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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

ENERGY AND MINERALS DIVISION

B-198431

July 22, 1980

The Honorable Charles W. Duncan, Jr.
The Secretary of Energy

AGC00912

Dear Mr. Secretary:

Subject: Concerns Over the Department of Energy's ~~(DOE's)~~ Program and Organization for Developing and Promoting the Use of Alcohol Fuels (EMD-80-88)

The General Accounting Office has recently completed a review of alcohol's potential for use as fuel for motor vehicles and the Federal efforts aimed at exploiting that potential. Our review resulted in a report to Senator Max Baucus entitled "Potential of Ethanol as a Motor Vehicle Fuel" (EMD-80-73, June 3, 1980), which he released on June 18, 1980, and which we recently sent to you under a separate cover letter. The report primarily discusses selected aspects of ethyl alcohol's (ethanol's) potential and the Federal and other efforts to assess that potential, but includes some of our observations relative to methyl alcohol's (methanol's) potential. Although the report contains no recommendations relative to ethanol's use as motor vehicle fuel, we do have a number of concerns which we believe warrant your immediate attention.

Our concerns are two-fold. First, DOE has yet to develop a comprehensive program for alcohol fuels which includes appropriate plans, goals, and strategies. Second, the effectiveness of DOE's recently created Office of Alcohol Fuels may be impaired due to limitations on its span of authority and responsibility and, relatedly, on the level to which the Office reports. While representing a significant step in the direction of achieving a comprehensive alcohol fuels program, we noted that the potential of methanol from coal is not being considered by this Office.

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In our opinion, these concerns are of sufficient magnitude to warrant your immediate attention. If left unresolved, they could lead to disparity in the Federal efforts to develop and exploit the use of these two alcohol fuels to their fullest potential.

The following sections provide a brief perspective on the potential of alcohol fuels which is needed for an understanding of the concerns raised during our review, as well as additional details on each specific area of concern. We are also providing a number of recommendations which you should implement to resolve these concerns.

BRIEF PERSPECTIVE ON ALCOHOL FUELS' POTENTIAL

The Nation's dependence on imported oil and the disastrous economic and political consequences that have become evident from that dependence, have made it crucial for the Nation to find alternatives to oil-based fuels. The U.S. dependence on foreign oil has increased from 35 percent at the time of the crippling 1973-74 Arab oil embargo to a level of nearly 50 percent in 1979. The Nation's cost for this imported oil has grown from $7 billion to about $60 billion during this same period.

The potential for using alcohols--principally ethanol and methanol--as substitutes for oil-based fuels has received widespread attention in recent years. Numerous studies, research and development projects, and testing programs touching on various aspects of alcohol fuels' potential have been conducted at all levels of Government, as well as by private organizations. Some of these efforts were identified in our report to Senator Baucus.

Although alcohols can be used as fuel in a number of applications, such as to fuel turbines for generating electricity, their use as a substitute for conventionally produced gasoline in the transportation sector can have the greatest impact on reducing the Nation's oil consumption. In this connection, nearly 40 percent of the oil consumed by the United States each year is used to produce gasoline. Based on current U.S. consumption levels, about 110 billion gallons of gasoline are needed each year to power the Nation's motor vehicle fleet. Both ethanol and methanol can, to varying degrees, be substituted for gasoline thereby reducing the Nation's dependence on this oil-based fuel.

Accordingly, we looked at the potential of both fuels from the perspectives of their potential production levels

and use in automobiles, the state-of-the-art of production technology, and potential cost competitiveness with gasoline. Overall, we found that alcohol fuels have vast potential to substitute for conventionally produced gasoline.

Production and use of alcohols for automobiles

Of the two alcohols, only ethanol is currently being produced and used as an automotive fuel in large quantities. By the end of 1979, ethanol was being used at an annual rate of nearly 80 million gallons in a blend commonly called "gasohol," consisting of 10 percent ethanol and 90 percent unleaded gasoline. At least 8 major oil companies, along with numerous independents, were marketing gasohol with generally positive results. As we pointed out in our recent report to Senator Baucus, it appears entirely feasible that, even considering constraints on the availability of feedstocks for producing ethanol, the Nation's entire vehicle fleet could be operating on gasohol by the year 2000.

