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Mr. Chairman. I am pleased to appear before this Commission today to discuss the potential for replacing oil and natural gas with coal. In my remarks I will focus on the potential within both the manufacturing and electric utility sectors.

Background

Since the embargo and the quadrupling of world oil prices in 1973, U.S. energy policy has had one clear goal--to reduce oil imports. In evaluating either short- or long-run policies to attain this goal, serious consideration is always given to increasing the nation's reliance on its enormous coal resources. Indeed, policies designed to encourage the substitution of coal for oil and natural gas were the cornerstone of the Administration's first National Energy Plan submitted to the Congress in April, 1977. Over two-thirds of the planned oil import reductions were to be achieved through coal substitution in the manufacturing industries and in existing electric utilities. Substitution was to be encouraged primarily through excise taxes, tax credits, and tax rebates, and by strengthening the existing regulatory program. As you know, only the regulatory initiatives and a limited tax credit were finally enacted into law.

While coal substitution is critical to reducing oil imports, the nation has actually been able to accomplish very little over the last several years.

A primary reason for this is that increasing coal use conflicts with other national goals such as protecting the health and safety of workers, and the physical environment. While oil prices have quadrupled since the early 1970s, the cost of using coal has also risen dramatically due to mine safety and health legislation, strip mining regulations, air pollution regulations and various other factors. While oil use faces uncertainty with respect to availability, coal use faces uncertainties with respect to labor relations and federal regulations.

A key task in identifying targets for coal substitution is to determine what form of coal is likely to be required by various energy users. The alternatives are coal in its natural, solid state or coal processed into a gas or liquid. For solid coal the prime targets are new boilers for manufacturers and electric utilities. Solid coal cannot be burned in existing boilers designed to burn only oil or gas and solid coal burning equipment is not generally available for most nonboiler industrial needs. For gaseous and liquid fuels from coal, the target is much broader and includes industrial and utility boilers, nonboiler industrial equipment, use as a chemical feedstock, and use for transportation, residential, and commercial energy needs. The conversion of coal into a gaseous or liquid form is still, however, not commercially available and when available it will be relatively expensive. Therefore, it represents an option for the future. The major short-term substitution possibilities are essentially solid coal use for boilers in both the manufacturing sector and electric utilities.

ELECTRIC UTILITIES

Overview

In recent years, oil and natural gas have been used for about 35 percent of the fuel needs in electric utilities. This accounts for about 10 percent of the Nation's consumption of these two fuels. In the future, oil and gas will probably play a steadily decreasing role in utilities simply because it's cheaper to produce electricity with coal and nuclear power. Oil and gas, however, will continue in use since even at today's oil prices, it's cheaper in many cases to continue operating existing oil or gas boilers rather than replacing them with new coal fired facilities. Furthermore, oil in new combined cycle facilities may be cheaper than conventional coal boilers when operating in intermediate load.

Policy Considerations

There are three ways to achieve coal substitution for oil and gas in electric utilities. The first is to convert existing boilers that now burn oil and gas, but once burned coal. The potential to convert has been steadily decreasing, but today it appears that the equivalent of 250,000 barrels of oil per day could be replaced if these so-called coal-capable units switched to coal. Since 1974, the federal government, has been trying to force these reconversions under the authority of the Energy Supply and Environmental

Coordination Act. Success to date, however, has been minimal. These efforts are expected to accelerate under the new Powerplant and Industrial Fuel Use Act (PIFUA), but success may not increase very dramatically.

A second method of coal substitution is to prevent the construction of any new oil or gas utility boilers. The economics are such that most new utilities are either coal or nuclear powered so that the potential for this is rather limited. However, new oil-fired combined cycle 1/ units are economic for intermediate load generation and it is estimated that such facilities would consume about 1 million barrels a day of oil by 1990. It's expected that the Department of Energy will prevent construction of oil-fired combined cycle units under the authority of PIFUA.

