



**VISION 2020: THE ROLE OF COAL
IN U.S. ENERGY STRATEGY**

February 18, 1997

THE NATIONAL COAL COUNCIL

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Frank Jackson
746 E. 12th Street #4
Los Angeles, CA 90021
Tel. # (213) 749-4540

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IN U.S. ENERGY STRATEGY**

**Steven F. Leer, Chairman
Coal Policy Committee**

**Girard F. Anderson, Chairman
Working Group**

The National Coal Council

February 18, 1997

THE NATIONAL COAL COUNCIL

Clifford R. Miercort, Chairman

James F. McAvoy, Executive Director

U.S. DEPARTMENT OF ENERGY

Charles B. Curtis, Acting 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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THE NATIONAL COAL COUNCIL, INC.

Post Office Box 17370, Arlington, Virginia 22216

(703) 527-1191

CLIFFORD R. MIERCORT
Chairman

February 18, 1997

The Honorable Charles B. Curtis
Secretary of Energy (Acting)
United States Department of Energy
Room 7A-219
1000 Independence Avenue SW
Washington, DC 20585

Dear Mr. Secretary:

The National Coal Council is pleased to submit the enclosed report: "VISION 2020: THE ROLE OF COAL IN U.S. ENERGY STRATEGY" for your consideration. It sets forth the results of an intensive study requested by the Honorable Hazel R. O'Leary.

This study updates and amplifies the Council's findings from three previous reports: "THE LONG RANGE ROLE OF COAL IN THE FUTURE ENERGY STRATEGY OF THE UNITED STATES", June 1990; "THE NEAR TERM ROLE FOR COAL IN THE FUTURE ENERGY STRATEGY OF THE UNITED STATES", January 1992; and "THE ROLE OF COAL IN ENERGY, THE ECONOMY, AND THE ENVIRONMENT--SPECIAL REPORT", February 1993.

We commend all three reports to your attention, as they, along with the VISION 2020 report, present a clear picture of the critical role coal must play in our nation's economy, the balance of trade, our energy future, and national security.

The major findings of the new report are as follows:

- ▶ Consumers in the United States demand low-cost electricity. According to the Energy Information Administration, the demand for electricity is continuing to grow at about 2% per year.
- ▶ Over 55% of the electricity generated by our nation's electric utilities comes from coal-fired sources. Low-cost electricity is the direct result of using low-cost coal.

An Advisory Committee to the Secretary of Energy

- ▶ The use of coal to generate electricity provides benefits such as jobs, a competitive economy, a high standard of living, and less dependence on imported oil.
- ▶ Modern use of coal is clean and efficient, especially with advanced technologies such as those developed in DOE's Clean Coal Technology Program. Electric generation from coal has increased substantially, yet emissions of pollutants have decreased.
- ▶ More stringent environmental programs and global climate change policies are being proposed that would restrict or reduce the use of coal, enacted they will put our energy independence, perhaps even the U.S. economy, at risk.

Regarding these findings, the National Coal Council recommends:

- ▶ That the Department of Energy should encourage the clean, efficient use of our abundant coal resources in order to satisfy the demands of U.S. consumers for low-cost electricity.
- ▶ We urge continued federal involvement in coal research and development in order to assure the continued enhancement of clean, efficient coal technologies.
- ▶ The Department of Energy should have a principal role in the development of environmental and global climate change policies and responses, ensuring that they will be based on sound scientific principles, have pragmatic objectives, will be justified economically, and will be strategically consistent.
- ▶ The Department of Energy should carefully study the potential long-term impact on energy independence and the price of electricity by the federal restructuring of the electric utility industry.

Our goal was to provide you with an objective, balanced report, fully utilizing the wide array of backgrounds and experience represented by our members. We sincerely hope that the findings and recommendations of this report prove useful to you in achieving that goal, thereby assuring economic growth, jobs, and energy independence for the United States.

We appreciate being asked to provide this updated report and remain ready to provide additional information or to answer any questions you may have.

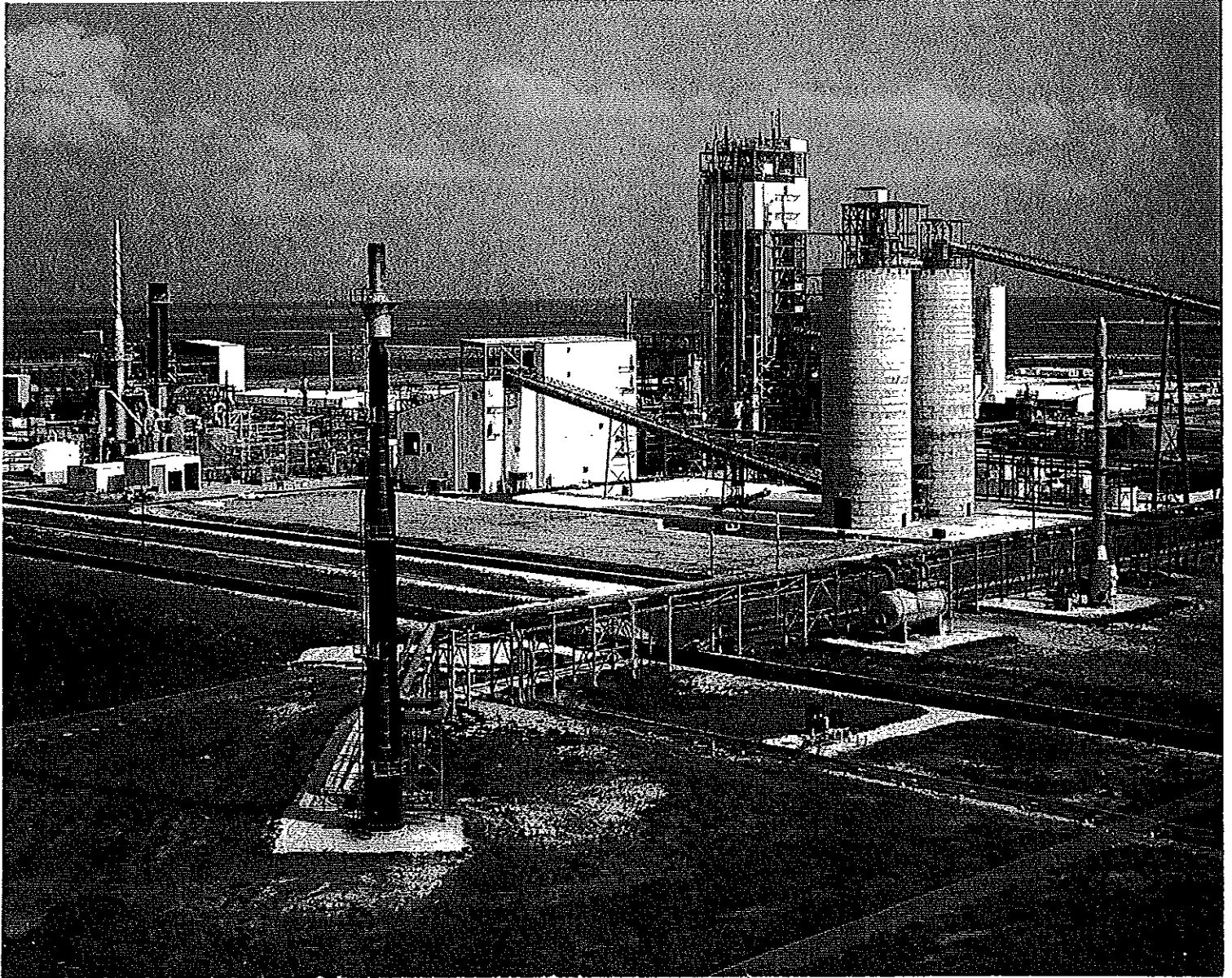
Sincerely,


Clifford R. Miercort

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Enclosures

cc: Jim McAvoy, National Coal Council

“To craft the technology to permit us to harness the wonder of coal, which is the most abundant fuel source in the world, and in so doing, to save the economy of the United States of America by shoving off lots of high priced imported petroleum whose volatile prices and whose locations, mostly in volatile parts of the world, make us subject to economic disruption, and yes, subject to disruption of our national security. And that the answer, or part of the answer, is in a power station like the one we dedicate today.” --- Former Secretary of Energy Hazel R. O’Leary, during the dedication of Tampa Electric Company’s Polk Power Station.



The future of electric power generation: Tampa Electric Company’s Polk Power Station, successfully demonstrating Integrated Gasification Combined Cycle technology, is part of the Department of Energy’s Clean Coal Technology Program.

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PREFACE

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

The mission of the Council is purely advisory: to provide guidance and recommendations as requested by the Secretary of Energy on general policy matters relating to coal. The Council is forbidden by law from engaging in lobbying or 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 members to support 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, and a broad spectrum of diverse interests from business, industry, and other such groups as:

- * Large and small coal producers
- * Coal users such as electric utilities and industrial users
- * Rail, waterways, and trucking industries as well as port authorities
- * Academia
- * Research organizations
- * Industrial equipment manufacturers
- * Environmental interests
- * State government, including governors, lieutenant 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.

ABBREVIATIONS

AC	Alternating Current
AGBM	Ad Hoc Group on the Berlin Mandate
AIJ	Activities Implemented Jointly
AOSIS	Alliance of Small Island States
Btu	British thermal units
CC	Combined Cycle
CAPI	Clean Air Power Initiative
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COP	Conference of the Parties
DC	Direct Current
DOE	Department of Energy
CAR	East Central Area of Reliability
EEI	Edison Electric Institute
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FACTS	Flexible AC Transmission Systems
FCCC	Framework Convention on Climate Change
FERC	Federal Energy Regulatory Commission
FY	Fiscal Year
GCC	Gasification Combined Cycle
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GW	Gigawatts
H ₂	Hydrogen
HAPs	Hazardous Air Pollutants
HCl	Hydrogen Chloride
HF	Hydrogen Fluoride
HHV	Higher Heating Value
IGCC	Integrated Gasification Combined Cycle
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
kW	Kilowatt
kWh	Kilowatt-hour
lb/MBtu	Pounds of emissions per million Btu of heat input
LRTAP	Long Range Transboundary Air Pollution Convention
MBtu	Millions of British thermal units
MW	Megawatts
MWH	Megawatt-hour
NAFTA	North American Free Trade Agreement
NAAQS	National Ambient Air Quality Standards
NO _x	Nitrogen Oxides
O&M	Operating and Maintenance

OECD	The Organization for Economic and Cooperative Development
OTAG	Ozone Transport Assessment Group
OTC	Ozone Transport Commission
PFBC	Pressurized Fluidized Bed Combustion
PM _{2.5}	Particulate Matter less than 2.5 microns in diameter
PM ₁₀	Particulate Matter less than 10 microns in diameter
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SNCR	Selective Non-Catalytic Reduction
SNG	Synthetic Natural Gas
SO ₂	Sulfur Dioxide
U.N.	United Nations
USAID	United States Agency for International Development
μg/m ³	Micrograms per cubic meter

EXECUTIVE SUMMARY

INTRODUCTION

The Secretary of the U.S. Department of Energy (DOE) requested the National Coal Council (NCC) to undertake a study of the contributions to be made by coal to the nation's future energy requirements and outline this vision for the industry over the next 25 years. This report sets forth the NCC's belief that the future role of coal will be defined by the issues and policies challenging the industry now and over the 25-year time period, and advances ideas and recommendations to help address those issues in order to position coal as a viable energy source in the year 2020.

VISION

The coal industry, including the coal production, transportation, and power generation and utilization sectors, will evolve over the next 25 years to preserve and, ideally, enhance coal's contribution in the production of clean, reliable, low-cost electricity. Doing so will provide for the continued electrification of the U.S. economy, improve the nation's trade balance through increased exports, and reduce dependence on imported oil. This vision can be realized if two powerful trends continue to mature into the future: 1) the demand for energy grows, especially for electricity; and, 2) the demand for this low-cost, clean, and reliable electricity can be met through advances in technology.

Coal serves as the low-cost fuel source for more than 55 percent of U.S. electric utility generation. Coal's position as the primary energy source for electric generation in the U.S. now and for the foreseeable future is contingent upon its vast domestic availability, a modern infrastructure for production and transportation, and the capability for use in an environmentally superior manner. As the demand for electricity continues to grow, U.S. coal reserves place the industry in the comfortable role of being able to meet that demand. To remain responsive in the future, the shape and complexion of the coal production, transportation, and utilization industries must keep up with the myriad of change expected in the next 25 years. Based on current trends, the industry will further consolidate. To the extent that this consolidation enhances efficiency and lowers costs, electricity will become even more affordable than it is today.

The coal industry will encounter many challenges and obstacles along the road to fulfilling this vision. The government, at all levels, should base its policy decisions on sound scientific and economic factors that promote the uses of all domestic energy resources. Government and industry should work together in continuing the development of sound technologies for coal use and become partners in educating the public on the significant benefits of relying on domestic resources, especially coal. The public should be shown the fact that coal can meet their needs in a cost-competitive and environmentally sound manner that promotes national security.

CONCLUSIONS

Coal's Indispensable Role in Our Nation's Economic Health

The U.S. is heavily dependent upon electricity as the primary source of usable energy. The abundant supply and low cost makes utility generated electricity a vital contributor to our nation's standard of living, low inflation, and global competitiveness. What may not be widely known is that over 55 percent of this low-cost, reliable supply comes from coal.

Coal is instrumental in supplying the low-cost, reliable electricity demanded by U.S. consumers. Coal fuels economic growth and is key in maintaining the stability of energy prices. Most technological advances that account for productivity improvements are made possible by electricity. The average price of electricity (adjusted for inflation) is about the same as it was 20 years ago and is expected to fall in real terms unless new policies and regulations adversely impact the use of the predominant low-cost fuel for the production of electricity: coal. Without continued federal and private industry research and development (R&D), the costs of enhanced coal technology will rise, impacting the competitive standing of coal-fueled generation with generation from other fuels.

Maintaining affordable and abundant supplies of energy within U.S. borders is paramount to national security and global competitiveness. True energy security means relative independence from international events and little reliance on a specific industry, such as the oil industry. Coal is a strategic asset to U.S. energy security because of its abundant reserves and availability at a competitive cost. The transportation sector relies heavily on imported oil as its energy source. Substituting gasoline-fueled vehicles with electric cars supplied with coal-fired electricity will further decrease U.S. dependence on imported oil. Enhancing the ability of coal to continue satisfying the public's need for low-cost electricity will profoundly affect the nation's standard of living, economy, jobs, and ability to achieve independence from the use of imported oil and its associated implications on national security.

The use of coal to replace oil imports is vital to our nation's economic future. The need to improve our trade deficit was never more evident than today. According to the U.S. Department of Commerce, the 1996 Trade Deficit was \$114.2 billion, the worst showing in 8 years. A major contributor — increasing oil imports.

Environmental Issues

The American people rely on coal to supply more than 55 percent of utility generated electricity and this demand for electricity continues to grow. Additional environmental laws or regulations that lead to a shift away from the use of plentiful domestic coal supply will mean higher costs for generating electricity and possible disruptions in electricity supply, with the attendant loss of jobs, and a downturn in the economy.

The future of coal in the U.S. hinges on the course selected to address such issues as global climate change, implementation of the Clean Air Act and its 1990 Amendments, the Environmental Protection Agency's (EPA) Clean Air Power Initiative (CAPI), the requirement that "environmental comparability" direct existing generation, and establishment of monetized externality costs. Without thorough examination and rational assessment of the impacts of present and future actions, a reliable

and inexpensive supply of electricity resulting from the continued use of coal, will be lost. The most pressing of these issues is action on greenhouse gases and global climate change.

Generation and End Use Technologies

Coal will remain a dominant fuel source throughout the world for many decades. In response to environmental challenges, the coal industry and related power generation and utilization industries must cooperate in the adoption of environmentally sound, economically viable coal utilization and electricity production technologies. It is in everyone's best interest that these and other advanced technologies be encouraged in support of using coal more cleanly and efficiently.

The federal government has a critical role in achieving this vision of coal as a premier clean fossil fuel through continued development and initial application of mid-term and long-term energy technologies. This role is being shaped by the near-term competitive pressures on the coal and electric utility industries, the increased desire for greater environmental protection, and the necessity that the U.S. remain a leader in energy technology to maintain its global competitive edge.

Low-cost, abundant, and reliable electricity is pivotal to improved U.S. international competitiveness. Domestic coal resources are the answer with abundant availability and competitive costs. Clearly, U.S. competitiveness is tightly linked to continued advances in the technology of extraction, conversion, and use of these energy resources in an environmentally acceptable manner. The combination of advanced power generation technologies, which use coal cleanly and efficiently, and electric technologies will provide the low-cost electricity for economic growth while continuing to protect the environment.

International Issues

International challenges to continued consumption of coal will escalate over the next two to three decades. It is vital that coal proponents learn how to participate in the international negotiation processes of the U.N. in order to protect the interests of U.S. consumers. The most accurate facts and data must be readily available during the Framework Convention on Climate Change (FCCC) negotiations to show beyond a doubt how coal is meeting the challenges of increased efficiency and decreased emissions through industry implementation of clean coal technologies both in the U.S., and in other parts of the world. The goal is to show how the increased use of efficient, clean coal technologies actually reduces the emissions of sulfur dioxide (SO₂), nitrogen oxides (NO_x), and metals, as well as carbon dioxide (CO₂). It must be shown that the efficient use of coal has caused a direct rise in economic growth in developed countries and standards of living in developing countries, and that this trend can continue if coal remains a dominant fuel source not only for the near-term, but for the future.

Given that developing countries will increase their use of coal, DOE should scrutinize more closely the factors and policies affecting the price of exportable coal. A review of taxes and fees that make U.S. coal, versus other coal sources, less competitive should be undertaken immediately to eliminate roadblocks to increased consumption of U.S. coal by our trading partners.

Programs for international funding and partnerships need reconsideration if they put domestic coal at a disadvantage on the international market. DOE should closely examine policies and programs that help other countries develop their coal resources, causing displacement of U.S. coal in the global

market. Clearly, that is a detriment to the domestic coal industry. On the other hand there are advantages to encouraging development of clean coal technologies in other countries, such as -- additional opportunities for export of U.S. technology, new markets for domestic coal, and better controls on global emissions of CO₂.

Role of the Federal Government vs. Private Industry

Throughout this report, there will be extensive discussion as to the separate and combined roles of the Federal Government and private industry. Recognizing that the days of big government expenditures for R&D have probably passed, leveraging relatively small investments can achieve tremendous breakthroughs.

As industry takes up the call to arms and provides sound investment in ensuring the future of coal, the government should not become a barrier to achieving this vision for 2020. Rather, the government should assure a level playing field for all fuels to compete in providing the U.S. and the world the most reliable supply of electricity at the lowest possible price.

RECOMMENDATIONS

1. DOE and the coal industry should support and encourage continued generation of low-cost electricity for the benefit of U.S. consumers, regardless of fuel type, including use of coal as a fuel that generates low-cost electricity because its price is competitive and its supply is stable.
2. DOE and the coal industry should encourage the use of technologies that will expand coal's benefits to society in producing electricity, transportation fuels, and chemicals to reduce use of both imported oil and natural gas, reinforcing the major role played by coal in U.S. energy strategy and balance of trade.
3. DOE and the coal industry should continue their collaborative programs for research, development, and demonstration of clean, coal-fueled technologies for repowering and new plant additions. Improvements in technology and efficiency, along with lower capital costs, will make coal-fueled technologies more attractive and more competitive, ensuring that coal-fueled generation will continue to be a source of low-cost energy to drive the U.S. economy.
4. DOE should lead the charge to ensure the development of energy policies and regulations that have a sound scientific basis, are economically justified, are environmentally acceptable, and are strategically consistent for the well-being and security of U.S. consumers. Equally important is expanding outreach programs that educate the public about how new coal-fueled facilities are clean, efficient, and utilize technologies that protect the environment.
5. DOE should work closely with federal, regional, state, and local environmental agencies to ensure that environmental policies and regulations are based on sound scientific principles, have pragmatic objectives, and utilize least-cost control methods in order to minimize the delivered price of electricity to U.S. consumers.

6. DOE should take a lead role in the scientific review of global climate change and the formation of global climate change policy by the Executive Branch to ensure that coal's contribution to low-cost electricity is not disadvantaged. This would include DOE's active participation in the Department of Commerce study on the impacts of global climate change policies on the nation's energy strategy. The coal industry should cooperate with the Executive Branch to support voluntary programs that reduce emissions of greenhouse gases; i.e. the Climate Challenge Program.
7. DOE should facilitate and support the development and application of mid-term and long-term coal technologies that are very efficient and have very low emissions to further the electrification of the U.S. economy. This can be achieved through demonstration of the benefits of integrating low-cost coal generation with the increased use of electric technologies, as well as the exploration of technologies that utilize coal along with alternative domestic fuels, such as solid waste or biomass.
8. DOE, in partnership with the coal industry, should promote the use of highly efficient coal-fueled technologies, along with electric technologies, in developing countries in order to improve air quality and lower the emissions of CO₂ per unit of electricity produced. Enhancements to these technologies will then be available for implementation in the U.S., providing benefits to U.S. consumers.
9. DOE, in partnership with the coal industry, the U.S. Agency for International Development (USAID), and the U.S. Department of State should encourage the use of clean coal technologies as a leading source of power generation in foreign development and within investment agencies (for example: the World Bank Global Environmental Facility; the Export-Import Bank; and the Asian, South American, North American, and African regional development banks), and highlight these benefits within the context of various international negotiations.
10. DOE should study the effects of eliminating taxes, fees, and policies that inhibit competitiveness of U.S. coal internationally, and encourage enforcement of trade agreements that promote the use of U.S. coal by foreign nations.
11. DOE and the Department of State should work together in the formation of foreign policy to ensure that resulting energy directives do not run counter to domestic economic concerns and negatively impact jobs, Gross Domestic Product (GDP), and the delivered price of electricity to U.S. consumers. In addition, a review of foreign assistance programs is necessary to address those negatively impacting domestic coal industry interests, national energy strategy, and balance of trade.

SECTION I

COAL'S INDISPENSABLE ROLE IN OUR NATION'S ECONOMIC HEALTH

INTRODUCTION

A highly reliable supply of low-cost electricity has contributed significantly to our nation's current standard of living, low rate of inflation, and global competitiveness. Other than for transportation, energy is delivered and consumed primarily in the form of electricity and, therefore, it must be a principal focus of a national energy strategy. Americans spend three times more for electricity than for gasoline. Expenditures for electricity are seven times more than for the largest non-energy commodity (cattle). Electricity is the single largest non-labor commodity in today's U.S. economy. A one-cent increase per kilowatt-hour would take \$30 billion yearly out of the pockets of U.S. consumers.

More than 90 percent of all electricity generated in the U.S. is consumed by the residential, commercial, and industrial sectors of the economy. These three sectors account for 90 percent of U.S. GDP. Oil use in these three sectors amounts to 34 percent of the total U.S. oil consumption. The transportation sector accounts for 66 percent of total U.S. oil consumption, while representing only 10 percent of total U.S. GDP. Regardless of these facts, consumers continue to watch the gas pump more than the electric meter.

Low-cost, reliable electricity is a key factor in the welfare of the U.S. economy. This is becoming clearer as the economy continues to replace technologies that use direct combustibles with electric technologies. Since 1973, the industrial and commercial sectors of our economy have grown by more than 60 percent. Electricity usage in these sectors grew by almost 80 percent, while direct combustibles declined by 15 percent.

Most new technologies that account for productivity gains are electric. Electricity's contribution to low inflation is not only tied to its relatively low cost, but to its integration with cleaner technologies. The result has been productivity improvements across the business spectrum. Any policies or actions that increase electricity prices will forestall these improvements.

Adjusted for inflation, the average price of electricity nationwide is about the same as it was twenty years ago. During the 1970s and '80s, costs increased because of the price of oil, nuclear power issues, and compliance with new environmental regulations. Over the last few years, however, that price has steadily fallen largely because of efficiency increases and productivity improvements in the mining and use of the predominant low-cost fuel for producing electricity: coal.

Almost 90 percent of the coal consumed in the U.S. is for producing electricity. According to the Energy Information Administration (EIA), coal is used for 55.2 percent of our nation's electric utility generation. Nuclear energy accounts for 22.5 percent, natural gas for 10.3 percent, hydroelectric for 9.8 percent, oil for 2.0 percent, and other renewable energy sources for 0.2 percent. If coal use were restricted by uneconomic or non-market mechanisms, the immediate result would be rising electricity prices and a negative impact on jobs, GDP, and our standard of living. Based on current and

projected prices, coal's share of the electric generation market should increase in the short-term, and perhaps in the long-term, because the available alternatives will continue to be more expensive.

Emissions from burning coal at electric generation stations have been drastically reduced and continue to decline. While coal consumption at electric generating stations has increased steadily since World War II, SO₂ emissions from such combustion have declined steadily since 1970. In 1995, the SO₂ emissions from fossil-fueled steam electric generation declined 30 percent from 1970 levels. Coal suffers from the outdated perceptions of black-smoke power plants of yesteryear. These notions of adverse environmental impacts severely impede the ability of the U.S. electric industry to construct low-cost, coal-fired power plants. Today's plants meet very stringent environmental limitations because new pollution control equipment removes particulate matter, reduces emissions of SO₂ and NO_x, and creates by-products that can be recycled for use by industry. These are the plants that fuel the increase in living standards for all Americans.

America's railroad and waterway infrastructure is heavily committed to coal. Transportation of coal, mostly to utilities, generates 22 percent of total Class I railroad revenues. For the nation's barge system, coal accounts for 40 percent of revenues. Without the continued growth in coal movements, the rail and barge sectors will be forced to increase prices on other commodities and severely reduce their infrastructure. Increased rail prices would encourage more trucking, creating greater congestion on our nation's highways and increasing air pollution per ton mile of transportation. Investment is driven by the future expectations of revenues and profits. Deterioration in transport infrastructure, caused by declining investment capital, can occur well before coal movements actually stagnate. Any policies that would reduce the use of coal, or its movement on the nation's rails and waterways, would significantly affect jobs and local economies.

THE ECONOMICS OF COAL AND GAS FOR ELECTRICITY PRODUCTION

The price of fossil fuels is the most critical element in the economics of electricity generation. Expected future fuel prices drive power plant investment decisions today. Once made, such investments in generating plants last 30 years or longer. Forecasting fossil fuel prices depends almost entirely on the expected availability and cost of extraction at a given demand level. Such expectations are based upon an inventory of the amount of fuel in the ground and its depth, geology, and cost of recovery.

Fuel price and reserve forecasts vary widely among the different resources. The National Coal Council does not infer that any one forecast should be considered the most accurate. However, the Council has traditionally used forecasts from the EIA, the official energy data entity for DOE.

It is noteworthy that EIA, in its 1997 Annual Energy Outlook, predicts that natural gas prices will continue to rise through the year 2015. It also predicts that gas reserves will increase, as will gas consumption for electricity generation. An historical review of natural gas prices, including a study of the futures market, shows that as the demand for natural gas increases, so does the price.

The volatility of natural gas and oil prices is well documented. An examination of the futures market bears this out well. A table on EIA's web site, dated December 23, 1996, compares NYMEX price

futures with Henry Hub Spot Prices. This table, along with the futures tables in any business journal, clearly show the volatility of natural gas and oil prices.

Coal prices, however, have remained relatively stable for several years. They are expected to decline in the future. In the EIA 1997 Annual Energy Outlook, the forecast for coal shows a "0.9 percent annual decline between 1995 and 2015." This same document also points out that "Natural gas prices to electricity suppliers rise by 1.0 percent a year in the forecast."

As demand drives up the price for natural gas, it is likely to spur development of new exploration and production technologies, which in turn will cause an increase in recoverable reserves. However, EIA forecasts a drop in reserves starting in the latter part of the forecast period. The combination of increased prices with decreased reserves is not one on which to build a reasonable national energy strategy.

