

CHAPTER IV OUTLOOK FOR EARLY COMMERCIALIZATION OF SYNTHETIC FUELS

A. PAST EXPERIENCE

Processes for making gaseous and liquid synthetic fuels from coal and oil shale have been available for many years. While some of these processes have been proven to be technically successful, none has yet been able to produce products that compete favorably with the costs of producing conventional oil and gas. During the past 30 years, synthetic fuels have been produced in relatively small amounts under special circumstances, and today, only South Africa produces substantial quantities of liquids from coal.

B. RECENT PRIVATE COMMERCIALIZATION EXPERIENCE

Examination of three cases, one relating to tar sands development, another relating to oil shale development, and a third to high Btu gas from coal reveals some of the recent problems experienced in initiating synthetic fuels ventures.

1. Canadian Tar Sands Experience

Commercial tar sands development dates back to 1960 when Great Canadian Oil Sands, Ltd., (GCOS) applied to the Alberta Oil and Gas Conservation Board for permission to produce 31,500 barrels of oil daily from Canada's Athabasca tar sands. This application was approved in 1962 and, in 1964, a production increase to 45,000 barrels per day was allowed.

Construction on the plant and supporting facilities began during the summer of 1964 and the first production was achieved in September 1967. The plant cost, first estimated at \$191 million, actually cost about \$260 million. For nearly two years following first production, numerous technical problems were encountered. Production records indicate a steady improvement in operations beginning in 1969; 21,671 barrels per

day for the first six months of 1969 and 33,003 barrels per day the second six months. Production continued to improve and, over the first three quarters of 1972, the target production level of 45,000 barrels per day was reached--10 years following approval of the application. During the first quarter of 1973, the first profit for any quarter was reported. To this date, although many companies have filed applications for tar sand production, no other firm has attempted tar sands production on a commercial scale.

Recent news concerning initiation of additional tar sands projects is not encouraging. Atlantic Richfield Company has withdrawn from the Syncrude project in which it held a 30 percent interest. Shell Oil Company has also postponed indefinitely its \$700 million tar sands project, and Candel Oil Ltd. is seriously considering dropping out of the Petrofina group project in which it holds a minority interest. The reasons given for changes in company policy are threefold. First, the companies will be unable to export their synthetic crude because the Canadian government decided in late 1974 to eliminate oil exports to the U.S. Second, the Canadian government has imposed additional Federal taxes on mining companies. Third, double-digit inflation has pushed costs to unbearable levels. This latter reason, inflation, has also caused the Colony Oil Shale Project to be delayed as discussed next.

2. Colony Oil Shale Project

The Colony Development Operation, with ARCO, TOSCO, SOHIO, and Cleveland Cliffs Iron Company as participants, has conducted large pilot plant operations (over 1,000 tons per day) on private land near Parachute Creek, Colorado, during the last several years. This work has included significant expenditures for baseline environmental studies, especially revegetation of spent shale disposal sites.

Based on this experience, a commercial plant was designed and commercial development was confidently projected in 1973 using underground room and pillar mining with surface retorting utilizing the TOSCO II process to produce 48,000 barrels per day of shale oil.

Original engineering cost estimates indicated plant construction costs of \$250-300 million. This cost estimate escalated to \$500 million by January 1974 and to \$800 million by September 1974.

In November 1974 Colony announced a decision to delay construction due to this dramatic rise in construction costs and the attendant uncertainty regarding the future competitiveness of the product. Colony recently submitted a proposal for Federal loan guarantees and price support to allow construction to proceed. The application requested loan guarantees for up to 75 percent of the plant costs plus purchase of total plant production for 20 years at a guaranteed price of \$11.15 per barrel.

3. High Btu Gas From Coal

Probably the most significant recent government/industry regulatory interaction on synthetic fuels is that between the Federal Power Commission and the companies with applications for synthetic gas projects before the Commission. Through the end of May 1975 the FPC received three applications for approval of high Btu gas plants. One of the applicants, El Paso Natural Gas, has asked the FPC to defer its decision pending resolution of matters pertaining to the acquisition of satisfactory commitments for coal and water. The most recent application was from American Natural Gas (Michigan-Wisconsin Pipeline Co.) filed with the FPC on March 27, 1975. No action has yet been taken on this proposal for a plant in North Dakota.

