



**California Energy Commission
August 09, 2023 Business Meeting
Backup Materials for Agenda Item No 12b:**

The Regents of the University of California, on behalf of the Los Angeles Campus

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

STATE OF CALIFORNIA
STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: The Regents of the University of California, on behalf of the Los Angeles Campus

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-23-004 with The Regents of the University of California, on behalf of the Los Angeles Campus for a \$2,992,909 grant to demonstrate a novel approach to monitor ground motion and impacts on gas pipeline integrity. The project will develop an integrated platform using remote and embedded sensing technologies and models to monitor, predict, and reduce the risk of natural hazard impacts to gas pipelines; 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 August 09, 2023.

AYE:
NAY:
ABSENT:
ABSTAIN:

Dated:

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: PIR-23-004

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Sean Anayah
3. MS-:43
4. Phone Number: (916) 931-5044

C. Recipient's Information

1. Recipient's Legal Name: The Regents of the University of California on behalf of the Los Angeles Campus
2. Federal ID Number: 95-6006143

D. Title of Project

Title of project: System Approach for Monitoring and Risk Assessment for Natural Force Damage to Gas Pipelines

E. Term and Amount

1. Start Date: 9/1/2023
2. End Date: 12/31/2026
3. Amount: \$2,992,909.00

F. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 8/9/2023
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Sean Anayah
5. Time Needed for Business Meeting: 5 minutes.
6. The email subscription topic is: NaturalGas (NG Research Program).

Agenda Item Subject and Description:

The Regents of the University of California, on behalf of the Los Angeles Campus.

Proposed resolution approving agreement PIR-23-004 with The Regents of the University of California, on behalf of the Los Angeles Campus for a \$2,992,909 grant to demonstrate a novel approach to monitor ground motion and impacts on gas pipeline integrity, and adopting staff's determination that this action is exempt from CEQA. The project will develop an integrated platform using remote and embedded sensing technologies and models to monitor, predict, and reduce the risk of natural hazard impacts to gas pipelines. (PIER NG funding) Contact: Sean Anayah

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":

Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because:

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 ; Cal. Code Regs., tit. 14, § 15306 ;

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.

California. Code Regs., tit 14, section 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 existing or former use, are categorically exempt from the provisions of the California Environmental Quality Act. This project will collect data using technologies that are divided into two groups: direct measurements (technologies measuring pipe strain) and indirect measurements (technologies measuring ground displacement). For this project, four sites have been identified. Multi-year satellite images will be collected at a site in Livermore that has been subjected to recent landslide movements. Two more sites are located at PG&E facilities where real-time ground motion sensors will be installed to measure ground movements in real-time. The last site is at UC Irvine, where controlled field calibration will evaluate measurement accuracy. These minor modifications will not result in expanding the capacity or use of the facility.

This project is also exempt under California Code Regs., tit 14, section 15306 which 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. This project will collect data within the field in real-time, for at least 12 months. Remote and embedded sensing approaches to data collection will facilitate monitoring of geohazard impacts under any natural hazard ground motion scenario (i.e., earthquake, landslide, subsidence, and liquefaction). The instruments will be accessed remotely to obtain the data recorded. With the data, a pipeline fragility (or capacity) model will then be employed to combine both direct and indirect measurements to provide a prediction of the gas pipeline probability of failure. Finally, the data processing algorithms and fragility model will be incorporated into a user-friendly, free, and open-source software package for gas pipeline operator decision-making. These activities will not result in a serious or major disturbance to an environmental resource.

For these reasons, the proposed work will not have any significant effect on the environment and falls under the exemptions in sections 15301 and 15306.

