



GRANT REQUEST FORM (GRF)

A) New Agreement # PIR-19-004

B) Division	Agreement Manager:	MS-	Phone
ERDD	Kevin Mori	51	916-327-1475

C) Recipient's Legal Name	Federal ID Number
Institute of Gas Technology dba Gas Technology Institute	36-2170137

D) Title of Project
Demonstration of Water Heating with Brewing/Distilling Waste Heat

E) Term and Amount

Start Date	End Date	Amount
6/15/2020	3/29/2024	\$ 1,410,566

F) Business Meeting Information

ARFVTP agreements \$75K and under delegated to Executive Director
 Proposed Business Meeting Date 5/13/2020 Consent Discussion
 Business Meeting Presenter Kevin Mori Time Needed: 5 minutes
 Please select one list serve.

Agenda Item Subject and Description:

INSTITUTE OF GAS TECHNOLOGY dba GAS TECHNOLOGY INSTITUTE. Proposed resolution approving Agreement PIR-19-004 with Gas Technology Institute (GTI) for a \$1,410,566 grant to demonstrate a novel technology combining low cost heat exchangers with automated heat extraction to recover waste-heat for heating water at two industrial facilities. The project will be demonstrated at two breweries and will reduce natural gas use and reduce air emissions.

G) 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:

a) Agreement **IS** exempt.

Statutory Exemption. List PRC and/or CCR section number:

Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, §15301; Cal. Code Regs., tit 14, §15306

Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: Cal. Code Regs., tit. 14, sect. 15301 provides that projects which consist of the operation repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of use beyond that existing at the time of the lead



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agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act. This project will involve the demonstration and installation of heat exchanges on the exhausts of brewery kettles along with an automated heat extraction system that includes sensors and software, none of which will require any modifications to the existing building. Therefore, this project will have no significant impact on the environment and falls within section 15301.

Cal. Code Regs., tit. 14, sect. 15306 provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of the California Environmental Quality Act. The majority of the project will be data collection and software development and analysis for the automated heat extraction system. Therefore, this project will have no significant impact on the environment and falls within section 15306.

b) Agreement **IS NOT** exempt. (consult with the legal office to determine next steps)

Check all that apply

- Initial Study
- Negative Declaration
- Mitigated Negative Declaration
- Environmental Impact Report
- Statement of Overriding Considerations

H) List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)

Legal Company Name:	Budget
TBD - Installation Contractor	\$ 95,000
To Be Determined	\$ 90,000
Bedrosian & Associates	\$ 40,000
Wilson Engineering Technologies	\$ 75,000
Tetra Tech, Inc.	\$ 75,506
Tower Brewing	\$ 45,000 (match)
Yolo Brewing Company	\$ 45,000 (match)

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

Legal Company Name:

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
NG Subaccount, PIERDD	18-19	501.001M	\$1,410,566

R&D Program Area: EERO: IAW

TOTAL: \$ 1,410,566

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:



GRANT REQUEST FORM (GRF)

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Kate Jauridez (Kaiser)
 Address: 1700 S Mount Prospect Rd
 City, State, Zip: Des Plaines, IL
 60018-1804
 Phone: 847-768-0905
 E-Mail: Kate.Jauridez@gastechnology.org

2. Recipient's Project Manager

Name: David Rue
 Address: 1700 S Mount Prospect Rd
 City, State, Zip: Des Plaines, IL
 60018-1804
 Phone: 847-768-0508
 E-Mail: david.rue@gastechnology.org

L) Selection Process Used

Competitive Solicitation Solicitation #: GFO-19-503
 First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

- | | | | | |
|---|-------------------------------------|-----|-------------------------------------|----------|
| 1. Exhibit A, Scope of Work | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> | Attached |
| 2. Exhibit B, Budget Detail | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> | Attached |
| 3. CEC 105, Questionnaire for Identifying Conflicts | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> | Attached |
| 4. Recipient Resolution | <input type="checkbox"/> | N/A | <input type="checkbox"/> | Attached |
| 5. CEQA Documentation | <input type="checkbox"/> | N/A | <input checked="" type="checkbox"/> | Attached |