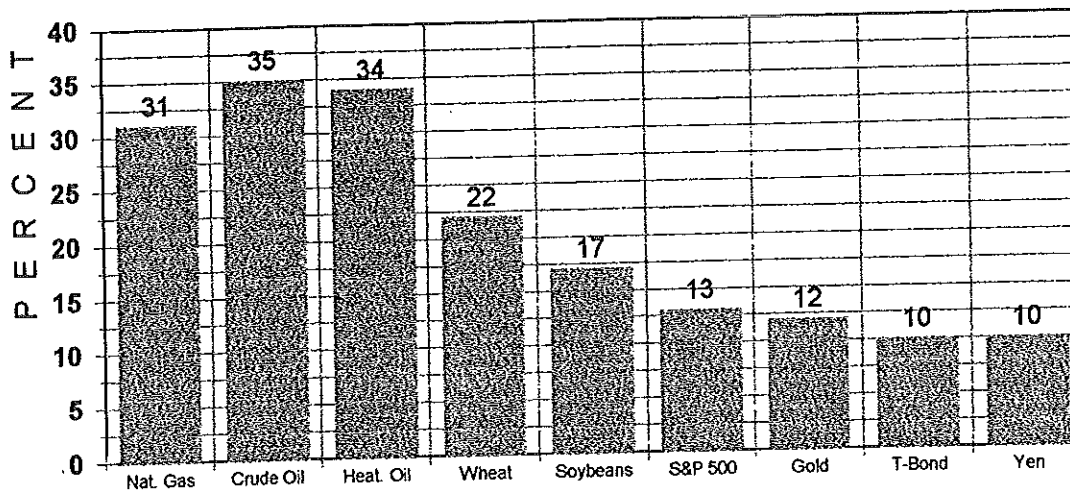
In its report entitled "U.S. Coal Reserves: A Review and Update", EIA states that there are 274 billion tons of recoverable coal reserves in the U.S. Likewise, the British Petroleum (BP) Statistical Review of World Energy 1996 estimates 240+ billion tons of proven reserves (quantities which "with reasonable certainty can be recovered in the future from known deposits under existing economic and operating conditions"). Using current EIA consumption figures, it is reasonable to estimate that these recoverable reserves could last as long as 270 years. This is further validated by BP's estimate.

Good economics and reliability of supply are overriding concerns for a national energy strategy. Our nation's recoverable coal reserves are well documented, and most of these reserves can be economically mined, and the transportation infrastructure is vast and flexible. This is the combination that has supplied, and can continue to supply this nation with reliable, low-cost electricity. This combination should form the basis of a national energy strategy, as it was in the past two DOE National Energy Strategies. If the historical price spread between coal and gas continues or even increases in the future, as EIA forecasts predict, coal-fueled electricity will continue to be the most economical.

A utility considering a new power plant must review the total cost picture, including capital, operating and maintenance, and fuel costs, over the projected plant life. The historical stability or volatility of the potential fuels can provide important information to be used as part of the long term evaluation. As Figure I.1 shows, gas prices have proven to be very volatile. Investors may require a capital return of 15-20 percent to compensate for this higher risk, increasing the overall evaluated cost of the power plant.

FIGURE I.1

**NATURAL GAS VS. OTHER MARKETS
AVERAGE HISTORICAL VOLATILITY**



Source: Presentation by David Prumer of KCS Energy Risk Management, EPRI Fuel Supply Seminar, Tampa, Florida, October 13-15, 1993

The economic consequences of fuels with high price volatility are magnified further by the way in which utilities must pick which generation units to operate. Electricity demand is not constant. It varies significantly season-to-season and hour-to-hour. In the short run, utilities minimize cash cost outlays by operating first those units with the least "cash" cost per kilowatt-hour (kWh) (Economic Dispatch). Because gas prices usually exceed coal prices, coal-fired units are normally dispatched first. Gas-fired unit efficiency deteriorates significantly when operated at partial load conditions. Thus, the risk of higher fuel prices is compounded by economic dispatch choices that produce lower efficiencies for the remaining units, especially if fueled by gas.

Presently, developers of power plants view the capital cost risk of coal-fueled technology to be greater than the price volatility and risk of gas-fired technology. Showing developers the improvements in coal-fueled technology and efficiency, along with lower capital costs, will help make coal-fueled technologies more attractive and ensure their continued competitiveness with generation from other fuels. Section III of this report discusses the ongoing improvements in those areas, along with the necessity for continued funding to demonstrate these improvements. Other issues which affect the consumption and economics of coal include utility deregulation, externalities, technologies, and foreign trade. These topics, as well as a brief discussion of the impacts of coal on national security, are reviewed in the balance of this report.

COAL BURNING TECHNOLOGY AND R&D

Current Initiatives

U.S. energy policy emphasizes the maximum utilization of all of its domestic energy resources in a clean, efficient, and cost-effective manner. Coal, oil, and natural gas have been central to meeting the nation's energy needs, accounting for more than 85 percent of the primary energy supply. Current domestic energy policy anticipates increased demand for electricity, foresees continued use of fossil fuels for power generation, and emphasizes a commitment to a cleaner environment. Over the last two decades, the U.S. has achieved dramatic reductions in both waste generation and air emissions associated with fossil fuel use through a combination of regulations, research and new technology development, and successful applications.

Funding of Research & Development Initiatives

Funding for most research and development has been attained through a combination of governmental and private sector initiatives, such as DOE's Clean Coal Technology Program. This program focuses on supporting demonstration of advanced technologies for the production of clean coal fuels and generation of clean, efficient, and cost effective electricity to meet the nation's energy and environmental needs into the 21st century. Also, private sector businesses and universities are recruited through economic incentives to assist DOE in achieving its domestic policy objectives.

However, the FY 1997 administration budget request for fossil fuel research and development reflects the continued trend begun with the FY 1994 request of significant increases in natural gas research and development funding, with large decreases in coal technology R&D. Environmental issues, particularly global climate change concerns, appear to drive the overall funding levels. A continued decline in coal R&D will prove to be short-sighted, ultimately raising the cost of electricity for all U.S. consumers and negatively affecting our global competitiveness.

The likely result of deregulation of the electric industry is a decrease in R&D funding from the private sector. As the regulated business environment for public utilities disappears, providers of electricity will be pressured to reduce present and future costs of production. Electric utilities, which are major consumers of fossil fuels, will be less willing to expend funds on research and development or demonstration programs applying new technologies. Many utilities have already withdrawn from the Electric Power Research Institute (EPRI), the major provider of research for this industry. Internal research and development has also been decreasing. Continuing down this road could place the U.S. in the undesirable position of having reduced federal research and development funding as the pressure mounts on the private sector to reduce its R&D programs.

U.S. Policy Determinants

The general public and policy makers are today confronted with a cornucopia of opinions, facts, information, and misinformation about the detrimental impacts that fossil fuels and, in particular, coal have on the global environment. While DOE's stated policy objective is to maximize utilization of all domestic energy resources, the reality is that it has advocated one resource to gain competitive advantage, often at the expense of another. Public policy issues should not be guided solely by competitive factors.

Rather than a continual shifting from advocating one fuel to another based upon perceived acceptability standards, the desired course should be a domestic energy policy that is balanced in its make up and application. The issues faced are global in nature, the analytical science utilized to measure impacts is just now becoming understood, and policy makers are often left with no broad consensus upon which to make decisions. Allocation of federal funds to support research and development should be based upon long-term domestic energy policy objectives that recognize the economic availability and application of all domestic fuel sources. While programs like the Clean Coal Technology Program will come to an end, continued collaborative research by the coal industry and the federal government is vital to advancing breakthroughs in efficiency. Continued support of the development and demonstration of coal-based technologies will, in the long-term, assure U.S. consumers (taxpayers) of a continued supply of reliable, low-cost electricity.

Policy Considerations

Public input is a driving force in the establishment of U.S. policy. With effective communication of information, accurate public perceptions are established and serve as the basis for the formulation, application, and eventual implementation of long-term domestic energy policy. Science is of little value if its findings are not disseminated nor well understood. Too often, short-term issues, generated by poor communication and lack of understanding, adversely impact long-term objectives.

Such a circumstance may have contributed to the recent decreases in federal funding of clean coal research and development. At a time when maximum utilization of domestic energy resources and continued progress toward exceptionally clean and efficient technologies are needed, just the opposite is occurring. Total funding for fossil energy research and development is down, while natural gas funding has increased. With more than 55 percent of electric utility generation coming from coal, cutting research and development of clean coal technologies and their demonstration and application is counter productive.

U.S. consumers want reliable, low-cost electricity. Coal is the best available means to accomplish this, with the resulting positive impacts on the economy. In order to ensure this goal for the future, coal must retain its prominence in the domestic energy mix. To achieve the concurrent goal of a clean environment, funding for research and development of efficient and clean coal combustion technologies must continue.

It is crucial in supporting an increase in R&D funding that a factual picture of coal consumption replace the misperceptions behind its use. DOE should take a lead role in promoting coal as a vital component of the national energy policy. Formulation of comprehensive educational and communication programs will be necessary to achieve balanced, long-term domestic policy objectives. The federal government, in cooperation with the private sector, environmental and consumer groups, and the public, must come to an understanding of what is best for the nation. Broad-based advocacy of a comprehensive energy policy, with clean coal playing an integral part, is needed. An effective communications effort with the public, and existing and new members of Congress regarding the necessity for R&D funding to achieve these goals is critical. Otherwise, the short-term issues, driven by negative public perceptions and confusion, will continue to impede DOE's ability to achieve the long-term domestic policy objectives of the nation.

IMPLICATIONS FROM DEREGULATION OF THE UTILITY INDUSTRY

In November 1995, the National Coal Council published its report "The Implications for Coal Markets of Utility Deregulation and Restructuring." This report analyzed the ongoing changes in the electric power industry and determine the near- and long-term effects on the coal industry.

The report made the following observations and conclusions:

1. In the short-term (two-to-five years), there may be a significant increase in coal demand, stemming from higher utilization of existing facilities with access to low-cost coal and the closing of older non-competitive plants.
2. Over the next five years, most of the increasing demand for electricity will be met by other fuels.
3. In the mid-term (five-to-ten years), and continuing into the longer-term, there is a potential for coal use to grow if one or more events occur:
 - a) The price of alternate fuels, primarily natural gas, rises or is perceived as likely to rise substantially relative to the price of coal.
 - b) New organizational partnering among coal suppliers, transporters, and users is developed to reduce coal's cost relative to other fuels.
 - c) Either existing or new coal technologies decline sharply in cost and in the time required to construct such projects.

Capital Costs of New Baseload Generation.

A key long-term implication of utility deregulation is the construction of baseload generation plants. In the short-term, gas-fired plants are being recommended because they have low capital costs of construction combined with low forecasted gas prices. Based on current natural gas prices, the construction of gas-fired plants can be economically justified. Construction of gas-fired plants often fills a shorter-term need for peaking capacity to supplement baseload nuclear and coal plants, even though they cost more to run. Longer-term, coal and natural gas represent the primary alternatives for new baseload capacity. The combination of higher than forecasted real price increases for natural gas and changes in coal technologies may well favor coal in the future. In most regions, coal appears to be the logical choice in the post-2005 time frame for baseload capacity additions, except where gas has a local advantage.

In the short-run, utilities are averse to committing more capital than absolutely necessary. In a competitive environment, capital additions will impact their ability to compete and to earn a reasonable rate of return. The uncertainties about recouping stranded investments deters utilities from making additional capital expenditures during the current deregulation implementation period. Thus, there is a risk that electricity shortages could develop in the mid-term.

The focus of a national energy strategy must include a goal of providing, in the long term, low-cost electricity necessary to support a robust economy, and a goal of decreasing dependence on imported oil. Achieving these goals requires ongoing advances in coal-fueled combustion technology. To remain competitive, coal technology will need to keep pace with the recent increases in efficiency and decreases in capital cost of gas-fired technology. Advances in clean coal technologies, such as integrated gasification combined cycle technology, will provide significant competition against natural gas when considering overall costs.

Retirement of Nuclear Units.

Nuclear power currently represents about 100 Gigawatts (GW) of electric utility generating capacity in the U.S. or about 22 percent of all electric utility generation. While nuclear plants are capital intensive, fuel costs are low, meaning variable costs of generation are generally low. Thus, nuclear units are usually dispatched before coal-fired units. The improvements in capacity factors of nuclear units have been achieved by more efficient refueling practices (lessening outage times caused by refueling) and more efficient and productive operating and maintenance programs. The average capacity factors at nuclear units were below 70 percent prior to 1991. In 1995, this improved significantly reaching over 78 percent. This trend is expected to continue and average capacity factors are forecasted to reach 80 percent by the year 2000.

With nuclear power providing a key portion of baseload electric generation in the U.S., a critical issue is whether or not these plants will be relicensed or retired when their initial 40-year operating permits expire. The EIA, in its 1997 Annual Energy Outlook, states: "Many Nuclear Plants will near the end of their 40-year operating licenses by the end of the forecast horizon. Of the approximately 100 gigawatts of nuclear capacity available in 1996, 38 gigawatts are assumed to be retired by 2015 - primarily during the last 10 years of the forecast". Coal and natural gas can be expected to be called upon to fill this void. Clearly, U.S. energy policy must incorporate all options available for both coal-fueled and gas-fired generation to most economically replace lost nuclear generating capacity.

Development of Clean Coal Technology.

In a deregulated environment, the primary focus of utility companies and other power producers will be to provide electric power at competitive rates. As a consequence, funds available for research, development, and demonstration of clean coal technologies and new technologies will likely be curtailed significantly. The burden of funding improvements in technology will likely fall to the equipment manufacturers and the Federal Government. To ensure continued availability of low-cost electricity and ongoing environmental improvements, emphasis should be placed on building upon the advancements in clean coal technologies from the Clean Coal Technology program. Research is critical for the continued use of coal as a fuel for electric power generation, given the environmental regulations that are currently in place, and new laws created in the future. The consequence of not funding this clean coal technology is likely to be a substantial increase in power generation costs, translating into higher electricity costs for consumers in the long-term and a negative impact on jobs and the economy.

Future Directions of the Electric Utility Industry.

As the industry moves from a cost-based regulated entity to an open market deregulated environment, utilities are becoming more averse to capital spending in the shorter-term to remain competitive. Some utilities have the burden of stranded investments that complicate their ability to compete.

Utilities will also be less willing to put money into research, development, and demonstration due to the pressure to keep budgets lean. At the same time, environmental pressures will continue to demand further emission reductions, particularly for NO_x, CO₂, and particulates.

Increasingly, stringent environmental regulations make it very difficult to outline a course of action for the future with regard to generation mix. Due to capital construction costs, nuclear power is disadvantaged in a deregulated environment and little, if any, new nuclear capacity is likely to be built in the U.S. Image, regulatory concerns, and waste disposal issues further complicate the nuclear picture. Less clear is what will happen with relicensing of the existing nuclear plants when their permits come up for renewal. Loss of nuclear generating capacity will have to be made up by other generating types since renewable energy sources are limited and are currently above market price; leaving coal and natural gas to fill the void. Natural gas has the advantage in the near-term as it is less capital intensive. In the long-run, however, coal will be the key to a least-cost electricity industry contributing to a steady improvement in air quality, as long as efficiency improvements, environmental advances, and research and development keep pace. The ultimate goal is stability of supply and price of fuel for future electric generation. Coal fits the bill.

IMPORTANCE OF COAL TO NATIONAL SECURITY AND GLOBAL COMPETITIVENESS

Coal has played a pivotal role historically in national security and will continue to do so in the future because of its abundance and low cost relative to other energy sources. A key component of national security and global competitiveness is maintaining affordable and abundant supplies of secure energy within U.S. borders to prevent potential vulnerability from international events. Coal is a "strategic asset" for the U.S. That role is based on coal's comparative advantages relative to other domestic and international energy sources, including: (1) abundant recoverable reserves sufficient to meet demands for almost 270 years at current rates of consumption; (2) the adoption of advanced technologies for mining, preparation, etc., supported by a well-capitalized industry; (3) an increase in productivity associated with the new and advanced technologies; and, (4) a decrease in real prices of coal primarily reflecting these productivity gains.

For the past quarter of a century, the U.S. had a stated policy of reduced dependence on imported oil. Efforts to reduce such imports have, however, been more difficult than initially envisioned. Low oil import prices have stymied domestic oil production. Table I.1 shows that net imports will continue to rise. U.S. imports of oil have increased from 3.2 million barrels per day in 1970 to 7.9 million barrels per day in 1995. Furthermore, EIA projections for imported oil in the 1997 Annual Energy Outlook range from 10.8 million barrels per day in 2015 to 15.9 million barrels per day, depending on price. Imported oil would then amount to well over half of our nation's total consumption. That would further obstruct achievement of the goal of energy independence needed to protect against recurrence of such events as the oil embargo of 1973-1974 and disruptions of 1980-1981, the extraordinary economic impact of inflation during the 1970's, and the significant threats posed by political instability in the Middle East and the Iraqi invasion of Kuwait in 1990.

TABLE I.1
IMPORTED OIL CONSUMPTION IN THE U.S.*
(MILLION BARRELS PER DAY)

	<u>Petroleum Products Supplied</u>	<u>Total Production</u>	<u>Net Imports</u>	<u>Percentage Imports**</u>
1970	14.7	11.3	3.2	22
1975	16.3	10.0	5.9	36
1980	17.1	10.2	6.4	37
1985	15.7	10.6	4.3	27
1990	17.0	8.9	7.2	42
1995	17.7	8.3	7.9	45

*Source EIA/Annual Energy Review - 1996

**Net imports as percentage of petroleum products supplied.

Adding to our inability to stem the tide of imports, natural gas reserves, which have increased with new discoveries, have not been sufficient to replace increased annual consumption. Operating problems and ever increasing safety and environmental regulations have contributed to the problem of displacing imported energy with domestic sources. History shows us that as the demand for natural gas has risen, so has its price. More natural gas reserves may be discovered, but without advanced technology, exploration and production costs will continue to rise. Recent innovations, such as 3-D seismic exploration, computer and satellite imaging, and horizontal drilling, may allow natural gas to remain competitive in the future.

A further concern must be the increasing imports of natural gas. In 1995, net natural gas imports represented 12.4 percent of total gas consumption. The EIA forecasts that this could increase to 14.0 percent in 2015. While most of these imports come from a relatively stable source of supply, Canada, they represent a drain on our balance of payments and our competitive position.

The United States imports a small amount of Liquefied Natural Gas with the potential for increased amounts over the next 25 years. In 1996, all of this Liquefied Natural Gas came from Algeria, a politically unstable area which bears watching from an energy security standpoint.

On the international front, the unpredictable environment further underscores the necessity of a national energy strategy that emphasizes the use of domestic resources and minimizes dependence on foreign supplies. There are indications that worldwide oil consumption is growing at a vastly accelerated rate. A further complication that does not bode well for the U.S. is the number of

predominately European nations that have adopted policies to greatly increase their reliance on natural gas, imported mainly from Russia, Africa, the Middle East, and Algeria.

When former President Carter signed the National Energy Act of 1978, coal's share of electric utility generation was only 44.2 percent. This has increased to over 55 percent, helping to enhance energy independence and national security. To successfully move further away from dependence on imported energy, programs aimed at increased utilization of coal as a source of low-cost electricity will further the electrification of our country. Technologies that use electricity, such as electric vehicles, will help attain that goal, making the U.S. less vulnerable to supply interruptions or inflationary pressures. Maintaining a defense system that is capable, in part, of ensuring a source of imported oil is a continuing strain on the U.S. economy. With continued government support for technological improvements, the coal industry can expand its role as a supplier of dependable, low-cost energy with political and economic security advantages that other energy sources cannot provide.

CONCLUSIONS

U.S. consumers want a reliable, low-cost supply of electricity in the future. The vision for the coal industry over the next 25 years reflects a desire to retain or improve coal's contribution in keeping electricity prices low. Increased coal production and reduced coal prices achieved by increased productivity, improved mining technology, and consolidation of a well-capitalized coal industry provide a secure base for U.S. energy. Continued focus on electrification will have a positive impact on GDP, jobs, the environment, a strong national security policy, and less dependence on imported energy. Federal R&D, along with private sector funding, will ensure that coal keeps electricity prices low and efforts continue to increase efficiency and steadily decrease emissions. Energy policies should encourage the economy to tap the strengths of all fossil fuels to ensure that future generations will have low cost electricity. Supporting coal development should be a key part of this program.

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SECTION II

ENVIRONMENTAL ISSUES

INTRODUCTION

An obvious linkage exists between the coal and utility industries that is expected to continue for at least the next several decades -- utility boilers account for almost 90 percent of U.S. coal consumption, while more than 55 percent of U.S. electric utility generation is produced from coal. Because of this linkage, environmental constraints that cause utilities to alter their fuel mix or method of burning coal will have direct impact on the price of electricity and on the U.S. coal industry.

As the debate develops over environmental issues, there is the potential for fundamental change in the role that coal plays in ensuring a reliable and inexpensive electrical supply. With electricity demand predicted to grow by as much as 2 percent per year, a shift away from a plentiful domestic coal supply means notable increases in the cost of generating electricity and disruptions in electricity supply, with the resulting negative impact on jobs and the economy.

CLEAN AIR ACT IMPLEMENTATION

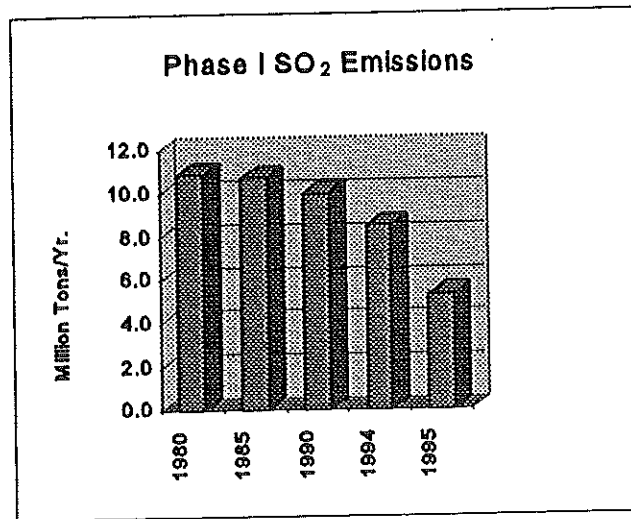
Sulfur Oxides

In 1970, total generation of electricity in the U.S. was 1,639.8 billion kWh. That doubled to a level of 3300 billion kWh in 1995. During these 25 years, utility emissions of sulfur oxides decreased from 17.4 million tons to 12.1 million tons, a 30 percent reduction. In response to the Clean Air Act (CAA) and amendments to it, the installation of flue gas desulfurization equipment and the conversion to low sulfur coal were the cause of these significant reductions. Further reductions are imminent through the industry's response to the Clean Air Act Amendments of 1990.

Title IV of the Clean Air Act Amendments of 1990 established requirements for major reductions in SO₂. To accomplish these reductions, a nationwide cap of 8.9 million tons of SO₂ was instituted on electric generating units. The SO₂ reduction program is being implemented in two phases. Phase I began January 1, 1995, involving 445 utility units at a reduction level of between 2.8 and 4.4 million tons per year of SO₂. Phase II begins January 1, 2000, and is expected to involve more than 2000 units, with the intended result of an overall 10 million ton reduction in annual SO₂ emissions from 1980 levels. The SO₂ emission rates during Phase I are limited to 2.5 lb/MBtu, while Phase II will lower the limit to 1.2 lb/MBtu.

Phase I Reductions. Based on 1995 emissions data, the 445 utility units in Phase I have reduced emissions by more than one-half from the 1980 level. Figure II.1 shows an emission level of 5.3 million tons of SO₂ in 1995 as compared to 10.9 million tons in 1980. These utility units succeeded in reducing 39 percent more than the 1995 emissions limit of 8.7 million tons required by the Clean Air Act Amendments of 1990.

FIGURE II.1



All 21 states in which Phase I units are located have seen reductions in their SO₂ emissions. These reductions were accomplished through a combination of switching to lower sulfur fuel, installation of control technologies, and reduced utilization of Phase I units.

Phase II Reductions. Reductions at Phase II units are anticipated to be even more significant across a larger scale. Some 2000 units, almost every steam-electric utility facility in the 48 contiguous states, will have reduced SO₂ emissions as of January 1, 2000. Phase II is projected to yield a 10 million ton annual reduction of SO₂ emissions, capping at 8.9 millions tons per year.

These reductions will be accomplished primarily by building upon Phase I achievements -- coal switching and installation of post-combustion removal technologies. Increased use of lower sulfur coal could translate into a corresponding increase in lower sulfur coal prices. However, early projections of price increases during Phase I never substantially materialized. Scrubber technologies may not be a prominent compliance method in Phase II until after 2005, and coal washing may be more common as higher sulfur mines seek to maintain market share. Lower sulfur western coal use may increase because it has low NO_x emission characteristics.

Short Term SO₂ Ambient Standard.

Section 109 of the Clean Air Act requires that EPA establish National Ambient Air Quality Standards (NAAQS) for a specific number of pollutants, including sulfur dioxide, particulate matter smaller than 10 microns, carbon monoxide, ozone, nitrogen oxide, and lead. EPA is statutorily required to review these standards every five years to assess ceiling levels for individual pollutant concentrations. These standards determine the degree of control imposed on existing sources and restrictions on new sources.

On May 16, 1996, EPA announce that it would not revise the SO₂ standard, though it considered adopting a 5-minute SO₂ standard due to concerns over health risks posed by short-term ambient peaks. Given the natural variability of sulfur content in a shipment of coal, normal operation may indicate that a source is contributing to a short-term exceedance of the ambient standard. Averaging time is critical for coal-burning facilities, as a short-term SO₂ standard can be difficult to meet.

Under a short-term ambient standard, facilities that are reducing emissions by switching to lower sulfur coal would have to procure coal with considerably lower sulfur content to avoid exceedances related to natural sulfur-in-fuel variability. For facilities using scrubbers, typical process upsets that result in short-term increases in emissions would be counted as exceedances. The current standard averages momentary upsets with extended periods of normal operation to determine compliance.

Even though EPA decided that a short-term SO₂ ambient standard is unnecessary to protect public health, the American Lung Association announced on July 19, 1996, that it intends to mount a court challenge against maintaining the current SO₂ standard. The Environmental Defense Fund brought an unsuccessful challenge in 1988 on a similar issue. EPA, in its latest decision not to revise the standard, concluded that any health risks associated with short-term SO₂ peaks "are localized in nature and therefore do not pose a significant public risk at a national level."

Fine Particulate Standard.

The fine particulate standard (PM₁₀ : <10 microns in size) is another NAAQS currently under review. In July of 1996, EPA's technical staff recommended adoption of a 24-hour PM_{2.5} standard. This new standard would likely be about 50 percent more stringent than the current PM₁₀ ambient standard. The current standard is dual in nature. It limits ambient level PM₁₀ concentrations to 150 µg/m³ over a 24-hour period, and an annual average limit of 50 µg/m³.

The reported primary concern associated with fine particulate matter is its ability to enter and reside in lung tissues undetectable by the immune system. A controversial report by the Natural Resources Defense Council suggests that premature mortality can occur from exposure to particulate air pollution. The study, however, has never been submitted to a professional journal for peer review. Some experts have observed that the study overestimates the mortality rate by approximately one-fourth. The research leaves undefined what might cause increased mortality rates. Additional research is needed to quantify the role of secondary factors, such as lifestyle, before a causal relationship can be established.

The particulate matter that the standard regulates is not just visible smoke and soot, it is invisible aerosols formed from gaseous pollutants. Over one-half of this matter emitted in the eastern U.S. is sulfur-related sulfate particles. The utility sector contributes 72 percent of this matter.

Particulate matter is primarily controlled by electrostatic precipitators or fabric filters. However, indirect or so called "precursor pollutants," such as emissions of SO₂ and NO_x, are not effectively controlled by these means. These gaseous combustion byproducts are converted in the atmosphere into fine particles in the range of one micron or less, and not covered by the current PM₁₀ particulate standard. Efforts to reduce SO₂ and NO_x emissions under Title IV will also reduce particulate emissions. EPA released a draft revised standard in late December 1996, with the final rule targeted for approval in June 1997. President Clinton has directed EPA through Executive Order 12866 to

evaluate the air quality benefits from changing the particulate standard in relation to the costs. After months of reviewing the fine particulate issue, the Clean Air Scientific Advisory Committee has not reached consensus on the level, averaging time, or form for a new standard. This Order also directed a similar evaluation on revising the ozone standard. While industry is hampered in doing cost/benefit analyses until a standard is proposed, it is clear that additional controls or fuel switching will be needed to meet a more stringent standard, and the number of areas in non-attainment for particulate would significantly increase.

