant could be used to generate electricity.

[2]A kilowatt is a thousand watts.

have not set retirement dates for their plants that are more than 30 years old.

- Northern States Power replaced a substantial portion of its 32-year-old Black Dog plant, in Minnesota, with a technologically innovative generating unit that is expected to extend the service life of the plant by 25 years and to increase capacity from 100 to 125 MW. This technology, known as repowering, is currently being demonstrated by several companies under DOE's Clean Coal Technology Demonstration Program. Cosponsored by the government and industry, the program is intended to demonstrate technologically innovative equipment and processes.

The decision of whether or not to extend the service life of power plants may vary considerably from utility to utility. Those utilities with adequate generating capacity and with little growth in demand may decide against renovating their older plants. On the other hand, those utilities facing increasing demand and with many plants nearing retirement are more likely to pursue power plant life extension. In addition, certain plants are more likely to have their service life extended than others. For example, smaller plants (those with less than 50 MW of generating capacity) constructed in the early 1950s using what is now obsolete technology, are less likely to be candidates for life extension than larger plants (those with over 100 MW of generating capacity) constructed in the early 1960s using more current technology.

## Uncertainties Temper Optimism Concerning the Reliability of Plants With an Extended Service Life

No consensus has emerged among utility industry experts on the degree of reliable performance that can be expected from plants with an extended service life. While the comments that we received from utility officials were generally positive, as are those that appear in government and industry publications, the optimism about life extension is tempered with caution. If life extension does not achieve its goal—to keep plants operating at acceptable levels of availability—the reliability of the electricity supply could be impaired in some areas of the United States.

Because the utilities we contacted do not distinguish between their power plant maintenance programs and life extension activities, comprehensive operating performance data for plants with an extended service life are generally unavailable. However, these officials are generally optimistic about the expected performance of their older plants. A representative for American Electric Power stated that considering the maintenance program of the company, he foresees reliable operation of its older plants until they are at least 50 years old. Though all 11 plants in the Ohio Valley Electric system will be at least 34 years

old in 1990, a company official stated that their availability remains very high and that the company plans to continue to rely on these plants through 2010. Officials of Pennsylvania Power and Light, Detroit Edison Company, and Central Illinois Public Service Company made similar comments about the life expectancy of older plants in their systems.

DOE publications express optimism regarding life extension. Two DOE studies, which use models to predict costs of life extension projects, assume that life extension will return plants to their original generating availability and operating efficiency and will extend their operating life 20 years. However, the studies caution that a lack of operating data make these assumptions difficult to confirm.

EPRI has funded many projects designed to provide utilities with a systematic approach to planning and implementing life extension programs, but the organization's studies provide no guarantee that plants with an extended service life will function as reliably as new plants. EPRI publications cite the considerable uncertainty among utilities about the generating availability that can be achieved for plants with an extended service life. Moreover, according to EPRI, the possibility of catastrophic failure from unforeseen deterioration in such plants is probably higher than for newly constructed plants.

NERC has expressed concerns regarding the reliability of plants with an extended service life. According to the organization's annual reliability assessments in 1988 and 1989, the continued operation of existing plants is subject to uncertainty, and the extent to which older plants will be available depends upon several factors, including the success of life extension.

## Dependence on Older Power Plants Is Expected to Increase

Older fossil fuel plants—defined here as plants 30 years or older—provided an average of only about 7 percent of U.S. utilities' electricity generation during the period 1985-88. However, utilities have been constructing fewer new plants and instead have relied increasingly on existing plants, a trend which is expected to continue and result in a significant increase in the percentage of plants 30 years old or older. In addition, because of the need to meet the future demand for electricity, utilities are expected to use older plants more than they do now.

## Older Plants Will Account for an Increasing Portion of Capacity

Utilities' decisions to construct fewer new plants and instead to extend the service life of existing plants probably will result in an increase of the number of older fossil fuel generating units. According to 1989 data from DOE, the number of fossil fuel generating units 30 years old or older is expected to increase from about 2,500 in 1989 to roughly 3,700 in 1998, increasing the share of generating capacity represented by these plants from 13 percent in 1989 to 27 percent in 1998.

This trend of older plants' comprising a larger portion of generating capacity will probably occur in all regions of the country. According to DOE, by 1998 older plants will account for more generating capacity than they did in 1989 in all nine NERC regions. NERC's ECAR and Southeastern Electric Reliability Council (SERC) were the two regions with the most generating capacity represented by older plants in 1989, with 20,103 MW and 18,937 MW, respectively. In 1998 these regions' older plants are expected to account for an even larger generating capacity, with ECAR's older plants projected to account for 32,763 MW and SERC's, 38,061 MW. Additionally, according to a recent GAO report, SERC is a NERC region where demand may exceed electricity supply if additions to capacity do not materialize.[3]

