



## CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

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August 19, 2008

Connecticut Energy Advisory Board  
C/O Donald Downes, Chairman, Connecticut Department of Public Utility Control  
Ten Franklin Square  
New Britain, CT 06051

Dear Chairman Downes,

Please find enclosed a "revised" final Project Proposal and Budget from the Connecticut Academy of Science and Engineering (CASE) for services regarding A Study of The Feasibility of Utilizing Waste Heat from Central Electric Power Generating Stations and Potential Applications. This proposal includes the revisions for the project scope of work that we discussed in our meeting on August 18, 2008.

I am available to discuss the details of the proposal at your convenience. Please let me know if you have any questions.

Best Regards,

A handwritten signature in cursive script, appearing to read "R. H. Strauss".

Richard H. Strauss  
Executive Director

# CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

## A STUDY OF THE FEASIBILITY OF UTILIZING WASTE HEAT FROM CENTRAL ELECTRIC POWER GENERATING STATIONS AND POTENTIAL APPLICATIONS

**PROPOSAL DATE:** JUNE 19, 2008; **REVISED:** AUGUST 19, 2008

### **BACKGROUND**

The operation of central power plants release waste heat into the atmosphere. Reportedly a federal appeals court has found that federal standards, regarding the temperature of releases from power plants are not a ceiling, but rather in some cases a floor, which leaves open the possibility applying more stringent standards for such thermal releases. During the re-licensing of the Millstone nuclear power plant the possibility of requiring the installation of cooling towers, at a significant cost, to reduce the temperature of waste heat releases into the atmosphere was raised. In this case the Nuclear Regulatory Commission determined it would not require the installation of cooling devices.

The Connecticut Energy Advisory Board (CEAB) is interested in determining if the waste heat produced from the operation of central power generating stations can be captured and used for a useful purpose based on concerns of potential added cost for cooling thermal releases from power plants along with the added potential benefits in power plant efficiency from the use of waste heat.

### **STUDY CONCEPT & SCOPE:**

The following provides an outline of the study process and preliminary project scope of work:

#### **Study Management Team and Process:**

- ◆ A Project Director will oversee all study activities.
- ◆ A Project Management Team will be selected by CASE to undertake primary research and to serve as principal writer of the study report under the direct control of the Academy's Study Committee. Additionally, CASE will utilize the services of a "Special Task" consultant for some mapping, surveying tasks and to assist in identifying possible applications of waste heat should it be found to be feasible.
- ◆ A Study Committee of knowledgeable Connecticut resident and non-resident experts, chaired by a CASE member, will oversee and guide the study effort and provide findings and suggestions for the consideration of the CEAB. CASE Governing Council will assure a balance of biases in the analysis as well as provide peer review and quality control of the final report.
- ◆ Periodic progress statements will be provided throughout the project period.

#### **Project Scope:**

Conduct a study to determine the feasibility of capturing waste heat from central power stations for useful purposes. The following is an outline of tasks that will be included in the study:

- Identify the power plants in Connecticut that are 65 MW or larger by type of fuel used and location. This task will include mapping and aerial photos of each power plant by either using existing information or creating new maps and producing new photos if where they are not available.
- Review the operation of each electrical generating facility identified through on-site interviews/survey that will include:
  - Determine characteristics of waste heat produced/released for each power plant identified:
    - An analysis of heat waste data to verify that it is consistent with the plant's power rating
    - Determine site specific issues regarding the availability and potential use of waste heat
    - Determine if electrical generation efficiency can be improved by reusing waste heat on-site or off-site.

- If the preliminary analysis indicates that waste heat produced at a power plant can be used for a useful purpose, then:
  - Identify availability of land on-site at each such power plant that could be used for potential development.
  - Identify the types of activities that could benefit from the use of available heat such as: Further production of electricity through various cycles including but not limited to the Kalina, Ormat and Cheng cycles; and additional end uses including but not limited to district heating, industrial process heat (preferably in an industrial ecology industrial park, see <http://indigodev.com/Kal.html>) and inlet air cooling to increase power output
  - Depending on the distance that the waste heat can be transported for a useful purpose, identify businesses in the area of the plant within an acceptable distance that would be candidates for the use of the waste heat. This task will involve a survey of businesses and a summary of findings.
  - This task will include additional mapping of power plant land area only for those power plant sites where waste heat can be used for a useful purpose. *Note: existing “maps” will be utilized where available.*
- Conduct a scenario analysis to compare the possibility increasing electrical generation of a power plant to the cogeneration application of waste heat for other useful purposes, if and where applicable.
- Identify and summarize the experience other power plant facilities, if any that utilize waste heat for useful purposes other than for the direct production of electricity for distribution.
- Research the possibility of using waste heat for hydrogen production

