ENERGY OUTLOOK

VIRGINIA CENTER FOR COAL & ENERGY RESEARCH WINTER 1996-97 /VOL. XVI, NO. 4

COAL - AN INDUSTRY IN TRANSITION

William G. Karis, President and CEO
CONSOL

The text of this article is derived from a speech given at the CoalTrans '96 Conference this fall in Madrid, Spain.

It is strongly suggested by the title above that the coal industry is "an industry in transition" - that we are passing from one stage to another. In fact, some would like the world to believe that we are passing from the stage entirely. I would, however, suggest that our transition is merely the continuation of an evolutionary process, a process that allows the coal industry to meet the changing needs of our customers while remaining the "steady hand" in an often volatile energy picture.

I would suggest that our transition is merely evidence of an industry taking the necessary steps to respond to environmental concerns and economic realities. Moreover, I would suggest that our transition is merely the act of ensuring that coal will remain the pivotal fuel in meeting the world's primary energy needs. We are an industry whose trademarks are reliability and price stability. In addition, we have demonstrated flexibility in meeting the changes that are occurring around us - responding, in effect, to a *world* that is in transition. In particular, we are responding to transitions in the need for energy in the developed *and* the developing countries; the manner in which industrialized countries view the coal industry and coal's impacts on the environment; the structure of the electric generating industry (coal's primary customer) as it encounters the turmoil of deregulation; and the increasing competition from natural gas as a fuel for the economy.

I will not belabor the statistics on the importance of coal to a healthy world economy, because the tie between energy consumption and economic growth is indisputable. Moreover, increased energy use and more consumption of fossil fuels - particularly coal - is predicted for the future. The most recent *World Energy Outlook*, prepared by the International Energy Agency (IEA), projects that fossil fuels will still account for 90% of global energy consumption in the year 2010, and world coal production is projected to reach 5.3 billion tons. Meanwhile, internationally traded coal will exceed 850 million tons, doubling today's figures.

Indeed, demand is projected to be so robust that, at current prices, the IEA anticipates a potential shortfall of invested capital to meet the increasing demand for energy. Under that organization's scenario, the price of internationally traded coal rises in real terms. Nevertheless, this increase in price is still less than the forecasted increase in the price of oil and natural gas, which will maintain coal's position as the least expensive form of primary energy. This forecast reaffirms that view that coal will continue to play a vital role in the world's economic future; in developed countries, continued use of coal will help to maintain the high standard of living that increased electrification has helped to achieve, while in the developing countries, expanded use of coal will

In this issue

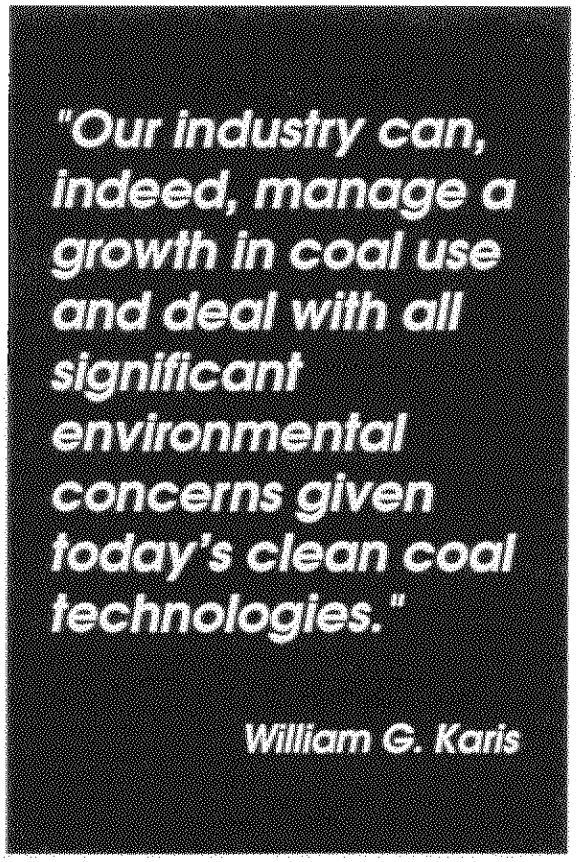
Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

fuel economic growth and increase prosperity.

This leads directly to a second point: that there is no doubt that increased coal use is compatible with improving the global environment.