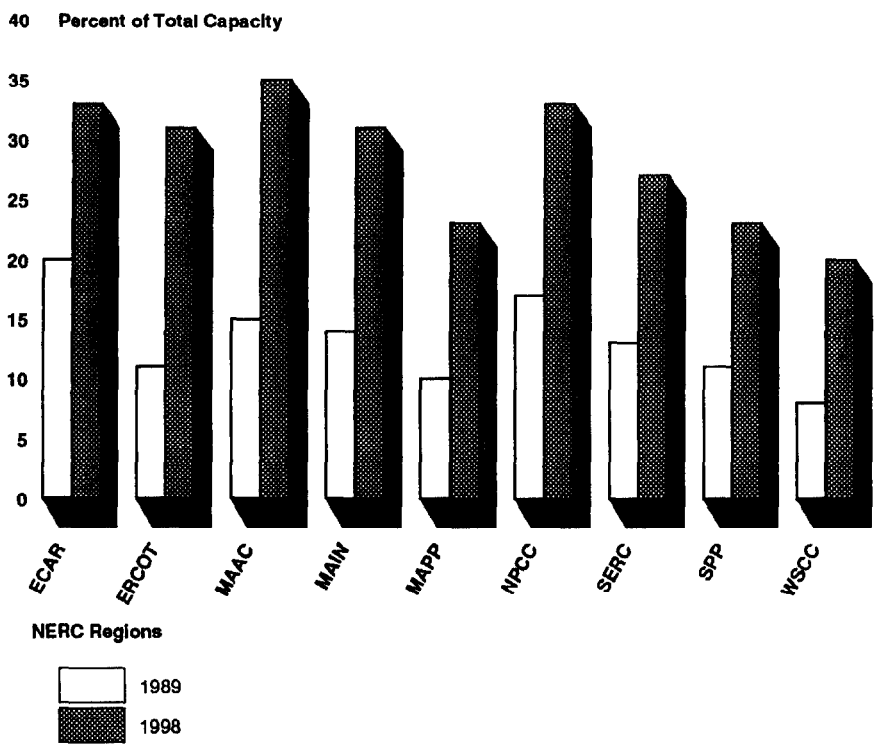
As the nation's utilities defer the retirement of power plants, plants 30 years old and older probably will provide an increasing share of the total generating capacity over this same time period. For example, while in 1989 ECAR and SERC relied on older plants for 20 percent and 13 percent of their generating capacity, respectively, in 1998 these percentages are expected to increase to 33 percent for ECAR and 27 percent for SERC. Figure 2.1 shows the expected growth in the shares of generating capacity represented by older plants in each NERC region.

## Older Plants Will Be Used More Intensively

Not only do utilities plan to continue to rely on older plants and to extend the service life of some, but also, recent trends indicate, utilities plan to operate some plants more than they do now. According to DOE, utilities are expected to increase the use of existing plants from an average of 60 percent of the time in 1989 to 66 percent of the time in 1995. Several utilities we contacted expect to operate their older plants as baseload plants—those used to meet the bulk of electricity demand—

[3]Nuclear Science: U.S. Electricity Needs and DOE's Civilian Reactor Development Program (GAO/RCED-90-151, May 29, 1990).

**Figure 2.1: The Generating Capacity of Older Fossil Fuel Power Plants as a Percentage of Total Capacity, by NERC Region, 1989 and 1998**




Legend

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Source: Prepared by GAO from DOE data.

during the next 10 to 20 years.[4] For example, Ohio Valley Electric plans to operate its plants, which are all fossil fuel plants over 30 years old, as baseload plants through the year 2009, when the plants will be over 50 years of age.

[4]Utilities generally maintain a mix of large coal-fired or nuclear plants and smaller generating facilities. The large baseload plants are rarely shut down, and the smaller, more flexible generating facilities are operated when demand peaks, such as during hot summer days.

American Electric Power, in Columbus, Ohio, provided us with forecasts indicating that it will operate its older fossil fuel plants an average of 56 percent of the time during the 1990-99 period. This represents an increase of nearly 5 percent over their operation during the previous 10-year period. Further, by 1999 several of the utility's plants will be 40 years old or older, and the company is planning to use them as baseload plants. This represents increases in use in some cases of as much as 16 percent over past levels.

Commonwealth Edison, in Chicago, Illinois, also provided us with data indicating plans to increase the operation of some of its older fossil fuel plants. The utility was planning to retire five of its older fossil fuel plants in the 1990s; however, because the company expects demand to increase, it is now expecting to keep the plants in service. Commonwealth Edison projects that it will increase the operation of these plants by 5 to 30 percent over the next 10 years.

# Changing Air Quality Requirements Could Affect Life Extension Plans

Fossil fuel power plants are significant sources of harmful pollutants, particularly sulfur dioxide and nitrogen oxides, and the plants exempted from the Clean Air Act produce a disproportionately large share of these pollutants. Recent legislative and regulatory developments could require significantly reduced emissions from these exempt plants and could cause electric utilities to alter some planned life extensions projects. Enactment of proposed acid rain control legislation probably would not preclude life extension, but this depends on the legislation's final requirements. Officials of DOE and utility organizations expressed concern, however, that exempt plants altered to extend their service life must meet the act's emission standards if EPA decides, as it did for one plant in 1988, that the alteration would result in increased emissions. According to the officials, the additional costs of achieving the more stringent standards could discourage some life extension projects. However, such decisions could also reduce the nation's total power plant emissions by eliminating an existing economic incentive to retain exempt plants.

