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United States General Accounting Office

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Fact Sheet for the Chairman, Subcommittee on Fossil and Synthetic Fuels, Committee on Energy and Commerce
House of Representatives

April 1986

ALTERNATIVE FUELS

Potential of Methanol as a Boiler or Turbine Fuel

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

April 4, 1986

RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION

B-217943

The Honorable Philip R. Sharp
Chairman, Subcommittee on Fossil and Synthetic Fuels
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

Your May 7, 1984, letter asked us to examine several aspects of methanol fuel use. In May 1985, we issued a report entitled Federal and State Methanol Fuel Projects, Coordination, and State Tax Incentives (GAO/RCED-85-97) in partial response to that request.

This fact sheet provides information we obtained on the potential of using methanol as a fuel for producing energy from stationary sources, such as electric utility and industrial boilers and gas turbines. The information was discussed with your office on February 13, 1986. We have underway another assignment examining the potential of methanol as a vehicle fuel.

Methanol is not economically attractive as a boiler or turbine fuel in the near term because of its high cost and a plentiful supply of coal, oil, and natural gas. Although tests have shown that methanol is technically viable as a primary fuel in boilers, it is generally not used because of its relatively higher cost compared to other boiler fuels. Tests have also shown that methanol has a somewhat lower thermal efficiency than these fuels in boiler uses. In addition, methanol has been laboratory tested, but not commercially demonstrated, as a fuel that could be used in the second stage of a two-stage boiler combustion system to reduce air pollution emissions of nitrogen oxides. This process is generally called fuel overfiring or reburning. However, the relative high cost of methanol has curtailed the development of the reburning process using methanol.

Methanol has been shown to have technical advantages over natural gas and jet fuel as a gas turbine fuel. Gas turbines, similar to jet engines, are used by utilities and large industrial plants to generate electricity, particularly during periods of peak demand. While methanol is more expensive, it may become more economically attractive over natural gas and jet fuel because it is clean burning. For example, to meet very low air pollution emission limits, turbines using natural gas and jet fuels in southern California are being outfitted with relatively expensive catalytic converters, which may not be needed if methanol were used. For this reason, the California Energy Commission and the South Coast Air Quality Management District have expressed interest in exploring the use of methanol as a turbine fuel in southern California. Methanol may also have potential as a standby turbine fuel in the event of the disruption of other fuel supplies in areas with strict air pollution emission restrictions.

This fact sheet also discusses the potential of producing less costly methanol at a coal gasification plant for utility use and mixing methanol with fine particles of coal to produce a fuel for stationary sources.

To gather information for this fact sheet, we interviewed government and industry experts familiar with using methanol in stationary sources. We also reviewed government documents, available literature, and public and industry test reports. We obtained data from the Department of Energy, the Department of Labor's Bureau of Labor Statistics, the Department of Commerce's International Trade Administration, and several industry firms and California state organizations.

If you have any questions about this fact sheet, please call me on (202) 275-8545.

Sincerely yours,

James Duffus III

James Duffus III
Associate Director

Contents

ABBREVIATIONS

Btu's	British thermal units
DOE	Department of Energy
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
GAO	General Accounting Office
IGCC	integrated gasification combined cycle
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NO_x	nitrogen oxides
SO_2	sulfur dioxide

SECTION 1

BACKGROUND

Methanol (methyl alcohol) is a clear, colorless, flammable liquid. Chemically, it is the simplest alcohol with the smallest molecule. Almost all methanol produced today uses natural gas (methane) as the primary raw material. Methanol is also known as wood alcohol because, in the past, wood was the primary raw material for methanol production. Methanol can also be produced from coal; however, this process is not currently economical except in operations where methanol is used directly in further synthetic chemical manufacture.

Methanol is a clean burning fuel which produces negligible emissions of particulates and sulfur compounds and low emissions of nitrogen compounds. It also produces low emissions of hydrocarbons, carbon monoxide, and aldehydes when used in stationary sources, such as electric utility and industrial boilers and gas turbines.