Methanol's use as an automotive fuel has not been nearly as extensive. Most methanol produced today is made from natural gas and used in the chemical industry. Some oil companies have blended methanol with gasoline in proportions much less than 10 percent but its use in this capacity has been minimal. Methanol is also being used in small quantities as a feedstock for producing an automotive fuel additive known as methyl tertiary butyl ether.

Finally, the production of methanol as a feedstock for making synthetic gasoline via the so-called "Mobil process" has also been proposed and is receiving considerable attention. With this process, the production of significant quantities of gasoline could be started in the near-term and no problems, other than those that presently exist with conventionally produced gasoline, are expected to be encountered in its distribution and use. Methanol use, on the other hand, may require new distribution facilities and, because of unresolved issues related to methanol's toxicity, may necessitate development of new handling techniques to facilitate its safe use. While offering advantages over alcohol blends and straight alcohol use, converting methanol to gasoline and using it as fuel would be significantly less energy efficient than using methanol straight and would sacrifice methanol's low emissions characteristic. Thus, any decision-making process involving the commercialization of methanol will have to take into consideration the comparative advantages and disadvantages of methanol's use as a straight fuel

or in blends with gasoline, versus its conversion into gasoline.

Although much larger quantities of ethanol are being produced today for fuel, methanol's ultimate production potential as an automotive fuel far exceeds that of ethanol. In this connection, vast quantities of methanol can be produced from coal which is in bountiful supply. Some studies have shown that existing coal reserves in this country, which are economically recoverable using current mining techniques, are sufficient to provide a methanol production capacity equivalent to fueling the Nation's entire motor vehicle fleet for about 100 years. Moreover, as we pointed out in our report to Senator Baucus, DOE has estimated that nearly 42 billion gallons of ethanol could be produced annually by the year 2000 with the use of cellulose feedstocks, such as trees, agricultural residues, and municipal solid waste. These same feedstocks, however, can potentially be used to produce nearly 155 billion gallons of methanol. Unlike ethanol then, which will probably be limited to the role of a valuable gasoline extender, methanol could eventually be produced in sufficient quantity to totally replace gasoline.

State-of-the-art of production technology

Unlike many other synthetic fuels options commonly being discussed, the technology to produce both ethanol and methanol is here today. Ethanol is now being produced from agricultural feedstocks using conventional fermentation-distillation techniques. DOE estimates that sufficient agricultural feedstocks can be made available using these techniques to annually produce about 11.5 billion gallons of ethanol by the year 2000. To produce additional quantities of ethanol, cellulose feedstocks would have to be used. Although the ethanol from cellulose technology is close at hand, additional improvements will be needed to make such production commercially feasible.

Methanol from coal technology has also been available for years. Prior to the availability of relatively inexpensive natural gas (which has subsequently faced periodic domestic supply shortages) as a methanol feedstock, France produced methanol from coal in the late 1940s, and in the mid-1950s the DuPont Chemical Company operated a methanol from coal plant in the United States. Advances which maximize the amount of methanol producible from a given volume of coal continue to be made. Nonetheless, industry officials told us that a commercial-sized methanol plant could, with existing technology, be in operation within 5 years.

The technology for producing methanol from cellulose feedstocks is similar to that for producing methanol from coal. Methanol produced from these feedstocks has a distinct advantage over methanol from coal in that the feedstocks are renewable. Also, methanol produced from these feedstocks would not entail the same degree of known environmental consequences that are inherent in producing methanol from coal. Economics, however, is a problem which most likely will have to be overcome before methanol from cellulose can be competitive with gasoline. This is largely attributed to the nature of the feedstock itself which is widely dispersed resulting in high costs for feedstock collection and transportation. According to a DOE official, a number of production processes are currently in the early stages of development which, when taking into consideration the rising price of gasoline, could lead to the economic production of methanol from cellulose in the near-term.

Cost competitiveness

As we pointed out in our report to Senator Baucus, the impact on the fuel consumer resulting from a nationwide gasohol program, as represented by the price at the service station pump, could be slight. On the other hand, with available technology, methanol's potential production costs indicate that the price of methanol could be significantly lower than ethanol's and, in fact, may be very competitive with gasoline's.

Considerable uncertainty exists over the potential production costs of methanol from coal plants since no domestic plants are operating today. However, the studies we reviewed indicated that methanol could be produced from coal for less than 50 cents a gallon at today's prices. This is about one-half the cost of gasoline and less than one-half the projected cost of ethanol. At this cost, methanol's price would roughly equal gasoline's on a constant energy basis since methanol contains only about one-half as much energy as the same volume of gasoline. Moreover, automobile engines designed for burning straight methanol are expected to achieve about 20 percent better fuel economy than existing gasoline engines and produce lower emissions, thus further improving methanol's competitive position relative to gasoline.