The third of these applications was made by Transwestern Pipeline Company (WESCO), a joint venture of Texas Eastern and Pacific Lighting. It was filed on February 7, 1973 and the FPC issued its opinion on April 21, 1975, the effect of which was to grant conditional approval of the project. However, the conditions set forth in this approval were unacceptable to the applicants as set forth in their application for rehearing filed with the Commission on May 21, 1975. In its application Transwestern's major argument is that it will be unable to finance the project unless the FPC allows recovery of substantially all costs. Even with such a favorable ruling, Transwestern claims that financing

the project may not be possible unless the investors can be assured by some creditworthy entity that the plant will be completed or, if not completed, the investors will be protected against loss.

Further complicating the Transwestern situation is a petition for rehearing filed by the Public Utilities Commission of the State of California. This petition expresses particular concern about exposing the gas customers to extremely high costs. To provide the minimum protection to the ratepayers this petition suggests the need to "find a way to apportion this risk between ratepayers, applicants, and third parties including governmental entities."

From the statements already in the record and the information received from company officials, it now appears that without changes in regulatory policy Government initiatives may be needed to assist industry to obtain the financing needed to construct the first one or two high Btu gas plants.

C. CURRENT COST ESTIMATES OF PRODUCING SYNTHETIC FUELS

Unsubsidized costs for producing synthetic fuels have been estimated for this analysis. The bases for these estimates are detailed in Volume III and summarized here in Table 5.

As shown in the Table, synthetic fuels are currently estimated to be expensive. For example, assuming that each fuel will need to compete with oil at a world price of \$11 per barrel and with imported liquefied natural gas at \$2.60 per million Btu, one can expect that, at present, nearly all synthetic fuels will require some subsidy to yield a discounted rate of return (DCF) of at least 15 percent.

Oil shale is the closest to being competitive and would be attractive if the world oil price rises much above the present \$11 per barrel. Electric utility fuels and high Btu gas from coal, financed in a regulated environment, are the next most attractive. High grade

TABLE 5
ESTIMATED CURRENT SYNFUELS PRICES WITHOUT INCENTIVES, 1975 DOLLARS

	PRICE REQUIRED TO YIELD RATE OF RETURN OF: 1, 2		
	12%	15%	20%
HIGH BTU GAS, \$/MILLION BTU ³			
REGULATED CASE	.	\$ 2.61 - 3.02	.
UNREGULATED CASE	\$ 3.69 - 4.12	4.43 - 4.84	\$ 5.89 - 6.27
FUELS DERIVED FROM BIOMASS, \$/MILLION BTU			
UNREGULATED CASE	3.26	4.09	5.69
UTILITY/INDUSTRIAL, \$/MILLION BTU ⁴			
REGULATED CASE	.	2.31 - 2.70	.
UNREGULATED CASE	3.15 - 3.53	3.71 - 4.10	4.86 - 5.22
SYNCRUDE, \$/BARREL ⁴			
UNREGULATED CASE	19.54 - 21.97	23.21 - 25.66	30.40 - 32.57
SHALE OIL, \$/BARREL			
UNREGULATED CASE	10.10	12.70	17.94

1. REGULATED RATE OF RETURN BASED ON UNDISCOUNTED RETURN ON EQUITY AFTER TAXES ASSUMING 75 PERCENT DEBT AND 25 PERCENT EQUITY.
2. UNREGULATED RATE OF RETURN BASED ON DISCOUNTED CASH FLOW AFTER TAXES ON ENTIRE CAPITALIZATION.
3. RANGE REPRESENTS COAL COST OF \$5 OR \$9 PER TON (WESTERN COAL).
4. RANGE REPRESENTS COAL COST OF \$11 OR \$17 PER TON (EASTERN COAL).

synthetic crude from coal is least attractive at the present time although R&D now being conducted could result in much lower costs in the future.

D. CURRENT INDUSTRY PLANS AND MAJOR CONSTRAINTS

Although industry is currently planning a number of synthetic fuels projects, none has actually proceeded to construction. The major projects, shown in Tables 6 and 7, are in high Btu gas from coal and in oil shale. Several projects related to utility and industrial fuels have been suggested, but have not yet reached the level of planning associated with shale oil and high Btu gas from coal. Most of the projects are in various stages of planning and none has yet acquired the necessary financing and other approvals needed to proceed. Only a few projects have actually reached the design phase.

The major reason the projects have not proceeded is that the risks associated with initiating synthetic fuels projects are large compared with other investments providing an equal or higher rate of return. The major risk is the uncertainty concerning the future price of world oil. Other important risks include:

- uncertainty about air and water quality standards,
- resource (coal, shale, biomass) availability,
- water availability,
- federal regulation of price of fuels,
- availability of labor, materials and equipment,
- need for environmental control technology,
- cost of socio-economic impact,
- other institutional barriers, and
- unforeseen project delays.

TABLE 6 ACTIVE HIGH BTU GAS FROM COAL PROJECTS*

Company	Location	Status
Western Coal Gasification Co.	New Mexico, Public Land	Federal Power Commission has issued opinion approving project with certain qualifications. The company has requested a cost of service authorization.
Michigan-Wisconsin Pipeline Co.	North Dakota, Private Land	Application filed with Federal Power Commission, March 1975. Lignite reserves of 3.7 billion tons dedicated to project by North American Coal Corp. Four plants planned. North Dakota has awarded conditional water permit.
El Paso Natural Gas	New Mexico, Public Land	Application before Federal Power Commission. Company has asked FPC to defer decision. Coal lease on Navajo Indian Reservation. Water application filed but not approved.
Panhandle Eastern Pipeline Co.	Wyoming, Private Land	Planning and design. Peabody Coal Co. has dedicated in excess of 500 million tons of coal. State has issued water permit.
Natural Gas Pipeline Co. of America	North Dakota, Largely private Land	Detail planning. Rights to 2.1 billion tons of lignite leased. Application for water submitted to North Dakota. Plans for eventual 4 plants with 250 million scf/d capacity each.
Cities Service Gas Northern Natural Gas	Montana-Wyoming	Study of coal gasification in Powder River Basin. Up to 1,000 million scf/d in four plants. Peabody Coal Co. has dedicated 500 million tons of coal.

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*All projects involve surface mine development and contemplate the use of the Lurgi Coal gasification system followed by methanation to about 1,000 BTU'S per standard cubic foot. See Volume III, Chapter III-E for details.

TABLE 7 ACTIVE OIL SHALE PROJECTS*

Company	Project	Location	Process/size	Status
Colony Development Operations**	Underground mine surface retorting	Colorado, private land	TOSCO II/50,000 b/d	Plant designed, but project suspended indefinitely. Some development work proceeding
Gulf Oil and Standard Oil (Indiana)	Surface and/or underground mine, surface retorting	Colorado, public land (Tract C-a)***	TOSCO II/50,000 b/d	Pre-development studies underway
Atlantic Richfield, TOSCO, Ashland Oil, and Shell Oil	Underground mine, surface retort	Colorado, public land (Tract C-b)***	TOSCO II/50,000 b/d	Pre-development studies underway
White River Oil Shale Corporation****	Underground mine, surface retort	Utah, public land (Tract U-a and U-b)***	Paraho and TOSCO II/50,000 b/d	Pre-development studies underway
Superior Oil	Underground mine, surface retort (Includes mineral recovery)	Colorado, private land	Rotating Grate Retort 44,000 b/d	Awaiting land exchange decision with Interior research continuing
Union Oil of California	Underground mine, surface retort	Colorado, private land	Steam-gas recirculation retort/50,000 b/d	Semi-works plant of 7,000 b/d being planned
Occidental Petroleum	Modified In Situ	Colorado, private land	Modified In Situ/33,000 b/d	Advanced stage of research

* Technology and status detailed in Volume III, Chapter III-C.

**Colony Development Operations consists of Atlantic Richfield, TOSCO, Ashland Oil, and Shell Oil.

***Part of the Department of the Interior's Prototype Oil Shale Leasing Program.

****Consists of: Sun Oil, Phillips Petroleum, and Standard Oil (Ohio).

E. ASSESSMENT OF OUTLOOK FOR PRIVATE SYNTHETIC FUELS COMMERCIALIZATION

High synthetic fuels costs and unproven technologies have largely inhibited past commercialization efforts. Recent large increases in world energy prices have improved comparative economics, but the possibility of unilaterally lowered world energy prices has added a new major element of risk. Moreover, construction costs, which traditionally have increased at a rate of 4 to 6 percent per year, soared nearly 30 percent in 1974 thus raising serious concerns about the economic viability of all synfuels projects.

Based on the technical and economic review contained in Volume III, it is concluded that, in the absence of Federally provided economic incentives or other policies creating a stable and favorable investment environment, significant amounts of synthetic fuels are not likely to be produced by 1985.

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