The United States uses about 1.4 billion gallons of methanol per year, predominantly for chemical purposes. Methanol's largest use is as a chemical precursor for the production of other chemicals, such as formaldehyde, which are further processed into glues, plastics, resins, and other commercial substances. Methanol is also commonly used as an industrial solvent. Recently, methanol has begun to play a role as an octane enhancer in gasoline and is being tested as a vehicle fuel. It has also been studied for use as a fuel in stationary sources.

SECTION 2

OBJECTIVES, SCOPE, AND METHODOLOGY

The Chairman, Subcommittee on Fossil and Synthetic Fuels, House Committee on Energy and Commerce, asked us to examine several aspects of methanol fuel use. In May 1985, we issued a report entitled Federal and State Methanol Fuel Projects, Coordination, and State Tax Incentives (GAO/RCED-85-97) in partial response to that request.

This fact sheet responds to the portion of the request which asked us to provide information on methanol's potential as a boiler fuel and to describe the work that has been done on using methanol as an overfiring[1] fuel in boilers to reduce air pollution emissions. We have underway another assignment examining the potential of methanol as a vehicle fuel.

During our preliminary inquiries, we were informed that methanol fuel has some potential for use in gas turbines (also known as combustion turbines). In subsequent discussions with the Chairman's office, we agreed to widen the scope of our inquiries to cover the potential use of methanol fuel in both gas turbines and boilers.

To gather data for this fact sheet, we interviewed government and industry experts familiar with using methanol in stationary sources. We also reviewed and analyzed literature on (1) methanol fuel production and use, (2) boiler and gas turbine technology, (3) combustion research, (4) environmental considerations concerning methanol and its air pollution impacts, and (5) economic factors. In addition, we obtained information from industry firms and California state organizations on the results of methanol fuel demonstration projects and plans for further testing. We did not make an independent technical or economic assessment of methanol's potential as a stationary source fuel.

We obtained information from federal agencies, including the Department of Energy (DOE); the International Trade Administration, Department of Commerce; the Bureau of Labor Statistics, Department of Labor; and the Environmental Protection Agency (EPA). We also contacted the California Energy Commission and the South Coast Air Quality Management District--the air pollution control authority with jurisdiction over the Los Angeles, California, area. In the private sector, we obtained information and held discussions with officials from the Electric

[1]Overfiring, or reburning, is a technique in which additional fuel is injected into a secondary combustion zone of a boiler to reburn the gases and reduce the nitrogen oxides (NO_x) emissions produced in the primary combustion zone.

Power Research Institute (EPRI) and firms doing research for, or brought to our attention by, EPRI and the above mentioned organizations.

Methanol's potential as a fuel for stationary applications is highly dependent on its comparative economics with other fuels. In order to evaluate economic factors, we obtained data on fuel prices and consumption from DOE's Energy Information Administration. We computed approximate methanol prices from the Bureau of Labor Statistics' Producer Price Index data and used methanol consumption estimates from the International Trade Administration.

Information contained in this fact sheet was gathered between July 1985 and March 1986.

SECTION 3

EXPERIMENTATIONS USING METHANOL

FUEL IN STATIONARY SOURCES

Methanol has been tested as a potential fuel in stationary sources, such as utility boilers and commercial cogeneration and utility gas turbines. Tests have shown that methanol has some advantages as a fuel for turbines, especially low NO_x emissions. Tests have also shown that methanol is a technically viable boiler fuel but is somewhat less efficient than other boiler fuels.

Other experiments include (1) using methanol in secondary combustion systems of boilers to control NO_x pollution emissions, (2) producing methanol in an integrated coal gasification combined cycle power plant system, and (3) mixing methanol with fine particles of coal for use in boilers.

However, methanol has little near-term potential for general use in stationary sources because of its relatively high cost in relation to conventional fuels.