A third way to encourage coal substitution is to accelerate the retirement of existing units designed to burn only oil or gas. That is, it must be made cheaper to produce electricity with a new coal-fired plant than with an existing oil or gas facility. Since it can take seven years or more to build a plant, substitution in this manner should not be expected before the late 1980s. The only case in which this type of fuel change could happen

1/ Combined-cycle technology refers to the use in sequence of an oil-fired gasturbine and a waste heat boiler and steam turbine.

sooner is when a utility is in the middle of constructing a coal plant and finds that electricity demand has not grown sufficiently to justify the completion of that plant. The typical response would be to defer construction. However, with financial incentives to encourage coal substitution, a utility might build the planned coal unit anyway, not to meet new capacity requirements, but rather to replace an existing oil facility.

Analysis completed for CBO by ICF, Inc., a Washington consulting firm, can be used to determine the necessary level of incentive. Table 1 displays estimated 1990 oil and gas use in electric utilities under alternative air pollution regulations and different crude oil prices. With a real crude price increase of \$5 per barrel, over the 1978 world price, oil and gas consumption might fall from 3.05 to 2.20 millions of barrels per day by 1990; that is, coal would be used to replace .9 million barrels per day of oil equivalent. With a real price increase of \$9 per barrel of crude, coal might be substituted for 1.4 million barrels per day of oil and gas by 1990. U.S. oil imports should be between 11 and 13 million barrels per day in that year so this would represent a 7 to 8 percent reduction in imports.

Given these estimates, the critical question is whether or not a federal price incentive is necessary or will OPEC provide this incentive through increased world oil prices. This of course is difficult to determine, since it depends not only on future OPEC prices, but also the cost of coal in the

TABLE 1. OIL AND GAS CONSUMPTION FORECASTS AT ALTERNATIVE OIL PRICES IN ELECTRIC UTILITY SECTOR IN 1990: IN 1978 DOLLARS (million barrels of oil equivalent per day)

Alternative New Sources Performance Standards	\$15.00 Per Barrel	\$20.00 Per Barrel	\$23.50 Per Barrel
85% removal on all plants	3.05	2.20	1.65
85% removal, except partial scrubbing allowed to an emission limitation of: <u>a/</u>			
.050 pounds of sulfur dioxide	3.05	2.15	1.50
.067 pounds of sulfur dioxide	2.95	2.15	1.50
.080 pounds of sulfur dioxide	2.90	2.15	1.45
Current standard:			
1.2 pounds of sulfur dioxide <u>b/</u>	2.65	1.85	1.3

a/ 24-hour average, in pounds of sulfur dioxide per million Btu.

b/ Long-term average, in pounds of sulfur dioxide per million Btu.

future. Assuming, however, that coal prices increase only slightly in real terms over the next 20 years and that OPEC increases world oil prices by several dollars in real terms over the next several years, then additional price incentives for coal may not be necessary for this sector. However, the Congress might still wish to leave the option of user charges open in the event that OPEC does not increase oil prices.

An important factor which may limit the speed with which utilities substitute coal for oil and gas is their inability to raise funds in the normal capital markets. This is due to the combination of increasing operating costs, and the fact that state public utility commissions may not be allowing sufficient rate increases.

INDUSTRIAL BOILERS

Overview

Within the industrial sector the potential for replacing oil and natural gas with solid coal is restricted largely to the manufacturing industries. Within this sector, the most promising target for coal substitution is oil and gas used in boilers. This target can be set in perspective by noting that, of

all U.S. oil and natural gas use, about 25 to 30 percent can be traced to manufacturing, and 30 to 40 percent of that can be traced to boiler uses. Thus, the prime target for coal substitution amounts to 8 to 12 percent of U.S. oil and gas consumption. Finally, since solid coal cannot be burned in existing boilers designed to burn only oil and gas, coal substitution must depend largely on firms purchasing new boilers. The equivalent of 1.1 million barrels a day of fossil fuels is projected to be consumed in all new boilers purchased to meet the demands of expansion and replacement for the 1981-1985 period.

With respect to the economies of industrial boilers a few points are important. Boiler equipment for coal is always more expensive than an oil or gas unit of comparable size. Coal boilers are bigger, coal delivery and handling equipment is more extensive, and coal generally requires more pollution control equipment. Operation and maintenance costs are also higher for coal. In contrast, the fuel prices for coal are lower than those for oil or gas in some regions of the country. A firm will prefer coal if the relative fuel cost advantage of coal overcomes its relative equipment, operation, and maintenance cost disadvantage. The larger the boiler and the higher the utilization rate (the percentage of time the boiler is in operation), the greater are the chances that coal will be chosen over oil or gas.

