### Division Agreement
**PIR-16-001**  
(To be completed by CGL Office)

<table>
<thead>
<tr>
<th>Division</th>
<th>Agreement Manager</th>
<th>MS-</th>
<th>Phone</th>
</tr>
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<tbody>
<tr>
<td>ERDD</td>
<td>Karen Perrin</td>
<td></td>
<td>916-327-1467</td>
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### Recipient’s Legal Name
Institute of Gas Technology dba Gas Technology Institute  
Federal ID Number  
36-2170137

### Title of Project
Demonstrating Natural Gas Heat Pumps for Integrated Hot Water and Air-Conditioning in Restaurants

### Term and Amount
<table>
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<tr>
<th>Start Date</th>
<th>End Date</th>
<th>Amount</th>
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<tbody>
<tr>
<td>2/16/2017</td>
<td>1/30/2020</td>
<td>$ 864,294</td>
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</table>

### Business Meeting Information
- **ARFVTP agreements under $75K delegated to Executive Director.**
- **Proposed Business Meeting Date**: 1/25/2017  
  - **Consent**:  
  - **Discussion**:  
  - **Business Meeting Presenter**: Karen Perrin  
  - **Time Needed**: 5 minutes

Please select one list serve.  
NaturalGas (NG Research Program)

### Agenda Item Subject and Description
INSTITUTE OF GAS TECHNOLOGY DBA GAS TECHNOLOGY INSTITUTE (GTI). Proposed resolution approving agreement PIR-16-001 with Institute of Gas Technology dba Gas Technology Institute (GTI) for a $864,294 grant to fund demonstration of low-cost gas fired heat pumps that integrate commercial hot water and air-conditioning. The demonstrations will occur at two restaurants in the Los Angeles Basin. Field and laboratory results will be used to extrapolate results to estimate statewide impact potential for energy, water, emissions, and operating cost savings. The goals include:  
(1) survey and quantify market barriers for adoption in California  
(2) educating prospective "early adopter" business owners and stakeholders to introduce the technology and summarize project findings, and  
(3) develop educational content and materials for contractors and affected stakeholders.

### California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a “Project” under CEQA?  
   - **Yes** (skip to question 2)  
   - **No** (complete the following (PRC 21065 and 14 CCR 15378)):  
     - Explain why Agreement is not considered a "Project":

2. If Agreement is considered a “Project” under CEQA:  
   - Agreement IS exempt. (Attach draft NOE)  
   - Statutory Exemption. List PRC and/or CCR section number:  
   - Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, § 15301 and 15306  
   - Common Sense Exemption. 14 CCR 15061 (b) (3)  
   - Explain reason why Agreement is exempt under the above section:

   This agreement consists of field demonstration of low-cost gas heat pumps (GHP) for integrated commercial hot water and air-conditioning, as applied to two casual dining restaurants in the Los Angeles basin. This agreement will involve the operation and minor alteration of existing facilities and mechanical equipment within the current footprints of two existing restaurants in the Los Angeles basin. The activities of this project will not involve any expansion of use beyond that currently existing at these facilities. The project will not have a significant impact on the environment and will not require any special permits. Part of this agreement also involves basic data collection of the affected systems, which does not result in a serious or major disturbance to an environmental resource.

   - b) Agreement IS NOT exempt. (Consult with the legal office to determine next steps.)
   - Check all that apply  
     - Initial Study  
     - Environmental Impact Report  
     - Negative Declaration  
     - Statement of Overriding Considerations  
     - Mitigated Negative Declaration

### List all subcontractors (major and minor) and equipment vendors:
(attach additional sheets as necessary)
Legal Company Name | Budget
--- | ---
ADM Associates, Inc. | $61,800
Stone Mountain Technologies Inc. | $99,000
Frontier Energy, Inc. | $99,280
JC Mechanical | $63,858
ConsumerQuest, Inc. | $51,000
Springboard Marketing Research and Consulting | $57,200

List all key partners: (attach additional sheets as necessary)