TURBINE USES

Gas turbines are used by electric utilities to produce electricity during peak use periods and by some commercial establishments to coproduce both electricity and heat. They operate in a manner similar to jet airplane engines. Fuel is burned in a combustor and the hot combustion gases rush past a turbine rotor with many blades, causing it to spin. This in turn drives a shaft which is used to turn an electric generator.

Natural gas and kerosene-type jet fuel are most commonly used as turbine fuels. In 1984, 82 percent of the electric utility gas turbine fuel used was natural gas and 18 percent was petroleum. A primary technical criteria for choosing a turbine fuel is to have a low content of noncombustible materials in the fuel. Since the turbines are directly exposed to the hot exhaust gases, it is important to use a clean burning fuel which will not cause turbine damage or wear.

Industry tests and reports have shown that methanol is a clean burning fuel with a low content of noncombustible materials, which can be used as a turbine fuel. Other attributes which enhance methanol's technical attractiveness as a turbine fuel include:

- °Low luminosity--methanol burns with a nearly invisible flame, which means that it produces very little radiant heat. This is advantageous in gas turbines because it reduces thermal stress on turbine parts.

- °High heat of vaporization--because it takes more heat to vaporize methanol than it does for comparable amounts of jet fuel, methanol can make better use of recirculated waste heat to vaporize the fuel prior to combustion, which increases energy efficiency. Further efficiency gains are possible if methanol is chemically converted into hydrogen and carbon monoxide or hydrogen and carbon dioxide prior to combustion (processes called reforming and dissociation).

According to a December 1983 EPRI report,[1] methanol experience in field-erected utility gas turbines had, at that time, been limited to two demonstration tests conducted in 1974 and 1979. In the 1979 test conducted by the Southern California Edison Company, methanol was used to fuel a utility gas turbine generator for a total of 523 hours. The turbine performed satisfactorily, displaying several especially favorable features. These included:

- Lower NO_x emissions--methanol produced from 64 to 78 percent less NO_x emissions than comparable operation with natural gas and jet fuel. Gas turbine NO_x emissions were lowered by injecting water with each fuel. NO_x emissions from methanol fuel without added water were still lower than those from natural gas and jet fuel with added water.

- Cleaner burning--methanol did not leave carbon deposits on internal turbine parts as jet fuel did, which indicated that methanol could provide less turbine wear and longer turbine part life than jet fuel. Turbine wear and life expectancy were considered comparable operating on methanol and natural gas.

We identified one other more recent field demonstration test in which methanol was used in an industrial-size gas turbine cogeneration unit. A cogeneration facility produces both electricity and process heat for commercial or industrial use. In this test, which was sponsored by the California Energy Commission in 1984, a 3.25 megawatt (MW) gas turbine was converted to methanol firing and operated for a total of 1,036 hours. The results showed that the turbine performed satisfactorily and that the relatively low NO_x emissions expected from methanol operation were obtained and were further reduced by mixing water with the methanol before fueling the turbine.

In addition, officials at California's South Coast Air Quality Management District told us in November 1985 that they were trying to organize a consortium of organizations to participate in a commercial demonstration project that would use methanol in a Los Angeles cogeneration plant that operates on a gas turbine. The tentative plans called for a 3.1 MW gas turbine, designed specifically for methanol fuel use, to be installed at

[1] Guidebook for the Use of Synfuels in Electric Utility Combustion Systems, EPRI, Dec. 1983.