## Plants Constructed Before August 1971 Produce the Most Pollutants

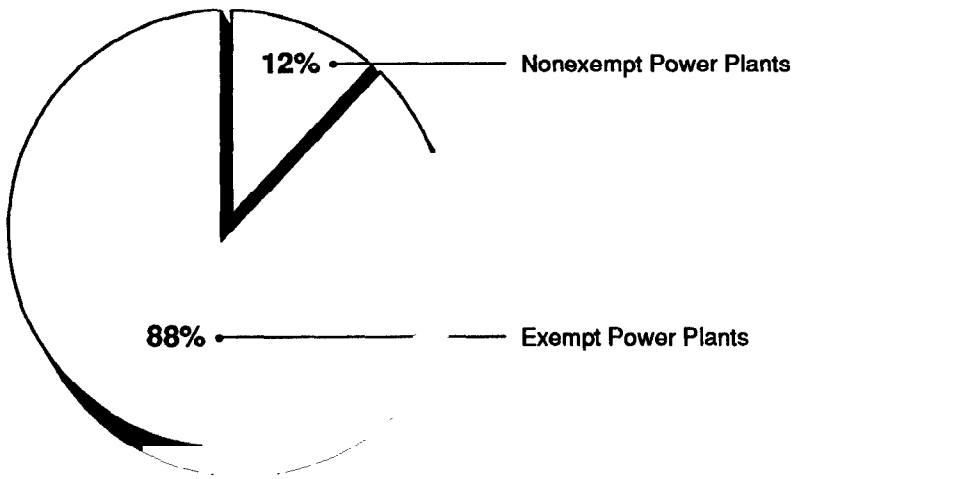
When Congress enacted the Clean Air Amendments of 1970, it exempted power plants constructed prior to the publication of EPA's regulations (August 17, 1971) from having to meet the legislated emission standards. The exempt plants produce a disproportionate share of utilities' sulfur dioxide and nitrogen oxide emissions.[1] Although these plants that were exempted from federal regulations are subject to state regulations, the states generally allow emissions at much higher levels than those specified in the Clean Air Act.

Emissions of sulfur dioxide and nitrogen oxides have associated health and environmental consequences. Sulfur dioxide, a colorless gas with a pungent and irritating odor, can aggravate symptoms of heart and respiratory diseases. Nitrogen oxides, gaseous air pollutants, can also aggravate respiratory problems. Emissions of sulfur dioxide and nitrogen oxides, which have been linked to the formation of acid rain, also represent a threat to natural resources, ecosystems, materials, and visibility.

[1]Burning fossil fuel also produces air pollutants such as particulate matter and carbon dioxide, but because the current Clean Air Act debate relating to utilities focuses on acid rain controls, our analysis was limited to sulfur dioxide and nitrogen oxides.

According to EPA's nationwide data for 1985,[2] the last year for which complete data are available, plants built prior to August 1971 contribute the majority of fossil fuel plants' emissions of sulfur dioxide and nitrogen oxides. In 1985 fossil fuel power plants emitted 16 million tons of sulfur dioxide; plants built prior to August 17, 1971, emitted 88 percent of the total (see fig. 3.1). Of the nearly 7 million tons of nitrogen oxides emitted in 1985 by fossil fuel plants, approximately 79 percent was emitted by the exempt plants (see fig. 3.2).

**Figure 3.1: 1985 Sulfur Dioxide Emissions by Exempt and Nonexempt Fossil Fuel Power Plants**

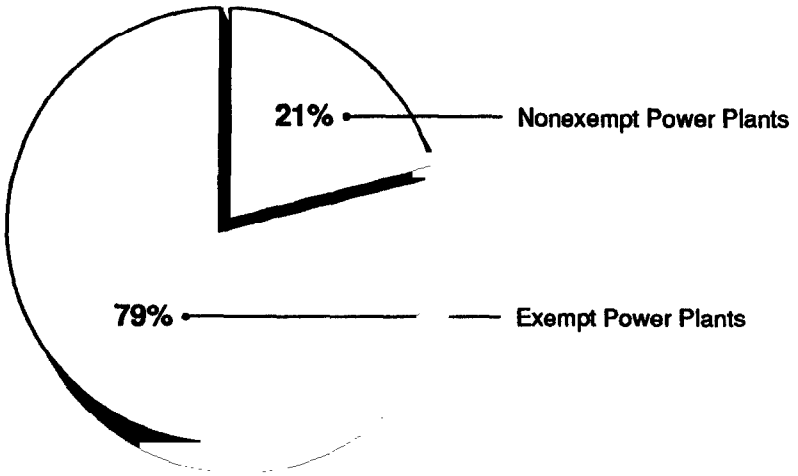



Note: Total 1985 sulfur dioxide emissions from electric utility fossil steam power plants were 16,046,190 tons.

Source: Prepared by GAO from EPA data.

[2]The data, from EPA's Air and Energy Engineering Research Laboratory, are not measurements of actual pollutants released into the atmosphere, but EPA's best estimates.