<table>
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<tr>
<th>Funding Source</th>
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<th>Budget List No.</th>
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</table>

R&D Program Area: EERO: Buildings

TOTAL: $864,294

Explanation for “Other” selection

Reimbursement Contract #: Federal Agreement #:

Recipient's Administrator/ Officer
Name: Kate Jauridez
Address: 1700 S Mount Prospect Rd
City, State, Zip: Des Plaines, IL 60018-1804
Phone: 847-768-0905 / Fax: - -
E-Mail: Kate.Jauridez@gastechnology.org

Recipient's Project Manager
Name: Merry Sweeney
Address: 123 C St
City, State, Zip: Davis, CA 95616-4632
Phone: 224-565-7804 / Fax: - -
E-Mail: merry.sweeney@gastechnology.org

Selection Process Used
☐ Competitive Solicitation
☐ First Come First Served Solicitation
Solicitation #: GFO-16-502

The following items should be attached to this GRF
1. Exhibit A, Scope of Work
☐ Attached
2. Exhibit B, Budget Detail
☐ Attached
3. CEC 105, Questionnaire for Identifying Conflicts
☐ Attached
4. Recipient Resolution
☐ N/A ☑ Attached
5. CEQA Documentation
☐ N/A ☑ Attached
I. TASK ACRONYM/TERM LISTS

A. Task List

<table>
<thead>
<tr>
<th>Task #</th>
<th>CPR</th>
<th>Task Name</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>General Project Tasks</td>
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<tr>
<td>2</td>
<td></td>
<td>Field Test Planning and Preparation</td>
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<tr>
<td>3</td>
<td>X</td>
<td>Prototype Field Demonstration</td>
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<td>4</td>
<td>X</td>
<td>Data Analysis and Modeling</td>
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<td>5</td>
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<td>Market Impact and Outreach</td>
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<td>6</td>
<td></td>
<td>Evaluation of Project Benefits</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Technology/Knowledge Transfer Activities</td>
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B. Acronym/Term List

<table>
<thead>
<tr>
<th>Acronym/Term</th>
<th>Meaning</th>
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<tr>
<td>A/C</td>
<td>Air Conditioning</td>
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<tr>
<td>CAM</td>
<td>Commission Agreement Manager</td>
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<td>CAO</td>
<td>Commission Agreement Officer</td>
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<td>COP</td>
<td>Coefficient of Performance</td>
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<td>CPR</td>
<td>Critical Project Review</td>
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<td>GHG</td>
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<td>Low-Cost Gas Heat Pump</td>
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<td>M&amp;V</td>
<td>Measurement and Verification</td>
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<tr>
<td>TAC</td>
<td>Technical Advisory Committee</td>
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</table>

II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this Agreement is to fund the field demonstration of an advanced pre-commercial gas heat pump (GHP) for commercial hot water and space cooling, as applied to two restaurants. With data generated, the project team will develop tools to extrapolate results to other restaurant-types, other light commercial facilities, and California climate zones and will quantify the barriers to adoption of this advanced technology.

B. Problem/ Solution Statement

Problem
By a significant margin, restaurants consume the most natural gas of any commercial building type and hot water heating is a significant portion of restaurant natural gas usage. As a result, restaurants are an important target for high-efficiency gas water heating technologies. Like the residential water heating market in California, the restaurant market is predominantly served by gas water heaters. However, the conventional method of operating with high-efficiency, using a condensing combustion (90-95% thermal efficiency), has several drawbacks. With relatively inexpensive natural gas prices, the greater installed cost of a condensing-efficiency gas water
heater is not commonly offset by the moderate increase in operating efficiency from 80% to 90-95%. The condensing-efficiency equipment when operating with a recirculating loop often do not operate at rated efficiencies.

