Proposed

DUAL - FUEL CONVERSION PROJECT

Lowell Regional Transit Authority
10 Kearney Square
Lowell, Massachusetts

In Co-operation with
University of Lowell Research Foundation
450 Aiken Street
Lowell, Massachusetts

Joseph G. Potzka, Jr.
Deputy Administrator
Lowell Regional Transit
Authority
10 Kearney Square
Lowell, Massachusetts 01852
(617) 459-0164

The Lowell Regional Transit Authority (LRTA) currently operates 31 diesel buses, powered with General Motors Corporation Detroit Diesel Allision Division (DDA) 6-71 or 6-53 diesel engines. A program of experimentally converting one engine to dual methanol and diesel oil fueling is directly relevant toward two desirable objectives:

1. Reduced usage of imported diesel fuel, in direct ratio to the proportion of methanol substituted from domestic coal, natural gas, or biomass sources.

2. Reduction in particulate exhaust emissions in direct ratio to the percentage of methanol fuel substituted. Thus, increased schedule densities may be achieved without increase in present particulate emission levels, without adverse effects on clean air standards.

The advantages of dual-fueling with methanol extend far beyond the LRTA, or even the Commonwealth of Massachusetts, since 95% of the U.S. urban bus fleet is powered by the DDA-71 and 53 series engines.

Dual-fueling has already been demonstrated in Mercedes and Klockner-Humboldt-Deuz heavy diesels under funding from the German Federal Ministry for Research and Technology. Volvo Diesel buses are now operating experimentally in Stockholm, Sweden with a similar dual-fueling system developed by SVENSK Metanolutveckling AB, a not-for-profit corporation jointly owned by the Swedish Government and Volvo AB. What is proposed is an adaption of this proven technology to the predominant U.S. bus engine type.

Recently, DDA has been working in cooperation with faculty from the University of Lowell's Research Foundation and several staff members of its Energy Center on a program to evaluate the conversion of several of its standard Detroit Diesel Allison engines to a dual-fuel mode. To date, this joint effort has produced only limited economic and environmental assessments but show that such a scheme may offer substantial advantages. Indeed, the use of methanol/diesel fuel mixtures in converted engines could save more than 30% in operating and maintenance costs as well as reduce environmental pollutants. The Thermo Electron, Inc. (TEC) and DDA have agreed to join with the LRTA and the University of Lowell (UL) in developing a complete feasibility and cost analysis to determine whether federal support from

DOT/UMTA to purchase and recondition three (3) buses (10% of the fleet) for the operation in the dual-fuel or diesohol mode is appropriate. UMTA funds would be used to develop the actual conversion kits, and to fund a three (3) vehicle fleet test. *

The LRTA is viewed as a near-ideal microcosm for this program, for the following reasons:

1. The Authority has a single maintenance and fueling facility, thereby simplifying maintenance and logistic problems.

2. The route structure combines "downtown" start-and-stop service with relatively long-haul service to other towns served by the LRTA.

3. The technical problems associated with operation at high and low temperature, and severe day-to-day temperature and humidity variations will be encountered in this geographic area, thus providing an ideal field test environment.

4. An appropriate combination of academic and industrial resources, in reasonable proximity is necessary. The University of Lowell and Thermo Electron,Inc. of Waltham, Massachusetts already a successful contractor on a comparable magnitude diesel truck program with Mack Truck, Inc., and the Department of Energy, provide such resources.

Based on commitments of support from Commonwealth of Massachusetts sources (Executive Office of Transportation and Construction, University of Lowell) and private sources, (Thermo Electron, Inc.) for initial feasibility and technology investigation, we seek federal share funding through UMTA. Among the unique features of our contemplated test program are:

1. Dual fuel utilization for public transit

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* This approach parallels a current UMTA program, whereby United Technologies gas turbine engines, specifically developed because they can be fueled with methanol or ethanol have been installed in 5 Baltimore Transit Authority buses formerly powered with DDA-71 series Diesels.