Acid Deposition Standard

Section 404 of the Clean Air Act Amendments of 1990 required EPA to review the acid deposition standard. The Report to Congress concluded that such a standard was not needed. This conclusion is supported by a recent U.S. Geological Survey study that noted a 10 percent - 25 percent reduction in rainfall acidity, particularly in the Midwest, Northeast, and Mid-Atlantic Regions. This reduction correlates with Phase I SO₂ reductions and this trend should continue as Phase II controls are implemented. However, the State of New York has challenged in court EPA's conclusions regarding acid deposition standards.

Nitrogen Oxides

Major reductions in NO_x from electric generating units were targeted in Title IV of the Clean Air Act Amendments of 1990. EPA set a standard in 1994 that was overturned in court. The current NO_x emission standard for Phase I tangentially-fired and wall-fired boilers (collectively known as Group I boilers) are 0.45 lb/MBtu and 0.50 lb/MBtu, respectively. These standards only apply to coal-fired units. Phase II begins on January 1, 2000, with a projected cumulative NO_x emission reduction of between 26 and 29 million tons through 2010.

NO_x reductions can be accomplished by combustion and post-combustion control methods. A common approach involved retrofit with low-NO_x burners. These burners alter the fuel-burn pattern and lower NO_x emissions. Switching to western coals with higher moisture content can also reduce NO_x emissions, an added benefit to its generally lower sulfur content. Post combustion techniques involve selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) of NO_x from the flue gas. The CAA and a 1994 D.C. Circuit Court of Appeals ruled that tangentially-fired and wall-fired units are not required to install more than low-NO_x burners in order to meet the emissions standard. If, after installing low NO_x burners, the limit is still unattainable, a petition can be made for a less stringent alternative.

Phase I Reductions. The national NO_x emissions data for 1995 is not yet available, but 1994 numbers indicate a 5 percent reduction from Phase I since 1985. Gauging from states that installed emission controls early, 1995 NO_x emissions should drop considerably. For example, in Georgia, a state that had most emission controls installed in 1994, NO_x emissions fell 45 percent between 1985 and 1994.

EPA has proposed more stringent Group I standards during Phase II. Tangentially-fired boilers would meet a 0.38 lb/MBtu standard while wall-fired boilers would have to annually average 0.45 lb/MBtu. EPA predicts that these new limits, when implemented in 2000, will decrease NO_x emissions by 200,000 tons annually.

These proposed new limits may be so restrictive that many utilities will be forced to apply for alternative emission limits. DOE has concluded that only about 55 percent of Phase II Group I boilers can meet the proposed standard. Incorporating over-fire air standards will mean significant costs to coal-burning units.

Phase II Reductions. Phase II NO_x reductions will involve approximately 2000 additional boilers. In addition to tangentially-fired and wall-fired boilers, are the Group II boilers, including cell-burners, cyclones, wet-bottoms, and vertically-fired units. These units, under the recently finalized emissions standards presented in Table II.1, would have to comply with limits of 0.68 lb/MBtu, 0.86 lb/MBtu, 0.84 lb/MBtu, and 0.80 lb/MBtu, respectively. Tangentially-fired and wall-fired boilers would have to meet Phase I limits or any revised standards. Collectively, these new standards are projected to reduce nationwide NO_x emissions by over 600,000 tons annually when fully implemented in 2000.

There is a significant difference in cost for Group I and Group II boilers. DOE estimates that Group I boilers can comply with the new standard for approximately \$260 per ton of NO_x reduction. Removal costs for cyclone boilers, of which a large number are Group II boilers, would be up to \$830 per ton.

TABLE II.1
NO_x EMISSION LIMITS
(lb/MBtu)

	<u>Group I</u>		<u>Group II</u>			
	Tangential	Wall	Cell	Cyclone	Wet	Vertical
1995 (Phase I)	0.45	0.50	-	-	-	-
2000 (Phase II)	0.40	0.46	0.68	0.86	0.84	0.80

Source: U.S. Environmental Protection Agency.

Ozone Transport Commission/Ozone Transport Assessment Group.

Section 187 of the CAA Amendments of 1990 established the Ozone Transport Commission (OTC) to address regional transport of pollutants that contribute to ozone non-attainment of a NAAQS in the Northeast. The OTC includes 11 states and Washington, DC.

Section 176 of the Act provided EPA with the authority to establish additional Transport Commissions to address broader regional issues pertaining to transported pollutants. These efforts have merged to form the Ozone Transport Assessment Group (OTAG), encompassing 37 states in the Northeast, Midwest and South. OTAG was formed in response to the region's inability to achieve ozone compliance deadlines. EPA agreed to withhold statutory sanctions while OTAG worked to solve these ozone non-attainment problems.

OTAG is considering a cap-and-trade program for NO_x emission modeled on the SO₂ allowance program. While the Clean Air Act does not provide EPA the authority to implement such a program,

one could be established with consensus of the 37 states. EPA's goal is the reduction of seasonal NO_x emissions from the current 3 million tons from utility sources to less than one million tons.

Concerns have been expressed over the economic implications of implementing OTAG. If OTAG is unsuccessful and EPA fails to achieve excepted emissions reductions through state or federal implementation plans, FERC says it will issue a Notice of Inquiry and a Notice of Proposed Rulemaking to try to implement an emissions mitigation program. FERC indicates that they have authority under the public interest provisions of Sections 205 and 206 of the Federal Power Act. Coal-burning utilities may be required to implement further NO_x controls to address ozone non-attainment and ozone precursor transport issues in the eastern U.S.

Ambient Ozone Standard

The ozone NAAQS declares an area in non-attainment if an ambient monitor records concentrations in excess of 0.121 ppm for one hour on three occasions over a three-year period. The degree of exceedance determines an area's designation of non-attainment, including marginal, moderate, serious, severe, and extreme. Since passage of the 1990 Amendments, several areas have reached attainment and petitioned EPA for reclassification as an attainment area.

EPA's proposed standard revision may be a 0.07 - 0.09 ppm eight-hour average. These changes are on the same track as the particulate matter rulemaking published as a draft in December 1996, with a final decision due by June 1997. Suggestions have been raised of individual monitor readings being weighted based upon surrounding population density or averaged across a geographic area. While substantial progress has been made in reducing ozone levels in many cities, implementation of a more stringent standard will impact previously unlisted areas and areas that have recently been reclassified. Areas still categorized as non-attainment will have greater difficulty coming into attainment.

Hazardous Air Pollutants

The 1990 Amendments required EPA to assess the danger to public health of Hazardous Air Pollutants (HAPs) from utility sources. EPA evaluated risks from radionuclides, arsenic, chromium, and dioxin and reportedly determined the concerns to be generally low. The report on regulating these emissions was originally due to Congress by November 15, 1993. Drafts of this delayed HAPs report indicate that EPA concluded mercury was of greatest concern. In the spring of 1996, EPA indicated that it would issue its HAPs report jointly with a mercury study, which was due to Congress by November 15, 1994. Controversy surrounding the mercury research has caused continued delays. On October 4, 1996, EPA released an interim utility air toxics report, indicating that inhalation cancer risks from coal-fired power plant emissions are less than one-in a-million at all but two power plants. All non-cancer risks from substances like hydrogen chloride (HCl) and hydrogen fluoride (HF) are more than 140 times less than the level of concern.

EPA raised concern with power plants' contribution to elevated fish mercury concentrations. EPA will not finalize this analysis until two crucial mercury epidemiological studies are completed and peer reviewed.

Mercury

The Departments of Energy and Commerce, several Congressional members, and utility groups have urged EPA to de-couple the HAPs and mercury studies. This push is primarily related to early

indications that two additional mercury research efforts may counter EPA's current findings. EPA, however, is under court order to issue a final report by December 30, 1996. EPA has chosen to await completion of the two new studies before they issue their report.

Regulation of mercury or other HAPs raises great concern to the utility industry. Monitoring and control of such emissions is expensive and relatively unpredictable. Experience in the utility industry is limited regarding control technologies. Electrostatic precipitators are very effective at removing low-volatility trace metals from the flue gas stream. But, mercury vaporizes in the combustion process and tends to remain in a gaseous state making removal difficult, particularly in the low concentrations in which mercury exists in utility flue gas.

CLEAN AIR POWER INITIATIVE

The Clean Air Power Initiative (CAPI) was established by EPA to address the effects on the power generation industry of future air pollution controls for nitrogen oxides, fine particulates from sulfur dioxide, and mercury. CAPI has been touted as the best way to craft a single regulation to control electric utility emissions for the next 10-15 years.

EPA has conducted a series of meetings and will publish a white paper summarizing the electric utility generation modeling, project emission trends, and proposed scenarios for accomplishing the goals of the CAA in a more cost effective and collaborative manner. EPA points to three options for implementing these goals: 1) staying on the current path of pollutant-by-pollutant regulation; 2) a cap and trade program accomplished through State Implementation Plans (SIPs); or, 3) a voluntary incentive program providing for early reductions and safe harbors. Congressional authority will be needed to depart from the current regulatory scheme.

Mercury has been dropped from the initiative, but a call for sharp voluntary reductions in NO_x and SO_2 is anticipated. EPA has proposed NO_x emission rates of between 0.15 and 0.25 lb/MBtu for utility sources and reduction of SO_2 emissions by 50 percent or 60 percent in 2005 or 2010. EPA would compensate with long-term safe harbors from additional regulation. Industry groups are concerned about how a safe harbor provision might be implemented and how secure it would be.

For coal-fired utility plants, proposed lower limits for NO_x could only be achieved with SCR. Such significant capital expenditure runs counter to utility efforts to reduce overhead prior to deregulation. Moves away from coal and toward natural gas could occur. The proposed SO_2 reductions would also dictate the installation of control technologies (scrubbers), utilization of lower sulfur coal, and additional shifts away from coal use.

Preliminary OTAG modeling indicates that transported NO_x from the Midwest and Southeast to the Northeast is less of a problem. In fact, the significant reductions proposed by CAPI could exacerbate the problem in certain cities.

It is too early to project the outcome of this initiative. Industry, in general, is not prepared to concede additional emission reductions outside of existing law without regulatory certainty regarding future emission reductions.

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GLOBAL CLIMATE CHANGE

Background

"Global climate change" refers to the effects of global warming and ozone depletion caused by an increase in the concentrations of greenhouse and other gases from human activities. Atmospheric concentrations of some greenhouse gases have increased markedly in the last 150 years resulting from fossil fuel combustion, deforestation, and other human activities and natural processes. Continued increases in atmospheric concentration of greenhouse gases will affect the earth's radiation balance and may cause an additional amount of greenhouse warming. While there is consensus about the increase in greenhouse gas atmospheric concentrations, there is major scientific uncertainty about the impact on the climate or what future alterations may occur. Some scientists believe that much of the increase in greenhouse gas concentrations over the last 150 years is responsible for the increase in the average global temperature of about 0.3 to 0.6°C (0.6 to 1.1°F) over the last 100 years. Other scientists believe that the historical temperature record is highly uncertain because of many factors, such as inadequate geographic coverage, changes in measurement techniques and urban heat island effects, and the level of increase that falls within the range of natural climate variability. There is also data showing wide variations in the average global temperature even prior to the industrial revolution.

Framework Convention On Climate Change

In 1992, the U.S. became a signatory to the Framework Convention on Climate Change (FCCC). The FCCC was the product of eighteen months of negotiations following the release of the 1990 Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment of Climate Change. The 1990 IPCC report stated that the Earth had warmed approximately 0.5° C in the last 100 years, and that a portion of the warming may be human-generated through emissions of greenhouse gases such as CO₂. The IPCC also called the change in temperature within the bounds of natural variability. Based on highly uncertain general circulation models, the IPCC guesstimated the climate change associated with a doubling of CO₂, expected in the mid-Twenty First Century, would be 1.5-4.5°C. The likely result would be a global mean temperature increase of about 1°C by 2025 and 3°C before the end of the next century. The FCCC directed Annex I Parties (basically developed countries) to implement programs and actions "aimed" at returning greenhouse gas emissions to 1990 levels by the end of the century.

In October 1993, the Clinton Administration released the Climate Change Action Plan in response to the FCCC. This plan represented the first major step toward a national policy for addressing the climate change issue. The plan identified voluntary initiatives for reduction of greenhouse gases by federal government agencies. In conjunction with this, DOE and the electric utility industry developed the Climate Challenge Program showcasing innovative ways to reduce, avoid, and sequester greenhouse gas emissions as an alternative to mandatory command and control type programs. DOE and the Edison Electric Institute (EEI) estimate that the current commitments to the program should reduce approximately 175 million metric tons of CO₂ (47 million metric tons of carbon) by the year 2000. Electric utility industries achieved the most significant reduction of the U.S. industry sectors targeted in the Climate Change Action Plan.

At the first meeting of the Conference of Parties (COP) to the FCCC held in Berlin in 1995, it was argued that commitments of Annex I countries were inadequate to stabilize atmospheric

concentrations of greenhouse gases at a level that prevents "dangerous interference" with the climate system because most developed countries would not meet their current commitments by the end of this decade. This "Berlin Mandate" called for negotiation of a protocol or other legal instrument to enhance the commitments of Annex I Parties beyond 2000. In its 1995 Second Assessment Report, the IPCC lowered resulting temperature change from the "business-as-usual" emissions by one-third and the sea level rise by 25 percent from the 1990 projections. Even though the IPCC was unable to lower the level of uncertainty surrounding this issue it still went so far as to state "... the balance of evidence suggests that there is a discernible human influence on global climate."

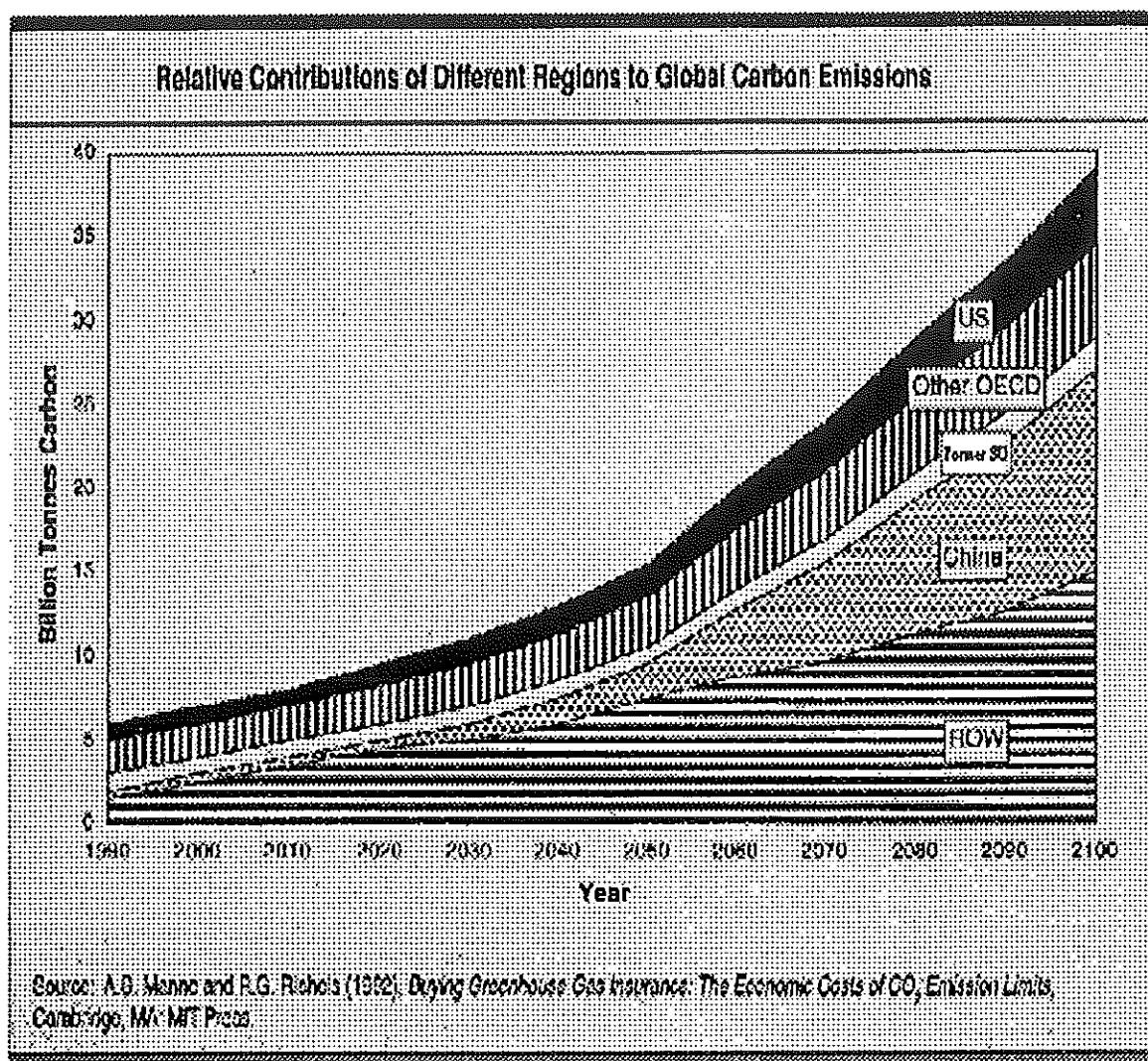
In reality, the developed world cannot stop the growth in greenhouse gas emissions because most emissions will originate in the developing countries. Even if the U.S. and the rest of the Organization for Economic and Cooperative Development (OECD) cut carbon emissions to zero, worldwide emissions would more than triple by the year 2100 primarily because:

- Predicted use of known coal resources in China, India, and Russia alone ensure that without their cooperation, policies aimed at reducing or stabilizing greenhouse gas emissions would fail; and,
- Global population growth and rapid economic development underway largely in developing countries are fundamental contributors to increased emissions of greenhouse gases.

A further complication is that developing countries have no commitments under the FCCC to limit the growth of greenhouse gas emissions. Figure II.1 estimates global emissions of carbon through the year 2100 by major regions.

While there is no consensus on the effect of "man-made" greenhouse gas emissions, about 7 billion tons (3.4 percent) of the approximately 207 billion tons of CO₂ released annually into the atmosphere result from human combustion of fossil fuels and deforestation practices. In 1992, 72 percent of all electric power generated in the U.S. used fossil fuels, resulting in production of 473 million tons of carbon. U.S. utilities contribute about 7.0-7.5 percent of the global "man-made" CO₂ emissions, roughly 0.25 percent of the global annual CO₂ emissions. CO₂ alone comprises half of any greenhouse gas atmospheric radiation; the rest would be caused by increases in other greenhouse gases.

FIGURE II.1



Berlin Mandate Negotiations

The Berlin Mandate calls for the negotiation of a protocol or other legal instrument to enhance the commitments of Annex I Parties for the period beyond 2000. An Ad Hoc Group on the Berlin Mandate (AGBM) is charged with elaborating policies and measures, setting quantified emissions limitations and reduction objectives within specified time-frames, and not introducing any new commitments for non-Annex I Parties. These negotiations are to be completed in early 1997 so adoption can occur at the third meeting of the COP in December of 1997 in Kyoto, Japan.

Legally-Binding Targets and Timetables and Coordinated Policies and Measures. U.S. public policy shifted at the July 1996 negotiating session when representatives stated that voluntary programs had "failed," and realistic but legally-binding targets to limit emissions of greenhouse gases within Annex I countries were required. While no specific target or timetable was proposed, the U.S. opposed internationally-coordinated policies and measures, adding that a 20 percent reduction by 2005 [the protocol of the Alliance of Small Island States (AOSIS)] was "unrealistic and unsupportable." The

U.S. delegation made clear its support of a cap on greenhouse gas emissions in the U.S. The delegation's written statement supported a medium-term goal or target past 2005, and a "longer-term concentration goal (e.g., for the next 50-100 years)" to achieve the ultimate objective of the Convention. This objective is to stabilize atmospheric concentrations of greenhouse gases, not merely to gain a small incremental reduction in emissions. According to the IPCC, a 60-80 percent reduction in global emissions is required to stabilize atmospheric concentrations.

The U.S. called for "cost effective and flexible policies (including emissions trading among nations) to achieve the greatest reductions at the lowest cost." This "trading" would be limited to Annex I Parties and others that we "can bring along in the negotiations." No details are available on how emissions trading would function or how international compliance would be verified and enforced.

Other target and timetable proposals being considered are:

- AOSIS - 20 percent reduction in CO₂ from 1990 levels by Annex I Parties by 2005.
- Germany - 10 percent reduction in CO₂ from 1990 levels by Annex I Parties by 2005, and a 15 percent-20 percent reduction by 2010.
- United Kingdom - 5 percent-10 percent reduction in CO₂ from 1990 levels by Annex I Parties by 2010.

Among the list of internationally coordinated policies and measures that have been considered includes:

- Carbon taxes
- Appliance efficiency standards
- Automobile fuel efficiency standards
- Generating station thermal efficiency standards
- Removal of fossil fuel subsidies
- Environmental taxes or penalties
- Tradable emissions permits

Joint Implementation. During the AGBM sessions, the U.S. agreed to restrict joint implementation to Annex I Parties. The U.S. policy statement at the Ministerial Session referred to meeting the medium-term target through maximum flexibility, including activities implemented jointly and trading mechanisms. Within the FCCC, activities implemented jointly (AIJ) is different than "joint implementation" (JI). AIJ is a program for pilot projects similar to JI, but restricted in scope and no credit is accrued. The U.S. delegation repeatedly clarified its position on joint implementation among all Parties with credits in AIJ terminology.

The U.S. proposal would allow no credits for reductions in emissions that result from joint implementation projects in developing countries. Continued restriction on credits for JI in developing countries would result in loss in economic benefits of 60 percent, estimated by EPRI and others, derived from lower compliance costs with emissions reductions. This decision could increase compliance costs under binding targets by roughly 0.5 percent of global GDP. The resultant impact on coal consumption would be significant and devastating.

Costs. Choosing dramatic near-term emissions reductions can prove less cost-effective than other paths, according to recent EPRI economics research. To achieve cost-effectiveness, emissions could continue to rise on a "business-as-usual" path through the early decades of the next century, stabilize at levels higher than currently observed for several additional decades, and only reduce well into the second half of the next century. Selecting these more efficient paths would allow technology to develop and the science of climate change to eliminate much of the uncertainty surrounding this issue.

According to EPRI, the short-term costs of CO₂ control will escalate if mitigation and the required level of achievement are increased. According to EEI, new proposals that stabilize carbon dioxide emissions for the electric utility industry at 1990 levels would require a 25 percent reduction from projected 2005 levels and a 49 percent reduction from 2015 levels, continuing upward in the later years. Stabilization or reduction of CO₂ emissions impacts significantly upon the electric utility industry and its customers. Annual compliance costs to the industry -- including incremental cost of fuel, O&M, capital, and demand side management programs -- range from \$24 billion in 2005 to \$91 billion by 2015. The price of electricity could climb from 7 percent by 2005 to 23 percent by 2015. These price increases would be in addition to the "normal business" costs and compliance expenses expected with the Clean Air Act Amendments of 1990.

A very recent analysis of the costs associated with a 20 percent reduction in CO₂ by as early as 2010, is an extremely striking illustration of the dramatic impact of an AOSIS proposal. The economic consequences to the U.S. with adoption of an AOSIS-type proposal are staggering. Reducing emissions by up to 20 percent from the 1990 levels by 2010 will mean a hike in carbon tax rates in the range of \$200-\$300 per ton of carbon emitted (1990\$). The effect on the GDP would likely be a drop of 1.5-3.5 percent. While the impact of a carbon tax across industries will vary depending on energy usage, the hardest hit would be energy producing industries such as coal, oil, natural gas, and electricity. The price of electricity will increase, significantly altering the standard of living of all Americans.

It is critical that all parties participate in the solution. Despite the many scientific uncertainties and the tremendous costs and competitiveness issues associated with near-term response measures, the U.S. and numerous other governments worldwide continue to be actively involved in the FCCC and the Berlin Mandate negotiating processes.

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A RESTRUCTURED INDUSTRY

Predictions of negative environmental impacts from increased competition in electricity markets assume dramatic increases in coal-fired generation, based on a continued price advantage of coal-fired over gas-fired generation. If that price advantage narrows, coal-fired generation becomes less desirable.

This issue was addressed in detail in the FERC Environmental Impact Statement (EIS) related to Order 888 on wholesale transmission access. In that EIS, the FERC indicated that increased emissions from coal-fired generation related to open competition for wholesale markets depend upon the price of coal relative to natural gas. While low gas prices would decrease emissions, low coal prices would increase emissions by 2 percent. FERC deemed that mitigation was unnecessary because this is a negligible increase.

Parties that disagreed with FERC's conclusions in the EIS suggested additional emission controls on coal-fired generation. These parties, including the EPA, Northeastern states, and a small group of utilities, mentioned two possible control options: 1) a cap and trade program for nitrogen oxide emissions; and, 2) the implementation of an "environmental comparability" regime on all existing generation.

Cap and Trade

To address continuing ozone non-attainment in parts of the eastern U.S., one option could be a large (up to 75 percent) reduction of nitrogen oxide emissions from coal-fired power plants in the region. NO_x emissions would then be capped at the lower level and any increases could only occur under an emission trading scheme similar to the sulfur dioxide trading program in Title IV of the Clean Air Act Amendments of 1990. Achieving large NO_x reductions would require the massive implementation of selective catalytic reduction technology over and above current requirements, and hiking the cost per ton of NO_x removal from coal-fired plants from approximately \$200/ton for low-NO_x burners to as high as \$2,000/ton for SCR.

While trading of emission allowances would lower the absolute cost of a NO_x control program, large scale SCR installation would still be required. Many issues require resolution concerning a NO_x trading scheme including the role of industrial NO_x sources, trading during "peak" ozone seasons, and mobile sources. NO_x trading requirements would be much more complex than SO₂ trading under CAA.

Environmental Comparability

Applying an "environmental comparability" standard is another suggested option. Essentially, every existing coal-fired plant in the U.S. would be retrofitted to meet new source standards defined under the CAA to provide "fair" competition between new and existing power plants. Every plant would be required to install flue gas desulfurization for SO₂ control and selective catalytic reduction for NO_x control, and to meet more stringent technology requirements for water discharges. The result would be billions added to the cost of coal-fired generation and rendering allowance trading moot for SO₂ or NO_x.

Considering that over 55 percent of the U.S. electric utility generation is coal-fired, an "environmental comparability" requirement would have a drastic impact on the use of coal. And, consumers would never see the projected cost savings of increased competition in generation.

ENVIRONMENTAL EXTERNALITIES

Despite significant emissions reductions by electric utilities, a push continues by some environmental groups and regulators to reduce further coal consumption by assigning an estimated economic value/cost to emissions for use by power plants in assessing electricity supply and demand options. This assessment tool is based on the theory of externalities, which represents the environmental cost or benefit to society excluding consideration of the price for production or consumption of a good or commodity such as fuel.

Regulatory commissions in a majority of states have considered but not yet implemented procedures to address externalities. Latent interest remains for incorporating monetized externality values into electric utility resource planning and acquisition on the state public utility commission level. Such interest could become more immediate if and when valuation methods and estimates become more accepted.

Implications

Requiring utilities to add monetized externality values directly to project costs in determining the mix of resources which minimize all costs, including environmental impacts, may adversely affect future use of coal resources. If the externality values used are not based on accurate estimation or monetization of damages, the results would yield no benefits while harmful to the economy. If externalities are applied only in the capacity bidding process, a resource with a potentially higher wholesale cost than coal could be chosen.

Requiring externality values in dispatch of existing and new generating plants would also impact future coal consumption. Utilities currently dispatch generating units on an economic basis. Dispatching on an environmental cost basis would be determined by the estimated lowest "social" cost (e.g., actual marginal plus externality costs). If the valuation of externalities becomes a requirement for dispatch of electric generating units, coal-fired power plants would be at a disadvantage in the dispatch order, causing a likely reduction in coal consumption and a sharp rise in electricity prices.