Solution
This project will evaluate and demonstrate an innovative technology at two restaurant sites, the Low-Cost Gas Heat Pump (LCGHP) for integrated commercial hot water and air-conditioning (A/C). This technology addresses the aforementioned problem by: delivering hot water more efficiently, with Coefficients of Performance (COP) between 1.4-1.9, yielding an Annual Fuel Utilization Efficiency of 140% or more and simultaneously provide space cooling by providing energy savings from site A/C and more consistently operating with high COPs, relatively independent of outdoor temperatures. Additionally, as a system, this LCGHP may operate more consistently than condensing combustion efficiency, as it is integrated with an indirect storage tank. The Recipient will verify these project benefits and energy savings at two Los Angeles-Basin restaurants, while developing guidance and sizing tools for business owners, performing benefits and cost-effectiveness analyses in preparation for inclusion within efficiency codes, and surveying business owners, contractors, and distributors to assess barriers to entry for the new technology.

C. Goals and Objectives of the Agreement

Agreement Goals
The goals of this Agreement are to:

- Evaluate the LCGHP technology as serving the hot water and A/C needs of restaurants in a critical regional market.
- Understand the interaction between the GHP and the balance of system components (storage tank, conventional water heater, building A/C) to better optimize system controls.
- Through analysis and evaluation, develop analytical tools to prepare new technology class for inclusion within critical frameworks, including utility incentive programs, energy efficiency codes, and building energy models.
- Share findings broadly to introduce the technology and solicit feedback from business owners, distributors, installation contractors, code officials, and other stakeholders.

Ratepayer Benefits:¹ This Agreement will result in the ratepayer benefit of lower energy costs through supporting the demonstration and commercialization path of an innovative, low-cost, GHP technology. As estimated in prior cold-climate demonstrations of the technology, the GHP provides heating with operating COPs of 1.5 or greater, with therm savings of 40% or more depending on usage and baseline equipment. Additionally, with design variations, the unit can deliver “free cooling” as well, simultaneously, to displace 20% or more of electricity used for A/C. Finally, the GHP emits fewer greenhouse gas (GHG) emissions than all other gas-fired options and, compared to other heat pump technologies, uses a natural refrigerant/absorbent pair, ammonia-water, using working fluids with zero ozone depletion potential and zero global warming potential.

¹ California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC “Phase 2” Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).
Technological Advancement and Breakthroughs: This Agreement will lead to technological advancement and breakthroughs to overcome barriers through evaluation, demonstration, and technology transfer. The novel integrated GHP system will provide high-efficiency water heating and supplemental cooling for energy-intensive light commercial applications. Focusing on restaurants, the energy cost expense of air-conditioning (A/C) will be offset and this technology will be deployed as an integrated system for hot water and supplemental A/C.

The agreement will result in ratepayer benefits noted previously by:
- Supporting the late-stage demonstration of a pre-commercial GHP system, supporting stakeholders and manufacturing partners in verifying performance claims and understanding the impact of "real world" operating conditions on the technology.
- Introducing the technology to "early-adopter" business owners, installation contractors, and the distribution network and soliciting critical feedback prior to market entry.
- Providing independent and verified estimates of energy, water, and operating cost savings and, with active dissemination of results and findings, introducing the novel integrated technology to relevant decision makers concerning positive market interventions (e.g. incentives) and requirements (e.g. codes & standards).

Agreement Objectives
The objectives of this Agreement are to:
- Assess the energy, water, and operating cost savings of a novel integrated gas heat pump system through a technology demonstration, providing hot water and space cooling to two restaurants in the Los Angeles Basin.
- Expand results through modeling and simulation from these restaurants to other restaurant types and sizes, light commercial businesses, California climate zones, and system configurations to determine total market impact potential of the technology.
- As a novel integrated system, prepare stakeholders and code officials with information sharing, model development, and analysis.
- Understand barriers to market entry through outreach with stakeholder surveys and obtain feedback from industry workshops.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products
The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the Project Schedule (Part V). Products that require a draft version are indicated by marking “(draft and final)” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “days” means working days.

2 California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state’s statutory and energy goals.
The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report:

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.

- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.

- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only:

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products:

- Submit all data and documents required as products in accordance with the following:

  Instructions for Submitting Electronic Files and Developing Software:

  o **Electronic File Format**
    
    Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission’s software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

    The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

    - Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
    - Text documents will be in MS Word file format, version 2007 or later.
    - Documents intended for public distribution will be in PDF file format. The Recipient must also provide the native Microsoft file format.
    - Project management documents will be in Microsoft Project file format, version 2007 or later.
EXHIBIT A
Scope of Work

Software Application Development
Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission’s Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting
The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:
- Attend a “Kick-off” meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The administrative portion of the meeting will include discussion of the following:
  - Terms and conditions of the Agreement;
  - Administrative products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Match fund documentation (subtask 1.7);
  - Permit documentation (subtask 1.8);
  - Subcontracts (subtask 1.9); and
  - Any other relevant topics.

The technical portion of the meeting will include discussion of the following:
  - The CAM’s expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
EXHIBIT A
Scope of Work

1. Technical products (subtask 1.1);
2. Progress reports and invoices (subtask 1.5);
3. Final Report (subtask 1.6);
4. Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
5. Any other relevant topics.

- Provide an Updated Project Schedule, List of Match Funds, and List of Permits, as needed to reflect any changes in the documents.

The CAM shall:
- Designate the date and location of the meeting.
- Send the Recipient a Kick-off Meeting Agenda.

Recipient Products:
- Updated Project Schedule *if applicable*
- Updated List of Match Funds *if applicable*
- Updated List of Permits *if applicable*

CAM Product:
- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings
The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient, and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:
- Prepare a CPR Report for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other Task Products that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.
EXHIBIT A
Scope of Work

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient’s input.
- Send the Recipient a CPR Agenda and a List of Expected CPR Participants in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a Schedule for Providing a Progress Determination on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a Progress Determination on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:
- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:
- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting
The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM’s discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
  - Disposition of any state-owned equipment.
  - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission’s interest in patented technology.
  - The Energy Commission’s request for specific “generated” data (not already provided in Agreement products).
  - Need to document the Recipient’s disclosure of “subject inventions” developed under the Agreement.
EXHIBIT A
Scope of Work

- “Surviving” Agreement provisions such as repayment provisions and confidential products.
- Final invoicing and release of retention.

- Prepare a Final Meeting Agreement Summary that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a Schedule for Completing Agreement Closeout Activities.
- Provide All Draft and Final Written Products on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:
- Final Meeting Agreement Summary (if applicable)
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices
The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:
- Submit a monthly Progress Report to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly Invoice that follows the instructions in the “Payment of Funds” section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:
- Progress Reports
- Invoices

Subtask 1.6 Final Report
The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least two months before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.
EXHIBIT A
Scope of Work

Subtask 1.6.1 Final Report Outline

The Recipient shall:
- Prepare a Final Report Outline in accordance with the Style Manual provided by the CAM. (See Task 1.1 for requirements for draft and final products.)

Recipient Products:
- Final Report Outline (draft and final)

CAM Product:
- Style Manual
- Comments on Draft Final Report Outline
- Approval of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:
- Prepare a Final Report for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (required)
    - Credits page on the reverse side of cover with legal disclaimer (required)
    - Acknowledgements page (optional)
    - Preface (required)
    - Abstract, keywords, and citation page (required)
    - Table of Contents (required, followed by List of Figures and List of Tables, if needed)
    - Executive summary (required)
    - Body of the report (required)
    - References (if applicable)
    - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
    - Bibliography (if applicable)
    - Appendices (if applicable) (Create a separate volume if very large.)
    - Attachments (if applicable)
  - Ensure that the document is written in the third person.
  - Ensure that the Executive Summary is understandable to the lay public.
    - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
    - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
EXHIBIT A
Scope of Work

- If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
  - Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
  - Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
  - Include a brief description of the project results in the Abstract.

- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the Final Report to the CAM along with Written Responses to Comments on the Draft Final Report.

Products:
- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

CAM Product:
- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds
The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:
- Prepare a Match Funds Status Letter that documents the match funds committed to this Agreement. If no_match_funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, and then state this in the letter.

