THE FUTURE FOR SYNTHETIC FUELS

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ABSTRACT

A decade ago one of this Country's highest priorities was to solve the Energy Crisis. Now, a brief six years after its formation, the Synthetic Fuels Corporation has been abolished and the Nation seems to have forgotten the gasoline lines and high energy costs of that era. Ironically, the conditions which brought about the Energy Crisis of the 1970's still exist, but the United States is only marginally better prepared than it was in 1979 to deal with another petroleum supply disruption. Also, if current low petroleum prices persist for an extended period, it will result in reduced non OPEC production and increased free world demand and will accelerate the process of placing OPEC back in control of petroleum supply and pricing in the next decade.

Although the synthetic fuels programs of the 1970's and 80's did not meet the expectations of the Congress which enacted the Energy Security Act of 1980, there have nonetheless been valuable lessons learned which will benefit those who are involved in molding energy policy for the future. The lessons relate to the inherent flaws in the Energy Security Act, the linkage between defense and energy security, the need to reduce the cost and improve the social acceptability of technology and the impetus to increase the level of research on synthetic fuels. The policy decisions made now will determine the role of oil shale and other synthetic fuels in the Nation's future energy mix.

INTRODUCTION

Synthetic fuels have been the energy source of last resort throughout this century, primarily because of the high cost of production as compared to petroleum and natural gas.

Around 1920 an oil shale boom occurred because of high oil prices. The discovery of the giant oil fields in Texas drove prices downward and oil shale was put on the shelf until the second world war era when the fear of loosing foreign supplies of petroleum stimulated research in the United States. In Germany, during that era, synthetic fuels from coal and oil shale were used extensively as a source of military fuels.

The resurgence of interest in synthetic fuels which began in the 1960's can be mainly attributed to a recognition by government and industry that the United States could no longer supply, from domestic sources, its own petroleum (and natural gas) needs. Computer projections of that era prompted planners to believe that petroleum prices would reach the $100 per barrel level before the end of the century. In the 1970's the extent of the domestic supply problem became acute, OPEC asserted its control over petroleum supply, and the price of oil settled at around $34.00 per barrel. In response to the gasoline lines and dislocations in the economy, Congress passed the Energy Security Act of 1980 in order to stimulate the production of synthetic fuels and move the Nation towards energy independence.

Now six years later the price of oil is in the $10 - 15 per barrel range and the Nation still imports approximately 30% of its petroleum needs.

This paper concentrates on the past, present and future for oil shale while only generally discussing synthetic fuels as a whole.

ENERGY SECURITY ACT

The Energy Security Act, Public Law 96-294, passed by Congress in 1980, was intended to "extend the Defense Production Act of 1950" for the purpose of fostering the creation of commercial production of synthetic ruel, fostering greater energy security and reducing the Nation's economic

vulnerability to disruptions in imported oil supply. The Act created the Synthetic Fuels Corporation (SFC) to oversee the program. The debate in Congress, which resulted in the Energy Security Act, resulted in a number of compromises which hindsight has revealed to have attributed to the lack of success of the program envisioned by the Congress. In general the SFC was given less authority and had more restrictions placed upon it than the Defense Department (DOD) had under the Defense Production Act (under which the DOD had awarded loan and price guarantees to three mega Syn fuels projects prior to the activation of the SFC).

The major problems in the Energy Security Act which led to difficulties for the SFC and industry are as follows:

FIRST, the award of price and/or loan guarantees had to be based upon competitive proposals. The process of getting organized, naming an SFC Board and issuing solications took over two years. Consequently, the SFC missed a window of opportunity during which time a consensus still existed for synthetic fuels.

