



**CALIFORNIA  
ENERGY COMMISSION**



**California Energy Commission  
November 13, 2024 Business Meeting  
Backup Materials for Renewable Technology Developments Inc.**

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution
2. Grant Request Form
3. Scope of Work

**[PROPOSED]**

**RESOLUTION NO: 24-1113-06b**

**STATE OF CALIFORNIA**

**STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION**

**RESOLUTION: Renewable Technology Developments Inc.**

**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 IND-24-004 with Renewable Technology Developments Inc. for a \$4,504,284.00 grant. This agreement will fund the planning, engineering, permitting and installation of a steam generating heat pump and demonstrate electrification of an industrial laundry facility in Patterson, replacing packet boilers and reducing greenhouse gas emissions and operating costs; and

**FURTHER BE IT RESOLVED**, that the Executive Director or their designee shall execute the same on behalf of the CEC.

**CERTIFICATION**

The undersigned Secretariat to the CEC 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 November 13, 2024.

AYE:

NAY:

ABSENT:

ABSTAIN:

Dated:

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Kristine Banaag  
Secretariat



## GRANT REQUEST FORM (GRF)

### A. New Agreement Number

**IMPORTANT:** New Agreement # to be completed by Contracts, Grants, and Loans Office.

**New Agreement Number:** IND-24-004

### B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Colin Lee
3. MS-:None
4. Phone Number: 279-226-1011

### C. Recipient's Information

1. Recipient's Legal Name: Renewable Technology Developments Inc
2. Federal ID Number: 27-2131158

### D. Title of Project

Title of project: Steam Generating Heat Pump at Industrial Laundry in Patterson

### E. Term and Amount

1. Start Date: 12/16/2024
2. End Date: 3/30/2028
3. Amount: \$4,504,284.00

### F. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 11/13/2024 .
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Patricia DeLaTorre
5. Time Needed for Business Meeting: 5 minutes.
6. The email subscription topic is: INDIGO Program

#### **Agenda Item Subject and Description:**

Renewable Technology Developments Inc

Proposed resolution approving agreement IND-24-004 with Renewable Technology Developments Inc. for a \$4,504,284.00 grant and adopting staff's recommendation that this action is exempt from CEQA. This Agreement will fund the planning, engineering, permitting and installation of a steam generating heat pump and the necessary balance of the plant. This project will demonstrate the electrification of an industrial laundry facility located in Patterson, Stanislaus County, replacing packet boilers with a steam generating heat pump, resulting in reduced greenhouse gas emissions and operating costs. (INDIGO funding) Contact: Patricia DeLaTorre

### G. California Environmental Quality Act (CEQA) Compliance

#### **1. Is Agreement considered a "Project" under CEQA?**

Yes

If yes, skip to question 2.



If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a "Project":

**2. If Agreement is considered a "Project" under CEQA answer the following questions.**

a) Agreement **IS** exempt?

Yes

Statutory Exemption?

No

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

If yes, list CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

CCR section number: Cal. Code Regs., tit. 14, § 15301 ;

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

No

If yes, explain reason why Agreement is exempt under the above section. If no, enter "Not applicable" and go to the next section.

Cal. Code Regs., tit. 14, sect. 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alternations of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of existing or former use at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act (CEQA).

This project falls under categorical exemption 15301 because it will retrofit the existing facility by converting existing gas-fired dryers to electricity, reducing both GHG and criteria air pollutant emissions, no floor area will be added to the existing structure, project will not result in any substantial additional environmental risks.

This project does not involve impacts on any particularly sensitive environment; does not involve any cumulative impacts of successive projects of the same type in the same place that might be considered significant; does not involve unusual circumstances that might have a significant effect on the environment; will not result in damage to scenic resources within a highway officially designated as a state scenic highway; the project site is not included on any list compiled pursuant to Government Code section 65962.5; and the project will not cause a substantial adverse change in the significance of a historical resource. Therefore, none of the exceptions to categorical exemptions listed in CEQA Guidelines section 15300.2



apply to this project, and this project will not have a significant effect on the environment.

b) Agreement **IS NOT** exempt.

**IMPORTANT:** consult with the legal office to determine next steps.

No

If yes, answer yes or no to all that applies. If no, list all as “no” and “None” as “yes”.

Additional Documents	Applies
Initial Study	No
Negative Declaration	No
Mitigated Negative Declaration	No
Environmental Impact Report	No
Statement of Overriding Considerations	No
None	Yes

**H. Is this project considered “Infrastructure”?**

No

**I. Subcontractors**

List all Subcontractors listed in the Budget (s) (major and minor). Insert additional rows if needed. If no subcontractors to report, enter “No subcontractors to report” and “0” to funds.

**Delete** any unused rows from the table.

Subcontractor Legal Company Name	CEC Funds	Match Funds
No subcontractors to report	\$	\$

**J. Vendors and Sellers for Equipment and Materials/Miscellaneous**

List all Vendors and Sellers listed in Budget(s) for Equipment and Materials/Miscellaneous. Insert additional rows if needed. If no vendors or sellers to report, enter “No vendors or sellers to report” and “0” to funds. **Delete** any unused rows from the table.