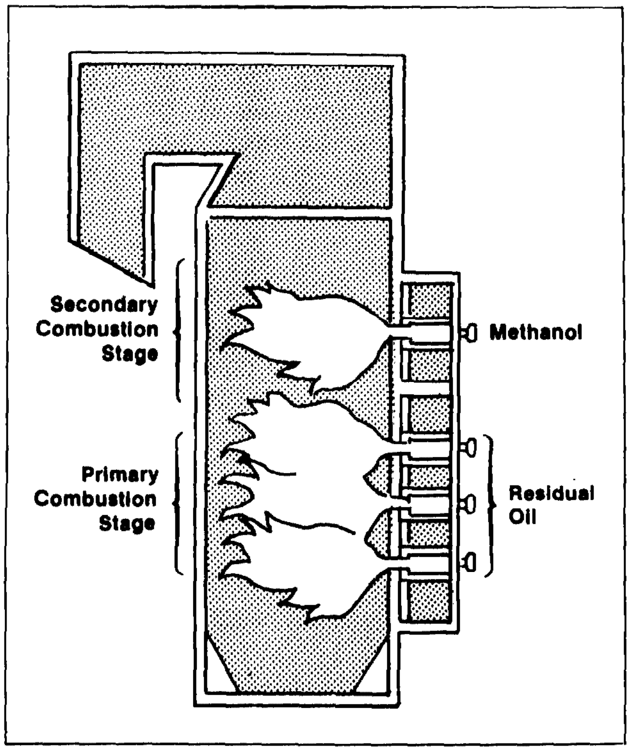
the plant and run for about 8,000 hours, or nearly a year of continuous operation, using about 5 million gallons of methanol. The purpose of the proposed project was to demonstrate that a methanol-fueled gas turbine could meet the District's low, 9 parts per million NO_x emissions limit for new turbines. We were subsequently informed that the proposed project plans had been dropped because the plant did not have sufficient storage facilities for the larger volume of methanol that would be needed to replace the currently used fuel.

BOILER USES

Methanol has been tested to a limited extent as a primary fuel for electric utility boilers. EPRI's December 1983 report discussed the results of two full-scale demonstration tests which were conducted in 1972 and 1981. These tests showed that methanol was an acceptable boiler fuel from a combustion and performance standpoint and produced much lower NO_x emissions than fuel oil and natural gas. They also indicated, however, that methanol was somewhat less efficient than the other boiler fuels. For example, using methanol required more British thermal units (Btu's) of energy input to generate an equivalent amount of electrical power. Methanol also resulted in a higher moisture content in the boiler exhaust gas, causing slightly greater heat losses.

In 1982, the California Energy Commission sponsored a small-scale laboratory experiment in which methanol and natural gas were tested as a secondary fuel to reduce NO_x emissions in a system simulating an oil-fired boiler. This process (generally known as fuel overfiring or reburning) consists of injecting methanol or another fuel into a secondary combustion zone of a boiler to reburn the gases and reduce the NO_x produced from the fuel used in the primary combustion zone. An illustration of the methanol overfiring concept is shown in figure 3.1.

Figure 3.1: Methanol Overfiring Concept



Source: California Energy Commission.

The study indicated that the overfiring process can achieve an effective reduction of NO_x emissions in residual oil-fired boilers. It also indicated that methanol was more effective than natural gas in reducing NO_x emissions when used as a secondary fuel in boiler reburning systems. However, the study stated that the laboratory results could only be confirmed in a commercial (full-scale) boiler demonstration of the overfiring process, such as planned at the time by the California Energy Commission. The Commission has since dropped plans for further testing of methanol in the overfiring process because relative fuel prices do not favor methanol and over 90 percent of the California utility boilers have been converted to use natural gas instead of residual oil.

We did not identify any other studies where methanol was tested as an overfiring fuel. Current interest in the utility and boiler industries is focused on the potential use of oil, natural gas, and coal as overfiring fuels for NO_x control.

OTHER METHANOL EXPERIMENTS

Other experiments, such as those discussed below, have been conducted to study the potential of producing or using methanol in stationary combustion systems.

°Methanol production added to existing integrated coal gasification combined cycle (IGCC) system--an IGCC power plant includes a coal gasifier that produces synthetic gas which is burned as fuel in a gas turbine and high pressure superheated steam which is used to drive a steam turbine generator. An IGCC plant can produce methanol because the synthetic gas generated by a coal gasifier is chemically similar to that required to produce methanol. Therefore, some methanol could be made from this synthetic gas in mid-stream and stored for utility use in on-site or off-site gas turbines during peak load periods.

