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USING COAL INSIDE CALIFORNIA FOR ELECTRIC POWER

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ABSTRACT

The use of coal to generate electric power is a well proven fact. The use of coal within California, however, faces a series of questions which may have to be answered before coal could be used within the state. Appropriate demonstrations, therefore, may be in order.

In a detailed analysis performed at Southern California Edison on a wide variety of technologies, the direct combustion of coal and medium BTU gas from coal were ranked just below nuclear power for future non-petroleum based electric power generation. As a result, engineering studies have been performed for demonstration projects for the direct combustion of coal and medium BTU gas from coal.

The ability to use coal to generate electric power has been well proven long before the national energy shortage was ever a serious consideration. This is due to the fact that coal is, and has been, a very inexpensive fuel for many areas of the country. Since the oil embargo and the establishment of the national goal of energy independence the utilization of coal has gained added importance - especially in areas such as California where the use of natural gas and petroleum has been widespread.

While the utilization of coal within California has received a considerable amount of publicity in the past few months, the use of coal to supply electricity to California has been taking place for a considerable period of time. Figure 1, for instance, shows the 1580 MW Mohave Generating Station located in the southern tip of Nevada -- a mere 21 miles from Needles, California. This station has been in operation since 1971 and is supplied with coal in a water slurry form by pipeline from Kayenta, Arizona, some 275 miles to the east. Other large out of state coal fired generating units are, at this very instant, producing power for us in California.

There are a number of important political and environmental issues involved with the utilization of coal within California which I understand will be the subject of other presentations at this conference. I would like, however, to outline for you the internal planning which has led us, as an electric utility company, to the point of seriously considering coal in California and to briefly discuss a few of our proposed projects.

Of vital importance to the future of any electric utility is the establishment of a viable generation resource plan directed at selecting the type and amount of generation needed to meet projected load growth and the retirement of older, less efficient plants.

An example of the historical and forecast peak demand for the SCE system is shown in Figure 2. Notwithstanding the reductions indicated by the most recent forecast the current projection indicates that the peak demand will increase by approximately 500 MW per year over the next 20 years. Of course, one of our primary concerns is where will this new generation be sited and how will this generation be fueled?

By comparison, the planning process for answering these questions was substantially more straightforward in the past than it is today. Technological, social, economic and regulatory changes now require an almost continual, complete reevaluation of future resources and generation requirements.

In light of this rapidly changing environment and in an effort to facilitate Edison's long range fuel supply and generation resource planning, we established a special task force in 1976 to assess the company's future energy base. Specifically, the Task Force was asked to determine which potentially available conversion technologies would ensure that the company would be able to continue to provide electric energy from both existing and future generating plants. This Task Force was comprised of representatives from our System Development, Power Supply, Fuel Supply, Advanced Engineering, and Engineering and Construction Departments. The objectives of this group were threefold:

First, to develop a list of energy sources, fuel production technologies and generation methods which were not dependent on petroleum and assess their technological and commercial availability.

Second, to prepare cost estimates and environmental assessments for the more promising technologies, and finally, to prepare recommendations for the implementation of programs to develop and accelerate these technologies.

I should add that this was by no means a simple task as it involved an evaluation of the complete spectrum of energy related technologies -- many of which are still in the conceptual stage. As you might expect, a certain amount of "SWAG" estimating was required to assess potential costs and environmental impacts for a number of the more advanced systems. The preliminary review identified some 41 different "technologies" which might applied prior to 1990 and an additional 42 technologies which may be sufficiently developed to allow application after 1990.

The attention was then focused on the more immediate concern of evaluating those technologies which hold the most promise and could be expected to be available for commercialization within the next 5 to 10 years. Detailed economic and environmental assessments were prepared on these for ranking purposes. Capital and operating cost, regulatory restrictions, cooling and process water requirements, land use, transportation of fuel, and basic fuel feedstock availability were a few of the considerations used in this evaluation. The results of the economic assessment are summarized in figure 3.

As shown, nuclear power stands as the number one choice for base load power production. This is followed by three other methods which could be available in the near term. Specifically, direct combustion of coal with advanced pollution controls, coal gasification integrated with combined cycle, and geothermal. You will note that of these three, coal gasification could serve a wider variety of needs as outlined in the objectives to this study. That is, it is non-petroleum based and it could theoretically provide clean fuel for both existing and new plants. The other two methods generally are applicable for new generation only. It should be pointed out that none of these technologies are completely without social and environmental impacts.