LACK OF COMPREHENSIVE PROGRAM FOR ALCOHOL FUELS

As noted in our report to Senator Baucus, DOE's policy on alcohol fuels is to help such fuels achieve their potential

in the Nation's energy future. DOE, however, does not have a comprehensive program aimed at carrying out its policy. Operating within its broad policy, DOE is working towards achieving ethanol production goals of 500 million gallons annually by the end of 1981 and between 2 and 3 billion gallons annually by 1985. DOE has set no goals for the period beyond 1985, and no goals of any kind have been set for methanol production, even though methanol is recognized as having much more potential than ethanol for replacing gasoline and reducing the Nation's dependence on oil. Furthermore, DOE does not have a comprehensive program plan for ethanol and methanol with appropriate milestones and strategies, although efforts have been made to develop such a plan.

As discussed in our report to Senator Baucus, DOE established an alcohol fuels task force in December 1977. In its March 1978 report, the task force concluded that there was a need to take aggressive action to develop alcohol fuels, both ethanol and methanol, and recommended a program "* * *to provide the information considered essential for the introduction of alcohol fuels as one means for supplementing and eventually supplanting petroleum-derived fuels." The report was in the form of an alcohol fuels program plan and contained specific program goals and objectives and a proposed program structure to achieve those objectives. It also included generalized milestones for completion of the activities set forth. However, the findings and proposals were regarded by DOE as preliminary and the program plan was not implemented.

Subsequently, in July 1978, the Under Secretary of Energy established an Alcohol Fuels Policy Review to fully explore the potential of alcohol fuels as an alternative source of energy and to develop policy recommendations. The report of this review was issued in June 1979, and contains recommendations to stimulate the use of alcohol fuels from renewable resources. The report does not contain specific goals for alcohol fuels production nor recommendations for promoting the use of coal-derived methanol.

Both ethanol and methanol can have a significant role in resolving the Nation's liquid fuels shortage. To ensure that the potential role of each is effectively defined, and systematic efforts to reach such potential are undertaken, DOE needs a comprehensive alcohol fuels program. Such a program--addressing both ethanol and methanol in complementary fashion--should be developed around a program plan that sets forth appropriate goals, milestones, and strategies.

DOE has taken steps to improve its planning of alcohol fuels activities. Its recently created Office of Alcohol Fuels has been assigned responsibility for developing a program plan covering alcohols from biomass and directed at achieving production goals for ethanol. However, by not considering the potential of methanol from coal, this effort falls short of the comprehensive alcohol fuels program that is needed.

LIMITATION ON THE POTENTIAL EFFECTIVENESS OF THE OFFICE OF ALCOHOL FUELS

As we noted in our report to Senator Baucus, Federal alcohol fuels activities have been fragmented. Within DOE, seven different organizational components have assumed roles in assessing and developing alcohol fuels potential. In addition, numerous other Federal agencies, including the Departments of Agriculture and Commerce, the Environmental Protection Agency, and the Tennessee Valley Authority, have initiated independent but related efforts. Until recently, there has been no mechanism to effectively coordinate and systematically organize these multiple efforts toward a common goal.

DOE's creation of a new Office of Alcohol Fuels in February 1980 was a significant and laudable step toward pulling together these previously fragmented activities. Among its mandated tasks, the Office was assigned the responsibility of coordinating all DOE policies, positions, and public statements regarding biomass and alcohol fuels, as well as working with other Federal agencies on alcohol fuels matters. In addition, the Office was tasked with developing a program plan to guide DOE's spending in fiscal years 1980 and 1981 related to alcohol fuels.

While we commend DOE for creating its Office of Alcohol Fuels, we are concerned that a major limitation on the Office's scope of work will hamper its ability to assemble a balanced and comprehensive alcohol fuels program. Within DOE, the Office has been given management authority to effectively coordinate efforts related to the development of ethanol, but efforts concerning methanol remain fragmented, with three different organizations sharing responsibility. The Office has been given responsibility for methanol produced from biomass. Methanol produced from coal, however, has been excluded from the Office's purview. That work remains split between the Assistant Secretary for Fossil Energy (research and development) and the Assistant Secretary

for Resource Applications (market analysis and commercialization).

