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Federal Methanol Fleet Status—January 1986

Federal Methanol Fleet
Project Staff

R. N. McGill

federal methanol fleet

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FEDERAL METHANOL FLEET STATUS — JANUARY 1986

Federal Methanol Fleet Project Staff

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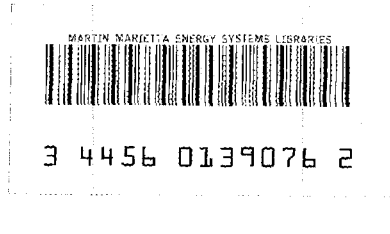

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SUMMARY

This report presents the status of the Federal Methanol Fleet Project as of January 1986. A methanol fleet was established on November 1, 1985, at Lawrence Berkeley Laboratory in Berkeley, California. Phase I activities of the Army Methanol-Fueled Administrative Vehicle Program, involving four security vehicles at the Presidio in San Francisco, have been completed; and Phase II, in which 24 vehicles will be used at Fort Ord, California, is well underway. House bill H.R. 3355 has been introduced to promote greater use of methanol as a transportation fuel. It has been proposed that methanol is the best solution to the U.S. oil import vulnerability.

FEDERAL METHANOL FLEET STATUS REPORT — JANUARY 1986

Federal Methanol Fleet Project Staff

R. N. McGill, Editor

1. LAWRENCE BERKELEY LABORATORY INITIATES OPERATION OF A METHANOL FLEET

Lawrence Berkeley Laboratory (LBL) officially initiated participation in the Federal Methanol Fleet Project on November 1, thus becoming the first civilian federal fleet to integrate methanol-fueled vehicles into its routine operations. "We are pleased to become the first federally funded organization to participate in the Methanol Demonstration Program for Federal Vehicles," says LBL Director, David Shirley. "The program has substantial support in Congress, which appropriated the funding, and in the Department of Energy, for which it represents the culmination of the methanol fuel research program that began in the 1970s."

The methanol vehicles in the Lawrence Berkeley fleet are five low-mileage 1984 model Chevrolet Citations with 2.8-liter V-6 engines. Conversion of these cars to operate on methanol was done by Bank of America in the same fashion that Bank of America has converted some 300 of its own vehicles. Paired with the methanol vehicles in LBL's operation are five more 1984 Citations with V-6 gasoline engines. LBL has placed all ten vehicles into its central motor pool service so that the cars will be used for a wide variety of driving missions by a large number of employees. Typical missions will include round trips to Lawrence Livermore Laboratory (about 100 miles total), trips to Stanford Linear Accelerator Center, and trips within the San Francisco-Berkeley area. The mixture of driving missions at LBL will be almost ideal for good comparative performance assessments between methanol and gasoline.

Personnel at LBL will be able to refuel the methanol vehicles conveniently at any of Bank of America's fueling stations in the San Francisco Bay area, or at LBL. For the latter case, through an agreement with Redwood Oil Company, a 2000-gallon tank, pump, and other

necessary equipment will be leased at nominal cost and installed near the motor pool facilities at LBL.

The establishment of this fleet at LBL is an outstanding example of mutually beneficial cooperation between government and commercial interests. Cooperation by Bank of America as well as Redwood Oil, representing suppliers of vehicles and fuel, has been exemplary. This, together with the enthusiasm at LBL for the project, gives great cause for optimism about the success of this particular fleet as well as the Federal Methanol Fleet Project in general. Project management extends heartfelt thanks to all who made this possible.

In future publications, we will report on developments of fleets planned at Argonne National Laboratory and Oak Ridge National Laboratory. Both laboratories are already committed to participation in the project. We still have room for more participants in Phase I.

2. MORE ON METHANOL PROPERTIES

In previous documentation, we said that "methanol has about 60% of the energy content of gasoline." This was not exactly correct; actually, fuel methanol has about 60% of the energy content of gasoline. Here's how this works: Remember that fuel methanol is a mixture of not less than 85% methanol with 15% unleaded regular gasoline. Pure methanol has only about half the energy content of a typical gasoline. The exact value of this ratio depends upon the definition of energy content being used (there are several) and what properties are assumed for a "typical" gasoline. If one uses exactly 50% as the ratio of the energy content of pure methanol to gasoline, then with fuel methanol (containing 15% of the same gasoline) this ratio is 57 1/2%, which was rounded to "about 60%".