Based on this evaluation it was determined that we should proceed with detailed planning for a demonstration coal gasification project as well as strengthen our programs in direct coal combustion and geothermal.

One option for coal utilization that has been most recently proposed by Edison is the construction of a direct coal-fired, 1500 MW plant at an acceptable eastern California desert location. This project could be possibly brought to commercial operation in the 1987-1989 time frame, and advanced technology for air and water quality control could theoretically be engineered into the plant. There is some concern, however, in the commitment to a project of this size since the pollution control systems required to meet projected new rules have not been demonstrated in an integrated fashion and we believe that a demonstration first on a smaller scale would be prudent.

As a result, this has led Edison to propose the option of the construction of two demonstration plants at our Coolwater Generating Station near Daggett, California.

As you know, we recently announced plans to conduct preliminary engineering studies with Texaco, Inc. to develop a 1000 tons/day coal gasification demonstration plant at Coolwater Station. We are also seriously considering the feasibility of converting one unit at this same station to direct firing with coal, coupled with advanced stack gas emission control devices.

The Demonstration Programs we presently envision will thus consist of separate Direct Coal Combustion and Coal Gasification Projects.

In the Direct Coal Combustion Project the existing 81 MW Unit 2 boiler will be retrofitted with the necessary equipment to burn coal, as indicated in Figure 4. As you might expect, the conversion of this oil-fired unit to burn coal is a sizable task. This unit, however, is one of the few on the Edison System originally designed with provisions for such a conversion, and, as a result, no major modifications to the basic boiler appear to be required. In addition to the new coal handling and combustion equipment, the unit will be equipped with a baghouse and downstream stack gas scrubbing system for removal of particulates and sulfur dioxide. Combustion modification techniques will provide the basis for NO_x control although an ammonia injection or a catalytic ammonia reduction system may also be considered. The demonstration of the ability to operate this rather complex system of control equipment will be a primary objective of the project. We believe the state-of-the-art of NO_x removal is far behind that of SO_x and particulate removal. The extent to which this modified plant will impact the environment is an integral part of the experimental program.

An artist's rendering of the plant after the conversion to coal is shown in Figure 5. The enclosed coal handling equipment is shown in the foreground. Midway is the new stack, stack gas scrubber and bag filterhouse. The existing unit and stack are in the background.

For the Coolwater Coal Gasification

Project a two phase demonstration is planned. The basic gasification system is depicted in simplified diagram (Figure 6).

First, medium BTU gas, produced from a Texaco oxygen blown gasifier and passed through a fuel gas cleanup system, will be fired in the existing 65 MW Unit 1 boiler, to demonstrate its use as a petroleum or natural gas substitute for existing units. Emissions from the boiler as well as the gasifier will be monitored to determine the environmental impact.

In the second phase the gas will be used in a new combined cycle unit with an overall rating of approximately 90 MW. The integration of the gasifier with a combined cycle unit to achieve the lowest possible heat rate will be the primary objective of this phase of the project along with the demonstration of system flexibility, turndown capability and low overall emissions. Advanced pollution and environmental controls will be used in every step of the process from the rail coal delivery to the ultimate by-product disposal. If successful, the entire facility will serve as a model to be emulated for years to come. Figure 7 is an artist's rendering of the coal gasification plant.

The financial commitment for this program is sizable -- on the order of $300 million for the gasification project and $80 million for the direct coal combustion project. Because of this and the technical risks involved we are actively seeking participation from both the private and public sectors.

In conclusion, we at Southern California Edison believe that coal is the only immediate choice of a major energy source we have in light of the recent rather discouraging decisions on nuclear power for California. Since there are a series of technical, environmental, and social questions which need to be answered if coal is to be accepted, we are of the opinion that appropriate demonstrations are necessary. Thus, we believe that this program, and programs like it, are of vital importance to demonstrate that coal, an abundant resource, can serve California's future energy needs at a reasonable cost to rate payers and in an environmentally acceptable manner.