SECOND, the Act imposed the requirement that a fixed dollar amount of award had to be agreed upon between the project sponsor and the SFC at the time of contract signing. The effect was that sponsors were forced to accept the risk of increases in inflation and interest rates and decreases in energy prices for the 10+ year duration of the projects - factors which were totally out of the control of the sponsors. Also it should be remembered that this was a period of dramatic increases in inflation and interest rates. Consequently, sponsors chose to use extensive contingencies in cost estimates used to determine the level of price and loan guarantees. This facet of the Act contributed to the ultimate demise of two major projects, which had been passed over to the SFC from DOD, and the withdrawal by many qualified industry proposers.

In essence industry and government were assuming the wrong risks. Industry should have assumed a portion of the risks associated with technology performance, budgets, schedules, operations and the like. Government should have borne the risk of changes in inflation, interest rates, energy prices and other factors out of the control of industry. In retrospect, an indexing arrangement should have been utilized, or alternatively, the government could have built and operated the plants under a GOCO contract arrangement. Either approach would likely have reduced the cost to the taxpayer for plant construction and operation and certainly would have expedited the process of making financial awards.

THIRD, the Congress created an entity in the SFC that was neither a government agency nor an independent corporation. It quickly came under the political scrutiny of Congress and the Reagan Administration because of its unique status, especially when Federal deficits began to grow and the effects of the 1979 oil embargo began to be forgotten.

The net effect was a near paralysis of the SFC. During its six year tenure the SFC funded only four projects for a total of $1.667 billion from an original authorization of $20 billion. The funded programs included two coal gasification projects, one heavy oil fireflooding project and a single oil shale award of $400 million in price and loan guarantees to Union Oil for its Parachute Creek project. A multitude of unsuccessful proposers spent millions of dollars in submitting proposals and in attempting to comply with the stringent strength and maturity requirements established as policy of the SFC. Ironically these millions were not spent productively because they did not go towards advancing technology or commercial projects, but instead were generally spent for administrative and legal purposes.

FOURTH, the Energy Security Act specifically prohibited financial awards for community development and socioeconomic impact assistance. As it turned out a significant proportion of the cost of a synthetic fuels facility in a remote area was related to such assistance. Additionally the Act did not give the SFC any authority to waive or delay evnironmental regulations to achieve production goals or to expedite the construction and operation of plants even though one of the purposes of the Act was to obtain environmental and socioeconomic data from a fledgling industry.

LESSONS FROM THE SYN FUELS PROGRAM

Although the synthetic fuels program of the 1970's and 1980's has ended before achieving its

initial goals, there has nonetheless been a great deal of information gained and a number of lessons learned which hopefully will be helpful to those who follow.

TECHNOLOGICAL CONSIDERATIONS

Because of the urgency to produce substantial quantities of synthetic fuels in a short time frame, only the technologies which were well developed were eligible for SFC financial grants. There had been little incentive to develop technologies prior to the events of the 1970's. Many of these technologies were first experimentally tested in the 1940's, 50's and 60's and may now, in some cases, be considered obsolete. Consequently, the United States is currently in a position of not having devoted enough research into the new technologies which have the potential for lower cost.

In the case of oil shale, the key technologies were based upon mining and surface retorting schemes. The operators were principally oil companies which generally fashioned designs after continuous hydrocarbon processing facilities. In retrospect one of the key problems was failing to recognize the lesser reliability and greater difficulty in handling solids as opposed to liquids and gases. Also, there seemed to be a lack of recognition that the characteristics of oil shale across a vertical stratigraphic section, even in the same mine, is quite variable and that retorts cannot be designed solely for the average grade being processed, but must take into account the extremes.

The scale chosen for initial commercial oil shale modules, at about 10,000 tons per day, now appears to have been too large. In general demonstration scale facilities in the range of 1,000 tons per day had been tested, but in some cases these tests did not precisely duplicate the process selected for the commercial module. Developers of technology appear to have been swept along by the optimism of the times and seemed prone to scale their commercial module either in response to the claims of competing developers and/or in response to economic paramenters - as opposed to basing decisions on sound technical and operational judgment.