Of course, in converting energy content to fuel consumption in miles per gallon, it is necessary to consider the fuel efficiency of the engine. Fortunately, with minor modifications, gasoline engines can be made to run well on fuel methanol. But, due to the high octane number of methanol, further engine modifications, such as raising the compression ratio, are possible so that from an energy efficiency standpoint a methanol engine can be made to be superior to its analogous gasoline engine. Currently no U.S. production engines are being designed specifically for operation on methanol.

With state-of-the-art engines, a conservative rule of thumb is that a methanol-fueled vehicle will go half the distance on a gallon of fuel as will a gasoline vehicle. This is one reason that some methanol vehicle conversions include installation of a larger fuel tank to give approximately the same driving range as an analogous gasoline vehicle.

3. UPDATE ON THE U.S. ARMY METHANOL DEMONSTRATION

Phase I activities of the Army's Methanol-Fueled Administrative Vehicle Program were completed during July 1985 at the Presidio in San Francisco. The four in-service vehicles had accumulated, in total, over 26,000 miles without experiencing any methanol-related problems. These vehicles were placed in 24-hour operation with the military police in an effort to accelerate mileage accumulation and expose the vehicles to a rigorous test environment. During this time, the vehicles performed very well. Performance (i.e., acceleration and drivability) was reported to be better than that for comparable gasoline vehicles. For these military police driving operations, fuel economy was at the bottom of the anticipated range due to the required long engine idle times.

The methanol fuel used during Phase I of this program was supplied by Bank of America. This fuel, which is identical to the fuel being used in Bank of America's methanol vehicle fleet, is reported to contain between 10 and 15 vol % unleaded gasoline, depending upon the season of year (i.e., summer versus winter). The needed gasoline component provides for improved cold starting and engine warm-up operations. In addition to the gasoline, Bank of America also utilized a special proprietary inhibitor, which is reported to reduce the potential for corrosion and upper end/cylinder wear. Refueling of the four vehicles during Phase I was accomplished by use of a portable fuel dispensing system that was temporarily loaned to the Presidio by Bank of America. Fuel samples were taken and analyzed to determine the quality and consistency of the delivered methanol fuel. A total of four samples were obtained during Phase I, and the variation in gasoline content for the four methanol fuel samples taken ranged from 11.3 to 15.6%.

The Phase I activities set forth a rigorous test of the converted vehicles. Considering the severity of the test activity, the less than "normal" fuel economy is not surprising. Other identified areas of concern will receive attention as Phase II progresses. Phase I operations, although officially completed, will continue during Phase II in order to accumulate additional test data under this severe military police service. Two additional Chevrolet Citations will be included as control

vehicles operating on gasoline to provide baseline data during this extended portion of Phase I.

During August, the Army held an internal review of the results from Phase I, at which time the decision was made to proceed on with Phase II. During this second phase, 24 Chevrolet S-10 pickup trucks will be operated by Army personnel at Fort Ord, California. Approximately 5000 miles of operation on gasoline will be accumulated per vehicle before vehicles are converted to methanol. Conversions of the vehicles to methanol operation will be performed by Army personnel, and Bank of America conversion technology will be used. Of the 24 S-10's at Fort Ord, three will not be converted but, instead, will remain gasoline-powered for comparison purposes.

Further updates of the Army's progress in its parallel methanol demonstration will appear in future publications.

4. CONGRESSIONAL ACTION — METHANOL STATEMENT BY CONGRESSMAN SHARP

The following statement was provided for publication by Congressman Philip R. Sharp (D-Indiana), Chairman of the Fossil and Synthetic Fuels Subcommittee of the House Energy and Commerce Committee. He is also a member of numerous other committees, study groups, and caucuses related to energy resources and transportation. Now serving in his sixth term, Congressman Sharp is a Democratic Whip At-Large for the 99th Congress. He has a reputation for exceptional skill at negotiations and an ability to put together constructive legislation.

> On September 18, 1985, Congressmen Broyhill (R-North Carolina), Dannemeyer (R-California), Markey (D-Massachusetts), Wyden (D-Oregon), and Wise (D-West Virginia) joined me in introducing H.R. 3355, a bill to promote greater use of methanol as a transportation fuel. H.R. 3355 builds on a demonstration fleet already under way in DOE and DOD. We sponsored this bill because the widespread substitution of methanol for gasoline and diesel fuel in our cars, trucks, and buses will achieve four important national goals: reduction of the trade deficit, improved energy security, better air quality, and more jobs.
>
> Balance of Trade — Our national bill for imported oil last year was almost $60 billion, over half of our trade deficit. Methanol has the potential to be made entirely from domestic resources. Conversion of 20% of U.S. cars to a domestically produced fuel would reduce oil imports by approximately 470 million barrels per year and might reduce the balance of payments deficit by well over $10 billion annually.
>
> Energy Security — By the end of the century OPEC may again be able to control the price of crude oil because demand will approach the world's production capacity and OPEC will become the world's marginal producers. OPEC will never be the marginal producer of methanol, however, and we should take steps now to substitute methanol for the 40% of our oil that is used for transportation. To the extent we can reduce our demand for petroleum-based transportation fuel we will reduce OPEC's ability to control the market and our vulnerability to OPEC actions.
>
> Clean Air — There are also major environmental benefits of methanol. Methanol buses may forever eliminate the stench and pollution currently associated with intracity buses. If widely adopted, methanol in cars also has the potential to be