This proposed project does not involve impacts on any particularly sensitive environment; 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. 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
DNV GL USA, Inc.	\$ 501,600	\$ 171,284
The Regents of the University of California on behalf of the Irvine Campus	\$ 190,000	\$0
California Institute of Technology	\$ 45,000	\$0
University of Nevada, Reno	\$ 73,903	\$0
Paulsson Geophysical Services, Inc.	\$ 200,000	\$ 370,340
Pacific Gas and Electric Company	\$ 0	\$ 225,000

I. 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
No vendors to report	\$	\$

J. 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

K. 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
NG Subaccount, PIERDD	21-22	501.001	\$ 2,992,909

TOTAL Amount: \$ 2,992,909

R&D Program Area: ESRB: ETSI

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: 601 Program Continuous Appropriation

L. Recipient's Contact Information



1. Recipient's Administrator/Officer

Name: Paula Noble

Address: Office of Contract and Grant Administration, Box 951406, 10889 Wilshire Blvd, 700-28

City, State, Zip: Los Angeles, CA 90095

Phone: 310-794-0216

E-Mail: paula.noble@research.ucla.edu

3. Recipient's Project Manager

Name: Yousef Bozorgina

Address: PO Box 951593 4731-C Boelter Hall

City, State, Zip: Los Angeles, CA 90095-1593

Phone: 310-825-9254

E-Mail: yousef.bozorgnia@ucla.edu

M. Selection Process Used

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

Selection Process	Additional Information
Competitive Solicitation #	GFO-22-503
First Come First Served Solicitation #	Not applicable
Other	Not applicable

N. 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	Yes

Approved By

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



STATE OF CALIFORNIA
CALIFORNIA ENERGY COMMISSION

Grant Request Form
CEC-270 (Revised 9/2022)

Agreement Manager: Sean Anayah

Approval Date: 6/30/2023

Branch Manager: Reynaldo Gonzalez

Approval Date: 6/30/2023

Director: Reynaldo Gonzalez for Jonah Steinbuck

Approval Date: 6/30/2023

**Exhibit A
Scope of Work
University of California, Los Angeles (UCLA)**

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	X	Technologies Measuring Ground Motion
3		Evaluation of Fiber Optics to Monitor Real-time Status of Gas Pipelines
4	X	Update of Fragility Database of Gas Pipelines
5		Decision-Making Computer Tool for Pipeline Risk Assessment
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
CSN	Community Seismic Network
EMF	Electromagnetic Field Survey
FEA	Finite Element Analysis
GPR	Ground Penetrating Radar
LIDAR	Light Detection and Ranging
ML	Machine Learning
GO	Gas Operator
PHMSA	Pipeline and Hazardous Materials Safety Administration
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to develop an integrated platform to monitor performance of gas pipelines against natural hazards and in near-real-time show probability of pipeline failure. This will help California reduce greenhouse gas emissions by monitoring and reducing the risk of pipeline failure caused by natural hazards.

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 University of California, Los Angeles (UCLA)

B. Problem/ Solution Statement

Problem

Permanent ground displacement from geohazards is one of the leading causes of pipeline damage. Other than direct pipeline strain measurement, there are no methods that reliably correlate pipeline deformation to a degradation in safety. Techniques using ground displacement to gauge pipe deformation vary widely in the resolution of ground displacement. Further, ground displacement data is only useful if there is a rapid means to translate ground displacement to the likelihood for pipeline damage.

Solution

The Recipient will collect data using novel technologies which are divided into two groups: direct measurements (technologies measuring pipe strain or load) and indirect measurements (technologies measuring ground motion). Then, the pipeline fragility (or capacity) model will be expanded and used to combine both direct and indirect measurements and predict gas pipeline probability of failure under various natural hazard ground motion scenarios (*i.e.*, earthquake, landslide, and liquefaction). Finally, the data processing algorithms and fragility model will be incorporated into a user-friendly, free, and open-source software package for gas pipeline operator decision-making.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Help California reduce greenhouse gas emissions by monitoring and reducing the risk of pipeline failure caused by natural hazards;
- Help reduce the potential for injury and property damage; and
- Maintain a safe and reliable California gas pipeline network that can be readapted in the future.

Ratepayer Benefits: This Agreement will result in the ratepayer benefits of (1) **greater gas supply reliability** by predicting where the state's gas infrastructure could fail and identifying the most appropriate mitigative action, (2) **lower costs** by reducing the need for costly site-specific risk assessments and helping decision makers determine the most cost effective means to achieve acceptable seismic performance, (3) **increased safety** by providing a software tool to key decision makers, and (4) **health benefits** by reducing the probability of accidental release of gas.

