

BUSINESS CRITERIA FOR COAL

GASIFICATION

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The '70's were an exciting time for the coal gasification fraternity. We were developing new technologies, planning demonstration plants, organizing commercial projects to supplement the declining supplies of natural gas and oil - all spurred on by the promise of rising prices and government incentives.

Now the climate is different. Oil prices are down, and there is a growing belief that oil and gas will be available in reasonable supply for the rest of the century. Many people have concluded that work on coal gasification is not needed and that the government should abandon its efforts to promote a synthetic fuels industry.

The list of abandoned projects grows longer almost daily. With Exxon's decision to abandon its East Texas lignite gasification plans, and then even its Colony Oil shale project, an investor might well ask, "If Exxon with its resources doesn't believe it can successfully develop a synfuels unit, why should I take such a risk?" And the newspapers have been full of stories where companies are announcing that they are cancelling or differing their synfuels plans. Obviously the business-community has concluded that today the risks are too great to justify committing the huge sums required to build most such facilities.

And this leads to a concern of mine. How can we reduce the unknowns in coal gasification so that the perceived risks are about the same as those in any other large project -- for example a coal burning power station? Only when the unproven items in a coal gasification plant are of the same magnitude as those for a large coal fired power station will industry and the investment community be willing to commit to such plants in the quantities needed to satisfy future markets.

The United States and the world have a respite from the fuel shortages and high prices predicted a few years ago. Let us use this period to deliberately prepare for the time when shortages and high prices do occur.

I would like to review today some of the criteria that a cautious organization might impose on a coal gasification project, and see if this list will give us some clues as to what should be under development at this time. I propose to do this by presenting lists of the more important criteria and commenting on where I believe we stand today in addressing the issues raised.

Exhibit I

On this first slide are the primary Process Selection Criteria. One thing that will strike you about this list is that it does not mention any requirement for lowest investment or operating costs. This is, of course, a very important item; however, until the above conditions are met you really cannot judge whether the reported costs are probably correct, or perhaps the process developer is unduly optimistic.

EXHIBIT I
BUSINESS CRITERIA FOR COAL GASIFICATION

Process Selection Criteria

1. Full Scale Gasifier Demonstration.
2. Full Scale Gasifier Coal Test.
3. Standard Processes Elsewhere.

Let us review this list item by item. First of all, a number of companies have insisted that they will not install a gasifier which has not demonstrated dependable operation with at least one unit of the size to be used in the proposed plant. The costs associated with unexpected problems in a large plant are so great that a knowledgeable investor would probably choose a proven process even though its costs are believed to be greater than a process which is nearly commercial.

There are a number of promising gasifiers being developed in this country which do not meet this criterion. I think it is very important that their developers be given the support to enable them to install and operate a full scale prototype unit.

We have the opportunity to prove these technologies before the nation's fuel needs require that large numbers of gasification plants be built.

The second item is as important as the first. A full scale test using a coal as similar as possible to the coal to be used in the new plant needs to be run in the prototype plant.

Coal tests in pilot scale gasifiers are indicative of the expected performance of a commercial unit, but there can be enough surprises that it is worth the cost to ship 20,000 - 25,000 tons of coal to England or Germany or South Africa or wherever to get a full scale test. The test will cost several million dollars, but you are then confident of how your coal will perform under actual operating conditions. This also provides an opportunity to collect samples of the ash and other waste streams to aid in the design of pollution abatement equipment and in securing environmental permits.

As more and more of these tests are run in a given gasifier, and data on every type of coal is collected the necessity for such a test will diminish. Finally, gasifiers will be no more mysterious than coal fired boilers, and that is the goal we should all be striving to attain.

The last item is often slighted in a plant design because of focusing so intently on the gasifiers and their peripherals. It is true that there is an order of magnitude more uncertainty in the design of a system involving solids than in one containing only liquids and gases. However, this does not mean the risk drops to zero on the rest of the plant. So the rule should be, no unproven equipment!

Thus, the message should go out to the engineering companies and equipment suppliers - now is the time to be demonstrating that new process that could be such an improvement in a coal gasification plant.

This leads me to acknowledge that the processes chosen, including the gasifier and the rest of the plant, must be competitive, so that

If a process is nearing true commercial status, and it offers a 10 - 20% reduction in costs, the investor should probably wait for it to be proven.

EXHIBIT II
BUSINESS CRITERIA FOR COAL GASIFICATION

Process Selection Criteria

1. Full Scale Gasifier Demonstration.
2. Full Scale Gasifier Coal Test.
3. Standard Processes Elsewhere.
4. A Fully Competitive Process.