the single largest contributor to reduction of smog in our cities.

Jobs — A 1984 report by the staff of the Fossil and Synthetic Fuels Subcommittee estimates that conversion of 20% of U.S. cars to methanol could create a market for an additional 300 million tons of coal per year if the methanol is produced from domestic coal. This increase in demand for coal would translate directly into 10,000 jobs in the coal mining industry and an undetermined number of other jobs in methanol production.

In short, methanol is a nearly perfect substitute for gasoline. What then prevents methanol from rapidly capturing the transportation fuel market? Two related factors: the lack of vehicles designed to run on methanol, and the lack of readily available retail sales outlets.

The problem is that methanol won't be distributed as a consumer fuel until there are sufficient vehicles able to run on this fuel. Conversely, the vehicle manufacturers will not manufacture methanol-compatible vehicles until the fuel is widely available. This circular problem is commonly called the chicken and egg dilemma.

H.R. 3355 is designed to stimulate a solution to this problem through a low-cost federal demonstration program. The bill proposes an action plan that requires:

- Five thousand methanol cars purchased annually by the government starting in fiscal year 1987;
- A long-haul, 18-wheel methanol truck demonstration;
- A methanol bus demonstration;
- That, if the methanol bus demonstration provides satisfactory results, all buses purchased in Clean Air Act nonattainment areas with federal assistance after 1991 must be methanol buses;
- Establishment of an interagency commission to coordinate all the methanol work under way within the government;
- That all vehicles purchased by the federal government be guaranteed by the manufacturer for use on all EPA-approved nonstandard fuels; and
- An incentive for auto manufacturers to produce methanol compatible vehicles by calculating miles per gallon for purposes of CAFE* standards on the basis of the petroleum content of the fuel. Vehicles capable of running on both

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*Corporate Average Fuel Economy standards, the regulations which govern the sales-weighted average fuel economy that must be attained annually by individual automobile manufacturers (Ed.).

methanol and gasoline will be counted for CAFE calculations as if the vehicles only ran on methanol.

Last year our methanol legislation had over 50 co-sponsors in the House. Both DOE and DOD are proceeding with a small methanol vehicle fleet. H.R. 3355 is the next logical step in the government's role to prove the potential and accelerate the adoption of methanol as an alternative to gasoline.

The Subcommittee on Fossil and Synthetic Fuels solicits comments on H.R. 3355 and expects to hold hearings before the end of the year.

The current surplus in crude oil supplies gives this nation the opportunity to develop its alternative fuels. Methanol is one of the best of these alternative fuels, and I believe this bill will help to advance its development.

5. METHANOL: THE BEST SOLUTION TO U.S. OIL IMPORT VULNERABILITY

by Bruce Netschert*
National Economic Research Associates

It is generally agreed that U.S. dependence on oil imports (currently about 30% of total available supply) will increase in coming years as domestic productive capacity declines. The Strategic Petroleum Reserve (SPR) can offset this threat to national security to some extent, but it is really intended to cope with short-term interruptions. For an extended interruption (an all too plausible possibility), something else is needed.

The true vulnerability lies in the transportation sector. It is possible to shift to other fuels in heating applications and to make do with lower levels of use. For transportation, in contrast, which accounts for the bulk of oil use, there is no current, large-scale substitute; yet, as the experience of the 1970s has shown, even a relatively small shortfall in supply can be extremely disruptive.

An alternative to gasoline does exist, however, that could eliminate the national security problem in oil. That fuel is methanol (formerly called wood alcohol to distinguish it from ethanol or grain alcohol), the closest thing to an ideal substitute for gasoline. With minor modifications, most gasoline engines can run satisfactorily on "fuel methanol," mixture of 85 to 90% methanol with gasoline and co-solvents. Indeed, 100% is the standard fuel for the Indianapolis 500 race.