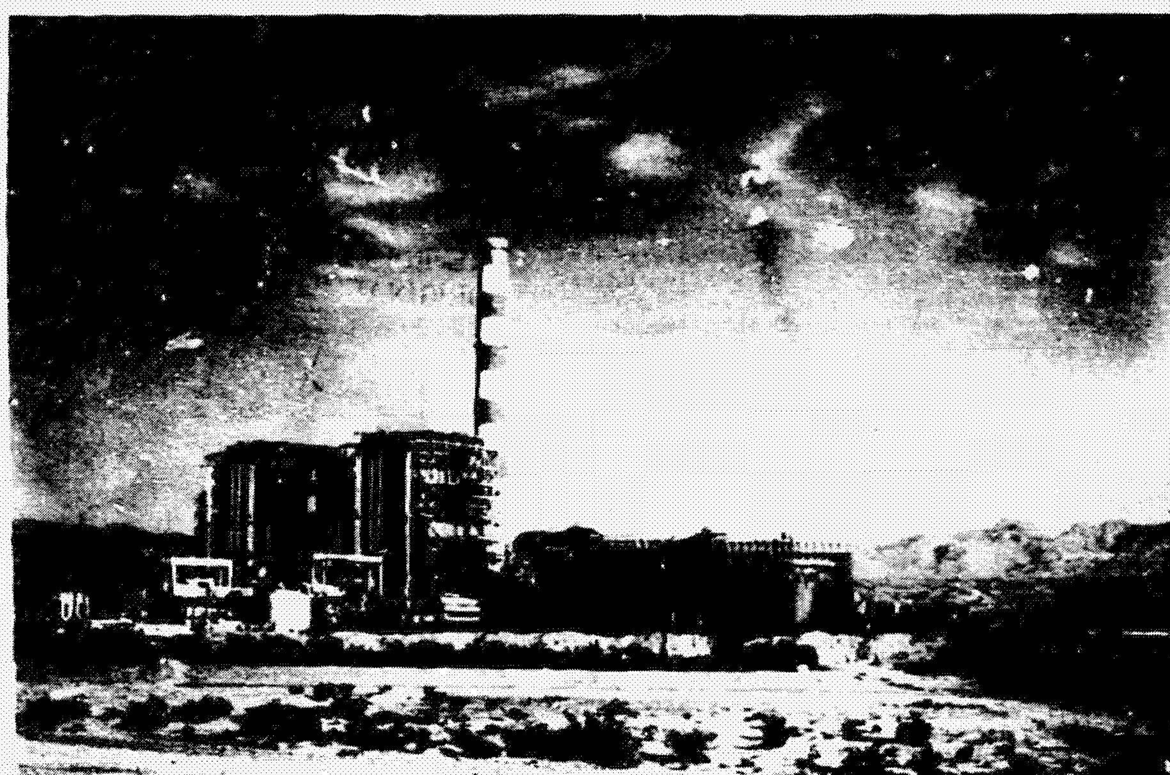

Figure 1 - Mojave Generating Station

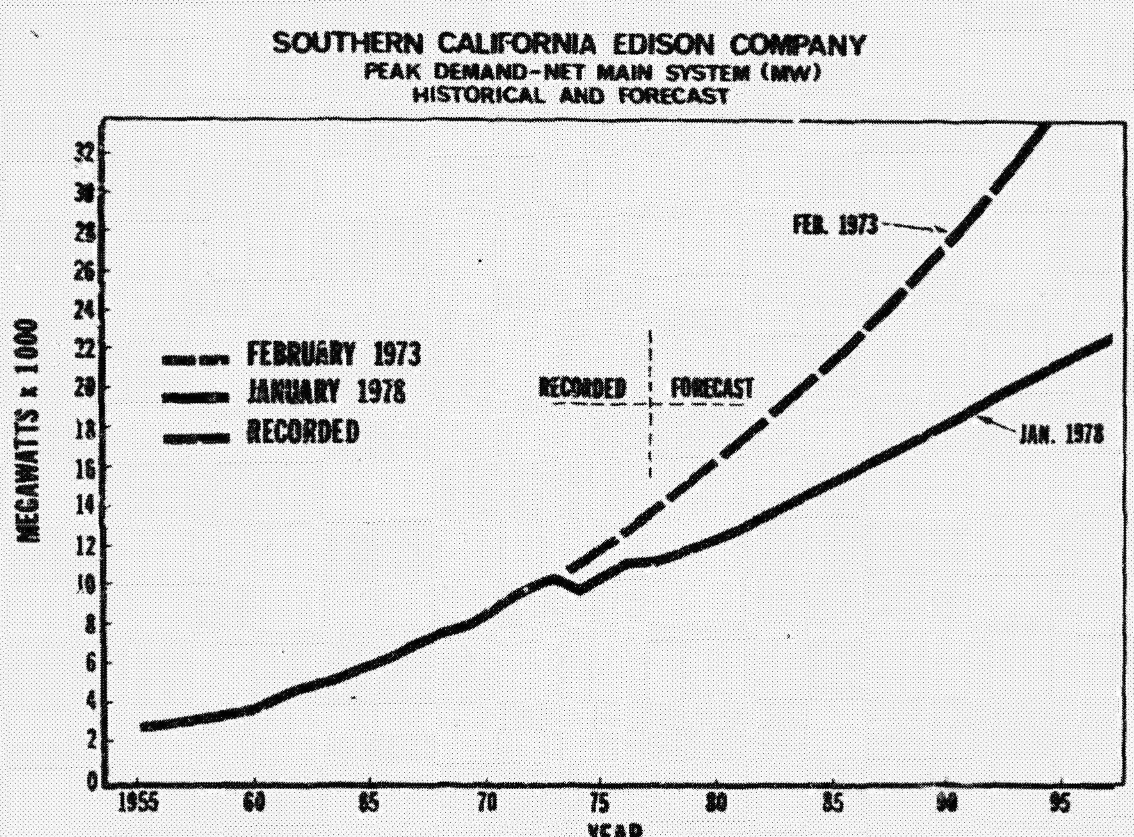