According to an October 1984 EPRI report, the cost of producing methanol in an IGCC power plant would be lower than that of methanol made in a separate free-standing methanol plant because adding a methanol production unit to an IGCC plant would not require all the other equipment needed in a free-standing methanol plant. The report also stated that coproduction of methanol with electricity would provide methanol for utility use at a lower cost than distillate oil.

Only one IGCC system is in operation in the United States, the Cool Water plant in southern California which is operated by Southern California Edison Company and jointly sponsored by the operator; EPRI; Texaco, Inc.; Bechtel Power Corporation; General Electric; and the Japan Cool Water Program Partnership. The U.S. Synthetic Fuels Corporation[2] is under contract to provide up to $120 million in price supports. The plant is still in a period of testing.

°Coal/methanol mixtures--fuel is produced by mixing fine particles of coal suspended in a liquid consisting entirely or partially of methanol. The liquid can include other alcohols (such as ethanol) and water. The mixture could be used directly as a boiler fuel.

DOE has found through experiments that coal/methanol mixtures are usable boiler fuels, but a combination of technical and economic factors have prevented their widespread use. In particular, when made with pure methanol as the liquid, the coal/methanol mixture is too expensive to be a competitive fuel. If some water is mixed with the methanol to lower the cost, then the mixture becomes much more viscous (thicker and harder to pump) and requires reducing the coal content to remain readily pumpable. However, this lowers the heat content of the mixture and lessens its value as a fuel.

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[2]The U.S. Synthetic Fuels Corporation was abolished, effective April 18, 1986, and its financial assistance commitments with synthetic fuels project sponsors were transferred to the Treasury Department.

SECTION 4

FACTORS AFFECTING THE USE OF METHANOL

FUEL IN STATIONARY SOURCES

In addition to technical performance, other factors that can influence the use of methanol as a fuel for producing energy from stationary sources are economics, air quality, and a need for standby fuels. The high cost of methanol compared to other fuels discourages its widespread use as a turbine and boiler fuel. However, methanol could be used in gas turbines to reduce air pollution emissions in some areas of the country with serious air quality problems such as Los Angeles, California. Also, methanol has potential use as a standby turbine fuel in such areas.

ECONOMICS

Costs play an important role in fuel choice decisions for turbines and boilers. Fuel cost is usually the dominant cost factor in gas turbine operations, the most favorable stationary source for methanol application. Gas turbines, however, cannot use the cheapest fuels--coal and heavy oil. Because gas turbines have much lower capital costs than boilers and can be started up and turned off more quickly and easily than boilers, turbines are usually chosen to provide power for short-term peaks of electricity demand despite their high fuel costs.

According to Department of Commerce figures, in late 1984 methanol was available in barge load and tank car quantities at 38¢ and 42¢ per gallon, respectively. These low prices were due to an excess supply and unused production capacity in the United States and abroad. While some U.S. producers have shut down because they are unable to cover all their costs at these prices, more capacity is being built around the world.

Despite methanol's excess supply and low prices, it is still more expensive than competing utility fuels. Since fuels contain a different amount of energy per volume, it is necessary to convert to Btu's for interfuel comparison. Table 4.1 shows a comparison of the average cost of fuels for the quarter April through June 1985 in terms of dollars per million Btu's. As shown in the table, methanol costs more than other fuels.

Table 4.1: Comparison of Average Cost of Fuels

From April Through June 1985

Fuel	Cost (Dollars/million Btu's)
Methanol[a]	$9.22
Kerosene-type jet fuel[b]	5.77
Residual oil[c]	4.14
Natural gas[c]	3.51
Coal[c]	1.67

