Section 4

THE DEPARTMENT OF ENERGY SYNTHETIC FUELS PROGRAM: A 1980 PERSPECTIVE

by

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Good morning.

I am delighted to participate in this conference, in particular because of its international character. This September, I had the privilege of visiting the Federal Republic of Germany, traveling specifically to Dusseldorf for the Fifth International Conference on Coal Research. I am particularly pleased to see present here today many of the new acquaintances I made in Dusseldorf.

More recently--last week in fact--I was in Morocco for a discussion of possible avenues of technology transfer in the area of oil shale. These trips have underscored for me personally the important international linkage developing between the oil-consuming countries in an effort to increase our energy security.

During the 1970s we acquired a new energy awareness--a recognition that our nations are overly dependent on a single part of the world and on a single energy resource, namely oil.

Out of that awareness has grown an international response to our energy problems. We have built that response on the twin foundations of conservation--or using energy more efficiently--and providing greater, more diversified energy sources.

Our success in energy conservation has been significant. For every seven gallons of gasoline and fuel oil that Americans burned two years ago, we are burning six today. For every four gallons of oil that we imported two years ago, we are importing three today.

The same energy analysts who, in the years prior to the 1973-1974 oil embargo, were forecasting total U.S. energy demand as high as 200 quads in the year 2000 are now feeling increasingly comfortable with estimates in the 100 quad range.

Conservation is indeed helping us buy the time we need to develop a wider range of new, more reliable energy resources.

Concurrent with our conservation efforts, we must also look to new sources of energy--fuels that are more abundant yet still in a form that is readily useable in our society. We must fuel millions of automobiles, light tens of millions of homes across the country, and power thousands of factories. This infrastructure has been forged on the premise of inexpensive energy, primarily in liquid form. Today this premise is disappearing.

The thousand-percent jump in oil prices during the last decade, plus today's combat reports from the Persian Gulf are warnings that we no longer have the luxury to orient an energy program around <u>just</u> research and development. Our program today must be geared to the <u>deployment</u> of technologies into the marketplace. In other words, no longer is it sufficient simply to bring new technologies to the commercial threshold. Today we must ensure that they cross over it.

That is the policy that has emerged during the last year for synthetic fuels. Many technologies are commercially available today. Had we possessed the foresight to begin building the first plants immediately after the 1973-1974 oil embargo, we would today be producing domestic synthetic oil and gas--and because of inflation and the price hikes of the oil cartel, their costs quite likely would be competitive with world oil. Many of these technologies would still eventually enter the commercial arena on their own, simply from the market forces of today's escalating oil prices.

But it is becoming clear that our countries cannot afford to wait. Even putting aside the vulnerability of our oil supplies and the implicit national security implications, none of us can continue to withstand the unchecked hemorrhage of our national economies.

In this country we are spending $90 billion annually for foreign oil--more than all the Fortune 500 companies earned last year. In doing so, we are eroding our economic foundations plus our ability to maintain a vigorous industrial base. That $90 billion is at the heart of our inflation problem, our balance-of-payments problem, and the weakness of our dollar.

Therefore, our program is geared to providing the strongest leverage possible to move technologies into commercial practice quickly. Moreover, the government

cannot be the ultimate customer. The true measure of our success with synthetic fuels will be their widespread acceptance into the private marketplace.

This policy has motivated creation of the Synthetic Fuels Corporation. It is also the reason we have restructured our research and development program to align it better with the requirements and timing demanded by today's energy situation worldwide.

Our objectives are straightforward:

First and foremost, we must reduce our dependence on oil imports--more rapidly than would be possible by traditional private industry actions alone.

Second, we have established a series of environmental objectives. Although we may differ on particular regulations or laws, we all share a concern for a clean, healthful environment. In reaching for the first objective, we will be expanding our domestic fuels production. In doing so, however, our efforts must not be directed at diluting environmental standards, but working to develop technology that will enable us to produce energy both in compliance with existing laws and in the future, in compliance with even stricter environmental requirements.