**Figure 3.2: 1985 Nitrogen Oxide Emissions by Exempt and Nonexempt Fossil Fuel Power Plants**

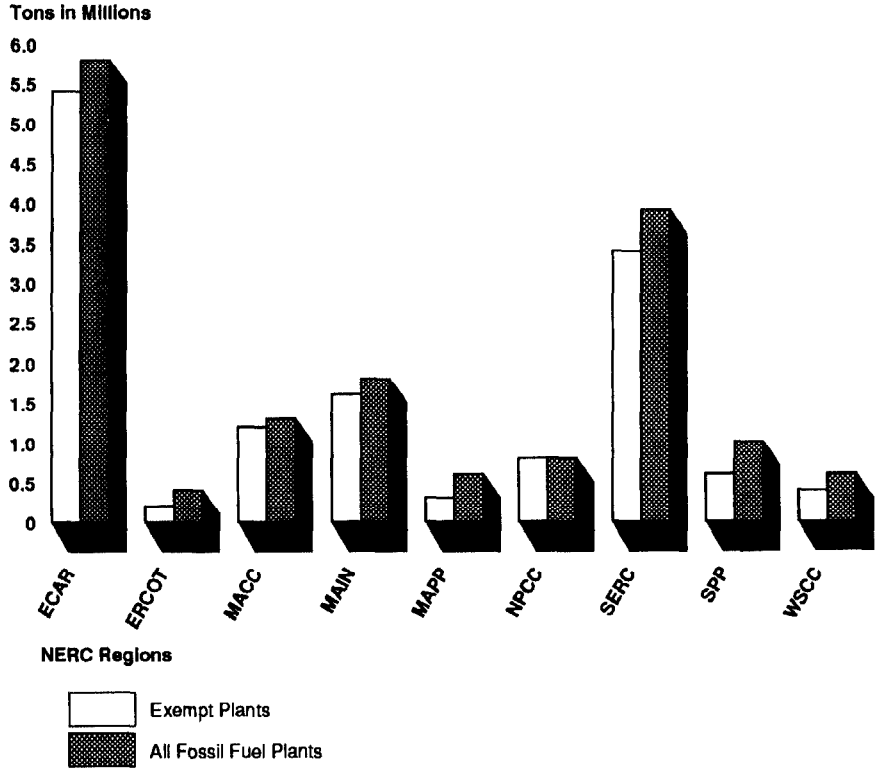



Note: Total 1985 nitrogen oxide emissions from electric utility fossil steam power plants were 6,671,390 tons.

Source: Prepared by GAO from EPA data.

Also according to EPA's data, the tendency for older plants to be the largest polluters prevails in almost all NERC regions, as shown in figures 3.3 and 3.4. In 1985 ECAR and SERC, which depend heavily on fossil fuel plants, produced the largest amounts of sulfur dioxide and nitrogen oxides.

**Figure 3.3: 1985 Sulfur Dioxide Emissions, by NERC Region**

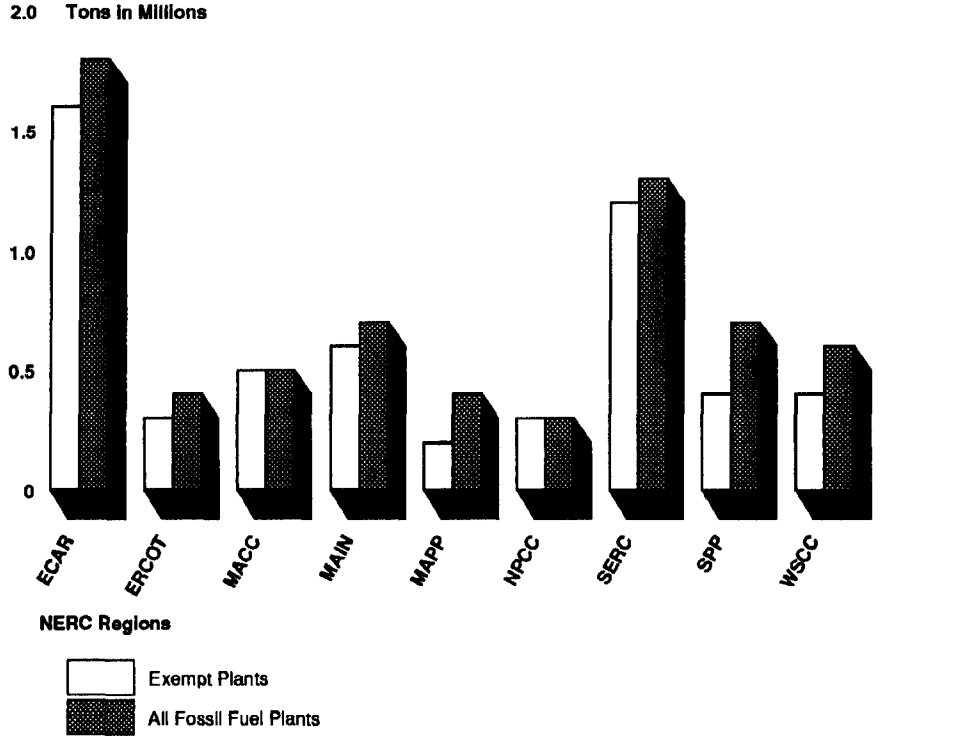



Legend

ECAR East Central Area Reliability Coordination Agreement
ERCOT Electric Reliability Council of Texas
MAAC Mid-Atlantic Area Council
MAIN Mid-America Interconnected Network
MAPP Mid-Continent Area Power Pool
NPCC Northeast Power Coordinating Council
SERC Southeastern Electric Reliability Council
SPP Southwest Power Pool
WSCC Western Systems Coordinating Council

Source: Prepared by GAO from EPA data.

**Figure 3.4: 1985 Nitrogen Oxide Emissions, by NERC Region**




Legend

ECAR East Central Area Reliability Coordination Agreement
ERCOT Electric Reliability Council of Texas
MAAC Mid-Atlantic Area Council
MAIN Mid-America Interconnected Network
MAPP Mid-Continent Area Power Pool
NPCC Northeast Power Coordinating Council
SERC Southeastern Electric Reliability Council
SPP Southwest Power Pool
WSCC Western Systems Coordinating Council

Source: Prepared by GAO from EPA data.