Vendor/Seller Legal Company Name	CEC Funds	Match Funds
Dos Rios Investments Inc	\$136,000	\$0
The Regents of the University of California, Merced	\$143,000	\$0
Simple Management Solutions, LLC	\$85,000	\$25,000
Sustainable Process Heat	\$920,888	\$0
Lavatec Inc	\$611,433	\$82,147
Dos Rios Investments Inc	\$205,425	\$67,875
Sun Light & Power	\$240,750	\$80,250



TBD-Heat reclaim solution	\$261,374	\$0
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### K. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter "No key partners to report." **Delete** any unused rows from the table.

Key Partner Legal Company Name
No key partners to report

### L. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter "N/A" for "Not Applicable" and "0" to Amount. **Delete** any unused rows from the table.

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
GGRF	2022	303.203	\$ 4,504,284

**TOTAL Amount:** \$ 4,504,284

R&D Program Area: ICMB: IAW

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

### M. Recipient's Contact Information

#### 1. Recipient's Administrator/Officer

Name: Peter Le Lievre

Address: 1001 Bridgeway # 453

City, State, Zip: Sausalito, CA 94965-2104

Phone: 650 521 6872

E-Mail: peter@peterlelievre.com

#### 3. Recipient's Project Manager

Name: Peter Le Lievre

Address: 1001 Bridgeway # 453

City, State, Zip: Sausalito, CA 94965-2104

Phone: 650 521 6872

E-Mail: peter@peterlelievre.com

### N. Selection Process Used

There are three types of selection process. List the one used for this GRF.



Selection Process	Additional Information
Competitive Solicitation #	GFO-23-313
First Come First Served Solicitation #	Not applicable
Other	Not applicable

**O. Attached Items**

1. List all items that should be attached to this GRF by entering “Yes” or “No”.

Item Number	Item Name	Attached
1	Exhibit A, Scope of Work/Schedule	Yes
2	Exhibit B, Budget Detail	Yes
3	CEC 105, Questionnaire for Identifying Conflicts	Yes
4	Recipient Resolution	No
5	Awardee CEQA Documentation	No

**Approved By**

Individuals who approve this form must enter their full name and approval date in the MS Word version.

**Agreement Manager:** Colin Lee

**Approval Date:** 10/2/2024

**Branch Manager:** Cody Taylor

**Approval Date:** 10/4/2024

**Director:** Delegated to Branch Manager

**Approval Date:** 10/4/2024

**Exhibit A**  
**Scope of Work**  
**Renewable Technology Developments Inc**

**I. TASK ACRONYM/TERM LISTS**

**A. Task List**

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2		Baseline test site M&V and MATLAB Model
3		Phase 1 Iterative SGHP modeling and design
4	X	Phase 1 System Engineering, Documentation and Permitting
5		Phase 1 Procurement and Construction
6	X	Phase 1 Operation, M&V and Optimization.
7		Phase 2 BOP Modeling and Design
8		Phase 2 Procurement and Construction
9		Phase 2 Operation, M&V
10		Evaluation of Project Benefits
11		Technology/Knowledge Transfer Activities

**B. Acronym/Term List**

Acronym/Term	Meaning
°C	Degrees Celsius
°F	Degrees Fahrenheit
ASME	American Society of Mechanical Engineers
BMS	Building Management System
BOP	Balance of Plant
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CBO	Community-Based Organizations
CEC	California Energy Commission
CO <sub>2</sub>	Carbon Dioxide
CPR	Critical Project Review
CPUC	California Public Utilities Commission
EPIC	Electric Program Investment
exergy	The maximum useful work possible during a process that brings the system into equilibrium with a heat source.
GHG	Greenhouse Gas
INDIGO	Industrial Decarbonization and Improvement of Grid Operations
IPMVP	International Performance Measurement & Verification Protocol
kW	Kilowatts
kW(th)	Kilowatts thermal
kWh	Kilowatt hour
kWh(e)	Kilowatt hour electric
M&V	Measurement and Verification

<sup>1</sup> 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**  
**Renewable Technology Developments Inc**

Acronym/Term	Meaning
MATLAB	Multi-paradigm programming language and numeric computing environment Transient System Simulation Tool
MS	Microsoft
MT	Metric tons
NFPA	National Fire Protection Association
P&ID	Piping and Instrumentation Diagram
PE	Professional Engineer
PV	Photovoltaic
SGHP	Steam Generating Heat Pump
sq ft	Square feet
SQL	Structured Query Language
TAC	Technical Advisory Committee
XML	External interfaces

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

**A. Purpose of Agreement**

The purpose of this Agreement is to fund the planning, engineering, permitting, installation, and measurement & verification (M&V) of a steam generating heat pump (SGHP) and necessary balance of plant (BOP).

**B. Problem/ Solution Statement**

**Problem**

Electrically driven heat pumps offer an economic alternative for the provision of heat in commercial and light industrial settings. However, to date, electrically driven heat pumps rated for temperatures above 100°C (212°F) are not yet widely available in the US due to the higher pressures and temperatures needed within the equipment. This limitation, combined with the low cost of natural gas has meant that steel tube, water jacket boilers remain the dominant source of process heat in California. Consequently, commercial and light industrial sectors have been slow to transition to carbon-free alternatives.