It appears to me that gasifier suppliers have a few years to prove their systems before the first wave of projects is launched.

My guess is that there will be relatively few makes of gasifier chosen because so few of the second generation models will be judged to be commercial when the choice has to be made.

The models that are chosen will have a tremendous advantage over the other designs in competing for future business. The second generation gasifiers all overcome any significant deficiencies of the first generation models, so there is not very much economic incentive to consider another gasifier design once several second generation systems have demonstrated acceptable commercial performance.

For the gasifier supplier who has yet to demonstrate a commercial scale unit, this lull in active projects is a heaven-sent opportunity to press on with their plans.

Now let us turn to a different sphere of risk, the area of public reaction to the project and political support or opposition.

Since these undertakings require around two billion dollars in investment and take about seven years to build and get started, there is a very large amount of money sunk into a plant for a long time before any returns are obtained. A delay caused by public resistance to the project can be terribly expensive.

For example, the interest on a two billion investment at today's rates is nearly a million dollars a day.

This is, of course, one of the reasons why many utility companies have backed away from nuclear power investments. And the investors in a coal gasification project will be aware of the same kind of risk.

To minimize the risk of a project delay the investors will probably establish the following criteria:

1. After reviewing the project, every state or federal agency having permitting authority must indicate they see no fatal flaws in the project and that they favor it.
2. The local government must support the project. The officials must be willing to help explain the advantages of the project to the community and aid in receiving the necessary permits.
3. The proposed plant must be explained to the public. The plant must not seriously alarm or offend any recognized organizations.

While a proposed plant may comply with the law, if some of its disposal practices alarm the public, you can be sure the plant will encounter delays. This is a special case of 3 above.

EXHIBIT III
BUSINESS CRITERIA FOR COAL GASIFICATION

Political Criteria

1. The administrations of both the Federal and State governments must favor your project.
2. The local government must support the project and help to expedite necessary approvals.
3. The proposed plant must not seriously offend any recognized organizations.
4. The plans for disposing of plant wastes and effluents must be conceptually acceptable to the public and to governmental agencies.
5. The protocols for handling and selling plant by-products must be established.

Some gasification systems produce by-products which are classed as hazardous chemicals. We have heard today of some of the problems associated with a pre-manufacturing notice on coal liquids. These liquids can be consumed in the plant, but have higher value as products. The protocol for handling and shipping these materials should be established before a plant is authorized.

These criteria are clear enough, but what can we do now to insure that they can be satisfied when a project is launched a few years from now?

Probably the best thing that can be done is to build a few pioneer plants in populated areas and show everyone that these plants are good neighbors.

We need enough operating plants that the weaknesses in design are uncovered and acceptable solutions are developed.

We need to have the by-products from coal gasification moving into the market place so procedures are in place for their handling and use.

We need to be able to interview people that live near a gasification plant who can testify that they were not bothered a bit by it.

We need to show people from other parts of the country that a gasification plant is no worse than other industrial installations which are routinely being constructed.

I have here a picture of a gasification plant which was in commercial operation for many years and still operates as a development center. It doesn't look threatening does it?

Here is another view of the same plant. Note the cattle and sheep in the foreground.

I can testify that cattle near the plant look as fat and healthy as any I have seen in fields in this country.

Some of the other areas of development which need continuing work can be identified by reviewing the uses for coal gasification products.

Medium btu gas can be used as a feedstock for a large array of products. Examples include ammonia, oil products via the Fischer Tropsch synthesis, methanol, and advanced products such as acetic anhydride and ethylene glycol.

Medium btu gas can be upgraded to synthetic natural gas or can be used directly as an industrial or utility fuel.

Low btu gas can be used as an industrial fuel also.

Methanol is a particularly interesting and versatile product, and many projects have been designed to yield methanol as the only or major product.