## Acid Rain Control Legislation Would Reduce Emissions and Could Affect Life Extension Plans

Enactment of acid rain control legislation similar to amendments proposed by the Bush administration probably would result in significant reductions in emissions of sulfur dioxide and nitrogen oxides from many of the same plants that currently produce the largest share of these emissions. Because some of these are the same plants that are also candidates for life extension, the additional cost of achieving emission reductions could discourage some life extension projects, but utilities generally are expected to find reducing emissions from existing plants more cost-effective than replacing them and to continue with life extension projects. The extent of the impact on life extension depends on the

specific levels of emission reductions required and the resulting compliance strategies that utilities choose.

## Acid Rain Control Legislation Has Been Proposed

Under current air quality requirements, fossil fuel plant emissions will increase steadily during the next decade, according to EPA's estimates. (App. II provides information on the expected emissions from utility power plants in the absence of acid rain control legislation.) With the goal of reducing emissions, dozens of acid rain control proposals have been introduced and debated in Congress since the Clean Air Act was last amended in 1977. The proposals have included provisions designed to reduce emissions of both sulfur dioxide and nitrogen oxides. In June 1989 the Bush administration proposed Clean Air Act amendments that include a plan to reduce these emissions that cause acid rain.

The goals of the acid rain control portion of the administration's proposal is to reduce electric utilities' emissions of sulfur dioxide by 10 million tons from the level in 1980 and of nitrogen oxides by 2 million tons from the level predicted for the year 2000. The sulfur dioxide reductions are to be accomplished in two phases, the first to be completed by the end of 1995 and the second by the end of 2000. Nitrogen oxide reductions are required in the second phase. Rather than mandating the manner in which emission reductions should be achieved, the proposal includes an allowance trading system whereby utilities could choose which methods to use on which plants to achieve emission reductions. In addition, the proposals would limit future sulfur dioxide emissions by requiring utilities to obtain emission allowances before increasing generating capacity. The 101st Congress is currently debating amendments to the Clean Air Act that contain acid rain control provisions very similar to those in the administration's proposal.

## Effects of Acid Rain Controls Depend on Severity of Requirements

To comply with proposed acid rain control legislation, utilities probably will have to make substantial investments to reduce emissions at many of the same fossil fuel power plants that are currently the largest sources of sulfur dioxide and nitrogen oxides and are also candidates for life extension. Such investments could reduce the cost-effectiveness of life extension, although the impact will depend on the severity of the requirements.

Two major analyses of the administration's proposal, conducted for EPA and the Edison Electric Institute, describe expected compliance strategies by utilities and suggest that life extension will remain a viable

option.[3] The analyses indicate it will be more economical for utilities to reduce emissions from their older plants that currently emit pollutants at a high rate than to retire these plants and replace them with new plants that would emit pollutants at a lower rate. The most frequently cited strategies include switching to lower sulfur coal, installing pollution control equipment, and adopting technologically innovative emission-reducing equipment. The studies project that few plants will be retired and that most will operate for about 60 years. A recent GAO study examining the relationship between acid rain control legislation and innovative "clean coal" technologies reaches similar conclusions about utilities' compliance strategies.[4]

An acid rain control program that requires more stringent reductions or presents less flexibility in choosing a compliance method than the administration's proposal could alter utilities' plans for life extension. More prescriptive requirements could force utilities to retire more power plants than anticipated, which would reduce the number of plants that would be available for life extension. For example, American Electric Power concluded that an acid rain control program requiring more stringent nitrogen oxide reductions than those proposed by the administration would significantly increase the number of power plants the utility would retire because some of the utility's plants could not be modified to install nitrogen oxide control equipment. In our recent study, GAO also concludes that stricter nitrogen oxide reduction requirements would tend to cause more power plants to be retired. According to a NERC survey analyzing utilities' responses to acid rain control legislation more stringent and less flexible than the administration's proposal, such legislation would cause utilities to retire a number of older plants.

[3]Since most of the differences between the administration's proposal and the House and Senate bills are minor, our discussion of compliance strategies by utilities and of the impact on life extension is also applicable to the House and Senate bills.

[4]Fossil Fuels: Outlook for Utilities' Potential Use of Clean Coal Technologies (GAO/RCED-90-165, May 24, 1990).

## Application of the Clean Air Act's Current Emission Standards to Plants With an Extended Service Life Is Uncertain

In developing regulations following the 1977 Clean Air Act amendments, EPA assumed that utilities would continue to replace most plants at the end of their traditional 30- to 40-year service life; consequently, the regulations do not explicitly address power plant life extension. In a 1988 case, the agency ruled that the Clean Air Act's emission standards would apply to a previously exempt power plant if the utility would pursue its life extension project as proposed. This ruling has created concern among DOE and electric utility organization officials regarding the potential costs, and therefore the economic viability, of some life extension projects.

### Clean Air Act Regulations Do Not Explicitly Address Life Extension

In enacting the Clean Air Act Amendments of 1977, Congress revised the New Source Performance Standards (NSPS) and established the Prevention of Significant Deterioration (PSD) program. The NSPS, established by Congress under Clean Air Amendments of 1970, regulate the emissions from new sources, including electric utility power plants. The standards were modified in 1977 to further restrict power plant emissions by requiring the use of emission control technology, typically flue gas desulfurization (FGD) equipment for reducing sulfur dioxide emissions, and other types of emission control equipment for reducing emissions of other regulated pollutants. The PSD program was established to preserve air quality in unpolluted areas of the country by regulating power plants' total annual emissions and, as the NSPS do, by requiring the use of the "best available" emission control equipment. EPA, in formulating the NSPS and the PSD program, included provisions regulating modifications of power plants, but because it did not anticipate life extension, it did not explicitly address life extension projects.

