

## SUMMARY OF BOARD ITEM

**ITEM NO. 00-5-5:** PUBLIC MEETING TO CONSIDER RECOMMENDATIONS FOR FUNDING PROPOSALS RECEIVED UNDER THE INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROGRAM

**STAFF RECOMMENDATION:** Five proposals will be recommended for funding.

**DISCUSSION:** The Board's Innovative Clean Air Technologies (ICAT) program was established in fiscal year 1994-95. Approximately one million dollars is available annually to foster the development of innovative pollution control and prevention technology. In response to our invitation, ARB staff received 82 project pre-proposals. ARB staff evaluated these pre-proposals and proponents of those that passed the initial evaluation were invited to submit complete proposals by February 2000. Twelve complete proposals were received and evaluated on their potential for reducing air pollution, rapid commercialization, and creating jobs in California.

Of the 12 proposals received, ARB staff recommends that five proposals be funded. These five were selected because they address important program needs at the ARB; are technically sound; and have the potential to improve air quality, be commercialized within a few years, and succeed in the marketplace.

The recommended projects are:

- Fast-Charged Electric Ground Support Equipment at Airports, proposed by Electric Transportation Engineering Corporation
- SCNOx<sup>®</sup> and SCOSOx<sup>™</sup> for Diesel Stationary Engines, proposed by Goal Line Environmental Technologies
- Oscillating Combustion on a High-Temperature Forging Furnace, proposed by the Institute of Gas Technology
- Low-Temperature Oxidation of NOx for Industrial Furnace, proposed by BOC Gases
- Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles," proposed by Hydrogen Burner Technology

**SUMMARY AND IMPACTS:**

The objective of the ICAT program is to co-fund the development and demonstration of technologies that will reduce air pollution. The goal of the program is to support technologies that have potential for commercialization and improving air quality in California, while simultaneously helping to stimulate the State's economy.

ICAT projects must increase the efficiency of existing air pollution prevention and control technologies, increase their cost-effectiveness, or offer new alternatives. All types of air pollution prevention and control technologies are eligible for funding.

Matching funds are required for all projects funded under the ICAT program. At least 50 percent of the project cost must be paid by matching funds; 20 percent must be committed by the applicant's firm. Also, all projects funded under the ICAT program must show high potential for job creation in California.

## CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER RECOMMENDATIONS FOR  
FUNDING PROPOSALS RECEIVED UNDER THE INNOVATIVE CLEAN AIR  
TECHNOLOGIES (ICAT) PROGRAM

The Air Resources Board (ARB or Board) will conduct a public meeting at the time and place noted below to consider recommendations for funding proposals received under the Innovative Clean Air Technologies (ICAT) program.

DATE: May 25, 2000

TIME: 9:30 a.m.

PLACE: Air Resources Board  
Board Hearing Room, Lower Level  
2020 L Street  
Sacramento, California 95814

This item will be considered at a meeting of the Board, which will commence at 9:30 a.m., May 25, 2000 and may continue at 8:30 a.m., May 26, 2000. This item may not be considered until May 26, 2000. Please consult the agenda for the meeting, which will be available at least 10 days before May 25, 2000, to determine the day on which this item will be considered.

This facility is accessible to persons with disabilities. If accommodation is needed, please contact ARB's Clerk of the Board at (916) 322-5594, or Telephone Device for the Deaf (TDD) at (916) 324-9531, or (800) 700-8326 for TDD calls from outside the Sacramento area, at least 14 days before the hearing.

The Board's ICAT program co-funds new technologies that have the potential for both improving air quality in California and helping to stimulate the State's economy. ARB staff recommends co-funding five proposals that were received in response to a public solicitation. The recommended projects are "Fast-Charged Electric Ground Support Equipment at Airports," proposed by Electric Transportation Engineering Corporation; "SCONOx<sup>®</sup> and SCOSOx<sup>™</sup> for Diesel Stationary Engines," proposed by Goal Line Environmental Technologies; "Oscillating Combustion on a High-Temperature Forging Furnace," proposed by the Institute of Gas Technology; "Low-Temperature Oxidation of NOx for Industrial Furnace," proposed by BOC Gases; and "Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles," proposed by Hydrogen Burner Technology. These were selected because they address important ARB program needs, are technically sound, have the potential to improve air quality, and have the potential to succeed in

the marketplace within a few years. The Board will consider proposed resolutions to co-fund these five proposals.

Staff will present oral statements at the meeting. The public may present comments relating to this matter orally or in writing at the meeting, and in writing or by e-mail before the meeting. To be considered by the ARB, written submissions must be addressed to and received by the Clerk of the Board, Air Resources Board, P.O. Box 2815, Sacramento, California 95812, or 2020 L Street, 4<sup>th</sup> Floor, Sacramento, California 95814, no later than 12:00 noon May 24, 2000, or received by the Clerk of the Board at the meeting. To be considered by the ARB, e-mail submissions must be addressed to [icat00@listserv.arb.ca.gov](mailto:icat00@listserv.arb.ca.gov) and received at the ARB no later than 12:00 noon May 24, 2000. The Board requests, but does not require, that thirty copies of any written statement be submitted and that all written statements be filed at least ten days prior to the meeting so that ARB staff and Board Members have time to fully consider each comment.

Inquiries regarding this matter should be directed to Mr. Bart E. Croes, P.E., Chief, Research Division, (916) 445-0753, P.O. Box 2815, Sacramento, California 95812.

CALIFORNIA AIR RESOURCES BOARD



*for*

Michael P. Kenny  
Executive Officer

Date: *May 19, 2000*

State of California  
AIR RESOURCES BOARD

innovative Clean Air Technology (ICAT)  
Resolutions

Research Division

May 25, 2000

## INTRODUCTION

Contained herein for Board review are summaries and accompanying resolutions to fund five projects for the Innovative Clean Air Technologies Program.

Item 1 is from Institute of Gas Technology, entitled, "Demonstration of Oscillating Combustion on a High-Temperature Forging Furnace."

Resolution No. 00-17

Item 2 is from BOC Gases in the City of Industry, entitled, "Demonstration of Low-Temperature Oxidation of NO<sub>x</sub> Using Ozone-Injection for Industrial Furnace Applications."

Resolution No. 00-18

Item 3 is from Hydrogen Burner Technology, entitled "Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles."

Resolution No. 00-19

Item 4 is from Electric Transportation Engineering Corporation, entitled, "Demonstration of the Use of Fast Charged Electric Ground Support Equipment as a Means of Reducing Airport Emissions while Minimizing Electrical Infrastructure Requirements."

Resolution No. 00-20

Item 5 is from Goal Line Environmental Technologies, entitled, "Demonstration of SCONOx<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn Diesel Stationary Engines."

Resolution No. 00-21

**PROPOSED**

**State of California  
AIR RESOURCES BOARD**

**INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROPOSAL**

Demonstration of Oscillating Combustion  
on a High-Temperature Forging Furnace

Resolution 00-17  
May 25, 2000

**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 99-07-06, entitled "Demonstration of Oscillating Combustion on a High-Temperature Forging Furnace," has been submitted by the Institute of Gas Technology in response to RFP No. 99-07;

**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 99-07-06, entitled "Demonstration of Oscillating Combustion on a High-Temperature Forging Furnace," submitted by the Institute of Gas Technology for a total amount not to exceed \$161,803.

**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 99-07-06, entitled "Demonstration of Oscillating Combustion on a High-Temperature Forging Furnace", submitted by the Institute of Gas Technology for a total amount not to exceed \$161,803.

**BE IT FURTHER RESOLVED**, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the research effort proposed herein in an amount not to exceed \$161,803.

## “Demonstration of Oscillating Combustion on a High-Temperature Forging Furnace”

### Background

The Institute of Gas Technology (IGT) has developed a system for reducing the formation of NO<sub>x</sub> in high-temperature industrial furnaces (e.g., glass furnaces, forges, metal-melters, cement kilns). Such furnaces generally do not have flue gas treatment for NO<sub>x</sub> and do not employ highly effective combustion modifications. The state inventory of NO<sub>x</sub> from industrial furnaces is 84 tons per day.

In IGT's system, the flow of natural gas to the burners is pulsed with a special valve, creating a sequence of rich and lean sub-zones in the combustion zone of the furnace. This rich-lean pattern reduces the formation of NO<sub>x</sub> in the flame. IGT proposes to install and demonstrate oscillating-flow valves on a forging furnace at Schultz Steel Company in South Gate, California.

### Objective

The objective is to demonstrate the utility of oscillating flow for NO<sub>x</sub> reduction on a high-temperature furnace.

### Expected Results

IGT expects to demonstrate a reduction of NO<sub>x</sub> emissions by 50 percent and an improvement of fuel economy by five percent.

### Significance to the Board

Voluntary retrofits of the technology could allow increased throughputs for furnaces under permit limits on the mass rate of NO<sub>x</sub> emissions or could result in decreases in NO<sub>x</sub> emissions that could be used to generate reduction credits under new source review rules. Air quality management districts could use the technology as a basis for NO<sub>x</sub> limits on furnaces. However, applicability of the technology to any particular furnace can be determined only through an assessment of potential chemical effects on the products in that furnace.

#### Proponent:

Institute of Gas Technology

#### Principal Investigator:

Harry Kurek

#### ICAT Funding:

\$161,803

#### Project Period:

Nine months

#### Cofunding:

IGT/SMP \$113,026

SoCal Gas 235,000

\$348,026

**Basis for Indirect Cost Rate:**

Rates are within the ICAT limits.

**Past Experience with this Principal Investigator:**

Although staff may not have any prior experience with the PI, the extent of review that each ICAT proposal is subjected to provides a sufficient level of confidence for staff to recommend the proposal for an ICAT award. The ICAT evaluation process includes reviews by five external technical and four external business advisors, as well as internal reviewers from Mobile Source Control and Operations Divisions, Stationary Source Division, Research Division, and the Executive Office.

**Prior ICAT Funding to Institute of Gas Technology:**

| Year    | 1999 | 1998 | 1997 |
|---------|------|------|------|
| Funding | \$0  | \$0  | \$0  |

## BUDGET SUMMARY

Institute of Gas Technology

Demonstration of Oscillating Combustion on a High-Temperature Forging Furnace

| <b><u>DIRECT COSTS AND BENEFITS</u></b> | <b><u>ICAT</u></b>          | <b><u>TOTAL</u></b>          |
|---|-----------------------------|------------------------------|
| 1. Labor and Employee Fringe Benefits   | \$ 52,953                   | \$133,311                    |
| 2. Subcontractors                       | \$ 0                        | \$ 0                         |
| 3. Equipment                            | \$ 0                        | \$ 50,000                    |
| 4. Travel and Subsistence               | \$ 41,354                   | \$ 54,554                    |
| 5. Electronic Data Processing           | \$ 0                        | \$ 0                         |
| 6. Reproduction/Publication             | \$ 0                        | \$ 0                         |
| 7. Mail and Phone                       | \$ 0                        | \$ 0                         |
| 8. Supplies                             | \$ 6,600                    | \$ 6,600                     |
| 9. Analyses                             | \$ 0                        | - \$ 0                       |
| 10. Miscellaneous                       | \$ <u>0</u>                 | \$ <u>0</u>                  |
| Total Direct Costs                      | \$100,907                   | \$244,465                    |
| <br><b><u>INDIRECT COSTS</u></b>        |                             |                              |
| 1. Overhead                             | \$ 52,953                   | \$172,827                    |
| 2. General and Administrative Expenses  | \$ 7,943                    | \$ 92,537                    |
| 3. Other Indirect Costs                 | \$ 0                        | \$ 0                         |
| 4. Fee or Profit                        | \$ <u>0</u>                 | \$ <u>0</u>                  |
| Total Indirect Costs                    | \$ <u>60,896</u>            | \$ <u>265,364</u>            |
| <br><b><u>TOTAL PROJECT COSTS</u></b>   | <br><b><u>\$161,803</u></b> | <br><b><u>\$509,829*</u></b> |

\*Schultz Steel will provide another \$100,000 of in-kind services.

**PROPOSED****State of California  
AIR RESOURCES BOARD****INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROPOSAL**

Demonstration of Low-Temperature Oxidation of NO<sub>x</sub>  
Using Ozone-Injection for Industrial Furnace Applications

Resolution 00-18  
May 25, 2000

**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 99-07-14, entitled "Demonstration of Low-Temperature Oxidation of NO<sub>x</sub> Using Ozone-Injection for Industrial Furnace Applications," has been submitted by BOC Gases in response to RFP No. 99-07;

**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 99-07-14, entitled "Demonstration of Low-Temperature Oxidation of NO<sub>x</sub> Using Ozone-Injection for Industrial Furnace Applications," submitted by BOC Gases, for a total amount not to exceed \$199,790.

**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, 99-07-14, entitled "Demonstration of Low-Temperature Oxidation of NO<sub>x</sub> Using Ozone-Injection for Industrial Furnace Applications," submitted by BOC Gases," for a total amount not to exceed \$199,790.

**BE IT FURTHER RESOLVED**, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the research effort proposed herein in an amount not to exceed \$199,790.

## **“Demonstration of Low-Temperature Oxidation of NO<sub>x</sub> Using Ozone-Injection for Industrial Furnace Applications”**

### **Background**

BOC Gases has developed a system for controlling NO<sub>x</sub> in the flue gases of high-temperature industrial furnaces (e.g., glass furnaces, forges, metal-melters, cement kilns). Such furnaces generally do not have flue gas treatment for NO<sub>x</sub> and do not employ highly effective combustion modifications. The State inventory of NO<sub>x</sub> from industrial furnaces is 84 tons/day.

In BOC's system, ozone is injected into the flue gas to oxidize NO to NO<sub>2</sub>. The NO<sub>2</sub> is then scrubbed from the flue gas with an alkaline solution. The system is commercial for boilers, for which it has been designated "LAER" (lowest achievable emissions rate) by the U.S. EPA, but it is not commercial for furnaces. BOC proposes to build and demonstrate the system on an aluminum-melting furnace at Custom Alloy Light Metals in the City of Industry, California.

### **Objective**

This project will demonstrate the feasibility of using the BOC system to significantly reduce NO<sub>x</sub> emissions from an aluminum-melting furnace.

### **Expected Results**

A successful demonstration project should validate BOC's NO<sub>x</sub> control technology for industrial furnaces in general. That would establish the first generally applicable and effective NO<sub>x</sub> control for furnaces. It could become best available control technology (BACT) standard for new furnaces. BOC expects to reduce NO<sub>x</sub> emissions from the melting furnace by 90 percent. In addition, the project will install heat recovery on the flue-gas and use the recovered heat to reduce the fuel used elsewhere in the plant by 25 percent, effecting a further NO<sub>x</sub> reduction from the rest of the plant.

### **Significance to the Board**

Voluntary retrofits of the technology could allow increased throughputs for furnaces under permit limits on the mass rate of NO<sub>x</sub> emissions. Voluntary decreases in NO<sub>x</sub> emissions could also be used to generate reduction credits under new source review rules. Air quality management districts could use the technology as a basis for establishing NO<sub>x</sub> limits well below current actual emission rates from furnaces.

**Proponent:**  
BOC Gases in the City of Industry

**Principal Investigator:**  
Paul Luberoff

**ICAT Funding:**  
\$199,790

**Project Period:**  
24 months

**Cofunding:**  
BOC Gases \$555,540

**Basis for Indirect Cost Rate:**  
Rates are within the ICAT limits.

**Past Experience with this Principal Investigator:**

Although staff may not have any prior experience with the PI, the extent of review that each ICAT proposal is subjected to provides a sufficient level of confidence for staff to recommend the proposal for an ICAT award. The ICAT evaluation process includes reviews by five external technical and four external business advisors, as well as internal reviewers from Mobile Source Control and Operations Divisions, Stationary Source Division, Research Division, and the Executive Office.

**Prior ICAT Funding to BOC Gases:**

| Year    | 1999 | 1998 | 1997 |
|---------|------|------|------|
| Funding | \$0  | \$0  | \$0  |

## BUDGET SUMMARY

BOC Gases

Demonstration of Low-Temperature Oxidation of NO<sub>x</sub>  
Using Ozone-Injection for Industrial Furnace Applications

| <u>DIRECT COSTS AND BENEFITS</u>       | <u>ICAT</u>          | <u>TOTAL</u>         |
|--|----------------------|----------------------|
| 1. Labor and Employee Fringe Benefits  | \$ 86,850            | \$173,640            |
| 2. Subcontractors                      | \$ 55,000            | \$125,000            |
| 3. Equipment                           | \$ 0                 | \$334,000            |
| 4. Travel and Subsistence              | \$ 0                 | \$ 7,000             |
| 5. Electronic Data Processing          | \$ 0                 | \$ 0                 |
| 6. Reproduction/Publication            | \$ 0                 | \$ 0                 |
| 7. Mail and Phone                      | \$ 0                 | \$ 0                 |
| 8. Supplies                            | \$ 0                 | \$ 0                 |
| 9. Analyses                            | \$ 0                 | \$ 0                 |
| 10. Miscellaneous                      | \$ 0                 | \$ 0                 |
| Total Direct Costs                     | \$141,850            | \$639,640            |
| <br><u>INDIRECT COSTS</u>              |                      |                      |
| 1. Overhead                            | \$ 47,100            | \$ 94,200            |
| 2. General and Administrative Expenses | \$ 10,840            | \$ 21,490            |
| 3. Other Indirect Costs                | \$ 0                 | \$ 0                 |
| 4. Fee or Profit                       | \$ 0                 | \$ 0                 |
| Total Indirect Costs                   | \$ 57,940            | \$115,690            |
| <br><u>TOTAL PROJECT COSTS</u>         | <br><u>\$199,790</u> | <br><u>\$755,330</u> |

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**PROPOSED****State of California  
AIR RESOURCES BOARD****INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROPOSAL****Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles**

Resolution 00-19  
May 25, 2000

**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 98-01-05, entitled "Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles," has been submitted by Hydrogen Burner Technology, in response to RFP No. 98-01;

**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 98-01-05, entitled "Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles," submitted by Hydrogen Burner Technology, for a total amount not to exceed \$300,000.

**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 98-01-05, entitled "Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles," submitted by Hydrogen Burner Technology, for a total amount not to exceed \$300,000.

**BE IT FURTHER RESOLVED**, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the research effort proposed herein in an amount not to exceed \$300,000.

## “Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles”

### Background

Hydrogen Burner Technology (HBT) proposes to construct a system to produce, compress, store, and dispense hydrogen for vehicle use. The hydrogen would be produced by partial oxidation of natural gas, followed by water-gas shift and pressure-swing adsorption of carbon monoxide (CO). The system would be located at Sunline Transit Agency in Thousand Palms, California.

### Objective

The project would demonstrate the feasibility of on-site production of vehicular hydrogen and allow the development of engineering and economic data for later optimization of the production/storage/dispensation system.

### Expected Results

The installation would provide the only commercial fueling site for hydrogen-powered vehicles in California. The combination of on-site production and the applicant's production technology should reduce the cost of providing vehicular hydrogen relative to other potential methods of supplying hydrogen.

### Significance to the Board

The ARB is a member of the California Fuel Cell Partnership. One of the Partnership's goals is to promote infrastructure for fueling fuel-cell-powered vehicles. Successful development and demonstration of this project will support this goal.

#### Proponent:

Hydrogen Burner Technology

#### Principal Investigator:

Steven Leweler

#### ICAT Funding:

\$300,000

#### Project Period:

12 months

#### Cofunding:

|         |                |
|---------|----------------|
| HBT     | \$171,000      |
| Sunline | 145,000        |
| SCAQMD  | <u>300,000</u> |
|         | \$616,000      |

#### Basis for Indirect Cost Rate:

Rates are within the ICAT limits.

#### Past Experience with this Principal Investigator:

Although staff may not have any prior experience with the PI, the extent of review that each ICAT proposal is subjected to provides a sufficient level of confidence for staff to recommend the proposal for an ICAT award. The ICAT evaluation process includes

reviews by five external technical and four external business advisors, as well as internal reviewers from Mobile Source Control and Operations Divisions, Stationary Source Division, Research Division, and the Executive Office.

**Prior ICAT Funding to Hydrogen Burner Technology (HBT):**

| Year    | 1999 | 1998 | 1997 |
|---------|------|------|------|
| Funding | \$0  | \$0  | \$0  |

## BUDGET SUMMARY

### Hydrogen Burner Technology

#### Hydrogen Fueling Station for Fuel-Cell-Powered Vehicles

| <u>DIRECT COSTS AND BENEFITS</u>       | <u>ICAT</u>           | <u>TOTAL</u>          |
|--|-----------------------|-----------------------|
| 1. Labor and Employee Fringe Benefits  | \$ 18,750             | \$ 71,000             |
| 2. Subcontractors                      | \$ 0                  | \$ 0                  |
| 3. Equipment                           | \$ 268,000            | \$ 801,000            |
| 4. Travel and Subsistence              | \$ 0                  | \$ 0                  |
| 5. Electronic Data Processing          | \$ 0                  | \$ 0                  |
| 6. Reproduction/Publication            | \$ 0                  | \$ 0                  |
| 7. Mail and Phone                      | \$ 0                  | \$ 0                  |
| 8. Supplies                            | \$ 7,750              | \$ 25,000             |
| 9. Analyses                            | \$ 0                  | \$ 0                  |
| 10. Miscellaneous                      | \$ <u>0</u>           | \$ <u>0</u>           |
| Total Direct Costs                     | \$ 294,500            | \$ 897,000            |
| <br><u>INDIRECT COSTS</u>              |                       |                       |
| 1. Overhead                            | \$ 5,500              | \$ 19,000             |
| 2. General and Administrative Expenses | \$ 0                  | \$ 0                  |
| 3. Other Indirect Costs                | \$ 0                  | \$ 0                  |
| 4. Fee or Profit                       | \$ <u>0</u>           | \$ <u>0</u>           |
| Total Indirect Costs                   | \$ <u>5,500</u>       | \$ <u>19,000</u>      |
| <br><u>TOTAL PROJECT COSTS</u>         | <br><u>\$ 300,000</u> | <br><u>\$ 916,000</u> |

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**PROPOSED****STATE OF CALIFORNIA  
AIR RESOURCES BOARD****INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROPOSAL**

Demonstration of the Use of Fast Charged Electric Ground Support Equipment as a Means of Reducing Airport Emissions while Minimizing Electrical Infrastructure Requirements

Resolution 00-20  
May 25, 2000

**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 research proposal, number 99-07-11 entitled "Demonstration of the Use of Fast Charged Electric Ground Support Equipment as a Means of Reducing Airport Emissions while Minimizing Electrical Infrastructure Requirements," has been submitted by Electric Transportation Engineering Corporation in response to RFP No. 99-07;

**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 99-07-11 entitled "Demonstration of the Use of Fast Charged Electric Ground Support Equipment as a Means of Reducing Airport Emissions while Minimizing Electrical Infrastructure Requirements," submitted by Electric Transportation Engineering Corporation, for a total amount not to exceed \$229,998.

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

Proposal Number 99-07-11 entitled "Demonstration of the Use of Fast Charged Electric Ground Support Equipment as a Means of Reducing Airport Emissions while Minimizing Electrical Infrastructure Requirements," submitted by Electric Transportation Engineering Corporation, for a total amount not to exceed \$229,998.

**BE IT FURTHER RESOLVED**, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the research effort proposed herein in an amount not to exceed \$229,998.

**“Demonstration of the Use of Fast Charged Electric Ground Support Equipment  
as a Means of Reducing Airport Emissions while Minimizing Electrical  
Infrastructure Requirements”**

**Background**

Infrastructure requirements for electric ground support equipment (GSE) at California airports typically exceed the available infrastructure, limiting growth in the use of this equipment. GSE consists of baggage tractors, cargo tow tractors, aircraft tractors, ground power units, and belt loaders. In a two-year test program, Electric Transportation Engineering Corporation (ETEC) has operated a fleet of electric GSE on fast charging for Southwest Airlines (SWA) at Phoenix Sky Harbor Airport. Their system has proven operationally effective in that environment, charging up to thirty pieces of GSE in a commercial operation on a continuous basis.

**Objective**

This project will demonstrate the feasibility of using fast charge electric GSE at Sacramento International Airport while minimizing the electrical infrastructure required to support the new electric equipment.

**Expected Results**

This project will result in the installation of ETEC's fast charging system for use by SWA at Sacramento International Airport. This system is specifically adapted for use with airport GSE and will replace 12 diesel baggage tractors with comparable electric-fueled equipment. It will reduce peak electrical demand and lower infrastructure cost. Installation of this system is expected to be the first phase of a plan to electrify all GSE at that airport.

**Significance to the Board**

The accelerated replacement of internal combustion GSE with zero-emission electric GSE will reduce airport emissions. Airport GSE emit 4 tons/day NO<sub>x</sub> statewide, representing seventy percent of airport emissions. A successful demonstration could accelerate the conversion of GSE from diesel to electric at other airports.

ARB is negotiating a Memorandum of Understanding with the U.S. EPA, the Air Transportation Association (the airline industry's association), and major California airports to reduce emissions from GSE. A successful demonstration would support this effort. Electric GSE seems to be recognized by the airline industry as the equipment of choice to meet increasingly stringent emission requirements. This project will provide tangible reasons for airline companies to accept the use of fast charged electric GSE. The availability of an acceptable fast charge system would also eliminate the time and expense of massive electrical infrastructure upgrades to support conventional electric GSE charging.

**Proponent:**  
Electric Transportation Engineering  
Corporation

**Principal Investigator:**  
Donald Karner

**ICAT Funding:**  
\$229,998

**Project Duration:**  
18 months

**Cofunding:**

|   |                |
|---|----------------|
| Sacramento Municipal Utility District (DARPA funds) | \$446,839      |
| Sacramento County Department of Airports            | 29,200         |
| Southwest Airlines                                  | 233,100        |
| ETEC  | <u>106,100</u> |
|   | \$815,239      |

**Basis of Indirect Cost Rate:**  
Rates are within the ICAT limits

**Past Experience with this Principal Investigator:**

Although staff may not have any prior experience with the PI, the extent of review that each ICAT proposal is subjected to provides a sufficient level of confidence for staff to recommend the proposal for an ICAT award. The ICAT evaluation process includes reviews by five external technical and four external business advisors, as well as internal reviewers from Mobile Source Control and Operations Divisions, Stationary Source Division, Research Division, and the Executive Office.

**Prior ICAT Funding to Electric Transportation Engineering Corporation:**

| Year    | 1999 - | 1998 | 1997 |
|---------|--------|------|------|
| Funding | \$0    | \$0  | \$0  |

## B U D G E T   S U M M A R Y

Electric Transportation Engineering Corporation

Demonstration of the use of Fast Charged Electric Ground Support Equipment as a  
Means of Reducing Airport Emissions while Minimizing Electrical Infrastructure  
Requirements

| <u>DIRECT COSTS AND BENEFITS</u>       | <u>ICAT</u>          | <u>TOTAL</u>           |
|--|----------------------|------------------------|
| 1. Labor and Employee Fringe Benefits  | \$177,951            | \$ 238,303             |
| 2. Subcontractors                      | \$ 10,000            | \$ 34,400              |
| 3. Equipment                           | \$ 0                 | \$ 628,400             |
| 4. Travel and Subsistence              | \$ 0                 | \$ 34,000              |
| 5. Electronic Data Processing          | \$ 0                 | \$ 0                   |
| 6. Reproduction/Publication            | \$ 0                 | \$ 0                   |
| 7. Mail and Phone                      | \$ 0                 | \$ 0                   |
| 8. Supplies                            | \$ 0                 | \$ 1,000               |
| 9. Analyses                            | \$ 0                 | \$ 0                   |
| 10. Miscellaneous                      | \$ 0                 | \$ 29,700              |
| Total Direct Costs                     | \$187,951            | \$ 965,803             |
| <br><u>INDIRECT COSTS</u>              |                      |                        |
| 1. Overhead                            | \$ 25,228            | \$ 47,660              |
| 2. General and Administrative Expenses | \$ 16,819            | \$ 31,774              |
| 3. Other Indirect Costs                | \$ 0                 | \$ 0                   |
| 4. Fee or Profit                       | \$ 0                 | \$ 0                   |
| Total Indirect Costs                   | \$ 42,047            | \$ 79,434              |
| <br><u>TOTAL PROJECT COSTS</u>         | <br><u>\$229,998</u> | <br><u>\$1,045,237</u> |

SMUD would bring \$446,839 in DARPA funds to the project. Southwest Airlines would contribute \$233,100 to purchase new equipment, as well as \$379,500 of in-kind support.

**PROPOSED****State of California  
AIR RESOURCES BOARD****INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROPOSAL**

Demonstration of SCONOX<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn Diesel Stationary Engines

Resolution 00-21  
May 25, 2000

**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 99-07-10, entitled "Demonstration of SCONOX<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn Diesel Stationary Engines," has been submitted by Goal Line Environmental Technologies, in response to RFP No. 99-07; and

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

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

Proposal Number 99-07-10 entitled "Demonstration of SCONOX<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn Diesel Stationary Engines," submitted by Goal Line Environmental Technologies, for a total amount not to exceed \$248,226.

**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 99-07-10 entitled "Demonstration of SCONOX<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn Diesel Stationary Engines," submitted by Goal Line Environmental Technologies, for a total amount not to exceed \$248,226.

**BE IT FURTHER RESOLVED**, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the research effort proposed herein in an amount not to exceed \$248,226.

## **“Demonstration of SCONOx<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn Diesel Stationary Engines”**

### **Background**

Stationary diesel engines are a reliable and widely used source of power for industry and agricultural water supply pumping across California. However, these engines are also a major source of oxides of nitrogen (NO<sub>x</sub>) air pollution since they generally have no emission controls. Since stationary diesel engines are one of the last remaining sources of uncontrolled emissions, operators, such as the military and agricultural industry, are facing strong pressure to dramatically reduce diesel emissions from these sources. They need a low-cost emission control solution that avoids costly engine fuel conversions, engine replacement, or aftertreatment controls that may have significant drawbacks.

The SCONOx<sup>®</sup> system has been developed and commercialized for use in reducing emissions of NO<sub>x</sub>, carbon monoxide (CO), and hydrocarbons from stationary natural gas-fired turbine and reciprocating engine installations. However, the catalyst used is subject to poisoning by the sulfur present in diesel fuel. The SCOSOx<sup>™</sup> portion of the system has been designed to remove the sulfur compounds from diesel exhaust upstream of the SCONOx<sup>®</sup> portion of the system, thus protecting the catalyst from sulfur poisoning. Unlike the current leading NO<sub>x</sub> aftertreatment control, selective catalytic reduction, the SCONOx<sup>®</sup>/SCOSOx<sup>™</sup> system does not require the use of ammonia or other toxic expendable, a definite advantage.

### **Objective**

The objective of this project is to further develop the combined SCONOx<sup>®</sup>/SCOSOx<sup>™</sup> system and demonstrate its viability for NO<sub>x</sub> control in stationary diesel engines.

### **Expected Results**

Goal Line will design and manufacture a prototype unit of the SCONOx<sup>®</sup>/SCOSOx<sup>™</sup> system. This unit will be installed and tested in a stationary diesel engine to prove the effectiveness and economic feasibility of the SCONOx<sup>®</sup>/SCOSOx<sup>™</sup> system for reducing emissions from the exhaust streams in this type of application. Goal Line expects results from this project to be comparable to the results of the SCONOx<sup>®</sup> system as used on gas turbines, with NO<sub>x</sub> reduction greater than 90 percent and CO reduction of greater than 95 percent. Hydrocarbon reduction is expected to be 80 percent or greater for non-methane hydrocarbons.

### **Significance to the Board**

The successful demonstration of this product would lead to commercialization of the SCONOx<sup>®</sup>/SCOSOx<sup>™</sup> system as a viable alternative to expensive alternative fuel conversions, engine replacements, or other aftertreatment systems, for the control of NO<sub>x</sub> and other emissions from stationary diesel engines.

**Proponent:**  
Goal Line Environmental Technologies

**Principal Investigator:**  
James Parks II, Ph.D

**ICAT Funding:**  
\$248,226

**Project Period:**  
12 months

**Cofunding:**  
\$254,742 by Goal Line

**Basis for Indirect Cost Rate:**  
Rates are within the ICAT limits.

**Past Experience with this Principal Investigator:**

Although staff may not have any prior experience with the PI, the extent of review that each ICAT proposal is subjected to provides a sufficient level of confidence for staff to recommend the proposal for an ICAT award. The ICAT evaluation process includes reviews by five external technical and four external business advisors, as well as internal reviewers from Mobile Source Control and Operations Divisions, Stationary Source Division, Research Division, and the Executive Office.

**Prior ICAT Funding to Goal Line Environmental Technologies:**

| Year    | 1999 | 1998 | 1997 |
|---------|------|------|------|
| Funding | \$0  | \$0  | \$0  |

## BUDGET SUMMARY

Goal Line Environmental Technologies

Demonstration of SCONOx<sup>®</sup> and SCOSOx<sup>™</sup> to Remove Pollutants from Lean Burn  
Diesel Stationary Engines

| <u>DIRECT COSTS AND BENEFITS</u>       | <u>ICAT</u>           | <u>TOTAL</u>          |
|--|-----------------------|-----------------------|
| 1. Labor and Employee Fringe Benefits  | \$ 188,500            | \$ 314,242            |
| 2. Subcontractors                      | \$ 0                  | \$ 0                  |
| 3. Equipment                           | \$ 0                  | \$ 48,000             |
| 4. Travel and Subsistence              | \$ 3,600              | \$ 3,600              |
| 5. Electronic Data Processing          | \$ 0                  | \$ 0                  |
| 6. Reproduction/Publication            | \$ 0                  | \$ 0                  |
| 7. Mail and Phone                      | \$ 0                  | \$ 0                  |
| 8. Supplies                            | \$ 0                  | \$ 45,000             |
| 9. Analyses                            | - \$ 5,000            | - \$ 5,000            |
| 10. Miscellaneous                      | \$ <u>4,000</u>       | \$ <u>40,000</u>      |
| <br>Total Direct Costs                 | <br>\$ 201,100        | <br>\$ 455,842        |
| <br><u>INDIRECT COSTS</u>              |                       |                       |
| 1. Overhead                            | \$ 23,563             | \$ 23,563             |
| 2. General and Administrative Expenses | \$ 23,563             | \$ 23,563             |
| 3. Other Indirect Costs                | \$ 0                  | \$ 0                  |
| 4. Fee or Profit                       | \$ <u>0</u>           | \$ <u>0</u>           |
| <br>Total Indirect Costs               | <br>\$ <u>47,126</u>  | <br>\$ <u>47,126</u>  |
| <br><u>TOTAL PROJECT COSTS</u>         | <br>\$ <u>248,226</u> | <br>\$ <u>502,968</u> |