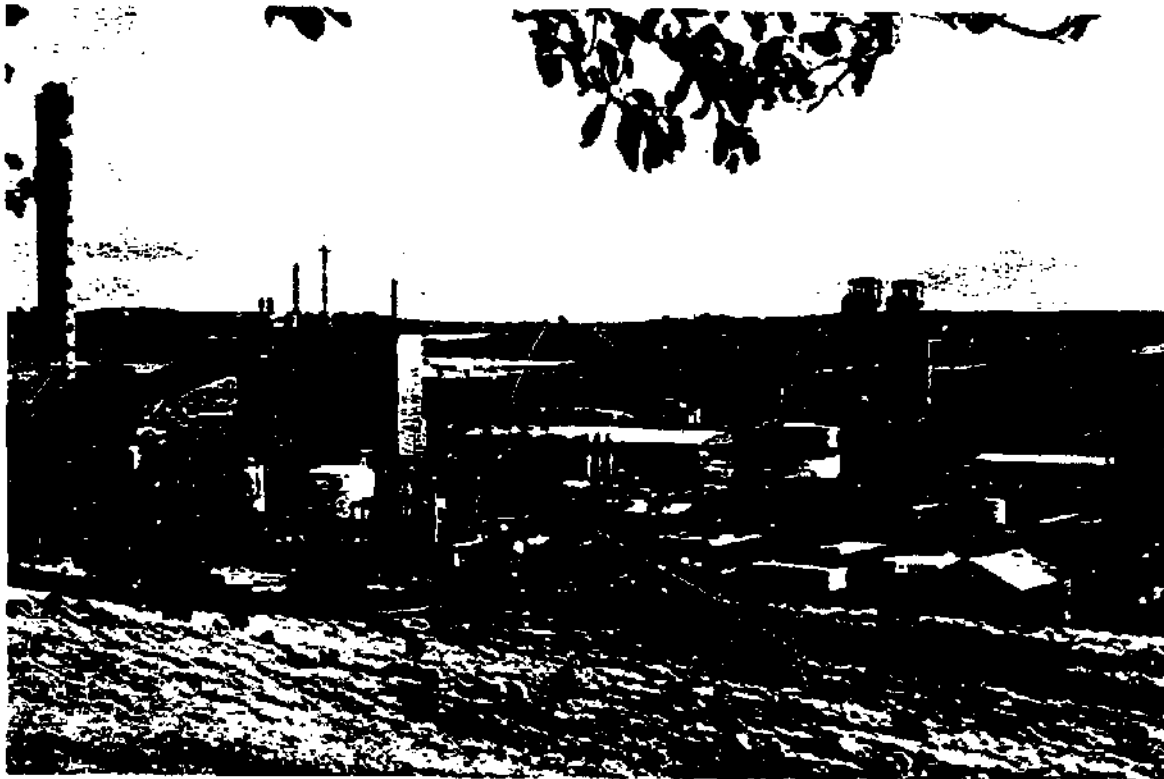


Fig 2

Coal Gasification Works at Westfield, Scotland

The exciting feature of methanol is its potential in automotive fuels. It can be used directly in modified cars, or it can be converted to gasoline by the Mobil process.

If methanol could be used directly in automobiles as a substitute for gasoline, it would realize its highest use value. However, much needs to be done to develop this market.

Requirements for a Methanol Fuel Market

1. Long term automotive use tests are needed to determine:
 - a. engine performance
 - b. corrosion
 - c. wear
2. Distribution experience is needed to uncover any problems.
3. Energy companies must be convinced of the profit potential of methanol and be willing to introduce another fuel at their stations.
4. Automobile companies must be convinced of the merits of producing cars adapted for methanol use.

The first step is the use of neat methanol in a number of automobile fleets. This is under way in a few instances, but interest would spread if more tests were planned.

A similar set of tests could be run on methanol-gasoline blends. Even though the potential use is lower, the market could still be huge and possibly no alterations to automobile or the gasoline distribution system would be required.

If an assured market for methanol at a price close to that of gasoline could be established, this would be a powerful inducement for coal gasification.

The second area of high potential is as a utility fuel. There have been a number of engineering studies which show that a coal gasification plant integrated with a combined cycle power plant could deliver electricity at a lower price than could a conventional coal fired boiler and steam turbine plant. Here is a sketch of what I am referring to. By "combined cycle" I mean a gas turbine which drives a generator and the hot exhaust from the gas turbine goes to a waste heat boiler delivering steam to a turbo-generator. Thus, the fuel is used twice to produce electricity in a very efficient combined cycle system.

If the studies comparing gasification/combined cycle economics to conventional power stations prove to be true, coal gasification could capture a very large share of the future power capacity in the United States. This is a very exciting prospect. There is one project under way to test out such a