Policy Considerations

At least three policy points seem appropriate on coal substitution in boilers used in the manufacturing industries. First, as shown in Table 2, and assuming oil decontrol and strict air pollution regulations, a real oil price increase by OPEC of \$6 per barrel over the 1978 world price or an equivalent user tax could result in coal being used for approximately 60 percent of new boiler fuel demand. Since current OPEC prices, including recently imposed surcharges, is close to that level, a large percentage of new industrial boilers should find coal use economical.

Second, under PIFUA, there is a blanket prohibition on oil or natural gas use in new boilers larger than 100 million Btu per hour. Possible exemptions from the prohibition, however, are many. For example, an exemption can be granted when the equipment, operation and maintenance, and fuel costs of coal use "substantially exceed" that for imported oil. DOE has decided to define substantially exceeds as not greater than 30 percent more expensive. From our preliminary work, this 30 percent test appears adequate to capture most large boilers for coal. But if the program is to be successful, DOE will have to be equally strict on exemptions granted for environmental reasons and site limitations.

TABLE II. ENERGY EFFECTS OF CURRENT POLICY AND FIVE ALTERNATIVE BOILER TAX POLICIES

	Energy Effects		
	1985 total coal use (millions of tons per year)	Percent of 1981-1985 new boiler fuel demand captured by coal <u>a/</u>	1985 oil and gas replacement (barrels per day equivalent)
Current Policy	58	6	
A \$3.00-a-barrel tax on oil and a tax on gas sufficient to increase its price to that of distillate oil (including the \$3.00 tax)	88	36	321,000
A \$6.00-a-barrel tax on oil and a tax on gas sufficient to increase its price to that of distillate oil (including the \$6.00 tax)	116	63	621,000
40 percent tax credit	95	--	403,000
New boilers	--	38	353,000
Accelerated retirements	--	--	50,000
Senate bill incentives	114	61	600,000
House bill incentives	140	--	883,000
New boilers	--	72	717,000
Accelerated retirements	--	--	166,000

SOURCE: Congressional Budget Office

a/ About 2.2 quadrillion BTUs of fossil fuels will be consumed in all new boilers purchased to meet expansion and replacement demand for the 1981-1985 period; these are the boiler investment decisions affected by federal policies enacted in 1979. The numbers in this column represent the portion of that new fuel demand satisfied by coal.

Finally, coal consumption can be affected dramatically by EPA's decisions on new source performance standards for industrial boilers and by its interpretation of nonattainment and prevention of significant deterioration policies. Air pollution equipment can equal 50 percent of a coal boiler system's capital cost. But one obvious but frequently overlooked point should be raised: The impact of air pollution regulations on coal demand can depend as much on the requirements for oil as it does for coal. The reason is very simple. A factory's choice between coal and oil depends, in part, on relative costs and air pollution regulations add to the equipment or fuel costs of using both fuels. It is possible to impose regulations that would be strict but "pro-coal;" that is the regulations would add more to the cost of burning oil than coal.

CONCLUSION

In conclusion, over the last few years and in the immediate future, there are two major targets for increasing United States coal consumption, that is, in the electric utility sector and the manufacturing industries. Both targets involve solid coal substitution through installation of new boilers. Our analysis indicates that real oil prices of approximately \$20 per barrel (1978 dollars) might be required to justify significant coal substitution. With

recent surcharges, OPEC prices will most likely reach this level in the near future. If OPEC does not increase oil prices, however, the Congress should keep open the option of user charges. Given user charges or OPEC price increases, coal would be less expensive than alternative fuels (gas and oil) from a total cost perspective for boiler use in both electric utilities and the manufacturing sector. Therefore, on a simple relative cost basis most firms would choose coal in the future. It is critical, however, that coal prices rise only moderately or even at \$20 per barrel, oil will continue to be used. For this reason, it is very important that regulations affecting coal production, transportation, and use be carefully reviewed for cost-effectiveness. It is through oversight of such regulations that Congress will have its largest effect on coal substitution in the coming years. Finally, it is equally important that public utilities in their rate making decisions and mine owners and mine workers allow coal's ultimate advantage to be realized.

