Section 2

SYNTHETIC FUELS IN CALIFORNIA

by

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The Southern California Edison Company is particularly interested in synthetic fuels processes that can produce clean fuels in an environmentally safe manner for offsetting, in the future, imported low-sulfur oil. The reduction of oil usage is an important objective because Southern California Edison has the unique distinction of being the largest utility consumer of oil in the United States.

The milestone that initially triggered the use of imported oil was the passage of Rule 62 by the Los Angeles Air Pollution Control District in 1958. This rule directed the Los Angeles-based utilities to burn natural gas or oil with less than 0.5 percent sulfur in the summer months. The only readily available source of low-sulfur oil was from Indonesia.

The use of low-sulfur oil in the Los Angeles Basin was given more emphasis in 1968 with modifications to Rule 62 that provided for year-round use of the 0.5 percent sulfur fuel oil and again in 1977 that reduced the sulfur content to 0.25 percent.

FUEL MIX

The fuel mix for Southern California Edison in the years prior to the 1970s consisted primarily of natural gas with oil as a standby fuel for cold winter periods. Natural gas was an ideal fuel for use in the Los Angeles Basin; no sulfur or ash and readily amenable to NO_x reduction strategies. The rapid load growth during the 1950s and 1960s meant that by the early 1970s, massive amounts of fuel as natural gas or low-sulfur oil was (and is) required to meet system load requirements.

A major shift in fuel usage occurred in the early 1970s as scarcities in the supply of natural gas resulted in burgeoning imports of low-sulfur fuel oil. The fuel oil imports peaked in 1977 as almost 58 million barrels of oil were burned in the Southern California Edison System. The energy crises in 1973 and 1979 jolted users of imported oil with scarcities in supply and major increases in price. The low-sulfur oil increased in price from $6 per barrel in 1973 to $33 per barrel in

1980. The rapidly increasing cost of energy has made alternate fuels look more attractive as future-based energy sources.

COAL AND NUCLEAR

Well before the oil embargo of 1973, Southern California Edison was diversifying its generation mix to include nuclear and direct-fired coal plants.

The first nuclear plant at San Onofre was completed in 1968. This 450-MW unit has operated safely over the years to provide a clean, reliable source of electric power. Ground breaking occurred in 1974 for two large sister units that will produce 2360 MW of electric power when completed.

Our company's first venture into coal-based generation was a part owner (48 percent) of Units 4 and 5 at the Four Corners Generating Station near Ship Rock, Arizona. This station addition was completed in 1970 and consists of two 750-MW generating units.

The second venture in coal resulted in the Mohave Generating Station, completed in 1971. Southern California Edison operates this plant and receives 56 percent of the 1580-MW output. A unique feature of this plant is that the coal for the plant is pulverized and transferred by pipeline in slurry form about 275 miles from the Black Mesa Mine, near Kayenta, Arizona.

The most ambitious coal-based generating station ever conceived by Southern California Edison was the 3000-MW Kaiparowits Project. This project was to be located near Page, Arizona, and was based on the use of Kaiparowits Coal. The project, if successful, would have shaved over 12 million barrels of oil annually from our imported oil equivalent. The project was never completed. A host of environmental-ecological-related organizations filed a number of lawsuits against the project that effectively delayed engineering for the plant. The delay caused a significant escalation in the cost of the project to the extent that the project was cancelled in 1976.

In the conversion of coal to produce synthetic fuels the products range from environmentally clean fuels free of particulates, sulfur, and ash to the so-called solvent refined coals and shale oil. These latter fuels, although tabbed as syn-fuels, contain varying amounts of sulfur and nitrogen to the extent that their use in the Los Angeles Basin for backing-out fuel oil would be prohibited. The reason

is that the NO_x control technologies cannot meet the existing regulations with high-nitrogen fuels such as shale oil and possibly high-nitrogen solvent-refined coal. The sulfur content in these fuels must be limited to 0.25 weight percent. Therefore, the clean synthetic fuels of interest to Southern California Edison are the gaseous fuels, methanol, sulfur-free and nitrogen-free Fischer Tropsch Liquids.

FUEL OIL BACKOUT

The California Energy Commission believes that it is prudent to implement policies to reduce the oil and gas consumption in California by 50 percent in the late 1980s and beyond. Meeting this often-mentioned goal will require the offsetting of 17 million barrels of oil per year by 1990, based on the 1974 to 1978 oil and gas usage.

The commitment to backout a substantial portion of our fuel oil demand will require an aggressive approach in synthetic fuels development. Synthetic fuels alone, however, cannot result in the achievement of our goal. The completion of our ongoing nuclear programs and direct-fired coal projects will also be required. But, perhaps an equally important ingredient required will be the conservation of energy and the reduction of load growth in the future.