2. Improved pollution controls
3. Cold and hot weather operational behavior
4. Cooperative effort with University and private sector.

The initial funds committed by the Commonwealth will not be used to support the detailed engineering designs and cost studies which are essential before the retrofitting of engines by TEC is begun. However, their early involvement is critical and they have offered assistance to the UL and our own team in the feasibility effort at no cost. In the final activity, however, we envision that DDA will provide consulting advice on the conversion, TEC will do the actual installations and environmental tests, while UL will have responsibility for overall system design and engine bench test. The dynamometer and environmental test facilities of the Transportation Systems Center of DOT at Cambridge, Massachusetts, approximately 40 miles from the LRTA and UL, with Thermo Electron's facility at Waltham, Massachusetts, approximately halfway between them. Commitment of such support from TSC (presuming internal DOT approval and funding) has been received. We in the LRTA will be primarily concerned with supervisory, fiscal and management responsibilities for the test and will of course operate the three (3) dual fuel buses as regular elements of our vehicular fleet, and maintain appropriate logs and technical data. A review board composed of principal investigators for each of the contractors (UL, DDA, TEC) will be consolidated under our general LRTA management group and be responsible for the total project's development.

Brief Summary of Team Members

University of Lowell -

The University is a major element of the Commonwealth's higher education system. Many of its faculty members in the Colleges of Engineering and Science as well as staff members of its Research Foundation are deeply involved in sponsored energy related research activities. The Energy Center operates as an arm of the Foundation and is headed by Dr. Leon E. Beghian, Professor of Physics and Associate Vice President for Academic Services at the University. He will serve on this proejct, along with Mr. Jerome Goldhammer, P.E., and Dr. Fred Manasse, Senior Research Associates of the Foundation, as co-principal investigators.

