

State of California  
AIR RESOURCES BOARD

Resolution 01-39

October 25, 2001

Agenda Item No.: 01-8-2

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a proposal, number 01-74, entitled "Development and Evaluation of a Tri-Fuel, Plug-in HEV with Vehicle-to-Grid Power Flow", has been submitted by AC Propulsion, Inc., in response to the 2001 Innovative Clean Air Technologies (ICAT) Program solicitation;

WHEREAS, the proposal has been independently reviewed for technical and business merit by highly qualified individuals; and

WHEREAS, the Research Division staff and the Executive Officer and Deputy Executive Officers have reviewed and recommend for funding:

Proposal Number 01-74, entitled "Development and Evaluation of a Tri-Fuel, Plug-in HEV with Vehicle-to-Grid Power Flow", submitted by AC Propulsion, Inc., for a total amount not to exceed \$230,071.

NOW, THEREFORE BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby approves the following:

Proposal Number 01-74, entitled "Development and Evaluation of a Tri-Fuel, Plug-in HEV with Vehicle-to-Grid Power Flow", submitted by AC Propulsion, Inc., for a total amount not to exceed \$230,071.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the efforts proposed herein, and as described in Attachment A, in an amount not to exceed \$230,071.

I hereby certify that the above is a true and correct copy of Resolution 01-39, as adopted by the Air Resources Board.

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Marie Kavan, Clerk of the Board

## ATTACHMENT A

### Innovative Clean Air Technologies (ICAT) Grant Proposal: **“Development and Evaluation of a Tri-Fuel, Plug-in HEV with Vehicle-to-Grid Power Flow”**

#### **Background**

The true cost of hybrid electric vehicles (HEVs) is currently greater than that of comparable conventional vehicles. But if the electrical generation capabilities of HEVs are harnessed and provided to the electric power grid, benefits would accrue to the electric power grid operators, vehicle owners, and system aggregators/service providers. The economic value thus created could help offset HEV ownership costs, thus maximizing their use. This project will address the technical aspects of this subject.

#### **Objective**

The primary project objective is to add value to the ownership of HEVs by using them to provide power to the electrical grid. This would ease an objection to their use and thus help reduce automotive air pollution. Intermediate goals include integration of all of the essential elements needed to demonstrate the operation of HEVs for providing net electric power to the electrical grid while parked and under the control of the grid operator. The vehicle’s engine would operate on gasoline when in use on the road and on low-pressure natural gas when parked and generating electricity for the grid.

#### **Methods**

The appropriate drive train equipment will be installed into an existing vehicle, which will be tested in actual use for its performance both as a vehicle and as an electrical power supplier while parked. Data will be collected regarding reliability, command response, and efficiency. The vehicle’s emissions will also be measured during the course of the project using a basic three-gas emission analyzer, with comprehensive dynamometer/constant volume sampling tests to be conducted at a later time.

#### **Expected Results**

It is anticipated that this project will demonstrate the technology, hardware and software for using HEVs for providing power to the electric grid and will evaluate the commercial feasibility of this approach.

#### **Significance to the Board**

The Air Resources Board’s zero emission vehicle program contains incentives for the development and sale of HEVs. The results of the proposed project will allow an HEV

to create value while the vehicle is stationary and plugged into the power grid. This added value will encourage and advance the purchase and use of HEVs, thus furthering the air quality improvement goals of the Board.

**Applicant:** AC Propulsion, Inc.

**Project Period:** 10 months

**Principal Investigator:** Thomas B. Gage

**ICAT Funding:** \$230,071

**Cofunding:** \$524,919

AC Propulsion:	\$ 79,895
SCAQMD:	\$180,026
Volkswagen:	\$225,000
NREL:	\$ 39,998

**Past Experience with This Principal Investigator:** This principal investigator conducted a 1996 South Coast Air Quality Management District project, to which ARB provided emission testing support. His interaction with ARB staff was satisfactory.

**Prior ICAT Funding to AC Propulsion, Inc.:**

Year	2000	1999	1998
Funding	\$ 0	\$ 0	\$ 0

Note: The Board approved research funding of \$164,676 in September 2001 for a separate contract with AC Propulsion, Inc., to develop a vehicle-to-grid technology for battery-electric vehicles.

## BUDGET SUMMARY

AC Propulsion, Inc.

### Development and Evaluation of a Tri-Fuel, Plug-in HEV with Vehicle-to-Grid Power Flow

<b><u>Direct Costs and Benefits</u></b>	<b><u>ICAT</u></b>	<b><u>Total</u></b>
1. Labor	\$ 85,050	\$196,938
2. Employee Fringe Benefits	\$ 22,146	\$ 51,282
3. Subcontractors	\$ 7,306	\$ 16,550
4. Equipment	\$ 26,227	\$283,035
5. Travel and Subsistence	\$ 393	\$ 755
6. Materials and Supplies	\$ 3,049	\$ 6,817
7. Other Direct Costs	\$ 0	\$ 705
Total	\$144,171	\$556,082
 <b><u>Indirect Costs</u></b>		
1. Overhead	\$ 85,900	\$ 198,908
2. Other Indirect Costs	\$ 0	\$ 0
Total	<u>\$ 85,900</u>	<u>\$ 198,908</u>
 <b>Total Project Costs</b>	 <b><u>\$ 230,071</u></b>	 <b><u>\$ 754,990</u></b>