ENVIRONMENTAL CONCERNS

Coal provides low-cost electricity, which in turn leads to increased substitution of electricity for other fuels, the more efficient use of energy, and increased economic growth. These are the necessary prerequisites of environmental improvement in the 21st century. Yet, policy makers show an increasing tendency to overlook the positive benefits that are attributable to coal - particularly its contribution to low-cost electricity and to economic growth.



Our industry can, indeed, manage a growth in coal use and deal with all significant environmental concerns given today's clean coal technologies. This, however, will only be possible if governments avoid hasty action regarding greenhouse gas emissions, and all countries - both developing and developed - utilize the most cost-effective emission-control technologies. There is no doubt that the global climate debate is hugely important to the future of our industry, despite the scientific uncertainties and the tendency of politics to outdistance scientific study with little regard for the economic impacts. I am confident, however, that if true cost/benefit analyses were done and all uncertainties factored in, the rational conclusion would be that there is neither an *imminent* nor even a *medium-term* need for regulatory controls on CO_2 emissions.

When governments try to influence energy markets, typical outcomes are massive economic dislocations and other unintended consequences. As a case in point, measures to control CO_2 emissions in the industrialized countries would be counterproductive on several fronts. Energy-intensive industries would move to developing countries where greenhouse-gas emissions are not controlled. The existing capital stock would operate longer because of financial and regulatory constraints on siting and building new capacity, even though such new capacity would be more energy-efficient. The consequences for developing countries would be even worse, because the slowdown of the industrial economies would reduce the formation of capital - capital that is critically needed for world economic growth as well as for environmental protection.

In Geneva, at the Second Conference of the Parties to the Climate Change Convention, the U.S. delegation stated that it would seek market-based solutions, such as a cap-and-trade system (presumably modeled after the U.S. SO_2 allowance program). However, the best that can be said about the use of so-called economic instruments to control CO_2 is that it may be a good way to implement bad policy. The discussion today among policymakers centers on "cost-effective" ways to limit greenhouse gases, while discussion typically ignores the primary question of the efficacy of the limits themselves.

Any solution to limiting the growth of greenhouse-gas emissions must, however, have a long-term planning horizon. First, new coal-burning technologies, such as supercritical and ultra-supercritical power plants, are much more energy-efficient and must be given time to penetrate the market. Second, it must be recognized that the turnover in capital stock in industrial countries will naturally occur over a time-frame of 20-to-30 years.

Finally, there must be explicit acknowledgment of the fact that most of the increase in CO_2 emissions will not be from industrialized nations, but from the developing countries. In fact, according to the IEA, between 1990 and the year 2010, India and China alone will increase CO_2 emissions more than all of the OECD countries *combined*. The emissions growth from developing countries is so large that it will be impossible to hold global emissions to current levels without the involvement of developing countries. For a token effect on emissions, then, the industrialized world is being asked to pay hundreds of billions - if not trillions - of dollars.

RESTRUCTURING

The third area of transition is that of the power-generation industry. We read every day of lawmakers trying to evaluate the best way to promote open competition in power generation, and there has been much speculation about the impact of utility restructuring on coal produc-

ers. Clearly, deregulation will make winners and losers of individual power companies as well as of individual producers, but there is likely to be little impact on coal as an industry. The coal business has always been extremely competitive, and its customers have attempted to extract the lowest price possible. So what has changed? Open competition in power markets should increase coal-fired generation. Subject to the constraints of transmission systems, the most cost-efficient units should run (and these units are typically coal-fired), and the customer should benefit.

COMPETITION FROM NATURAL GAS

A final area of transition that is worthy of discussion is competition from natural gas. In most areas of the world, natural gas cannot compete with coal at *existing* plants. Natural gas, however, is a formidable competitor as a fuel for *new* power plants. Most of the plants that have been built in recent years in the U.S. and Europe are gas-fired.

The reasons for this are many. Environmental constraints on coal use have certainly been a major factor. Also, in certain regions, gas has been relatively cheap and plentiful. In addition, where gas enjoys an economic advantage, gas-fired plants have predominantly been built for peaking and intermediate load use. Coal, however, has a significant economic advantage over gas for new base-load capacity. Such new capacity will be required as we look out beyond the year 2000 to meet the projected growth in electricity demand and to replace nuclear capacity that will be taken out of service.