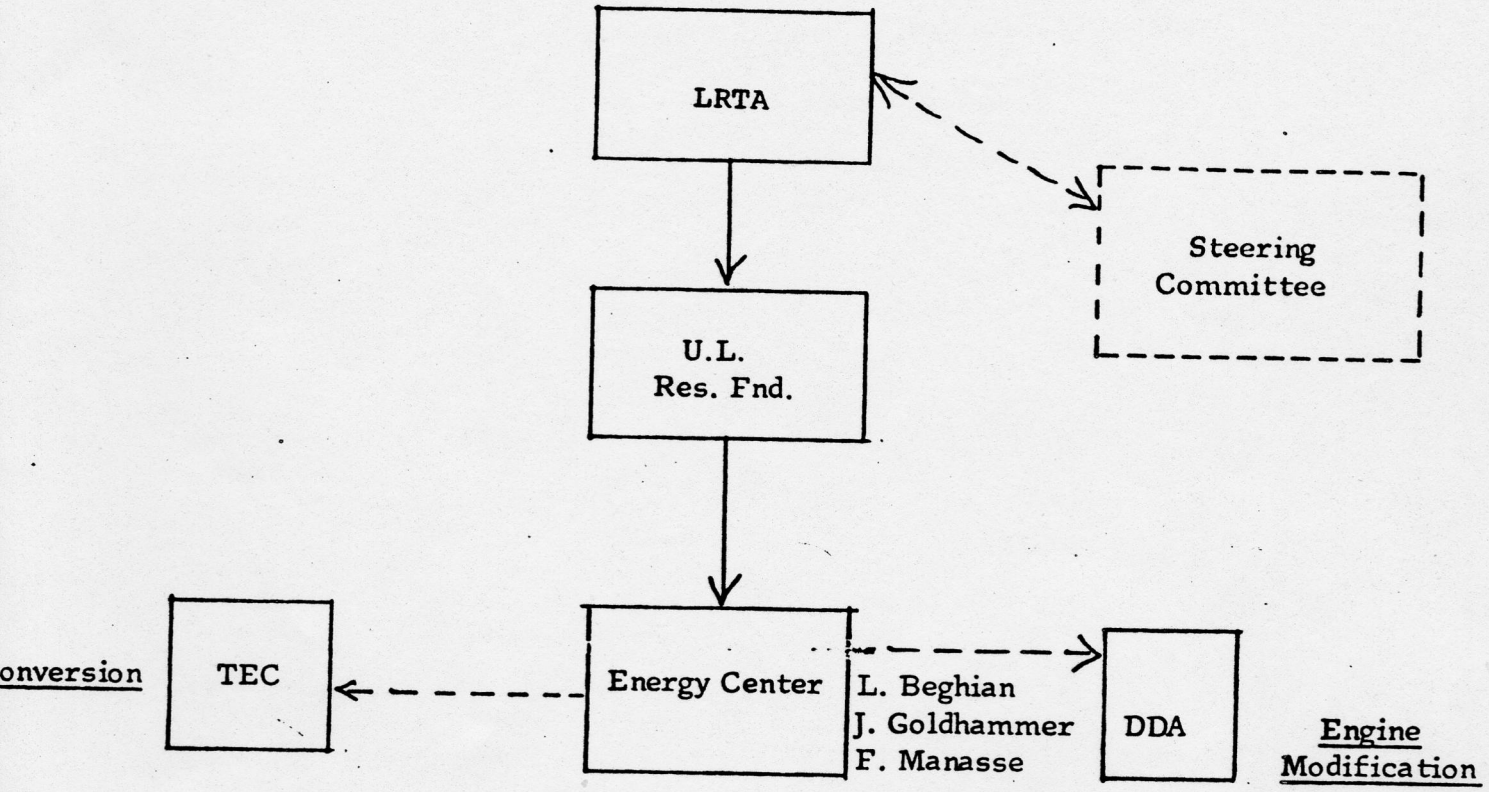
Dr. Beghian has long been involved and is nationally recognized as an expert in the use and production of alcohol fuels for transportation. Mr. Goldhammer brings more than 20 professional years of experience in gas turbine, spark ignition and diesel engine design, test and evaluation to this program as well as having extensive background in dual-fuel operation of such engines. His background includes engine modification design and operation of a 4-car Sports Car Club of American Racing Team. Three (3) vehicles were modified for "production" class road racing, using premium leaded fuels, and the fourth for "modified" class, using methanol blended fuels. Spare engines from the "production" class cars were used to race the "modified" chassis in different displacement classes. The basic engines were a 960 cc Austin-Healy, 1300 cc Alfa-Romeo, and 1990 cc Trimph engine. All could be switched from gasoline to methanol blended fuel operation in minutes.

Subsequently, Mr. Goldhammer served as a Senior Staff Member with the Institute for Defense Analyses, where his duties included evaluation of ongoing and proposed research and development programs on helicopter, tactical and logistic aircraft, and army ground vehicle and stationary power plant propulsion systems including spark ignition diesel and gas turbine engines. Since 1975, as an engineering consultant, he has been concerned with biomass methanol programs, and investigations of diesel and gas turbine compatability with alcohol fuels.

Dr. Fred Manasse has been involved in alternate energy research and its application to consumer uses for more than five (5) years. Previously, as an electrical engineering professor, researcher and administrator for more than sixteen (16) years, he has been involved in student advising for projects in hydrogen fueled autos as well as being an expert in electronics and control systems. Staff members in methanical engineering who are combustion experts and Energy Center staff experienced in environmental monitoring, electronics and computer analysis, along with graduate students, will also be involved in the final project.

Theremo Electron Inc.

The staff members of the Thermo Electron R & D Department along with the Engineering Department will be involved in the complete program. TEC has long been involved in waste energy recovery, development of improved efficiency burners and heat exchangers as well as design of highly efficient small engines. Their extensive experience working with Mack Trucks under DOE sponsorship to improve tractor/trailor engine performance for increased fuel economy by incorporating a Rankine Cycle exhaust drive turbine coupled into the drive system is especially relevant to the activity contemplated. Their test equipment and engine conversion staff and facilities will be an essential ingredient in our ability to perform the complete dual-fuel retrofit on the DDA supplied diesel engines.