**Solution**

New high-temperature heat pumps are emerging which can supply much higher temperatures at higher efficiencies. The Recipient aims to design, install and optimize the performance of a new technology SGHP, at an industrial laundry site. The SGHP will be able to supply 1000 kilowatts thermal (kW(th)) of steam at up to 140°C (284°F). The pump is named a 'ThermBooster' and represents the state-of-the-art in high temperature electrically powered alternatives to gas-fired boilers. The recipient will also engineer and install a BOP to support the SGHP by improving thermal efficiency at the site and better gathering source heat for 'pumping' by the SGHP. The BOP will therefore reduce site thermal loads allowing the SGHP to more easily satisfy them and will also limit the impact of greater reliance on electrical grid supply in the absence of natural gas consumption.

# Exhibit A

## Scope of Work

### Renewable Technology Developments Inc

#### C. Goals and Objectives of the Agreement

##### Agreement Goals

The goals of this Agreement are to:

- Overcome technology risk presently associated with SGHP technology and BOP through demonstration
- Provide real-time operating data in order to evaluate efficiency and reliability
- Demonstrate electrification of the dryer equipment, displace fossil gas consumption of over 250,000 therms per annum and reduce GHG emissions by over 1200 metric tons of carbon dioxide (MTCO<sub>2</sub>).
- Iteratively optimize the technology in order to bring the SGHP closer to Technology Readiness Level 9 and widespread deployment on normal commercial terms.

Technological Advancement and Breakthroughs:<sup>2</sup> 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 aiding the transition of annual process heat production to electric alternatives. SGHP technology provides a major advancement in the ability of California to decarbonize the industrial sector and offers scope for a dramatic reduction in mandated Sulfur Oxides, Nitrogen Oxides and CO<sub>2</sub> emissions. And in sensitive urban areas, this technology will cause the improvement of Californian workplace occupational health and safety by hastening the removal of polluting and potentially harmful/explosive gas boiler plants.

#### 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)**. All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations. All technical tasks should include product(s). 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:**

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<sup>2</sup> 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.

# Exhibit A

## Scope of Work

### Renewable Technology Developments Inc

#### 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:

##### ○ **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 California Energy Commission's (CEC) 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.

The following describes the accepted formats for electronic data and documents provided to the CEC 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.
- 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, (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.

## Exhibit A Scope of Work Renewable Technology Developments Inc

- C# Programming Language with Presentation User Interface, 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).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the CEC'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, and other CEC staff relevant to the Agreement. The Recipient's Project Manager and any other individuals deemed necessary by the CAM, or the Project Manager shall participate in 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., Teams, Zoom), with approval of the CAM.

The Kick-off meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Terms and conditions of the Agreement;
  - Invoicing and auditing procedures;
  - Travel;
  - Equipment purchases;
  - Administrative and Technical products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Monthly Calls (subtask 1.5)
  - Quarterly Progress reports (subtask 1.6)
  - Final Report (subtask 1.7)
  - Match funds (subtask 1.8);
  - Permit documentation (subtask 1.9);
  - Subawards(subtask 1.10);
  - Technical Advisory Committee meetings (subtasks 1.11 and 1.12);
  - Agreement changes;
  - Performance Evaluations; and
  - Any other relevant topics.
- Provide *Kick-off Meeting Presentation* to include but not limited to:
    - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)

## Exhibit A

### Scope of Work

#### Renewable Technology Developments Inc

- Project schedule that identifies milestones
- List of potential risk factors and hurdles, and mitigation strategy
- Provide an *Updated Project Schedule*, *Match Funds Status Letter*, and *Permit Status Letter*, 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:**

- Kick-off Meeting Presentation
- Updated Project Schedule (*if applicable*)
- Match Funds Status Letter (subtask 1.7) (*if applicable*)
- Permit Status Letter (subtask 1.8) (*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 CEC 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 CEC 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 CEC.

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 may 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 CEC, 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 and submit 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.
- 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.

## Exhibit A Scope of Work Renewable Technology Developments Inc

- Send the Recipient a *CPR Agenda* with a list of expected CPR participants in advance of the CPR meeting. If applicable, the agenda may 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. A determination of unsatisfactory progress This may result in project delays, including a potential Stop Work Order, while the CEC determines whether the project should continue.
- 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)

### CAM Products:

- CPR Agenda(s)
- 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 CEC 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 of the following Agreement closeout items:
  - Disposition of any procured equipment.
  - The CEC'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.

**Exhibit A**  
**Scope of Work**  
**Renewable Technology Developments Inc**

- 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 copies of *All Final Products* organized by the tasks in the Agreement.

**Products:**

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Final Products

**MONTHLY CALLS, REPORTS AND INVOICES**

**Subtask 1.5 Monthly Calls**

The goal of this task is to have calls at least monthly between the CAM and Recipient to verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement on time and within budget.

The objectives of this task are to verbally summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, to verify match funds are being proportionally spent concurrently or in advance of CEC funds or are being spent in accordance with an approved Match Funding Spending Plan, to form the basis for determining whether invoices are consistent with work performed, and to answer any other questions from the CAM. Monthly calls might not be held on those months when a quarterly progress report is submitted, or the CAM determines that a monthly call is unnecessary.