By then, it is widely anticipated that the differential between coal and gas prices will be much greater than it is today - and the difference does not have to be that great in order to favor coal. At capacity factors in the range of 70-80%, typical for new base-loaded units, coal has an economic advantage over gas when the delivered price differential exceeds $2.50 per million Btus. At this price differential, the fuel-cost savings of coal outweigh the lower capital and non-fuel operating costs of natural gas. If it is further assumed that gas prices will increase 2% per year faster than coal, then the break-even price differential drops to about $1.50 per million Btus. Add to this the much greater security of the coal supply versus natural gas, and the advantage of coal is clear.

CONCLUSION

At the beginning of these remarks, I suggested that our industry is responding to a world in transition. This reality is being reflected in coal markets in various ways. The U.S. will continue to be competitive in Europe, and will continue to be a reliable supplier. However, it is likely that supply will become increasingly tight because of a lack of new mine construction, particularly in the eastern United States. We are already beginning to see a significant tightening in the country's coal markets, due to recent development in several areas. The most important has been the U.S. Clean Air Act Amendments of 1990, which have resulted in the closing of up to 50 million tons of production capacity. Even though the reduction has been in high-sulfur coal, it has had a direct impact on the supply available for export by diverting some exported coal to domestic markets.

Termination of high-priced contracts has forced the closing of less efficient mines, while consolidation of the industry again results in the closing of mines that are inefficient. Finally, reserves are being depleted. Over the last five years, total U.S. production has been flat, at a little more than one billion short tons per year.

More than 50 million tons of that decline are from the Appalachian coal basins that supply export markets. Although we will continue to see improvements in productivity, this will not be sufficient to meet the projected growth in demand both in the U.S. and overseas. This is a major departure from the situation as it has existed for the past 15 years. Meanwhile, price levels are beginning to react to the increasing tightness of the marketplace. Prior to 1996, prices generally reflected an oversupply situation. This has now changed dramatically, and the outlook going into 1997 looks extremely tight as power generators and coal producers enter the winter season with very low inventory levels.

Unlike during previous periods, this is unlikely to be a short-term phenomena. It seems to reflect a more fundamental movement of supply and demand coming into balance. New capacity in the Appalachian coal fields will be the only way in which increased demand will be met. That new capacity will require higher prices than have been experienced in recent years.

So, in conclusion, let us not forget that coal is an extremely important sector of the world economy. Through increased electrification and the employment of clean coal technologies, we can continue to leave our imprint on world economic growth while showing environmental stewardship. Let us, too, understand that natural gas is a formidable competitor - but one which will need to demonstrate a sustained record of price stability and deliverability for power generation. Let us recognize, with certitude, that new capacity *will* be necessary if world coal demand is to be met. And finally, let us believe unwaveringly that not only will this industry survive its transition - it will be stronger because of it.

EVALUATING THE ACID-RAIN PROGRAM

The following article grew out of work undertaken by Leonard C. Gilroy as a part of his Masters Thesis in Urban and Regional Planning.

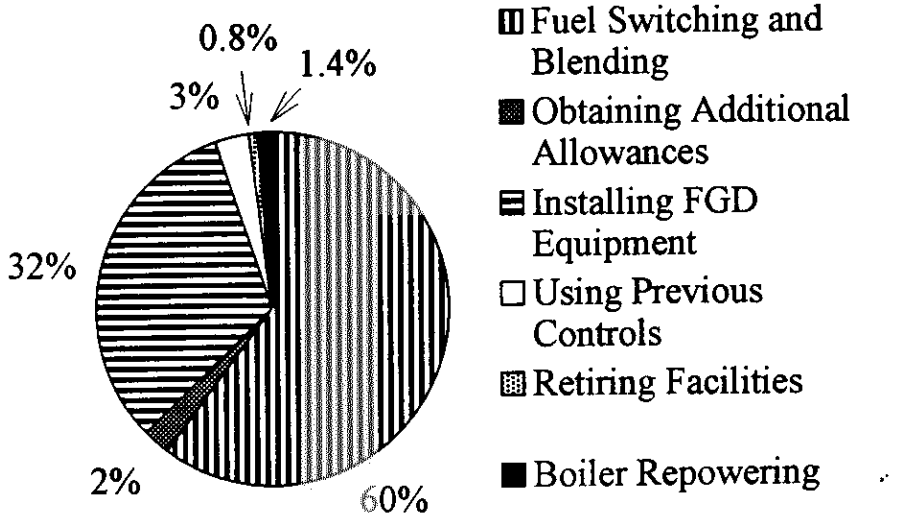
The Clean Air Act Amendments of 1990 (CAAA90) established a national program to control sulfur dioxide (SO_2) air emissions. Known as the "Acid Rain Program," Title IV of CAAA90 takes a market-based approach that includes trading and banking of emissions allowances, the aim of which is to reduce annual electricity utility SO_2 emissions by 10 million tons from the 1980 level (18.9 million tons) by the year 2010, while at the same time minimizing control costs. The Acid Rain Program represents the largest-scale application of a marketable permit approach to environmental control undertaken in the United States. The program has had a major effect on coal markets, as well as on electric utilities. In this research, we have analyzed data describing electric utility compliance strategies for 1995, the program's first year of implementation.