This would especially be likely if the externality values are not accurate representations of net economic impacts. The greater the overstatement of impact, the more adverse the economic result

of using the externality value. High "proxy" values fell out of favor in large part because they failed to reflect actual impacts of pollutants. If externality costs only apply to utilities under state or FERC jurisdiction, then unregulated electric generators (i.e., municipalities, cooperatives, and industrial self-generators) may gain a competitive advantage and capture larger electric power market shares by being free to produce power from any fuel source, including coal.

Studies by EEI, EPRI, and electric utilities have concluded that environmental dispatch would substantially increase the production cost of electricity as compared to traditional dispatch. There is no clear evidence that environmental dispatch would improve emissions reductions beyond current achievements. As it is doubtful that adding externality values to the dispatch price of electricity would achieve socially optimal benefits at a reasonable cost, DOE should advocate against mandatory environmental dispatch to protect U.S. consumers continued access to low-cost electricity.

CONCLUSIONS

Coal-fueled generation technologies have continued to respond successfully to ever stricter environmental laws and regulations. But, the uncertainty of future environmental laws and regulations creates substantial risk for the power generator in making decisions on the type of fuel to be used. Additional environmental laws and regulations that are not based on sound science can significantly reduce the competitiveness of one fuel over another.

Pending environmental issues such as short-term SO₂ standards, a fine particulate standard, additional NO_x reductions, and air toxics all have had the effect of steering electric utilities away from low-cost, coal-fueled generation. Environmental comparability and the potential to further penalize coal-fueled generation with environmental externalities add more long-term risk to today's decision-makers. Also, the threat of CO₂ reduction targets and timetables has had a chilling effect on the decisions by electric utilities to build coal-fueled power plants or even retrofit older plants with efficient clean coal technologies.

If these pending laws and regulations come to pass, or stringent global climate policies are put into place, coal will be disadvantaged. Meeting newer, stricter standards will become more difficult and costly, even for new plants based on clean coal technologies. This will lead to significant increases in the cost of electricity, with negative impacts on our nation's economy, jobs, and standard of living. Increased involvement by DOE in these issues and policies is key to balancing environmental goals with our nation's demand for low-cost electricity and its goal of energy independence.

SECTION III GENERATION AND END USE TECHNOLOGIES

INTRODUCTION

The long-term goals for coal-fueled technologies are to provide environmentally benign, reliable, and low-cost energy for electric power generation and co-generation, synthetic liquid and gaseous fuels, and other direct applications. Reaching these goals is critical to U.S. global competitiveness and continued economic health. Success will depend upon a variety of external trends and advances in technology. In today's increasingly competitive industrial environment, the focus is on the near-term. The Federal government and, in particular, DOE must look toward mid-term and long-term development and initial application of technology to achieve these goals. The vision for twenty-five years from now is clear -- making coal the premier clean fossil fuel.

Trends

In 2020, coal will still be the dominant fuel for power generation and will be making initial contributions to synthetic fuels for selected applications. The trends key to realizing this vision during the next 25 years will be stable or declining coal prices, abundance of supply, and more efficient and cost-effective end-use technologies. Oil and, to a lesser degree, natural gas will experience price increases and a growth in imports to meet rising demand. Even with a dramatic increase in gas use, coal will remain vital to prevent significant expansion of the trade deficit and dramatic increases in capital spending. Barring drastic changes in re-licensing requirements and public and business perceptions, nuclear electricity generation will decline with no new capacity additions on the horizon.

Use of renewable energy will see growth, but comparatively higher costs and limited availability and reliability (around the clock, 365 days per year) will limit the extent that it will affect market share. Electricity use (see Table III.1) will continue to increase. Finally, continuing environmental protection concerns will push up cycle and emissions control efficiency, reducing the emissions per kilowatt hour. These trends implicitly assume that major dislocations do not occur during the period, such as blackouts that lead to utility re-regulation, an oil embargo or cut-back, or a binding CO₂ target.

Vision 2020

Detailed study by the NCC and its working group together with input received from numerous expert individuals (See Appendix F) indicates that based upon these trends and reasonable technology advancements, electricity is expected to be produced from a flexible network of large centralized facilities and medium-to-small sized distributed power sources. Coal will be the major fuel for the existing and new centralized facilities where economies of scale and cost-effective environmental protection combine with a low-cost fuel to provide reliable, economic generation costs. Distributed generation facilities will generally rely on non-coal fuels, although coal-derived synthetic gas and liquid fuels may prove cost-effective. High capacity, very long distance (low energy loss) transmission systems will bring power to urban centers.

TABLE III.1
PROJECTED TOTAL U.S. ELECTRICITY GENERATION

	Year				
	1995	2000	2005	2010	2015
Total Generation (billion kWh)	3362	3665	3948	4207	4483
Coal Generation (billion kWh)	1714	1843	1902	1992	2103
Coal Share (%)	51	50	48	47	47
Coal- Fired Capacity (1000 MW)					
Utility/NUG	305	299	298	304	315
Cogeneration	8	9	9	9	10
Total	313	308	307	313	325
Coal-Fired Capacity Additions (1000 MW) (5 Year Total)	--	4.3	7.5	8.5	15.2

Reference: Extracted from DOE/EIA, Annual Energy Outlook, 1997 (1/15/97), Tables A8 and A9.

The new, large, remotely-sited centralized facilities will be highly efficient -- reducing costs and CO₂ emissions -- and ultra-clean -- approaching the low emission rates from natural gas combustion. Any byproducts will either be converted into useable raw materials -- gypsum, sulfur, and sulfuric acid -- or applied in highway construction, as soil enhancement, or for mine reclamation. Fuel blending and co-firing will provide minimum cost fuel input in appropriate applications and locations, and advanced instrumentation and controls will ensure optimal coal use.

A transition will result from deregulation. In the near-term, electricity supply growth will be addressed by capacity increases and life extension at existing cost-effective plants, repowering of selected older plants, or small unit additions up to 300 MW to control capital expenditures. Owners will minimize balance sheet costs while financial institutions adjust to these new markets. In the long-term, large minemouth plants, built to minimize transportation costs, will transmit power to users "over the wires," necessitating significantly expanded transmission facilities to accommodate power wheeling over long distances.

Facilities will also be located in energy intensive industrial centers where co-generation of power and heat will increase efficiency. For industrial load centers using coal, transportation costs will be added to the delivered coal prices, requiring a high efficiency rail transport system and cleaner fuels for transport.

Distributed power generation will provide electric power production at industrial and commercial sites, and potentially for residences. Only the largest sites will use coal. Other sites will rely on oil, gas, and biofuels unless reasonably priced coal-derived gas and liquid fuels can be produced.

The year 2020 could see commercial expansion of synthetic liquid and gas fuels and chemicals derived from coal. This depends upon a sufficient differential between coal and other fossil fuel prices, and significant technology and application advancements that reduce the delivered price of coal-derived fuels. Application as a transportation fuel could provide an economic trade-off among oil, natural gas, electricity, and synthetic fuels.

Direct coal-use applications (except electrical power) will utilize unique attributes of coal to a process or economic advantage. The largest of these will be the steel industry where technology improvements provide incremental energy savings and significantly reduced emissions.

Achieving this future vision requires clarity. Environmental regulations continue in flux. The Middle East oil supply remains volatile. The actual level of growth in Asia and other developing areas is unclear. The speed with which China and India will shift from imported to domestic fuel (impacting fuel markets in the U.S., Australia, South Africa, and Poland) will depend upon completion of their infrastructure. Energy technology development and commercial adoption involve years of work, high initial capital costs, and risks. Current business pressures have industry focused on the short-term, increasing the uncertainty for longer-term technology development. One thing is certain: coal use will dramatically increase over the next 25 years in developing nations with or without improved technology.

COAL-BASED POWER GENERATION TECHNOLOGIES IN 2020

Capacity expansion through 2020 will be met with evolutions of today's leading advanced systems, incorporating increased efficiencies and reduced capital and operating costs. The following highlights select systems. A more comprehensive coverage is provided in these National Coal Council reports:

- 1) "Clean Coal Technology for Sustainable Development, February 1994.
- 2) "A Critical Review of Efficient and Environmentally Sound Coal Utilization Technology," May 1995.

Advanced Pulverized Coal (PC) Boiler Systems

PC systems will evolve with technological improvements and higher capacity factors. PC will provide the lowest capital cost option at a lower cycle efficiency. Contemporary systems operate at efficiencies in the range of 33-38 percent. By 2020, it will be greater than 42 percent, perhaps approaching 48 percent (note: all efficiencies listed are based upon the higher fuel heating value or HHV). Improvements will be driven by pressure increases up to 6000 psia (41 MPa), steam temperatures up to 1200° F (650° C), use of waste heat recovery, reduced auxiliary power usage, and selected plant-wide changes. Primary pollutants will be minimized: 95-99 percent SO₂ removal with advanced scrubbers; 99.5-99.75 percent particulate control; and, 90-95 percent reduction in NO_x through a combination of combustion and post-combustion technologies. Ash and other byproducts will take on usable forms.

DOE programs, like Combustion 2000, provide incentives and critical support to achieve this vision. Emission control technologies including combustion and post-combustion options top the list. High-temperature, corrosion-resistant materials will permit projected efficiency gains if work continues. Future programs include waste heat recovery/utilization, optimization of co-generation opportunities, balance-of-plant equipment, and co-firing of other fuels. Construction costs will dip further with continued modularization and smaller, more efficient components.

Integrated Gasification Combined Cycle (IGCC) Systems

This technology has the potential to become one of the cleanest, most efficient means of producing electricity from coal. IGCC, basically a pre-combustion clean-up system, converts coal into a clean gaseous fuel for combustion in a high efficiency combustion turbine, utilizing waste heat in a steam turbine system. Potential pollutants are converted to marketable byproducts such as elemental sulfur or sulfuric acid. There are eight major IGCC technologies being demonstrated, which provide cycle efficiencies of 38-41 percent. Future improvements, including combustion turbine advances and hot gas clean-up, promise efficiencies of 45-48 percent. Hot gas clean-up will remove 99 percent of the sulfur and produce a range of useable byproducts. Capital costs will remain higher than for pulverized coal systems because of IGCC's greater scope and complexity. But, these costs will potentially be offset by higher efficiencies, use of low-cost coal, and the sale of byproducts. IGCC also offers retrofit/repower of both natural gas and coal-based systems with high efficiency technology.

DOE's support for IGCC technology through the Clean Coal Technology Program is a major step toward achieving successful commercialization. Demonstrations are vital to address the "nuts and bolts" problems of any new commercial power systems, determine availability and reliability, evaluate real costs, and provide a test bed for future technologies. Without these demonstrations, IGCC will not be a viable option by 2020. Achieving longer-term efficiency of IGCC systems will be possible with: advancement of hot gas clean-up systems to remove ash, sulfur, and other pollutants without cooling the gas to below 1400° F (760° C); high-temperature materials for the radiant cooler, and integration of advanced combustion turbine technology. Capital and operating cost reductions will remain a challenge and further full scale demonstrations are required as advanced systems are incorporated.

Pressurized-Fluidized Bed Combustion (PFBC)

This offers a high efficiency coal-based combined cycle system. A fluidized bed is operated at high pressures to cleanly burn coal and generate steam, providing a clean exhaust gas to drive a gas turbine. SO₂ is removed in the bed. NO_x formation is minimized in the fluidized bed and final control achieved through post-combustion SNCR or SCR. Significant reductions of NO_x formation during combustion can be gained through systems for advanced combustion turbines. The first generation is nearing commercialization, offering cycle efficiencies of approximately 40 percent, with sulfur retention of 95 percent and low NO_x emissions with post-combustion controls. Second generation systems, targeted for 2020, will achieve cycle efficiencies greater than 45 percent by integration of a partial flow carbonizer (mild gasification) to gasify parts of the fuel, resulting in clean gas to boost the gas turbine inlet temperature. This technology is well-suited to repowering existing boiler systems to increase capacity and reduce emissions.

The Clean Coal Technology Program of the Department of Energy has made it possible to test systems integration at large scales, determine availability and operability data, evaluate real costs, and optimize the systems. To achieve long-term efficiency of second generation PFBC systems, focus must be on integrating the carbonizer, topping combustor development, advancing high temperature gas filtration to remove particulate matter, and high temperature materials. Capital and operating cost reductions remain a challenge. Additional full scale demonstrations are required.

Additional Systems

A variety of systems can provide smaller blocks of power (25-250 MW) where unique fuel, size, location, application, and co-generation potential exist. Circulating fluidized bed combustion systems are expected to continue being the technology of choice in 2020 for direct combustion of coal as well as low grade fuels. These systems limit SO_2 and NO_x while operating at cycle efficiencies of 34 percent and overall energy utilization greater than 80 percent with co-generation/steam supply. Improvements to this mature commercial technology continue to evolve.

By 2020, one or more of the following systems will be available to supplement intermediate coal-based power systems: 1) indirect- or externally-fired combustion turbines; 2) coal-fired diesel combined cycles; 3) fuel cells and fuel cell/gas turbine-combined systems with potential efficiencies of over 60 percent when combined with coal gasification; and, 4) co-firing and blending of fuels where site specific economic opportunities exist for biomass waste, sludge, petroleum coke, or another low cost fuel (an example is blending biomass and coal in a high temperature gasifier coupled to a combustion turbine).

CO_2 is classified as one of the greenhouse gases, along with methane, nitrous oxide, chlorofluorocarbons, and other trace gases. Based on the potential effects on global climate change, the coal industry is studying ways to mitigate the growing CO_2 emissions from global coal use. To date, improvements in cycle efficiency (more electricity for the same fuel input) and conservation (less electricity use) have proven most cost-effective. Large reductions in CO_2 emissions will require development of technology for the recovery, transportation, and eventual disposal (sequestration) of CO_2 with: 1) dramatically lower power and energy consumption; 2) improved overall cycle efficiency; 3) reduced initial capital costs; and, 4) lower operation and maintenance costs.

Conversion Technologies

Production of synthesis gas, liquid hydrocarbons, and other chemicals through conversion technologies will enhance coal's position with natural gas and petroleum products. Even if the price differential between coal and other fossil fuels widens as predicted, conversion technologies will only be possible with attention paid to technology improvements and innovative integration of power and gas/liquid products.

Conversion begins with generation of synthesis gas rich in hydrogen (H_2) and carbon monoxide (CO), the building blocks necessary to produce the final products. The synthesis gas can also be used directly in gas turbines with IGCC. Impurities are removed using conventional technology and energy is consumed as part of this overall process. Large scale production of synthesis gas from coal will require lower capital costs, ultimately through commercial IGCC systems. Other issues involve

reducing auxiliary power requirements and integrating the entire gasification/power/conversion process.

Synthesis gas conversion processes require active catalysts, many of them precious metals, which must be recovered or recycled. Innovation will be required to simplify the overall process if conversion technologies are to achieve their goals.

Low-cost hydrogen (the ultimate clean fuel) from coal will require full integration with the gasification process, advancements in catalysts, and improved hydrogen separation. Though synthetic natural gas (SNG) is unlikely to be a major contributor by 2020, the capability for competitive production should be feasible with improved catalysts and full integration of gasification, power, and SNG conversion plants. While commercial production of methanol from coal remains economically unattractive, technology advancements for process, catalyst, and heat recovery (including co-production with power generation and other chemicals) could enhance its future viability. After 20 years of R&D, Fischer-Tropsch (F-T) indirect liquefaction has achieved only limited commercial exploitation, and technology breakthroughs will require more research to be an attractive process by 2020. Direct production of liquids from coal has been demonstrated (Exxon Donor Solvent and H-Coal processes), but at too high a cost (\$35-40/bbl) for commercialization. Commercial size direct liquefaction of coal may occur by 2020 if oil prices become unstable and cost reductions are achieved. A comprehensive overview of this technology is provided in the 1995 National Coal Council report: "A Critical Review of Efficient and Environmentally Sound Coal Utilization Technology."

COMPETING NON-COAL TECHNOLOGIES FOR POWER GENERATION

The non-coal-based option for generation of electricity and heat by 2020 will include:

- Combustion turbines firing natural gas
 - Simple cycle
 - Combined cycle
- Reciprocating engines
- Fuel cells
- Hydro-electric
- Nuclear
- Selected renewables and waste fuels

The competitiveness of coal will largely depend upon relative fuel prices, availability, transportation costs, environmental protection regulations, and technological successes. Current projections indicate a widening price differential between coal and natural gas. Meeting demand will mean increased gas imports which will push gas prices up (even with technology advances). Advances in mining technology and a more competitive marketplace will send coal prices downward. Tighter emissions standards are not expected to put coal in an "economically" impossible position. Hydro-electric resources have already been fully utilized except for the very smallest sizes, which might be better classified as distributed power. Nuclear power will still be struggling with public perceptions, and the newest "passively safe" advanced systems may receive consideration late in this period. Finally, renewables and waste fuel systems will grow but, like distributed power, will meet market niche

requirements with little penetration in the overall U.S. power market. Thus, the major competitors to coal for electric power generation will be: gas-fired combustion turbines (with and without combined cycle); reciprocating engines; fuel cells; and power from selected niche fuels (renewables, waste fuels, and OrimulsionTM). Gas-fired combustion turbine (simple and combined cycles) electricity generation will provide the bulk of the power competition; though, combustion turbines can also be operated successfully on coal-derived gasified fuels. Diesel, fuel cells, and niche fuels will be competitive in the distributed generation area.

FUTURE POWER SYSTEMS: CENTRALIZED AND DISTRIBUTED GENERATION

General Power Systems

The overall power system by 2020 will comprise centralized and distributed sources with a more flexible delivery system. The backbone of this system will be centralized, largely coal-fired, electricity generating facilities plus a flexible dynamic transmission system capable of moving large blocks of power over greater distances. Coal will be vital in supplying energy to these baseload and intermediate-load centralized facilities where high cycle efficiency and stringent emissions control are most effectively addressed. Distributed power systems of a few hundred kilowatts to over a hundred megawatts will supplement these systems at a 5-10 percent range of total installed capacity, with most firing natural gas. Coal will only be a direct major fuel source for distributed power systems at large industrial facilities where fluidized bed combustion can provide effective process steam production, power generation, and emissions control. It is possible that coal-derived liquid and gaseous fuels may power combustion turbines, diesels, or fuel cells at distributed sites.

Centralized Generation Facilities

Major coal-based technologies -- Advanced Pulverized Coal, IGCC, and PFBC-- will undergo a design evolution as a part of new installations in 2020. These new installations will be highly efficient and clean, with useable byproducts. Selection among these options will be based upon production economics (capital, operating, and total costs), with greatest usage for baseload operations where capital assets are most effectively utilized. Existing facilities will either be upgraded, repowered, or shut down depending upon site specific economics. Coal cleaning will be employed where economically beneficial.

Centralized intermediate and peaking facilities will rely on coal, oil, and gas to meet fluctuating power needs. Natural gas-fired combustion turbines and, where applicable, combined cycle plants will provide much of the load following capability. Once proven, fuel cells using natural gas or clean coal-derived syngas may be utilized in larger distributed power facilities in centralized generation plants where waste heat is used in a combined cycle system.

Distributed Generation Facilities

"Distributed power generation" will significantly evolve over the next 25 years. Generally, this entails siting small, individual, modular power generation systems with capacities ranging from 100 kW to 20 MW throughout a service area, connected to a distribution/sub-transmission system. Several hundred megawatt units may be used at some sites. Distributed power generation already exists with on-site generation (co-generation) for large industrial and commercial customers, although only a small part of total generation. The current market for small (1-20 MW) power generation gas-fired

turbines and diesel/reciprocating engines for peaking or continuous service (excluding standby) is 1000 MW, or about 650 units per year. These units have been installed to meet in-house loads and provide reliability. As the concept evolves, it could: 1) be initiated by the large power generators; 2) involve part or full ownership by large power generators; 3) be sited alone or at a customer facility; and 4) be partly or fully dispatched/operated remotely by electric power grid control systems. Strategic issues under evaluation include: overall economics; effect of delaying transmission and distribution system expansion and upgrades; and overall reliability enhancements.

Today, distributed power generation technologies are predominantly diesel and internal combustion engines and small gas turbines. Photovoltaics, wind energy, biomass, and other renewables fill niche applications while fluidized bed combustion of coal and waste fuel are used in larger industrial facilities. By 2020, improvements in these technologies will be supplemented with advanced technology fuel cells, fuel cell and gas turbine combined systems, energy storage, and improved (lower cost) photovoltaics. These systems must be totally automated, self-contained, low-cost, highly reliable, and requiring minimal maintenance. Technical issues to resolve involve interconnection to the main power grid and control of a significant distributed network -- distribution grid capacity and overload, system security, and maintaining power quality (non-interrupt, voltage and 60 Hz frequency). Low usage (<1 percent) will involve minimal issues. If the contribution is 20 percent (in at least one local area), more issues arise. Advanced energy storage technologies will be key in maintaining the quality of the power system, expanding electrical grid facility throughput, meeting peak and back-up power needs, and expanding the application of many intermittent renewable services.

Widespread availability of distributed power by 2020 will depend upon:

- 1) Wheeling charges.
- 2) Electricity prices.
- 3) Price and availability of natural gas, distillate fuels, heavy oil, coal, and other options.
- 4) Capital and non-fuel operating costs.
- 5) Successful evolution of advanced systems (i.e., fuel cells, photovoltaics).
- 6) Level of integration of distributed power.
- 7) Environmental and regulatory requirements.

Technology development is keyed on:

- 1) Efficiency and emissions improvements in gas turbine and reciprocating engine systems.
- 2) Advancements in fuel cell, biofuels, and photovoltaic technologies to reduce cost and achieve automation.
- 3) Development of small scale reforming and gasification technology to provide economic and reliable fuel for gas turbines and fuel cell systems.
- 4) Creation of methodologies to control and operate remotely a system of large centralized power sources and a distributed network of generating assets.

- 5) Evolution of energy storage technologies with demonstrated reliability, reduced costs, and effective in response to load changes. Additional storage systems will be needed to support solar and selected distributed power systems.
- 6) Capability of co-firing coal with other fuels (e.g., biofuels).

TRANSMISSION OF ELECTRICITY

Issues

Effective transmission of electric power is vital in meeting the growing market driven power system of 2020. Of the 3200 billion kWh transmitted in power grids in 1995, less than 7 percent or approximately 207 billion kWh were transferred through regional interconnections. Bulk transmission between regions will escalate under deregulation requiring major upgrades and expansion. Annual electricity load growth of 1-1/2 to 2 percent over the next quarter century will require at least a 50 percent increase in load carrying capability. Opening access and wheeling of electric power in the near-term will require the ability to move large blocks of power effectively through the power grid, necessitating identifying and eliminating bottlenecks. These changes may affect system power quality (degree of interruptions, voltage, frequency) to the end user at a time when customers will demand high quality to run manufacturing processes and electronic components. Environmental issues and public concerns will complicate siting of new power transmission right-of-ways. In summary, issues in need of addressing include: higher efficiency (fewer losses); expanded infrastructure to carry the increased load (including the unknown costs of expanding the power grid); and amended public policy in the siting of new facilities.

Vision

Completing this vision of the system by 2020 will require significant technology advancements to expand load carrying capacity. The current system will provide the backbone for reaching 2020, with incremental improvements made to increase its effective capacity through the flexible alternating current (AC) transmission system. Sophisticated controllers and conditioning systems are used simultaneously to control both the voltage and power throughout the system, increasing total load carrying capability without disrupting the reliability and security of the interconnected power grid.

Additional right-of-ways and upgraded load carrying capability will permit the transmission of large blocks of power over long distances with minimal losses. This is key if power wheeling is to support a fully deregulated power supply market. These infrastructure improvements will permit remote siting of power systems at coal mines and transmission of power to users more than 1500 miles away. Ultimately, the local and regional transmission facilities must evolve to become a truly national power grid over the next 25 years, similar to the East Central Area Reliability (ECAR) system. This will involve billions of dollars in capacity upgrades and public support of additional right-of-ways.

Technologies

The broad range of control technologies grouped as Flexible AC Transmission Systems (FACTS), includes rather old and proven concepts plus newer unified power flow controllers which simultaneously control voltage and power. To operate FACTS in an increasingly dynamic power transmission environment will require new software and hardware. Superconducting magnetic energy

storage technology can supplement FACTS and maintain power quality with its dynamic operating benefits -- enhanced frequency regulation, transmission stabilization, and load-following capability.

Increasing long distance transmission with minimal power losses depends upon technology advancements. Direct current (DC) transmission offers lower losses, but the AC conversion equipment at the beginning and end make it too costly today for distances less than 500 miles. Technology must evolve from a point-to-point concept to a distributed system with many access points. DC transmission systems are in place in Europe and parts of the U.S.

Expansion of load carrying capability can be enhanced by the application of potential advanced high temperature superconducting cable systems and underground microwave transmission. While in the early stages of development, they may be the key to meeting long distance, low-loss needs.

The steps in development of longer-term, next generation fundamental technologies are high temperature superconductors (to increase temperature and develop manufacturing methods) and advanced storage systems. The prospects are good for high temperature superconductor research and other transmission-related technology. But, continued R&D is of paramount importance to enhance breakthroughs.

ELECTRIC TECHNOLOGIES

The consumption side of electricity offers a host of positive environmental and economic benefits that have gone largely untapped. Combining the efficient generation of coal-fired electricity with efficient useage can benefit both the economy and the environment by replacing direct combustion of other fossil fuels.

It has been assumed that increased electricity automatically means higher CO₂ emissions, especially when the electricity is produced by coal. However, switching from direct fossil fuel-fired equipment at an industrial or commercial plant to new electric technologies can reduce total energy use by improving end-use efficiency. Even accounting for electric power conversion efficiency and losses, lower emissions of CO₂ and other substances result.

U.S. electricity use has increased by nearly 70 percent over the last two decades, while total energy consumption has only climbed 10 percent because businesses and consumers have increased the use of electric technologies, displacing many direct-fired processes. Today, approximately half of the non-transportation primary energy consumed in the U.S. is first used to produce electricity, then used by the industrial, commercial, and residential sectors. This trend from point-of-use firing to electricity use is expected to continue.

Moving toward an electricity-dominated economy has numerous implications. The marketplace is less dependent on the availability of raw resources as coal provides a dependable electric power supply; partially insulated from upward fuel price swings as fuel constitutes one part of the total cost of electricity, and coal prices are projected to be stable or fall over the next 25 years; and prime for adopting new technologies because of the inherent flexibility of electricity.

During the last twenty years, the amount of CO₂ per dollar of GDP has declined by 50 percent. This is because the conversion from fuel-fired processes to electric end-use technologies has caused increases in productivity and output, while lowering the overall CO₂ emissions.

Industrial Applications

Electric technology will greatly impact the manufacturing industries that consume large quantities of energy: the primary metals, stone/clay/glass, chemical, petroleum refining, pulp and paper, and food industries. Combined, these industries consume about 10 quadrillion Btus of energy annually, primarily from oil, natural gas, and some waste products. Electric technologies will provide overall efficiency and productivity benefits, along with lower emissions of CO₂, SO₂, and NO_x.

Steel made with coal-fired electricity uses less energy and emits significantly less CO₂ than steel made in a conventional blast furnace. Switching from a blast furnace to an electric arc furnace cuts energy use by more than 70 percent and eliminates one pound of CO₂ for every pound of steel produced, including the energy and CO₂ required to make electricity. Conversion to electric technologies such as the electric arc furnace, plasma tundish heating, ladle preheating, and ladle refining has helped turn the U.S. steel industry around and made it more competitive in the global marketplace.

Table III.2 highlights the electric technologies that are available for use in commercial and industrial sectors. The table also shows the decreased energy use and CO₂ emissions benefit with each electric technology.

Transportation

Oil comprises more than 97 percent of all transportation energy, producing one-third of the total man-made CO₂ emissions in the U.S. Substituting electric vehicles for gasoline-powered automobiles, trucks, and buses would significantly lower CO₂ emissions. A greater short-term impact would be cuts in emissions of hazardous air pollutants, carbon monoxide, and nitrogen oxides. Replacing conventional gasoline-powered vehicles with electrical automobiles can result in emissions reductions of 90 percent for NO_x and 51 percent for CO₂, effectively tackling urban smog and ozone non-attainment problems, and lowering U.S. dependence on imported oil.