While Congress exempted plants constructed prior to the enactment of the new emission standards, it also instructed EPA to apply the standards where EPA determines a plant has been "modified." In amending the act in 1970, Congress defined a modification as a physical or operational change to an existing facility resulting in an increase in the emission of any controlled pollutants or of pollutants not previously emitted. The NSPS are triggered by any change that increases the hourly emission rate for any controlled pollutant. The PSD program provisions are triggered by any change that increases the total amount of annual emissions for any controlled pollutant. EPA also applies the new emission standards in cases where it determines a plant has been "reconstructed"—a determination applicable if the cost of the alteration exceeds 50 percent of the cost that would be incurred to construct a comparable new facility.

The regulations regarding power plant modifications contain exemptions allowing utilities to undertake certain routine activities that could increase emissions without making the plant subject to either the NSPS or the PSD program. These activities include routine maintenance, routine repair and replacement of equipment, and certain operational changes, such as increasing the hours of operation in response to a higher demand for electricity.

## Life Extension Projects May Constitute Modifications or Reconstructions

Power plant life extension projects involve physical or operational changes to power plants that potentially can invoke either the modification or reconstruction provisions and thus trigger the NSPS and the PSD program provisions. In recent years, EPA, DOE, and the utility industry recognized the potential for these projects to invoke either the modification or reconstruction rules.

In March 1986 members of EPA's policy analysis staff noted the trend toward power plant life extension and its adverse effect on attempts to reduce sulfur dioxide emissions.[5] Explaining ways in which plants undergoing life extension might be required to achieve the NSPS and the PSD program provisions, the article suggested, for example, that the reconstruction rule might be revised or that all power plants over 30 years of age could be required to achieve the NSPS and the PSD program provisions.

Various DOE and industry studies of life extension and guidelines for implementing life extension programs also have noted that the modification or reconstruction rules might be invoked by life extension projects, thus making previously exempt plants subject to the requirements of the NSPS and the PSD program. These documents suggested that utilities planning life extension projects should incorporate into their decision process the possibility of having to meet stricter environmental standards. In 1987 EPRI noted that plant life extension projects involve the risk that the NSPS could be applied.[6]

In September 1988, after the Wisconsin Department of Natural Resources asked for EPA's review of the Wisconsin Electric Power Company's (WEPCO) proposed life extension project, EPA determined that the project would constitute a "modification" under the act and that the

[5]DeMocker, Greenwald, and Schwengels, "Extended Lifetimes for Coal-fired Power Plants: Effect Upon Air Quality," Public Utilities Fortnightly (Mar. 20, 1986).

[6]John Douglas, "Longer Life for Fossil Fuel Plants," EPRI Journal (July/Aug. 1987).

plant, if altered as proposed, would be required to meet the act's more stringent emission standards. This decision was the first instance of EPA's requiring a plant undergoing life extension to achieve the NSPS and the PSD program requirements. EPA's ruling was based on a determination that (1) the proposed changes to the power plant would go beyond "routine repair" and would therefore not be exempt and (2) emissions would increase as a result of the project.

The utility challenged EPA's definition of routine repair and its method for calculating increases in emissions. Following litigation, in January 1990 the United States Court of Appeals for the Seventh Circuit affirmed EPA's application of the NSPS, but remanded the decision to apply the PSD program standards back to EPA for further review. Specifically, the Court held that, in this instance, the proposed changes were not routine and thus not exempt from the standards and that an increased emission rate would result; thus, EPA had correctly applied the NSPS. However, the court ruled that EPA had not used an appropriate method for determining the total annual increase in emissions and instructed EPA to reexamine the application of the PSD program provisions. The Court added that EPA is entitled to broad discretion in interpreting the technical provisions of the Clean Air Act and its own regulations.[7]

## Effects of WEPCO Ruling Are Uncertain

Officials of DOE and utility organizations have expressed concern that the WEPCO decision may result in EPA's application of the NSPS and the PSD program requirements to other previously exempt power plants and that the additional costs of achieving these standards and requirements could discourage some life extension projects. However, EPA officials do not consider WEPCO's project typical of most utility life extension projects, and they expect that the ruling will not significantly affect utilities' decisions to undertake power plant life extension projects.

According to NERC, the ruling could seriously threaten the reliability of the nation's electric system if it were applied to other life extension projects, as the additional cost for emission control equipment could force utilities to remove older plants from service. According to EEI, serious problems with the reliability of the electric system could be encountered, including brownouts, as utilities adjust their plans and

[7]Wisconsin Electric Power Co. v. Reilly, AD. EPA, 893 F.2d 901 (7th Cir. 1990)

pursue other sources of new generating capacity. The Utility Air Regulatory Group (UARG)[8] has expressed concern over whether power plants can be maintained properly without being required to achieve the more stringent emission standards. DOE has stated that EPA's WEPCO ruling could discourage some utilities from extending the service life of their power plants and that this could aggravate an expected shortfall in electric generating capacity in the 1990s.

The frequent application of the NSPS and the PSD program requirements to previously exempt power plants or similar legislative action could improve air quality. During 1985 power plants exempt from the Clean Air Act's more stringent emission standards produced sulfur dioxide emissions at up to nearly 3 times the rate, per unit of electricity produced, of power plants subject to these standards. Because new power plants are subject to more stringent emission standards, there is an incentive to extend the life of existing plants that are not subject to these costly standards. If decisions similar to the WEPCO decision were rendered more often, a decision to build a new plant or extend the service life of an existing plant would depend on the relative costs of two sources emitting pollution at a low rate, and not on a comparison of the high cost of a new plant emitting pollution at a low rate and the lower cost of an older plant emitting pollution at a higher rate.