Maintaining acceptable energy prices and minimizing societal disruptions are also important objectives. We must give high priority to reducing the social and economic costs of our energy program to the consumer.

How then does the synthetic fuel program of the Government conform to these objectives?

The answer is that our program today brings into play a number of tools--a variety of incentives, plus an aggressive research and development program--each designed for a critical need and for a clearly defined timeframe. With the President's initiatives of the last year, for the first time, we have available the full diversity of such mechanisms to stimulate the commercialization of synthetic fuels.

The incentives will be the responsibility of the Synthetic Fuel Corporation. The Corporation will permit companies to have access to capital through loans and loan guarantees while being assured of a reliable market through purchase commitments and price supports.

Our selection of these mechanisms for today's commercial synfuel plants--rather than direct government financing--reflects an understanding that the future of this industry rests in the hands of a competitive private industry.

The Government is not in the business to build commercial synthetic fuel facilities, nor is it in the business to supplant the private enterprise system. These incentives are fashioned to work within the marketplace, not to overwhelm it.

Perhaps the most significant event to date in the synthetic fuels effort has been the response of the private sector. As many of you know, two hundred million dollars of an initial $2.2 billion were made available this summer to firms for feasibility studies and cooperative agreements. This effort is designed to lay the groundwork for a set of commercially viable synthetic fuel plants. One hundred and ten proposals were selected.

What is more significant is that 110 proposals were selected from nearly 1000 submitted. Two weeks ago, another 1000-plus proposals were received in a second round of feasibility studies and cooperation agreements, this one totaling $300 million.

Last week the Department issued the solicitation for those companies ready to begin actual construction of the first commercial synthetic fuels plants--this coming under a $5 billion funding allocation and involving price and loan guarantees and purchase commitments.

Industries in each of our countries are indeed beginning to gear up for a synfuels industry. They are now beginning to look beyond the energy problem to the opportunities inherent in an international energy solution.

The Great Plains Gasification plant has been one of the early beneficiaries of the synfuels commercialization effort. This summer, the project's sponsors received a $250 million loan guarantee and hopefully full-scale construction will begin next spring in Mercer County, North Dakota.

This important step has finally come more than six years after the first permit for the project was issued and after the private companies had invested $40 million of their own money.

By 1984, the plant should be producing pipeline-quality synthetic gas equivalent to nine million barrels of oil per year.

The Great Plains project exemplifies the engineering and financial challenges facing private synthetic fuel investors today. Designed initially to produce 125 milion cubic feet of pipeline-quality gas per day--equivalent roughly to 25,000 barrels of oil--the Great Plains project is estimated to cost $1.5 billion. It will be located on approximately 2 square miles of land, and its Lurgi gasifiers will consume 14,000 tons of lignite per day. That is equivalent to one railroad car of lignite every eight minutes around the clock, seven days a week.

A full-capacity plant using the Great Plains technology would produce 250 million cubic feet of gas per day using 24 gasifiers, probably with four spares. The gasifiers would be housed in the equivalent of 8-story-high buildings--yet they comprise only a small portion of the entire plant.

But meeting and overcoming engineering challenges like these is not an unfamiliar task to our industrialized societies. Yet we must start now to gain the actual construction and operating experience that will be vital to the continued growth of this industry.

Concurrent with this commercialization effort, we have intensified our efforts to complete the development process of a new generation of technologies that will form what might be called the "second wave" of synthetic fuel processes.

To understand better the special role played by our research and development, let me return to our energy objectives: national security, a clean environment, and acceptable energy prices. The problem with these objectives is that the means to achieve one often conflicts with the others.

For example, today's technologies can solve our national security problem and still maintain environmental quality, but the costs will be large. We can have national security and low prices but at the expense of the environment. Incentives cannot overcome this inherent conflict. All they can do is shift the burden from one group to another, but ultimately it comes down to the individual citizen.

That's where research and development can play its most significant role. Unlike other instruments for carrying out our energy policy, research and development is

the only one that leads to the evolution of new processes in concert with all three objectives, that is, increasing domestic energy supplies within both an acceptable environmental and economic framework.