If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
EXHIBIT A
Scope of Work

- A list of the match funds that identifies:
  - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
  - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
  - A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.

- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a Supplemental Match Funds Notification Letter to the CAM of receipt of additional match funds.
- Provide a Match Funds Reduction Notification Letter to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:
- Match Funds Status Letter
- Supplemental Match Funds Notification Letter (if applicable)
- Match Funds Reduction Notification Letter (if applicable)

Subtask 1.8 Permits
The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:
- Prepare a Permit Status Letter that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
  - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
  - The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
• If during the course of the Agreement additional permits become necessary, then provide the CAM with an Updated List of Permits (including the appropriate information on each permit) and an Updated Schedule for Acquiring Permits.
• Send the CAM a Copy of Each Approved Permit.
• If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

**Products:**
- Permit Status Letter
- Updated List of Permits *(if applicable)*
- Updated Schedule for Acquiring Permits *(if applicable)*
- Copy of each Approved Permit *(if applicable)*

**Subtask 1.9 Subcontracts**
The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

**The Recipient shall:**
- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each Subcontract required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

**Products:**
- Subcontracts *(draft if required by the CAM)*

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**TECHNICAL ADVISORY COMMITTEE**

**Subtask 1.10 Technical Advisory Committee (TAC)**
The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM’s discretion. The purpose of the TAC is to:
- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
EXHIBIT A
Scope of Work

- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:
- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:
- Prepare a List of Potential TAC Members that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a List of TAC Members once all TAC members have committed to serving on the TAC.
- Submit Documentation of TAC Member Commitment (such as Letters of Acceptance) from each TAC member.

Products:
- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings
The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:
- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a TAC Meeting Schedule that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
EXHIBIT A
Scope of Work

- Prepare a TAC Meeting Agenda and TAC Meeting Back-up Materials for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare TAC Meeting Summaries that include any recommended resolutions of major TAC issues.

Products:
- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

IV. TECHNICAL TASKS

TASK 2: FIELD TEST PLANNING AND PREPARATION
The goals of this task are to (1) finalize commitment of two restaurant field host sites, (2) develop engineering specification for integrated system components and controls based on site characteristics, (3) specify and procure the field data acquisition systems for fault detection and diagnosis and independent measurement and verification (M&V), and (4) prepare the GHP prototypes for field testing and ship to host sites.

The Recipient shall:
- Finalize selection of two restaurant host sites, following interviews and site inspections.
- In conjunction with the independent M&V contractor, develop a data acquisition specification to meet the parallel goals of M&V of energy savings and other benefits and prototype fault detection and diagnosis.
- Using site characteristics and performance data from prior low-cost gas heat pump field and laboratory studies, develop engineering specification for the integrated system, including indirect storage tank, hydronic cooling coil, conventional backup gas water heater, and system controls. Solicit past utility bills from host sites to support analysis. Prepare and issue an Integrated Low-Cost Gas Heat Pump for Commercial Hot Water and Air-Conditioning System Design, including site characteristics, system performance data and engineering specifications for the integrated system, and annual energy consumption for each host site to support design analysis.
- Prepare and issue a summary of the field test plan in the Field Demonstration Execution and Monitoring Plan including data acquisition specification and integrated system design.
- Procure data acquisition hardware, package, test, and prepare for shipment to host sites.
- Prepare an end user and installation contractor survey instrument for pre/post prototype installation.
- Direct subcontractors to build two (2) low-cost gas heat pump prototypes GE, conduct field-worthiness with limited laboratory testing to verify performance and prepare for shipment to host sites.
EXHIBIT A
Scope of Work

Products:
- Integrated Low-Cost Gas Heat Pump for Commercial Hot Water and Air-Conditioning System Design
- Field Demonstration Execution and Monitoring Plan (draft and final)

TASK 3: PROTOTYPE FIELD DEMONSTRATION
The goals of this task are to (1) acquire, install and commission field data acquisition systems at the host sites, (2) perform baseline monitoring of the site water heating and A/C equipment, (3) ship low-cost gas heat pump prototypes to host sites and install as integrated system, (4) monitor prototypes for 12 months including hardware troubleshooting as needed, and (5) prepare datasets for analysis and review.