As indicated earlier, methanol produced from coal has vast potential. The availability of coal means it has potential for being produced in huge quantities and, using currently available technology, at a cost substantially below that of ethanol. By not considering the potential of methanol from coal in the Office of Alcohol Fuels, we are concerned that a comprehensive, balanced consideration of alcohol fuels, from the standpoints of both their development and commercialization, may not be achieved.

Within the realm of alcohol fuels, we believe methanol from coal activities would ideally be centralized within the Office of Alcohol Fuels. On the other hand, we recognize that a valid argument can be made for treating all coal-liquid technologies together so that their comparative potential can be measured and a comprehensive coal-use strategy developed. Still, we believe the development of a rational and comprehensive alcohol fuels program requires that consideration of methanol from coal be coordinated with alcohol fuels from other sources.

Accordingly, we believe that an acceptable alternative would be for DOE to establish an integrating mechanism that ensures methanol from coal be brought into the mainstream of alcohol fuels development and commercialization efforts so that a program of support for all alcohol fuels can be established based on their comparative potential. Such a mechanism could include creation of a standing coordinating committee, chaired by the Director of the Office of Alcohol Fuels, with members from organizational components having responsibility for those alcohol fuels activities that do not fall under the Office's purview.

Regardless of the mechanism used, however, for incorporating methanol from coal into the mainstream of alcohol fuels activities, the current requirement that the Office of Alcohol Fuels report to the Deputy Assistant Secretary for Solar Energy (within the Office of Assistant Secretary for Conservation and Solar Energy) would have to be reexamined. We believe the efforts to develop and commercialize alcohol fuels, through implementation of the type of comprehensive program needed, are sufficiently important to warrant that the Office be accorded a high level of visibility and management attention within the DOE organizational structure. This does not appear to exist under the current organizational alignment for the Office of Alcohol Fuels. Also, expansion of the Office's responsibilities to include methanol from coal

technology would seem to render inappropriate the current requirement that the Office report to the Deputy Assistant Secretary for Solar Energy. The technology for producing methanol from coal does not involve solar energy and hence we are concerned that its incorporation into an office reporting to the Assistant Secretary for Solar Energy may not provide the technology with the visibility, importance, and attention that it might otherwise deserve. Under these circumstances, therefore, it would be preferable to require the Office of Alcohol Fuels to report, instead, directly to the Secretary of Energy or to the Under Secretary.

CONCLUSIONS AND RECOMMENDATIONS

Solutions to the Nation's oil dependency problems are critically needed. The current level of imports is exacting a heavy penalty on the Nation's economy and can impact on its ability to conduct an objective foreign policy. In this context, the Nation can ill-afford further inaction and needs to begin making timely progress toward developing alternatives to the use of imported oil. Alcohol fuels offer a rare opportunity to provide the Nation with a partial solution that can be implemented with existing technology. Few other potential solutions can begin making so important a contribution without additional research and development.

Accordingly, we believe alcohol fuels merit the creation of a comprehensive program aimed at the rapid development and deployment of these fuels in the U.S. economy. In connection with creating such a program, we believe a comprehensive program plan with clear-cut goals and milestones is essential. Such a plan should provide definitive strategies to enable both ethanol and methanol to achieve their full potential and assume their appropriate roles in the Nation's fuel supply picture.

Further, we believe that DOE's activities related to ethanol and methanol should be balanced in consonance with their relative merit and potential. The presently existing fragmentation of these activities within DOE's organization, primarily with respect to methanol from coal, provides little assurance of achieving the desired balance. Consequently, a mechanism needs to be established to ensure that methanol from coal not be subjugated to a position of lesser urgency and importance vis-a-vis ethanol and methanol from biomass and thereby receive disparate treatment in commercialization activities.

// We therefore recommend that you:

--Establish a comprehensive and balanced program for alcohol fuels and develop a definitive program plan setting forth appropriate commercialization goals, milestones, and strategies for both ethanol and methanol.

--Ensure that from an organizational standpoint, methanol from coal is brought into the mainstream of those activities aimed at promoting the development and use of alcohol fuels. This can be accomplished by establishing an integrating mechanism, such as a standing committee chaired by the Director of the Office of Alcohol Fuels and assigned responsibility for coordinating those alcohol fuels activities that currently do not come within the purview of that Office. Regardless of the integrating mechanism used, we believe the Office should be required to report directly to you or to the Under Secretary.