Officials from seven of the nine utilities we contacted indicated that the WEPCO decision was not interfering with their plans for the continued operation of their existing plants.[9] These officials explained that WEPCO's project involves the restoration of generating capacity at a deteriorated plant and that this situation is unlikely to occur in their systems because their maintenance programs prevent their plants from deteriorating. Officials from one of the nine utilities we contacted indicated that the WEPCO ruling has played a role in the utility's revising its plans. In its annual submission to its public utility commission, this utility explained that because of legislative and regulatory uncertainties (including the uncertainty raised by the WEPCO decision), it has deferred implementing a life extension program. However, the utility reported that it will continue to maintain its plants to ensure their reliable and safe operation.

According to EPA policy officials, WEPCO's life extension project is not typical of the majority of utilities' life extension projects, and concerns

[8]UARG is an ad hoc association of utilities and trade associations of the utility industry.

[9]One utility did not respond to our questions about the potential impact of the WEPCO ruling on power plant projects.

that the agency will broadly apply the ruling it applied to WEPCO's project are unfounded. The officials noted that many life extension projects do not result in increased emissions, while other activities are routine in nature and thus exempt from the modification rule. Lending evidence to the officials' statements, EPA's 1989 emission forecast assumed that the WEPCO decision would not result in a significant number of additional power plants' having to comply with the NSPS and the PSD program requirements.

## Supplying Electricity May Result in Short-term and Long-term Trade-offs

In the short term, utilities may face trade-offs between ensuring the existence of generating capacity sufficient to meet needs and reducing air pollution. More stringent emission requirements could adversely affect electricity supply in the short term. However, applying more stringent emission requirements to currently exempt plants would have the benefit of eliminating the power plants that pollute the most.

A trade-off between sufficient capacity and clean air need not exist in the long term. Requiring exempt power plants to meet the requirements of the NSPS and PSD program would result in emission reductions at existing plants or less-polluting new plants. The cost of reducing emissions would be reflected in the cost of producing electricity. The long-term trade-off could be between cleaner air and more expensive electricity rather than between cleaner air and insufficient capacity.

## EPA Has Taken Steps to Reduce Uncertainty Over Emission Standards

EPA has taken steps to reduce the uncertainty over the emission standards applicable for renovated power plants. According to EPA officials, EPA relies on state environmental agencies to identify power plant renovation projects and apply the requirements of the NSPS and PSD program on a case-by-case basis and provides guidance to the agencies when requested to do so. EPA's review is required when a state agency determines a modification permit is necessary. Two state environmental agencies we contacted indicated that they have not routinely reviewed utilities' life extension plans or coordinated with public utility commissions and so are generally unaware of utilities' renovation projects.

In 1989 EPA initiated a survey of utilities that was designed to help the agency identify, among other things, the extent to which life extension activities are occurring and the distinction between routine activities and life extension projects. In explaining the need for the survey, EPA noted that (1) the number of utilities requesting EPA to determine whether a proposed project constitutes a modification is expected to

increase in the future as more plants have their service life extended and the enactment of acid rain control legislation requires further plant alterations and (2) the survey would help EPA distinguish routine maintenance from life extension, a central issue of the WEPCO case. However, the Office of Management and Budget denied EPA's request to circulate the survey, indicating the need for EPA to clarify its objectives in accordance with the Paperwork Reduction Act.

Citing limited resources and the likelihood that the Clean Air Act will soon be amended, EPA officials told us that they no longer intend to pursue issuing the survey. EPA instead plans to develop additional policy guidance to address the expected plant alterations it referred to in its survey justification. For example, EPA plans to issue a ruling that would allow utilities to install or modify power plant pollution control equipment without a review for the potential applicability of the PSD program provisions. Also, the agency has assured utilities that it will not apply the NSPS or the PSD program provisions to plants involved in DOE's technology demonstration program, which requires the alteration of existing power plants to incorporate technologically innovative equipment and processes. In addition, in May 1990 testimony, EPA, in conjunction with DOE and the Bush administration, outlined a proposed amendment to the Clean Air Act designed to clarify the emission standards applicable to power plants that undergo physical or operational changes. The provision would, among other things, require the EPA Administrator to issue guidance to help state agencies to distinguish between routine and nonroutine power plant maintenance.

## Compliance Costs for Acid Rain Control Legislation and for Clean Air Act Are Independent

Utility groups have expressed concern that the application of the position taken by EPA in the WEPCO case could force some utilities, in order to comply with the requirements of the NSPS and the PSD program, to choose emission control methods more costly than those they might choose in order to comply with acid rain control legislation. According to a November 1989 study by UARG, if EPA determines that a life extension project constitutes a modification, as the agency determined in the WEPCO case, a utility is forced to use more expensive emission control technology, such as FGD equipment, to achieve the requirements of the NSPS and the PSD program rather than less costly options, such as switching to lower sulfur coal or using technologically innovative processes, to achieve emission reductions required for proposed acid rain control legislation. An analysis conducted by the Clean Air Working Group, a national coalition representing industry groups and trade associations, also concludes that the application of the position EPA took

in the WEPCO ruling would lead utilities to choose compliance options other than those they might choose to meet proposed acid rain control requirements.