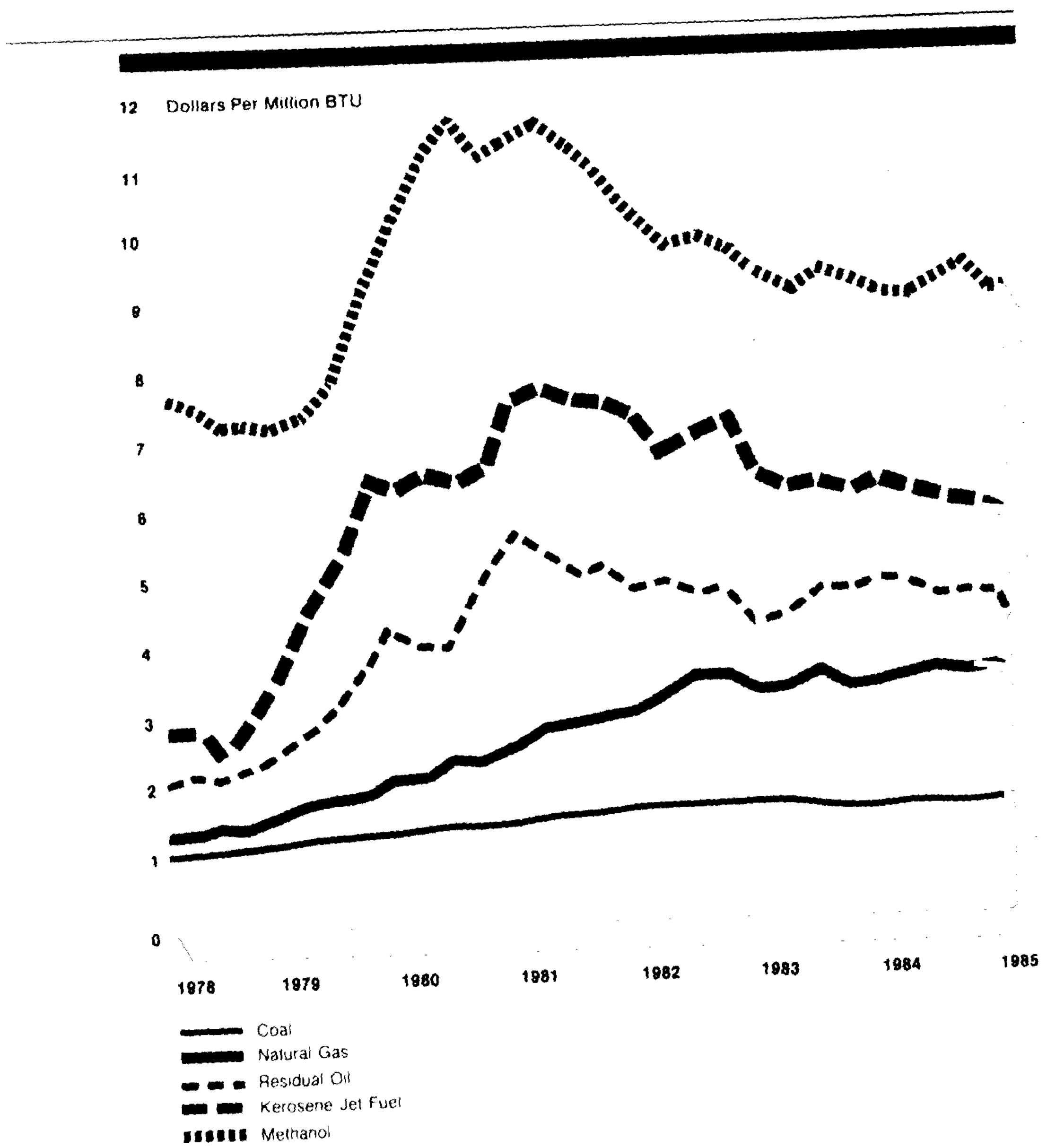
[a]Average producers price of methanol, as calculated by us from changes in the Bureau of Labor Statistics' Producer Price Index.

[b]Average refiner wholesale price of kerosene-type jet fuel, as reported by DOE's Energy Information Administration.

[c]Average cost of fuels delivered to electric utilities, as reported by DOE's Energy Information Administration.

