

**SUMMARY OF BOARD ITEM**

**ITEM # 02-6-5:** Public Meeting to Consider the Approval of New Grants under the Innovative Clean Air Technologies (ICAT) Program.

**STAFF RECOMMENDATION:** Approve grants totaling \$431,850 for three projects.

**DISCUSSION:** The Innovative Clean Air Technologies (ICAT) program was established in fiscal year 1994-95. Any new technology or application that is technically challenging, useful to Air Resources Board (ARB) programs and goals, and economically beneficial to California can be considered for a grant. Matching funds for at least 50 percent of a project's cost are required for all projects supported by ICAT. Ten percent of the funding, in cash, must be committed by the grantee.

In response to the 2002 solicitation of applications, the ARB staff received 30 project proposals, of which 19 were deemed complete and eligible for ICAT grants. The 19 proposals were reviewed for the quality of their innovative technologies, their potential for reducing air pollution and for commercial application in California, their potential economic benefits for California, the quality of the proposed demonstration projects, and their utility to ARB's programs.

The ARB staff is recommending grants for three of the proposed projects which are as follows:

GE Energy & Environmental Research Corp.:  
"Integrated Autothermal Cyclic Reformer and PEM Fuel Cell" -- \$200,000 (\$100,000 provided by SCAQMD)

S. T. Johnson Co.: "Demonstration of the Ultralow NOx Burner in a Firetube Burner" (renewal of an existing ICAT project) -- \$132,526

Southwest Texas State University: "High Performance Low VOC Waterborne Coatings" -- \$99,324 (\$20,000 provided by South Coast Air Quality Management District (AQMD))

**SUMMARY AND IMPACTS:**

Two new projects are being recommended for a total of \$299,324 in ICAT grants, of which the South Coast AQMD will provide \$120,000. In addition, staff recommends supporting an existing project by renewing \$132,526 in unspent ICAT funds. The technologies to be demonstrated have the potential to support ARB programs and initiatives, as well as facilitate emission reductions in California.

State of California  
AIR RESOURCES BOARD

**NOTICE OF PUBLIC MEETING TO CONSIDER THE APPROVAL OF GRANTS  
UNDER THE INNOVATIVE CLEAN AIR TECHNOLOGIES (ICAT) PROGRAM**

DATE: July 25, 2002

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency  
Central Valley Auditorium, Second Floor  
1001 I Street  
Sacramento, CA 95814

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., July 25, 2002, and may continue at 8:30 a.m., July 26, 2002. This item may not be considered until July 26, 2002. Please consult the agenda for the meeting, which will be available at least 10 days before July 25, 2002, 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 the Clerk of the Board at (916) 322-5594, or Telephone Device for the Deaf (TDD) (916) 324-9531 or (800) 700-8326 for TDD calls from outside the Sacramento area, by July 11, 2002, to ensure accommodation.

The Board's ICAT program co-funds demonstrations of new technologies that can improve air quality in California and support Air Resources Board (ARB) programs while helping to stimulate the state's economy. The ARB staff will recommend that the Board approve co-funding for three projects that were received in response to a public solicitation. These projects were selected because they address important ARB program needs, are technically sound, can reduce emissions, and can succeed commercially within a few years. The Board will consider proposed resolutions to approve co-funding for these three projects.

This notice and additional information related to the ICAT program can be found at ARB's internet site <http://www.arb.ca.gov/research/icat/icat.htm>. If you are a person with a disability and desire to obtain this document in an alternative format, please contact the Americans with Disabilities Act (ADA) Coordinator at (916) 323-4916, or TDD (916) 324-9531 or (800) 700-8326 for TDD calls from outside the Sacramento area.

The ARB staff will present oral statements at the meeting. Interested members of the public may present comments orally or in writing at the meeting and in writing or by

email before the meeting. To be considered by the Board, written submissions not physically submitted at the meeting must be received no later than **12:00 noon, July 24, 2002**, and addressed to the following:

Postal mail is to be sent to:

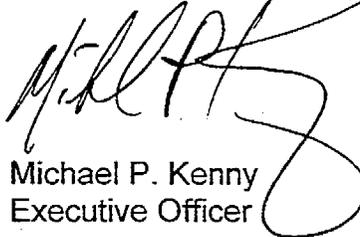
Clerk of the Board  
Air Resources Board  
1001 "I" Street, 23<sup>rd</sup> Floor  
Sacramento, California 95814

Electronic mail is to be sent to [icatpro@listserv.arb.ca.gov](mailto:icatpro@listserv.arb.ca.gov) and received at the ARB no later than **12:00 noon, July 24, 2002**.

Facsimile submissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at the ARB no later than **12:00 noon, July 24, 2002**.

The Board requests, but does not require, 30 copies of any written submission. Also, the ARB requests that written and email 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. Further inquiries regarding this matter should be directed to Mr. Bart E. Croes, P.E., Chief, Research Division, P.O. Box 2815, Sacramento, California 95812, (916) 445-0753.

CALIFORNIA AIR RESOURCES BOARD



Michael P. Kenny  
Executive Officer

Date: July 1, 2002

*The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at [www.arb.ca.gov](http://www.arb.ca.gov).*

## PROPOSED

State of California  
AIR RESOURCES BOARDResolution 02-26  
July 26, 2002

Agenda Item No.: 02-6-5

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 02-30, entitled "Demonstration of the Ultralow NOx Burner in a Firetube Boiler", has been submitted by S. T. Johnson Company, Inc., in response to the 2002 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 02-30, entitled "Demonstration of the Ultralow NOx Burner in a Firetube Boiler", submitted by S. T. Johnson Company, Inc., for a total amount not to exceed \$132,526.

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 02-30, entitled "Demonstration of the Ultralow NOx Burner in a Firetube Boiler", submitted by S. T. Johnson Company, Inc., for a total amount not to exceed \$132,526.

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 \$132,526.

## ATTACHMENT A

### Innovative Clean Air Technologies (ICAT) Grant Proposal: **Demonstration of the Ultralow NOx Burner in a Firetube Boiler**

#### **Background**

In 1999, Altex Technologies Corporation, with Gordon Piatt Energy Group (GPEG) as a funding partner, obtained an ICAT contract to develop a low-oxides of nitrogen (NOx) burner technology. ARB staff amended that contract to make GPEG the contractor because of its planned commercialization role. Under the contract, GPEG successfully tested a production prototype of the burner. However, GPEG was sold to John Zink Co., which dropped the project without completing the contract with a field demonstration.

S. T. Johnson, a California manufacturer of boiler burners, has agreed to perform the rest of the project. However, the original contract period has expired. If granted a restoration of the unexpended funds from the original ICAT contract, S. T. Johnson and Altex would perform the field demonstration (final phase) of the original project.

#### **Objective**

This project would demonstrate an ultra-low-NOx burner (ULNB) on a boiler. All other low-NOx burners in this application use a single flame zone, near pre-mixing, and/or massive flue gas recirculation. These techniques entail poor operability, inefficiency, and high capital and operating costs. The ULNB should achieve very low NOx with good performance and minimized flue gas recirculation and its associated costs.

#### **Methods**

To demonstrate the ULNB, a production prototype version will be tested in the field in a boiler that produces 21 million British thermal units per hour (21MM Btu/hr). S. T. Johnson will demonstrate the performance, durability, and serviceability of the ULNB. Also, economic analyses will be performed to quantify the costs and benefits of the ULNB in boiler applications.

#### **Expected Results**

On the basis of a successful demonstration, S.T. Johnson will create a plan to commercialize the ULNB. The first sales of the burner are expected within 4 months of the end of the demonstration.

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

Commercialization of the ULNB burner would reduce the cost of NOx control in boilers and enable flue gas concentrations of NOx below what is usually required as BACT.

**Applicant:** S. T. Johnson Co.

**Project Period:** 6 months

**Principal Investigator:** Dan L. Wiedeman

**ICAT Funding:** \$132,526

**Co-funding:**

S.T. Johnson -- \$28,860

Penny Newman Milling Co. -- \$127,141

**Past Experience with This Principal Investigator**

Staff has no prior experience with S.T. Johnson. However, the extent of review of the ICAT proposal provides an adequate basis for recommending a grant. The application was reviewed externally by academic engineers and scientists, other agencies, and academic business reviewers, and internally by the Stationary Source Division, Research Division, and the Executive Office.

**Prior ICAT Funding**

	2001	2000	1999
S. T. Johnson	0	0	0
Gordon Piatt Energy Group	0	0	\$217,136*

\* Funds expended from original grant of \$349,663

## BUDGET SUMMARY

S. T. Johnson Co.

### Demonstration of the Ultralow NOx Burner in a Firetube Boiler

<u>Direct Costs and Benefits</u>	<u>ICAT</u>	<u>Total</u>
1. Labor	\$ 34,760	\$ 34,760
2. Employee Fringe Benefits	\$ 12,166	\$ 12,166
3. Subcontractors	\$ 28,485	\$ 76,985
4. Equipment	\$ 0	\$ 0
5. Travel and Subsistence	\$ 1,553	\$ 1,553
6. Materials and Supplies	\$ 15,498	\$ 15,498
7. Other Direct Costs	<u>\$ 90</u>	<u>\$107,591</u>
Total, Direct	\$ 92,552	\$248,553
<u>Indirect Costs</u>		
1. Overhead	\$ 39,974	\$ 39,974
2. Other Indirect Costs	<u>\$ 0</u>	<u>\$ 0</u>
Total, Indirect	<u>\$ 39,974</u>	<u>\$ 39,974</u>
<b>Total Project Cost</b>	<b>\$132,526</b>	<b>\$288,527</b>

## PROPOSED

State of California  
AIR RESOURCES BOARDResolution 02-27  
July 25, 2002

Agenda Item No.: 02-6-5

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 02-29, entitled "High Performance Low VOC Coatings for 2006", has been submitted by Southwest Texas State University in response to the 2002 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 02-29, entitled "High Performance Low VOC Coatings for 2006", submitted by Southwest Texas State University, for a total amount not to exceed \$99,324.

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 02-29, entitled "High Performance Low VOC Coatings for - 2006", submitted by Southwest Texas State University, for a total amount not to exceed \$99,324.

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 \$99,324.

## ATTACHMENT A

Innovative Clean Air Technologies (ICAT) Grant Proposal:  
**“High Performance Low VOC Coatings for 2006”**

**Background**

Coatings are a major source of VOC emissions in California. Several air pollution control districts and air quality management districts have adopted regulations limiting the VOC contents of coatings. The South Coast Air Quality Management District's (SCAQMD) current VOC limits range from 100 to 420 grams per liter (g/L), depending on the coating category. For some categories, the SCAQMD will enforce stricter limits in 2006. Advances in paint technology are needed to meet the stricter limits. Hyper-branched, phosphate ester polyol resins potentially are one such technology. The goal for this technology is 100 g of VOC /L or less.

**Objective**

The objective of this project is to demonstrate the technical suitability and cost-effectiveness of hyper-branched vegetable oil polyol phosphate esters (POLYOL) to meet a VOC limit of 100 g/L in drum and wood coatings.

**Methods**

The Southwest Texas State University (SWT) has developed a resin that has desirable properties for paints. The resin is a hyper-branched phosphate ester polyol (POLYOL), which can be produced from vegetable oils. The POLYOL resin provides better adhesion to substrates, reduces the need for surfactant, and reduces the water sensitivity of the coating. As a result, it appears to be a promising technology for producing lower VOC coatings. SWT intends to combine its work in the area with the expertise of others in order to bring its resin technology to commercialization.

SWT will work with Atofina, Inc. in the construction, optimization, and evaluation of a pilot-scale process for the production of POLYOL. Atofina is a chemical company and a major manufacturer of epoxidized oils. Atofina will supply pilot plant development personnel and equipment to produce drum quantities of POLYOL for industry evaluation. SWT will supply much of the initial contacts with technical leadership at resin and paint manufacturers. The United States Soybean Board will fund much of this early work. POLYOL from the pilot-scale process should be available within a year.

Precision Coatings, Inc. will formulate prototype paints for drum coatings. The performance of the paints will be demonstrated at a Precision Coating's customer location. Another company would be selected for a demonstration on ambient-cured architectural wood coatings and Direct-to-Metal aqueous latex coatings. In the demonstration phase, the POLYOL-based coatings would be tested in head-to-head comparisons with metal coatings and wood coatings that are currently being used.

Following the demonstration, Atofina will supply technical service/marketing personnel to introduce the product to market and will follow-up on the industry evaluations of the POLYOL-based coating.

### Expected Results

The project should show that drum and wood coatings that meet a VOC limit of 100 g/L, or less can be made from hyper-branched vegetable oil polyol phosphate ester resins.

### Significance to the Board

The POLYOL resin technology could provide a cost-effective way of achieving additional VOC emissions reductions from coatings.

**Applicant:** Southwest Texas State University

**Project Period:** 24 months

**Principal Investigator:** John L. Massingill

**ICAT Funding:** \$99,324\*

\*\$20,000 provided by SCAQMD

### Co-funding

SWT: \$44,000

United States Soybean Board: \$148,549

Paint Partners: \$25,000

Atofina, Inc.: \$120,000

### Past Experience with This Principal Investigator

Staff has no prior experience with Southwest Texas State University. However, the extent of review of the ICAT proposal provides an adequate basis for recommending a grant. The application was reviewed externally by academic engineers and scientists, other agencies, and academic business reviewers and internally by the Stationary Source Division, Research Division, and the Executive Office.

### Prior ICAT Funding to Southwest Texas State University

Year	2001	2000	1999
Funding	0	0	0

**BUDGET SUMMARY**

Southwest Texas State University

**High Performance Low VOC Coatings for 2006**

<b><u>Direct Costs and Benefits</u></b>	<b><u>ICAT</u></b>	<b><u>Total</u></b>
1. Labor	\$47,680	\$200,269
2. Employee Fringe Benefits	\$13,350	\$ 55,969
3. Subcontractors	\$ 0	\$ 0
4. Equipment	\$ 0	\$ 44,000
5. Travel and Subsistence	\$ 3,000	\$ 11,400
6. Materials and Supplies	\$ 4,000	\$ 34,100
7. Other Direct Costs	<u>\$ 0</u>	<u>\$ 26,000</u>
Total	\$68,030	\$371,738
<b><u>Indirect Costs</u></b>		
1. Overhead	\$31,294	\$ 65,135
2. Other Indirect Costs	<u>\$ 0</u>	<u>\$ 0</u>
Total	<u>\$31,294</u>	<u>\$ 65,135</u>
<b>Total Project Costs</b>	<b>\$99,324*</b>	<b>\$436,873</b>

\* \$20,000 will be provided by SCAQMD

## PROPOSED

State of California  
AIR RESOURCES BOARDResolution 02-28  
July 25, 2002

Agenda Item No.: 02-6-5

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 02-06, entitled "Integrated Autothermal Cyclic Reformer and PEM Fuel Cell", has been submitted by GE Energy and Environmental Research Corporation in response to the 2002 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 02-06, entitled "Integrated Autothermal Cyclic Reformer and PEM Fuel Cell", submitted by GE Energy and Environmental Research Corporation, for a total amount not to exceed \$200,000.

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 02-06, entitled "Integrated Autothermal Cyclic Reformer and PEM Fuel Cell", submitted by GE Energy and Environmental Research Corporation, for a total amount not to exceed \$200,000.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the efforts proposed herein, and as described in Attachment A, in an amount not to exceed \$200,000.

## ATTACHMENT A

Innovative Clean Air Technologies (ICAT) Grant Proposal:  
**“Integrated Autothermal Cyclic Reformer and PEM Fuel Cell”**

**Background**

The critical barriers for commercialization of proton exchange membrane (PEM) fuel cells in the market are the high capital costs and low efficiencies of existing small-scale fuel reformers. GE Energy and Environmental Research Corporation (GE EER) is developing an economical fuel cell system based on Autothermal Cyclic Reforming (ACR). ACR produces hydrogen from many fuels, including natural gas, diesel fuel, coal, and renewable feed-stocks. The ACR process has significant advantages in comparison with the competing technologies of autothermal reforming and partial oxidation: the ACR-produced hydrogen is not diluted with nitrogen, and sulfur from the fuel is rejected in-situ. Also, in comparison to conventional steam reforming, the ACR process has significantly lower capital costs, higher conversion efficiency, higher hydrogen purity, and lower emissions.

**Objective**

This proposed program will demonstrate and optimize an integrated fuel processor and PEM fuel cell system. The National Fuel Cell Research Center will supply a PEM fuel cell and will assist GE EER in the integration of the fuel cell with the ACR reformer. The goals are to:

- Produce at least 10 kW with a system availability of at least 90%.
- Exceed the US Department of Energy's target of 40% for electrical efficiency.
- Achieve NOx emissions of less than 1 ppm.

**Methods**

A fuel processor prototype will be operated in the laboratory for an extended period, and monitored for durability, efficiency, and purity of the hydrogen output. Then a single processor will be integrated with at least two PEM fuel cells, and the combined system will be operated for extended periods to collect data on electrical efficiency, durability and robustness. Simultaneously, the proponent will analyze the system using its rigorous methods and criteria to ascertain the sensitivity of the system's performance to various parameters. Finally, all data and analysis results will be used to optimize the system design for maximum efficiency and robustness.

### Expected Results

The project will demonstrate that the ACR for reforming natural gas for fuel cell use is cleaner, more efficient, less expensive, and more robust than alternative technologies.

### Significance to the Board

The novel reforming process, when combined with PEM fuel cells, represents a significant improvement in pollutant emissions resulting from electricity production. The pollutant emissions from the ACR unit are <1 ppm NOX and <10 ppm CO. These numbers are substantially lower than the emissions from conventional steam generating power plants and distributed generation technologies such as micro-turbines and reciprocating-engines. The advanced hydrogen production using ACR along with fuel cell technologies will allow distributed power generation to be economically competitive with central power generation. When fully commercial, the technology could benefit California rate-payers with lower emissions and reliable low-cost power.

**Applicant:** GE Energy and Environmental Research Corporation

**Project Period:** 30 months

**Principal Investigator:** Ravi Kumar, Ph.D.    **ICAT Funding:** \$200,000  
 (\$100,000 provided by SCAQMD)

### Co-funding

GE Energy and Environmental Research Corporation	\$200,000
U.S. Department of Energy	\$100,000
California Energy Commission	\$300,000

### Past Experience with This Principal Investigator

Staff has no prior experience with GE EER. However, the extent of review of the ICAT proposal provides an adequate basis for recommending a grant. The application was reviewed externally by academic engineers and scientists, other agencies, and academic business reviewers, and internally by Stationary Source Division, Research Division, and the Executive Office.

### Prior ICAT Funding to GEE EER

Year	2001	2000	1999
Funding	0	0	0

## BUDGET SUMMARY

GE Energy and Environmental Research Corporation

### Integrated Autothermal Cyclic Reformer and PEM Fuel Cell

<u>Direct Costs and Benefits</u>	<u>ICAT</u>	<u>Total</u>
1. Labor	\$ 71,716	\$190,005
2. Employee Fringe Benefits	\$ 0	\$ 0
3. Subcontractors	\$ 0	\$200,000
4. Equipment	\$ 0	\$ 58,500
5. Travel and Subsistence	\$ 2,000	\$ 2,000
6. Materials and Supplies	\$ 5,850	\$ 23,400
7. Other Direct Costs	<u>\$ 0</u>	<u>\$ 0</u>
Total	\$ 79,566	\$473,905
<u>Indirect Costs</u>		
1. Overhead	\$120,434	\$326,095
2. Other Indirect Costs	<u>\$ 0</u>	<u>\$ 0</u>
Total	<u>\$120,434</u>	<u>\$326,095</u>
<b>Total Project Costs</b>	<b>\$200,000 *</b>	<b>\$800,000</b>

\* \$100,000 will be provided by SCAQMD