The application of EPA's position in the WEPCO decision, however, does not increase the cost of complying with an acid rain control program. The costs of complying with a decision like the one reached about WEPCO's project are incurred to achieve the requirements of the NSPS and the PSD program, independent of acid rain control legislation. As noted by EPA officials, the acid rain control program contained in the Bush administration's proposed Clean Air Act amendments was not intended to replace the current requirements of the NSPS or PSD program, but rather to be used in addition to the existing regulations. Therefore, in the absence of acid rain control legislation, any utility that renovates its plant and is required by EPA to meet the more stringent emission standards would bear the full cost of achieving these standards. However, if proposed acid rain control legislation that includes an allowance trading system is enacted, the same utility could receive allowances for reducing emissions beyond those required for the acid rain control program. These allowances could be retained to offset future emissions or sold to another utility company, thereby lowering the net cost of achieving the requirements of the NSPS and the PSD program. Also, according to these officials, utilities should not expect to avoid forever the cost of controlling pollution at plants exempted from the Clean Air Act, and utilities should consider this cost when making an investment in existing plants, as utilities consider this cost when constructing new plants. These EPA officials suggest that considering this cost in the planning stages allows utilities to use the most cost-effective emission control options.

# Utilities and Other Organizations Contacted During This Review

| | |
|---|---|
| Utilities | American Electric Power Service Corporation<br>Central Illinois Public Service Company<br>Cincinnati Gas and Electric Company<br>Commonwealth Edison Company<br>Detroit Edison Company<br>Ohio Edison System<br>Ohio Valley Electric Corporation<br>Pennsylvania Power and Light Company<br>Public Service Company of Indiana, Incorporated |
| Utility Industry Professional Organizations | American Public Power Association<br>East Central Area Reliability Coordination Agreement<br>Edison Electric Institute<br>Electric Power Research Institute<br>Mid-America Interconnected Network<br>North American Electric Reliability Council<br>Ohio Electric Utility Institute<br>Utility Air Regulatory Group |
| Federal Agencies | Department of Energy<br>Environmental Protection Agency |
| Public Service Commissions | Illinois Commerce Commission<br>Indiana Regulatory Commission<br>Public Utilities Commission of Ohio |
| State Environmental Agencies | Illinois Environmental Protection Agency<br>Indiana Department of Environmental Management<br>Minnesota Pollution Control Agency<br>Pennsylvania Department of Environmental Resources<br>State of Ohio Environmental Protection Agency |

## Others

Center for Clean Air Policy
Environmental and Energy Study Institute
Environmental Action
Izaak Walton League
MSB Energy Associates
Natural Resources Defense Council

# Electric Utility Power Plant Emissions in the Absence of Acid Rain Control Legislation

In the absence of acid rain control legislation, various emission forecasts projected utility sulfur dioxide emissions to increase until at least the year 2000 and, in some cases, through 2010. This trend is due in part to the longer service life of older plants that pollute at a high rate. In the absence of the legislation, emissions of nitrogen oxides also are expected to increase.

In its 1989 forecast, the Environmental Protection Agency (EPA) projected in its low-case scenario that utility sulfur dioxide emissions will increase through the year 2000 and then begin to decline. In its high-case scenario, EPA predicted that these emissions will increase steadily through 2010. The increases are due in part to the longer service life of power plants. The forecast assumed that most fossil fuel plants will be renovated and operated for an additional 25 to 35 years.[1]

The National Acid Precipitation Assessment Program (NAPAP), administered through an interagency task force, established to evaluate the effects of acid deposition on the environment, projected that sulfur dioxide emissions between 1985 and 2010 will remain roughly constant (with an assumed power plant service life of 45 to 50 years) or will increase (with an assumed 60-year service life). After 2010, emissions are projected to decline as the older plants that pollute at a high rate are replaced with new plants that pollute at a lower rate. NAPAP's projections were based on studies prepared by organizations including EPRI, DOE's Energy Information Administration and Argonne National Laboratory, the Congressional Research Service, the Office of Technology Assessment, and the Congressional Budget Office.

Two state studies—from states with high sulfur dioxide emissions—have shown similar trends regarding sulfur dioxide emissions. A 1988 study performed by the Ohio Office of Consumer's Counsel indicated that, without the enactment of acid rain control legislation, sulfur dioxide emissions in Ohio are expected to increase by 14 percent during 1987-2007. The increase is attributed to expected increases in the use of existing plants. Further, a study performed by the Illinois Department of Energy and Natural Resources indicated that after a period of declining emissions between 1980 and 1990, Illinois utilities' sulfur

[1]EPA's forecasts assumed that all fossil fuel power plants with generating capacity of more than 50 MW will be refurbished at age 30. In the low-case scenario, EPA assumed an additional 25 years of service life, and in the high-case scenario, an additional 35 years. Also, EPA's forecasts were based on the absence of federal acid rain control legislation and assumed that application of the New Source Performance Standards (NSPS) and the Prevention of Significant Deterioration (PSD) program provisions will not be widespread (see ch. 3 for more on the application of the NSPS and the PSD program provisions).

dioxide emissions will increase until 2005 and that they should decline after that as older plants are removed from service.

Regarding nitrogen oxide emissions, under its two scenarios EPA projected them either to increase until 2005 and then level off or to increase steadily through 2010. NAPAP also projected that nitrogen oxide emissions will increase through 2010. The studies noted that the retirement and replacement of older power plants with newer plants is not as effective in reducing nitrogen oxide emissions as it is in reducing sulfur dioxide emissions because the difference in the nitrogen oxide emissions of plants achieving the NSPS and of those exempted typically is small.

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| | |
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