The Acid Rain Program of CAAA90 requires a two-phase tightening of the restrictions on SO_2 emissions placed on fossil fuel-fired power plants. Phase I began on January 1, 1995.

The original legislation identified 261 electric generating units at 110 plants operated by electric utilities in 21 eastern and midwestern states. These original Phase I units are mostly coal-fired, generally older, and include the nation's highest SO_2 emitters. Phase I seeks to reduce SO_2 emissions at these plants to below 2.5 pounds per million Btu of fuel input during the years 1995 to 1999. Phase II, which begins on January 1, 2000, will seek to reduce the rate of SO_2 emissions to below 1.2 pounds per million Btu at all fossil-fueled electric generating plants with a nameplate capacity of 25 megawatts (MW) or greater, and will apply a nationwide annual SO_2 emissions cap. Since 1990, all newly constructed generating units larger than 25 MW have been required to comply with the Phase II SO_2 emission rate.

The U.S. Environmental Protection Agency (EPA) has issued utilities limited authorizations to emit SO_2 in the form of "allowances"; each allowance is equivalent to one ton of SO_2 emissions. Each allowance has a "use year" attached to it, which identifies the first year in which the allowance can be used for compliance purposes. EPA has issued allowances for the years 1995 through 2025. At the end of each calendar year, a utility must hold allowances in an amount equal to or greater than its SO_2 allowances for that year. Utilities whose annual SO_2 emissions do not exceed their allotment of allowances may either sell their extra allowances or "bank" them for future use. However, allowances cannot be transferred "backwards" - that is, 1996 allowances cannot be used to cover 1995 emissions.

Figure 1. CAAA90 compliance strategies responsible for reductions in sulfur-dioxide emissions (1990 - 1995) by the 261 original Phase I generating units.



A striking aspect of Phase I implementation so far has been the dramatic reduction in SO_2 emissions at Phase I-affected generating units. Total SO_2 emissions at these units declined by more than 50 percent over an 11-year period beginning in 1985. The 261 original Phase I units were responsible for 95 percent of total emissions reductions, with the other 5 percent taking place at generating units declared by affected utilities to be "substituting" or "compensating" for the original Phase I units, which is allowable under CAAA90.

By 1995, the 261 original Phase I units had re-

duced SO_2 emissions by over 4 million tons from 1990's 8.7-million-ton level, representing a 49% decline (see Figure 1). Over 90% of this emission reduction can be attributed to units opting to either switch or blend fuels (*i.e.*, utilize low-sulfur coals), or to install scrubbers. The 162 units that opted to switch/blend fuels account for emissions reductions of 2.57 million tons of SO_2, or roughly 60% of the total. Phase I units located at plants that purchased substantial amounts of western coal were responsible for reductions of about 1 million tons.

The 27 generating units that opted to install flue-gas desulfurization scrubbers reduced their 1995 emissions by over 1.36 million tons below 1990 levels, accounting for roughly 32% of the SO_2-emission reductions at units affected by Phase I. SO_2 emissions at these 27 units have declined by almost 85% from 1990 levels. SO_2 emissions at these units are expected to decline even further by this year, as the last 6 of the planned scrubber installations become operational.

Projections of current trends through the year 1999, the conclusion of Phase I, indicate that about 14 million allowance credits will have been banked by utilities for use during the program's Phase II, which will require stricter controls and begins in the year 2000. VCCER projections agree with other published sources. Factors contributing to the accumulation of this sizable allowance bank include increased use of western coal, falling prices for eastern low-sulfur coal and desulfurization equipment, and a presumed desire by utility planners to minimize financial risks inherent in CAAA90's more stringent Phase II requirements. Cumulative consumption of allowances during the first decade of Phase II is forecast by EPA at less than 10 million tons.