In the 1960's the upgrading of the products of synthetic fuels processes was not judged to be as serious a consideration as it turned out to be when detailed marketing and transportation plans were finalized. It was learned that the cost of upgrading into products which could be substituted for conventional products was much higher than earlier estimated. For shale oil final estimates exceeded $10 per barrel for upgrading to a synthetic crude oil. The high cost was aggravated by the small scale of initial plants and the remoteness of the projects. The need to conduct expensive and time consuming health testing of new products also added to the cost and complexity of the problem. The remoteness of the projects also led to additional cost for moving the products to market.

In the 1970's individual oil shale developers established varying strategies toward the grade of shale to be processed commercially. On one hand some operators chose to retort the highest grade material available through large scale underground mining, believing that the recovery of about 35 gallons per ton (gpt) of oil constituted a significant economic advantage because the costs of mining and retorting were related closely to the tons of shale processed and not the quantity of oil recovered. These developers geared their retort design efforts to processes which were not limited by grade. On the other hand some operators pursued a strategy of exploiting their entire oil shale reserves down to a cut off grade of some 25 gpt through surface mining or insitu techniques. However, some developers adopted the latter strategy because either their oil shale reserves were of lesser quality or because their technology could not process rich oil shale. In the future, if the industry is to compete, it would appear that efforts should concentrate on exploiting the highest grade/most economic oil shale deposits.

ENVIRONMENTAL/SOCIOECONOMIC CONSIDERATIONS

The oil shale program stimulated by the energy crisis of the 1970's reached such grandiose proportions before its cooling off stage that it frightened even the most ardent development advocates. At one point there were over twenty announced commercial projects in Colorado and Utah totalling well over a million barrels per day of output that was projected to be in production before 1990.

The effect of the influx of hundreds of thousands of people to that remote area and the

cummulative effect on the physical environment were studied in detail and debated across the Country. The end result was the conclusion that such a grandiose industry could not be assembled in such a short time frame and that existing environmental regulations would likely not allow such to be operated using the proposed technologies. Unfortunately, the operators which persevered with smaller scale suffered from the stigma of the grandiose plans of the industry. As an example, community facilities, which are now well under-utilized, were built largely at industry expense. Also stringent environmental restraints were imposed which were in some cases meant to control the larger industry which never materialized.

In retrospect it has to be judged that if significant production is ever to be achieved from the oil shales of Colorado, Utah and Wyoming then technology will have to evolve in a manner which utilizes fewer people (per unit of oil output) and results in less cummulative environmental impact to the air, land and water resources of the area - unless the situation at the time warrants war time expediency.

NATIONAL SECURITY CONSIDERATIONS

The argument in favor of subsidizing the development of synthetic fuels has generally evolved from the belief that the energy and defense security of the Nation are integrally linked, and that the United States cannot be at the mercy of foreign oil suppliers whose political aims may not coincide with our own. In times such as these with low oil prices and an over supply of petroleum in the world, that concept is easily forgotten. Thus the industry has cycled from feast to famine and back again several times in the last decades. It is still the case, however, that the United States imports some 30% of its petroleum. The only stop gap measures developed since the 1974 and 1979 incidents are the partial filling of the Strategic Petroleum Reserve and the modest advancement in the synthetic fuels and other energy related technologies. A long range energy policy is needed to establish the priorities for research, testing and other actions which should be instigated at this time.

ENERGY PROJECTIONS

The next resergence of synthetic fuels will likely be in response to another impending petroleum supply crisis. Predicting the time of such an event has proven to be nearly impossible, because of the multitude of intangible factors which go into the determination. One thing seems clear, however, it will not occur in any manner we are currently anticipating, and the trends in energy supply and demand will not follow the computerized projections of today. However, it is enlightening to examine the fundamental principles which control the supply and demand for petroleum and to review some of the recent projections by experts in the field.