There are, to be sure, some disadvantages. Engine modification is necessary because methanol attacks some metals and plastics in the fuel system at concentrations above 10% of the fuel. Engine starts are difficult in cold weather. Special engine oil is needed to avoid

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*Bruce Carlton Netschert is Vice President of National Economic Research Associates, Inc. He has worked as Senator Research Associate for Resources for the Future, Inc., and is a Fellow of the Geological Society of America and the Institute of Petroleum.

excessive wear. The energy content of methanol is only half that of gasoline, so a tankful gets less total mileage and the fuel cost per mile may not be lower than with gasoline.

Against these are the advantages. With the exception of formaldehyde (which is still a matter of dispute), methanol combustion produces fewer air pollutants than does gasoline combustion. In small concentrations (10% or less) methanol is a superior octane enhancer. By far the greatest advantage, however, is on the supply side. Methanol is currently produced for the chemical industry from natural gas, but it can be made from coal as well as from vegetable material. Given the enormous size of U.S. coal reserves, there is little resource constraint on the level of domestic production that could be sustained. It would be physically feasible to supply national needs for transportation fuel from domestic coal sources.

If the economics were equally favorable there would be a methanol-from-coal industry in existence today. With today's technology, unfortunately, methanol from coal costs substantially more than gasoline, although methanol from natural gas (depending on the specific circumstances) is in the competitive range.

If it is considered desirable as a matter of a national policy to make this country potentially immune to the interruption of overseas oil supplies, methanol is unquestionably the best means of achieving this goal. The great impediment is institutional: there is no distribution network capable of supplying methanol to the public; the existing automobile fleet cannot use fuel methanol without engine modification, nor do the manufacturers offer such cars as original equipment. It is a classic chicken-egg relationship, each depending on the other.

Existing cars can, however, use gasoline with methanol as the octane enhancer. Moreover, the current phase-out of lead in gasoline provides the perfect opportunity to begin the phase-in of methanol. Thus, the adaptation to methanol use can be begun at minimal cost and with minimal disruption. A further step would be to provide manufacturers with a stimulus to make the necessary design modifications by crediting cars able to use fuel methanol against the CAFE mileage

requirements. Over the next decade an even larger proportion of the existing car fleet would be capable of using fuel methanol.

If an interruption did not occur, with an existing methanol capability the government would be able to stretch the SPR to whatever degree was desired by mandating the appropriate methanol concentration in gasoline. At the same time, as the institutional barriers were being overcome, the existence of a potential market would justify the necessary R&D on methanol from coal to effect a reduction in its cost from that source. Indeed, given the inevitability of a very high dependence on foreign oil for transportation in the 21st century, it is not at all premature to begin now to create the ability to make the changeover.

Although the general public remains unaware of methanol's potential as a transportation fuel, awareness of that potential has been growing. Several states have encouraged methanol use as an octane enhancer with tax subsidies. California has gone well beyond this, with a program to use fuel methanol in test fleets of state vehicles as well as private fleets and to install methanol filling stations. Both public and privately owned test fleets have been operating in different parts of the country for several years. Again, this process has been carried furthest in California, where the Bank of America has converted nearly 300 fleet vehicles to fuel methanol on the basis of tests it found highly satisfactory and clearly cost effective.

It may be argued that if a large market for fuel methanol were to develop in the United States, the cheapest source of supply would be the huge gas resources of the Middle East currently languishing for lack of a market, the result being the substitution of OPEC gas for OPEC oil. This is certainly a possibility, but there are also large unutilized gas reserves in the Western Hemisphere, most notably at Prudhoe Bay in Alaska, which alone contains 26 trillion cubic feet. If a fuel methanol market could first be developed in California, the Prudhoe Bay gas would constitute an ideal source. Methanol produced in a plant at Prudhoe Bay could be transported south as well as crude oil in the Trans-Alaska Pipeline System.

The overall advantages of methanol over gasoline are great, first as a supplement, then as a substitute. With the physical feasibility of

such conversion so clearly evident, it is time to begin removing the institutional obstacles to the creation of a functioning fuel methanol market.

6. FURTHER INFORMATION ON THE FEDERAL METHANOL FLEET

The purpose of this publication is to provide current information about the Methanol Demonstration program for Federal Vehicles (Federal Methanol Fleet). Government agencies are encouraged to participate in the program by incorporating about five methanol-fueled vehicles and five analogous gasoline-powered vehicles with their motor pools. DOE will pay for the incremental cost of the methanol vehicles as well as some operating costs associated with vehicles and data collection. For more information about the project, please write or call:

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