**The CAM shall:**

- Schedule monthly calls.
- Provide questions to the Recipient prior to the monthly call.
- Provide call summary notes to Recipient of items discussed during call.

**The Recipient shall:**

- Review the questions provided by CAM prior to the monthly call
- Provide verbal answers to the CAM during the call.

**Product:**

- Email to CAM concurring with call summary notes.

**Subtask 1.6 Quarterly 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 *Quarterly Progress Report* to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of

## Exhibit A Scope of Work Renewable Technology Developments Inc

work for the reporting period, 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. Progress reports are due to the CAM the 10th day of each January, April, July, and October. The Quarterly Progress Report template can be found on the ECAMS Resources webpage available at: <https://www.energy.ca.gov/media/4691>

- Submit a monthly or quarterly *Invoice* on the invoice template(s) provided by the CAM.

### Recipient Products:

- Quarterly Progress Reports
- Invoices

### CAM Product:

- Invoice template

### Subtask 1.7 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. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC Style Manual provided by the CAM.

#### Subtask 1.7.1 Final Report Outline

##### The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Energy Commission Style Manual* provided by the CAM.

### Recipient Products:

- Final Report Outline (draft and final)

### CAM Products:

- Energy Commission Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

#### Subtask 1.7.2 Final Report

##### The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Energy Commission 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**)



## Exhibit A Scope of Work Renewable Technology Developments Inc

- 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)
- Submit a draft of the Executive Summary to the TAC for review and comment.
  - Develop and submit a *Summary of TAC Comments on Draft Final Report* received on the Executive Summary. For each comment received, the Recipient will identify in the summary the following:
    - Comments the Recipient proposes to incorporate.
    - Comments the Recipient does propose to incorporate and an explanation for why.
  - 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.
  - Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.
  - Submit the revised *Final Report* electronically with any Written Responses to Comments within 10 days of receipt of CAM's Written Comments on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

### Products:

- Summary of TAC Comments on Draft Final Report
- Draft Final Report
- Written Responses to Comments (*if applicable*)
- Final Report

### CAM Product:

- Written Comments on the Draft Final Report

## **MATCH FUNDS, PERMITS, AND SUBAWARDS**

### **Subtask 1.8 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. 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 application that led to the CEC awarding this Agreement and none have been identified at the time this Agreement starts, then

## Exhibit A

### Scope of Work

#### Renewable Technology Developments Inc

state this in the letter.

If match funds were a part of the application that led to the CEC 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.
- 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 1.9 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.

## Exhibit A

### Scope of Work

#### Renewable Technology Developments Inc

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 1.10 Subawards**

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

#### **The Recipient shall:**

- Manage and coordinate subrecipients activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subaward.
- Include any required Energy Commission flow-down provisions in each subaward, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subaward terms.
- If requested by the CAM, submit a draft of each *Subaward* required to conduct the work under this Agreement.
- If requested by the CAM, submit a final copy of each executed subaward.
- Notify and receive written approval from the CAM prior to adding any new subrecipient (see the terms regarding of subrecipient additions in the terms and conditions).

#### **Products:**

- Subawards (*if requested by the CAM*)

### **TECHNICAL ADVISORY COMMITTEE**

#### **Subtask 1.11 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:

## Exhibit A

### Scope of Work

#### Renewable Technology Developments Inc

- 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.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- 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, to the extent the TAC members feel is appropriate, 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 ensure a long-term perspective on decision-making and progress toward the project's strategic goals.

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 1.12.
- 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.

# Exhibit A

## Scope of Work

### Renewable Technology Developments Inc

#### Products:

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

#### Subtask 1.12 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.
- 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 ensure a long-term perspective on decision-making and progress toward the project's strategic goals.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

#### Products:

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

#### Subtask 1.13 Project Performance Metrics

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic

**Exhibit A**  
**Scope of Work**  
**Renewable Technology Developments Inc**

metrics that provide the most significant indicator of the research or technology's potential success.

**The Recipient shall:**

- Complete and submit the project performance metrics section of the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.
- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:
  - TAC comments the Recipient proposes to incorporate into the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
  - TAC comments the Recipient does not propose to incorporate with and explanation why.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the Recipient met each of the performance metrics in the *Final Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

**Products:**

- TAC Performance Metrics Summary
- Project Performance Metrics Results

# Exhibit A

## Scope of Work

### Renewable Technology Developments Inc

#### IV. TECHNICAL TASKS

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. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.

#### TASK 2: BASELINE SITE M&V and MATLAB MODEL

The goal of this task is to establish an understanding of baseline operations for the site. The recipient will measure existing thermal and electrical energy flows for process operations and establish baseline site exergy, operating costs, and an understanding of baseline greenhouse gas (GHG) emissions. The task will also establish a robust measurement and verification (M&V) plan to compare baseline operations to the impacts of the intended SGHP technology. A MATLAB model of the system will also be developed to assist with product development and application integration. MATLAB has been selected as the modeling tool due to its prevalence in industrial process modeling and management as well as the availability of engineering staff trained to program and use it.