A significant problem facing the increased use of synthetic fuels to backout fuel oil for power generation in California will be the availability of such synthetic fuels. The acquisition of synthetic fuel sources for utility consumption will likely require the participation of the utilities in synfuel projects, either as equity-owners or as purchasers of the fuel production under long-term contracts. Participation as an equity-owner has the advantage of providing a reliable supply of synthetic fuels and for Edison might provide its ratepayers with the most cost-effective sources. However, without timely regulatory support for the assured recovery of equity contributions, the risk associated with financing the substantial amounts required would preclude participation.

The more traditional approach of bidding and contracting for securing supplies of synthetic fuels requires that the regulating authorities provide rate-setting backup for the firm purchase contracts. These contracts would be required for financing the synthetic fuels plant by the developers. Regulatory support is required in addition to the incentives which may be available from the Federal Energy Security Corporation. The regulatory supports will be required early in

the synthetic fuels development phase if California utilities are to be participants or purchasers of synthetic fuels.

A timely development of synthetic fuels will also require that the permitting and licensing processes on federal, state, and local bases be streamlined. The requirements must be defined and held constant during the design phases of the project.

COOL WATER PROGRAM

The Cool Water Program represents Southern California Edison's first venture into the construction and operation of a synthetic fuel demonstration plant. This program is designed to demonstrate the technical and economic feasibility of the Texaco Coal Gasification Process for producing clean, medium-Btu gas from coal for electric power generation. The power generation step will involve the use of medium-Btu gas in a gas turbine combined-cycle facility for generating 92 net MW of power. The plant is expected to begin operation in 1983.

SYNTHETIC FUEL PROJECTS

Southern California Edison is also participating, as a full-share partner, in consortia dedicated to the comprehensive feasibility studies on retorting shale oil and on coal to medium-Btu methanol and/or SNG. These feasibility studies will be completed in sufficient detail to facilitate a decision of the sponsors on whether to proceed with the project or not. If the decision is to proceed, the next phases would involve regulatory application, final design, financing, and construction. Such feasibility studies will develop comprehensive data in the areas of (1) preliminary facility design, (2) economic and financial analysis, (3) siting considerations, (4) market analysis, (5) resource assessment, and (6) environment, health, and safety. In addition, an in-house study is investigating the Fischer-Tropsch synthesis process.

COMBUSTION STUDIES

Southern California Edison is continuing studies of the combustion behavior of synthetic fuels to determine the firing characteristics, emissions, and control strategies. In addition to the full-scale studies with methanol and shale oil described below, SCE performed small-scale combustion tests with SRC-II in a program sponsored by Gulf Oil.

METHANOL COMBUSTION

In 1975, Southern California Edison developed plans to test methanol in a gas turbine. The test was designed to compare the operational and emission characteristics with methanol in a Turbo Power and Marine Gas Turbine in the "Twin-Pac" Configuration. To directly compare the data produced, methanol was fired in one gas turbine while distillate fuel was fired in the sister engine. The test duration was 523 hours. The Electric Power Research Institute provided some of the funds for this study which was completed this year.

The NO_x emissions, with the methanol-fueled gas turbine, were lower by about 10 percent than the distillate-fueled engine with water injection. Water injection in the methanol-fueled gas turbine produced an additional reduction in NO_x. No significant problems occurred during the test that could be attributed to the use of methanol. The use of methanol actually slightly improved engine performance because of the higher mass flow through the turbine.

Southern California Edison, along with some other utilities, participated in the testing of methanol made by the New Orleans Public Service at the A. B. Paterson Station in 1972. These tests, made in a 49-MW boiler, were only partially successful in demonstrating the feasibility of using an alcohol fuel in a power boiler.

In order to further examine the use of methanol in a power boiler, a study is being planned to test methanol in a 44-MW boiler. Modifications to handle methanol are almost complete, and testing should take place at the end of this year.

SHALE OIL COMBUSTION

Southern California Edison conducted a series of tests burning about 5000 barrels of a crude Paraho shale oil in 1975 and 1976. These tests were conducted in a 44-MW boiler at our Highgrove Generating Station. Combustion of the shale oil containing two percent nitrogen produced a NO_x level of about 1000 ppm uncontrolled.

In later experiments, the raw shale was blended with a low-sulfur oil. The NO_x emission was reduced by 50 percent over the combustion of raw shale oil.

CONCLUSION

Southern California Edison believes that synthetic fuels can play an important role in developing our independence from foreign oil. With appropriate and timely regulatory and permitting treatment, synthetic fuels can make this contribution by 1990. The need for now is to take the steps necessary to aggressively pursue the most favorable projects through the study phase and definitive engineering, construction, and operation.