ORGANIZATION OF FEASIBILITY STUDY

The Commonwealth of Massachusetts
Executive Office of Energy Resources
73 Tremont Street
Boston, Massachusetts 02108

EDWARD J. KING
Governor

JOSEPH S. FITZPATRICK
Secretary

(617) 727-4732

October 1, 1980

Mr. James O'Sullivan
Administrator
Lowell Regional Transit Authority
10 Kearney Square
Lowell, Massachusetts

Dear Mr. O'Sullivan:

RE: Proposed Use of Diesel and Methanol Fuel

The Massachusetts Executive Office of Energy Resources supports the innovative proposal to equip vehicles in your fleet with the capability of burning a mixture of methanol and diesel fuel.

This project would serve as a model for public transportation authorities throughout the country and could lead to a significant reduction in our dependence on expensive unreliable foreign sources of petroleum fuels.

Sincerely,

Joseph S. Fitzpatrick
Secretary

JSF:ps

JAMES M. SHANNON
5TH DISTRICT, MASSACHUSETTS

COMMITTEE:
WAYS AND MEANS

SUBCOMMITTEES:
HEALTH
TRADE

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LEXINGTON, MASS.
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October 8, 1980

Mr. James O'Sullivan
Greater Lowell Regional
Transportation Authority
10 Kearney Square
Lowell, Massachusetts 01852

Dear Jim,

As you are aware, my staff has been working with Jerry Goldhammer of the University of Lowell Research Foundation regarding duel fueling of diesel transit buses. Given the critical state of our energy resources, it is obvious that efforts at conservation such as this ought to be encouraged and supported.

It is with that thought in mind that I write to let you know my intention to do all in my power to support these efforts.

Any assistance you can provide will be greatly appreciated and you can be assured of my cooperation.

Sincerely yours,

James M. Shannon

JAMES M. SHANNON
Member of Congress

JMS:pjs

The Commonwealth of Massachusetts
Executive Office of Transportation & Construction
One Ashburton Place
Boston, Massachusetts 02108

BARRY M. LOCKE
SECRETARY

October 8, 1980

Mr. Charles Gallagher, Chairman
Lowell Regional Transit Authority
10 Kearny Square
Lowell, MA 01852

Dear Mr. Gallagher:

I strongly support the efforts of the Lowell Regional Transit Authority to obtain assistance to develop an innovative diesel/methanol fuel project. The scale and efficiency of the LRTA and the geography and climate of the Lowell area provide the ideal environment for a working energy demonstration program with national impact.

The Executive Office of Transportation and Construction will work with LRTA to provide all available state technical and financial assistance to the project. An energy project of this type would contribute significantly toward providing cost-effective and energy-efficient mass transit and toward stimulating a community making major strides toward economic revitalization.

Sincerely,

James F. O'Leary
Acting Secretary

JFO'L:HT:gmb

Thermo Electron
CORPORATION

R&D/New Business Division

101 First Avenue
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(617) 890-8700

Telex: 92-3323
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October 9, 1980

Mr. James O'Sullivan
Administrator
Lowell Regional Transit Authority
10 Kearney Square
Lowell, Massachusetts

RE: LRTA's Proposal to Develop and Operate Diesel Methanol Dual Fuel Buses

Dear Mr. O'Sullivan:

We have been having preliminary discussions with Dr. Leon Beghian and Mr. Jerry Goldhammer of the University of Lowell Research Foundation regarding dual fueling of diesel transit buses. We are highly enthusiastic about working with you on this program. It is our understanding that exact roles of various parties and resource allocations will be determined after further discussions.

We are fully supportive of your objectives and would like to assure you of our full cooperation.

Cordially,

Ravi K. Sakhuja

Ravi K. Sakhuja
Director
Thermal Systems Department

RKS/ch