Figure 2 - Power Demand

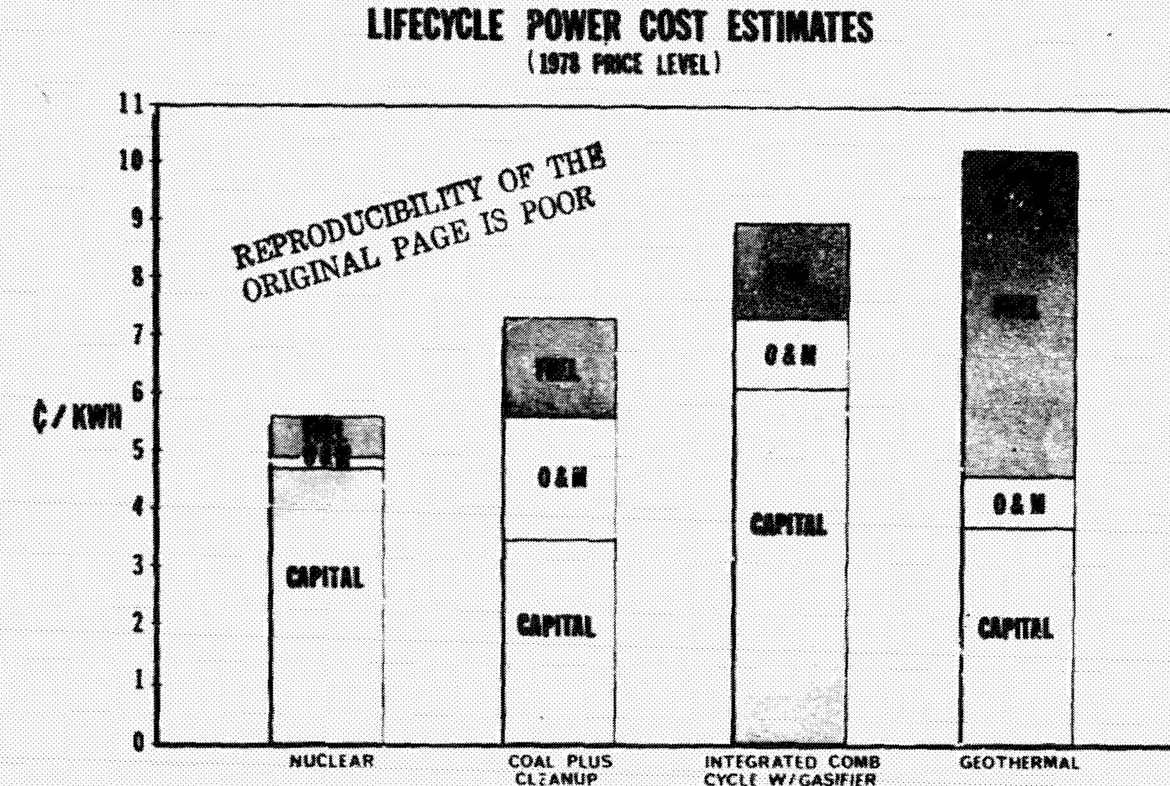

Figure 5 - Power Cost