The Recipient shall:
- With the installation contractor, install data acquisition systems at the two restaurant sites. Commission data acquisition system for monitoring of baseline water heater and A/C equipment for a period of at least four months, encompassing a substantial portion of the cooling season.
- Collect and summarize data during baseline monitoring phase, following the Field Demonstration Execution and Monitoring Plan from Task 2, collect the pre-installation survey responses from end users and installation contractors, and include all data and responses in the Baseline Field Demonstration Monitoring Report.
- Ship the two gas heat pump prototypes to restaurant host sites. Install prototypes on-site, following inspection of prototypes with repairs as needed. Install the balance of the integrated system (e.g. indirect storage tank). Modify site instrumentation as needed and shift to prototype monitoring phase.
- Commission integrated system and test fault detection and diagnostic system. Initiate prototype monitoring period, collecting data for 12 months. Troubleshoot system remotely and, on an as-needed basis, perform site repairs to prototype and/or data acquisition hardware.
- Halfway through the prototype monitoring period, prepare CPR Report #1 in accordance with subtask 1.3 (CPR Meetings) and include preliminary results from the prototype monitoring.
- Participate and prepare CBR report #1.
- De-commission the integrated systems and associated equipment and ship the equipment back to the manufacturer for teardown analysis.
- Set up second baseline monitoring for the site water heating with the high efficiency water heaters and original A/C equipment and monitor energy usage for up to 3 months. Collect and summarize data during second baseline monitoring phase to compare to baseline and prototype energy data.
- Summarize data collected and survey results in Low-Cost Gas Heat Pump Field Demonstration Monitoring Report, to include a review of system performance, reliability, end user satisfaction, contractor feedback, and a discussion whether the ratepayer benefits identified in Section II. C were achieved.

Products:
- Baseline Field Demonstration Monitoring Report (draft and final)
- CPR Report #1
- Low-Cost Gas Heat Pump Field Demonstration Monitoring Report (draft and final)
EXHIBIT A
Scope of Work

TASK 4: DATA ANALYSIS AND MODELING
The goals of this task are to (1) use field and laboratory results, in conjunction with data from previous and complementary efforts, to extrapolate results to estimate statewide impact potential for energy, water, emissions, and operating cost savings, (2) develop a simplified, user-friendly model of the low-cost gas heat pump system for integration with existing tools, including design guides and life-cycle/energy cost calculators, (3) develop a white paper explaining how the low-cost gas heat pump could be a solution for Zero Net Energy Food Service, and (4) survey codes and standards, including building energy efficiency standards, relevant to the integrated system.

The Recipient shall:
• Using data gathered from Task 3 and from prior gas heat pump studies, extrapolate results from the casual dining sites to other restaurant types, light commercial facilities, and California climate zones. Aggregate data to estimate statewide potential for energy and water savings, GHG and criteria air pollutant emission reductions, and operating costs.
• Work with subcontractor to develop a simplified model of the low-cost gas heat pump system for commercial water heating and A/C for incorporation into a water heater design guide and, with prior data analysis, develop a life-cycle/energy cost calculator. Issue a Water Heating Design Guide for commercial food service and develop an Integrated Gas Heat Pump Life-Cycle Cost Calculator.
• Work with subcontractor using the statewide impact and cost-effectiveness analysis, develop a white paper on gas heat pump technology and its potential for use in Zero Net Energy Food Service facilities, publish Gas Heat Pumps in Zero Net Energy Food Service White Paper through an appropriate venue (e.g. ASHRAE).
• Work with subcontractor to perform a codes and standards impact analysis on the integrated low-cost gas heat pump system, as deployed in light commercial facilities with a focus on restaurants, including an in-depth review of California building energy efficiency code requirements. Issue a Codes and Standards Impact Analysis to discuss results of review and requirements.
• Prepare CPR Report #2 in accordance with subtask 1.3 (CPR Meetings).
• Participate in CPR meeting #2.