Agreement Manager

Date

Office Manager

Date

Deputy Director

Date

Exhibit A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Contract Execution
3		Demonstration Test Plan
4	X	Design and Engineering of Waste-Heat Recovery Systems
5		Fabrication and Installation of Waste-Heat Recovery Systems
6		Baseline Testing without Waste-Heat Recovery
7		Demonstration Testing with Waste Heat Recovery
8	X	Performance Monitoring and Evaluation
9		Evaluation of Project Benefits
10		Technology/Knowledge Transfer Activities
11		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
HVAC	Heating Ventilation and Air Conditioning
M&V	Measurement and Verification
NOx	Nitrogen Oxides
TAC	Technical Advisory Committee
WHET	Waste Heat Effective Transfer

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the demonstration of a novel technology for recovering waste heat from industrial processes and to use the recovered heat to heat water for the facility's hot water system to reduce natural gas demand, while also lowering emissions.

¹ Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

Exhibit A

Scope of Work

B. Problem/ Solution Statement

Problem

Many industrial processes including breweries, distilleries, commercial cooking and drying operations, and chemical processing facilities produce low level waste heat that is lost to the atmosphere with the exhaust gas. Recovery of low-level waste heat for practical applications is possible but generally too expensive to be installed. Recovery of energy from high temperature exhaust gas streams is common and economical. Low-level heat under 400°F is generated in large amounts but with low energy content per cubic foot of exhaust gas. This makes heat recovery equipment, such as recuperators, too large and costly to be practical to fit into many facilities or to pay for themselves in energy savings.

The most practical means of recovering low-level waste heat are to preheat burner combustion air and use the waste heat to generate power. Preheating combustion air requires the installation of a gas-to-gas heat exchanger. These devices have very high surface areas, are large, and are costly. Preheated air to a burner does lead to a decrease in natural gas demand, but the higher burner inlet air temperature leads to a higher flame temperature and increased levels of NO_x emissions. These drawbacks make burner inlet air preheating impractical. Technologies such as thermo-electric generators can produce power from low-level waste heat without increase air emissions. The power generated can reduce facility power requirements but at a cost that is too high to be practical. The efficiency of power generation and the cost of this equipment is still too high to pay for itself with electricity savings.

Solution

Many industrial facilities have both low-level exhaust gas heat from natural gas combustion and a need for hot water. In these facilities (breweries, distilleries, commercial cooking and drying operations, agricultural drying plants, chemical plants, etc.) a simple process such as the Waste Heat Effective Transfer (WHET) can be economically employed. The WHET process consists of several key components. A heat exchange module made of a modified tubing such as fluted, flared, or spiraled copper tubing, is installed in the flue containing hot exhaust gas. The modified tubing, being deployed today in advanced HVAC systems, provides excellent heat transfer in minimum space and with minimum pressure drop. Water flows through the tubing, and the water flow rate is controlled by a controller receiving temperature data from the exhaust gas and water before and after the tubing. The controller is critical because many processes of interest are carried out batch-wise. Water flow rate must be regulated to avoid extracting too much heat from the exhaust gas and producing problems with condensation in the flue. Another component is a flow control loop with valves to mix the heated WHET product water with plant water in a water heater or a working process needing heated water. The WHET process is designed to be inexpensive, easy to install, and nearly invisible to the plant operator. Simple payback time will be under five years.

Exhibit A

Scope of Work

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Identify and overcome the operational and technical hurdles that may arise during a field-demonstration of the WHET waste-heat recovery technology; providing valuable insights which will guide decisions as the project team moves towards impending commercialization efforts
- Prove, via independent third-party monitoring and verification (M&V), the ability of the system to achieve the stated performance objectives, while operating under real-world conditions at an end-user facility
- Validate the ability of the WHET waste-heat recovery system to maintain robust and reliable operation throughout an extended performance monitoring period of at least 12 months
- Demonstrate the benefits of the WHET waste-heat recovery technology in terms of providing reduced natural gas use and costs without increasing emissions
- Disseminate the findings of this demonstration project and provide technology transfer to industrial and commercial markets in California in order to increase public awareness and adoption of the WHET waste-heat recovery technology, and reduce natural gas consumption
- Facilitate efforts to transition the WHET waste-heat recovery technology to a commercial product offering to be deployed in the California industrial and commercial market segments

Ratepayer Benefits: This Agreement will result in the ratepayer benefit of providing industrial users with a straightforward, cost-effective path towards reducing the use of natural gas. Industrial facility efficiency will be increased by accelerating public awareness, and by adoption of the emerging WHET waste-heat recovery technology for application to breweries, distilleries, commercial cooking, and other processes that generate low to high temperature exhaust gases. The WHET process has the potential, in many applications, to reduce natural gas demand by heat process water for multiple facility needs.

Technological Advancement and Breakthroughs: This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by validating the performance and cost benefits of the proposed emerging novel WHET waste-heat recovery technology. The advanced technology demonstrated under this project achieves high-performance with low cost by employing a mass-customization design approach in which predesigned modular WHET waste-heat recovery units are configured per site-specific load requirements as based upon design criteria generated by an exclusive model. This state-of-the-art approach allows for low-cost, customized WHET units to be fabricated per customer requirements, enabling peak efficiency and performance, and further reducing site-specific engineering and installation costs.

This project will demonstrate the benefits of the WHET waste-heat recovery technology in two micro-breweries (with two micro-distilleries as back-up sites), providing technological breakthrough, which ultimately fosters broad adoption of the technology to reduce natural gas demand in many industrial and commercial markets.

Exhibit A

Scope of Work

Agreement Objectives

This project goal is to demonstrate the benefits of the WHET waste-heat recovery technology in two micro-breweries (with two micro-distillery back-up sites), with waste heat repurposed to heat facility water. The technological breakthrough of this flexible, low-cost process will ultimately foster broad adoption of the technology to reduce natural gas demand in many industrial and commercial markets.

The objectives of this Agreement are to:

- Validate the ability of the technology to provide robust and reliable operation for industrial waste-heat recovery applications where waste heat is available and water heating is needed
- Achieve a 15 to 25% recovery of heat from the brew kettles or 60% of the available waste heat in the exhaust gases
- Provide sufficient operational flexibility to match real-time variations in facility operating load
- Demonstrate the cost-benefits of the WHET technology by achieving a payback period of less than five years in a techno-economic analysis from data at two demonstration sites
- Complete a technology transfer plan and production readiness plan
- Comply with local air quality management regulations, with no adverse impacts on NOx and carbon monoxide levels

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.

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.

Exhibit A Scope of Work

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:
 - **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.
- **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.
 - Visual Studio.NET (version 2008 and up). Recommend 2010.
 - C# Programming Language with Presentation (UI), Business Object and Data Layers.
 - SQL (Structured Query Language).
 - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
 - Microsoft SQL Reporting Services. Recommend 2008 R2.
 - XML (external interfaces).

Exhibit A Scope of Work

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;
- Technical products (subtask 1.1);
- Progress reports and invoices (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- 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*)

Exhibit A Scope of Work

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.

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.

Exhibit A Scope of Work

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.
 - "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

Exhibit A Scope of Work

- 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.

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
- Acceptance of Final Report Outline

Exhibit A Scope of Work

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.
 - 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*.

Exhibit A Scope of Work

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, 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:

- 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.
 - If different from the solicitation application, provide 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.

Exhibit A Scope of Work

- 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)*

Exhibit A Scope of Work

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*)

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.
- 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);

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- 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.
- 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.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.

Exhibit A Scope of Work

- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

Products:

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

Exhibit A Scope of Work

IV. TECHNICAL TASKS

TASK 2: Contract Execution

The goals of this task are to: (1) confirm the availability of the project demonstration sites; (2) confirm the availability of a M&V contractor; and (3) execute any agreements necessary to secure the demonstration sites and M&V contractor.

Subtask 2.1 Execution of a Contract with the Demonstration Site(s)

The Recipient shall:

- Reach agreement with the manager(s) of the selected demonstration sites and execute a *Demonstration Site Contract* (for each site), which outlines and confirms the project timeline, space reserved for the project, equipment installation, permit and insurance requirements, indemnity, and the Recipient's use of any removal or support staff.
- If a selected demonstration site becomes unavailable during the project term, negotiate with the back-up site, and work with the CAM to select a new site.

Products:

- Demonstration Site Contract

Subtask 2.2 Execution of a Contract with the Selected M&V Contractor

The Recipient shall:

- Execute a *Contract with the M&V Contractor* which secures the contractor's services during the project term and includes:
 - Confirmation that the contractor will follow M&V protocols and will prepare a detailed analytical report that verifies energy consumption and engineering calculations for energy and cost savings.
 - Confirmation of the selected contractor's ability to provide required hardware, software, and staff to conduct the required measurements during the project term.
- If the selected M&V contractor becomes unavailable during the project term, work with the CAM to select a new M&V contractor.

Products:

- Contract with the M&V Contractor

TASK 3: Demonstration Test Plan

The goal of this task is to prepare a detailed test plan to allow for field evaluation of the WHET waste-heat recovery system performance relative to the demonstration performance objectives.

The Recipient shall:

- Prepare a detailed draft *Demonstration Test Plan* consisting of: 1) drivers for the demonstration, 2) performance objectives, 3) the rationale for selection of the test conditions, 4) predicted technology performance based on the results of previous development work, 5) a test matrix showing the number of test conditions and replicated runs, 6) a description of the facilities, equipment, and instrumentation required for the

Exhibit A Scope of Work

system evaluation, 7) a description of the test procedures, and 8) a description of the data analysis procedures.

- The test plan will include the M&V details to be fulfilled by the independent third-party M&V contractor. These include: 1) project overview, 2) procedure to determine and verify savings, 3) overview of M&V activities, 4) baseline conditions, 5) measurements, 6) savings calculation, and 7) references.
- Evaluate the test plan with the project team, including technical advisory committee and M&V subcontractor, for appropriateness of instruments, parameters, operating conditions, duration of measurements, and procedures planned for comparing technical and economic performance.
- Prepare final *Demonstration Test Plan* incorporating feedback from the project team evaluation, and CAM comments.

Products:

- Demonstration Test Plan (draft and final)

TASK 4: Design and Engineering of Waste-Heat Recovery Systems

The goal of this task is to generate the demonstration site engineering package, procure ancillary equipment and instrumentation, and prepare the host sites for installation of the WHET waste-heat recovery system.

The Recipient shall:

- Evaluate facility water load demand, and exhaust gas temperature, flow rate profiles, prepare system specifications and design the WHET waste-heat recovery system
- Prepare *Site 1 Design Package* and *Site 2 Design Package* which includes:
 - Site layout drawings that indicate system integration with the existing host facility process water needs, the facility exhaust and the overall infrastructure. and utility connections and locations for installation of instrumentation in accordance with the Demonstration Test Plan.
 - A bill of materials identifying the ancillary equipment (pressure/flow regulators, valves, etc.) and materials (pipe, fittings, etc.) required for the installation
 - Specifications for the instrumentation in accordance with the Demonstration Test Plan.
 - Description of any other activities and/or resources required to decommission and remove pre-existing equipment and support installation of the WHET waste-heat recovery system.
- Provide for each site, a *Notification Letter on the Release of the Site Design Packages* for installation. The letter will include, but not be limited to, documentation of the completed site design packages, and will include a copy of the overall layout.
- Prepare *CPR Report #1* and participate in a CPR Meeting in accordance with subtask 1.3.

Exhibit A Scope of Work

Products:

- Site 1 Design Package (draft and final)
- Site 2 Design Package (draft and final)
- Notification Letter on Release of Site Design Packages
- CPR Report #1

TASK 5: Fabrication and Installation of Waste-Heat Recovery System

The goal of this task is to complete the installation of the WHET waste-heat recovery system and commission it for continued operation by the two demonstration host facilities.

The Recipient shall:

- Confirm approved building applications and permits for the installation of the WHET waste-heat recovery system at the host sites are in place.
- Procure the ancillary equipment (pressure/flow regulators, valves, etc.) and materials (pipe, fittings, etc.) required for the installation through California-based vendors.
- Procure the instrumentation required to satisfy Demonstration Test Plan through California-based vendors.
- Solicit bids from California-based equipment fabricators and establish agreement with a selected contractor to fabricate major components of the WHET waste-heat recovery systems.
- Fabricate major components of the WHET waste-heat recovery systems
- Prepare a *Notification Letter on Fabrication* of Major Components, which shall include, but not limited to a summary of the major components fabricated, building and other permits obtained and any issues in in the fabrication process, and lessons learned for each site.
- Solicit bids from California-based installation contractors and establish agreement with a selected contractor capable of fulfilling the WHET waste-heat recovery system installation efforts.
- Conduct two site visits (one per demonstration site) and meet with the installation contractor prior to beginning installation of equipment to coordinate and review the installation scope of work.
- Monitor the removal of any pre-existing equipment and supervise the installation of the WHET waste-heat recovery system and the ancillary equipment required per the installation specifications.
- Commission the WHET waste-heat recovery system for continued operation by the demonstration host facilities, ensuring the primary and ancillary components are operating properly within design specifications.
- Prepare a *Notification Letter on Installation and Commissioning*, which will include, but not be limited to, a summary of the installation and commissioning work done in this task, any issues encountered, lessons learned and a confirmation the installation has been successfully completed for each site.