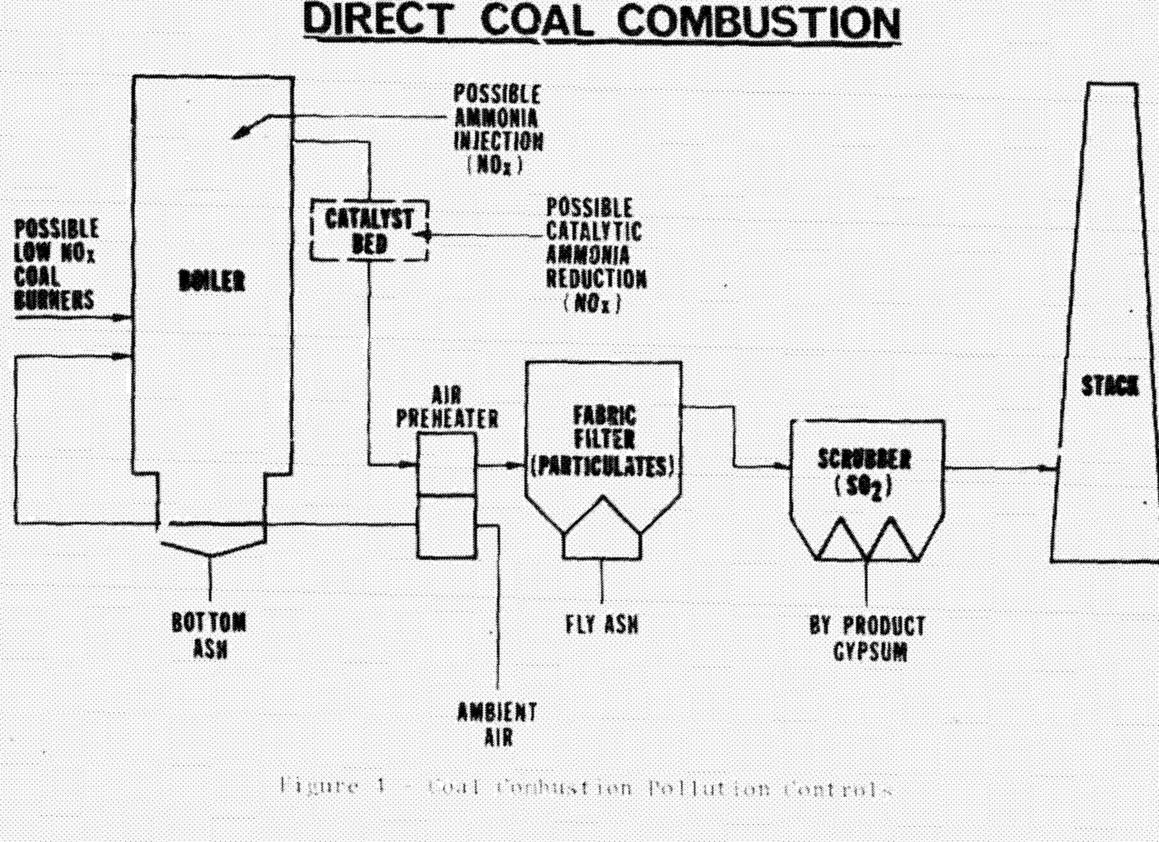

Figure 4 - Coal Combustion Pollution Controls

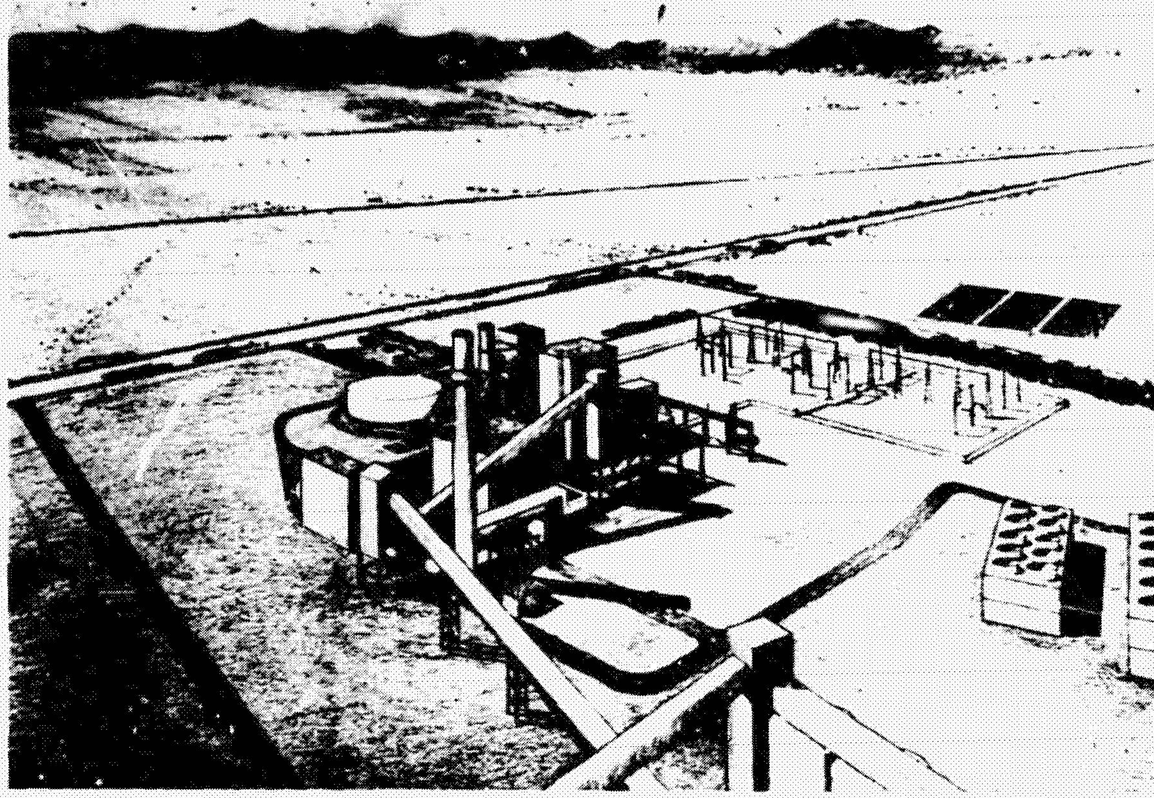