The recipient will measure energy flows of existing boiler operations. This means measuring gas inputs and thermal outputs of the boilers as well condensate and effluent returns of washing machines and site wide equipment. These energy flows data are recorded offsite using digital monitoring equipment. Then, using International Performance Measurement & Verification Protocol (IPMVP) protocols, an hour-by-hour heat balance of the site is to be developed. This data allows the recipient to establish a Baseline site exergy from which later engineering and design modifications can be compared and input into later MATLAB modeling.

#### The Recipient shall:

- Develop a detailed *M&V Plan* based on IPMVP to accurately and precisely evaluate SGHP technology. The Measurement Boundary will be the whole facility (IPMVP Option C) site perimeter, and key site parameters to measure will be:
  - hourly grid kilowatt-hour (kWh) consumption
  - grid peak demand (volts x amps)
  - fossil gas consumption (therms)
  - amount of laundry/linens processed (pound)
  - process water consumed (gallon)
  - ambient conditions (air temperature/humidity)In addition, Option A (Retrofit Isolation) measurements will be taken within the site in preparation for the installation of the SGHP and include:
  - boiler steam flow and metering (mass flow/temperature)
  - process water metering (mass flow/temperature)
  - condensate return (mass flow/temperature)
  - washing machine effluent (mass flow/temperature)
  - process electricity consumption (major pumps, heaters etc.)
  - lost heat to ambient air (indoor air temperature/mass flow)
- Develop a detailed *Instrumentation and Data Acquisition Plan* to identify thermal and electrical monitoring equipment requirements and data handling needs to complete M&V. This will include a detailed plan on how to deal with any potential breaks in data.
- Install M&V instrumentation and commission at the Site.

## Exhibit A

### Scope of Work

#### Renewable Technology Developments Inc

- Operational staff will be interviewed before installation to gain a baseline understanding of their initial opinions and understanding of SGHP technology.
- Develop *Report on Initial Findings from Operator Interviews*.
- Prepare a *Data Acquisition and Validation Report* to ensure data is accurate and precise.
- Develop a robust hourly baseline by measuring energy flows of existing operations.
- Build a MATLAB model that accurately mimics M&V data under various operating conditions.
- Develop *MATLAB Model Results & Comparison to Baseline*
- Develop *Baseline Exergy Report* including, but not limited to:
  - Piping and Instrumentation Diagram (P&ID) of existing Site,
  - Specifications of relevant process assets needed to confirm baseline data,
  - Existing energy flows for process operations,
  - Site exergy, operating costs, and GHG emissions.
- Prepare reports and documentation.

#### **Products:**

- M&V Plan
- Instrumentation and Data Acquisition Plan
- Data Acquisition and Validation Report
- Report on Initial Findings from Operator Interviews
- MATLAB Model Results & Comparison to Baseline
- Baseline Site Exergy Report

#### **TASK 3: PHASE 1 ITERATIVE SGHP/BOP MODELING AND DESIGN**

The goal of this task is to take the baseline data from Task 2 and model the proposed SGHP and BOP design for the site. The model will estimate the site exergy impacts of the SGHP installation under various conditions, which will include providing washers with heated process water from the intermediate stage of the SGHP and steam for Ironers and general plant use from the upper SGHP stage. The modeling will include impacts of source heat from lower temperature sources (e.g. ambient air handler) compared to source heat of up to 55° C (130 °F) from condensate, waste heat, and solar streams. The model will incorporate external factors that may impact operational performance such as weather. The total system coefficient of performance will be modeled and optimized to assist with SGHP/BOP design and installation.

#### **The Recipient shall:**

- Develop an SGHP/BOP design model, coordinating with the technology provider to ensure the model is accurate and robust under all operating conditions.
- Add design to the MATLAB baseline model developed in Task 2 and evaluate site exergy effects with direct replacement of incumbent technology with SGHP.
- Evaluate alternative condensate return and steam supply points on existing boiler performance compared to a lower temperature supply.
- Evaluate the impacts of condensate return and steam supply points on SGHP performance compared to a low-temperature supply.
- Evaluate the impacts of external factors that may occur during normal system operation such as varying ambient temperature.
- Summarize findings as *MATLAB Model Results*
- Prepare *P&ID of SGHP/BOP Optimized Design*.



## Exhibit A

### Scope of Work

#### Renewable Technology Developments Inc

- Develop *Modeling Report* on design and estimated annual hourly exergy benefits, potential GHG reduction, cost, other operational benefits, and any potential utility bill impacts.

#### **Products:**

- MATLAB Model Results
- P&ID of SGHP/BOP Optimized Design
- Modeling Report

#### **TASK 4: PHASE 1 SYSTEM ENGINEERING, DOCUMENTATION & PERMITTING**

The goal of this task is to engineer and document the 1000 kW(th) SGHP/BOP design for construction. The design will be tailored to integrate with the existing site water and electrical grid connections and will be specifically focused on displacing natural gas consumption at the site.

For this task the recipient will initially conduct site assessment and planning. Recipient will perform a complete and thorough inspection of the existing boiler, controls and piping system. The recipient will then develop a risk assessment and develop a safety plan for the project. In particular, disruptions to ongoing site operation during SGHP work are to be minimized.