A longer term cost comparison, using the same sources as table 4.1, is shown in figure 4.1. This comparison shows that methanol has been more expensive than competing fuels for several years.

Figure 4.1: Comparison of Methanol With Other Fuels



Source: Computations based on quarterly averages from monthly data compiled by the Bureau of Labor Statistics and DOE's Energy Information Administration. Methanol spot prices may be somewhat lower because of poor market conditions and unused production capacity.

AIR QUALITY

Methanol has low air pollution emissions relative to other fuels and it, therefore, offers the potential to lessen the air quality impact of fuel combustion at facilities such as peaking power plants and cogeneration plants. According to the California Energy Commission, methanol could have the greatest potential for improving air quality at these types of facilities located in urban areas which are in noncompliance with the National Ambient Air Quality Standards (NAAQS) established under the Clean Air Act.

The sources and effects of the air pollutants related to boiler and turbine operations are shown in table 4.2, which we prepared on the basis of various environmental studies and reports, including our past reports. A comparison of the relative air pollutant emissions from boiler and turbine operations using methanol, coal, oil, and natural gas fuels is shown in table 4.3. We prepared this table based on our discussions with EPRI and the limited tests conducted on methanol use in boilers and turbines (see sec. 3). Because of the limited information available, the comparisons should be considered only as a general indicator of relative emissions that might be expected using like equipment under like conditions.

Table 4.2: Sources and Environmental and Health Effects of Air Pollutants Related to Boiler and Turbine Operations

Pollutant	Source	Effect
Sulfur dioxide (SO_2)	Released by burning fuels containing sulfur	Contributes to **suspended particulates** Contributes to two-thirds of **acid deposition** in eastern North America (acid deposition may damage forests and aquatic life in fresh water lakes and streams) Can aggravate heart and respiratory disease Can be toxic to plants; corrosive
Nitrogen oxides (NO_x)	Formed directly from nitrogen in the fuel (fuel NO_x) Formed indirectly from released heat that causes nitrogen in the surrounding air to oxidize (thermal NO_x)	Contributes to **ozone** formation (ozone can damage forests, crops, and materials such as rubbers and paints and can irritate respiratory systems) Contributes to **acid deposition** Can increase susceptibility to viral infections and irritate the lungs Can cause brown discoloration of atmosphere; toxic to plants
Suspended particulates	Noncombustible matter in the fuel Incomplete combustion of combustible matter Sulfates formed from sulfur in the fuel	Major contributor to health risks Impairs visibility; dirties buildings; corrodes metals
Hydrocarbons	Evaporation from fuel storage and transfer Formed from incomplete fuel combustion	Contributes to **ozone** formation Some are recognized as carcinogens; others are noxious and irritating
Carbon monoxide	Formed from incomplete fuel combustion	Potential health hazard
Aldehydes	Formed from incomplete fuel combustion	Methanol can produce formaldehyde, a suspected carcinogen

Table 4.3: Comparison of Relative Air Pollutant Emissions From Boiler and Turbine Operations Using Methanol, Coal, Oil, and Natural Gas

Pollutant	Benefits from using methanol	Methanol emissions compared to:		
		Coal	Oil	Gas
ulfur ioxide (SO_2)	Methanol contains no sulfur and does not produce SO_2 emissions	Much less	Much less	Same
itrogen xides (NO_x)	Methanol contains no nitrogen and will not produce fuel NO_x Methanol flame temperature is lower than other fuels and causes less thermal NO_x	Much less	Much less	Much less
ıspended articulates	Methanol produces no particulates because it contains no noncombustible matter and no complex molecules	Much less	Much less	Same
ydrocarbons	Methanol produces no unburned hydrocarbons	Less	Less	Same
arbon ɔnoxide	Methanol produces very small quantities	Varies	Varies	Varies
ldehydes	Methanol produces very small quantities	Varies	Varies	Varies