Figure 5 - Coal Combustion Artist Rendering

COAL GASIFICATION

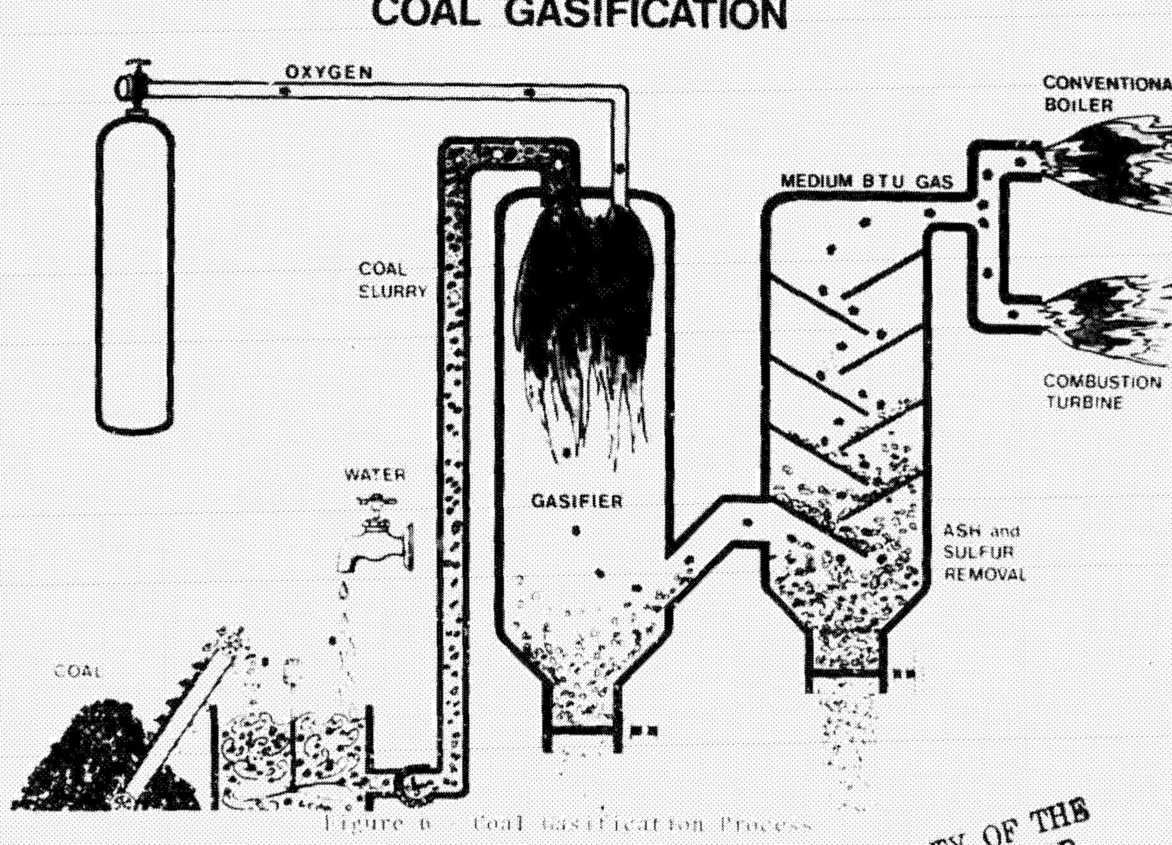