Food Service

Electric technologies have been a great benefit to the food service industry with microwave ovens, fast baking/heating ovens, electric steaming tables, induction fryers, electric barbecue grills, infrared heating, freeze concentration for dairy processing, and ultrasonic dishwashing. The technologies have enabled faster preparation of food, longer holding times, lower ventilation and air conditioning requirements, cooler kitchens, higher productivity, and, of course, lower energy costs.

Residential

Natural gas and electricity meet the vast majority of residential needs, with direct coal use at less than 1 percent. Beyond 2020, coal-based liquids or gases may fulfill part of the gas and oil demand. In the interim, expanded indirect use of coal through further electricity penetration in more energy efficient components provides a realistic alternative to premium gas and oil fuels.

TABLE III.2
COMMERCIAL/INDUSTRIAL APPLICATIONS FOR
ELECTRIC TECHNOLOGIES

<u>Electric Technology</u>	<u>Percent Decrease in Energy Use from Fuel-Fired Technology</u>	<u>Percent Decrease in CO₂ from Fuel-Fired Tech.</u>
Clothes drying, heat pump	72	67
Copper melting	42	32
Dishwashing, ultrasonic	98	98
Electric steel mill	50	42
Gas line compressor	50	42
Heat pump, geothermal	93	92
Magazine ink drying, UV	61	55
Medical waste destruction	11	34
Paint curing, infrared	89	87
Powdered coating curing, UV	80	78
Supermarket chiller	51	43
Toxic spill decontamination	22	27
Tube welding, resistance	34	23
Water purification	78	84

Source: Mills-McCarthy and Associates

CONCLUSIONS

Coal will continue as a dominant fuel source in the U.S. and the rest of the world. The coal industry faces challenges that can be overcome by adoption of environmentally sound, economically viable usage strategies and electric technologies.

The Federal government plays a critical role in achieving the vision of coal as a premier clean fossil fuel by facilitating the development and initial application of mid-term and long-term energy technologies following the lead established by the private sector. This role is being shaped by the near-term competitive pressures on the industry, increased attention to environmental issues, and the need for the U.S. to remain a leader in energy technology to maintain a global competitive edge.

With the shift to a deregulated power industry and intensifying global competition, the importance of this role cannot be understated; especially as the power industry is forced to turn its focus to:

1. Minimizing capital costs - not necessarily minimizing emissions or maximizing efficiency.
2. Reducing planning horizons to meet near-term needs.
3. Postponing mid-term and long-term research and development, crucial to future development, to avoid commercial risk.
4. Avoiding the financial risk of first-of-a-kind or early application of new energy systems.

At the same time, low-cost, abundant, and reliable electricity is key to U.S. competitiveness. With the worldwide explosion of information technology and globalization of equipment supply, low-cost, reliable electricity remains a major competitive advantage for the U.S. Energy resources, especially coal, are abundant, available, and low cost. Thus, U.S. competitiveness is contingent upon advances in the technology of extraction, transportation, conversion, and use of these energy resources in an environmentally acceptable manner.

Specific Technical Areas

The May 1995 NCC Report entitled "A Critical Review of Efficient and Environmentally Sound Coal Utilization Technologies," provided a comprehensive look at both near-term and long-term needs for coal utilization technologies. This Section highlighted some of the more pressing long-term needs in technology development and initial trials before technology can be adopted in the commercial marketplace. Among these trends are:

1. Large power systems: Improved environmental performance, including high temperature clean-up; development of higher temperature, stronger, and corrosion/erosion resistant materials; and, continued evolution of applied technology through full scale applications in order to accelerate adoption.
2. Advanced power technology: Key technology improvements -- design, materials, manufacturing -- are vital to reduce costs to competitive levels without long-term subsidies, while also meeting life and performance goals.

3. Coal Conversion to Liquid and Gaseous Fuels: Investigation of alternative concepts to provide breakthroughs in final fuel costs.
4. Distributed Power: Development of systems for the remote monitoring and control of an increasingly dispersed group of generating assets.
5. Transmission: Development of technologies which permit more flexibility, reduce line losses over very long distances, and expand the load carrying capability.
6. End Use Technologies: Provide incentives for the more rapid development and adoption of electricity and energy efficient systems.

SECTION IV INTERNATIONAL ISSUES

INTRODUCTION

There are several international negotiations underway which could affect the future of coal, namely the U.S.-Canada agreement on clean air and those within the context of the United Nations (U.N.). These types of agreements will potentially impact the worldwide consumption of coal in a variety of ways.

The U.S. Department of State has gained tremendous influence in shaping U.S. energy and environment policies. This leadership role will grow over the next several years as more and more issues are resolved on the international level. Evidence of this power shift became clear when the Clinton Administration, through the Office of the Secretary of State, announced that foreign policy will now include a clear environmental component on the same level as that of national security.

What this means for domestic consumption of coal is that the Department of State assumes an equal policy footing with the EPA and the DOE. And, it is feasible that the Department of State will become the lead government agency on coal issues in the fields of energy and environment. The following highlights this trend.

INTERNATIONAL VISION -- THE NEXT 25 YEARS

This report has taken a close look at the various actions that will change the consumption patterns of coal into the next century. Many of these changes will result from international agreements, treaties, and regulations. Pressure will mount on industries relying on coal to either use less or switch to another fuel entirely. To face these challenges head-on requires the coal industry to change the way it does business.

Producers and consumers must form partnerships similar to the close coordination established on environmental issues. The Clean Coal Technology Program administered by DOE is a perfect example of an effective partnership. A close working arrangement among producers, consumers, and equipment manufacturers will ensure that efficiency gains continue to be made both in the technological and environmental areas.

Mergers and partnerships in the electric utility industry are becoming routine. These kinds of arrangements, mergers, and joint ventures will broaden to include all types of energy firms, allowing coal producing and consuming businesses to partner with these large energy providing companies. Companies will need to offer a diverse menu of options to customers, with coal included. The key question will be how large a part of that menu will coal occupy?

Consider China. One out of every five people in the world today lives in China; that country has some of the largest coal reserves in the world. Coal can play a huge role in fueling the economic growth of China. This growth begins with the simplest of things such as an adequate amount of

energy to provide each Chinese citizen with a new pair of shoes or a 60 watt light bulb. Adding water purification, sanitation, hospital care, and other similar services that China will require points to the vital contribution to be made from energy derived from coal.

India is another example. One out of every eight people in the world lives in India. India, too, has large coal reserves that they plan to use. Improvements are needed to its coal industry infrastructure to enable the building of environmentally-friendly power plants using clean coal technologies. This, too, holds promise for U.S. business.

Internationally, the opportunities are extensive if the U.S. maintains a strong domestic coal industry. Doing so keeps coal on the menu of energy options with a pool of talent to serve as experts to compete in these foreign markets. Energy providers will find the international arena the focus of competition for customers. Just as the environmental challenges are becoming international, so too is the energy marketplace.

Coal consumption in the U.S. has tremendous growth potential. As nuclear power plants are retired, clean coal technologies are the likely replacements, causing coal consumption to increase. But, dramatic growth opportunities are ripe in foreign markets where a U.S. mining company works with a host government to produce and transport coal to their marketplace. U.S. industry will also be able to provide efficient clean coal technologies for use in that country's economy. The industry must remain flexible to take advantage of the opportunities presented as developing countries grow their economies.

If U.S. coal is not positioned to compete with other fuels in the international arena, it has little chance of success in that market. The coal industry must become more active in the international fora, such as the U.N. climate negotiations and other bilateral and regional negotiations, to insure its competitive position is not disadvantaged against other fuels. To do that, the industry must look at new ways to seize the opportunities to develop partnerships and joint ventures with other energy providers and with foreign governments. The DOE, in co-funding the Clean Coal Technology program, can help facilitate additional opportunities for the U.S. coal industry. More importantly, DOE must work closely with the Department of State to protect the interests of the U.S. coal industry.

FRAMEWORK CONVENTION ON CLIMATE CHANGE

The FCCC was signed in Rio De Janeiro in June 1992. That agreement established the COP to negotiate treaties, protocols, or other legal instruments which would limit the concentrations of greenhouse gases in the atmosphere to a level that would not pose a danger to humankind. The COP met twice and a third meeting is scheduled for the fall of 1997 in Japan. The results of negotiations within the COP process and its various subgroups will not be known until that meeting, and may remain unclear. However, there is intense pressure from several voting blocks within the U.N. for some limit on greenhouse gas (GHG) emissions. Proposed limitations range from 2005-2010 out to 2020. In the scientific community, as well as some environmental groups, there is talk of extending these time periods out as far as 2050.

Irrespective of the agreed-to time period and the established levels of GHG emissions, by agreeing to this negotiating process, the U.S. is no longer in control of its own destiny in terms of GHG

emissions control requirements. Because of the way in which the U.N. conducts its business, other countries will establish U.S. energy policy. This, in turn, could adversely affect U.S. competitiveness, GDP, and jobs. Economic activity that is displaced to countries less efficient than the U.S., may result in increased emissions. Such negative impacts are expected if the U.S. signs and ratifies the agreements reached by the COP.

Section II of this report addresses potential effects of GHG emission reduction policies on coal consumption, GDP, and the cost of electricity to U.S. consumers. Clearly, such reductions could have a dramatic impact on coal consumption. While the international negotiation process itself is based on science and economics, it would appear that the Department of State may be negotiating solely from an environmental standpoint.

The international deployment of efficient, clean coal technologies would help to lower both the growth rate of CO₂ emissions and the overall cost of meeting greenhouse gas emission reduction goals. This would be a direct result of the widespread utilization of low-cost coal reserves by these efficient technologies.

China provides a good scenario for analysis. Even with strong energy conservation measures, and a 16-fold increase in non-fossil energy use, China is projected to double its use of coal during the period between 1990 and 2050. If China were to deploy very efficient (50-60 percent) clean coal technologies, its carbon emissions would be reduced by over 400 million tons, a 50 percent reduction from what emissions would be using current technology .

If the U.S. could capture 25 percent of that market in China, the result would be increased exports of about \$1.2 billion per year, creating as many as 18,000 new jobs. The overall international benefit would be significant reductions in emissions of CO₂, NO_x, and SO₂, decreased costs to meet greenhouse gas emission reduction goals, along with direct benefits to our nation's economy.

LONG RANGE TRANSBOUNDARY AIR POLLUTION CONVENTION

Another convention within the U.N. dealing with emissions into the atmosphere is the Long Range Transboundary Air Pollution Convention (LRTAP). This convention is divided into several parts, each with its own protocol. There is a protocol on SO₂ emissions (which the U.S. has not signed), a protocol on NO_x, and negotiations are underway to add protocols on heavy metals and persistent organic pollutants. These negotiations are at different phases with varying completion dates, but all are scheduled for signing and ratification within the next three years, or sooner. In each case, the international community, under the direction of the U.N., is looking to require signatories to dramatically reduce emissions of all of these substances.

While coal consumption is not directly impacted by all of these protocols, it is clearly in the case of SO₂ and NO_x. Further emission reduction requirements will add to the cost of using coal, which could lead to coal's replacement by other fuels. This, again, is a case of the U.S. Government relinquishing total control over emissions requirements that will not only directly affect the environmental policy of the country, but also the energy policy.

U.S.-CANADA AIR TREATY; BORDER XXI PROGRAM; NAFTA

The U.S. and Canada have had a bilateral agreement on air pollution since the 1924 Trail, British Columbia smelter decision. The most recent agreement followed passage of the 1985 Canadian action to curb acidic deposition and the 1990 Clean Air Act Amendments. Negotiations in the 1980s were intense on the issue of transboundary acidic deposition. Renewed intensity may result when each country takes up reauthorization of their respective Clean Air Acts in the late 1990s.

In May 1996, the U.S. and Mexico signed the Border XXI Program to address common environmental issues relating to air, water, solid and hazardous waste, and pollution prevention. A part of this program is an agreement to work toward reducing air emissions in and around El Paso, Texas, and Juarez, Chihuahua. Implementation of the Border XXI Program will continue into the next century and could significantly impact coal consumption in both countries.

The environmental agreements contained in the North American Free Trade Agreement (NAFTA) are in their embryonic stages of implementation. It is clear that the three countries hold different perspectives on environmental protection. Issues of transboundary pollution in the air and water will clash with concerns over sovereignty, and compromise will result in the three countries losing complete control of their future from an environmental standpoint.

TAXES AND FEES

Coal production concentrates on domestic markets, even for incremental production. Like other commodities, there is an international market for coal. About 10 percent of the coal mined in the U.S. is exported. But, the taxes and fees applied to the mining of coal and to the coal itself have made it less competitive in the world market because of the price.

Taxes not only apply to mining, but to transportation of coal as well. For international markets, the coal must first go to a transfer facility or port for export, where taxes and fees are added causing further erosion of marketability. One example is the Inland Waterways Fuel Tax, which is levied on the diesel fuel used by the towboats and barges that haul the coal. This tax was only a few cents per gallon when first passed and now is levied at 24.3 cents per gallon. Having already impaired domestic marketability of many U.S. coals, these taxes make export extremely difficult on a price basis. Elimination of this tax would lower the delivery price and make U.S. coal more globally competitive.

CONCLUSIONS

The coal industry faces numerous challenges over the next two to three decades, including becoming a more effective participant in international negotiations. Accurately depicting the role of coal is crucial during FCCC and LRTAP negotiations. Coal has risen to the challenges of increased efficiency and decreased emissions through implementation of clean coal technologies not only in the U.S., but in other parts of the world as well. Technology has made coal use cleaner and more efficient while reducing the traditional emissions of SO₂, NO_x, and metals, as well as CO₂. Efficient use of coal has a direct relationship to the rise in economic growth in developed countries and the

standard of living in developing countries. This leadership role of coal is assured for the near- term, but needs reinforcement as the fuel for the future.

Given that developing countries will increase their use of coal as an energy source, the DOE should closely scrutinize all of the factors that affect competitiveness of coal exports and clean coal technology products and services. Elimination of taxes and fees that are detrimental to U.S. coal's competitiveness versus other coal sources is necessary to enhance consumption of U.S. coal by our trading partners. The DOE should promote international funding and partnership programs which put domestic coal at an advantage on the international market, and develop clean coal technologies in other countries to boost export markets for domestic coal, while controlling emissions of CO₂. Policies and programs aimed at developing coal resources in other countries must be assessed based on the harm caused to the domestic coal industry.

APPENDIX A

Description of the National Coal Council

APPENDIX A

Description of the National Coal Council

In the fall of 1984, The National Coal Council was chartered on the advice of the White House Conference on Coal; becoming fully operational in 1985. Recognizing the critical role of coal to America and to the world's energy needs for the future, this industry advisory council was created with the conviction that such an assemblage would make a vital contribution to America's energy security. By providing information, this group could help shape policies relative to the use of coal in an environmentally sound manner which, in turn, could lead to decreased dependence on other, less abundant, more costly, and less secure sources of energy.

The National Coal Council is chartered by the Secretary of Energy under the Federal Advisory Committee Act. Its purpose is solely to advise, inform, and make recommendations to the Secretary of Energy with respect to any matters relating to coal or the coal industry about which the Secretary requests its expertise. Members of the National Coal Council are appointed by the Secretary of Energy and represent all segments of coal interests and geographical regions. The National Coal Council is headed by a Chairman and a Vice-Chairman who are elected by the Council.

The Council is supported entirely by voluntary contributions from its members. It receives no funding from the Federal government. In fact, by conducting studies at no cost to the Department, it saves the government money.

The National Coal Council does not engage in traditional trade association activities. It does not participate in lobbying efforts. The Council is a broad, objective advisory group whose approach is national in scope. The Secretary of Energy requests in writing the nature and scope of the requested study to be undertaken by the Council. The first major studies undertaken by the National Coal Council were presented to the Secretary of Energy in the summer of 1986, barely one year after the startup of this advisory body.

APPENDIX B

The National Coal Council Membership Roster

APPENDIX B

The National Coal Council Membership Roster

James R. Aldrich
State Director
The Nature Conservancy
Kentucky Chapter

Sy Ali
Director
Advanced Industrial Programs
Allison Engine Company

Barbara F. Altizer
Executive Director
Virginia Coal Council

Girard F. Anderson
President and COO
TECO Energy, Inc.

John Q. Anderson
Executive Vice President
Sales and Marketing
CSX Transportation, Inc.

Henri-Claude Bailly
Chairman
Hagler Bailly, Inc.

Charles J. Baird
Baird, Baird, Baird & Jones, P.S.C.

William B. Bales
Senior Vice President, International
Norfolk Southern Corporation

Richard Bajura
Director
National Research Center for Coal & Energy

Janos M. Beer
Professor Emeritus of Chemical Engineering
Director, Combustion Research Facility
Massachusetts Institute of Technology

Frank J. Benner
President and Chief Operating Office
Cogentrix, Inc.

Klaus Bergman
Chairman
Allegheny Power System, Inc.

Jacqueline F. Bird
Director, Ohio Coal Development Office
Ohio Department of Development

Sandy Blackstone
Natural Resources Attorney/Consultant

Charles P. Boddy
Vice President of Governmental Relations
Usibelli Coal Mine, Inc.

William H. Bowker
Private Consultant

James W. Boyd
President
John T. Boyd Company

Gregory Boyce
President
Kennecott Energy Company

L. G. Brackeen
Vice President, Fuel & Energy Management
Houston Lighting & Power Company

Julian J. Brix
General Manager
Cooperative Power Association

Mr. B. R. Brown
Chairman
CONSOL Inc.

Donald P. Brown
Chief Executive Officer
International Executive Services

Louis E. Buck, Jr.
Vice President and Chief Accounting Officer
Entergy Corporation

Robert A. Burns
Vice President
Parsons Power Group, Inc.

Frank Calandra
President
Jennmar Corporation

Donald Carlton
President
Radian International LLC

William Carr
President & Chief Operating Officer
Jim Walter Resources, Inc.

Wilfred Connell
Vice President
Illinois Power Company

Robert P. Cooper
Executive Vice President
Farrell-Cooper Mining Company, Inc.

Maryann R. Correnti
Partner
Arthur Andersen & Co.

Ernesto Corte
President and CEO
Gamma-Metrics

Joseph W. Craft III
President
MAPCO COAL Inc.

James B. Crawford
Chairman and CEO
James River Coal

H. Douglas Dahl
President
Eastern Association Coal Corporation

James K. Davis
Senior Vice President
Georgia Power Company

Mark O. DeMichele
President and CEO
Arizona Public Service Company

Nancy DeSchane
Vice President
Duke/Louis Dreyfus

E. Linn Draper Jr.
Chairman, President and CEO
American Electric Power Company

John Dwyer
President
Lignite Energy Council

Mary Anne Eggleston
President
Lehigh Valley Coal Sales

Irl F. Engelhardt
Chairman and CEO
Peabody Holding Company, Inc.

Robert H. Essenhigh
Professor of Mechanical Engineering
The Ohio State University

Raymond Evans
Chief Executive Officer
International Home Products

Wayne Ewing
Private Consultant

Myrleen B. Fairchild
Chairwoman/Chief Executive Officer
Fairchild International, Inc.

Robert J. Farling
Chairman, President and CEO
Centerior Energy Corporation

Thomas Frost
Vice President Coal
General Manager
C&O Business Unit
CSX Transportation

Peter M. Garson
President
PMG Advisory Group

Sondra J. Gillice
Senior Vice President
Drake, Beam and Morin

Bruce S. Graving
President & General Manager
Horizon Coal Services

Alex E. S. Green
Graduate Research Professor
University of Florida

Dianna Green
Senior Vice President
Duquesne Light Company

Joel E. Greenwood
Vice President
Charles River Associates

Lawrence C. Grundmann, Jr.
Senior Advisor, Power Development
UNOCAL Corporation

John Hanson
President and COO
Harnischfeger Industries, Inc.

Vascar G. Harris
Professor
Tuskegee University

Bill Harrison
Private Consultant

J. Brett Harvey
President and CEO
Interwest Mining Company

T. Parker Host, Jr.
Chairman
T. Parker Host, Inc.

Henry McC. Ingram
Reed, Smith, Shaw & McClay

Georgia L. Johnson-Scott
Pikeville, KY

Joseph P. Kearney
President and Chief Executive Officer
U. S. Generating Company

William M. Kelce
President
Alabama Coal Association

Richard D. Keller
President and CEO
Electric Fuels Corporation

Michael S. Koleda
Principal
Koleda Childress Inc.

Steven F. Leer
President and Chief Executive Office
Arch Mineral Corporation

A. David Lester
Executive Director
Council on Energy Resource Tribes

Peter B. Lilly
President and COO
Peabody Holding Company, Inc.

René H. Malès
President
Strategic Decision Inc.

William B. Marx
Private Consultant

E. Morgan Massey
Evan Energy Company

Christopher C. Mathewson
Director
Center for Engineering Geosciences
Texas A&M University

Emmanuel R. Merle
President
Energy Trading Company

Clifford R. Miercort
President & Chief Executive Officer
The North American Coal Corporation

James Mockler
Executive Director
Montana Coal Council

Nicholas P. Moros
Senior Vice-President
Sales and Marketing
Cyprus-AMAX Coal Company

David J. Morris
General Manager and CEO
Pacific Coast Coal Company

Charles W. Mueller
President and CEO
Union Electric Company

Molly Murphy
Director
Center for Family Business
Marquette University

Robert E. Nickell
The TEK-KOL Partnership

George Nicolozakes
President
Marietta Coal Company

John P. O'Brien, Sr.
Chairman
Jeffrey Mining Products

Daniel F. Packer
President
Entergy New Orleans

Larry T. Papay
Senior Vice President and Manager
Research and Development
Bechtel Group

Timothy J. Parker
Vice President and General Manager
Metropolitan Stevedore Company

James H. Porter
President and Chief Executive Officer
Energy and Environmental Engineering, Inc.

Paul Portney
President
Resources for the Future

George T. Preston
Vice President, Generation
Electric Power Research Institute

William Pusey
Huton and Williams

David M. Ratcliffe
Senior Vice President
The Southern Company

Bill Reid
President
International Longwall Consultants

J. Kenneth Robertson
Private Consultant

Daniel A. Roling
First Vice President
Merrill Lynch Corporate
Strategy & Research

Stephen Salay
Group Vice President, Power Operations
CINERGY Corporation

R. Neil Sampson
Executive Vice President
American Forests

Debbie Schumacher
Women in Mining

F. Kenneth Smith
Private Consultant

Sherwood Smith, Jr.
Chairman and CEO
Carolina Power and Light Company

Dwain F. Spencer
Principal
SIMTECHE

Garold Spindler
President
Cyprus-Amax Coal Company

Timothy P. Statton
Senior Vice President & Manager
Fossil Global Industry
Bechtel Power Corporation

David F. Surber
National Director
Izaak Walton League

L. A. Thaxton
President
Marion Tower Shovel Company

Paul M. Thompson
President
Phillips Coal Company

William E. Thompson
Senior Partner
Global Power Business Development

Neal S. Tostenson
President
Ohio Mining & Reclamation Association

John Turner
President and CEO
The Conservation Fund

Richard P. Verret
President of Power Generation
Central and South West Services

The Honorable J. T. Waggoner
Healthsouth Corporation

The Honorable Robert T. Wilson, Jr.
Private Consultant

Wendell H. Wiser
Professor, Fuels Engineering
University of Utah

James F. Wood
President
Babcock & Wilcox Power Generation Group

C. O. Woody
Senior Vice President, Power Generation
Florida Power and Light

Alan D. Wright
Partner
Porter, Wright, Morris & Arthur

Nancy Zausner
Vice President
PECO Energy Company

APPENDIX C

The National Coal Council Coal Policy Committee

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James R. Aldrich
State Director
The Nature Conservancy
Kentucky Chapter

Sy Ali
Director, Advanced Industrial Programs
Allison Engine Company

Barbara F. Altizer
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Robert P. Cooper
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Ernesto Corte
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H. Douglas Dahl
President
Eastern Assoc. Coal Corporation

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Neal S. Tostenson
President
Ohio Mining & Reclamation Association

Nancy Zausner
Vice President
PECO Energy Company

APPENDIX D

The National Coal Council Working Group for the Report

“Vision 2020: The Role of Coal in U.S. Energy Strategy”

APPENDIX D

The National Coal Council Working Group for the Report

“Vision 2020: The Role of Coal in U.S. Energy Strategy”

Chairman

GIRARD F. ANDERSON
TECO Energy, Incorporated

Project Coordinator

STEPHEN D. JENKINS
TECO Energy, Incorporated

Members

DR. SY ALI
Allison Engine Company

DENNIS CONN
Cyprus Amax Coal Company

DR. RICHARD BAJURA
West Virginia University

JAMES B. CRAWFORD
James River Coal

GEORGE W. BARTLETT, JR.
North American Coal Corporation

DR. ELLIOTT DOANE
Kerr-McGee Coal Corporation

THOMAS E. BAYRER
Norfolk Southern Corporation

DENNIS G. EDWARDS
Electric Fuels Corporation

ROBERT A. BECK
Edison Electric Institute

T. FECHO
AEP Energy Services

JOSEPH C. BILARDELLO
AEP Fuel Supply

JEF FREEMAN
Cogentrix Energy, Incorporated

JACQUELINE F. BIRD
Ohio Department of Development
Coal Development Office

ROBERT F. GEOSITS
Bechtel Power Corporation

DR. ALEX E. S. GREEN
University of Florida

MICHAEL J. MUDD
AEP Service Corporation

BARRY J. HALPER
Air Products and Chemicals, Incorporated

JERRY J. OLIVER
Bechtel Corporation

E. J. HARBISON
Air Products and Chemicals, Incorporated

DAVID R. QUATTROCIOCCHI
Bechtel Power Corporation

DR. WILLIAM B. HARRISON
Consultant

DR. RICHARD A. SCHMIDT
Commonwealth Edison

L. RAY HARRY
The Southern Company

GARY R. HART
Southern Company Services, Incorporated

DR. GERALD A. HOLLINDEN
Dow Radian Corporation

RONALD D. JUST
The Southern Company

J.B. KITTO
Babcock & Wilcox

ALICE LEBLANC
Environmental & Economic Consulting

R. LORDAN
Electric Power Research Institute

DWAIN F. SPENCER
SIMTECHE

DAVID STOPEK
Illinois Power Company

P. STOWE
Southern Company Services Incorporated

Ex officio Members

STEWART CLAYTON
Department of Energy

THOMAS GRAHAME
Department of Energy

JAMES F. MCAVOY
The National Coal Council

APPENDIX E

Correspondence Between National Coal Council and U.S. Department of Energy



The Secretary of Energy
Washington, DC 20585

September 28, 1995

Mr. Joseph W. Craft III
Chairman
National Coal Council
P.O. Box 17370
Arlington, Virginia 22216

Handwritten: JWC
29 Sept: 95

Dear Mr. Craft:

I am writing to ask the Council to prepare two reports that would further address issues raised in the Council's May 1995 report, "A Critical Review of Efficient and Environmentally Sound Coal Utilization Technology." The report analyzed the status of the development of a wide variety of clean coal technologies and identified generally obstacles that could impede the commercialization of those technologies. In view of the importance of deploying clean coal technologies to national economic stability and sustainable development throughout the world, a brief update of a previous National Coal Council report examining the role of U.S. coal in energy, the economy, and the environment would be a timely and valuable source document for the Department of Energy. Also, recent developments in electric utility deregulation and restructuring have made evident the need for a focused study on the implications on coal and coal utilizations markets of these developments.

Therefore, I again seek the advice of the Council and request that the Council prepare two studies described as follows:

- o Consumption Issues Affecting the Role of Coal in the U.S. Energy Strategy - This study should outline the major obstacles to the full use of coal as an energy source for the U.S., and highlight the issues related to recent developments in international markets for coal utilization technologies. This study should serve as an update of the prior National Coal Council report, The Role of U.S. Coal in Energy, the Economy, and the Environment.
- o Implications on Coal Markets of Possible Utility Deregulation and Restructuring - This study should be designed on a simple, limited effort basis and (1) be based on existing literature regarding utility change; (2) include the development of simple models as appropriate; and (3) evaluate the direction of the impact on coal markets of possible utility deregulation using these simple models.