As shown in table 4.3, using methanol as a fuel in stationary turbines and boilers in place of conventional fuels can generally reduce emissions of four types of primary pollutants released from fuel combustion: sulfur dioxide (SO_2), NO_x, and suspended particulates (all of which are regulated under NAAQS) and hydrocarbons (some of which are regulated). SO_2 and NO_x also contribute to the formation of two secondary pollutants formed after the oxides are released into the atmosphere: acid deposition, commonly referred to as acid rain, and ozone, which is also regulated under NAAQS. Methanol emits less NO_x than natural gas and neither contain SO_2, but natural gas is less expensive than methanol. Accordingly, methanol does not appear to offer an economic advantage for control over acid rain compared to the less expensive fuel of natural gas, from which it is usually produced.

The emission levels of carbon monoxide, another pollutant regulated under NAAQS, and aldehydes, a group of chemical compounds under consideration by EPA for listing as a hazardous air pollutant, are difficult to compare among fuels because numerous factors vary the emissions of these pollutants. For example, carbon monoxide emissions can vary considerably with the same fuel by changing the firing conditions. However, as shown in table 4.3, methanol produces very small quantities of these emissions.

According to the California Energy Commission, the cost of emissions controls on gas turbines might make methanol more economically competitive, especially in areas with stringent NO_x emissions regulations such as Los Angeles. In the South Coast Air Quality Management District of southern California, the NO_x emission limit for exhaust from new gas turbine powered cogeneration units is 9 parts per million. This compares to a national limit of about 155 parts per million for new, large gas-fired boilers. The low NO_x limit is an attempt to reduce the ozone problems now experienced in the area.

According to a 1985 report by the South Coast Air Quality Management District, two methods of complying with this standard are (1) natural gas combustion with water or steam injection combined with catalytic exhaust control and (2) using methanol fuel without the need for catalytic control. Several other methods are under development. While we are not aware of any economic comparisons of these methods, catalytic exhaust treatment is a very expensive option, which might increase the attractiveness of using methanol fuel. Table 4.4 compares the NO_x emissions reduction techniques that are currently available or under development.

Table 4.4: Comparison of NO_x Emissions Reduction Techniques Available or Under Development

Technique	Complexity	Cost	Extent of NO_x reduction	Status in United States
Combustion modification[a]	Simplest	Cheapest	Least NO_x reduction	In use
Low NO_x burner[b]				Some in use
Air overfiring[c]				Available
Reburning[d]				Under development
Selective catalytic reduction[e]	Most complex	Most expensive	Most NO_x reduction	Recently required in some new facilities in California; in use in Japan

[a]Usually involves some form of "staged" combustion in which fuel and air are mixed and burned in gradual stages, lowering both flame temperature and oxygen availability. These methods are limited by tradeoffs between NO_x reduction, combustion efficiency, unburned fuel and other emissions.

[b]Specially designed burners which reduce NO_x formation by delaying fuel and air mixing.

[c]Part of the combustion air is injected above the burners to provide "staged" combustion.

[d]Reburning provides a second flame zone in which additional fuel is injected to reduce NO_x formed in the primary combustion zone.

[e]Uses catalysts and ammonia to chemically reduce NO_x in the exhaust gas.

According to South Coast Air Quality Management District officials, a significant amount of capacity additions to power plants are now being considered in the southern California area.

They said that about 175 MW of gas turbine powered cogeneration electric capacity using selective catalytic reduction for NO_x control has already been granted permits, and another 836 MW capacity has permit applications pending. In addition, they said that over 13,000 MW of similar capacity has qualified for possible use in the state, including about 4,600 MW in the southern California area. The officials indicated that the capacity additions may provide a market opportunity for the use of methanol because of its low NO_x emissions.

STANDBY FUEL

To assure continuous operations, natural gas fueled turbines normally need a standby fuel supply in case of disruptions to the gas supply, such as would occur in a pipeline break. A liquid fuel is usually used for back up because natural gas is not easily stored on site. Methanol has potential use as a standby fuel if the facility is required to meet low NO_x emission limits which cannot be met using other liquid fuels.

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