Products:
• Water Heating Design Guide
• Integrated Gas Heat Pump Life-Cycle Cost Calculator
• Gas Heat Pumps in Zero Net Energy Food Service White Paper
• Codes and Standards Impact Analysis (draft and final)
• CPR Report #2

TASK 5: MARKET IMPACT AND OUTREACH
The goals of this task are to (1) survey and quantify market barriers to broad low-cost gas heat pump adoption in California, including input from business owners, installation contractors, and distributors, (2) educate prospective “early adopter” business owners and other affected stakeholders through a series of workshops to introduce the low-cost gas heat pump technology and summarize project findings, and (3) develop educational content and materials for contractors and affected stakeholders.
EXHIBIT A
Scope of Work

The Recipient shall:

- With input from CAM, the manufacturing partners and subcontractors, develop business owner, distributor, and contractor surveys to develop a better understanding of barriers to gas heat pump adoption in California.
- Work with project partners to host two (2) public workshops, with one hosted at the Southern California Gas Energy Resource Center facility and another hosted by subcontractor inviting installation contractors, code officials, restaurant owners, and other interested parties to learn about the low-cost gas heat pump technology, review project results, and solicit feedback on this new technology. Prepare *Workshop Presentation and Written Materials* for public use and make available online.
- Prepare and publish *Installation Contractor Educational and Training Materials*, prepared in digital form and published online for general use.

Products:
- Market Impact Analysis of Low-Cost Gas Heat Pumps in California (draft and final)
- Workshop Presentation and Written Materials (draft and final)
- Installation Contractor Educational and Training Materials

**TASK 6: EVALUATION OF PROJECT BENEFITS**
The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
  - For Product Development Projects and Project Demonstrations:
    - Published documents, including date, title, and periodical name.
    - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
    - Greenhouse gas and criteria emissions reductions.
    - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
    - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
EXHIBIT A
Scope of Work

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

  - **Additional Information for Product Development Projects:**
    - Outcome of product development efforts, such copyrights and license agreements.
    - Units sold or projected to be sold in California and outside of California.
    - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
    - Investment dollars/follow-on private funding as a result of Energy Commission funding.
    - Patent numbers and applications, along with dates and brief descriptions.

  - **Additional Information for Product Demonstrations:**
    - Outcome of demonstrations and status of technology.
    - Number of similar installations.
    - Jobs created/retained as a result of the Agreement.

  - **For Information/Tools and Other Research Studies:**
    - Outcome of project.
    - Published documents, including date, title, and periodical name.
    - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
    - The number of website downloads.
    - An estimate of how the project information has affected energy use and cost, or has resulted in other non-energy benefits.
    - An estimate of energy and non-energy benefits.
    - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
    - A discussion of project product downloads from websites, and publications in technical journals.
    - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

**Products:**
- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire
EXHIBIT A
Scope of Work

TASK 7: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:

- Prepare an Initial Fact Sheet at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a Final Project Fact Sheet at the project’s conclusion that discusses results. Use the format provided by the CAM.
- Prepare a Technology/Knowledge Transfer Plan that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop Presentation Materials for an Energy Commission-sponsored conference/workshop(s) on the project.
- Provide at least (6) six High Quality Digital Photographs (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a Technology/Knowledge Transfer Report on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.
RESOLUTION NO: 17-0125-9a

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: GAS TECHNOLOGY INSTITUTE

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the Energy Commission approves Agreement PIR-16-001 from GFO-16-502 with Institute of Gas Technology dba Gas Technology Institute (GTI) for a $864,294 grant to fund the demonstration of an advanced gas fired heat pump for commercial hot water and space cooling at two restaurants in the Los Angeles Basin. This technology uses an integrated system for hot water and supplemental air conditioning and could reduce natural gas use for water heating and deliver free cooling to offset air conditioning needs of the restaurants; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on January 25, 2017

AYE: [List of Commissioners]
NAY: [List of Commissioners]
ABSENT: [List of Commissioners]
ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat