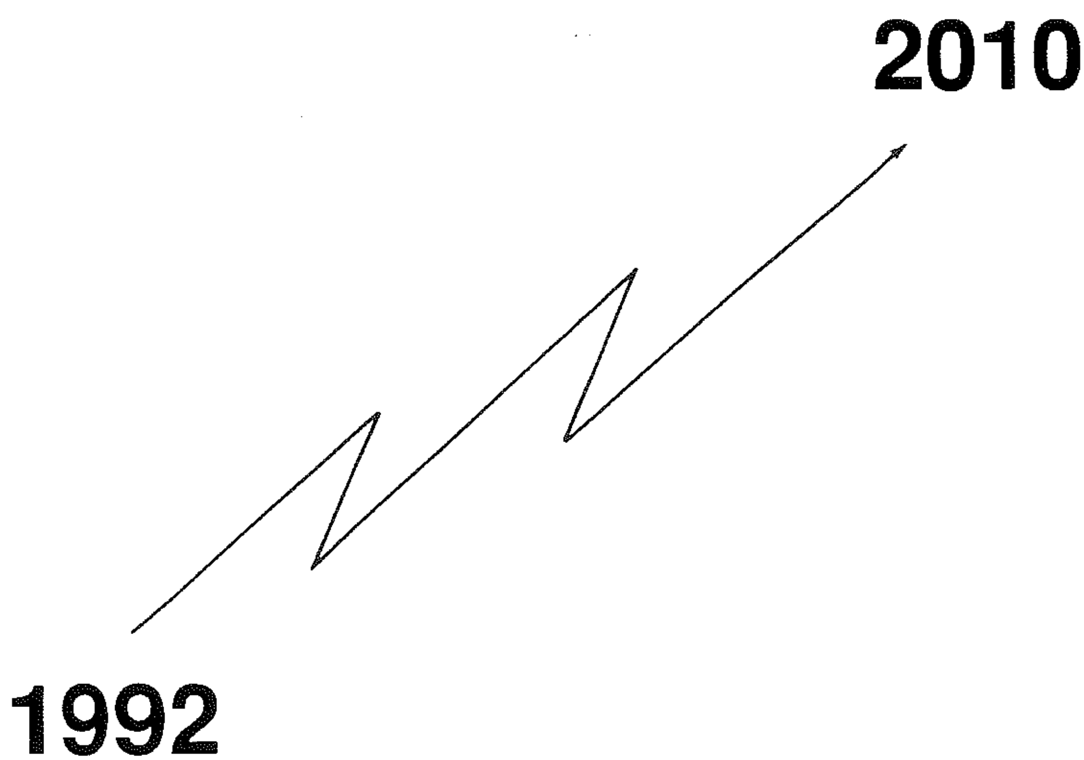
The Near Term Role for Coal in the Future Energy Strategy of the United States

JANUARY 1992



THE NATIONAL COAL COUNCIL

THE NATIONAL COAL COUNCIL, INC.
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January 28, 1992

The Honorable James D. Watkins
Secretary of Energy
U.S. Department of Energy
Forrestal Building, Room 7A-257
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Mr. Secretary:

On behalf of the National Coal Council, I am pleased to submit the attached report, "The Near Term Role for Coal," prepared in response to your request of November 7, 1990, and approved by the Council on January 28, 1992.

This report builds upon the findings of the 1990 study prepared by the Council, "The Long Range Role of Coal in the Future Energy Strategy of the United States." It recognizes the fundamental importance of coal to our nation's economy and security. Its purpose is to provide advice to you on actions the Federal Government can take now to ensure that coal remains an economically viable fuel for the future.

The Council concluded that there are many critical issues facing coal production, transportation and utilization, which can be appropriately addressed by government. We recognize and commend your leadership efforts in developing and working towards implementation of the National Energy Strategy. We particularly commend your recognition of and emphasis on the role of coal in meeting our nation's energy needs. The report concludes and recommends that the Department of Energy continue its efforts to ensure that state and federal officials seek balanced solutions to energy and environmental issues by supporting the following:

- Development of public policy based upon objective scientific analysis;

- Continuing support for and expansion of the Clean Coal Technology Program;

- Further development of regulatory and economic incentives for development of new, cleaner coal technologies;

- Expansion of energy education programs to better inform the public of the importance of coal;

- Provision of adequate Congressional appropriations for improvements to inland transportation systems.

The workgroup and the Council have strived to present an objective and balanced report. We are hopeful that it will be useful to the Department of Energy as it formulates energy strategy. As always, we stand ready to provide you with any additional information in this matter you may desire.

Sincerely,

W. Carter Grinstead, Jr.

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THE NEAR TERM ROLE FOR COAL
IN THE FUTURE ENERGY STRATEGY
OF THE UNITED STATES

William R. Wahl, Chairman

Coal Policy Committee

J.L. Mahaffey

Work Group Chairman

The National Coal Council

January 1992

THE NATIONAL COAL COUNCIL

W. Carter Grinstead, Jr., Chairman

William R. Wahl, Vice-Chairman

James F. McAvoy, Executive Director

U.S. DEPARTMENT OF ENERGY

Admiral James D. Watkins, Secretary

The National Coal Council is a federal advisory committee to the Secretary of Energy.

The sole purpose of the National Coal Council is to advise, inform, and make recommendations to the Secretary of Energy on any matter requested by the Secretary relating to coal or the coal industry.

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PREFACE

The National Coal Council is a private, non-profit advisory body, chartered under the Federal Advisory Committee Act.

The mission of the Council is advisory only, providing guidance and recommendations as requested by the Secretary of Energy on general policy matters relating to Coal. The Council is forbidden by law from lobbying or carrying out other such activities. The National Coal Council receives no funds or financial assistance from the Federal Government. It relies solely on the voluntary contributions of the members for the support of its activities.

The members of the National Coal Council are appointed by the Secretary of Energy for their knowledge, expertise, and stature in their respective fields of endeavor. They reflect a wide geographic area of the United States, representing more than 30 states. They reflect a broad spectrum of diverse interests from business, industry, and other such groups as listed below:

Large and Small Coal Producers

Coal Users such as Electric Utilities and Industrial Users

Transportation interests from the Rail, Waterways, and Trucking Industries as well as port Authorities

Academia

Research Organizations

Industrial Equipment Manufacturers

Environmental Interests

State Government, including Governors, Lt. Governors, Legislators, and Public Utility Commissioners

Consumer Groups including special women's organizations

Consultants from scientific, technical, general business, and financial specialty areas

Attorneys

Special interest groups that are regional or state in concentration

Indian tribes

The National Coal Council provides its advice to the Secretary of Energy in the form of reports on subjects requested by the Secretary and at no cost to the Federal Government.

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EXECUTIVE SUMMARY

INTRODUCTION

In June 1990, the National Coal Council submitted to the Secretary of Energy findings on coal's capacity to contribute to the nation's future energy requirements. That report, "The Long Range Role of Coal in the Future Energy Strategy of the United States," included strategic recommendations covering a 60-year planning horizon established by the Department of Energy.

This study, "The Near Term Role for Coal," addresses the critical next 10 years. It focuses on significant issues currently confronting coal, issues which will influence coal's position well into the 21st century. Coal's future in energy in the year 2000 will largely depend on events occuring during the 1990's, a decade when the rate of change will continue to escalate as will the potential for instability.

One has only to reflect on the events of 1990 and 1991 to appreciate that the world has entered a period of profound change. Since completion of our last report, we've witnessed yet another oil crisis, this time resulting in unprecedented military response. We've seen Germany unite, eastern Europe "democratize," and are now witnessing the most momentous event of all — the transformation of the Soviet Union. At home, our concerns have escalated, energy legislation is under consideration, but future energy policy remains uncertain.

The Secretary of Energy and the President are to be commended for the emphasis which the Administration has placed on energy strategy, a major issue directly connected to growth, competitiveness and international relations. However, the National Coal Council remains concerned about coal's future role in that energy strategy. In view of the profound changes that lie ahead for the United States, it's in the best interest of the nation that coal assume a larger role in meeting domestic energy needs and those of other nations.

The case for increased coal utilization is compelling. Availability, security of supply, economic benefits, environmental considerations, a comprehensive transportation system and technological developments point collectively to the advantages of greater reliance on coal as an energy resource. However, coal's future remains uncertain because of existing governmental regulations, the real possibility of new punitive legislation and regulation and because of the public's lack of understanding about coal's impact on the environment and its capacity to contribute to societal welfare.

This summary presents a condensation of the key issues concerning coal utilization, a brief discussion of impediments, and, most importantly, recommendations to the Secretary of Energy regarding coal's use in the near term.

DISCUSSION

Coal is the United States' most abundant, price-stable fossil energy resource. Coal represents almost 95 percent of the country's fossil fuel reserves. Oil and gas reserves are expected to be depleted at some point during the next century, while U.S. coal reserves amount to a 250-year supply. Using more coal during the near term makes sense from an economic point of view. For the past two decades, it has remained the price stable economic backbone of the U.S. fossil fuel industry. Utilization of U.S. coal reserves helps reduce the negative balance of payments associated with imported oil. For instance, if the 772 million tons of coal consumed by U.S. electric utilities in 1990 had been oil instead of coal, an additional three million barrels of imported oil per day would have been required. Importing that amount of oil would have meant a $60 billion per year negative effect on the nation's balance of payments.

Recent and ongoing technological improvements support the increased use of coal to shoulder more of the nation's energy burden during the 1990s. Advances have been made in production, transportation and consumption technologies.

NEAR TERM ROLE FOR COAL

Industry analysts expect much, if not all of today's experimental end-use technology, such as pre-combustion, combustion and post-combustion cleaning, NO_x controls, gasification and other conversion processes, to be deployable within 10 to 12 years. Deployment of these and future technological innovations will enhance coal's usefulness as well as its environmental compatibility.

Finally, there is the matter of need. By the turn of the century, total world energy requirements will be about 50 percent greater than today. Coal is heavily relied on worldwide for the generation of electricity. For example, in the U.S., 85 percent of the coal is used for the generation of electricity. If the world's economies are to develop, an even greater reliance on coal-fired electricity generation will be essential.

In view of coal's abundance, availability, economic advantages, technical advances, logistical support and the estimated rise in energy demand, increased utilization would seem to be assured. But, serious threats to coal use exist. Excessive regulation, control and legislation, especially that borne of a well-intentioned desire to protect the environment, all pose serious obstacles for the near <u>and</u> long term. These threats affect production, transportation and the ultimate use of coal and its by-products.

Because of these impediments, industry will be deterred from developing the plans and programs required to expand the energy potential of coal in the 21st century.

Coal production and electricity generation, the major use of coal, are long-term, capital intensive enterprises and companies in these industries will continue to bear the risks associated with marketing and production. However, a change in public policy is needed to reduce the consequences of this poorly conceived legislation and regulation. Simply stated, the industry requires a rational, stable, and predictable public policy.

RECOMMENDATIONS

The National Coal Council supports the key coal-related actions proposed in the National Energy Strategy. Therefore, the Council urges the Secretary to vigorously pursue the following initiatives. Transforming this vision into a reality will require that additional steps be taken. Accordingly, the Council submits these recommendations.

1. The Secretary should work with the Administrator of the Environmental Protection Agency, the Secretary of The Interior, the Secretary of Transportation and other appropriate State and Federal officials to seek balanced solutions to energy and environmental issues.

   —Ensure that environmental regulations are economically feasible for the utilization of coal. Reference Chapters 1 & 2.

   —Modify what changes in emissions and plant equipment or operation will trigger Prevention of Significant Deterioration and new source review in light of emission caps. Reference Chapter 2.

   — Comment on analytical methods and conclusions regarding air toxics to ensure regulations are based upon sound technical data. Reference Chapter 2.

   — Support appropriate regulations of large volume coal ash and scrubber sludge product reuse and disposal, and oppose controls typically developed for more hazardous and chemically active wastes. Reference Chapter 2.

- Help substantiate the conclusion that SO_2 standards adequately protect the public health from adverse responses to peak, short term SO_2 concentrations. Reference Chapter 2.

- Support access to and development of the most economic and environmentally acceptable federal coal reserves. Reference Chapter 2.

- Help remove barriers to re-mining abandoned mine areas. Reference Chapters 1 & 2.

- Support increased research and incentives for industry participation in development of coal production automation technologies. Reference Chapter 4.

- Encourage the development of a national strategy for expanding the use of coal in the transportation sector. Reference Chapter 2.

2. The Secretary should continue to exercise his leadership role to assure that scientific analysis is the basis for policy decisions regarding global climate change.

3. The Secretary is urged to continue to develop and implement energy education programs to better inform the public of the important role the coal industry plays in the nation's energy supply, the development of new technologies and the industry's successes in meeting environmental and safety standards. Reference Chapter 1.

4. The Secretary should continue the Clean Coal Technology Program and recommend a similar program following Clean Coal V to further improve energy efficiency and reduce CO_2 emissions per unit of energy. Reference Chapter 4.

5. The Secretary should encourage State and Federal agencies to develop regulatory incentives for utilities and industry to invest in projects using innovative clean coal technologies. Reference Chapter 4.

6. The Secretary should, through legislation, seek financial incentives such as accelerated depreciation and investment tax credits to speed the deployment of Clean Coal Technologies. Reference Chapter 4.

7. The Secretary is urged to support Congressional authorization and appropriation bills for improvements to locks and dams on inland waterways. Reference Chapter 3.

8. The Secretary should establish an information clearing-house to facilitate the exchange of technology developments among both producers and users of coal, and develop a closer liaison with U.S. representatives in other countries to facilitate coal related exports. Reference Chapter 1.

COAL RESOURCES AND ECONOMICS

THE ISSUES

Energy is the common denominator imperative to sustain economic growth, improve standard of living and support an expanding population. Economic growth and an adequate, reasonably-priced secure energy supply go hand-in-hand.

Coal, as the most abundant and price-stable fossil energy resource in the United States, must play an important near-term role as a major contributor to the security and economic well-being of this nation. The production capacity of coal mines in the United States, with its efficient transportation system, is capable of performing this role. However, the availability and production of coal to meet future demand can be severely hampered by regulatory policy in general and Federal coal leasing policy in particular. The resulting increases in development time and costs, together with the uncertainty created by rule changes, may inhibit the flow of capital necessary for future needs.

National energy policy should seek to reduce or minimize reliance on imported oil, diversify the nation's domestic energy supply, promote conservation and increase the efficiency of energy use, while minimizing the social costs, environmental impacts, and safety concerns.

ENERGY DEMAND

In the U.S., energy requirements through the year 2000 are forecast to increase by an average 1.3 percent per year. Today's energy consumption of approximately 84 quadrillion Btu (quads) will be approximately 96 quads by 2000, according to the base case estimates included in the "Annual Energy Outlook" prepared by the U.S. Department of Energy and released in April, 1991. A recently published forecast prepared by the Office of Technology Assessment (OTA), "Energy in Developing Countries," predicts that energy demand in all Organization for Economic Cooperation and Development (OECD) countries will increase at the same annual rate — 1.3 percent — over the next 10 years.

The incremental energy demands of the developed Western world will be dwarfed by the new energy needs of the Third World countries or "developing nations" and the former USSR, China and Eastern Europe. In these countries, energy use is expected to increase geometrically to support sharp growth in population while at the same time supporting improvements in the economic status of each country.

The OTA assessment shows that the rate of increase in energy demand in developing countries through 2000 is expected to average 3.8 percent per year, almost 3 times that of the OECD. The expected rate of growth in energy demand in the former USSR and Eastern Europe, is anticipated to average an annual 2 percent over the next two decades, also higher than the OECD.

By the turn of the century, total world energy requirements could be almost 50 percent greater than today. Almost 60 percent of the energy consumed in the world by then would be in the bloc of developing nations, the former USSR and Eastern Europe. Providing for this sharp increase in energy, at the same time that new domestic energy needs (and new domestic environmental requirements) must be met, will present the U.S. and the rest of the developed world with an unprecedented challenge.

Electricity's Role Will Increase

As energy demands increase, economies become more dependent on electricity to meet end use energy requirements. In the U.S., electricity met 27 percent of 1973 end-use energy needs. In 1990, this figure was over 30 percent. By 2000, electricity will meet 41 percent of U.S. end-use energy requirements.

The increase in dependence on electricity is equally notable in other OECD countries, where use of electricity in the future is expected to be greater. For example, as electricity meets more of a growing transportation requirement, that product will be in even greater demand. This will not be a phenomenon unique to OECD nations, use of efficient electricity will also be increasing in importance throughout the developing world.

Conservation and greater efficiencies (beyond those assumed in the model used in this report) may serve to slow the anticipated rate of growth. Demand for energy will not decline unless economic activity declines: 1) for fiscal, monetary or business cycle reasons, or 2) because energy is unavailable, or 3) because it is only available at prohibitive costs. Government and industry must work together to ensure that these future requirements are met and that they are met at reasonable costs.

ROLE FOR COAL

Economics

Coal production directly contributes over $21 billion annually to the economy and directly employs more than 130,000 workers. The economic activity attributed to coal production has far-reaching effects throughout America's business sector, resulting in a total economic impact nearly four times greater than that produced by the industry alone. This impact of $81 billion is equivalent to about 1.5 percent of the United States Gross National Product (GNP). The economic activities associated with coal production also translate into more jobs than would be indicated by direct employment alone -- seven jobs in the economy at large for every direct coal industry job. Of course, the employment attributed to coal mining activities is most heavily concentrated in the coal producing states, but the transport and manufacturing jobs that support the industry are nationwide.

Use of domestic coal reduces the negative balance of payments which would directly or indirectly result from replacing coal with imported oil. In 1990, U.S. electric utilities consumed 772 million short tons of coal. [1] Had oil been used instead of coal, nearly three million barrels per day of oil, most of it imported, would have been required. If that oil were to come from imports, the balance of payments effect would be approximately $60 billion per year.

Finally, U.S. coal is an important export commodity. In 1990, over 100 million tons were exported to 50 countries. This coal was valued at almost $4.5 billion, a valuable offset towards this nation's otherwise negative trade imbalance.

Coal is equally important to the economies of other regions of the world and has made significant gains in the decade just past. Outside the U.S., coal production increased by over 30 percent between 1980 and 1990. In the OECD nations, coal-generated electricity now totals 40 percent. To support this, thermal coal export trade has increased by 30 percent, or 100 million tons over the last decade.