IMPACT OF RECENT LEGISLATION

While our report was undergoing final processing, the Congress passed and the President signed into law the bill S. 932 known as the Energy Security Act (Public Law 96-294, June 30, 1980). This act contains a number of provisions which impact on this report and our recommendations. Most notable among these provisions are those contained in Title I, which establishes the U.S. Synthetic Fuels Corporation, and Title II which creates, and organizationally aligns within DOE, an Office of Alcohol Fuels.

The Corporation provided for under Title I is to be headed by a seven-member board of directors and is chartered for a 12-year life. The Corporation is authorized to issue financial assistance to synthetic fuels projects in a number of forms including loan guarantees, purchase agreements, and direct loans. In addition to providing such financial assistance, the Corporation is required to submit a comprehensive synthetic fuels development strategy within 4 years of the bill's enactment.

The synthetic fuels included among the Corporation's purview are coal, oil shale, and tar sands. As a coal-based synfuel, methanol from coal consequently falls within the Corporation's commercialization responsibilities.

The establishment of the Corporation therefore has a definite impact on our recommendations related to developing

a comprehensive alcohol fuels program and ensuring that methanol from coal be integrated into the mainstream of alcohol fuels activities. Although the exact effects on DOE's existing organizational structure and activities are not known at this time, it is clear that a new entity with responsibilities related to methanol from coal has been created. However, for a variety of reasons, including the present uncertainty over when the Corporation will become fully operational, a provision of the act which authorizes DOE to assist the Corporation in carrying out its assigned functions, and the specific exclusion of fuels from biomass from the Corporation's purview, we believe our recommendations continue to have merit and should be acted upon as soon as possible.

Concerning the Corporation's uncertain operational date, it will probably take a number of months before the Corporation's directors are nominated and confirmed, an office established, and an operating program of action developed and implemented. In the interim, DOE can serve a valuable function by integrating its methanol from coal development and related activities into its overall alcohol fuels activities. In this context, we believe the adoption of our recommendations could improve the effectiveness of these activities and, ultimately, the transition of certain of these activities to the Corporation.

Even when the Corporation is fully operational, DOE will retain considerable responsibility for alcohol fuels development under the act. In this connection Section 172 of the act authorizes the Secretary of Energy to provide technical assistance to the Corporation, and directs the Corporation and the Secretary to exchange technical information relating to synthetic fuels. DOE's input into the Corporation's assistance programs and the development of the Corporation's synthetic fuels development strategy could be especially vital avenues of assistance. We believe the adoption of our recommendations could help DOE provide the best assistance possible. In this connection, by beginning now in the development of a comprehensive alcohol fuels program and strategy DOE can readily provide the Corporation with the technical assistance it may need in preparing an important part of its legislatively mandated strategy.

Finally, the Corporation is specifically excluded from any role in developing and commercializing fuels made from biomass. Lead responsibility for biomass-based alcohol fuels is retained by DOE's Office of Alcohol Fuels, which under the act is not authorized any role concerning methanol from coal. Divided responsibility for alcohol fuels development

is therefore maintained. Consequently, our recommendations related to the development of a comprehensive and organizationally integrated alcohol fuels program continue to be equally, if not more, important with the introduction of the Corporation.

Our conclusions and recommendations related to the organizational alignment of DOE's Office of Alcohol Fuels are also affected. Section 220 of the act directs that the Office of Alcohol Fuels "shall be responsible directly to the Secretary of Energy." Thus, the Congress has taken what we believe to be a much needed action which on the surface appears to address our recommendation to this end.

There remains, however, some uncertainty over how this provision will be implemented. In this connection, DOE officials advised us that they are considering a number of options for implementing this provision. One option, for example, would have the Office of Alcohol Fuels report to the Secretary but continue to have its funding and administrative support provided through the Assistant Secretary for Conservation and Solar Energy. We are concerned that this option or possibly others under consideration could dilute the Office's authority and potentially hamper its effectiveness in developing and promoting the use of alcohol fuels. Consequently, we believe our recommendation in this area continues to have merit and we emphasize that in its implementation the Office's reporting relationship should be direct and not circumvented through an intermediary level within the DOE organization.

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As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report, and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We appreciate the courtesy and cooperation extended to our staff during the review and would appreciate being informed on the actions you take on our recommendations.

Sincerely yours,

J. Dexter Peach
Director