Products:

- Notification Letter on Fabrication of Major Components
- Notification Letter on Installation and Commissioning

Exhibit A Scope of Work

TASK 6: Baseline Testing without Waste-Heat Recovery

The goal of this task is to evaluate the baseline system performance of the two demonstration sites regarding natural gas use without waste-heat recovery.

The Recipient shall:

- Gather and analyze data on the performance of the two demonstration sites, without waste heat recovery, in accordance with the Demonstration Test Plan.
- Complete independent third-party testing by the selected M&V subcontractor in accordance with the M&V aspects of the Demonstration Test Plan.
- Prepare a *Baseline Performance Report*, which shall include, but not limited to, a summary of at least three months of baseline energy measurement results of each site and updated projected impacts of the WHET waste-heat recovery system.

Products:

- Baseline Performance Report (draft and final)

TASK 7: Demonstration Testing with Waste-Heat Recovery

The goal of this task is to evaluate the system performance of the WHET waste-heat recovery system over an extended monitoring period at the two demonstration host facilities, to gather data and information on the system performance.

The Recipient shall:

- Gather and analyze data on the performance of the WHET waste-heat recovery system as installed at the two demonstration host facilities in accordance with the Demonstration Test Plan.
- Evaluate the system performance and consider any possible improvements in performance or installation engineering that would be of benefit in future deployments.
- Provide field service and support for the WHET waste-heat recovery system to ensure satisfactory operation throughout the field demonstration period.
- *Prepare a System Demonstration Test Report*, which shall include, but not be limited to, a summary of the testing results from each demonstration site, discussion on any issues or barriers during the demonstration and how they were overcome, and discussion on lessons learned.

Products:

- System Demonstration Test Report (draft and final)

TASK 8: Performance Monitoring, Evaluation, and Reporting

The goal of this task is to independently evaluate the system performance of the WHET waste-heat recovery system in accordance with the M&V aspects of the Demonstration Test Plan.

The Recipient shall:

- Gather and analyze data on the performance of the WHET waste-heat recovery system as installed at the two demonstration host facilities over an extended monitoring period

Exhibit A Scope of Work

(minimum of nine months) in accordance with the M&V aspects of the Demonstration test Plan

- Complete independent third-party testing by the selected M&V contractor in accordance with the M&V aspects of the Demonstration Test Plan
- Provide field service and support for the WHET waste-heat recovery system to ensure satisfactory operation throughout the M&V period
- Prepare a *Project M&V Report*, which shall include, but not limited to a summary of the parameters and approach for the M&V, a discussion of any barriers during the setup and operation of the M&V, summary of the final results of the demonstration and whether the goals and objectives and target payback of less than five years was achieved, and a discussion of next steps for commercialization and potential future uses and markets for the WHET waste-heat recovery system.
- Prepare *CPR Report #2* and participate in a CPR Meeting in accordance with subtask 1.3.

Products:

- Project M&V Report (draft and final)
- CPR Report #2

TASK 9: 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:

Exhibit A Scope of Work

- 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.
- 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 have 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.

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.
- 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

TASK 10: 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.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- 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.

Exhibit A Scope of Work

- 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)

TASK 11: Production Readiness Plan

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
 - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
 - The estimated cost of production.
 - The expected investment threshold needed to launch the commercial product.
 - An implementation plan to ramp up to full production.
 - The outcome of product development efforts, such as copyrights and license agreements.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: INSTITUTE OF GAS TECHNOLOGY DBA GAS TECHNOLOGY INSTITUTE

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

RESOLVED, that the CEC approves Agreement PIR-19-004 with Gas Technology Institute (GTI) for a \$1,410,566 grant to demonstrate a novel technology combining low cost heat exchangers with automated heat extraction to recover waste-heat for heating water at two industrial facilities. The project will be demonstrated at two breweries and will reduce natural gas use and reduce air emissions; and

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

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 CEC held on May 13, 2020.

AYE:

NAY:

ABSENT:

ABSTAIN:

Cody Goldthrite
Secretariat