The recipient shall meet and coordinate with relevant community-based organizations (CBO's), technology providers, construction staff, site staff, and utilities. The Recipient will identify necessary infrastructure and permitting requirements and shall engineer the design to satisfy the ASME Boiler and Pressure Vessel Code as well as the California Electrical Code (NFPA 70) and coordinate with the SGHP and other suppliers to ensure that the proposed equipment complies with these codes. Whilst Phase 1 is aimed at installing the SGHP only, Task 4 will be mindful of the additional work planned in Phase 2 and Task 7 so that those later work packages (solar, battery, water and thermal efficiency measures) can be readily integrated into the Project.

The recipient will produce a Construction Package with all relevant documentation needed for permitting, general contractors and subcontractors to perform construction. Indicative pricing will be sought based on the documents and a preliminary budget planned. A budgetary GO/NOGO decision will be made based on proposed construction budgets and contingencies allowable in Task 5 (Construction).

#### **The Recipient shall:**

- Meet with CBO's affected by the project and integrate feedback
- Engineer, develop and document the SGHP/BOP proposed design to comply with the ASME Boiler and Pressure Vessel Code as well as NFPA 70 (California Electrical Code).
- Source and specify an equipment list.
- Develop and Agree to a Site Construction Plan with the Site Owner.
- Prepare *Phase 1 Construction Package* in preparation for Task 5 that includes the following:
  - Risk Assessment and Safety Plan
  - Mobilization Plan

## Exhibit A Scope of Work Renewable Technology Developments Inc

- Project Construction Gant Chart
- Professional Engineer (PE) Stamped Drawings
- Bill of Materials
- Permits
- Commissioning Plan
- Summary of CBO engagement and feedback integration description
- Meet/Liaise with SGHP Manufacturer to coordinate manufacture of SGHP to specification and code.
- Secure a Professional Engineer's stamped approval and all relevant Permits
- Secure, Commission and brief a general contractor for Task 5 work.
- Prepare the *Critical Project Report #1* and complete CPR review prior to Task 5 – Budget GO/NOGO→Task 5.

### Products:

- Phase 1 Construction Package
- Critical Project Report #1

### TASK 5: PHASE 1 PROCUREMENT AND CONSTRUCTION

The goal of this task is to procure, construct and commission the SGHP/BOP system at the Patterson site. The recipient shall work with the General Contractor and relevant trade subcontractors to prepare the site and install the plant and equipment documented in the Construction Package from Task 4. Site preparation will include foundational pad, electrical infrastructure, piping interconnects for steam and pressurized water outputs as well as condensate and source heat (hot water) inputs. Required buffer (unpressurized) and steam (pressurized) tanks will be installed. Digital controls will be interconnected to existing site operations such that new plant and equipment can be monitored and controlled alongside existing site plant and equipment.

The SGHP will be sourced and delivered to site in good time after import from Germany. The SGHP will then be inspected, installed and commissioned to produce primary steam and hot water for consumption in plant operations. SGHP operating parameters such as electricity demand, operating efficiency and startup-shutdown modes will be ready to be tested and measured in Task 6.

### The Recipient shall:

- Prepare Demonstration Site including staging area and temporary personnel accommodation/facilities.
- Procure the SGHP/BOP/M&V equipment list.
- Install foundations, piping channels, electrical cabinets and cable runs.
- Upgrade site electrical infrastructure to accept increased electrical load.
- Install new piping using materials that meet ASME B31.3 standards for process piping.
- Ensure proper sizing of pipes to accommodate required flow rates and pressures.
- Install new valves, fittings, and connections as per the approved design.
- Implement proper support and anchoring systems for piping, controls and valves.
- Conduct pressure tests on all new piping to ensure integrity and leak-free operation.
- Perform non-destructive testing on welds and critical connections.

# Exhibit A

## Scope of Work

### Renewable Technology Developments Inc

- Apply high-quality insulation to all hot piping, tanks and controls to improve energy efficiency.
- Install heat tracing systems where necessary to prevent freezing or maintain specific temperatures.
- Install new sensors, gauges, and control valves as required.
- Integrate new controls system with the existing boiler controls and building management system (BMS).
- Procure, import, deliver to site and install SGHP and remainder BOP/M&V.
- Complete and secure relevant inspections.
- Commission SGHP/BOP/M&V according to the Commissioning Plan.
- Develop *Report on SGHP Installed at Site*.
- Develop *Report on BOP Installed at Site*.
- Provide complete as-built drawings of the new piping and electrical system.
- Produce and deliver *Operation, Safety and Maintenance Manual* for SGHP.
- Adhere to all OSHA regulations and site-specific safety requirements throughout the project.

#### Products

- Report on SGHP installed at Site
- Report on BOP installed at the Site
- Operation, Safety and Maintenance Manual

#### TASK 6: PHASE 1 OPERATION, M&V AND OPTIMIZATION

The goal of this task is to operate the SGHP and iteratively ramp up performance to meet the nominal performance equivalent of the 100-horsepower natural gas-fired boiler it replaces. Electrical input power (nominal 229 KW) will be compared to the steam flow measured by the M&V system and performance calculated. Start-up and shutdown routines for the SGHP will be developed and tested as well as integration into the broader Site plant and equipment operating requirements. Optimization will be carried out on timing and turn-down procedures to mitigate peak electricity demands and preserve grid resilience. Source heat of up to 55°C (130°F) of unpressurized water will be tested to evaluate impacts as well as a range of other condensate/feedwater temperatures from nominal ambient to 100°C (212°F). Performance will be evaluated and compared to Industrial Decarbonization and Improvement of Grid Operations (INDIGO) calculator environmental and cost predictions. A go/no decision will then be made to proceed to Phase 2 based upon a net performance of at least 75% with INDIGO targets.

#### The Recipient shall:

- Brief and train local operators on SGHP operation and safety procedures. Validate new data acquired by SGHP operations under expected operating modes such as startup, normal operation, shutdown and emergency shutdown.
- Operate the SGHP to feed primary hot water and steam to Site operations for a minimum of 90 days.
- Analyze M&V data and compare performance to MATLAB model and baseline data.
- Iteratively attend to the whole of site operating parameters to achieve target exergy benefits.

## Exhibit A Scope of Work Renewable Technology Developments Inc

- Prepare *Report on the Impact of Operational Parameters* on exergy potential GHG reduction, cost, and other operational benefits as well as any potential utility bill impacts. Both quantitative and qualitative results will be reported.
- Examine that measured electrical → thermal COP of SGHP is within 30% of manufacturer specification (3.3) at nominal conditions for GO/NOGO→Phase 2 decision.
- Prepare the *Critical Project Report #2* describing performance for GO/NOGO in Phase 2 to meet at least 75% of INDIGO model predicted benefits.
- Develop *Optimized Exergy Report* including, but not limited to existing energy flows for process operations, site exergy, operating costs, and GHG emissions.

### Products:

- Report on the Impact of Operational Parameters
- M&V Data Summary
- Optimized Exergy Report
- Critical Project Report #2

### TASK 7: PHASE 2 BOP ENGINEERING DOCUMENTATION AND PERMITTING

Phase 1 provided the site with 1000 kW(th) of electrically heated process water and steam generating ability; however, dryers onsite remain gas powered and a second gas boiler is still required to meet consumption needs beyond 1000 kW(th). The goal of Phase 2 is therefore designed to displace the dryer and second boiler gas consumption and complete the laundry transition to zero natural gas consumption and subsequent zero site emissions. The recipient will achieve this goal by implementing steam repowering of the dryers (from gas) such that electrically generated heat is used to dry laundry instead. The recipient will also implement process efficiency improvements onsite to eliminate need for thermal energy beyond 1000kW(th). This goal will be implemented by reducing the amount of primary steam required primarily through substitution of steam by heated process water for washers. Steam is then only to be used for tempering. Overall water consumption will also be reduced by modifying wash cycles and recycling/treating hot effluent. Site renewable thermal and electrical generation will also be installed to expand solar supplied source heat and Photovoltaic (PV) supplied electricity with battery storage. The ultimate goal is to completely displace all site natural gas consumption and thus achieve the modelled INDIGO benefits proposed. This task therefore models, engineers and then designs all proposed BOP Phase 2 improvements to meet these goals. A Phase 2 construction package is then prepared for use in Task 8. A GO/NOGO→Task 8 decision is made based on budget estimates received from the general and sub-contractors.

### The Recipient shall:

- Engineer and design conversion of the existing laundry dryers from natural gas to steam.
- Engineer ironers to be fed steam from the SGHP.
- Engineer wastewater Shell/Tube source heat recovery system such that residual waste heat in effluent and wastewater is fully recovered.
- Design Air handlers to extract waste heat in the ambient factory air (especially from ironers).
- Model washer steam side arm heaters for process water tempering (not direct bubbling).
- Engineer and model expansion of existing 3850sq ft rooftop solar thermal field to > 7700 sq/ft. Engineer installation of elevated car park 50 Kilowatt (kW) Solar PV installation.
- Develop and model ~100kWh battery backup for grid supplementation and resilience.

## Exhibit A Scope of Work Renewable Technology Developments Inc

- Integrate and evaluate the proposed Phase 2 upgrade into the MATLAB model.
- Compile exergy benefit review of Phase 2 upgrade with go/no go decision based on >75% of target INDIGO benefits.
- Develop *Updated MATLAB Model Results & Source Code*.
- Develop *BOP Upgrade Design and Performance Report* including theoretical coefficients of performance for the SGHP and system.
- Complete P&ID of Phase 2 Upgrade.
- Source and complete the Phase 2 upgrade equipment list.
- Complete Construction Drawings.
- Secure PE signoff.
- Prepare *Phase 2 Construction Package* and documentation which includes the following:
  - P&ID of Phase 2
  - Phase 2 Construction Drawings
  - Phase 2 Commissioning Plan
- Secure budget estimates for construction and make GO/NOGO→Task 8.

### Products:

- Updated MATLAB Model Results & Source Code
- BOP Upgrade Design and Performance Report
- Phase 2 Construction Package

### TASK 8: PHASE 2 PROCUREMENT AND CONSTRUCTION

The goal of this task is to procure and construct the Phase 2 BOP upgrade at the demonstration Site. The recipient shall work with the General Contractor and relevant trade subcontractors to prepare the site and install the plant and equipment documented in the Construction Package from Task 7. The Recipient shall:

- Procure the Phase 2 BOP upgrade equipment list.
- Install required foundations, solar racking, connecting pipework and electrical equipment.
- Install and commission piping and controls such that Ironers be fed steam from the SGHP.
- Procure and install a wastewater Shell/Tube source heat recovery system such that residual waste heat in effluent and wastewater is fully recovered.
- Procure and install main hall air handlers to extract waste heat in the ambient factory air.
- Procure and install washer steam side arm heaters
- Install rooftop solar thermal field expansion field to total size of at least 7700sq ft
- Procure and install elevated car park 50 kW solar photovoltaic system with grid connection.
- Procure and install a ~100kWh(e) battery backup system and integrate into BMS.
- Secure PE signoff.
- Complete and secure relevant inspections.
- Commission BOP Upgrade according to Phase 2 Commissioning Plan and prepare *Report on Phase 2 BOP Installation and Commissioning* outlining the results.
- Review and provide *Updated Operation, Safety and Maintenance Manual*.

### Products:

- Report on Phase 2 BOP Installation and Commissioning
- Updated Operation, Safety and Maintenance Manual.

# Exhibit A

## Scope of Work

### Renewable Technology Developments Inc

#### TASK 9: PHASE 2 OPERATION, M&V

The goal of this task is to operate the SGHP with Phase 2 BOP upgrades and iteratively ramp up performance to meet the nominal Site productivity equivalent to BOTH displaced 100HP natural gas fired boilers. Start up and shutdown routines for the SGHP and connected equipment (ironers/dryers/washers) will be developed and tested. Black start (cold) procedures using solar thermal sources and buffer storage will be developed and tested. Optimization will be carried out on timing and turn down procedures to mitigate peak electricity demands and preserve grid resilience now with PV system and battery storage. Performance will be evaluated and compared to INDIGO calculated environmental and cost predictions.

#### The Recipient shall:

- Brief and train local operators on revised SGHP operation and safety procedures.
- Operate the SGHP for all Site operations for 90 days. Any difficulties in operation will be reported.
- Analyze M&V data and compare to MATLAB and baseline. Use International Energy Agency Task 53 Protocols for measurement of PV driven heat pump systems<sup>3</sup>.
- Iteratively attend to whole Site operating parameters to achieve target exergy, with benefits including, but not limited to system performance, cost benefits, GHG reduction, grid resilience and energy savings.
- Develop *Report on MATLAB Modeling Versus M&V Collected Operational Data*.
- Identify any unquantifiable benefits or disadvantages with the SGHP operation by interviewing Site operators. These results should be compared to the initial interview results conducted in Task 2. This will include an analysis of comparative 'practical' benefits/problems of SGHP relative to displaced gas fired boiler equipment.
- Develop *Report on Findings from Interviews with Operational Staff*.
- Develop *Final Exergy Report* including, but not limited to existing energy flows for process operations, site exergy, operating costs, and GHG emissions.
- Prepare a *Report to Assess Project Success Relative to INDIGO Project Benefits*.

#### Products:

- Report on MATLAB Modeling Versus M&V Collected Operational Data.
- M&V Data Summary
- Report on Findings from Interviews with Operational Staff
- Final Exergy Report
- Report to Assess Project Success Relative to INDIGO Project Benefits

#### TASK 10: EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

#### The Recipient shall:

- Complete the *Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.

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<sup>3</sup> <https://www.iea-shc.org/Data/Sites/1/publications/IEA-SHC-Task53-C1-1-Final-Report.pdf>

## Exhibit A Scope of Work Renewable Technology Developments Inc

- Complete the *Annual Survey* by December 1 of each year. The Annual Survey includes but is not limited to the following information:
  - AB 209 Requirements<sup>4</sup>
  - Technology scalability, and adoption by other industries
  - News media and publications
  - Technology Company growth
  - Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

### Products:

- Initial Project Benefits Questionnaire
- Annual Survey(s)
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

### TASK 11 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to ensure the learning that resulted from the demonstration(s) is captured and disseminated to the range of professions that will be responsible for future deployments of this technology or similar technologies.

### The Recipient shall:

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The Project Case Study Plan should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the project's development.

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<sup>4</sup> Assembly Bill 209, Chapter 251, Statutes of 20222, Section 25660.2

**Exhibit A**  
**Scope of Work**  
**Renewable Technology Developments Inc**

- Specific activities the Recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
- Presentations/webinars/training events to disseminate the results of the case study.
- Present the Draft Project Case Study Plan to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the draft *Project Case Study Plan*. This document will identify:
  - TAC comments the Recipient proposes to incorporate into the *Final Technology Transfer Plan*.
  - TAC comments the Recipient does not propose to incorporate and explanation why.
- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final *Project Case Study Plan* and develop and submit a *Project Case Study*.
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual symposium(s) sponsored by the CEC.
- 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.

**Products:**

- Project Case Study Plan (draft and final)
- Summary of TAC Comments
- Project Case Study (draft and final)
- High Quality Digital Photographs

**V. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.