Performance of the Past Decade

Coal is the nation's most abundant and most price-stable fossil energy resource. As illustrated in Figure 1, coal represents about 95 percent of the fossil fuel reserves of the United States.

U.S. NONRENEWABLE ENERGY RESOURCES

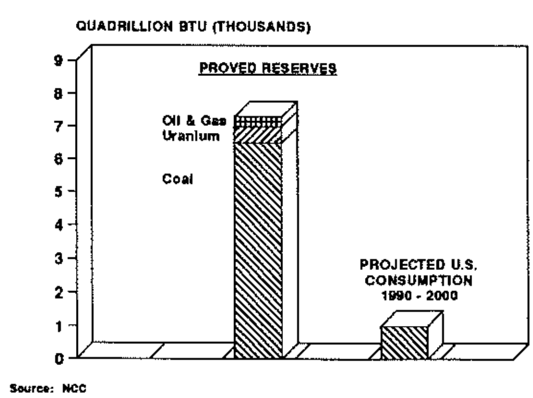


Figure 1

COAL RESOURCES AND ECONOMICS

Estimated total U.S. energy consumption for the period 1990-2000 as shown is less than 15 percent of proven U.S. coal reserves.

In recent years, domestic coal has supplied nearly one-fourth of the total U.S. energy consumption, which has been growing at a rate of about 2 percent per year. Current coal use is equivalent to nearly 7 billion barrels of oil each year, approximately equal to the nation's petroleum imports.

United States coal production and consumption/exports passed the 1 billion ton/year milestone in 1990. This achievement marked the end of a decade in which total coal production increased by 24 percent, going from 829 Million to 1.029 Billion tons. Domestic coal use jumped by over 27 percent, a record not equalled by any other fuel source in the United States. Coal's share of overall U.S. energy production increased from 28 to 33 percent.

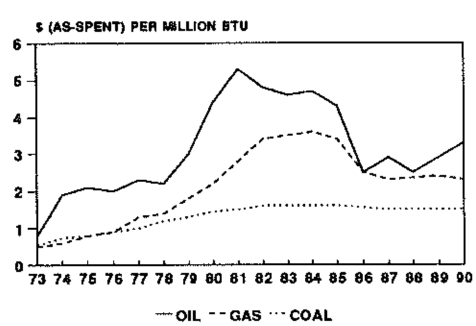
While the coal industry was setting record production almost every year in the 1980s, other milestones were being reached. First and foremost, the industry became safer to work in. Moreover, productivity (tons/man-day) improved by almost 100 percent, enabling coal to become even more competitive in the energy market.

Figure 2 shows that the average coal price has been more stable and consistently lower than oil or gas since 1973, when petroleum price first became a political issue. It should be noted that actual mine-site coal prices have *declined* in past years. In current dollars, the mine-mouth price of coal has dropped from an average of $24.50/ton in 1980 to $21/ton by 1990.

This long term stability in base energy prices (and thus in electricity prices) contributed to the prosperity of the 1980s and was one reason for the improved competitiveness of manufacturing industries, both at home and in overseas markets.

Eighty-five percent of coal use in the U.S. is for electricity generation, with two-thirds consumed by the residential/commercial sector and one-third by the industrial sector. Electricity generation has been growing at about 2-1/2 percent per year. The total kilowatt hours of electricity generated by coal increased by over one-third as coal's share of the total pie jumped from 50 to 57 percent. (Figure 3) Consumption of coal at utilities in 1990 totaled 772 million tons.

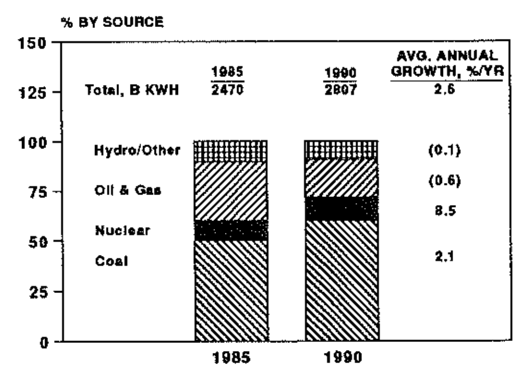
COST OF FOSSIL FUELS DELIVERED TO STEAM-ELECTRIC UTILITY PLANTS



Source: DOE/EIA

Figure 2

NET ELECTRICITY GENERATION BY SOURCE



Source: DOE/EIA

Figure 3

NEAR TERM ROLE FOR COAL

COAL FOR THE NEAR TERM

Viewed broadly, production capability within each producing region is more than sufficient to meet the nation's near-term needs. The production capacity of existing mines is compared against 1990 production in Figure 4.

Figure 5 compares this capacity against the forecast U.S. coal production through the year 2005.[2] Production from new mines is not included in the capacity estimate, and perhaps, can be assumed to balance mine retirements during the period.

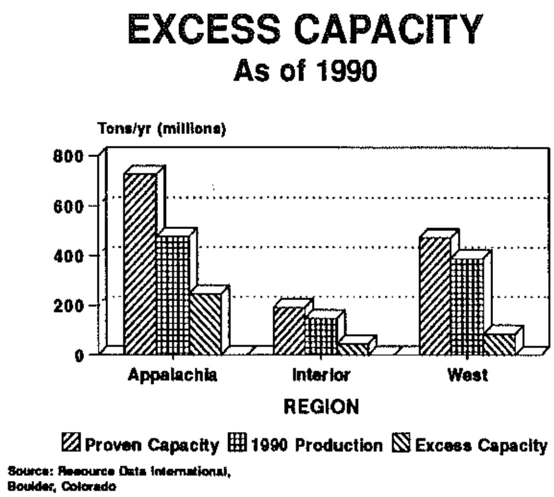


Figure 4

There is a concern that there may be some capacity shortfalls in the supply of low sulfur coal to meet increased demand occasioned by the 1990 amendments to the Clean Air Act. However, the level of increased demand for low sulfur coal is difficult to predict, given the uncertainties surrounding regulatory implementation of the Clean Air Act amendments, as well as the political and economic trade-offs influencing individual utility implementation decisions.

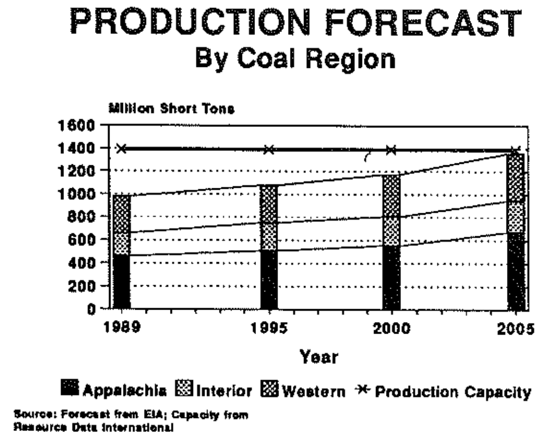


Figure 5

Regulatory Policy

Federal Leasing — Approximately 80 percent of the western coal reserves are either owned or directly impacted by the Federal Government.[3] Federal leasing policies during the near-term period will have a significant impact on the long-term capability to meet forecasted demand for western low-sulfur coal.

Several provisions of the Federal Coal Leasing Amendments Act of 1976 (FCLAA) do not fit current and expected market and reserve development considerations. Primary issues include: unrealistic and rigid due diligence requirements; possible premature mine closings caused by requiring all reserves within a logical mining unit (LMU) to be mined within 40 years; and cumbersome, inflexible procedures governing competitive leasing of large tracts.

FCLAA provisions also adversely affect the near-term availability of coal because of overly rigid requirements for leasing of tracts adjacent to existing mines, and because of the requirement that all properties contained in a LMU be contiguous. As a result, coal reserves which should logically be produced may be bypassed, and in some cases, left unsuitable for future recovery.

COAL RESOURCES AND ECONOMICS

An additional issue exists in the special situation of low Btu (lignite) federal coal. In contrast to other western coals, the sales price to which the royalty rate applies is, essentially, a delivered price because the lignite is consumed by mine-mouth generating plants. Lowering the royalty rate on lignite to correct this imbalance would result in more efficient use of federal lignite resources by avoiding the bypass of Federal lignite tracts.

Permitting and Environmental Enforcement

Since 1899, environmentally driven statutes and their corresponding regulations have increased both in number and in complexity, as shown on Figure 6.[4] This increase has created impediments to the development of reserves. Many of the changes and/or additions to the regulations have tended to address issues which are actually, local or site specific problems, as evidenced by permitting trends toward requiring more detailed applications.

U.S. LAWS ON ENVIRONMENTAL PROTECTION

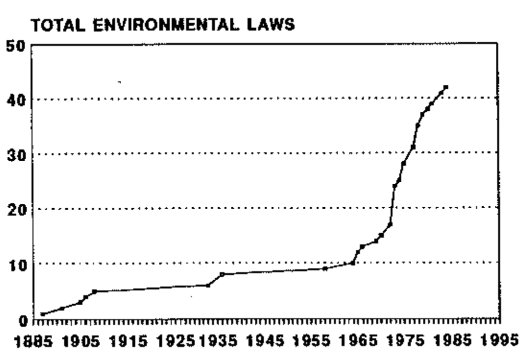


Figure 6

The proposed legislative actions and the regulatory process together could create barriers for many companies of both unforeseen costs and time involved. Specific examples in the near-term include the amendments to the Clean Air Act signed in 1990, and the numerous regulations that will be promulgated as a result during the early 1990's. Another major Congressional priority for addressing environmental concerns will deal with the re-authorization of the Clean Water Act. This is expected to be similar to the Clean Air Act Amendments of 1990, and may seriously restrict mining in bottomland hardwood areas and wetlands, even where restoration and mitigation are undertaken. The re-authorization of the Resource Conservation and Recovery Act could regulate solid wastes in the same manner that the 1985 amendments regulated hazardous waste. The impacts to clean coal technology by-products, including fly ash, bottom ash, scrubber sludge, etc. would significantly increase the cost of handling and disposing of wastes, which would add to the cost of utilizing coal and would reduce its attractiveness.

In addition to these statutes, numerous changes to the corresponding regulations are being proposed. Those associated with surface mining activities under the auspices of the Office of Surface Mining and Reclamation Enforcement and/or corresponding state agencies which have obtained primacy of the program have the most direct impact on the industry. Specific examples of these include subsidence regulations and the restrictions that may be imposed on longwall mining operations. The regulatory method for evaluating whether an applicant is eligible for a mine permit causes significant delays in the permitting process due to incorrect information in the federal computer system and the difficulty of correcting that information in a timely and cost efficient manner. A variety of performance standards currently being proposed or evaluated may limit a state's ability to decide issues on a case-by-case basis.

Among major non-coal sources of electricity, nuclear generation has experienced the greatest growth rate in recent years, while other sources have lost share. Nuclear's share appears to have peaked due to the lack of new facility construction and the closing of partially constructed facilities. No new facilities are considered possible during the 1990's.

NEAR TERM ROLE FOR COAL

Currently, domestic natural gas is available at low prices and can be used in highly efficient combustion turbines and combined cycle generators which have relatively low capital requirements and short construction lead times. Constraints include the difficulties in securing long-term supplies at reasonable (predictable) prices and the lack of sufficient pipelines and distribution facilities in some areas, such as the Northeast.

The growth in coal consumption is forecast to occur primarily for the generation of electricity, both by the traditional electric utility company and by the non-traditional "Non Utility Generator" or NUG. In the year 2000, approximately 884 million tons will be used by utilities and another 10 -20 million tons will be used by NUGs.

The other growth area for coal will be in the export market where demand for U.S. coal is forecast to increase by one-third to 140 million tons. This will support a 40 GigaWatt (GW) increase in coal-fired generating capacity by the turn of the century. In addition, the demand for coal in the developing countries and in Eastern Europe will require another 120 GW of new coal-fired capacity to be built. This will mean a new market for some 300 million tons of coal by 2000, according to the Electric Power Research Institute.

The potential for the U.S. role in the world market could be greater than forecast, but the outlook depends upon many economic and political factors. Economic factors include, in addition to the traditional rate of economic growth, costs of production and transportation, exchange rate movements and overall competitiveness of U.S. coal with coal produced in other nations. Political factors that will affect the outlook for U.S. coal include environmental requirements in customer countries, the rate at which other nations phase out subsidies for indigenous coal production (whether for domestic use or for export), trade barriers that may be in place in importing countries, and the political relationship between the U.S. and the purchasing country.

RECOMMENDATIONS

1. The Secretary should work with the Administrator of the Environmental Protection Agency, the Secretary of The Interior, and other appropriate State and Federal officials to seek balanced solutions to energy and environmental issues.

   -Ensure that environmental regulations are economically feasible for the utilization of coal.

   - Support access to and development of the most economic and environmentally acceptable federal reserves.

   - Help remove barriers to re-mining abandoned mine areas.

2. The Secretary should establish an information clearing-house to facilitate the exchange of technology development among producers and users of coal, and develop a closer liaison with U.S. representatives in other countries.

3. The Secretary is urged to continue to develop and implement energy education programs to better inform the public of the important role the coal industry plays in the nation's energy supply, the development of new technologies, and the industry's successes in meeting environmental and safety standards.

References

1. Energy Information Administration, "Annual Energy Outlook 1990," Table A5, p. 44.

2. Energy Information Administration, "Annual Outlook for U.S. Coal 1990." Table 7, p. 14.

3. Terry O'Conner, "Amending the Federal Leasing Program," Coal Voice, National Coal Association, January/February 1991, Special Report p. 1.

4. Richard L. White, "Texas, an Environmental Leader in Coal Mining," Presentation to the Texas Mining and Reclamation Association, Slide #6, September 7, 1991

THE ENVIRONMENT

THE ISSUES

The potential role for coal in meeting energy needs of the United States can hardly be overstated. It is a versatile resource, abundantly available, and is a low-cost fuel which provides the majority of electricity generation in the United States. Coal can also serve as the fuel component of a coal-water slurry (with other applications in power generation), and as the raw material for production of chemicals and coal-derived liquid and gaseous fuels used to offset growing national dependence on imported fuels. The best interest of the nation can be served if all domestic energy resources are used effectively and efficiently for applications which represent their "highest and best" uses.

Oil imports now exceed 50 percent of domestic use and gas imports have reached about 7 percent. It is clear that growing dependence on imports increases the security risk related to energy supply, the balance of trade deficit and endangers economic growth. In fact, if costs can be reasonably contained, coal and clean coal technologies offer unique export opportunities for the U.S., which would provide relief to the above problems.

The National Coal Council in its June 1990 report to the Secretary of Energy, entitled "The Long Range Role of Coal in the Future Energy Strategy of the United States," emphasized the need for balanced regulatory solutions that achieve the environmental results while improving the industry competitiveness. The coal industry has made strides in minimizing the environmental impact of its temporary use of the land. Opportunities and technologies exist to achieve these balanced solutions and to provide incentives for even greater progress in achieving environmental goals. These balanced environmental approaches are key to the economics of the coal industry and its ability to contribute to improving the competitive position of the United States.

While the energy intensity (Btu's consumed/GNP) of the U.S. economy is declining, the correlation between growth in GNP and electricity generation remains intact. Electricity consumption is up nearly 50 percent since the mid-1970's, almost identical to economic growth, while overall energy consumption has declined in relation to GNP. Electricity is projected to expand from 30 percent of total U.S. energy use today to over 41 percent in 2000[1], making it the sole growth area in the energy industry. Coal supports over 56 percent[2] of the electrical production today and is projected to maintain a greater than 50 percent[3] level through 2000. Consequently, the cost-competitiveness of a major portion of U.S. industry is affected by the cost of mining and supplying coal to electric utilities and industry.

U.S. coal exports, representing 10 percent of U.S. production and totaling 100 million tons in 1990, are recognized as swing products in international markets. Price competitiveness is the key issue for coal in these markets. With a more competitive cost of production and transportation through better environment/cost balances, U.S. coal exports could play a significant role in U.S. economic growth as well as help improve the U.S. balance of payments.

The proliferation of laws and regulations affecting extraction, transportation, and ultimate use of coal and its by-products over the past 30 years has created many non-productive domestic cost increases. This proliferation has been further increased with the Clean Air Act Amendments of 1990.

For coal and other energy resources to be efficiently and effectively utilized, it becomes increasingly important to ensure that environmental and other regulatory constraints are clearly needed and that benefits to be derived from such constraints are commensurate with the costs. This has not been the case in the past, perhaps because of attitudes developed when the U.S. had greater energy and economic security. It is therefore timely for the Department of Energy to instigate a systematic review, working cooperatively with the affected parties, to determine if all the constraints now in place are really needed and if they meet the test of cost-effectiveness. This is especially true in the area of environmental protection.

There is continued and recent cause for concern, occasioned by the failure to use the findings of the National Acid Precipitation Assessment Program (NAPAP) while drafting and enacting the Clean Air Act Amendments of 1990. Though NAPAP provided the most authoritative and credible information currently available, (at a cost to taxpayers of over $500 million), Congress was determined to respond to popular hypotheses, rather than act upon scientific evidence.

Now that the legislation has passed, it is imperative that the Department of Energy use its influence to ensure that forthcoming regulations are developed so as to minimize cost and to optimize the use of domestic resources. As acid rain has been addressed by legislation, the environmental groups now have turned to the subject of global warming. The public again is being given hypotheses as though they were facts. It is timely and important, therefore, for the DOE to recognize global warming as an energy issue and assume a leadership role in determining the facts before Congress acts, rather than afterwards.

Environmental Protection

In order to achieve reasonable goals related to the domestic economy and national security, coal must be efficiently utilized in a number of ways. Unless coal is properly used, unemployment, the balance of international trade, national debt, general economic well-being and the quality of life we enjoy will be adversely affected. It is the achievement of this proper role which is called the "near-term vision" for coal. With so much at stake and with many options for coal use, it should be a matter of national concern that the image and uses of coal appears to be negative. This is the subject of a 1992 National Coal Council Report, "Improving Coal's Image: A National Energy Strategy Imperative."

Of even greater concern is the manner in which laws and regulations affecting the extraction, transportation, processing, and utilization of coal have proliferated over the last three decades. Even if one assumes that each of these laws and regulations are well-intentioned and serve a useful function, there are still many constraints which are not cost-effective. Thus, existing laws and regulations should be examined systematically so as to remove unnecessary constraints which add to the cost of using coal. New legislation and the uncertainty of regulatory issues threaten to bring and added burden. These threats must be resolved in a manner which minimizes additional costs unless they are strongly justified.

Examples of current issues are briefly discussed in the following pages.

1. Global Warming

It is being argued that increasing levels of certain "greenhouse" gases, including carbon dioxide (CO_2), Chlorofluorocarbons (CFC), Nitrous Oxide (NO_x), which trap infrared radiation reflected by the earth's surface, will lead to a global increase in the average temperature of the lower atmosphere. Significant uncertainties exist regarding the magnitude and timing of the change in global average temperature as a result of the increases in greenhouse gas concentrations. The action of clouds, oceans, volcanic activity, and biota can, either enhance or offset, the magnitude, direction, and the rate of the temperature response. Concern over climate change is driven by hypothetical projections of significant adverse effects on man and natural ecosystems. However, making an accurate assessment of these future effects is not possible, given the predictable uncertainties of regional or global climate changes.

The coal and the utility industries are visible targets for those seeking reductions in greenhouse emissions. Of all the fossil fuels, coal, utilizing current combustion technologies, produces the highest CO_2 per unit of heat output. Yet the amount

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of CO_2 produced from coal combustion is actually a very small percentage of total CO_2 emissions. Carbon dioxide, both from natural sources and from man's activities, makes up about 50 percent of world greenhouse gases.[1] Man-caused CO_2, however, is only 3 - 5 percent of total CO_2 emissions.[2] Combustion of solid fuels, primarily coal, is responsible for 27 percent of man-caused CO_2.[3] Therefore, world coal combustion is responsible for about 1.4 percent of total CO_2 emissions (27% of 5%). Since the United States produces about 20 percent of world CO_2 produced by man, the combustion of U.S. coal results in about 0.3 percent of world CO_2.

In 1991, 56 percent of the electricity produced in the U.S. is generated from coal. The possibility of future limits on the use of coal come (a) from the National Energy Strategy proposal for the U.S. to stabilize CO_2 emissions at or below 1990 levels by the year 2000, (b) from international negotiations which could result in emission restrictions for greenhouse gases, (c) from the possible imposition of emission, energy, or carbon taxes which would drive the price of coal-derived electricity up, (d) from analysis of environmental externalities which do not consider the benefits of inexpensive electricity. Any of these possibilities could serve to diminish the viability of coal as a long-term energy source.

Already it appears that politics are getting ahead of facts regarding global warming. It is imperative that an emphasis be placed on scientific research on global climate change. The complexity and degree of uncertainty that exists about this issue dictate the need for research in order to make informed decisions. Action plans must include research on technologies that increase the efficiency of using coal, technologies that minimize the overall emission of CO_2 when coal-generated energy is used. All aspects of the climate system must be understood, so that increased confidence can be placed in predictions and assessments of climate change and in methods and technologies that will reduce or afford protection from future climate change, if needed.

The U.S. must avoid treaty proposals calling for premature reductions of CO_2 and/or imposition of carbon taxes until adequate scientific information is available. It is interesting to note that there is not only uncertainty about whether the globe is really warming but there is also a debate about whether the effect of increased CO_2, if it occurs, would be good or bad. Surely these basic questions must be carefully explored before any strategies for control are implemented. In fact, it is alarming that with the prevailing high level of uncertainty, there are still many proposals for immediate action.

2. Environmental Externalities and Conservation

The effort to evaluate environmental externalities in the process of making energy-related decisions is gaining support in several states. "Externalities" refer to the negative effects of an activity which are not accounted for in the cost of the activity. This definition as used by most states contemplating their application allows externalities only to be "bad". In many cases, studies of externalities have been thinly disguised efforts to create arbitrary bias or seek favortism for one alternative in the decision-making process. Efforts to evaluate externalities must be developed with great care.

The biggest challenges are two-fold: (1) to be sure that all factors have been considered, and (2) to be sure that each factor has been assigned the appropriate value, relative to the value of all other factors. Examples related to energy decisions would include evaluating the cost of secure supply lines in making long-range plans to use oil. Also, in this case, one would need to quantify the impact on the international balance of trade which arises from using imported fuel. These are economic externalities and clearly they must be evaluated along with environmental externalities if reasonable and fair comparisons are to be made.

Conservation is not controversial like externalities. In this context, conservation means that one does not use energy resources unless it is necessary, and then the resources are used as efficiently as practicable. Though coal is abundantly available relative to other domestic energy resources, conservation is an important criterion for its use. Improved efficiency in extracting energy from coal is a major goal of the ongoing Clean Coal Technology program. This goal produces both economic and environmental dividends and extends the useful life of this important domestic resource.

3. Clean Air Act Amendments of 1990

A. Title IV: Acid Deposition

Starting in 1995 approximately 260 units at 111 coal-fired plants will have to operate subject to an annual SO_2 emissions tonnage cap. The cap corresponds to an SO_2 emissions rate of approximately 2.5 lb/mmBtu, assuming no growth in generation at an affected unit. A key feature of the legislation is that, if emissions are lower than the annual tonnage limitation, the unused allowances can be transferred, sold, or held for future years.

The major activity over the next several years will be rulemakings of the Environmental Protection Agency (EPA) for implementing the Clean Air Act Amendments of 1990. The principal focus of this acid rain activity will be the definition of the rules and regulations for allowance trading and compliance monitoring and tracking.

Since these amendments were adopted without taking into account the findings of the National Acid Precipitation Assessment Program (NAPAP), it becomes more important that the information derived from NAPAP be utilized in the rule-making or regulatory process. Misguided politics and public opinion appear to have been a strong influence in forming the amendments. It is therefore of extreme importance to adopt reasonable and cost-effective forthcoming regulations. It is of greatest urgency that the regulations be based on fact, not conjecture, and that flexibility be allowed in the strategies for meeting those regulations.

B. Air Toxics

The Clean Air Act Amendments of 1990 include a long list of toxic pollutants (189 substances) and require the EPA to impose controls on the emissions of these pollutants from industrial sources. EPA must identify categories of industrial facilities which emit substantial amounts of each pollutant and regulate all major sources within each category. A major source is one capable of emitting 10 tons per year of any single pollutant or 25 tons per year of a combination of pollutants. Additional limits to the use of coal might come from the results of two studies EPA is scheduled to perform (a study of air toxics risks from electric utilities is due by November 1993; and a study of mercury emissions from electric utilities and other sources is due by November 1994). If the studies recommend additional emission controls on these sources, the consequences will be a likely reduction in the amount of coal being used by electric generating units and a potential shortfall in the supply of electricity.

4. Continuing Regulatory Initiatives

A. WEPCo

Since a 1988 EPA ruling on proposed repairs at a Wisconsin Electric Power Company (WEPCo) plant, possible new source review has threatened virtually all power plant repair, maintenance and replacement activities. Further, WEPCo introduced uncertainty as to whether retrofits undertaken to comply with the Clean Air Act amendments of 1990 would be subject to new source review. Because coal is the fuel for much existing utility capacity, and the unnecessary addition of new source controls would make that capacity much more expensive to operate, the WEPCo issue is extremely important to the coal industry. As a policy matter new source review requirements need to recognize that SO_2 emissions are now capped and that local air quality is protected by ambient air quality standards.

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In June 1991, EPA issued a proposed rule on WEPCo that is much more favorable than earlier rulings. While it does not remove all of the WEPCo issue uncertainty, it makes it less likely that new source review will be required for Clean Air Act compliance actions and retrofits to existing power plants. The ruling has garnered opposition from environmental groups and attention on Capitol Hill. There are other key WEPCo issues that the proposal does not address, such as the definition of exempted routine maintenance, repair and replacement. Continued participation in the WEPCo issue by the coal industry is crucial.

B. ONE-HOUR SO_2 STANDARD

The 1970 Clean Air Act mandated that EPA set National Ambient Air Quality Standards (NAAQS) to protect public health, with an ample margin of safety, from the adverse effects of SO_2 and other pollutants. Currently, the SO_2 NAAQS are based on 3-hour and 24-hour averages. EPA is now considering proposing a short-term (one-hour) SO_2 standard to protect the health of a sensitive sub-population (exercising asthmatics) from peak SO_2 levels. However, analysis has shown that less than one[4] percent of the asthmatic population is exposed to and affected by peak, short-term SO_2 concentrations. When changes in their respiratory function occur, the changes are transient and reversible. Based on the small number of exposures, a one-hour SO_2 ambient standard would not substantially reduce the number of times asthmatics experience respiratory problems.

Coal would be affected by a short-term SO_2 standard because SO_2 emissions from coal-fired generating plants would be further limited, increasing the cost of coal-fired generation. Such site-specific, stringent limits could disrupt the SO_2 allowance trading program established by the Clean Air Act amendments of 1990 by limiting utilities' ability to make SO_2 reductions at the most cost-effective sites. If a stringent standard mandates extensive and costly control requirements, electric utilities would be forced to consider alternatives to coal.

5. Solid Waste

Ash Disposal and Scrubber Sludge Disposal: EPA has reported to Congress that existing disposal and utilization practices satisfactorily protect human health and the environment, and that these fossil fuel combustion byproducts (ash and sludge) are not hazardous wastes and need not be regulated as such. EPA is reexamining this position and there is a risk that the byproducts of coal combustion may be classified as "hazardous" wastes rather than "solid" (i.e., non-hazardous) wastes. If coal combustion byproducts are required to meet hazardous waste regulations, the increased cost of disposal would ultimately raise the price of electricity to consumers without a corresponding gain in environmental protection.

In the 1988 EPA report to Congress, it was estimated that the annual increased cost to the electric utility industry for regulating fly ash and scrubber sludge as hazardous wastes would be $3.7 billion. Coal ash and scrubber sludge are high volume wastes. It is important to encourage the reuse of these by-products to save the expense of disposal, land use, and use of other virgin materials. Any additional constraints, such as arbitrarily forcing them to be treated as hazardous wastes, will have a very large financial impact. Several variations of risk appear to be under consideration: federal regulations, as opposed to state regulations, which will not take site-specific climatic and geologic conditions into account; federal regulations which use design standards rather than performance standards for coal combustion byproduct disposal and use; and siting restrictions such as attempts to ban disposal in certain geological settings or demographic conditions.

6. Surface Mining Control and Reclamation Act (SMCRA)

After a long and bitter debate, Public Law 95-87, *The Surface Mining Control and Reclamation Act (SMCRA)*, was finally enacted on August 3, 1977. It is the most comprehensive piece of environmental legislation to ever impact the coal industry. It addressed virtually every aspect of both surface and underground coal mining, covering things such as coal exploration, permitting, operation and reclamation standards, provisions for designating lands unsuitable for coal mining, bonding, inspection and enforcement, and provided for public participation in all phases of coal mining and reclamation operations. SMCRA authorized the establishment of the Office of Surface Mining (OSM) and the promulgation of regulations to support the legislation.

SMCRA has been effective as the environmental performance of every responsible coal operator has improved dramatically. OSM noted this performance in its 1988-89 Annual Report - "Along with unsurpassed production, the nation is experiencing improved compliance with the requirements of SMCRA. Despite the fears of many when SMCRA became law, this is confirmation that ever-increasing production and environmental protection can occur together."

The regulatory programs promulgated under SMCRA, however, are complex and have been controversial and hotly contested. This has led to numerous court decisions and revisionary efforts. These revisionary processes continue today at the federal and state levels. Areas of reform to SMCRA and the related state implementation programs which could reduce the burden and cost of compliance while still providing protection for the environment, and in some cases provide incentives for faster and improved environmental action, include the following:

a. Federal law provides that state regulatory programs under SMCRA can recognize the differences unique to parts of the country and allow experimental practices to develop new reclamation techniques. However, federal regulations and policies constrain the legislative intent in both cases. Greater recognition of the unique areas in various states and possible new techniques should be allowed in the regulatory programs. Coal mine operators find the regulatory process for implementation of experimental practices extremely burdensome and inflexible. Modifications of the existing policies and procedures are necessary to remove the current disincentives to development of new techniques.

b. Under legislation, all land must be restored after mining to a condition which would support the uses it was capable of prior to mining. The land must be restored to its approximate original topography with no highwalls and the site restored to an equal or better use. More flexibility in this area can allow reclamation to benefit an area by creating a higher, better use for some post mining lands. Flat areas for buildings, recreation areas, bodies of water, mining-created wetlands and improved access by new roads need to be increasingly valued in permitted reclamation approaches.

c. Surface coal mining and reclamation operations can often relocate water bearing strata or create a new water bearing zone where none previously existed before. The movement of the water as the result of mining and its contact with natural substances present in the strata can result in groundwater containing higher levels of minerals and dissolved solids after mining.

Although surface water can be collected and treated, there is no current technology to effectively treat in-place groundwater. Consequently, coal mining cannot exist under "non-degradation" groundwater programs. Programs to identify current and potential groundwater uses and to incorporate measures to protect those uses are more compatible with coal mining operations. The extensive plans required under SMCRA address the impacts of coal mining on both surface and groundwater regimes; therefore, additional federal and state groundwater protection laws and rules should not conflict with the specific intent of SMCRA.

Groundwater regulatory decisions should also recognize the socially beneficial uses of mining created aquifers for livestock watering, mineral development, and other industrial uses. State regulatory approaches that include non-degradation policies should consider all relevant factors, including comparative risks, in decision-making that can result in costly misallocation of resources. Groundwater regulatory approaches should address the effects of mining by promoting groundwater protection programs through improved management practices.

d. Subsidence is the lowering of the earth's surface following underground coal extraction. It can impact land, water resources and structures. Concerns stem from both unplanned subsidence associated with partial mining or planned subsidence associated with full extraction mining.

Requirements to prevent subsidence can force operators to leave large amounts of coal unmined. Leaving coal in-place to avoid subsidence can severely increase mining costs, constrain mining in many areas and preclude mining altogether in other areas. This latter scenario is particularly true for a full extraction mining method known as longwall mining. Under SMCRA, planned subsidence effects are accounted for through planning, and mitigation measures. Any subsidence impacts are mitigated either through state mandated programs or voluntary programs offered to surface owners by coal mining companies. Future impacts from unplanned subsidence associated with partial mining should be addressed by state subsidence insurance programs.

A great deal of research is currently underway in the subsidence area. More effort is needed to demonstrate the temporary nature of groundwater impacts associated with subsidence and to quantify the duration and magnitude of these temporary impacts in certain geographic regions. Regulatory programs must continue to recognize established case law relative to mining rights in severance deeds. Before any new regulations are considered, OSM should look at the successes of existing programs and determine if a real need exists for rules to further address subsidence impacts. Any new regulations should continue to consider fundamental requirements to mitigation of damages caused by subsidence and the different legal and policy implications between damages to the land surface and damages to structures. Regulatory policy should be flexible to allow operator discretion in dealing with impacts.

e. It is estimated that 40 percent of lands with abandoned mined reclamation problems contain recoverable coal reserves. SMCRA, designed to protect undisturbed lands, poses substantial regulatory impediments to remining. Operators contemplating remining face inflexible performance standards, primarily related to water treatment, which are either impossible to achieve on previously mined lands or are economically prohibitive. More realistic standards that insure overall improvement of remined areas are needed. A successful remining program should strive to remove unnecessary regulatory impediments, limit the risk of future liability of the miner putting forth the best effort to improve the land's condition, and avoid a burdensome process for obtaining the necessary permits and approvals to commence operations.

The current system, in some cases, discourages remining because of unrealistic standards, and then pays someone else from the Abandoned Mine Land (AML) Fund to restore the area to less stringent standards. A realistic regulatory system should be developed to encourage remining of AML lands, making the recovered coal more economic in an effort to get the environmental issues addressed more quickly and economically.

f. Wetlands have become a key environmental issue of the 1990's. President Bush has endorsed a goal of no net loss of wetlands. Programs designed to achieve "no net loss" will affect land development, including coal mining. As we rush toward implementation of the no net loss concept, it should be recognized that 1) some wetlands are more valuable than others, 2) placing all wetlands off limits to future development is impractical, 3) creating new wetlands and restoration of disturbed wetland sites are positive factors in the no net loss formula and, 4) creating wetlands during coal mine reclamation often makes technical and economic sense. A federal memorandum of agreement on wetlands mandates avoidance, the minimization of any disturbance, and that mitigation of any and all wetlands losses be met sequentially with no differentiation allowed due to the size, or quality, of the wetland involved.

The impact of protecting wetlands on coal production can be significant. The relocation of coal related structures and facilities is sometimes possible to avoid wetland areas, although avoiding marginal value wetlands under any scenario can require considerable expenditures and will result in questionable environmental benefit.

It is relatively easy to incorporate wetland creation and/or enhancement practices into reclamation plans for mined lands. The expensive mitigation requirements for the replacement of less valuable wetlands are more onerous, although federal and state regulations generally do not encourage this practice. There needs to be a cooperative effort among numerous federal and state agencies to demonstrate effectively that coal mine reclamation can create and enhance wetlands in a cost-effective manner, thus yielding overall environmental benefits.

Coal mining must be viewed as a temporary land use with the unique ability to create an enhanced post-mining environment. An incentive program could be structured with wetland creation credits that could be traded or sold to help economically achieve the President's "no net loss" goal. Legislation moving in this direction providing for wetlands classification by value and use, compensation, and mitigation banking has been introduced by Rep. Jimmy Hayes (D-LA) and Sen. John B. Breaux (D-LA). However, these bills' rigid classification systems would remove the flexibility needed to disturb some wetlands when mining but later restore or mitigate those losses.

7. Electric Vehicles

The increasing dependence of the United States on imported oil creates an increasing threat to national security and to the national economy. Since about two-thirds of the oil used in the U.S. is for transportation, an obvious strategy to reduce such dependence is to substitute transportation fuels based on domestic resources and to develop alternative transportation concepts which are not dependent on oil. In addition, there is a general need to improve the efficiency with which energy is used, and a growing concern about urban environmental pollution.

As noted in the report "The Future Long-Term Role of Coal in the Energy Strategy of the United States," coal today plays a very minor role in transportation. However, there is a vast opportunity for using coal-derived transportation fuels and coal-derived electricity for meeting transportation needs of the future. Coal-derived fuels may be substituted directly for petroleum fuels, while coal-derived electricity has potentials related to urban light rail, trolley bus, subway, and commuter rail systems, passenger cars and vans, and some intercity railway systems, including magnetic levitation. In France, high-speed electric trains already clearly demonstrate the technical and economic attractiveness of this option.

Concerning coal-derived transportation fuels, the production technology is available, but there is little commercial incentive because facilities are capital-intensive and the estimated product cost is not currently competitive with the costs of petroleum fuels. This cost disadvantage of coal-derived fuels would disappear immediately if the cost of protecting foreign oil supply lines were to be added to the cost of imported oil in the United States. Direct firing of coal in locomotive engines has been under investigation for a number of years, but problems must be resolved before commercialization is possible.

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There is, however, much activity in support of electric transportation, largely to be derived from coal. Major automobile manufacturers are active in developing electric vehicles, and a number of electric vans currently are in service. A present obstacle is the relatively high cost of the electric vans compared with vans powered with internal combustion engines, but it is expected that costs will become competitive as demand increases.

Though electric vehicles currently have a limited range, based on amounts of energy which can be stored on board, there clearly is a large market potential in urban fleet operations and two-car families. They have significantly greater energy efficiency and significantly less total environmental emissions than gasoline-engine cars.

Programs of the Electric Power Research Institute, the Electric Vehicle Development Corporation, and the Department of Energy directly support the development and commercialization of electric vehicles. In addition, there are a number of legislative efforts in place or pending which could create incentives for accelerating the pace of commercialization. The California Air Resources Board has adopted a rule which will require any manufacturer selling cars in the state to offer zero-emission vehicles after a certain future date. In 1998, 2 percent of cars and light trucks must be zero-emission; the percentage increases in later years.

Rep. George Brown (D-CA) and Sen. John D. Rockefeller (D-WV) have announced their intent to introduce major federal legislation to encourage the commercialization of electric vehicles. The recently released National Energy Strategy calls for renewed research and development of efficient "alternative fuel" vehicles that can be market-ready by the middle to late 1990s, including electric vehicles. Also emphasizing alternative fuel vehicles, which must include electric, are National Energy Strategy bills introduced by Senators J. Bennett Johnson (D-LA) and Malcolm Wallop (R-WY) and Representatives John Dingell (D-MI) and Norman Lent (R-NY).

Major automobile manufacturers in the U.S. and abroad have announced plans to make electric vans and passenger cars. The "big three" automobile makers in the U.S. have formed a research consortium with electric utilities, battery makers, and the U.S. government to develop a cheap, durable battery for application in the electric cars of the future. Major Japanese automakers have also made significant progress in this area. Meanwhile, the Electric Power Research Institute has electric vans on loan to selected utility companies, and others have acquired such vans for integration into their routine fleet operations. There is clearly a great opportunity to use domestic coal resources to offset dependence on oil, while at the same time achieving important environmental benefits.

RECOMMENDATIONS

1. The Secretary should work with the Administrator of the Environmental Protection Agency, the Secretary of The Interior, and other appropriate State and Federal officials to seek balanced solutions to energy and environmental issues.

   - Ensure that environmental regulations are economically feasible for the utilization of coal.

   - Modify what changes in emissions and plant equipment or operation will trigger Prevention of Significant Deterioration and new source reviews in light of emissions caps.

- Comment on analytical methods and conclusions regarding air toxics to ensure regulations are based upon sound technical data.

- Support appropriate regulations of large volume coal ash and scrubber sludge by product reuse and disposal, and oppose controls typically developed for more hazardous chemically active wastes.

- Help substantiate the conclusion that SO_2 standards adequately protect the public health from adverse responses to peak, short term SO_2 concentrations.

- Support access to and development of the most economic and environmentally acceptable federal reserves.

- Help remove barriers to remining abandoned mine areas.

- Encourage the development of a national strategy for expanding the use of coal in transportation.

2. The Secretary should continue to exercise his leadership role to assure that scientific analysis is the basis for policy decisions regarding global climate change.

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COAL TRANSPORTATION

THE ISSUES

At forecast production rates, the U.S. has at least a 250-year supply of coal. In contrast to the volatility of oil and gas prices, coal is a stable, dependable low cost fuel source. Served by an efficient and economical transportation system, the industry supplies the fuel for the generation of more than half of the nation's electricity at prices below those of oil and gas, an economic advantage expected to widen through the year 2000.

One reason for coal's economic advantage is the complex multi-modal transportation system linking coal suppliers with customers here in the U.S. Railroads provide the majority of coal transportation in the United States and have the capacity to handle significant growth. Trucks provide a vital short-haul transportation link in each coal producing region. Conveyors, tramways and pipelines are significant in the transport of coal where the customer is close to the source, as in "mine mouth" situations, or in certain special circumstances.

Waterborne transportation handles approximately 15 percent of coal movements, and is particularly important in the transport of coal from the Appalachian and Interior producing regions. The river system accommodates a multi-modal sourcing, gathering and delivery network in which terminals and barges link coal mines, rail-truck-conveyor transport, and customers. It is expected that waterways coal traffic will grow 2 percent annually over the next 20 years, with coal accounting for about 35 percent of total traffic.

The United States' modern terminal facilities were substantially expanded in the 1980's at many deep draft coastal ports and on the Great Lakes. Recent and ongoing dredging improvements at coastal ports allow loading of 150,000 deadweight-ton vessels from state-of-the-art coal loading and storage terminals. U.S. ports have the flexibility and capability to handle the expected growth in coal exports to Canada, Europe, the Mediterranean, the Far East and other world markets.

TRANSPORTATION CAPABILITY

Regional Breakdown, Infrastructure In Place

Coal transportation in the U.S. consists of a complex multi-modal system linking suppliers with consumers. The system is characterized by interdependence among different modes and requires coordination and flexibility to ensure reliability, capacity utilization and noninterruptible service. Transportation logistics are very decentralized and not dependent on one company, system, or mode.

Coal, in contrast to other fossil fuels, is able to utilize various transportation modes, either separately or in conjunction with one another, to link production to consumer.

Figure 1 shows transportation of coal in the U.S. by supply source.[1]

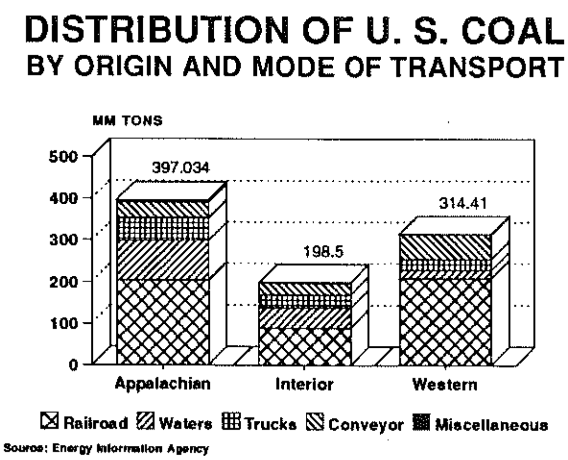


Figure 1

Rail—Railroads provide the majority of coal transportation in the United States. In 1989 sixty four percent of the coal produced was shipped by rail. The United States rail system is uniformly distributed, with extensive infrastructure in place to serve eastern, western, and interior coal production areas. The rail system has accommodated growth from all coal supply sources, and has the track capacity to handle further significant growth.

Figure 2 shows coal transportation in the United States by rail and origin.[2]

COAL HAUL BY RAIL
BY ORIGIN

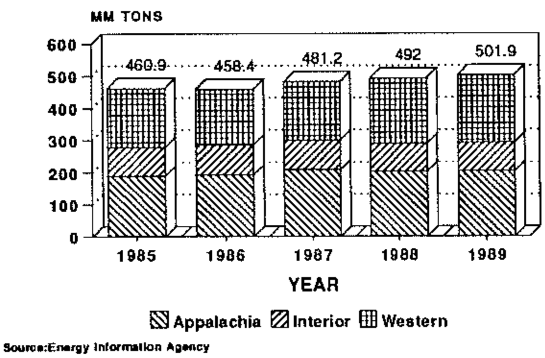


Figure 2

Railroads participate in an intensely competitive environment involving other railroads and coal supply sources. In the east, Norfolk Southern competes throughout its system with CSX and to a lesser extent with Conrail. In the west, Burlington Northern competes with the Chicago Northwestern/Union Pacific consortium in some parts of the Powder River Basin. Western railroads compete with trucks and minemouth sources for the regional market and with one another for coal destined to eastern markets and western ports.

Figure 3 shows coal tons hauled by the major coal hauling railroads in 1989.[3]

Railroad coal transportation is becoming more important as various coal supply sources enter new and diverse markets. It is the integrated transportation network that provides the means for coal producers to access new markets. Rail transportation has added value to coal as a fuel alternative by increasing the breadth of geographic markets and providing coal consumers with increased sourcing options. As an example of extended geographic reach, Powder River Basin coal is now consumed domestically in 25 states and is exported to the Pacific Rim, Canada, Mexico, and Europe.

MAJOR COAL HAULING RAILS
1989 DATA

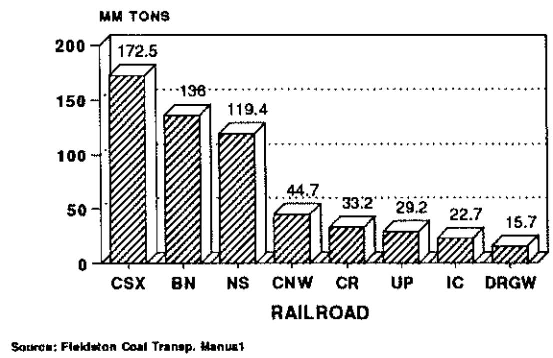


Figure 3

Figure 4 shows the increase in average coal haul since 1973, the year of the Arab Oil embargo.[4]

AVERAGE COAL HAUL
CLASS I RAILROADS

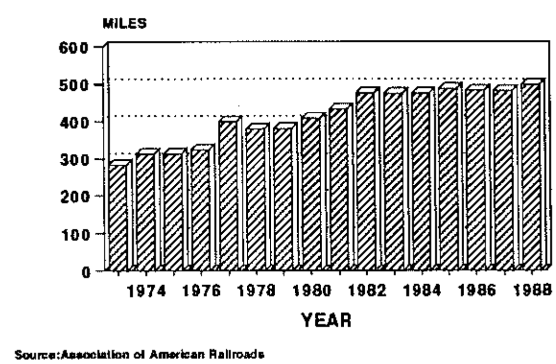
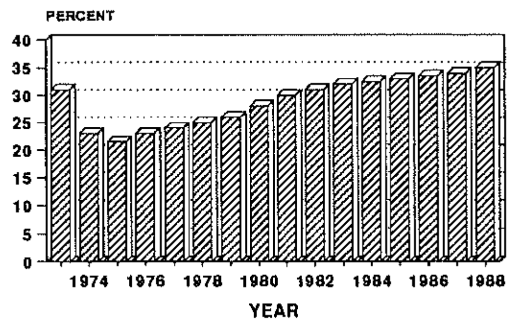


Figure 4

Even though the average rail haul has increased by 76 percent since 1973, the percentage of rail transportation costs in the delivered price of coal has increased less than 5 points. This is illustrated by Figure 5.[5]

RAILROAD PERCENT OF
DELIVERED PRICE OF COAL



Source:Association of American Railroads

Figure 5

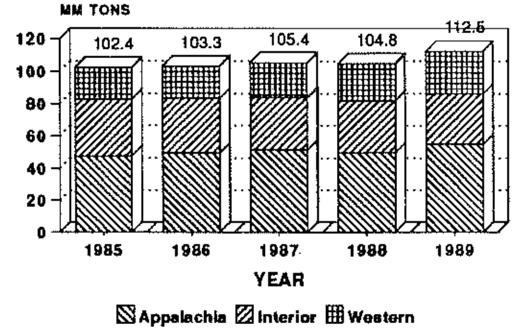
Specific rail issues, while complex and critical to the continued operations of the nation's transportation system, have been adequately discussed in the report titled, "The Long Range Role of Coal In the Future Energy Strategy of the United States," prepared by the NCC in 1990.

Trucks — Trucks are an integral part of the overall transportation system and are relied upon for short-haul movements of coal. Trucks provide a quick response time and are well positioned to expand the short haul capacity of the overall system on short term notice. Trucks provide service for all three coal supply regions.

Figure 6 shows the distribution of truck transportation of coal.[6]

Waterborne Transportation — An extensive navigable river system is relied on to transport approximately one-fifth of all Appalachian and Interior coal. With Acid Rain Phase I implementation on January 1, 1995, the river system and Great Lakes will provide a more important role in the transportation of both western and Appalachian coals.

COAL HAUL BY TRUCK
BY ORIGIN

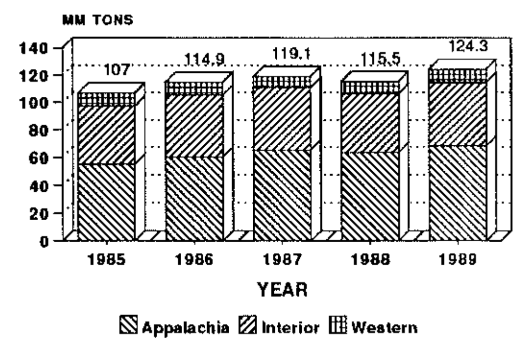


Source: Energy Information Agency

Figure 6

Figure 7 shows coal transportation along the river system.[7]

COAL HAUL BY RIVER
BY ORIGIN



Source: Energy Information Agency

Figure 7

The river system accommodates a multi-modal sourcing, gathering and delivery network. Terminals and barges are the link between production supply source, rail-truck-conveyor transport, and ultimate delivery to the consumer. Terminal operators provide additional flexibility by providing blending potential at many locations on the river system. Blending provides an enhanced coal product and increased market penetration that can benefit both low-sulfur and high-sulfur coal producers.

Figure 8 shows coal by mode delivered to the river system.[8]

COAL DELIVERIES TO RIVERS
1989

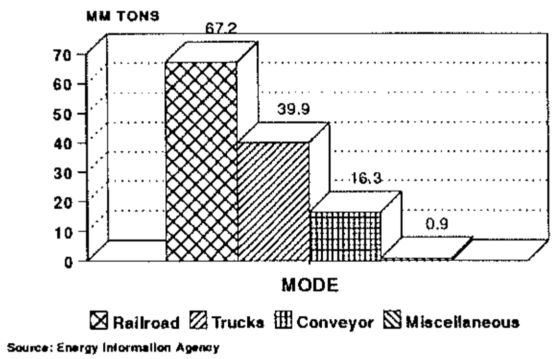


Figure 8

Waterborne transportation systems are major components of the total coal freight distribution network in the United States. The inland waterways system comprised of navigable channels adequate in draft for commercial barge transportation together with river terminals having coal storage, blending, and transloading facilities represents a primary source of efficient coal transportation in mid-America and in the eastern and southeastern portions of the U.S. Inland barge lines are engaged in carrying coal produced in Appalachia, the Midwest, and the West to utilities, other industries, and deep draft port terminals on the Gulf of Mexico at Mobile, Alabama and on the Lower Mississippi River below Baton Rouge, Louisiana where coal is transferred to vessels operating in U.S. coastal trade and in international export trade.

Similarly, the Great Lakes furnish important routes for distribution of U.S. coal to domestic utility consumers, to Canada, and, through the Saint Lawrence Seaway, to export markets overseas. Like river terminals, ports on the Great Lakes have vital coal storage, blending, and transloading facilities which furnish valuable flexibility in handling coal arriving from various originating mines. These ports assemble the ultimate coal cargo sought by domestic and export customers at an intermediate point in the overall trip from producer mines to consumer plants, both in U.S. and in world markets. The same situation prevails at coastal port terminals on the Atlantic, Gulf, and Pacific coasts. Therefore, taken together, the inland waterways of the U.S., the Great Lakes, and coastal navigation routes and ports serve both domestic and international traffic and are crucial elements of the comprehensive coal freight network across the U.S.

Inland Waterways System — The U.S. system of commercially navigable inland waterways now handles more than 600 million tons of cargo annually of which about 170 million tons, or 28 percent of total waterways traffic, represent coal shipped to domestic consumers and to port terminals on the Gulf of Mexico. From there it is transshipped for subsequent haulage in domestic coastal trade and in international coal export trade. It is expected that waterways coal traffic will grow approximately 2 to 3 percent annually over the next 20 years, with coal accounting for about 35 percent of total traffic, or 270 out of 770 million tons of waterways cargo by the year 2010. Thus, waterways coal traffic is forecast to increase by nearly 60 percent from 1989, the latest year for which U. S. Army Corps of Engineers figures are available to the year 2010.

The inland waterways coal network includes an interconnected set of waterways segments, particularly the Mississippi River; the Ohio River with its upper basin tributaries, the Kanawha and the Monongahela Rivers; the Tennessee River; the Warrior-Tombigbee and the Tennessee-Tombigbee River Systems; and the Illinois Waterway; with several other feeder rivers joining the main coal routes. The waterways system is a classic example of cooperative efforts by the Federal Government, private industry, and state and local governments in providing efficient, competitive freight transportation facilities. With Federal appropriations from general revenues in the U.S. Treasury, the U.S. Army Corps of Engineers operates and maintains the waterways, including preservation of channels from 9 to 14 feet deep on various segments of the designated system and functioning of locks and dams utilized to control the water flow and at the same time allow towboats and their barges to pass through.

Likewise, the Corps is responsible for planning, design, and construction of improvements at locks and dams, subject to Congressional authorization of specific projects, a subject considered by the Congress in bi-annual water resources legislation. Construction of improvements currently authorized results from the enactment of such legislation in 1986, 1988, and 1990. Therefore, the Congress is slated to visit this subject next in 1992, under prevailing practice. On the other hand, the completion of authorized construction projects depends on securing year-to-year appropriations by the Congress for construction work incorporated into the Corps of Engineers annual budget. Typically, the construction of lock and dam improvements to replace obsolete installations takes from 4 to 8 years from start of work at the site, and often involves \$300 to \$500 million or more in total costs over the construction period. Therefore, it is extremely important to take into account the total costs of a project in the authorization process to assure that once projects are authorized and construction commences, work can be completed in a timely, orderly manner with sufficient funds available in the Inland Waterways Trust Fund, as well as from general revenues, to finance the overall program annually. Fuel taxes in the trust fund cover 50 percent of construction costs.

The private sector also contributes to the inland waterways system. Private parties develop terminals linking private, competitive barge lines with railroads, truck lines, and sometimes, conveyor systems, which carry coal and other bulk commodities to and from terminals. This completes the intermodal freight transportation services essential for movement of coal and other bulk commodities like grain, chemicals, and minerals. Rounding out the partnership for effective waterways transportation are the state and local units of government which are responsible for assuring that adequate ground access is in place and that appropriate land may be developed for port terminals. This role sometimes includes involving these governmental units directly, sometimes indirectly, through the establishment of port authorities, in the ownership and operation of waterways terminals.

In all, through joint Federal, private sector, state and local government actions, the U.S. has succeeded in developing a unique, far-ranging inland and intracoastal waterways system which represents a critical component of the freight distribution network so vital to U.S. domestic commerce and participation in international trade.

Coal has long been a leading commodity carried on the waterways system, and is expected to remain a major item of freight carried by barge lines in years ahead. Waterways transportation is attractive for movement of coal not only because it is efficient and competitive, but also due to the enactment of the Clean Air Act Amendments of 1990 which made port terminals more useful as in-transit points for blending coals from various mines. This enables coal from many sources to be utilized in meeting the heat value, sulfur content, and other specifications set by coal users. These parties must give particular attention to meeting new emissions limitations by 1995 and by 2000, to implement the 1990 legislation.

The last decade was a significant era in the evolution of modern freight transportation systems in the U.S. Both railroads and barge lines led the changes that have streamlined the network of long-haul transportation providers. They eliminated less competitive operations and advanced carrier productivity and levels of service to shippers, especially those distributing large amounts of heavy freight such as coal over substantial distances. Barge lines, like railroads, have consolidated their services in many instances through mergers and acquisitions during the 1980s, and much of the older barge fleet has been retired, all of which has led to more productive barge operations. In addition, the barge lines have been implementing advanced fleet management systems, characterized by computer-assisted command and control facilities as integral components of fleet communications and dispatching. Improved utilization of towboats and crews has optimized the amount of cargo handled at various points along the route, with minimal need to move empty barges.

In 1989, more than 4,700 towboats and 26,000 barges on the inland waterways system, dominated by dry bulk and liquid bulk cargo varieties, served traffic loaded in many central, midwestern, Appalachian, and southern states, and linked to points on the Gulf coast. Today, the typical barge in a set used to carry coal is the "jumbo" barge which can carry 1,500 tons; and, for the first time in more than a decade, orders were placed for construction of additional coal-carrying "jumbo" barges in the 1990s, a signal that waterways coal traffic is growing.

In summary, the national system of inland and intracoastal waterways in the U.S. is an extensive, well maintained bulk freight transportation network having numerous intermodal linkages with other surface transportation systems, notably with railroads and truck lines. The barge lines operating on the waterways are efficient, competitive bulk carriers that have rationalized their fleets and adopted advanced management practices; and the port terminals which serve as traffic originations and terminations for barge services represent flexible in-transit coal-handling facilities especially useful in assembling and in blending coals to accommodate consumer requirements.

Deep Draft Coastal and Great Lakes Port — The United States has modern terminal facilities that were substantially expanded in the 1980s at many deep draft ports on the Atlantic, Gulf, and Pacific Coasts and the Great Lakes which are designed for efficient coal handling and storage in the process of loading vessels engaged in export coal trade and in domestic coastal and Great Lakes shipments. Dredging to deepen shipping channels and harbors at Baltimore, Maryland; Newport News and Norfolk, Virginia; Charleston, South Carolina; Mobile, Alabama; and a 240-mile segment of the Lower Mississippi River from Baton Rouge, Louisiana to the Gulf of Mexico, together with existing channels at Los Angeles and Long Beach, California which previously have been capable of accommodating very large bulk cargo vessels has placed the U.S. in a highly competitive position by holding down ocean freight rates on coal exports.

The ability to fully load Cape-size vessels in the 150,000 deadweight-ton classification, realized through dredging improvements at U.S. coastal ports, and the availability of state-of-the-art coal loading facilities and coal storage terminals constructed in the previous decade enhances the competitiveness of U.S. coal in world markets. In 1989 the U.S. exported in excess of 100 million tons of coal: 48 percent from Hampton Roads (Newport News and Norfolk), Virginia; 16 percent from the Great Lakes ports; 21 percent from the Lower Mississippi River; 9 percent from Baltimore, Maryland; 9 percent from Mobile, Alabama; and 7 percent from other ports on the Atlantic and Pacific Coasts.

This illustrates the flexibility that the U.S ports furnish in the movement of coal exports to Europe, the Mediterranean, the Far East, and other world coal markets. Flexibility is essential considering that U.S. coal exports are expected to increase significantly. The Great Lakes fleets, like the inland waterways system, are key movers of U.S. coal, handling 38 million tons in 1990, dominated by 22 million tons from Lake Erie ports and more than 12 million tons from Lake Superior. It is especially noteworthy that, whereas coal shipments from Great Lakes ports overall dropped 3.7 percent in 1990 from the previous year, Lake Superior coal loadings increased 4.2 percent, reflecting the role of the Great Lakes in the movement of coal produced in the West and carried by railroad to the Great Lakes.

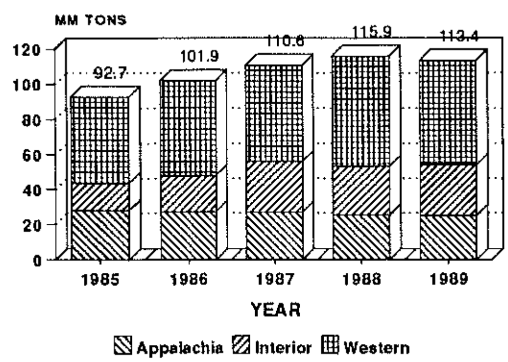
COAL TRANSPORTATION

Other Transport Modes

Not all coal distribution is dependent on regional or national transportation systems, particularly where the consumer is located at the "minemouth" or in close proximity to the coal source. In those cases, or where an existing distribution infrastructure does not already exist, conveyers, tramways or pipelines may serve transportation needs. This market segment represents 13 percent of coal domestic consumption.

Figure 9 shows coal distribution by these transport modes.[9]

COAL HAUL BY TRAMWAY, CONVEYOR
AND SLURRY PIPELINE BY ORIGIN



Source: Energy Information Agency

Figure 9

Electricity Transmission and Distribution

A major impediment to the increased use of electricity, generated by coal, in the near term to meet our nation's energy needs is positioned by serious problems with the existing electric transmission grids. Major obstacles prevent electricity from being "wheeled" from some parts of the country to other regions. In June, 1986, the National Coal Council presented the Secretary of Energy with a report entitled "Interstate Transmission of Electricity." The findings, conclusions and recommendations contained therein are as valid and applicable today as when the report was issued.

Another serious problem that could have deleterious impacts on the transmission of electricity is posed by growing concern about electromagnetic fields from electrical lines. Substantial study of this matter is underway and must continue under the direct supervision of DOE.

RECOMMENDATIONS

1. The Secretary is urged to monitor studies concerning electromagnetic fields from transmission lines and to ensure that scientific data is developed before any policy actions are taken.

2. The Secretary is urged to support Congressional authorization and appropriation bills for improvements to locks and dams on inland waterways.

References

1. Energy Information Administration, "Coal Distribution. January - December 1989," p.25

2. Ibid, p. 32

3. Fieldston Company Inc., "Fieldston Coal Transportation Manual 1991," p. 26.

4. Association of American Railroads, "1989 Coal Book," p. 19.

5. Energy Information Administration, op. cit., p. 41

6. Ibid, p. 38.

7. Ibid, p. 34.

8. Ibid, p. 27

9. Ibid, p. 40.

COAL TECHNOLOGY

THE ISSUES

Worldwide economics and concern for the environment are the principal issues surrounding the use of coal and the deployment of new Clean Coal Technology. This concern is most recently evidenced by the passage of legislation in the United States requiring additional SO_2 and NO_X emissions reductions. Caution must be exercised, because, in the effort to address the environmental concerns, there is a tendency to move towards creating regulatory requirements which cannot be met economically by existing technical means.

The requirements placed on coal by the Clean Air Act Amendments of 1990 can, however, be met with technology presently available. But new power plants in some parts of the country will no longer consider coal to be economically viable. Industry and government have, over the past several years, worked together to develop technology and to place it on the commercial stage to meet the current environmental and legislative concerns. The list of available technologies, as shown in the subsequent sections, is impressive. Technologies range from those used to consume coal, to the production of coal in the mines.

Although mining production technology has continuously improved, the question of open pit versus underground mining and productivity and their relationship to regulations, remains a serious concern. Government and industry cooperation is needed. The introduction of some alternate mining methods and equipment is contingent upon the interpretation of existing regulations by regulatory authorities. Transportation of coal to the consuming site is an area which will also need to be addressed. For example, the rights of coal slurry pipelines versus the rail transportation of product still remain open issues.

NATIONAL ENERGY STRATEGY CONSIDERATIONS

Coal is an integral part of any national energy strategy and should be seen throughout the country as a resource that must be used. The National Energy Strategy, as an ongoing process, should emphasize the necessity for the rapid deployment of the clean coal technologies, which are listed herein. This also can be addressed by the continuation of the Clean Coal Technology Program. The program has been a major factor in the demonstration of new, improved and economic technologies. This use has resulted in confidence in the technology's performance and ability to meet the economic and environmental needs of potential users.

Society's desire for a clean environment should go hand-and-hand with technology's ability to achieve it, while allowing for a high standard of living. Any plan to utilize technology must secure these basic elements.

A continuation of joint industry and government discussions to provide a review of research programs for the future is required. Industry and government together will move new technology into the 21st century. Incentives will accelerate deployment and minimize the developmental and financial risk associated with bringing new technologies to the marketplace. Accelerated deployment for new coal technologies is required for continuous growth and utilization of our most abundant fuel.

Economic clean coal technologies to meet the current regulatory environmental requirements are available today. However, as a considerable amount of this technology will result in a first-of-a-kind deployment, there is a need to assist industry in the reduction of financial risk from unforeseen performance parameters.

To overcome these problems, there is a need for government to work with industry to encourage the rapid deployment of technology. Improvements in tax policy, with incentives such as accelerated depreciation and/or an investment tax credit should be given for the use of these technologies to assist in the deployment. Further, assistance is also needed by government to provide rapid plant siting and permitting and to allow some flexibility and consideration for unexpected environmental problems during operation.

The presumption of prudence should be a part of any use of the technologies listed in this section. The Secretary should work with state governments to ensure that these areas are promptly and effectively addressed.

TECHNOLOGIES: UTILIZATION

The technologies listed on Table I (page 27) have seen significant development, some of which was in the Clean Coal Technology Program. There is a consensus among users, suppliers, federal agencies, and regulators that, with reasonable effort and support from government and industry, these technologies can be commercially deployed in the next 10 to 12 years, if not sooner. This near term technology deployment list was developed by the Clean Coal Technology Coalition in conjunction with Electric Power Research Institute (EPRI).

These technologies are explained more fully in the following brief discussions. It should be noted that the discussions are relative to the deployment or technology type as opposed to the specific technology. Descriptions of the latter are dependent upon the specific design and application and may be hybrids of developing specific technologies.

PRECOMBUSTION TECHNOLOGIES

Micronization

Micronization is defined as coal ground to ultrafine sizes (less than 325 mesh or 45 microns) prior to combustion. This results in very rapid combustion and a heat liberation rate that has physical burning characteristics similar to oil and a decrease in the tendency for coal ash to deposit on internal heat transfer surfaces of the boiler. In addition, limestone can be micronized with coal, thus significantly reducing sulfur dioxide (SO_X) emissions.

One coal micronization system supplier has commercially installed over 90 facilities in the industrial boiler and process heat market. It currently is installing its largest system at an electric utility plant in Rochelle, Illinois, which is scheduled for commercial operation in Summer 1992. Partially funded by the State of Illinois' Clean Coal Program, this project will demonstrate an SO_X reduction program utilizing high-sulfur coal, and a conversion of the plant from its current gas firing capability to coal.

Advanced Froth Flotation

Froth flotation uses the selective adhesion properties of some solids to separate coal from its impurities. The froth flotation technique treats a slurry of finely ground coal and water with an oil-based additive that adheres to the coal. The slurry is fed into a "flotation cell" where air bubbles, generated mechanically in the cell, attach themselves to the coal and rise to the surface of the slurry. The impurities whose surfaces are attracted to water remain in suspension or sink to the bottom of the

COAL TECHNOLOGY

Table 1
NEAR TERM COAL TECHNOLOGY DEPLOYMENT

Technology	Deployment Type	Technology Type
Low Rank Coal Beneficiation	Retrofit	Pre-Combustion
Coal Upgrade	Retrofit	Pre-Combustion
Chemical Coal Cleaning	Retrofit	Pre-Combustion
Advanced Physical Coal Cleaning	Retrofit	Pre-Combustion
Combustion No_x Control	Retrofit	Combustion Mod
Furnace Sorbent Injection	Retrofit	Combustion Mod
Advanced Combustor Design	Retrofit	Combustion Mod
Duct Sorbent Injection	Retrofit	Post-Combustion
Advanced Fuel Gas Desulfurization	Retrofit	Post-Combustion
Post Combustion No_x Control	Retrofit	Post-Combustion
Advanced Regenerable FGD	Retrofit	Post-Combustion
Micronized Coal	Retrofit	Combustion Mod
Magnetohydrodynamics, MHD	Retrofit	Combustion Mod
Pressurized Fluidized Bed (400 + mwe)	Repowering	Fluidized Bed
Utility Atmospheric Fluidized Bed (400+mwe)	Repowering	Fluidized Bed
Integrated Gasification Combined Cycle	Repowering	Gasification
Industrial Atmospheric Fluid Bed	Repowering	Combustion Mod

cell. Advanced froth flotation techniques are being developed that may include the use of 1) new flotation cell designs that improve the separation of coal from minerals; 2) novel reagents for improved coal surface control with regard to pyrite removal; 3) new methods of feed coal conditioning prior to separation; 4) new concepts in bubble size and generation; and 5) new circuit designs involving classification, staged flotation, and pyrite flotation.

Heavy-Media Cyclones

Heavy media separation processes are practical extensions of a float-sink test. The process treats coal by submerging it into a liquid or liquid suspension (fine magnetite) that has a specific gravity intermediate between the coal and the mineral impurities. The coal floats and the waste sinks in the liquid. Heavy-liquid cyclones are an extension of this technology in which "heavy liquids" such as Freon or methylene chloride are used, instead of magnetite suspensions, in conjunction with a cyclone device. In the cyclone the normal gravitational forces are replaced by much stronger centrifugal forces (20 to 200 times gravity) and when operated with a heavy liquid allow the separation of coal from ash and minerals at very fine sizes (minus 400 mesh or 38 microns).

Microbubble Flotation

In order to remove the pyritic sulfur in coal, the coal must be ground to very fine sizes (minus 400 mesh). Fine coal particles are difficult to separate by froth flotation and require large reagent dosages because of their high surface areas. Microbubble flotation is an advanced froth flotation concept in which tiny bubbles (50-100 microns) are generated to enhance the separation of fine coal from mineral matter. The use of micron-size bubbles during flotation increases the probability of collision of air bubbles and fine coal particles which results in improved coal recovery. Microbubble flotation is also more selective than conventional flotation for removal of mineral matter from fine coal. The improvements in recovery and selectivity are attributed to the fast flotation rate, increased bubble loading, and reduced turbulence obtained by using the smaller bubbles.

Molten Caustic Leaching

Current physical coal cleaning processes are capable of removing up to 60 percent of the ash and pyritic sulfur but essentially none of the organic sulfur from coal. Chemical cleaning processes are required to remove organic sulfur. Chemical processes based on the treatment of coal with molten alkali mixtures are being evaluated by DOE. The TRW "Gravimelt" Process exposes coal to a mixture of molten sodium hydroxide and potassium hydroxide for durations of 20 hours at temperatures in excess of 700°F. The coal is then skimmed, drained, and rinsed with water followed by a weak acid solution.

Organic Solvent

Organic solvents have been used in coal liquefaction processes to dissolve coal under moderate hydrogen pressure and high temperature to produce ultraclean liquid or solid coal-derived fuels. These processes require intensive operating conditions which are expensive and can cause major changes in the fuel properties of the coal. An alternative is to treat coals with an organic solvent under mild processing conditions. The solvent penetrates the pores of the coal causing the coal to swell. It also causes natural fracturing and the disruption of the linkages holding mineral impurities to carbonaceous material within the coal matrix. Thus, solvents when used in conjunction with other physical and chemical cleaning processes may help to reduce the energy needed to grind the coal, enhance the liberation of the ash and minerals, and improve the transport of reagents into the coal.

COAL TECHNOLOGY

COMBUSTION TECHNOLOGIES

Limestone Injection Multistage Burners

The original limestone injection multistage burners concept was to retrofit multistage burners into a pulverized coal fired boiler. These multistage burners would reduce nitrogen oxide (NO_X) emissions and would be designed so that limestone could be injected into the secondary air ports for sulfur dioxide (SO_2) control as well. The NO_X and the SO_2 removal goal was 50 percent. Further development of the technology revealed that limestone injection through the secondary air ports would not achieve 50 percent SO_2 removal at economic limestone injection rates, due to the low limestone reactivity and deadburning of sorbent in the lower furnace. The present state of the technology is to inject a more reactive sorbent, hydrated lime into the upper part of the furnace. This modified LIMB will achieve the removal goals for both NO_X and SO_2.

Low NO_X Combustion Technologies

Combustion tuning programs and overfire air addition typically provide modest reductions in NO_X emissions at the lowest cost. Dual register burners (DRBs) and XCL burners provide greater NO_X emission reductions for new and retrofit applications. The low-NO_X cell burner (LNCB) provides a low-cost retrofit option for the standard "cell" burner design. In-furnace NO_X reduction and the B&W cyclone reburn technologies offer the potential of destroying NO_X after the initial phase of the combustion process.

Gas Reburning

Reburning is a process by which NO_X molecules formed in the primary zone are destroyed via secondary fuel injection downstream of the main burners. Usually, the primary zone, the main burners, are low-NO_X burners and operate close to a stoichiometry of one. The secondary fuel with little or no air is added downstream of the main burners to create a reducing zone which is inductive to NO_X destruction. The overfire air is added downstream of the reburning zone for final combustible burnout. From the technical standpoint, natural gas is an ideal fuel for reburning. The NO_X reduction capability is the best, especially when the technology is applied to wall-fired or tangential units. Potential side effects of the technology such as fireside corrosion, unburned combustibles, and increased Furnace Exit Gas Temperature (FEGT) are minimal. Therefore, gas reburning has been the subject of several field demonstrations.

Coal-Gas Co-Firing

By substituting natural gas for a portion of the boiler's fuel requirement, plant operators may be able to reduce SO_2 and particulate emissions by a proportionate amount. Natural gas contains virtually no organic nitrogen, and with proper burner design, produces much lower levels of NO_X than coal. In addition to the direct reduction of NO_X, a small reduction may also be achievable through using gas to lower the excess air requirements to burn the coal, which reduces the conversion of organic nitrogen in the coal to NO_X. Particulate collection efficiency may benefit from the increased flue gas moisture content associated with gas firing, which lowers the fly ash resistivity.

Gas co-firing also can improve operation in a number of ways. These include: displacement of fuel oil for the ignitor/warm-up system, improvements in boiler capacity/availability (air pollution derate, pulverizer outages, periods of wet coal), flame stabilization, improved load following capability, and improved control of steam temperature. Trade-offs to such potential advantages include the availability and cost of coal compared to natural gas.

Coal-Water-Gas Co-Firing

Coal-water fuel (CWF) becomes attractive as a substitute fuel as the price of premium fuels, natural gas/oil, increases relative to coal. Many of the advantages for coal-gas co-firing can also apply to coal-water-gas co-firing. Through coal beneficiation, the sulfur in the coal feedstock can be potentially reduced so as to eliminate the need for flue gas scrubbers, converting the coal-water fuel essentially into a premium fuel. Co-firing natural gas with CWF can lead to improved burner designs, which could find application for harder-to-burn coals (e.g., high ash/low volatiles). Parameters affecting flame stability that would be affected by co-firing include air preheat, atomizer design and pressure drop, slurry quality, and atomizer media (e.g., air/steam).

Rotary Cascading Bed Combustors

A rotary cascading bed combustor is analogous to a rotary kiln. The difference is that rather than employing a slow tumbling of the solids, the solids are thrown into the upper portion of the reactor where they can cascade downward to the bottom. This results in enhanced flow of gases through the solids. A somewhat higher rotation speed is necessary, and lifters (as in a clothes dryer) must be added to the inside of the drum to impart an upward momentum to the solids. PEDCO, Inc. has tested a rotary cascading bed boiler (RCBB). Sulfur was removed from a low-grade, high-sulfur coal by limestone addition with 90 percent removal at Ca/S ratios less than 1.5. High-ash fuels (up to 58 percent ash) were successfully burned. The boiler demonstrated an ability to burn a wide variety of co-fed waste materials which could make it valuable to the industrial community.

"Magnetohydrodynamics" Technology

Magnetohydrodynamics (MHD) power generation is a method for converting thermal energy from coal directly into electric power without going through the steam cycle. The MHD generator uses flowing ionized gases, or liquid metals, as the moving conductor in the electrical generator. MHD offers the potential of lowering the cost of electricity via increased efficiency, while at the same time reducing environmental emissions to levels well below the current New Source Performance Standards (NSPS) requirements. Additionally, the MHD system can use a wide variety of coals without major changes to the operational characteristics or emission controls.

MHD power plants are projected to be able to convert coal-derived heat directly to electricity with a system "coal to busbar" plant efficiency in the 50% to 60% range. MHD can extend the useful life of existing power plants and increase coal-fired plant capacity in an environmentally acceptable manner through retrofitting. A demonstration of a proof-of-concept coal-fired MHD electric power plant is scheduled for the early 1990's. MHD test data indicate that while there are no fundamental technical barriers impeding the commercialization of MHD power plants, technical, as well as financial, risks remain. Many issues addressed elsewhere in this NCC report relate directly to these risks.

POST COMBUSTION TECHNOLOGIES

Sorbent Injection

In-duct sorbent injection is a retrofit technology for removing SO_2 from the flue gas of coal-fired power plants. The process consists of two separate systems — a sorbent injection system, and a flue gas humidification system. Sorbent injection takes place downstream from the air heater and involves the injection and dispersion of an appropriate sorbent into the flue gas. In most applications, a dry, powdered, calcium-based sorbent such as hydrated lime is used. Fresh sorbent also can be mixed with recycled material from the particulate collection device in order to improve sorbent utilization. The purpose of the humidification system is twofold. First, it supplies the water that initiates SO_2 removal from the flue gas. This water promotes SO_2 removal by creating an aqueous layer on the surface of the lime particles that dissolves the lime and absorbs SO_2. The humidifier also improves the performance of electrostatic precipitators, which can be overloaded because of the increased particulate loading, by decreasing both the volume of the flue gas and the resistivity of the fly ash.

Selective Catalytic Reduction (SCR)

SCR consists of an ammonia injection system and a vessel which contains a catalyst. Ammonia (NH_3) is injected into the flue gas downstream of the boiler, and the catalyst is operated around 600-800°F. In the presence of a catalyst, NH_3 reacts with NO_X to form nitrogen and water. The process is common in Japan on oil-fired boilers. Potential problems with SCR on coal-fired boilers include pluggage and erosion of the catalyst by fly ash and poisoning of the catalyst surface by SO_X and fly ash.

Furnace Injection with Water Activation Reactor

In this process, capture of sulfur dioxide formed during coal combustion takes place in two locations. Furnace injection results in some sulfur capture in the upper part of the furnace while additional capture is obtained in a water activation reactor located after the boiler. At the inlet to the activation reactor, water is sprayed into the flue gas flow to convert unreacted limestone into calcium hydroxide. In the activation reactor, calcium hydroxide and sulfur dioxide react, forming calcium sulfite. The reaction products consist of calcium sulfate formed in the boiler during the injection phase, calcium sulfite formed in the activation reactor, and unreacted calcium oxide or calcium hydroxide. By the addition of water to the flue gas, particulate resistivity is reduced and operation of the electrostatic precipitator collector is improved.

Post-Combustion Oxidation with Fluid Bed Lime Reactor

In this process, sulfur dioxide contained in flue gas emissions is oxidized in a catalytic converter to sulfur trioxide (SO_3). The SO_3 is subsequently reacted in a fluidized bed with lime to form calcium sulfate. The solid product consists of a core of lime surrounded by a shell of anhydrous calcium sulfate which has a plurality of cracks. It can be used in construction material and for water and wastewater treatment.

Fluid Bed Absorption

Fluid bed reactors can be utilized with various sorbents for post-combustion SO_X/NO_X removal. Examples of such processes are the copper oxide fluidized bed process and the NO_XSO process. In the copper oxide process, alumina spheres are coated with copper oxide and suspended in a fluidized bed using the SO_2 and NO_X laden flue gas. The copper oxide reacts with SO_2 to produce copper sulfate, which can be regenerated with natural gas. The NO_X reacts with ammonia, in the presence of copper sulfate which serves as catalyst, to produce molecular nitrogen. In the fluidized bed NO_XSO process, the sorbent, as initially prepared, has a surface layer of alumina and sodium carbonate. SO_2 is absorbed to form sodium sulfate. Steam and NO_X greatly enhance SO_2 removal through the intermediate reaction steps.

Spray Dryers

The spray drying process injects a finely atomized alkaline lime slurry into a dry scrubber chamber to remove sulfur dioxide from flue gas. In the chamber, the slurry evaporates to a dry product and sulfur dioxide is absorbed. The treated flue gas and dry waste product pass through a baghouse or electrostatic precipitator for particulate collection before discharge to the atmosphere. The collected waste product contains unreacted lime, coal fly ash, and a reaction product of calcium sulfates and sulfites. The waste product is usually disposed of untreated in landfills or used as a concrete additive.

Regenerable Scrubbers

Flue gas desulfurization processes which reuse the same reagent over and over again by "regenerating" the reagent are known as regenerable processes. A partial list of these processes includes: the Cat-Ox Process, the Formate Process, the Citrate Process, the Wellman-Lord Process, the Ionics Process, the Manganese Oxide Process, the Aqueous Carbonate Process, the Dual Alkali Process, and the Magnesium Oxide Process. These processes produce as a side product one of the following: elemental sulfur, dilute sulfuric acid, calcium sulfite sludge, gypsum, or a sulfur-bearing fertilizer.

Dual Alkali Scrubbers

The Dual Alkali process is an example of a regenerable process. There are actually several variations of this process in which an aqueous solution of sodium hydroxide and sodium sulfite is used in a wet scrubber to react with sulfur dioxide to form sodium bisulfite. Sodium sulfate is an unwanted byproduct because it is not easily regenerated to sodium hydroxide. The regeneration is done in a separate tank by adding slaked lime and precipitating out calcium sulfite and calcium sulfate. The main motivation in this process is to avoid using slurries in contact with flue gas to prevent scaling or deposition problems in the gas pass. The process is more costly because it is more complex than straight lime/limestone, and sodium recovery is usually less than 90 percent.

Magnesium Enhancements

Magnesium sulfate is used to enhance the SO_2 removal efficiency of lime and limestone wet scrubbing. The magnesium sulfate enhances the rate of SO_2 mass transfer by permitting an increased soluble sulfur loading in the scrubbing slurry. The two methods commonly used to add magnesium to the wet scrubbing slurry are to use dolomitic lime (which contains magnesium) as the fresh reagent or to add a separate stream of dolomitic lime to a limestone reagent wet scrubber.

Post Combustion NO_x Control

Numerous NO_x specific control processes are being developed for utility boiler applications. Of these processes, the selective catalytic NO_x reduction (SCR) and homogeneous selective NO_x reduction (thermal $DeNO_x$) are the most advanced in terms of development and commercial application. Both processes rely on the reduction of nitrogen oxides in the presence of ammonia to form nitrogen gas and water. The SCR process relies on reduction by ammonia in the presence of a catalyst. In the thermal $DeNO_x$ process, the reaction with ammonia is non-catalytic and highly dependent on temperature (1600°F to 2000°F) to be effective. NO_x reductions with these processes vary. Up to 80 percent NO_x reduction appears feasible with SCR, while thermal $DeNO_x$ may be limited to 30 to 60 percent reductions.

Electrode Precharger Enhancements to Precipitators

Electrostatic precipitators (ESP) have been in use since 1923 to control coal fly ash particulate emissions. Electrode precharger enhancements to an ESP have been required when the fly ash to be collected has a high electrical resistivity. The purpose of the precharger is to separate the particle charging and collection into two physically separated processes, thereby minimizing the neutralizing effect of back corona. In the ESP, the fly ash particles become negatively charged and migrate to the collective place which is at ground potential. A high resistivity fly ash will cause a condition known as "Back Corona" at the collecting plate that reduces the charge on the fly ash particle. ESP upgrades with electrode prechargers may be required when the fly ash resistivity has increased, as may occur with a change in the type of coal being burned or when the particulate removal efficiency of an existing ESP has to be increased.

High Temperature Baghouses

Conventional baghouses will operate from 150-300°F. Until recently, commercially available bag material was able to operate up to only 550°F. Several high-temperature materials have recently been introduced, including the 3M Nextel ceramic fiber which can withstand temperatures up to 2600°F. In a utility application, the high temperature baghouse would be located after the economizer where the temperature may range from 500-900°F. A high-temperature baghouse upstream of an SCR DeNO$_X$ system allows fly ash particulates to be removed before the SCR reactor.

FLUIDIZED BED COMBUSTION TECHNOLOGIES

Atmospheric Bubbling Fluidized Bed Combustion

In atmospheric bubbling fluidized bed combustion (usually known as AFBC), coal (or other fuel) is burned in a bed of limestone which is suspended by combustion air fed from under the bed of solids. The bed is maintained at the optimum temperature (usually about 1550°F) by removing heat with water-cooled or steam-cooled tubes in the bed. The intense movement of the solids around the tubes results in very high heat transfer coefficients. At these temperatures, the limestone calcines to produce calcium oxide (CaO) or lime. The lime reacts with the SO_2 produced from the combustion process to produce a dry product, calcium sulfate ($CaSO_4$). At the relatively low combustion temperatures, NO_X emissions are significantly reduced compared to conventional coal-fired boilers. Also, because of the low combustion temperatures, slagging of the boiler tubes is not a problem, and sootblowers are usually not required. Because of the relatively low combustion temperatures, the once-through combustion efficiency is not as good as in a conventional pulverized-coal (PC) fired boiler. To compensate for the poor once-through efficiency, ash collected in the back-end equipment is usually recycled to the furnace, resulting in acceptable combustion efficiencies.

Pressurized Fluidized Bed Combustors

The principle of a pressurized fluidized bed combustor (PFBC) is to enclose a bubbling bed combustor within a pressure vessel and operate it at elevated pressure using the hot flue gas to drive a gas turbine. A PFBC burns coal (or other fuel) in a bed of sorbent which is suspended by combustion air fed from under the bed. The sorbent is usually dolomite since pure limestone will not completely calcine under the high pressure conditions in a PFBC furnace (the partial pressure of CO_2 is too high). The bed is usually maintained at about 1580°F using water-cooled or steam-cooled tubes in the bed. This temperature will minimize the release of volatile alkali vapor from the coal ash and minimize the formation of nitrogen oxides (NO_X). The intense movement of the solids around the tubes results in very high heat transfer coefficients. The combustion air is fed from a compressor which is driven by the system gas turbine. The furnace operates at elevated pressures (usually on the order of 10-16 atmospheres), and the flue gases are passed through a particulate removal device and expanded through the gas turbine. Depending on the cycle, the gas turbine may generate some net electricity or may be sized to drive only the compressor. Advanced PFBs claim to have cycle efficiencies that are better by as much as 15 percentage points than a conventional PC boiler with a scrubber.

Circulating Fluidized Bed Combustion

Circulating fluidized bed combustors (CFBCs) operate similar to a bubbling fluidized bed, in that a bed of solids is suspended with the combustion air fed from under the bed. However, the superficial velocity of a CFB is usually much higher than that of a bubbling fluidized bed (17-26 ft/sec versus 6-12 ft/sec). With the higher velocity, more solids are carried out of the lower furnace region and are then recycled to the furnace at a sufficiently high rate such that the bulk density in the furnace equilibrates at a relatively high value, and a large amount of internal circulation of solids results. Because of this circulation, CFBCs tend to be very amenable to burning difficult-to-burn fuels. In addition, because elutriation of solids from the primary zone is not a concern, smaller limestone particles can be used in the system. This combined with higher turbulence and recycle rates results in better combustion efficiency and sulfur capture. Two of the major advantages of CFBC technology are its ease of load control and its fuel flexibility.

Bubbling-Circulating Fluidized Bed Hybrid Designs

A concern regarding bubbling fluidized bed combustors relates to erosion of the in-bed tubes. The main disadvantage of circulating fluidized bed combustors is the primary hot solids collector. Cyclones are expensive, quite large as the CFB furnace is scaled up and are usually a high-maintenance item. The large amount of refractory results in long warm-up times due to the thermal inertia of the system. U-beam separators appear to have physical limitations which set an upper limit on furnace size. Recently some attention has been given to so-called hybrid designs which incorporate the advantages of the AFBC (e.g., low velocity, high-in-bed heat transfer) with those of the CFBC (e.g., load control, air staging for NO_x control). These types of units are just beginning to be studied in the United States. Testing in hybrid fluidized bed units is more advanced in Europe, but its development is still behind that of the CFBC.

COAL GASIFICATION TECHNOLOGY

Coal gasification systems are in commercial operation, producing electric power, and industrial chemicals. The Great Plains Project in North Dakota represents an application of first generation Lurgi technology. A number of large scale plants in the United States and foreign countries have established the commercial application of newer coal gasification technologies. The Texaco, Dow and Shell coal gasification systems have been in operation at installations and commercial plants in the U.S. and abroad. The DOE has selected two projects under the Clean Coal program. Several new proposals for integrated gasification combined cycle (IGCC) plants have been selected by the DOE (Clean Coal IV).

Current designs indicate that ICGG systems produce electricity at overall efficiencies of 38-40 percent. Improvements, represented by an installation underway in a commercial plant in Holland that is more integrated, show 42-44 percent efficiency. Improved cycles and equipment innovations (Humid Air Turbine cycle) increase the efficiency to 50 percent and higher. Systems featuring advanced technology such as molten carbonate fuel cell will increase efficiency to greater than 50 percent. The improvements represent research and development challenges that are expected to be realized in this decade.

COAL TECHNOLOGY

Economic analyses indicate that coal gasification systems are competitive with conventional coal fired pulverized coal plants. These systems realize much higher levels of pollutant control of emissions and marked lower volume of solids wastes that must be disposed of.

Importantly, coal gasification systems are flexible and are capable of handling a wide range of feedstocks. Plants have been designed for coke, mixtures of solid waste and coal, heavy fuel oil, and a variety of coals.

Coal gasification systems in operation, planned and under construction in the U.S. and abroad for power generation represent a capacity of about 4000 MWe that is scheduled for installation over the next 10 years.

Externally Fired Combined Cycle

The technology is based on the utilization of an indirect fired heat exchanger coupled with a combustion turbine. The heat exchanger operates in the exhaust of an atmospheric high temperature boiler. Combustion turbine compressor discharge air passes through the heat exchanger where the air temperature is raised to turbine inlet conditions. This products-of-combustion-free high temperature, high pressure clean air passes through the turbine to extract energy and is then exhausted. The EFCC cycle accommodates water/steam augmentation, and can be operated in a co-generation or combined cycle mode. The overall cycle efficiency is expected to be about 45 percent. DOE (METC and PETC) and EPRI are strong supporters of the EFCC technology.

TECHNOLOGY: PRODUCTION

Application of new technologies including: equipment and process automation, mine monitoring systems, and transport mechanisms could significantly improve worker health, safety, and productivity. Significant resources are being independently committed to some rather innovative mining concepts in hope of developing revolutionary changes in technology. The long term goal of intelligent autonomous mining systems is certainly admirable, but from the mine operators' standpoint, a more pragmatic approach would be to focus on near term solutions to existing problems. Extraction, ground control, haulage and processing are the key components of the mining cycle that the mine operator normally controls.

More stringent emissions-based environmental controls imposed in the Clean Air Act require utilities to install scrubbers or seek a low sulfur coal supply. Powder River and Appalachian Basin coals are prominent sources of low-sulfur coal; however, PRB coals have low thermal heat values and are transportation disadvantaged, while in Appalachia, thick seams of low-sulfur coal are being depleted. Consequently, more economical mining methods are needed to extract coal from deeper and/or thinner seams. Automation of mining activities offers improved safety and productivity and an evolutionary approach to remove the miner from the production face.

Mining Equipment Robotization

The Bureau of Mines (BOM) has been aggressively pursuing the robotization of existing mining equipment. At the Bureau's Pittsburgh Research Center, a Joy 14 CM 9 continuous miner was selected as the host machine for development of software and hardware for intelligent control systems including: position sensors for all moveable appendages, navigation and guidance systems, on-board control and data acquisition computers, machine diagnostic expert systems, and machine mounted video cameras. The autonomous miner is a computer-controlled continuous miner driven by algorithms developed from studies of machine functions and operating characteristics. A field testing program is underway to develop the script or command sequence based on the machine behavior characteristics, and to build a programmed knowledge base.

Continuous Haulage System

Development of a continuous haulage system to replace the intermittent queuing of shuttle cars is essential for compatibility with existing high capacity extraction equipment. Reasons for the continuous haulage system failures include: mechanical unreliability, labor intensity, inability to make 90° turns, vertical clearance, horizontal flexibility, throughput capacity, and cost.

Equipment manufacturers such as Long-Airdox and Jeffrey lead the industry in development and installations of cascading continuous haulage systems; however, new entrants with novel design concepts like DM Enterprises and Kloeckner-Becorit may contest this dominance.

A tire-mounted Automated Bridge Conveyor Train (ABCT) developed by the BOM has been delayed as a result of budget cuts. The prototype unit is about 275 feet long, tracks precisely along a guidance cable, and requires a single operator. Success of any continuous haulage system will require a minimum length of 500 feet from the working face to the outby feeder. Development of gate entries for longwall panels is an ideal application for continuous haulage technology as these sections are typically low production units due to the limited number of entries. Thin seam operators are disproportionately dependent on development of this technology to remain competitive.

Longwall Mining

Longwall mining technology has dramatically improved over the past 10 years with innovative changes in electro-hydraulic controls, shearer-initiation systems and shield, face conveyor and shearer design. With these advancements have come improved worker safety and productivity. Production enhancements also have spawned concerns about effective control of respirable dust. Techniques such as the use of air atomizing sprays, surfactants, water jet assisted cutting, alternate cutting design concepts to replace rotary cutting drums, and longwall face automation represent encouraging news for resolution of this problem.

For an immediate solution to the dust control problem, twin-fluid atomizing sprays offer the greatest potential for significant contributions to worker health and safety; however, a more desirable goal is to remove the operator from the working face. Automating the longwall face can be achieved with existing technology, but it will require cooperation between mine operators, equipment manufacturers, and federal agencies. Programmable logic controllers (PLC) are commercially available which are capable of programming repetitive activities to control the operation of the longwall shearer. Development of this system requires direct linkage of the PLC's to the shearer initiation control computer. Mine operators and equipment manufacturers must work together with MSHA to ensure that electrical permissibility and safety are not compromised. Coal interface detection for horizon control of the shearer would be helpful in controlling dilution, but it is not essential in this application. Implementation of this technology is about one year to eighteen months away.

Automation of the longwall shearer becomes even more important as existing technology is applied to thin seam reserves. One equipment manufacturer has developed an off-pan shearer capable of operating in coal seams between 31.5 and 51 inches thick. Others are also working on development of low profile shearers, presently two years away from commercial application. Near term generations of computer-based longwall machines minimize human exposure to respirable dust and other occupational injuries associated with traversing the face.

Mine Stabilization

Every mine operator knows that the major cause for accidents/injuries is uncontrolled ground movement, which may occur as roof falls, rib failures, or bumps. Maintaining stable mine entries in today's modern underground mines rests on the shoulders of skilled roof bolter operators whose only protection is their knowledge of local ground conditions and the temporary roof support systems on the bolting machine.

The first fully-automated dual boom roof bolter field tested in 1991 features the rear access walk through chassis design leading to an on-board operator control cockpit. A single machine operator controls both booms from a canopy protected enclosure located two rows of bolts out by the face. PLC technology is used to monitor and control the bolting cycle. Mechanical or resin bolts stored in carousels can be installed in cut depths up to 40 feet.

Smart bolter technology under development by the United States Bureau of Mines (BOM) will be critical for the acceptance of autonomous roof bolters. To replace the need to drill required test holes, the bolter module must monitor rotation speed, torque, and thrust for determination of competent anchorage zones. Industry must work with MSHA for certification of PLC control cards and data recorder ports as intrinsically safe. Data recorder ports will allow the machine operator to download information about each hole drilled and bolt installed. Other bolter subsystems critical to development of a fully automated machine include a further improved flexible steel drill, bolt bender system, durable rock bits and resin injection systems. Improvement of these component systems will enhance the development of low profile bolters.

Satellite bolter technology to successfully integrate a roof bolter and mining or haulage machine may be just around the corner. Fairchild has announced plans to market its F-525 bolter-miner in 1991. The bolter operates independent of the miner, yet functions simultaneously.

As the section equipment in a room-and-pillar operation advance, the belt feeder assembly and section conveyor must be routinely moved. Typical belt moves often require a four-man crew up to six hours to make. A track-mounted, three-way dump feed assembly featuring hydraulic anchor and belt alignment systems has been developed. A belt tail piece is incorporated in the feeder design which includes an automatic wire rope dispenser for hanging belt structure. Design and fabrication of a belt storage system to link with the feeder assembly is underway. The goal is to automate the belt move process.

Transporting Mined Product

Transporting the mined product from the working face to storage and processing areas is a vital link in the chain. Typical surface and underground operations use various haulage vehicles and conveyors. Exotic technologies such as slurry, pneumatic, or coal-log pipelines do not appear to be economical for near term deployment at the mine level. In-pit conveyor assemblies and continuous haulage systems will help reduce bottlenecks in the transportation system. Extensive use of conveyor systems on the surface and underground has prompted mine operators to implement and use mine-wide monitoring systems. Applications of technology to measure additional parameters for ensuring a safe work environment is in its infancy. Licensing reliable analysis technology and mine-wide monitoring systems to provide real-time data to the mine operator will require cooperation of mine technicians, equipment vendors, and state and federal regulators.

Skip hoisting is a limiting factor in deep mine operations where substantial productivity improvements at the work face have occurred. Technological advances in vertical conveying systems offer opportunities for minimizing development cost and ensuring uniform continuous product flow. A vertical conveying system has been in use for approximately 9 years to transport coal from 300 feet underground to the surface. Improvements have been made to expand throughput capacity and operating depth. Further research is necessary to use this technology at mine depths of 600 to 1,000 feet, but this goal is achievable within 5 years.

NEAR TERM ROLE FOR COAL

Cleaning the Mined Product

Coal cleaning technology has become increasingly important in recent years as mine operators have observed the impact of plant recovery, utilities have become more sophisticated in assessment of combustion characteristics of coal and attitudes have changed regarding the environment. Further markets for coal such as gas turbine or diesel engine applications and coal-water mixtures for utility plants and industrial boilers are also driving forces for improving this technology. The ability to make super-clean coal for these applications requires fine grinding to liberate finely disseminated mineral matter and a practical cost effective method for recovering and de-watering fine coal. Microbubble column flotation is being tested on a commercial scale.

Use of on-line nuclear ash analyzers has gained acceptance in the mining industry; however, expanded use and acceptance of this technology requires approval and acceptance by ASTM.

RECOMMENDATIONS

1. The Secretary should encourage State and Federal agencies to develop regulatory incentives for utilities to invest in projects using innovative clean coal technologies.

2. The Secretary should continue the Clean Coal Technology Program and recommend a similar program following Clean Coal V to further improve energy efficiency and reduce CO_2 emissions per unit of energy.

3. The Secretary should seek through legislation financial incentives, such as accelerated depreciation and investment tax credits, to accelerate the deployment of Clean Coal Technologies.

Appendix A

Correspondence Between National Coal Council and Department of Energy

The Secretary of Energy
Washington, DC 20585

August 13, 1990

Mr. William Carr
Chairman
National Coal Council
P.O. Box 17370
Arlington, Virginia 22216-7370

Dear ~~Mr. Carr~~ Bill:

It was a pleasure meeting with you and your National Coal Council colleagues on July 17, 1990. The reports you presented to me will be extremely useful in preparing the National Energy Strategy. I have requested my Assistant Secretary for Fossil Energy ensure that the reports and your letter receive full consideration in the analyses and formulation of policy options currently underway.

Although fully operational for only 5 years, the National Coal Council has made significant contributions to energy policy and programs. Your reports have been timely and have addressed the key coal-related policy issues of the day. In particular, the two most recent reports are well written, focused and full of useful recommendations.

As I mentioned at our meeting, preserving and enhancing the Nation's ability to use coal efficiently and in an environmentally sensitive manner is a key objective of the National Energy Strategy. From an economic perspective, the Nation and the world cannot abandon coal. It powers our electric utility industry. Its use results in reasonably priced energy and a healthy economy. You and others in the coal industry have proven that it can be used in ways that are compatible with our environmental objectives. The advancement of clean coal technologies will ensure that coal will remain an important part of our energy mix well into the twenty-first century.

I have asked my Fossil Energy staff to quickly scope out additional studies for the National Coal Council to conduct. As we discussed, I have a great interest in pursuing two studies: (1) improving the public image of coal, and (2) once again making the U.S. the world's technology leader, with emphasis on coal and coal technologies. It may also be useful to conduct an assessment of how the coal industry will be affected by the Clean Air Act amendments and what additional policy changes should be considered to help the coal industry successfully meet the challenges posed by the new Clean Air Act. I will be in touch with you soon on this subject.

I remain committed to the National Coal Council and will make every attempt to participate in your November meeting.

Sincerely,

Jim

James D. Watkins
Admiral, U.S. Navy (Retired)

The Deputy Secretary of Energy
Washington, DC 20585

November 7, 1990

Mr. William Carr
Chairman
National Coal Council
P.O. Box 17370
Arlington, Virginia 22216-7370

Bill!
Dear ~~Mr. Carr~~:

In my letter of August 13, 1990, I indicated I would get back to you regarding studies the Council might conduct. The Fossil Energy staff has had an opportunity to analyze various study areas and has identified two areas of study that would be timely and most beneficial in dealing with this country's energy security. Therefore, I am requesting that you conduct the following two studies:

1. <u>Educating the Public About Coal</u>. Public perception of coal mining and use is based largely on what coal was before environmental, health, and safety became important factors in the United States coal industry. The study should identify means of educating the public on the current practice of using coal and on the role of clean coal technologies to further improve the economic and environmental performance of coal-based systems to more freely contribute to solving near-term energy and environmental needs.

2. <u>The Role Coal Can Play in Meeting Our Energy and Environmental Objectives in the Near Term</u>. A challenge exists for coal and clean coal technology to assist in achieving our environmental goals, balance of trade, our electricity and liquids need, and many other requirements. Therefore, this study should identify public policy and regulatory requirements which could stimulate necessary technological developments and encourage private sector initiative in meeting the challenge.

I appreciate and value the Council's contributions to the Nation's energy well-being and look forward to receiving two more excellent studies.

Sincerely,

James D. Watkins
Admiral, U.S. Navy (Retired)

THE NATIONAL COAL COUNCIL, INC.
Post Office Box 17370, Arlington, Virginia 22216
(703) 527-1191

November 9, 1990

The Honorable James D. Watkins
Admiral, U.S. Navy (Retired)
The Secretary of Energy
United States Department of Energy
Forrestal Building
1000 Independence Avenue, S.W. - Room 7A-257
Washington, D.C. 20585

Dear Mr. Secretary:

On behalf of the members of the Council, I wish to express our very deepest appreciation for the time that you spent with us during our recently completed and highly successful meeting.

Your joining us at our reception was greatly welcome and highly beneficial. Many of our members remarked that they were most pleased to have the opportunity to interact with you personally.

The remarks made by you at the Full Council meeting were very warmly received and extremely helpful. Particularly appreciated were your words of support and encouragement of the Council. The many insights that you shared with us were most beneficial.

We wish also to acknowledge receipt of your letter of November 7, 1990, requesting that we undertake two studies. The members voted in favor of proceeding to undertake these efforts. We shall work with the Fossil Energy staff to resolve any concerns or differences which we might have relative to content, approach, titles, etc.

Finally, on a personal note, I want to express my sincere thanks for your most kind and gracious expressions of concern over my recent illness. I cannot tell you adequately how much your support meant to me.

Again, Admiral, it was wonderful visiting with you and we thank you most sincerely.

Very truly yours,

WCarr.

William Carr,
Chairman

Appendix B

Comments on Report

Donald M. Carlton
President

3 October 1991

Mr. Jack L. Mahaffey
President
Shell Mining Company
c/o Greg Brand
P.O. Box 2906
Woodcreek
Houston, TX 77252-2906

Dear Jack:

Only someone who has been through it can fully appreciate how much work you have put into the most recent Coal Council report, "Coal - The Near-Term Vision." Obviously, you have thought through the near-term challenges, and I think you have presented those in excellent fashion.

I have two comments that I would offer, and they are both found on page 9, under the "Global Warming" section. In the first paragraph, the term "man-caused" is used; most often the term anthropogenic is used in place of man-caused. My more substantive comments are related to the tone of the global warming discussion. I have no problem with the facts as presented; however, it seems to me from a political viewpoint we are best advised to comment on the uncertainties associated with global warming, but also to present a plan of action which can be implemented to address global warming concerns. My recommendation is that we place conservation at the core of that effort and point out that there are technologies that can use coal in an evermore efficient fashion, which is in the report, just not in this section. Further, a reforestation program and an effort to export U.S.-derived efficient coal-based technologies seem to be other proactive steps which can be offered. Together with an aggressive research program, it seems to me that these collective actions can diffuse the charges against coal that it is causing global warming and that nothing is being done.

My concerns in this area are exacerbated by the fact that in Europe the concerns about global warming are far higher than they are in the United States. It is the opinion of Kurt Yeager of EPRI that this is European

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economic chauvinism, in the sense that the United States would be more adversely impacted by a carbon tax to combat global warming. That may be a thought that has merit for inclusion in the report.

Thanks for the opportunity to comment. Congratulations on an excellent effort.

Best regards,

Donald M. Carlton

DMC:mc

ROBERT H. SHANNON
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P. O. BOX 2264
ROCKVILLE, MARYLAND 20847

301-984-9254

November 1, 1991

Mr. J. L. Mahaffey
c/o Greg Brand
Shell Mining Company
200 N. Dairy Ashford
Houston, Texas 77079

Dear Mr. Mahaffey:

Subject: National Coal Council - Coal Policy Committee Meeting, October 23, 1991

This letter is directed to discussions pertaining to review of the draft report, "Coal: The Near Term Vision", at the subject meeting. I was especially interested in the excellent report you have developed and, therefore, have addressed this letter to you as Chairman of the working group responsible for the report.

The 'Near Term' report is certainly of significant importance to the coal industry; especially coal utilization for electric power generation in view of the 1990 CAAA - Titles I, II, III and IV will have long term impact on the use of coal for power generation.

The EPA met with the Clean Air Act Advisory Committee on Thursday, Oct.24, in Washington, D.C. Quite noticeable (as an observer) was a lack of Coal industry participation. For further reference -- based on the EPA Acid Rain Advisory Committee (ARAC) meetings (as an observer), there was a notable absence of Coal industry active participation.

Additional references that may be of interest relevant to your report include:

(a) Report, "America's Energy Choices", published by the Union of Concerned Scientists.
(b) Report, "Reliability Assessment 1991-2000", North American Electric Reliability Council.
(c) Coal Technology (Chapter 4) of your report:
- Suggested addition
  . Coal Liquefaction
- Regarding AFBC, PFBC and CFBC Boilers
  Some recent test results have indicated a potential N_2O (nitrous oxide - a Greenhouse gas) problem. Further testing is planned. N_2O problem projected to be due to Fluidized Bed operating temperature range.
- Page 30 of the report - Selective Catalytic Reduction (SCR) - statement notes, SCR is the most common process for Post-Combustion control for a utility application. To date, there is limited ex-

perience with SCR for coal-fired plants. Southern Company Services has a CCT SCR demo project underway based on hi-sulfur coal.

(d) WEPCO issue:

The report noted the need for defining key terms -- would add to your list the term 'preventive maintenance'. In addition, the EPA needs to eliminate ambiguity; for example, use of duplicate terminology:

. modification/major modification
. significant net emissions increase/net emissions increase

Further, the 'Reconstruction Rule' (as summarized in the Preamble) states that changes which cost 50 percent or more of the total cost of a comparable new facility subject the facility to NSPS as a new source facility even if there is no emissions increase. This appears to be an anomaly without reasonable justification. It is difficult to understand the rational for keying mandated NSPS requirements to a dollar cost basis -- especially if there is no emissions increase. This effectively negates potential 'Life Extension' for a number of existing older units, especially older coal-fired units. The Reconstruction Rules are directed against Units 'Grandfathered' under the 1970 CAAA; however, as implemented, the Rule impacts potential 'Life Extension' for all units.

As noted during the Coal Policy Committee meeting, the "Global Warming' issue is of increased concern (at least Politically) in the near term. A proactive policy position could be of value in assuring coal's continued use for electric power generation.

If you need additional information concerning the items as noted, please let me know.

Very truly yours,

Robert H. Shannon
Robert H. Shannon

RHS:scs

I. Leibson
Executive Consultant

Bechtel Group, Inc.
Fifty Beale Street
San Francisco, CA 94105

November 15, 1991

Mr. James F. McAvoy
Executive Director
The National Coal Council
P.O. Box 17370
Arlington, VA 22216

JFM
11/16/91

Dear Jim.

The Work Groups and their leaders for both the reports: "Coal: Today's Image" and "Coal: The Near Term Vision" are to be congratulated on assembling a great deal of important information and doing a thoughtful job of developing recommendations for the Secretary of Energy on these subjects.

I would like to offer a few suggestions which may not be original with me but which may further enhance these reports:

Coal: Today's Image

I share the belief that a coal industry coordinating council should be created to develop and implement a program to improve the image of coal as outlined in Exhibit 5-1, pages 5-5 and 5-6. Furthermore, I believe that the report should fully highlight in the executive summary, the recommendations as given on pages 5-3, 5-4, 5-5, and 5-6, making it very clear that we are defining the coal industry as including coal producers, users, and equipment and service suppliers to each; not just the coal producers alone. It is important that this be emphasized since the effort to improve coal's image needs to be founded upon a broad initial base if it is to be successfully expanded to the target audience of the informed public and the media.

Coal: The Near Term Vision

The section labeled "No. 7. Electric Vehicles" on page 15 of the draft dated Nov. 6, 1991 should be relabeled "Transportation Sector: Coal Derived Fuels and Electric Vehicles". I applaud the recommendation that a national energy strategy is needed for expanding the role of coal and coal derived fuels in the transportation sector. The write-up in Section-7 should be slightly expanded to note that further demonstration at a larger semi-commercial scale is needed for the process technologies and required in producing coal derived transportation fuels in a number of cases.

Best Wishes.

Sincerely,

I. Leibson

B. R. Brown
President
and Chief Executive Officer

Consolidation Coal Company
Consol Plaza
Pittsburgh, Pennsylvania 15241
(412) 831-4018

November 18, 1991

Mr. James F. McAvoy
Executive Director
The National Coal Council, Inc.
P.O. Box 17370
Arlington, Virginia 22216

Dear Mr. McAvoy:

The National Coal Council's draft report "The Near Term Role for Coal" is a commendable effort to address the policy issues facing the coal industry in the next 10 years. My principal suggestion to strengthen the report's message would be to prioritize the recommendations. In my view, global climate change will clearly be the critical issue for coal in this decade. I would suggest that Recommendation No. 2 in the Executive Summary, which urges DOE to use science as the basis for global climate change policy, be made No. 1. Similarly, Chapter 2 (which discusses global warming) might be more effective as Chapter 1.

A second policy issue of growing concern is the use of "environmental externalities" as a means to bias the choice of new U.S. electricity generating capacity against coal. The report should recommend a DOE analysis of the adverse economic and policy impacts of accounting for externalities in the choice of future energy sources. This is particularly important when such actions are carried out in piecemeal fashion at the state regulatory level.

Listed below are a few editorial comments:

1. Chapter 1, pg. 1, third paragraph under the heading "The Issues": the phrase "encourage low cost, secure, domestic energy sources" should be inserted immediately following the phrase "National energy policy should seek to..."

2. Chapter 1, pg. 2, first sentence under the heading "Role for Coal" that begins "While almost every state..." should be deleted. It weakens the point being made and confuses the discussion.

3. Chapter 1, pg. 5: The graph and references to the graph regarding U.S. environmental laws should be deleted. It's not necessary to graphically illustrate the obvious. In addition, the environmental laws referred to are not specific to the coal industry.

4. Chapter 2, pg. 8: The discussion under "The Issues" should begin with a stronger opening paragraph, perhaps drawing the analogy between global warming and acid rain (where politics preceded science).

5. Chapter 2, pg. 10, under the heading "Environmental Externalities and Conservation": The term externalities does not refer only to the "negative effects of an activity." It refers to costs <u>and</u> benefits of production and consumption that are not reflected in market prices. Also, the discussion of conservation in this section doesn't fit and should be taken out.

6. Chapter 2, pg. 15: The last sentence "There is much activity in support of electric transportation, largely to be derived from coal," doesn't make sense.

Sincerely,

/ams

American Electric Power
Service Corporation
1 Riverside Plaza
Columbus, OH 43215

AMERICAN ELECTRIC POWER

Mr. James F. McAvoy, Executive Director
The National Coal Council, Inc.
P.O. Box 17370
Arlington, VA 22216

12/09/91

December 4, 1991

W. S. White, Jr.
Chairman of the Board
614 223 1500

Dear Mr. McAvoy:

Re: Comments to Coal Council Technology Report September 16, 1991, Chapter 4, Pages 29-33

At our meeting on November 20th you requested comments on the draft of the report "The Near Term Role For Coal". Our engineers do have several comments with regard to Chapter 4 "Coal Technology" on Pages 29-33.

LOW NO_x COMBUSTION TECHNOLOGIES (Page 29)
Concerning overfire air, we do not believe that overfire air is a low cost NO_x reduction. It is our opinion this will cause boiler tube corrosion and ultimately result in furnace and burner tube replacements.

The low-NO_x cell burner (LNCB) is being tested at the Dayton Power & Light Station, Stuart No. 4, but the test just started in the early part of November, 1991. No significant information is available to us at this time.

Concerning the B&W cyclone reburn technologies, Ohio Edison's Niles Plant has a small test program operating, with very limited operating experience to date. The Nelson-Dewy Unit 2 program at Wisconsin Power & Light is scheduled for startup in December, 1991.

GAS REBURNING (Page 29)
We believe when employing gas reburning, furnace exit gas temperature (FEGT) will increase about 50°F above the original design value. An increase in temperature of this magnitude will exceed the original allowable stress level of the material. Since we would expect the superheater to be operating where material stresses are above their allowable, material upgrades will be required to avoid excessive forced outages. To upgrade the materials wouldbe very expensive. In addition, we expect a greater potential for slag accumulations on the superheater face. This would require increased maintenance cost from excessive slag blowing and resultant higher EFOR due to curtailments to minimize or remove the slag.

COAL-GAS CO-FIRING (Page 29)
The utilization of gas for co-firing will reduce the SO_2 and particulate emissions by a proportionate amount. The paper proposes there is a potential reduction of excess air requirements when coal-gas co-firing. We believe operators should not follow this recommendation. Nobody has the ability currently to determine absolute stoichiometry in the burner zone. To make certain we do not operate in a reducing atmosphere and guard against boiler tube wastage, we have always followed the OEM's long standing recommendations, tempered with our past experience, concerning excess air.

COAL-WATER-GAS CO-FIRING (Page 29)
The paper implies that coal beneficiation can reduce the sulfur content in the fuel and thereby eliminate the need for flue gas scrubbers. Although there are numerous processes that are being proposed, we do not believe that coal beneficiation is an economically, viable alternative to scrubbers.

SELECTIVE CATALYTIC REDUCTION (Page 30)
We believe there are concerns with the disposal of the spent catalyst (vinadium pentoxide) because it is considered a hazardous waste.

NOx SPECIFIC SCRUBBERS (Page 32)
We do not believe that NO_x specific scrubbing has achieved a proven design status. It has not been tested commercially with high sulfur coals. In our opinion, there are significant problems with thermal de-NO_x. Of particular concern is the stratification of temperature within a steam generator. There is a very small temperature window for injecting the ammonia. Our information to date indicates there is a large uncertainty of the temperature range wherein the process will work. Steam generator conditions are very sensitive to load variations and, thus, a major consideration when considering this process.

Jim, I hope these comments will be helpful.

Sincerely,

Pete

W. S. White, Jr.
Chairman of the Board

Appendix C

Description of the National Coal Council

APPENDIX C

DESCRIPTION OF THE NATIONAL COAL COUNCIL

Recognizing the valuable contribution of the industry advice provided over the years to the Executive Branch by the National Petroleum Council and the extremely critical importance of the role of coal to America and the world's energy mix for the future, the idea of a similar advisory group for the coal industry was put forward in 1984 by the White House Conference on Coal. The opportunity for the coal industry to have an objective window into the Executive Branch drew overwhelming support.

In the fall of 1984, the National Coal Council was chartered and in June, 1985, the Council became fully operational. This action was based on the conviction that such an industry advisory council could make a vital contribution to America's energy security by providing information that could help shape policies leading to the decreased dependence on other, less abundant, more costly, and less secure sources of energy.

The Council is chartered by the Secretary of Energy under the Federal Advisory Committee Act. The purpose of the National Coal Council is to provide advice and to make recommendations on general policy matters relating to coal and the coal industry on a continuing basis as requested by the Secretary of Energy.

The National Coal Council is not a trade association nor does it engage in any of the usual trade association activities. It specifically does not undertake any lobbying efforts. The Council does not represent any one segment of the coal or coal-related industry nor the views of any one particular part of the country. It is instead a broad-based, objective advisory body whose approach is national in scope.

Matters which the Secretary of Energy would like to have considered by the Council are submitted as a request in the form of a letter outlining the nature and scope of the study. The request is then referred to the Coal Policy Committee which makes a recommendation to the Full Council. The Council reserves the right to decide whether or not it will consider any matter referred to it.

The members of the Council may also present to the Secretary issues which they believe warrant study. If the Secretary concurs, the Council may then proceed.

Upon completion and approval of a study by the members a report of the findings is presented to the Secretary. These reports are given very extensive distribution throughout the Executive Branch of the Federal Government, the Congress, to State and local governments, the academic community, as well as a broad segment of the coal and coal-related industries. The reports are also widely circulated to the media.

The accompanying presents a list of the reports of the National Coal Council presented to the Secretary of Energy from 1985 to the present.

The mission of the National Coal Council is to enable the coal industry to objectively advise, inform, and make recommendations to the Secretary of Energy of the United States with respect to any policy matter relating to coal, in order to aid in achieving economic and energy security. The goal of the National Coal Council is to accomplish this mission in an objective, expeditious, thorough and highly credible manner.

REPORTS OF STUDIES COMPLETED BY THE NATIONAL COAL COUNCIL

In 1986
- *Coal Conversion*
- *Clean Coal Technologies*
- *Interstate Transmission of Electricity*
- *Report on Industrial Boiler New Source Performance Standards*

In 1987
- *Coal Reserve Data Base*
- *International Competitiveness of U.S. Coal and Coal Technologies*

In 1988
- *The Use of Coal in the Industrial, Commercial, Residential, and Transportation Sectors*
- *Innovative Clean Coal Technology Deployment*

In 1990
- *The Long-Range Role of Coal in the Future Energy Strategy of the United States*
- *Industrial Use of Coal and Clean Coal Technology - Addendum Report*

In 1992
- *The Near Term Role of Coal in the Future Energy Strategy of the United States*
- *Improving the Image of Coal: A National Energy Strategy Imperative*

CHAIRMEN OF THE NATIONAL COAL COUNCIL

June 1985 - June 1986	*The Honorable John N. Dalton (Deceased)* *Attorney at Law. McGuire, Woods & Battle* *Former Governor of Virginia*
January 1986 - June 1986	*(ACTING) B.R. Brown, President* *CONSOL Inc.*
June 1986 - June 1987	*James McGlothlin, President and CEO* *The United Companies*
June 1987 - June 1989	*James G. Randolph* *Former President, Kerr-McGee Coal Corporation* *(Current, 1992 - Assistant Secretary for Fossil Energy, U.S. Department of Energy)*
June 1989 - May 1991	*William Carr, President and CEO* *Jim Walter Resources*
May 1991 - Present (Jan. 1992)	*W. Carter Grinstead, Jr., Vice-President* *Exxon Coal and Minerals Company*

Appendix D

The National Coal Council Membership Roster — 1992

APPENDIX D

THE NATIONAL COAL COUNCIL MEMBERSHIP ROSTER — 1992

DR. SY ALI *
Manager
Industrial Engine Technology
Allison Gas Turbine Division
General Motors Corporation

MR. JOHN ARLIDGE *
Senior Vice President
Government Affairs
Nevada Power Company

MR. CHARLES J. BAIRD
Baird and Baird

THE HON. GERALD BALILES
Hunton & Williams

MR. JOHN BARKER, P.E. *

MR. GLEN BARTON
Group President
Caterpillar, Inc.

MR. DANIEL BEAM
Commercial Fuels, Inc.

MR. WILLIAM W. BERRY *
Chairman of the Board
Dominion Resources

MS. JACQUELINE F. BIRD
Director, Ohio Coal Development Office
Ohio Department of Development

MR. GERALD BLACKMORE *

DR. SANDRA BLACKSTONE *
Natural Resources Attorney/Consultant

MR. THOMAS H. BRAND, JR.
BBI Environmental

DR. ROBERT W. BROCKSEN
R.W. Brocksen, Inc.

MR. BOBBY R. BROWN *
Chairman/CEO
CONSOL, Inc.

MR. DONALD P. BROWN *
President
Cyprus Coal Company

MR. THOMAS BROWN
Representative
Eastern Conference of Teamsters

DR. DONALD CARLTON *
President
Radian Corporation

MR. WILLIAM CARR *
President
Jim Walter Resources, Inc.

MR. FRED CLAYTON
Chairman and CEO
Shand Mining, Inc.

MR. WILFRED CONNELL
Vice President
Illinois Power Company

MR. ROBERT P. COOPER *
Executive Vice President
Farrell-Cooper Mining Company

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President
MAPCO Coal, Inc.

MR. JAMES B. CRAWFORD
Chairman and CEO
James River Coal

MR. DAVID C. CRIKELAIR
Vice President
Texaco

DR. H. DOUGLAS DAHL
President and Chief Operating Officer
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MR. ROBERT G. DAWSON
Vice President, Fuel Services
Southern Company Services

MR. JOHN DWYER *
President
Lignite Energy Council

MR. IRL F. ENGELHARDT
President and CEO
Peabody Holding Company, Inc.

DR. ROBERT H. ESSENHIGH
Professor of Mechanical Engineering
Department of Mechanical Engineering
The Ohio State University

THE HON. GEORGE EVANS
Secretary
Kentucky Energy Cabinet

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Chairman/CEO
Fairchild International

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McWane Coal Co., Inc.

MR. MASON FOERTSCH
President
Foertsch Construction Company

MR. JOSEPH A. FRANK
President
Centralia Coal Sales Company

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Professor of Law and Director of
the National Energy Law and
Policy Institute
The College of Law

MR. GEORGE FUMICH, JR.
George Fumich Associates, Inc.

MR. PETER M. GARSON
President
PMG Advisory Group

MS. SONDRA J. GILLICE
Vice President of Sales and Marketing
Guest Services, Inc.

DR. ALEX E.S. GREEN *
Graduate Research Professor
University of Florida

MR. W. CARTER GRINSTEAD, JR. *
Vice President
Exxon Coal and Minerals Company

MR. JOHN GRISHAM
President
Industrial Mining Company

DR. BILL HARRISON *

MR. J. BRETT HARVEY
Vice President - Fuels Resources
PacifiCorp

MR. H. RICHARD HORNER *

THE HON. STANLEY W. HULETT
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MR. RICHARD W. INCE *

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Executive Vice President and
General Manager
Texas Utilities Mining Company

MR. WILLIAM M. KELCE *
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Alabama Coal Association

THE HON. ALLEN C. KOLSTAD

DR. IRVING LEIBSON *

MR. PETER B. LILLY *
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MR. JAMES L. LITMAN
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Valley Camp Coal Company

DR. ROBERT E. LUMPKIN *
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Alternative Feedstock Development
Dept.
Amoco Corporation

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Council of Industrial Boiler Owners

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Norfolk Southern Corporation

MR. WILLIAM H. MELLOR, III
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Burlington Northern Railroad

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President & Chief Operating Officer
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Kentucky Utilities Company

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Marietta Coal Company

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Fuels Management
Entergy Services

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MR. JAMES J. O'CONNOR
Chairman & President
Commonwealth Edison Company

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MR. JERRY J. OLIVER *
President
Handex of Florida

MR. LOUIS PAGNOTTI, III
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MR. DAVID PETERSON *
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A Subsidiary of Northern States
Power Company

MR. ABE PHILLIPS *
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MR. JIM ROSE
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Interstate Coal Company, Inc.

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Vice President
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President
Kerr-McGee Coal Corporation

MS. DEBBIE SCHUMACHER *
Women In Mining

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President
TECO Coal Corporation

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Utility Fuels, Inc.

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President & CEO
Riley Stoker Corporation

MR. JOHN W. SNOW
President/CEO
CSX Corporation

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Electric Power Research Institute

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Group Executive
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State of Kentucky

THE HON. MIKE SULLIVAN
Governor of Wyoming

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Hall Estill Hardwick Gable
Golden & Nelson, P.C.

MR. L.A. THAXTON
Vice President
Field Operations
Dresser Industries

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Winston & Strawn

MR. PAUL M. THOMPSON
President
Phillips Coal Company

MR. NEAL S. TOSTENSON *
President
Ohio Mining & Reclamation Association

MR. RICHARD TRUMKA
President
United Mine Workers of America

MR. MITCH USIBELLI
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MR. GERALD D. WALTZ *
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Indianapolis Power and Light Company

MR. JOHN D. WARD
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MR. BILL W. WAYCASTER
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Hydrocarbons Department
DOW Chemical USA

MR. W.S. WHITE, JR. *

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Joy Technologies

MR. ALAN D. WRIGHT
Partner
Porter Wright Morris & Arthur

MR. TAY YOSHITANI
Deputy Executive Director
Maritime Affairs
Port of Los Angeles

* Denotes member of Coal Policy Committee

Appendix E

The National Coal Council Study Group for the Report "The Near Term Role for Coal"

APPENDIX E

THE NATIONAL COAL COUNCIL STUDY GROUP FOR THE REPORT "THE NEAR TERM ROLE FOR COAL"

J.L. Mahaffey, Chairman
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Sy Ali
Manager
General Motors Corporation

Jerry Bartlett
Burlington Northern Railroad

Greg Brand
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Jon Browne
North American Coal Company

David Clement
Pacific Power

Jim Cole
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Farrell-Cooper Mining Company

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Alan Edwards
Governor's Office - Wyoming

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Bill Henry
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Connie Holmes
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M.C. Kirk, Jr.
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