1980 has been a watershed year for our technology program.

This summer we began operating two coal liquefaction pilot plants--currently the largest synthetic fuel facilities in the United States. In both, we are pleased to have the Electric Power Research Institute as one of our industrial partners.

The H-Coal plant outside Catlettsburg, Kentucky, processes from 200 to 600 tons of coal per day. The reason for the variation is that the plant is designed to operate in two modes: one--the 200-ton per day mode--produces roughly 600 barrels of synthetic crude oil suitable for refining. The other processes 600 tons per day of coal and produces approximately 1800 barrels of product more closely comparable to heavier, low-sulfur fuel oil.

In both modes, a catalyst is present in the reactor to aid in liquefying the coal. The process was developed by Hydrocarbon Research, Inc., now a subsidiary of Dynalectron Company. The plant was built by Badger Plants, Inc., under the joint sponsorship of DOE, the Commonwealth of Kentucky, and an industrial consortium. It will be operated by Ashland Synthetic Fuels until at least 1982.

Although we have had some problems with valve erosion in the early startup tests of the H-Coal plant, our opinion is that the question is one of the right engineering modifications, and these are currently being done.

The second plant is the Exxon Donor Solvent plant in Baytown, Texas. If we had to single out one project as the way R&D projects should be done, it would probably be this plant.

When construction was completed, the project was within seven percent of anticipated costs--adjusted for inflation. As many of you know who have followed R&D, this is not frequently the case. Startup has been as smooth as we could have anticipated, and we have just passed 1000 hours of cumulative operating time.

The key feature of this process is the use of a catalyst in a separate vessel to hydrogenate a solvent that is then recycled back into the liquefaction vessel. There it transfers the hydrogen to fresh coal, hence the name "Donor Solvent."

The process is a proprietary development of the Exxon Corporation. The 250-ton per day pilot plant is funded through a 50-50 cooperative agreement between DOE and a group of industrial sponsors. Key partners in this project include industrial firms from the Federal Republic of Germany, Japan, and as was recently announced, Italy. We are pleased to have available the technical innovation that these countries bring to our research and development program. Operation of this pilot plant is planned to extend through 1982 with activity on a commercial-scale plant possibly initiated during 1983-1984.

The Solvent-Refined Coal process is the flagship of our liquefaction technology program--or I might also say, the lightning rod. Work on this technique dates back to 1962, and we are now moving into the final stages of full-scale development.

The international agreement signed this summer by President Carter and the Ambassadors of Germany and Japan to jointly fund a full-scale SRC demonstration plant may well be regarded as one of the most significant steps in our march to a more secure international energy future. The experience we gain in this project--as well as our other demonstration efforts--will far exceed the development of any single synfuel technology.

Construction of these plants will give us early experience in meeting the engineering challenges of full-scale, first-of-a-kind facilities. Information learned in building the SRC-II plant in West Virginia--and its SRC-I counterpart in Kentucky--will be directly transferable to other facilities, regardless of the process. That includes the first-generation plants proposed for construction in the mid-1980s, both in this country and internationally. In short, we view the SRC plants both figuratively and literally as cornerstones of a commercial synthetic fuels industry.

The success of these plants is hinged on much more than the demonstration of new synthetic fuels processes, however. We must be equally confident that sufficient environmental safeguards are in place so that a national industry can grow with both public acceptance and public confidence.

Therefore, the SRC demonstration plants will also serve as "environmental demonstrations," built and operated under all federal, state, and local standards. They will demonstrate that synfuel plants can be built in concert with the environment, not in conflict with it.

Each SRC demonstration plant will process 6000 tons of high-sulfur coal per day, producing a varied slate of products. From the SRC-I plant, the primary product will be a solid, low-sulfur, nearly ashless fuel. Use of this solid product as a clean-burning utility fuel was demonstrated in 1977 with a successful combustion test at a Georgia Power Company power plant in Putney, Georgia. A second step can be integrated into the SRC-I process to produce a liquid product and we plan to demonstrate this technique also in the demonstration plant.