### **STUDY WORK PLAN**

1. The Study Committee will meet periodically throughout the study period to guide the efforts of the Project Management Team and Special Task consultant.
2. Finalize project scope of work with CASE Study Committee.
3. The Project Management Team and the Special Task Consultant will conduct interviews, research, and other study tasks, as assigned.
4. The Study Committee will develop its findings based upon the results of the research efforts of the Project Management Team and Special Task Consultant.

### **DELIVERABLES AND SCHEDULE**

#### Deliverables:

- Oral Presentation: An oral presentation of the final report will be provided to CEAB.
- Final Report: A final written report will be provided to the CEAB. 100 – 150 copies of the Final Report will be provided, as well as an electronic PDF file.

Schedule: Best efforts will be made to complete the project within 10 months from authorization to begin work.

# CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

## SCIENCE AND TECHNOLOGY ADVISORY SERVICES FOR THE CONNECTICUT GENERAL ASSEMBLY

### A STUDY OF CONNECTICUT'S ECONOMIC, ENERGY AND CLIMATE SECURITY

#### PROJECT BUDGET

This project shall include expenses for the project management team, project director, project consultant, editor, report printing, and other expenses including travel, teleconference cost, meals, and other printing expenses of prior reports and information for consideration of the study committee as may be necessary. Also, CASE will be paid for its indirect expenses at a rate of 47% for FY09 based on project expenses as specified below. In addition, the project will include payment for the value of the project study committee at \$25,000.

The Budget is based on a project start date of authorization to commence work, which will be assumed to be on or about August 1, 2008.

#### Known estimated project expenses are as follows:

◆ Project Management Team (Study managers and student assistants)	\$23,000
◆ Project "Special Task" Consultant - initial work	\$ 3,000
◆ Project Director	\$12,069
◆ Project Assistant	\$ 3,828
◆ Editor	\$ 2,000
◆ Printing	\$ 2,500
◆ Other Expenses (Travel, Teleconference, Meals, etc)	\$ 2,500
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Total known estimated project expenses:	\$48,898
CASE Indirect Expenses @ an estimated @ 47% for FY09:	\$22,982
Study Committee:	\$25,000
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Total Estimated Project Cost:	\$ 96,880

#### Additional Potential Expenses if waste heat from power plants has a useful purpose

- ◆ Project "Special Task" Consultant
  1. Land availability at selected power plants research and mapping, if necessary: **\$ 2,000**
  2. Identification types of businesses/industry targets appropriate for use of waste heat, if it is determined to be feasible and useful at one or more power plants; as well as a survey of businesses located in the area of such power plants, if appropriate. Cost is estimated not to exceed **\$15,000**.
  3. CASE Indirect Expenses at @47% will be added to the actual cost for these tasks
  4. Total maximum cost for items 1, 2, 3 above including CASE Indirect Expenses is: **\$24,990**

#### Maximum Project Cost: \$121,870 (\$96,880 + \$24,990)

The known estimated budgeted project cost for the Project Director, and the Project Management Team will be fixed upon the development of the final budget based upon the final project scope of work. Other known estimated budgeted expenses are subject to change based on actual cost. The final project cost will be adjusted based on the actual cost for these expenses, with the related CASE indirect expense payment also being adjusted for any variance. The cost assigned to the Study Committee is also fixed.

**Project Payment Schedule:**

- ◆ **Initial Payment** upon execution of Project Agreement: \$25,000
- ◆ **Progress Payment #1** - on December 1, 2008 or upon delivery of draft study report to CASE by the Project Management Team, whichever is sooner: \$25,000
- ◆ **Final Payment** - balance due CASE upon reconciliation of actual expenses for Editor, Printing, Special Task Consultant, and expenses categorized as "Other Expenses" and related CASE Indirect Expense.