There is only a limited amount of excess petroleum producing capacity worldwide. In the event of increased demand for petroleum, there would be upward pressure on prices long before this capacity would be fully utilized. Previous experience indicates that when even 80% of OPEC capacity is utilized, only about 22 million barrels per day (MBPD), prices will probably rise. Thus, demand for OPEC crude oil need rise by only 4 to 6 MBPD, some 10% of world demand, for this point to be reached. Therefore it takes a relatively small increase in demand, or decrease in non OPEC production, to put OPEC back in control of prices.

The recent reduction in world oil prices will likely stimulate petroleum consumption. The American Petroleum Institute (API) have conducted analyses which indicate that oil consumption will grow at a rate of about 4% per year, assuming a real annual growth in GNP of 3%. At this rate consumption in the United States would reach 23 MBPD by 1995, some 7 MBPD above today's consumption. This trend of increased consumption would be contrary to the trend of the last years which saw demand decline until 1984 when a slight increasing trend began. However, this was a period of reasonably high and stable petroleum product prices, and a period when energy conservation policies were taking effect. Now, however, the Nation is entering a period of lower prices, an improving world economy (especially in light of the weakening of the value of the dollar against other currencies) and a trend toward relaxation in conservation. All in all it does not seem unreasonable that worldwide consumption of

petroleum will rise during the end of the 1980's.

The API estimated that if the recent decline in oil prices is sustained for a number of years, the long term consequences on domestic petroleum production will be severe and possibly irreversible. That estimate reveals that the reduction would be between 2 and 3 MBPD, depending on the duration of the reduced prices, out of a current total U.S. production of about 10.5 MBPD.

Data Resources, Inc. (DRI) estimates that the average crude oil wellhead price will be $15 per barrel in 1986. They project that if prices fall to $13-14 per barrel in 1987 and 1988 and rise to $29 (real) by 1995, U.S. oil production would be reduced by about 2.5 MBPD during that period.

Together, the low-oil-price supply and demand scenarios suggest that U.S. oil imports would grow substantially from the current 5 MBPD. Based upon the API/DRI estimates imports would increase to about 10 MBPD in 1990 and 15 MBPD in 1995. OPEC currently produces 16 - 18 MBPD and has an estimated production capacity of 26 - 28 MBPD. Thus, a 10 MBPD increase in U.S. demand for imported oil would absorb much of OPEC's current excess productive capacity. Moreover an increase in demand for imported oil in other non OPEC countries would accelerate the process.

CONCLUSIONS

The future for synthetic fuels continues to be uncertain, as it has been for most of this century. However, the experience of the energetic programs of the 1970's and 1980's have given the Nation a new perspective. It is no longer a certainty that when energy prices rise again, as they most certainly will in the next decade, that synthetic fuels will participate in the effort to solve the problem. The nature and extent of a synthetic fuels industry will instead depend entirely upon the planning and action taken now to prepare to meet the needs of the future in an economic and socially responsible manner.

There is a need to conduct research into technologies which holds the potential for lower cost and greater environmental and social acceptability. The technologies fostered under the Energy Security Act have proven to be too expensive to be competitive with other practical sources of energy and have demonstrated the inability to comply on an industry basis with the current environmental and socioeconomic expectations of the Nation. Insitu techniques are among the types of technologies which have the potential to compete.

There is a need to develop less expensive techniques for converting the raw products produced from synthetic fuels processes into products which are compatible with products presently in commerce and which can be moved to market in conventional transportation facilities.

There is a need to conduct comprehensive testing of the products, waste streams and intermediate materials involved in synthetic fuels processing so as to be prepared to answer the health, safety and environmental questions concerning these materials before an urgent commercialization program is instigated.

There is a need for government to develop a comprehensive energy policy to guide the Nation into the 21st century.

There is a need for the defense establishment to take an expanded role in the development of synthetic fuels. The obvious linkage between energy and defense security suggests that the Defense Department is the agency with the greatest incentive to stimulate the development of military fuels from oil shale, coal and tar sands.

There is a need to document the results of the synthetic fuels program of the 1970's and 1980's for use of those who follow.

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