Thank you for considering this request.

Sincerely,
Handwritten signature: Hazel R. O'Leary
Hazel R. O'Leary

THE NATIONAL COAL COUNCIL, INC.

Post Office Box 17370, Arlington, Virginia 22216

(703) 527-1191

March 28, 1996

The Honorable Hazel R. O'Leary
Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Madam Secretary:

On September 28, 1995 you wrote to us asking that we perform two new studies. The first one entitled, "Implications for Coal of Utility Deregulation and Restructuring," was approved by the Council in November 1995, and copies of the report are now being distributed.

We are about to begin work on the second study called, "Consumption Issues Affecting the Role of Coal in the U.S. Energy Strategy." To this end, I have appointed Girard Anderson, President, TECO Energy, to serve as chairman of this effort. It is most respectfully requested that you appoint an individual representing the Department to serve as liaison with our work group and so inform us of the name of that individual.

We are most pleased to have this study underway and shall keep you informed of our progress.

Warm personal regards and best wishes.

Very truly yours,



Joseph W. Craft III
Chairman



Department of Energy
Washington, DC 20585

APR - 8 1996

Mr. Joseph W. Craft III
Chairman
National Coal Council, Inc.
P.O. Box 17370
Arlington, Virginia 22216

MAA
10 April 1996

Dear Mr. Craft:

Thank you for your letter of March 28, 1996, to Secretary Hazel O'Leary in which you report the status of two reports the Secretary asked the National Coal Council (NCC) to undertake in September 1995.

I was pleased to note that the NCC report entitled "Implications for Coal of Utility Deregulation and Restructuring" has recently been distributed. I personally look forward very much to reading this final version.

With respect to the second study "Consumption Issues Affecting the Role of Coal in the U.S. Energy Strategy," I have appointed Mr. Tom Grahame (phone 202-586-7149) to act as the Department's liaison with the NCC's group tasked with preparing this report. Additionally, and for your information, I have tasked Mr. Stewart Clayton (phone 301-903-9429) to be the Department's principal coordinator on all NCC matters and, as a result, he will be working closely with Tom on this particular task.

I appreciate you apprising me of your progress on this matter.

Very truly yours,

Patricia Fry Godley
Patricia Fry Godley
Assistant Secretary
for Fossil Energy



The Secretary of Energy
Washington, DC 20585

June 24, 1996

RECEIVED

JUN 25 1996

Clifford R. Miercort

Mr. Clifford R. Miercort
Chairman
National Coal Council
P.O. Box 17370
Arlington, Virginia 22216

Post-it® Fax Note 7671		Date 6/25	# of pages 2
To Cliff Miercort	From	Jim McAvey	
Co./Dept.	Co.		
Phone #	Phone #		
Fax #	Fax #		

Dear Mr. Miercort:

Since the 1960's, the United States has greatly increased its use of coal for the production of energy while at the same time decreasing the environmental effects of such use substantially. Coal remains the cheapest and most abundant of our natural resources, supplying not only domestic demand but significant export markets as well. Mining productivity is at an all-time high and new technologies to burn coal even more cleanly and efficiently are now being demonstrated.

The future is still uncertain. As your recently completed study "Implications on Coal Markets of Possible Utility Deregulation and Restructuring" shows, many factors in addition to unprecedented prospective changes in the utility industry could play a significant role in future coal use. You are also about to begin a study on "Consumption Issues Affecting the Role of Coal in the United States Energy Strategy." Such issues, as delineated by the Council, will also be pivotal in assessing coal's future in the United States economy.

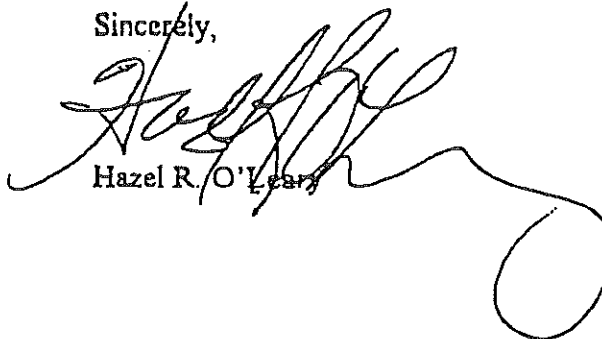
Twenty-five years from now we may see energy production and use as a simple evolution of today's markets, or we may see a radically different energy market structure shaped by unforeseeable events. The Clinton Administration faces important policy choices. We need to make these choices with a sound analysis of the possible futures from the United States coal industry.

Please expand your current study to include: a vision of the role of the coal industry in the United States economy twenty-five years from now; and the issues and policies that will shape the industry. Please indicate the actions that the Federal Government and industry participants need to take to enable a healthy coal industry to fulfill its mission of supplying United States citizens with an affordable and reliable domestic energy resource with minimal environmental impact.

Ms. Patricia Godley, Assistant Secretary for Fossil Energy, will work with Council representatives to refine the additional issues I have identified and to establish a timetable for publication.

Thank you for your leadership as Chairman of the National Coal Council and the excellent work you do on behalf of the Nation and the Coal Industry.

Sincerely,

A handwritten signature in cursive script, appearing to read "Hazel R. O'Leary". The signature is fluid and extends to the right with a long, sweeping tail that loops back down.

Hazel R. O'Leary

APPENDIX F

Correspondence From Industry Experts on a Vision for Coal

MASSACHUSETTS
INSTITUTE OF TECHNOLOGY

DEPARTMENT OF
CHEMICAL ENGINEERING



Room 66-548
Cambridge
Massachusetts 02139-4307
Telephone (617) 253-6661

Master File

János M. Beér
Professor Emeritus of Chemical and Fuel Engineering

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

November 24, 1996

Dear Jim,

Vision 2020; The Role of Coal in US Energy Strategy

At the last meeting of the Council, the draft report rightly earned praise from Members for selecting the salient issues for discussion and making valuable recommendations. I am writing regarding the prospects of introducing Clean Coal Technology into practice in the US and offer recommendations. I consider, and was pleased to find strong support for this view in the Report, that Clean Coal Technology is the "sine qua none" for the successful future of Coal in the US Energy Strategy.

During the last decade we have seen the demonstration of a number of new and retrofit technologies which have the prospect of significantly improving the efficiency of coal fueled electric power generation, and reducing emissions without increasing the cost of electricity. The introduction of these new technologies would, however, be slow, mainly because of the small additions of new power generating capacity in the US during the next 10-15 years. Most of the new coal fired electric generating plant will be built in the Far East, China, India, Indonesia, and Eastern and Central Europe. While wanting to erect environmentally benign plants, most of these countries can not afford the additional cost of these novel, technologically more advanced power plants.

Some international financial instrument is needed to break the above vicious circle. If power producers in countries of the Far-East or Eastern Europe, could qualify for funds to bridge the gap between the cost of routine and advanced Clean Coal Technology plants, two important parallel objectives could be achieved :

- the pollutant emissions including CO₂ would be reduced, world-wide, and
- the experience gained with the operation of these new plants could open the application of Clean Coal Technology in the US when new electric power generating capacity will be needed around the second decade of the 21st Century.

The Department of Energy and the State Department should be urged to work toward the establishment of such a financial framework.

With best regards

Yours sincerely

JMB
02 Dec '96

James



THE NORTH AMERICAN COAL CORPORATION

SIGNATURE PLACE II, 14785 PRESTON ROAD, SUITE 1100
DALLAS, TEXAS 75240-7891

CLIFFORD R. MIERCORT
President and
Chief Executive Officer

October 9, 1996

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


16 Oct. '96

Dear Jim:

As per our conversation today, the following relates to my vision of the coal industry twenty-five years from now:

Vision The demand for energy worldwide will increase as lesser developed countries continue their economic growth; therefore, all sources of energy will be important and each source must be evaluated on a level playing field. Coal will be able to compete head-to-head based on economics with other sources of energy and maintain its current share of electricity generation. This growth (constant share of an increasing demand) will be accomplished in an environmentally acceptable manner.

Challenge *The challenge to the coal industry in achieving this growth is finding a way to ensure that the U.S. Government makes policy decisions based on scientific fact rather than perceived environmental idealism. More specifically, we need to find ways to convince U.S. Government officials that unilateral action regarding externalities will only result in great economic harm to all in the U.S., while having virtually no impact on global environmental conditions.*

Vision Technology developed under the Department of Energy's Clean Coal Technology program will be utilized both here in the U.S. and in developing foreign countries to encourage the use of coal for the generation of electricity.

October 15, 1996
page 2

Challenge *The challenge is to ensure that governmental policies will encourage the commercialization of such technologies in the U.S. and the exportation of such technologies to developing countries. These include incentive in monetary policies that will assist U.S. companies in working with foreign governments to construct new facilities that incorporate the advancements developed in the Clean Coal Technology programs.*

Vision The United States will not become overly dependent upon any one source of energy, e.g., Middle East oil; rather, we will maintain a balance of domestic and various imported energy sources that will enable us to cope with long-term interruption of any one source.

Challenge *The primary challenge is to ensure that the country and, in particular, the Government policy makers will not become complacent regarding the availability of foreign imports.*

Vision Coal will be used to create other forms of energy, e.g., coal gasification and other valuable by-products such as fertilizer. The technology to perform these types of conversions is proven, and the economics of such conversions will improve.

Challenge *The challenge is the lack of governmental policies to encourage development and the reduction in the Department of Energy's coal utilization research budget.*

Jim, I know you have probably heard all of the above before, but I guess it bears repeating. If you require anything further, please advise. I look forward to our meeting on the 16th.

Sincerely,



Clifford R. Miercort

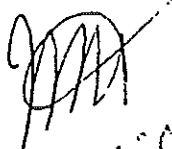
L:\CRMWCCM\CAVOY.LTR Val

B. R. Brown
Chairman of the Board

CONSOL Inc.
Consol Plaza
1800 Washington Road
Pittsburgh, PA 15241-1421
412-831-4018
FAX: 412-831-4916

September 27, 1996

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


07 Oct. '96

Dear Jim:

Attached is what I consider to be the "vision" for coal in
the future based on the questions asked in your letter
dated June 24.

Kindest regards,



/ds

Vision For Coal In 2020

Over the next 20 to 25 years, coal will remain the primary energy source for electricity generation in America. By the year 2020, American industry will adopt new electrotechnology processes, electricity will play an increasingly important role in transportation, and residential use of electricity will become more intensive.

Coal will increase its share as the primary base-load fuel for electricity generation, as nuclear plants are closed after their 40-year licenses expire. Natural gas plants will continue to be used for intermediate and peaking loads. Aging coal-fired plants will be repowered with clean coal technologies with significantly reduced emissions. Coal combustion by-products will have greater penetration in construction material markets. The combination of clean-burning power plants and the substitution of electrotechnologies for end-use fuel will improve our environment and stimulate our national economy.

The coal industry will consist of fewer, but larger mines. Western surface mines will produce 20 to 50 million tons per year, and deep bituminous mines will produce 5 to 10 million tons per year. As few as 100 mines will produce most of the annual coal demand of 1.2 to 1.3 billion tons.

Electricity will be even more affordable than it is today. National security will be improved because the U.S. will be less dependent on imported oil and natural gas.

Large domestic reserves make coal the ultimate sustainable resource for America. Its use will improve energy productivity, prevent pollution and improve national security — the three main goals of energy policy.

The greatest obstacles to accomplishing this vision are as follows:

1. Global climate change legislation that taxes or caps CO₂ from electricity generation .
2. Overly stringent pollution control legislation that is not based on sound scientific evidence and economic study.
3. Government policy that discourages electricity use and the employment of clean coal technologies.
4. Road-blocks to expanding the electricity transmission system to ensure open competition among generators and the wheeling of power.
5. Unrealistic assumptions regarding natural gas and renewables as major contributors to reliable, cost-effective electricity generation by the year 2020.

MEMO TO FILE

SUBJ: Telecom 26 September 1996

Bill Carr called on the Vision Study. His comments are as follows:

As outlined in previous NCC reports there are compelling economic and security reasons why coal should continue to be the predominant domestic energy source for many years to come

To attain this however requires that:

Clean Coal Technologies must continue to be developed and deployed.
The Image problem must be overcome through a very vigorous education program.
Equitable price appreciation needs to be achieved.

This telecom replaces a letter.

James F. McAvoy

BERWIND
NATURAL RESOURCES CORPORATION

THOMAS V. FALKIE
President
Chief Executive Officer

September 26, 1996

TF
30 Sept '96

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

Dear Jim:

This is a response to your June 24, 1996 letter (which we didn't receive until recently) requesting our thoughts on several questions.

1. What would we like to see as the role of coal in 20-25 years?

Conventional wisdom is that U.S. coal consumption will increase 1-2% per year for the foreseeable future. The market for U.S. coal is constrained by such factors as delivered costs in relation to competitive fuels, growth of electric demand and power generation, transportation capability, government regulations, etc. The coal industry is capable of producing at greater rates and of being competitive with other fuels. The transportation industry is capable of expanding to ship increased amounts of coal. The electric power industry is unclear right now, but in the long run will be able to respond to increased demand. Therefore, the big uncertainty in the equation is government policy/government regulations.

2. What should the coal industry look like in that time frame?

Reality is that consolidation of the industry will continue, but that the industry will still be highly competitive. Coal mine productivity has doubled in the last ten years. While the same general mining technology will be used, coal mine productivity will continue to increase despite thinner, dirtier seams, etc. Hopefully real prices for coal, which have declined since 1979, will level or increase, but I'm not ready to predict that. Also hopefully coal producers will someday get their fair share of the "economic rents."

Mr. James McAvoy
September 26, 1996
Page 2

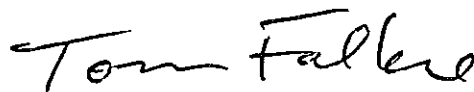
3. What are the 5-6 greatest obstacles?

- The threat of premature, non-science based global climate change targets or taxes.
- The uncertainty regarding NO_x and toxic substance regulations as they relate to coal.
- The uncertainties as to the direction and effects of electric utility deregulation.
- The speed of development and degree of subsidization of coal production in the underdeveloped countries (e.g., China, Russia).
- Government policy in general and, over 20-25 years, the changes in government policy.
- Continued adversary attitude of government and its regulatory regime against the coal industry.

I hope these few "off the top of the head" comments will be useful.

Best regards.

Sincerely yours,

A handwritten signature in cursive script that reads "Tom Falke".

TVF/jmd

INTERNATIONAL LONGWALL CONSULTANTS

Millway No. 6 • 526 Whites Mill Road
Abingdon • Virginia 24210-2956
Phone or Fax (540) 628-2581

VISION FILE
8 FAX to W.G.

September 20, 1996

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

[Handwritten signature]
20 Sept. 1996

Dear Jim:

Subject: A Vision For Coal For The Future

Thank you for your letter of June 24, 1996 on the study for the Secretary of Energy. My views on the Vision For Coal by the year 2015 are as follows:

Role of Coal

- ▶ 1,250 million tons production per year
- ▶ Providing 50 % of total US electrical generation
- ▶ Increased reliance on DOE clean coal technology demonstration program

Shape of the Coal Industry

- ▶ Further concentration
- ▶ Top five largest producers producing 50 % of annual tonnage
- ▶ 50,000 tons per shift production longwalls
- ▶ Number of mining machinery manufacturers halved

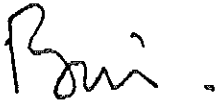
Possible Obstacles

- ▶ World economic growth and energy demand
- ▶ New discoveries of oil and natural gas reserves
- ▶ Further environmental regulation
- ▶ Transportation costs
- ▶ Miscalculation of economic coal reserves
- ▶ State initiatives to restructure the electrical industry

Page 2
September 20, 1996

I trust that all is well with you and your staff, and please accept my warmest personal regards.

Sincerely yours,
INTERNATIONAL LONGWALL CONSULTANTS

A handwritten signature in cursive script, appearing to read "Bill Reid".

Bill Reid
President

BR:lr

Arizona Public Service Company

P.O. BOX 53999 • PHOENIX, ARIZONA 85072-3999

MARK De MICHELE
PRESIDENT AND
CHIEF EXECUTIVE OFFICER

September 20, 1996

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

Dear Jim:

I am responding to your September 4, 1996 letter requesting input on our "vision for coal".

First, let me emphasize that we believe coal must continue to play a significant role in the generation of electricity far into the future, even beyond 20-25 years. Utilities have made a significant investment in coal burning power plants and pollution control equipment like scrubbers to ensure that environmental concerns are mitigated. I would not want that investment wasted. Furthermore, coal generation has been developed and improved for nearly a century and because coal is an abundant U.S. natural resource, we should continue development and utilization of this resource in the generation of electricity.

As the electric industry now moves into a deregulated environment, we face many challenges and uncertainties. Trying to predict what the coal industry should look like is even more challenging. However, I do believe the coal industry must be prepared for change--and rapid change--as the electric marketplace becomes more competitive. The coal industry must be prepared to form effective partnerships with utilities so that the coal industry can face the challenges of natural gas and new generation technology. Pricing mechanisms must be flexible and ready for change as the power market changes, yet they must still allow the coal industry the opportunity to prosper.

The obstacles that I see facing the coal industry are continued clean air concerns, rail transportation, competition from new gas technology, new taxes,

Handwritten signature:
JMM
20 Sept '96

James F. McAvoy
September 20, 1996
Page 2

and other regulations which force coal generation into a non-competitive position. The competitive forces in the energy marketplace must not be disrupted by government or other forces to cause coal to become non-competitive.

We look forward to the continued cooperation that must exist between the electric and coal industries so that we can succeed in the future.

Sincerely,

A handwritten signature in black ink, appearing to read 'Mark DeMichele', written over the printed name.

Mark DeMichele

OMD:cjs

Donald M. Carlton
President

19 September 1996

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

Dear Jim:

My apologies for not responding to you sooner. You are right, I have been up to my eyeballs, but I intended to input to the Vision Statement. While I'm afraid my good intentions got off track, hopefully I can make amends with this brief letter. I recently gave a talk at the Pittsburgh Coal Conference in which I discussed the ideas outlined briefly below. I would, of course, be pleased to expand on these thoughts if you thought it appropriate.

There seems to be general agreement that the current political and economic climate dictates against any significant new initiative to increase coal consumption. On top of that, we have the dual threats of global warming and air toxics regulations that have the potential for significantly impairing coal's role in the future. Nevertheless, in my view there is no question but that at some point in the future we will have to use our coal resources as chemical feedstocks and as synthetic fuels.

What could change the current gloomy picture are either world events or technology. If one looks at the cost of using coal to generate electricity by whatever technology versus the cost to generate electricity by whatever gas-based technology, the differences in cost are substantial. It is possible that technology could be the difference. But, in the current climate, a major program in coal

RADIAN
INTERNATIONAL LLC

(Mailing) P.O. Box 201088
Austin, TX 78720-1088
(Shipping) 8501 N. Mopac Blvd.
Austin, TX 78759
(512) 454-4797

MR. JAMES F. MCAVOY

19 September 1996

Page Two

technology development is very unlikely. I believe it is important that the National Coal Council get behind an effort to convince the Department of Energy that they must continue a contract research and development program focused on coal technology for the foreseeable future.

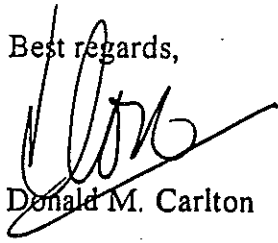
My basis for this proposal is that if one looks at coal consumption today, 250 million tons of coal are burned because we have scrubbers. Those scrubbers were developed by a government-funded research and development program that attracted the private sector to this area of technology so that when there was commercial opportunity, the private sector took full advantage of that opportunity. The private sector added their own resources and developed a commercial marketplace for this technology.

I believe we have a similar situation today. The private sector cannot continue to invest in technology R&D for coal in light of the current economic and political climate, but we must have that technology. More importantly, we must have a private sector that is interested in and committed to the coal business. I believe that a contract research and development program at the \$100-200 million per year level could be the catalyst to maintain that interest on the part of the private sector and to ultimately produce the technologies that will allow us to use our coal resources. Further, universities would be the beneficiaries of such a program which would supply a stream of coal-oriented technical people necessary for any commercialization of new technology.

Jim, again my apologies. Please don't hesitate to let me know if any additional information would be helpful.

I look forward to seeing you again soon.

Best regards,



Donald M. Carlton

DMC:ds



BUCKEYE INDUSTRIAL MINING CO.

4719 INDUSTRIAL ROAD
P.O. BOX 389
LISBON, OHIO 44432

SALEM, OHIO (330) 337-9511
LISBON, OHIO (330) 424-7281
FAX (330) 337-3730

September 12, 1996

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

[Handwritten signature]
17 Sept. '96

Dear Mr. McAvoy:

In belated response to your letter of June 24, 1996, I appreciate the opportunity to provide my observations about the role of coal in the next century.

With the notable exception of steel-making, virtually all coal is consumed in the generation of electricity. Coal has emerged as the fuel of choice for power generation because of its comparative cost and availability. Among the industrialized western nations, the United States enjoys the greatest advantage in power generation because of these two factors. Any alternative fuel for electric generation is either much more expensive, or not as available, or both. To the issue of availability we must also consider the fuel most under national control to be the most desirable for reasons of national security.

When and if a fuel emerges which compares favorably to coal under the economic test of cost and availability, then coal will no longer deserve to exist as having other, intrinsic value. I believe that we in the coal industry are devoted to the notion that we earn our right to exist only as we are able to serve the greater interests of the nation and society.

I'm sure you would agree that none of the above represents anything new. We in the industry have often argued that the energy issues being debated today should focus on what coal-fired electricity means to the American people in terms of jobs, standards and costs of living, and national security. We must deflect criticism by insisting that the debate be cast in issues of national, not industry, interests. And we must remind our fellow Americans that they run the risk of trading away their greatest energy advantage in the face of greatly expanding global competition.

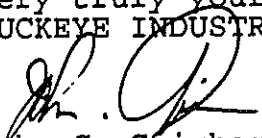
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Mr. James F. McAvoy
Page 2

Jim, we have been involved in the debate about the proper role of coal for years. We have allowed the critics of coal-fired generation to distract public attention from the vital economic concerns, and speculate about the significance and impact of environmental concerns. We and our political leaders have allowed the debate to be improperly framed and for that mistake the quality of life of future generations of Americans is at risk. To return to the Secretary's question of what I would like to see in the coal industry of the next century I can only respond that I would like to see our sector allowed to fulfill its potential in preserving low-cost electricity to serve the needs of future generations.

Jim, I do thank you for the opportunity to comment, and apologize for taking so long. It was great to see you at the mining convention and I certainly wish you the best in your endeavor at the National Coal Council.

Very truly yours,
BUCKEYE INDUSTRIAL MINING CO.


John C. Grisham

JCG/nb

September 12, 1996

Cinergy Corp.
221 East Fourth Street
P.O. Box 960
Cincinnati, OH 45201-0960
Tel 513.287.2266

STEPHEN G. SALAY
Group Vice President
Power Operations

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

CINERGY.

Dear Jim:

SM
16 Sept. 96

I am in receipt of your September 4, 1996 correspondence in regards for my "vision for coal" for secretary Hazel O'Leary. My perspective on coal, as denoted below, represent a utility's perspective. However, I truly believe that coal is the country's "ace in the hole." To remain truly globally competitive, coal must be an integral part of our future energy strategy.

With the fast approach of utility deregulation, one undeniable aspect will be the downward pressure on coal prices in order for utilities to compete effectively and produce low cost power. Utilities will focus more on both cost and reliability. Coal suppliers that can meet those parameters will be successful. Utilities will consider variations in coal quality that result in the most efficient conversion to electricity. Trade offs will constantly take place between fuel costs and O&M costs. Transportation modes will have to be competitive, and full consideration will have to be given to the environmental impacts.

We believe coal prices will eventually gravitate to a relatively short term market clearing price. This movement will be caused by the electric futures market, the coal futures market, shorter term coal contracts, and/or market price reviews, and enhanced utilization of the spot market.

Having low fuel costs will not be enough. Having the lowest regional fuel costs may be the only winning strategy. Coal producers must understand the changes that the utility industry is now facing. They must be flexible, not only in terms of volume and pricing but also in terms of quality and other terms and conditions. "Out of the box" fuel supply agreements will become typical. Value added services such as ash haulback and disposal, carrying of inventory and technical assistance by the coal producers to enable the power station to become more efficient will increase the value of the relationship.

Coal Magazine has stated "Utility deregulation is expected to alter coal economics, markets, and distribution patterns radically due to competition for wholesale power markets, retail wheeling, and open transmission access. The elimination of service territory boundaries resulting from utility deregulation will

September 12, 1996
Page 2

cause a shift from high-cost generation sources to the lowest cost producers where transmission access is affordable and capacity is available, with coal-by-wire supplanting coal-by-rail."

The future for coal burns bright. However, as deregulation approaches, look for increased competition for coal companies in different coal mining regions, along with competition from other types of fuels. This will make for strategic alliances between competitive mines and competitive power stations.

These are only a few of my thoughts on the vision of coal in the future. I wish you much success as this study progresses.

Sincerely,

A handwritten signature in cursive script, appearing to read "Steve".



**CYPRUS AMAX
COAL COMPANY**

A Cyprus Amax Company

Cyprus Amax Coal Company
9100 East Mineral Circle
Post Office Box 3299
Englewood, Colorado 80112-3299
(303) 643-5846
Fax: (303) 643-5757

Garold R. Spindler
President

September 13, 1996

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

Dear Jim:

My apologies for a late response. I did indeed receive your request for input on my vision for coal. As well as relying on the old reliable excuses of the pressures of business, I would add that having been so recently appointed to the Council, and its Board, I was withholding comment pending more familiarization with the group. Nevertheless let me begin an admittedly rambling discourse in response to your questions.

As deregulation unrolls and long term contracts expire, coal will become more and more of a commodity. This will have specific impacts on what can be characterized as an already beleaguered industry. Among these:

1. There will be continued pressure on the delivered costs of Btu's. This pressure will not leave railroads unscathed and issues such as universal access and subsidized rail transport will eventually be retabled. Marginal areas in Kentucky and West Virginia, facing a tougher marketplace and stiffer tax and regulatory burdens, will lose production and the predictable fight to shift social burdens will ensue.
2. The industry will continue to consolidate and employ fewer people producing more coal which is sold for an average realization less than today's realization. Regional market niches will begin to disappear and operations which depend upon these niches, such as some mines in Alabama, Tennessee, Kentucky and the Midwest, will see their world change. The focus of regulation may, in the face of these

Letter to James F. McAvoy
September 13, 1996
Page 2

changes, switch from controlling the cost of expansion (environmental, subsidence, etc.) to managing the social costs attendant with a regionally dying Industry. Legislative issues sure to emerge are:

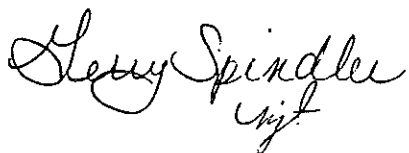
- a. Presumptive awards of Black Lung;
 - b. Federal subsidies for Worker's Compensation, as well as massive restructuring of State Worker's Compensation Funding; and
 - c. Reclamation and long term water treatment issues.
3. Even within the Industry there will be fierce infighting to keep legacy costs incurred in one region from being transferred along with the production. Issues like the use of AML fees and the funding of regionally weighted welfare programs will, in some cases, divide the Industry.
 4. The single most pressing issue for the Industry will be the Government's view of Green House contributions from fossil fuel burning. I don't believe that Congress is too pragmatic to adhere to a non-proliferation commitment when it comes to Green House gas emissions. The issue creates a wonderful smoke screen to enhance the palatability of taxes which may be required as revenue raising devices, particularly with the strong possibility that electric rates may fall under deregulation. The move to enhance tax revenues may focus on making up the difference through a carbon tax which could be explained away as a disincentive to use fossil fuels. As long as this tax is recognized for what it is (a tax on electricity) and is levied as such the Industry probably would tolerate it, but more selective alternatives could be disastrous.
 5. Regardless of the administration, efforts focusing on MSHA, OSHA and OSM will continue to hold high visibility for the next four years. Based on any rational cost benefit

Letter to James F. McAvoy
September 13, 1996
Page 3

analysis, they represent one of the vulnerable targets for rationalization of Government expenditure. Certainly these agencies need to be revitalized and rationalized at a minimum.