The primary products of the SRC-II plant will be fuel oil and naphtha, which can be refined into gasoline. Other products will include synthetic natural gas and liquid petroleum gas. Consolidated Edison conducted highly successful burn tests of the liquid fuel in one of their New York City power plants in 1978, and they are spearheading the effort to ensure widespread commercial introduction of this fuel.

We have been extremely encouraged by the utility interest growing out of this effort. To date, 16 companies have indicated their intentions to participate in a purchase program to acquire SRC fuel for conducting combustion tests. Another nine have expressed interest. This is the type of foresight we need for the rapid commercial acceptance of this technology.

The fuels produced by each SRC demonstration plant will total the equivalent of 20,000 barrels of oil per day. A full-scale plant would produce up to five times the output by adding additional process components. Each of our proposed demonstration plant sites is of sufficient size to permit expansion to a full-size, 100,000-barrel-per-day plant.

The common thread running through these large-scale liquefaction projects is that they convert coal directly into a liquid--thus the generic name of "direct liquefaction." Our research and development program has focused on this technique.

So-called "indirect" techniques--which first gasify the coal, then convert the gases to various liquid forms--are commercially ready today. All the coal liquefaction processes being funded under the feasibility study and cooperative agreement program I referenced earlier are indirect processes.

One of the pioneer commercial indirect liquefaction facilities could be the W. R. Grace plant, proposed for Baskett, Kentucky. This project is an outgrowth of our medium-Btu gasification demonstration program, but increased in scale and with the addition of first a methanol, then a gasoline synthesis step.

Last week we gave Grace the go-ahead to begin a 2-year design of the plant. Following this effort, the firm will be in a position to determine if they want to proceed with actual construction through either private financing or with assistance from the Synthetic Fuels Corporation.

This plant represents one of the most promising--and earliest--payoffs of the nation's technology program, one of the primary reasons why we decided to move forward with the project without further delay. It incorporates a Texaco gasifier on the front end and the Mobil methanol-to-gasoline process as the final step.

The plant would process 29,000 tons of coal per day, converting it into 50,000 barrels of high-octane gasoline. Its projected cost, in 1979 dollars, totals more than $3 billion, and if all goes as planned, its first synthetic product would be produced in 1986.

Yet, although indirect liquefaction techniques are no longer experimental, research and development can still play a major role. The major improvement area is the gasification step, and therefore indirect liquefaction has added a new dimension to our coal gasification development program.

It is important to realize that the costs of liquids produced from indirect processes are mostly dependent on the cost of the synthesis gas--up to 80 percent in some cases. Consequently, our research and development focus for indirect liquefaction is centered on minimizing the cost to gasify coal.

The motivation in our gasification program is to develop new generations of gasifiers--descendants, one might say, of the benchmark Lurgi and other first-generation, units. These new technologies will be tailored to a wide variety of coals, particularly the caking bituminous coals found in the East and Midwest which have proven troublesome for conventional gasifiers.

By developing techniques to use all varieties of coal, we can ensure that the synthetic fuels industry of the future can be matched to available resources and located in regions close to both supply and end use.

Our high-Btu program includes two demonstration projects--one proposed for Noble County, Ohio; the other proposed for Perry County, Illinois.

We are designing a medium-Btu fuel gas demonstration plant planned for construction outside Memphis, Tennessee, where it will manufacture fuel gas for nearby industries.

And two weeks ago, the Department announced it had awarded Combustion Engineering a contract to begin designing a low-Btu utility demonstration plant that would be located at the Gulf States power plant near West Lake, Louisiana.

The decision to move ahead with the Combustion Engineering process grew out of the successful test runs accomplished at a pilot plant at Windsor, Connecticut. More than 2000 hours of testing have been accumulated at this plant since 1978.

With particular respect to utility power generation, we have recently restructured our strategy for the commercial introduction of improved efficiency techniques, including the integrated combined-cycle gasification system. This technology offers the potential for substantially improved environmental performance at reduced economic costs.