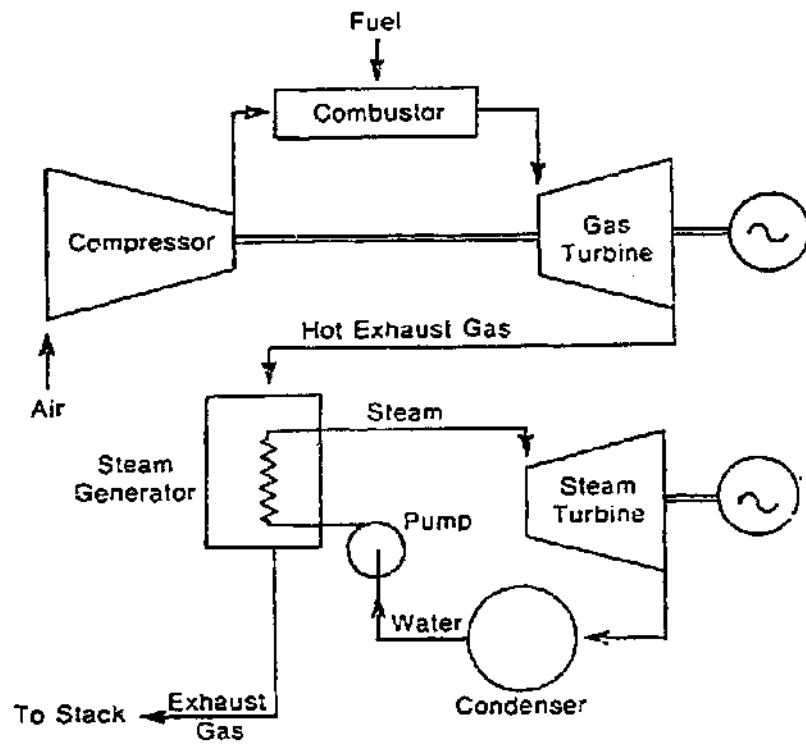
EXHIBIT IV
BUSINESS CRITERIA FOR COAL GASIFICATION

Uses of Coal Gasification

- I. Feedstocks
 - A. Ammonia
 - B. Oil Synthesis
 - C. Methanol
 - D. Advanced Synthesis
 - 1. Acetic Anhydride
 - 2. Ethylene Glycol

- II. Fuel
 - A. SNG
 - B. Industrial/Utility Fuel
 - 1. Medium Btu
 - 2. Low Btu

Fig 2
BASIC COMBINED CYCLE



system. The Cool Water project at Daggett, California, is scheduled to start operation in late 1983.

Other demonstrations of other gasifiers in a similar arrangement should be supported to speed this development to successful completion.

Long term this could be the largest single market for coal gasification.

In conclusion, I believe that you can see that there are still some exciting potentials for coal gasification, even under today's economic conditions. However, these potentials cannot be realized without the demonstrated successful operation of prototype facilities of several technologies.

We have a breather before many projects will be authorized, and we should use this opportunity to gain the experience needed to successfully build and operate a major new plant.

In summary, before a significant coal gasification industry can be launched the following events will have to occur:

1. Enough prototype units must have operated to give the owner a choice between several gasifiers.
2. These prototype units must have operated long enough to experience the normal difficulties of a new plant and to have overcome the difficulties. The local communities near these units must have accepted them as satisfactory industrial neighbors.
3. Enough test marketing must have been completed to uncover any problems in the distribution and use of methanol or medium or low btu gas.
4. Several combinations of coal gasifiers and combined cycle power systems should have attained sustained operation.
5. The gasification by-products should have been characterized and the protocols for handling and using these materials should be established. Permitting should be a formality which is no different from meeting other code requirements.

I contend that we are fortunate that the need for synfuels plants is not as urgent as we all thought a few years ago. The only way that some of the projects being considered then would have paid off is if the price of oil and gas would have continued to escalate. And the world doesn't need higher fuel prices now - we are already in a depression with today's prices.

Oil and gas are still depleting, however, and the day of synfuels is not so distant that work is not needed now. Let's get on with these tasks so we are ready when the day of decision arises.

EXHIBIT V
BUSINESS CRITERIA FOR COAL GASIFICATION

Major Developments Needed

1. Sustained operation of full-scale prototype gasifiers.
2. Enough public exposure to commercial gasification operations that any serious problems are uncovered and acceptable solutions have been developed.
3. Established markets for the expected major products from gasifier plants; e.g., methanol, medium and low Btu gas.
4. Sustained operation of integrated coal gasifier/combined cycle power systems.
5. Characterization of gasification by-products so that pre-manufacturing notice becomes only a formality.

The Department of Energy, the Synthetic Fuels Corporation and other interested organizations should be financially encouraging those projects required before regular commercial ventures could be authorized. Such industry organizations as the Electric Power Research Institute and the Gas Research Institute have contributed heavily to such projects in the past. The real need for such support continues today. The only thing that has changed is that we now might have time to incorporate some of the developments funded into the first round of commercial plants built. At the pace that the synfuels industry was moving a year or so ago, few new developments would have been seen in the plants that were constructed.