Figure 6 - Coal Gasification Process

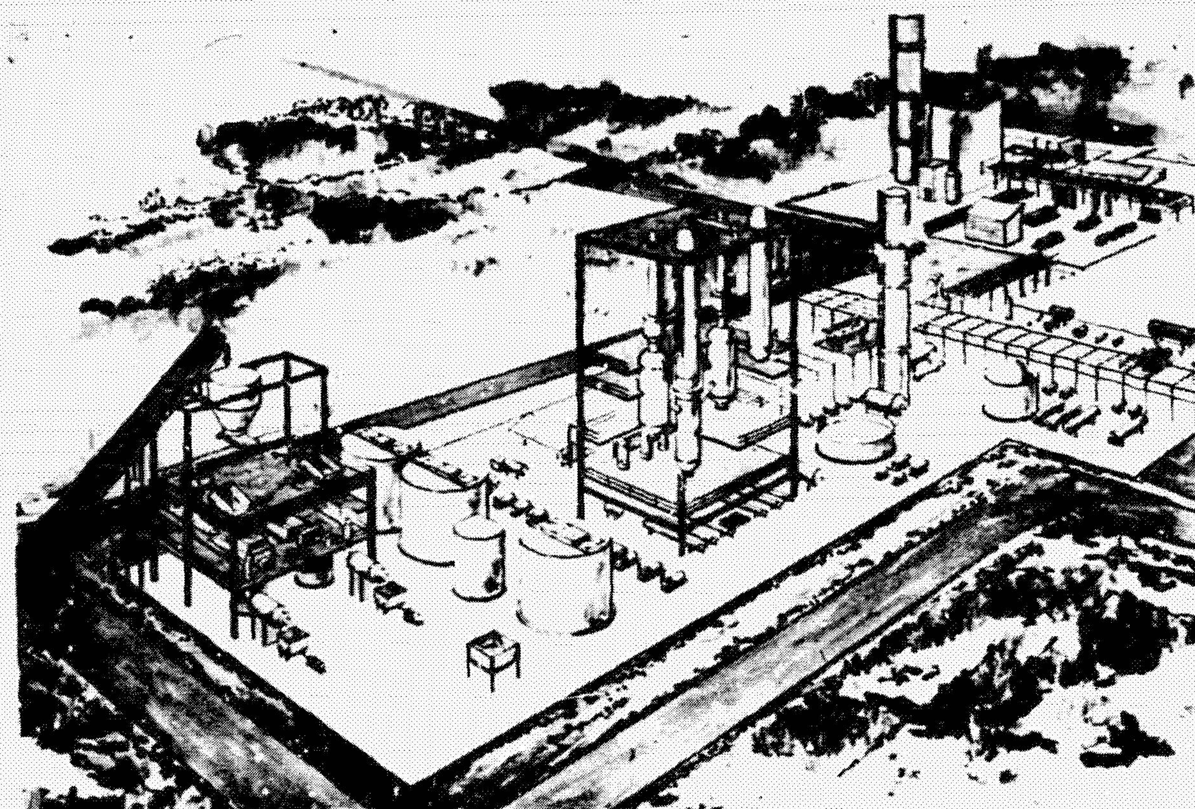
Figure 7 - Coal Gasification Artist Rendering