Moreover, because of the greater efficiencies of these technologies in converting coal to electricity, environmental impacts would be reduced not only at the point of power production but also across the entire coal system, beginning at the mine. We have looked at this technology to determine if its development can be accelerated to the mid-to-late 1980s so that commercial systems can be constructed and on-line by the early 1990s.

These early versions, moreover, appear capable of providing exceptional performance since they offer the potential of reducing emissions, depending on the pollutant, much lower than conventional, currently available coal-burning technology.

To have this advanced technology demonstrated as early as, for example, 1986, some compromises in performance will be necessary. As a result, the costs of power from this system will be comparable rather than significantly less than conventional technology.

Our analyses to date, however, indicate that particularly in environmentally sensitive areas, the early versions of combined-cycle gasification will clearly be the economic systems of choice. We are also confident that having these systems in place will expedite the evolution to more advanced configurations capable of penetrating significant portions of the utility market.

We have been encouraged by the private sector interest emerging for this approach. We intend to ask for private sector participation for site specific feasibility studies for gasification-combined-cycle technical demonstration plants.

Coal, as you have heard in this presentation, comprises the bulk of our research effort--simply because of the enormity for the resource. However, we have a considerable effort underway in other synthetic fuel areas--namely oil shale and tar sands.

Shale oil is potentially the least expensive of all synthetic fuels and therefore closer to being economically competitive. It may thus be the first synthetic fuel technology that will permit us to judge the effectiveness of a multipronged program incorporating both incentives and research and development.

Next to coal, oil shale is the nation's largest fossil fuel resource. Deposits within a 16,000 square mile area of Colorado, Utah, and Wyoming could provide up to 700 billion barrels of oil--almost twice the proven reserves of the Middle East. Deposits in the East hold even greater quantities of energy, although the shale is of lower quality.

Also, as with coal, technologies exist today to extract synthetic hydrocarbons from shale. For the most part, these technologies involve extracting the shale--using either surface or underground mining methods--and then heating it above ground.

Several firms have initiated site preparation for commercial plants or modules; others have major design efforts underway.

In our R&D program, we are actively pursuing major efforts focused primarily on the in situ or in- place processing of shale. Our efforts include:

- The development of vertical, modified in situ technology where a portion of the shale is mined--perhaps 20 to 40 percent--before the remainder left underground is rubbled and then retorted
- The development of true in situ technologies which require no mining at all
- And the development of advanced technology such as radiofrequency retorting along with processes for the more abundant, but lower quality, eastern shales

Another unconventional source of fossil oil is tar sand. Commercial tar sand operations are being conducted in the rich deposits of Alberta, Canada. Unfortunately, the U.S. deposits--some 80 percent of which are located in Utah--pale in comparison with the Canadians'. Nevertheless, our deposits may contain up to 36 billion barrels of oil.

The Department will be announcing this week the preliminary results of our first field experiment to test the feasibility of extracting oil from U.S. tar sands by injecting steam. This experiment, which began last spring, was conducted on the Sohio property in the Northwest Asphalt Ridge tar sand deposit near Vernal, Utah.

A key accomplishment in this test is that we did succeed in getting steam to move through the reservoir, heating the reservoir to a maximum temperature of 465°F. During the course of the experiment, we produced almost 1000 barrels of synthetic oil from the tar sand.

In summary, the national synthetic fuels program today has a strong emphasis on replacing foreign oil with clean, economic substitutes, with technology being supported to derive petroleum and gas from coal, oil shale, and tar sands.

The thing to remember is that sensible measures always take time to produce good results. Our nation's imbalance between demand and supply has been a long time coming and it will be a long time before we bring it back into order. There is no quick fix, no technological breakthrough in sight. Each new understanding is based upon the last.

And it is important that the momentum continues. At present inflation rates, the cost of a synfuels plant costing $2 billion today increases almost $30,000 an hour.

But by beginning as we have now, we are moving closer each day to the time when synthetic fuels will compete in the marketplace with conventional hydrocarbons. Moreover, we are closer to the day when we can place a cap on the price of world oil.

That alone would make the synthetic fuels effort well worth the price.

Thank you.