The reduction of SO_2 emissions well beyond expectation, combined with falling prices for allowance credits, can be viewed as a success for market-based environmental controls. The implications for Virginia's low-sulfur coal producers, however, are not quite as favorable. While the principal southeastern markets for low-sulfur Virginia coals have not experienced major inroads by low-sulfur western coal, or by installation of flue-gas desulfurization scrubbers that make high-sulfur coal purchases possible, central Appalachian coal-price differentials based upon sulfur content have declined noticeably since the initiation of Phase I in early 1995. Under CAAA90, coal purchasers can link SO_2 emissions allowances with high-sulfur coals as a substitute for compliance-grade low-sulfur coals, such as those produced by many Virginia mines. Wide availability of allowance credits makes it unlikely that Virginia coal producers will be able to increase the "price premiums" commanded by their low-sulfur product anytime in the near future. The use of scrubbers and the sale of low-priced western coal effectively remove low-sulfur Appalachian producers from consideration as coal suppliers at a number of midwestern generating units, which in turn has the effect of intensifying competition in the southeast. Electric utilities in states that are major purchasers of Virginia coal have been among the heaviest purchasers of allowances in the open markets.

Although the Clean Air Act Amendment of 1990 has resulted in greater benefits to the enviroment than anticipated, the impacts of Phase I on Virginia coal have been less positive than might have been hoped for. As the last of the Phase I generating units come into compliance, the picture will become even clearer. A complete report of this research - authored by former graduate student Leonard Gilroy and VCCER Associate Director Carl Zipper - will soon be available from the VCCER.

COAL EXPORTS RISE

Figures recently released by the Hampton Roads Maritime Association indicate a 3.3% increase in total coal shipments between 1996 and the previous year, and a 22.2% rise since 1994. The following table will appear in the *1997 Virginia Coal*, the comprehensive VCCER data reference to be published early this summer. (Source of figures: Hampton Roads Maritime Association, February 1997.)

HAMPTON ROADS COAL SHIPMENTS - TOTAL: 1989-1996
(in millions of short tons)

Exporter	1989	1990	1991	1992	1993	1994	1995	1996
Dominion Terminal	12.2	14.3	18.0	18.1	12.3	12.3	15.9	16.4
Norfolk Southern	35.5	39.5	38.5	34.7	27.6	27.8	28.9	29.5
Pier IX	7.9	8.1	8.7	7.5	4.4	3.2	6.4	7.1
TOTAL	**55.6**	**61.9**	**65.2**	**60.3**	**44.2**	**43.3**	**51.2**	**52.9**

ENERGY SCOUT:
Current Energy News

The Georgia-based EnerTech Environmental, Inc., a developer of waste disposal and energy technologies, recently announced that it had signed an agreement with Mitsubishi Corporation and four other Japanese companies to develop and market commercial installations of EnerTech's Municipal Solid Waste (MSW) disposal process in a China, Japan, Indonesia, Malaysia, Vietnam, the Philipines and Thailand. A 20-ton-per-day demonstration plant will be built in Ube City, Japan. The company said that it will license its patented "SlurryCarb™ " process, a method of chemically changing garbage into a liquid fuel that combusts more cleanly than coal.

With the SlurryCarb™ process, collected MSW is processed as a fluid in continuous equipment, providing savings in both capital and operating costs. The original garbage is chemically altered so that it becomes a uniform, pumpable, slurry fuel which can then be used on-site or pumped, piped, or tankered to a customer. In addition, waste-stream components which typically must be cleaned form the flue gas after combustion (*i.e.*, chlorine, ash, sulfur, *etc.)* instead are removed in the front-end of the process at a lower cost-per-ton of pollutant removed.

The target countries represent a multi-million dollar waste disposal market. According to figures provided by EnerTech, total MSW in the licensed countries currently exceeds 350 million tons per year.

ENERGY OUTLOOK (ISSN 0279-6635) is a bimonthly publication of the Virginia Center for Coal and Energy Research, 109 Femoyer Hall, Virginia Polytechnic Institute and State University, Blacksburg, VA 24060-0411. Telephone: 540/231-5038. FAX: 540/231-4070. Email: lisab@vt.edu. Director: Malcolm J. McPherson. Publications: Johanna Jones. *Virginia Tech does not discriminate against employees, students, or applicants on the basis of race, color, sex, sexual orientation, disability, age, veteran status, national origin, religion, or political affiliation. Anyone having questions concerning discrimination should contact the Virginia Tech Equal Opportunity/Affirmative Action Office.* **ENERGY OUTLOOK is printed on recycled paper. Publication no. VT/176/1196/3.65M/972758.**