Many thanks for the opportunity to express these views, Jim. Hopefully I will have an opportunity to expand further.

Sincerely,

A handwritten signature in cursive script that reads "Henry Spindler". Below the main signature, there is a smaller, less legible mark that appears to be "njt".

GRS:njt

EVAN ENERGY COMPANY

VISION FILE (3)

P.O. Box 674
Richmond, Virginia 23206
Phone: (804) 788-1823/1820
Fax: (804) 788-1809
E-Mail: energy@sprynet.com

September 9, 1996

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

[Handwritten signature]
12 Sept. '96

Dear Jim;

I highly applaud your mission to articulate the "vision for coal". There is certainly no consensus on this within the coal industry. Most "coal miners" would like for the world to believe that coal is clean. Which it ain't and probably won't ever be.

The vision for coal is a bit more complex. The one thing that can underwrite the combined luxuries of a high standard of living and a high level of environmental respect is **ECONOMIC GROWTH**. This is true in every country in the world.

Thus the vision for coal - **COAL PROVIDES THE CHEAP SOURCE OF ENERGY NECESSARY TO FUEL ECONOMIC GROWTH.**

- COAL is the most **ECONOMICAL** fuel to use in the generation of electricity without which modern life and economic growth are impossible.
- Supplies of COAL are **SECURE** and **PLENTIFUL** worldwide.
- COAL in modern usage is environmentally **SOUND**.

Please feel free to elaborate in any way you like. The central concept is universal for this and the 21st century.

Sincerely,

[Handwritten signature]

E. Morgan Massey



ANKER ENERGY CORPORATION

2708 CRANBERRY SQUARE • MORGANTOWN, WV 26505 • 304-594-1616

VISION FILE 9

9

September 9, 1996

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

12 Sept 1996

Dear Jim:

My apologies for taking so long to reply to your letter. It got sidetracked as I was involved in a major re-capitalization of my company which has been completed successfully. Meanwhile, you asked for my vision of the role of coal in 20 - 25 years.

I see the role of coal increasing in two important sectors of our economy. First with respect to electrical generation, it will be even more important than it is today as it will remain our most economical fuel. I expect environmental standards to continue to rise. I am also confident that the coal and electricity industries will continue to make strides in both safety and environmental compliance through evolving technologies with the clean burning and utilization of coal. I believe that in twenty years, most coal produced will come from underground mines utilizing highly automated computer controlled equipment and that high tech coal processing facilities will prepare higher grade coals. I also believe that power plants utilizing the coal will be far better equipped to deal with emissions.

I see the need for the industry to put more emphasis into creating and developing aesthetically pleasing facilities and plants and becoming a more integral part of the communities in which they operate. The leadership of the coal industry will become better equipped to deal with these challenges as better capitalized companies with forward thinking managers evolve in order to grow and survive.

The greatest challenge is overcoming the negative perceptions of coal and the threat of global climate change. Our CEED group has put a dent in externalities. All of us have to work hard to overcome the politics of global climate change. To accomplish these goals, our industry will have to address challenges in all sectors of our society and at all levels of government. We'll need to continuously improve our safety, the cleanliness and appearance of our operations, the acceptance of our product, how we transport our product, and the sale of our product to the public; i.e. coal is now, with our new technology, the cleanest and most reliable and economical long-term fuel for our country. Oil, nuclear power and natural gas are all subject to uncertainties and interruptions.

10

Mr. James F. McAvoy
September 9, 1996
Page 2

Nothing new here, but I hope it helps.

Sincerely,


John J. Faltis
President

JJF/ceg



Paul R. Portney
President and Senior Fellow

August 9, 1996

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

JP
1A Aug. 9/6

Dear Jim:

I am responding, admittedly tardily, to your letter of June 24th asking my views in response to Secretary O'Leary's inquiries about a vision of coal in the future. I shared your letter with my colleague Joel Darmstadter, and his thoughts are reflected heavily in this response.

It is hard to envision anything but a rather bleak future for the coal industry if the nations of the world decide that global climate change is a problem worthy of a significant policy response, and if that response is keyed to the carbon content of fuels. Should such an effort occur contemporaneously with a significant tightening of the particulate standard, as well as further reductions in SO₂ and NO_x emissions, the outlook for coal would be bleaker still. It seems to me this issue is almost pre-eminent in any attempt to speculate about the future role of coal.

Other environmental issues that must be considered include trace metals that might be subject to future emissions standards and the possible further devolution of SMCRA to the states. Finally, the coal industry has a major stake in the ongoing restructuring of the electric utility industry, and any report on coal's future would have to address that issue.

Once again, my apologies for the lateness of my response, which I hope is helpful to you.

Sincerely,
Paul
Paul R. Portney

cc: Joel Darmstadter

August 6, 1996

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

Handwritten: JFM
14 Aug '96

Dear Jim:

I apologize for taking so much time to respond. You'd think that a semi-retired person could find all kinds of time, but I've really filled the time easily. At any rate, I want to try to answer the several questions posed about the "vision" for coal for the future. One nice thing about it, a look twenty-five years into the future is really a shot that cannot be disaffected by the actions upon our industry at the present.

Trusting that the Secretary of Energy is sincere and not simply giving us the traditional forum from which to say that we were involved in the planning and the consensus to go where they were going anyway, I will comment to the best of my beliefs.

I'm not going to deal with statistics, trends, or events of the past other than to indicate the opportunities missed. If I'm a harsh critic at times, perhaps that goes with the five decades in the business, decades which have covered all the industrial cycles and reform imaginable. I have been in the coal industry since January 2, 1948 following WW II and ran the ranks from mine surveyor, general inside labor as a United Mine Worker of America, foreman, manager, officer of several coal companies and completed the professional career as a top officer of a major electric utility buying more coal than any other system with the exception of the Southern Company.

Add in the terminals and the transportation on rail and river, and I believe I may have certain unique experience ingredients. And, as you know, the Chairmanship of the former National Coal Association and several State Coal Associations filled out experience in that segment of the industry.

Wow! Half a page just to assure the reader that I may have some insights into the coal business, and energy, particularly electric energy. But we also played with the synfuels potential when with Island Creek Coal, and the in-situ gassification with

Consol and Occidental Petroleum, Coal/Water mixtures with Occidentaljust how much playing can one do?

And while we were "playing", we managed to improve the productivity of our industry and reduce our safety statistics to the point that supermarkets have a higher rate than we do. And, through all the trials with labor, labor reformation, the shift of tonnage to the West, we approach the fifth year of producing a billion tons annually with the immediate potential to increase it 20%

The point I make here is that our industry has performed admirably within and in it's ability to control. It has weathered external forces that have put down many other major industries. Coal, in fact, remains the only basic industry left in our country. There's a parallel lesson to be learned from the electric utility industry.....one can play around with small peaking units and try to convince everyone to "conserve" (translates: do not use) electricity, but, Buddy, you had better have some nice baseline units hanging on to that baseload! And our country can "play" around with exotic fuels and energy sources, but had better be securing the future of coal and nuclear.

Yes, a Coal man acknowledges that nuclear has a strong and necessary place in the energy present and future. Only one word on nuclear and then I'll return to coal. The United States should continue to move steadily toward the standardization of nuclear generators so that the utilities can be assured of a smooth line to build and complete the next ones. And, of course, it's about time we figure a way to permanently dispose the first spent nuclear fuel, isn't it?

The role of Coal in the next 20-25 years? Coal will continue to maintain it's percentage of electrical generation and energy. We've seen impressive conservation efforts, impressive improvement in efficiency, but growth is essential and there will be required capacity improvement from all energy sources. Since few generators are in the planning stage for the next ten years, the following decade will experience a broad movement to install new facilities.

Coal's percentage and presence is constantly at risk as the modern monsters of global warming and NO-x have many lives. Any reflexive response to irresponsible international pressure has the propensity to abort U.S. growth and further weaken competitiveness. Recently, most articles across the board are spouting the same phrases we heard on-cue over the last two decades! Since the electric utilities and the coal producers met the latest clean air act shenanigans quickly and at a lower cost than expected, the purity zealots are bold again!

The danger is much greater this time, since technology and fuel switching are not options for the standards sought. Since such campaigns usually run a decade, it's possible that our basic energy source, coal, could be clumsily erased from the future in the last fifteen years of the Secretary's interest. I'm not a doomsayer, but we're

going to cut the wrong wire one of these days. Let's not let it get to that! Our air and water are cleaner than they've ever been and improving even beyond stringent standards. There has been an enormous price paid and being paid for this.

What do we think the coal industry and related entities should look like in that time frame? We're already watching that future evolve as a great portion of our national production is falling under fewer mining groups. This has become efficient from a management standpoint, but always presents caution that fewer groups control a large energy source. It has certainly not affected pricing, has it? What other industry can state that it is selling its product for the lowest real dollars FOB mine since the late 1950's! Bituminous coal and Lignite, of course. So, I'm not worried about advantages of few producing groups, but it does not speak well for the smaller producers who work difficult properties and are essential to our mix. They're falling off fast!. The long-term future, however, will require alliances between industries that will call for enormous resources.....that's where the larger companies will be essential.

The greatest obstacles to accomplishing this vision?

1. Coal and its related entities continue to be the Cinderella of energy. Our nation must get over its self-imposed embarrassment that it has to even use coal! While our organizations such as the National Coal Council perform yeoman duty to educate and expose the youth of our country to coal and mining, the groups which affect our destiny are not persuaded in spite of it all. The leaders of our nation must endorse coal as the cornerstone of energy for our future. Nuclear, of course holds the next largest piece, albeit a dangerous one from the standpoint of fuel disposal. That leaves about 20% of those energy requirements for the other proposed solutions. They've still left a bad taste in the young American's mind when they inferred that solar power, wind power, fusion were just around the corner and economically possible. None of the progress in the last five years on the exotic power sources offers any confidence that the energy percentages that coal and nuclear have will change over the next twenty years!.

2. Deregulation of the electric utility industry is going to show great benefits, but carries a burden that falls back onto local and state jurisdiction. While the federal government has turned them loose with wholesale opportunities, the retailing of power presents some dichotomies. Most of us endorse returning controls to the states, yet it is the local utility commissions who are so politically influenced as to find it almost impossible to deal with avoided costs, industrial intervention that threatens to move facilities which employ, and the many years of built-in restraints upon the utilities. And the utilities carry some of those same genes from the past. The Federal government is well-versed in applying influence to states as they control other grants and projects. This brand of influence can be welcomed to assure that respective States streamline the process of approvals for privatization and sales off-system of retail power. Both Federal and State

governments should stay out of the way of power generators, transporters and users, letting the marketplace determine all such relationships.

Energy costs would fall steadily with all the attendant benefits to the entire country.

3. American coals are yet at a competitive disadvantage overseas. Part of the reason is the subsidies that several European countries still provide. Part is transportation costs from the mines to the ports. For a period of time, our railroads "walked the walk", but there are disturbing trends that indicate a return to yesteryear. Transportation must continue to realize its importance to coal, and stay on coal's side of the table. The inland waterways of our nation must be maintained and follow the recommendations of the board. Waterway projects have suffered with funding and priorities and must move back up to the top of our priority list.

4. Often, certain government agencies work against the whole picture. Coal and its value to energy are impeded with Department of Labor activities which oppose industrial efficiency. An example is the recent opposition to closer management/labor groups or special industrial labor unions within a company. The very goals we seek of labor involvement are denied in deference to the persuasion of large unions working fields of the past. Modern company/labor relationships have become sophisticated and successful, but the rhetoric is deteriorating almost daily in an effort to take our modern industrial worker back to the old days. The cabinet should work as a team sorting out the real issues before one or two work a liberal program which will impede the solution to our energy future. Sadly, energy is taking a backseat to most other cabinet interests.

5. A twenty-five year timeframe must consider the value of the many chemicals that were the byproduct of the synfuels programs. The successful SASOL systems we envisioned for West Kentucky only needed assurance that the chemical byproducts could be used. Absent that, we missed the opportunity to enhance those coal fields and firmly cement our energy independence. We will need and use all of them twenty-five years from now, so should accept proven synfuel technology and set the long-range planning to be completed for several Sasol plants in Western Kentucky. The coals and mining interests are already there, with excellent proximity to the river system.

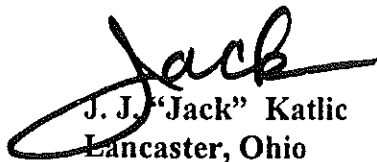
Jim, this has probably been too much narrative, but you and your staff can extract the meat of it. There's nothing strange nor is there a need to stretch the capacity of the coal industry. Coal has always met any market in its history, and can provide limitless volumes if a use exists. While we often cite about 300 years of reserves, we are aware that the words "economically recoverable" set that low a figure. Coal has had to share mostly all of its gains due to efficiency, productivity, safety and technology with the marketplace. It has not been able to keep enough

money to replenish itself and put capital back into its facilities. The industry must see a return of percentage depletion, and be given breaks on the massive investment needed to set up a modern longwalling operation.

Within the government, the reconciliation of all the proposed rules in the Surface Mining & Reclamation should be quickly put to bed. Two decades is enough time to be jerking the industry all over the board. And, with little substance. If the bureaucrats persist, they are eventually going to wear that segment down and out in the East.

Mining schools are disappearing, the labor pool is aging, and youth does not respect the industry as a career. We cannot get to the end of the existing mining and then try to recreate it all. This calls for formal training programs, subsidized and carefully drawn so as to provide a skilled progression of miners for all locations. If we're not careful, we'll lose the mining bloodlines.

Enough for now. You'll be getting nice, formal responses with neatly defined answers, liberally documented. But, I believe that while they are necessary, the overriding solution to all the questions posed and a secure, economical energy future lies in the acceptance and endorsement of coal as the base fuel.....endorsement at the highest levels of government and society. Since we do not have an energy policy, that would be a good place to start.


J. J. "Jack" Katlic
Lancaster, Ohio
August 7, 1996

BIOGRAPHY

J.E."Jack" Katlic, retired senior vice president of the American Electric Power Service Corporation's fuel supply group was responsible for the general management of the coal mining, preparation and transportation subsidiaries of the system's operating utilities, as well as overall fuel procurement activities. Annual tonnage responsibilities exceeded 55 million tons.

A leader in the coal industry, Katlic is a past chairman of the National Coal Association and recently completed an appointment to the National Inland Waterway Users Board which advises the Secretary of the Army and Congress on inland waterways priorities and funding. He received the Coal Age magazine award for 1987, and in 1988 was honored as Ohio's "Coal Man of the Year" by the Ohio Mining and Reclamation Association. In 1995 He received the Erskine Ramsay Award of the American Institute of Mining & Metallurgical Engineers, and the Pittsburgh Coal Mining Institute of America Kingery Safety Award.

Prior to joining AEP, Katlic was executive vice president-administration, engineering and government relations for Island Creek Coal Company, Lexington, Kentucky. Island Creek was a subsidiary of Occidental Petroleum.

Katlic is a graduate of West Virginia University where he received bachelor's and master's degrees in mining engineering. He began his career in the mining industry in 1948 with Rochester and Pittsburgh Coal Company at Indiana, Pennsylvania.

During the course of his career, Katlic has held positions as mine superintendent, general superintendent, senior mining engineer, and vice presidents of personnel, safety, industrial relations, administration, government relations, research and development and engineering with companies such as CONSOL, Eastern Associated Coal, Allied Chemical, before joining Island Creek in 1975 as its executive vice president-administration. Work has included projects in China, Australia, Russia, Kazakhstan and South Africa..

He has been a director of the West Virginia, Kentucky and Virginia Coal Associations and was chairman of the West Virginia Coal Association in 1981-82. An honorary board member of the National Coal Association, he is also in the National Mine Rescue Association and the Society for Mining, Metallurgy and Exploration.

Katlic has given numerous speeches to various groups such as the American Mining Congress, National Coal Association, Columbia University, chambers of commerce on subjects including labor relations, energy, clean air, power, transportation, technology, safety and fuel supply. Safety and motivation were successful activities in the attainment of the No. 1 position in mine safety in the United States of America for the mining operations of AEP. Productivity was also enhanced as Southern Ohio Coal longwalls held the world record for raw tons produced in a month in 1993.

His Community efforts included chairmanships of the Lancaster Fairfield County Chamber of Commerce and the Lancaster Medical Center, and as a trustee of the Fairfield County Foundation.

Listed in Who's Who in America, Katlic was a member of the negotiating team for the 1978 bituminous coal wage agreement. Born in Washington, Pennsylvania, he is a veteran of WWII and Korea.

Kennecott Corporation
150 East Social Hall Avenue
Suite 400
Salt Lake City, Utah 84111
(801) 322-8274
Fax: (801) 322-8260

Bob E. Cooper
President and Chief Executive Officer

Kennecott

August 1, 1996

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

AAA
14 Aug. '96

Dear Jim:

Thank you for your letter of June 24, 1996 regarding the National Coal Council study for the Secretary of Energy on a "vision" for coal for the future.

As you are aware, Kennecott sees coal playing a major role 20-25 years into the future in electrical generation -- not only in the United States, but throughout the world. For this to become a reality, policy makers in governments need to continue to remove artificial barriers to the mining, transportation, and use of coal. Environmental, health, and safety requirements must be based on sound science, particularly on international issues such as greenhouse gases, and global warming. Governments should seek to ensure real competition in the transport markets and to eliminate predator pricing by coal transporters.

We are encouraged to see the efforts in the United States to de-regulate the electric utility industry. This will bring long needed efficiencies to this industry and have positive spillover effects on the coal mining industry. We envision enhanced partnerships between coal producers, energy suppliers, and energy users over the next two to three decades.

The greatest obstacles we see inhibiting the future of the coal industry are: 1) misguided laws and regulations in both the national and international arenas -- primarily in the environment, taxes, transportation, and health and safety areas; 2) a slower than necessary movement towards retail competition in the electric utility industry; and 3) continued shipping problems in relation to Powder River Basin rail competitiveness, infra-structure adequacy, and international shipping costs.

Kennecott's vision for coal is "providing, a dependable, environmentally clean, cost effective and long term increasing fuel source to society." To provide this and maximize its value to society, coal must be mined, transported and utilized with the minimum practicable environmental and societal impacts in the most efficient manner possible.

To achieve this vision, the coal industry and governments need to work together to ensure that:

- the maximum economic value is extracted from the nation's coal resources, with the least long term social impacts;
- the standards by which environmental effects are judged need to be scientifically rational and economically sustainable, and not swayed by interest groups or political motives;
- the highest standards of safety must be maintained in the coal industry and by its customers, while eliminating overburdensome and ineffective legislation;
- the industry should continue to provide satisfying and well-compensated employment; and lastly,
- the industry and government should continue to develop efficient and clean coal technologies.

Cost effectiveness is essential for the long term survival of the coal industry and for providing a valued service to the community. To ensure improved cost effectiveness:

- the coal industry should continue its impressive drive for even better mining efficiencies;
- the industry and government should review and strive to eliminate taxes and charges that are economically unjustified; and
- the positive moves to de-regulate electric utilities should proceed with out political influence and hindrance.
- a major analysis of the role of rail carriers in the coal supply chain should be completed with a view to increasing competitiveness of the railroads.

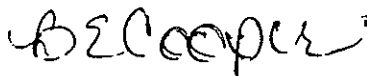
The utility industry faces the task of commercializing new combustion technologies that will dramatically reduce emissions far below those of existing plants. However, this task comes at a time of industry deregulation, where cost competitiveness will be the key to survival. We believe there may be a role for government in fostering the commercialization of clean coal technologies during this period of transition for the utility industry.

As you are well aware, the image of the coal industry is worse than reality. The public perception is commonly based on the industry as it was decades ago, and by the emotional claims of environmental and other pressure groups. Often, politically motivated actions by governments and the bureaucracy reinforce these impressions. In the end, only decisions based on good science and persistent communication can help rectify this imbalance.

The Coal Industry Advisory Board to the International Energy Agency is currently working on studies to identify the impediments to the uptake of clean combustion technologies. This work is scheduled to be complete in November 1996, and should be published early in 1997. I have enclosed an extract from an earlier CIAB study, "Factors affecting the take up of clean coal technologies - overview report" for your reference.

As the National Coal Council moves forward with this important study, I would urge you to work directly with Greg Boyce, President Kennecott Energy Company. Greg can be reached at (307) 687-6001.

Sincerely,

A handwritten signature in cursive script, appearing to read "B. E. Cooper".

B. E. Cooper

Enclosure

cc: G. H. Boyce

Bechtel

9801 Washingtonian Boulevard
Gaithersburg, Maryland 20878-5356
(301) 417-3000

July 31, 1996

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

AAA
1A Aug. '96

Dear Jim:

I am glad to be able to contribute to your study for the Secretary of Energy. Enclosed you will find a summary of Bechtel's "vision" of coal for the future.

Sincerely,

Tim

Timothy D. Statton
President
Bechtel Power Company

Enclosure



Vision of Coal for the Future

Through the further development of Clean Coal Technologies, coal will be known both in the US and globally as an economical and environmental fuel of choice for power generation. Coal will be seen in the US as the key contributing factor to limiting dependence on imported oil and globally as a key ingredient to maintaining stable energy prices.

Role of Coal in 20-25 Years

- Low cost/clean fuel for global power generation
- Key role in maintaining the stability of energy prices
- Economic catalyst for local revenues and employment (coal mines, power production facilities, coal transportation)
- To keep in check levels of imported fuels, a step toward US energy independence
- Source of US trade revenue as opposed to gas and oil which contribute to trade deficit
- Support sustainable development throughout the world

What The Coal Industry and Related Entities Should Look Like in that Time Frame

- Coal industry will be vibrant as power needs on a global scale increase the demand for coal
- Greater collaboration will take place between the coal industry and businesses, as well as the coal industry and government, to further develop and optimize clean coal technologies
- Power generators will increasingly look to coal as a source of fuel as gas and oil prices increase

The 5-6 Greatest Obstacles to Accomplishing this Vision

- Acceptance by public of coal as a clean source of power generation
- Trends toward development of natural gas power plants
- Cost of technology to clean up existing plants
- Coal transportation costs
- Limitations of research in developing advancements in Clean Coal Technology

Response File

July 24, 1996

Telephone call from Carter Grinstead:
(not to be quoted)

VISION OF COAL IN NEXT 20-25 YEARS

Would like to see coal as the key source of energy in the US

WHAT THE INDUSTRY SHOULD LOOK LIKE:

Environmentally safe that operates efficiently and safely

OBSTACLES:

Meeting the challenge to be looked on as an environmentally safe industry

~~MAA~~
18 July '96

PHILLIPS COAL COMPANY

2929 NORTH CENTRAL EXPRESSWAY
RICHARDSON, TEXAS 75080

PAUL M. THOMPSON
President



214-669-5906

July 24, 1996

Jim McAvoy
The National Coal Council, Inc.
P.O. Box 17370
Arlington VA 22216

Handwritten notes:
4/11/96
J. McAvoy

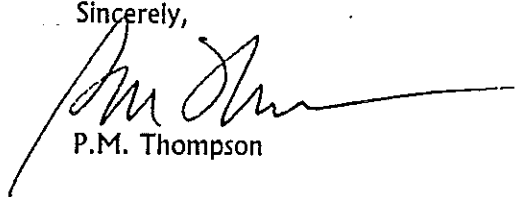
Re: "Vision" for Coal Study

Dear Jim:

As per your request, enclosed are some thoughts we have on what the future might look like 20-25 years out.

If you have any questions, please so advise.

Sincerely,


P.M. Thompson

enclosure

1. Role of Coal in 20-25 years?

- ✓ Providing fuel to generate 60% electricity
- ✓ Baseload plants utilizing clean-coal, high-efficiency technology
- ✓ Lower transportation costs through competition and productivity improvements

2. What will the coal industry and related entities look like in 20-25 years?

- ✓ Fewer and larger companies producing 90% of coal
- ✓ More partnering between fuel suppliers, power plant owners, and end-users to bring down prices
- ✓ The "plant of choice" will be some type of gasification-combined cycle technology for low emissions and greater efficiencies

3. What are the greatest obstacles to accomplishing the vision?

- ✓ Making major decisions re CO₂ reductions prior to having any scientific basis to do so
- ✓ Externalities--in effect, regulated out-of-business by government actions--both federal and state.
- ✓ Continued improvements in technology without continuous funding of R&D programs--both public and private

Glenway Avenue
P.O. Box 1280
Bristol, Virginia 24203

The United Company



July 22, 1996

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

JMT
30 July 96

Dear Jim:

Thank you for your inquiry dated June 24, 1996, specifically requesting my input in regards to a "Vision" for coal in the future and major obstacles that need to be overcome in order for this vision to be realized.

In looking ahead the next 20-25 years, absent coal making inroads as an alternative energy use source, it is essential for the coal industry to maintain its market share with its primary domestic customers consisting of the electric utility and coking industries. It would also be significant if we were more of a "base", rather than "swing" supplier to our export customers. The domestic utility industry is undergoing massive structural and growing economic pressures which will require changes in the way our industry supplies their energy needs. In addition, our many foreign customers will continue to seek a portion of their coal needs from the U.S. for both quality and reliability. It is important that we recognize and find more efficient ways to meet these exact needs.

Continued competitive pricing, both domestically and abroad, will in the end carry the coal industry for the next 20-25 years. This will not be achieved by coal producers and customers working alone. It will require continued cooperation, understanding, and long-term planning by various governmental and business related entities, including the following:

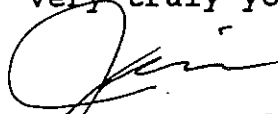
1. Federal, state and local environmental agencies and organizations
2. Federal and state mining and regulatory agencies
3. Rail, barge and ocean going vessel carriers

4. River terminal and port authorities
5. Mining equipment and supply manufacturers
6. Financial institutions

All of these related parties will have to find better ways of planning future growth, improving efficiencies, and promoting economic viability in order for the coal industry to continue to thrive. Continued improvements in mining technology, transportation, burn efficiency and electrical distribution, and environmental technology can work to the benefit of all parties if properly communicated and expanded. In the end, if the coal industry is to survive, we must continue to deliver to our final customers better and more reliable service, low cost energy, while maintaining the environment for future generations. This likely will result in further consolidation of the coal industry whereby needed economics can be achieved through diversification of product sourcing location and quality. All of this and more can be accomplished, but will require the concerted efforts of all related parties dedicated to the preservation of our coal industry.

I hope you find the above comments of some interest and benefit. Please keep us advised of future activities.

Very truly yours,



James W. McGlothlin
Chairman and CEO

MASSACHUSETTS
INSTITUTE OF TECHNOLOGY

DEPARTMENT OF
CHEMICAL ENGINEERING



Room 66-548
Cambridge
Massachusetts 02139-4307
Telephone (617) 253-6661

Response file

János M. Beér
Professor Emeritus of Chemical and Fuel Engineering

JMB

Mr. James F. McAvoy
Executive Director
The National Coal Council, INC.
Post Office Box 17370, Arlington, Virginia 22216

Dear Jim,

July 15, 1996

Many thanks for your letter of June 24. The Secretary of Energy's request for a study to develop a "vision" for the Future of Coal is a challenge. I am pleased to give my thoughts and initial reactions to such a study. During the last three years that I had the privilege of serving on the Council I noticed a move in the Council's views from the assumption that market forces will by themselves satisfactorily deal with the coal industries problems, to the more realistic view that the coal industry for its survival needs Federal Funds for R&D and Demonstration Programs along the lines of the Clean Coal Demonstration Program, somewhat modified with our hindsight of 10 years experience.

In this discussion I have taken it for granted that we all agree that coal is a national asset; it gives us more energy independence, and with a contribution of \$ 20 billion to the GNP, it contributes significantly to the national economy. However, coal is a strongly polluting fuel and is under pressure globally by growing environmental concerns and tightening regulations.

The salient questions for the next 25 years of coal use are closely related the questions of pollution, and in particular to Global Warming : How high is the expected rate of global warming, How good is the science of modeling and what are the "error bars" of prediction?

Is the rate of warming sufficiently low, so that energy conservation, use of advanced, high efficiency coal based power generation can cope? Or, will there be convincing evidence of a higher rate of global warming which would require significant and urgent changes in our use of fossil energy?

At present there is no convincing evidence for the latter case. So, what are the technological options, what are the domestic and the international political -economic environments for a strategic plan to be formulated at present ? I think that there is reasonable certainty about the range of our technological options, the political -economic background for these decisions is, quite uncertain. There are, however, trends which can be predicted, such as the adoption of a

carbon tax. We do not believe that a carbon tax is useful, but judging from events and public opinion in the industrially developed countries, we should be ready for it. I think that if it has to come it should not just join the funds of General Taxation of the Federal Government but, instead, should form a Special Fund, from which Utilities in developing countries with increasing coal use (China, India, Indonesia) can borrow to build up-to-date efficient and clean plants. This could produce opportunities for our manufacturers and make additional funds available for the development of clean coal technologies.

Advanced Technologies of Power Generation, high efficiency Single (Supercritical steam) or Combined Cycles will have to be in the center of Clean Coal R&D. Energy conservation is capable of reducing all pollutants simultaneously in direct proportion to the improvement in efficiency.

There would need to be a technical-economic reassessment of the Clean Coal Technologies as an extension of the Council's excellent "Critical Review" in 1994 to support the Energy Secretary's Strategic Plan . Emerging technologies and their combinations with ongoing developments (e. g. Kalina Cycle-LEBS and HIPPS combinations) present continually new challenges and opportunities. While the manufacturers are increasingly prepared to meet these challenges, there may well be lack of an "impedance match" between the long leadtimes of R&D, Demonstration and the Construction of new advanced power plants, and the need of their urgent application. The Federal Government may have therefore an important role to help speed up Advanced Technology Developments in close cooperation with the Electric Utilities and Equipment Manufacturers.

I hope that I understood correctly your request for my views. Please let me know if you wish me to give more information

Yours very truly

A handwritten signature in cursive script, appearing to read "James", followed by a period.

The Gates #18
4272 Bit and Spur Road
Mobile, AL 36608
July 8, 1996

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

AAA
18 July '96

Dear Jim:

In response to your letter of June 24, I recalled a paper I wrote three years ago. I realize that it is too lengthy to send to the Secretary but I enclose it to give you the rationale for the brief statement I offer in response to your request.

When coal is viewed in the broad context of energy resources on which the U.S. must rely during the next 25 years, it is obvious, as often stated in NCC documents, that coal is the most abundant and least expensive of the alternatives. It is clearly destined to be the fuel of choice for generation of electricity, and it will also play an increasingly important role in offsetting or supplementing energy applications now depending on oil and natural gas as they become relatively less plentiful and more expensive. It is likely that, in the time frame of 25 years, a growing market for coal also will be for production of synthetic natural gas and liquid transportation fuels. It is imperative for the U.S. to properly manage and optimize the use of coal resources in order to enable international competitiveness and national well-being through reliable and reasonably priced energy.

If coal is to fulfill its destined role, the principal obstacles to be overcome are negative public perceptions about coal, regulatory overkill, and misinformed or uninformed persons in positions which influence public opinion and political action. The NCC has addressed the public perception problem, but it is difficult to see if significant improvements are being made. A wealth of evidence is available about regulatory overkill, but neither the politicians nor the media seem to show any interest. And misinformation is standard fare among the activists who are supporting agenda other than the national energy strategy which would provide the maximum advantage to the public and the national interest. If these obstacles are not overcome, and timing is critical, the results will be evidenced in loss of international markets for U.S. goods and services, higher cost of living, and general decline in the leadership position of the U.S. in the world. Thus, the stakes are high, but strong national leadership will be required to achieve the needed results.

With best regards -

Bill Harrison

THE FUTURE ROLE OF COAL

William B. Harrison
April 1993

Energy is basic to practically every activity of modern society, and the United States, throughout its history, has depended on plentiful and economic sources of energy to sustain prosperity and advance the standard of living. The subject of this paper is the role of coal in the context of energy imperatives and alternatives. The term "imperatives" is used here to refer to physical, financial, institutional, geopolitical, or technological factors which place real limits on the choices available to meet energy needs. It follows that "alternatives" are those choices which remain within those limits. To illustrate these definitions, consider energy supply and demand relationships for commonly used fossil fuels - natural gas, oil, and coal.

Fossil fuels are finite resources in the sense that they are being consumed and eventually they will be gone, for all practical purposes. The total amount of each fuel throughout the world imposes limits on the potential value of the fuel and how long it will last if consumed at a known rate. On the other hand, the marketplace determines the actual price and demand for each fuel in terms of its local availability and the cost of producing it and using it for specific applications. Currently, the result is a serious mismatch in supply and demand for these fuels. In the world at large, oil and gas are used to meet about two-and-a-quarter times more energy needs than coal, though the known reserves of coal represent over two-and-a-half times as much energy as the combined known reserves of gas and oil (1)*. In the United States, the mismatch in supply and demand is even worse. Combined domestic reserves of oil and gas represent less than 6% of the energy available in domestic coal reserves, yet they are used to provide about 65% of domestic energy needs (2). An "imperative" derived from these facts is that supplies of gas and oil will be depleted long before supplies of coal throughout the world, and especially in the United States, unless the patterns of use of these fuels are changed significantly. This idea will be picked up later, but some background information will help to provide perspective on its importance.

One must not view energy supply and demand from a "snapshot in time", for history reveals dynamic changes that have come about through a variety of forces. There is a constantly evolving mixture of energy resources and uses which accompanies changes in the economy, resource availability, and technical development. In 1850, wood provided about 90% of the nation's energy needs. Subsequently, coal began to replace wood in many applications, and, by 1885, coal and wood provided almost equal amounts of

* Numbers in parentheses identify references in the Bibliography.

energy. From then, the use of coal increased steadily until, by 1910, it provided about 75% of the nation's energy needs. From that point, natural gas and oil began to replace coal in many energy applications, leading to the current supply/demand relationship described above (3). In recent years, other energy resources, such as nuclear, solar, wind, and geothermal, have begun to fill special places in the energy marketplace. With all of these alternatives emerging, and with the historic pattern of change, what are the "imperatives" which can be identified?

The most conspicuous imperatives relate to oil. In 1945, the United States was a net exporter of oil. In 1990, the U.S. imported 42% of the nation's oil requirements at a cost of over fifty-five billion dollars (4). The U.S. position in the Gulf War was motivated not only to right a wrong, but also to protect oil on which the world, as well as the U.S., has become so dependent. The Department of Energy (DOE) estimates that, without new energy policy initiatives, oil imports will rise to 57% of domestic oil consumption by the year 2000, and to 65% by 2010. Further DOE estimates predict that, without new initiatives, the nation's oil import costs would double to \$110 billion by 2000 and increase to more than \$200 billion by 2010 (in 1990 dollars) (4). Thus, the nation's dependence on imported oil creates significant risks to both the national security and the national economy. The security risk is addressed by military strength to protect supply lines, primarily from the Middle East. If the cost of this protection were added to the price of imported oil, it has been estimated that the price per barrel would more than double. The outflow of dollars also has a serious impact, since the payments for oil are a major portion of the tremendous imbalance in the U.S. world trade position. At \$55 billion per year, the outflow of dollars in the past ten minutes was about \$1 million. Over the next 24 hours it will be about \$150 million. It is even harder to imagine the magnitude of \$200 billion, but, for comparison, the assets of the Fortune 500 companies were estimated to total \$2500 billion in 1992. The assets of the 50 biggest companies amount to about \$1600 billion, which means that the next 450 companies of the Fortune 500 have combined assets of about \$900 billion (5). It is a sobering thought to realize that, in a very few years of continually rising oil imports, the U.S. will have traded sums of money equivalent to the total assets of so many major corporations - just for oil.

There are those who say that all that is needed is an energy conservation program to reduce the need for oil. As energy costs have escalated, everyone has become more aware of the dollar savings associated with energy savings. In recent years, significant improvements in productivity and profitability in the U.S. manufacturing sector are related to the energy conservation which has taken place. The virtues of conservation are obvious, and most of the easy conservation measures already have been implemented. On the other hand, there are many forces at work to constantly create new energy demands - a major one of which is

population growth. A recent article in Forbes (6) quoted Commerce Department figures to show that the U.S. population doubled between 1930 and 1990, and it is expected to increase by 25 million between 1990 and 2000. (It also is estimated that the population will increase by over 80 million between 2000 and 2050 - which is more than the entire current population of Germany.) The addition of 25 million in this decade may be visualized as a requirement to provide new homes, new streets, new factories, new health facilities, new recreation centers, new schools, new shopping centers, and related services equivalent to creation of a new city of over 200,000 residents every month during the next ten years. Every aspect of this growth requires energy. Clearly, conservation alone cannot solve the problems associated with imported oil.

What, then, are the strategies available to address the problem of too much reliance on imported oil? Conservation is the starting point so as to eliminate or reduce uses of all forms of energy where possible and to use energy as efficiently as possible, when necessary. The remaining strategies become clearer if one imagines for a moment that imported oil were simply not available. Strategies based on such an extreme scenario may be, in a sense, useful in prolonging the day when there really is no more oil. Meanwhile, they provide tools for analysis to see the best way to deal with national energy needs and wisely manage domestic energy resources.

It has been noted above that domestic oil supplies are insufficient to meet domestic needs. Though some national leaders are encouraging wider uses of natural gas, supplies of natural gas are not sufficient to replace imports of oil. Furthermore, the U.S. already is importing natural gas and growing demand for imported gas someday could become as serious a problem as imported oil. It is prudent, then, to identify those applications where oil and gas are most needed because of their special characteristics and dedicate the limited supplies to meeting those needs. Oil would be committed to transportation and to selected petrochemical facilities. Natural gas would be committed to domestic heating and to selected chemical process industries where it is uniquely needed. Those additional energy uses which otherwise would come from oil and gas would then come from electricity derived from coal and nuclear resources, or from substitute fuels made from coal or biomass, or from solar or wind or geothermal energy, or some combination of all of these alternatives. At present, solar, wind, and geothermal energy are not cost-effective except in limited and relatively small geographic areas. Biomass is either not available in sufficient quantity or at competitive prices to make much impact on energy needs in the near term. Therefore, coal and nuclear resources would be required to make up the major shortfalls if imports of oil and gas were reduced.

This outlook should not be viewed with despair. The U.S. has more coal than the Arabs have oil. Furthermore, the U.S. nuclear

resources are greater than domestic oil and gas combined, and could be multiplied significantly when "breeder" reactor technology becomes commercially available. Perhaps another imperative is that negative images of coal and nuclear energy must be overcome and national policies which limit the use of these resources must be avoided.

It is most unfortunate that public perceptions about nuclear energy are so heavily based on news stories of the accidents at Three Mile Island and Chernobyl and movies like China Syndrome. The public has been conditioned to fear anything "nuclear" because of the threat of exposure to nuclear radiation. The fact is that there have been no fatal radiation injuries attributed to nuclear energy in the entire history of the U.S. civilian nuclear power industry. Furthermore, there has been no case in the U.S. in which members of the public have been damaged by the presence of radiation from a commercial nuclear power plant. The U.S. now depends on nuclear power for about 20% of its electricity. The threat to future use of nuclear energy comes from the relentless anti-nuclear activism of a small number of people who have been given sensational publicity by the media, and whose credentials and motives are seldom questioned. The general public is not prepared to analyze the risks associated with nuclear power relative to other risks which are accepted by society, and the sensational anti-nuclear stories have created public distrust which resulted in a proliferation of unduly restrictive regulatory and institutional barriers to nuclear energy. The Three Mile Island accident was the most serious nuclear power accident to ever happen in the U.S., and though it was an economic calamity for the owners, the public was not damaged. France has managed to maintain the trust of the public and now relies on nuclear energy for about 70% of its electricity. The U.S. has permitted extremists to bias the public against nuclear energy to the point that, in a few years when greater commitment to nuclear energy becomes inevitable, it may be necessary for the U.S. to buy the latest and best nuclear technology from France or Japan.

The negative images of coal have their origin in the past when, in fact, many aspects of coal production and use really were negative. The concerns about mine safety and black smoke are no longer valid, but they have been replaced in recent years by environmental issues related to headlines about "acid rain" and "global warming". Sulfur dioxide, nitrogen oxides, or greenhouse gases (particularly carbon dioxide) - emissions from coal-burning - have been dramatized and publicized by environmental activists, who also generally oppose nuclear power. Little is said about the fact that burning natural gas and oil also produces oxides of nitrogen and greenhouse gases, or that natural gas itself is a more important greenhouse gas than any of the combustion-product gases from burning coal, so often cited. The Clean Air Act of 1970, amended in 1977 and again in 1990, requires stringent controls on emissions of the gaseous and particulate emissions from coal-

burning power plants - stringent now and even more stringent in the future. Great strides have been made in achieving environmental goals, mainly through development of new technologies. Since 1975, electric utilities in the U.S, have spent more than \$100 billion to reduce emissions of sulfur dioxide, and about \$8 billion is now being spent annually for compliance with air quality standards. Since 1973, electric utilities have increased their use of coal more than 80%, while at the same time reducing their total emissions of sulfur dioxide by about 12% (7).

The most conspicuous program of development to address environmental concerns and also to improve the efficiency of processes to generate electricity is called the Clean Coal Technology Program - funded jointly by government and industry. It was started by Congress in 1986 and expanded since then to finance projects valued at almost \$6 billion to be completed during this decade.

Many of the regulations and compliance standards which are imposed on coal-burning facilities are not cost-effective in the sense that benefits, if any, are not commensurate with their costs. Nevertheless, the requirements, both good and bad, have the force of law and the electric utilities are working diligently to be able to comply as the future timetable for greater stringency has been set. In some cases, successful demonstration of new technologies from the Clean Coal Technology Program will be required for compliance with regulations already established for the future. Clearly, new technologies will be expensive, and, to the extent that regulations are overly stringent, some of the added costs will have negative impacts on the national economy.

That some regulations are overly stringent is obvious in a review of the Clean Air Act Amendments of 1990. After years of steady media support for scare headlines about the alleged damages from acid rain, these amendments were adopted mainly to further restrict emissions of sulfur dioxide to protect "thousands of lakes, miles of forests and hundreds of streams..."(8). These amendments completely ignored the scientific information gathered under another act of Congress passed in 1980 to determine the causes and effects of acid rain. This legislation created the National Acid Precipitation Assessment Program which, by 1990, had been ongoing for a decade at a cost of \$540 million. The facts are that very few lakes, forests, or streams are affected by acid rain and that there are far more cost-effective ways to treat those special cases than those required by the legislation. Even William K. Reilly, former Administrator of the Environmental Protection Agency, recognized this problem of misguided legislation, and he has been quoted as follows: "People have a right to expect that public officials are making the right choices for the right reasons. We need to develop a new system for taking action on the environment that isn't based on the nightly news. What we have had in the United States is environmental agenda-setting by episodic

panic." (9) Another imperative may be that the U.S. cannot use its energy resources efficiently and cost-effectively until constraining laws and regulations are critically reviewed to determine what constraints are really needed and to eliminate those which are not.

There is yet another imperative related to energy which must be considered. Energy costs must be kept as low as practicable because so many national objectives and values are connected. In a speech last Fall, Mr. James G. Randolph, then Assistant Secretary of the Department of Energy, summarized a basic truth as follows: "The availability of reliable, affordable energy largely dictates the potential for future domestic growth, the competitiveness of U.S. goods in global markets, and the ability of the U.S. to exercise continued leadership in a changing world." (10) Reminders of the U.S. competitive position in the world economy are visible in almost every field of commerce. Since energy costs are basic components of the cost structure of every business, it follows that enterprises engaged in international competition will be placed at a serious disadvantage if their energy costs are permitted to rise unduly. Even worse than the negative impact on competitiveness are the domestic consequences as rising energy prices undermine many other worthwhile national goals. The Department of Energy expects that by 2010, the prices for oil and gas will have increased eight times as fast as the price of coal (11). Clearly, it is in the national interest to keep the prices of all fuels as low as practicable so as to minimize costs of all goods and services, leading to improved international competitiveness, stable and expanding employment, and general improvements in the nation's standard of living.

Imagining once again that the nation really had to do without imports of oil and natural gas, consider some of the possible implications. First for oil, the implications relate mainly to transportation. The need for conservation would continue to motivate development of more efficient engines, and accelerate the public acceptance of smaller cars and low-performance vehicles. Demand for gasoline would be reduced somewhat by dilution with other fuels, such as ethanol, or by direct substitution by other energy resources such as methanol, hydrogen, or electricity. This also would increase the need for better mass transportation and ensure the market expansion of electric vehicles. Since long-distance transportation can be achieved by trains with about one-quarter of the energy per ton-mile required by trucks, one might foresee increases in rail transportation, at least for freight, and probably also for people. City planners would develop communities which require less transportation so that people could live, work, and shop in a relatively small area and the large personal vehicle would not be needed to the extent it is today. Coal would be used as a raw material to make some materials now derived from oil. The production of gasoline from coal would eventually be commercially viable. Electricity would replace oil in applications in which oil

is used as a source of heat in manufacturing.

Electric heat pumps would replace natural gas in some domestic heating applications and synthetic natural gas, derived from coal, would augment gas supplies. Further emphasis would be placed on good thermal insulation in all construction projects - including homes, office buildings, stores, and factories.

The role for coal would be in generation of electricity and process heat for manufacturing, and as a raw material for producing synthetic natural gas and synthetic crude oil, as mentioned above, and as a substitute for oil or gas in certain petrochemical industries.

In the scenario being imagined here, even the anti-nuclear activists would have to accept an increased role for nuclear energy, primarily to make electricity. This need for nuclear energy might also sweep away some of the current unwarranted obstacles and stimulate the commercial development of new nuclear power technologies, including the "breeder", which produces more nuclear fuel than it consumes.

During this rearrangement of patterns of use for the conventional fuels, there would be emerging cost-effective uses for geothermal, solar, wind, and other energy resources as their respective costs become more competitive.

Electricity, regardless of its energy source, would serve a growing fraction of the nation's total energy needs, and new technologies may be expected to produce significant improvements by increasing efficiency and reducing environmental impacts.

Most of the concerns and most of the approaches for dealing with them as noted here are found in the National Energy Strategy, published by the Department of Energy in 1991. There can be no doubt that the nation needs a strategy that provides affordable and reliable energy, and that minimizes economic and security risks related to energy. The development of a national energy strategy was a significant achievement, though it undoubtedly can be improved, and it is encouraging that a major government department is trying to address, in realistic terms, one of the most basic requirements for the nation's wellbeing.

In conclusion, please take note of the positive elements in this discussion of energy imperatives and alternatives. The U.S. has abundant resources of coal, and significant resources of oil, natural gas and uranium. There are numerous existing and emerging new technologies with which to use the nation's energy resources wisely and well. Furthermore, the nation is blessed with enough intelligent and dedicated people to undertake the tasks necessary for proper management of it's energy resources if they are given the opportunity to do so. It is now up to the national leaders to

see the merit of implementing a national energy strategy which assures affordable and reliable energy to drive the nation's economic engine.

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APPENDIX G

Selected Comments on the Report, VISION 2020: THE ROLE OF COAL IN U.S. ENERGY STRATEGY

University
of Florida
1853

ICRAAS
Clean Combustion
Technology Laboratory

Bryant Space Science Center
PO Box 112050
Gainesville FL 32611-2050

Phone-(352) 392-2001 Fax-(352)392-2027 Email-aesgreen@pine.circa.ufl.edu

February 10, 1997

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

[Handwritten signature]
13 Feb. 1997

Dear Jim,

Enclosed are some "easy to implement" suggested changes in the February 19, 1997 Draft of "Vision 2020.." intended to increase its effectiveness. They divide into: (ED), editorial; (TA), instances where the present words appear too advocatory; (CL), suggestions for clarification; (SU), substantive suggestion and (ST) strengthening suggestions. In addition two general comments might be given editorial consideration.

China, India and other Asian countries generally have low quality coals but will undoubtedly be greatly increasing their use. Before the year 2020 the US public might recognize that a Balance of Trade is almost as important as a Balance of Budget. As I see it, a trade deficit is equivalent to selling that much of the USA to the foreign country, increasingly for manufactured goods or liquid energy. Working harder towards a Balance of Trade could foster greater use of cleaner US coal. along with our Clean Coal Technology. This "carrying coals to Newcastle" would mitigate the large CO₂ increases expected from Asia.

The report seems to write off the US nuclear industry, which might be unwise. We have a lot of surplus weapon fuel to use up and by 2020 the advanced reactors designed by US companies for foreign use might be acceptable in the USA.

Since my more timely suggestions on domestic fuel blending have been graciously included I will not be offended if the enclosed late suggestions are ignored or used selectively. The major contributors are certainly to be commended for their very good report.

Very sincerely,

Alex Green

Alex E. S. Green

Hagler Bailly, Inc.

1530 Wilson Boulevard, Suite 900
Arlington, Virginia 22209-2406
Telephone: (703) 351-0300
Fax: (703) 351-0344

Henri-Claude Bailly
President

February 20, 1997

Mr. Clifford R. Miercort
Chairman
The National Coal Council, Inc.
Post Office Box 17370
Arlington, Virginia 22216

HA
29 Feb. 1997

Dear Mr. Miercort:

I regret I was not able to attend the meeting of February 18 due to pressing issues needing my immediate attention upon return from travel. Enclosed is a memo with my notes in response to the draft report "Vision 2020: The Role of Coal in U.S. Energy Strategy".

Sincerely,



Henri-Claude Bailly

MEMORANDUM

TO: Coal Policy Committee and
The Full Council Meeting as a Committee of the Whole

FROM: Henri-Claude Bailly

DATE: February 18, 1997

SUBJECT: Revision of "Vision 2020: The Role of Coal in the U.S. Energy Strategy"

The Importance of Coal in the Economy

The arguments about the importance of electricity and coal generation in the U.S. economy strikes us as rather verbose and poorly organized. Some rewrite would certainly help. P.13, pp.2 is tautological. To say that 90% of the economy consumes 90% of the electricity doesn't tell us anything meaningful. A better way to make the point of the increasing importance of electricity in the U.S. economy is to present 2 simple graphs: electricity consumption per unit of GDP (which has been climbing steadily) and total energy consumption per unit of GDP (which has been declining steadily). The message, of course, is simple: The economy is becoming increasingly electrified.

Questionable Economic Analysis

The report references a study of comparative power supply costs done by Energy Ventures Analysis (pps. 16, 17 & 20) but does not provide a citation. We assume it is the study commissioned approximately one and one-half years ago by CEED (The Center for Energy and Economic Development) to compare the economics of gas vs. coal generation. EVA's conclusions were contingent on some rather Herculean assumptions and the report was roundly criticized in the PUCs where it was presented.

If the NCC is serious about its claim to participate in the debate in an advisory capacity and not an advocacy organization, we would suggest basing the economic arguments on more credible sources of analysis, because the EVA study is an easy target for coal opponents.

Nuclear Shutdown

The premature retirement of a hand-full of troubled nuclear units will not have any structural impact on either the market price of power or air quality. After all, we are talking about a few thousand MW in the context of an 800,000 MW system. We feel the language in the NCC report is overstating the point.

Restructuring and the Environment

From an environmental point of view, we think the "environmental community," broadly speaking, is missing the point when it argues that more open and competitive markets for electric power will result in older, dirtier coal plants being utilized more heavily. From the modeling of bulk power markets we have done, it is patently clear that the most important variable in determining how the old, dirty coal plants will operate is the cost of natural gas -- specifically, the degree to which new, efficient gas-fired units will displace the older coal plants. New environment regulations notwithstanding, the degree to which old coal units will be operated will be contingent on their non-fuel O&M costs (very high for most old plants) and the market power of the operator. In addition, the modeling we have done also shows that substantial increases in power sales from northern ERAR to New England and New York, the basis for most of the claims of declining air quality, seem to be greatly overstated. The best markets for the excess capacity in Ohio are to the south, not east.

Criticisms of the Coal Industry Not Addressed

The report did not address some of the criticisms with regard to the structural changes that have been taking place in the coal industry and their public policy implications. Obviously, the NCC is aware of these issues and perhaps a preemptive response might be appropriate.

Stated briefly, the criticisms generally fall into three categories:

- the wave of coal company mergers of the 1990s that is increasing the concentration of coal production under the control of the largest producers
- the increasing proportion of U.S. coal produced by foreign-controlled firms
- the exit of oil and gas companies from the U.S. coal industry

The number of U.S. mines producing coal today is less than half the number 20 years ago. Yet, U.S. coal production increased by roughly 50% during this period, as the average mine size more than tripled. Nearly two-thirds of U.S. coal is produced by only 7 percent of the nations mines - those mines with an annual output of 1 million tons or more.

Coal company size (in terms of production) has increased dramatically. According to a 1993 DOE report, the number of firms producing more than 20 million short tons of coal per year accounted for 41 percent of U.S. coal production, up from 22 percent in 1976. Firms producing 3 million tons or more annually -- major coal producers -- accounted for 77 percent of national coal production in 1991, up from 57 percent in 1976.

The increase in the size of coal firms is attributable to several factors. Primarily, production has shifted toward the West, where low-sulfur coal is produced from thick seams in large surface mining operations. Large firms are better situated to meet the long-term capacity requirements for gigantic drag line operations.

13 Feb. 1997.

Comment by R.H. Essenhigh on "Vision 2020"

I would agree to release of the *Vision 2020* study as it stands. However, I would strongly urge far more emphasis on the research end of the problem than is given at this time. A suggested additional statement for inclusion in the Recommendations follows (with a supporting commentary, for inclusion in the text or not as the Working Group think fit)

Recommendation. "DOE and the coal industry should recognize the need for and adequate support of a critical mass of coal research groups at universities allowing for *non* targeted exploratory/fundamental research and inquiry on coal structure, properties, reaction behavior (pyrolysis, combustion, gasification, liquefaction . . .) with the twin targets of: (1) maintaining continuing scientific exploration of coal properties and behavior as the essential basis for upgrading existing technologies and for development of new technologies in the future; and (2) maintaining an adequate supply to industry of scientists/engineers *educated* (not just trained) in the science and engineering that underlies coal technology and use."

Commentary. The central issue here is the joint need, on a continuing basis for supply of trained and educated manpower to the coal and utility and related industries: (1) to be able to maintain the plant operations with increasing understanding and efficiency; and (2) to be able to recognize and develop into practice new concepts arising from research as the basis for new technologies in the future.

On the first count it has always been a standard component of Management Principles that, in recruiting, the aim should always be to improve the level of training and education over the level of the last group of hires. This will fail if there is not a resource base of institutes that can provide steadily improved training and education. This introduces two additional issues. The first is that courses on any aspects of coal at most institutes and universities are marginal to zero unless and generally *only* if there is a strong research group at the institute. Consequently, as the research support declines, the resource base declines, generally even faster. Without that research support, it is a matter of time before supply can not meet demand.

The second, and associated issue can be defined as recognizing the difference between *Know How* and *Know Why*. *Know How* is training, focusing on well established techniques, and this can be taught, even by the using industry. *Know Why* is education, and this requires the inquiry that only comes from research. *Know How* gives you the job today. *Know Why* gives you the base to update and keep the job tomorrow. If the *Know How* is not updated by *Know Why*, the using industry will become backward and lose ground.

The need for education in *Know Why* by those in the industry is the need for the industry leaders -- managers -- to be able to recognize the technological significance of new developments, and to be ready to take advantage of those developments as they become available, or even to initiate the new technologies as the fundamental research on which a new technology will be based is developed. Failure to do this leads to obsolescence. This requires a country-wide research base, with targets that are not necessarily tied to short-term industry needs. Lacking that country-wide research base, the inevitable consequence will be that the industry will become backward, and/or will only be able to obtain updated technology by purchase from outside the country. Is this a desirable outcome?

APPENDIX H

Acknowledgments

APPENDIX H

Acknowledgments

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**Editorial Consultant: Catherine Kaliniak,
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