Additionally, the financial consequences of a gas pipeline leak can be substantial, and these costs typically fall on the community, and naturally the burden is higher for disadvantaged communities. A system of early warning of pipeline failure, such as the one proposed here, can substantially reduce the pipelines recovery time and ratepayers' costs.

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 capturing knowledge from multiple domains of expertise and combining them with a complete system approach which includes:

1. Direct measurement of pipeline response and measurement of ground displacement that can be used to compute pipeline response.

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2. The gas infrastructure part of this project will capture knowledge through iterative Finite Element Analysis (FEA) analysis. Therefore, the model created will be able to outperform the speed of detailed analyses and outperform the quality of simple qualification tools.
3. The software tool will integrate real-time seismic activity and therefore will be able to perform predictions (before earthquake) and failure analysis (after earthquake).

Agreement Objectives

The objectives of this Agreement are to:

- Demonstrate novel technologies for geotechnical pipeline monitoring;
- Use direct measurement of stress/strain change along pipelines using fiber optic cables;
- Collect measurement of ground movement at critical sites (indirect measurement);
- Use ground motion measurements to predict pipe strain;
- Create intelligent sampling and monitoring algorithms;
- Compile all algorithms into an open-source user-friendly risk quantification software tool;
- Validate the software using the field data; and
- Evaluate the project benefits and conduct training and knowledge transfer to California gas investor-owned utilities.

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:

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.

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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 (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).

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.

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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 CEC 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;
- Invoicing and auditing procedures;
- 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 (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); 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.)
 - 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*)

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

Recipient Products:

- CPR Report(s)

CAM Products:

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- CPR Agenda
- 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 and the CAO 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.
- 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* on a USB memory stick, organized by the tasks in the Agreement.

Products:

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

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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 Funds 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. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC 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 *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

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

Subtask 1.6.2 Final Report

The Recipient shall:

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

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- 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 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 CEC 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 CEC 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 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,

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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 1.8 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.

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- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of each 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.

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- 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 insure 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 1.11.
- 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.

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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 insure 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 1.12 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 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:

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- 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

IV. TECHNICAL TASKS

TASK 2: TECHNOLOGIES MEASURING GROUND MOTION

The goals of this task are to collect data for at least 12 months. Light Detection and Ranging (LIDAR) data will be provided by PG&E and Satellite data will be provided by Planet. This data will be used to create the algorithms that extract ground movement from satellite imagery and LIDAR point cloud data.

Subtask 2.1 Using Satellite Images and LIDAR Data to Detect and Quantify Ground Movement

The goal of this subtask is to utilize a multi-resolution approach that employs high resolution data only when needed. Multi-spectral data with a multi-resolution approach will be employed to detect ground movements when they occur and estimate the amount of ground displacement.

The Recipient shall:

- Collect data from Satellite and LIDAR:
 - Collect satellite data at Livermore site for at least 12 months.
 - Collect LIDAR data provided by PG&E.
- Develop Algorithms for Analysis of Satellite and LIDAR Data to Measure Ground Displacement:
 - Use the data to create algorithms that extract soil movement from satellite imagery and LIDAR point cloud data.
 - Develop and submit *Indirect Measurement Data Collection Report* (satellite imagery and LIDAR) that will include but not be limited to the following:
 - Multiple year data collected and assessed.
 - Methodology for data collection and analysis.
 - Satellite and LIDAR imagery examples.
 - Develop and submit *Algorithms for Indirect Measurement Report* that will include but not be limited to the following:
 - Description of Algorithms for Indirect Measurement Code.
 - Expected inputs include:
 - Multi-spectral image data from satellite imagery (both low resolution and high resolution);
 - Ground and airborne LIDAR data.

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- Expected outputs include: translation to quantifiable ground movements and displacements.

Products:

- Indirect Measurement Data Collection Report (satellite imagery and LIDAR)
- Algorithms for Indirect Measurement Report

Subtask 2.2 Real-Time Measurement of Ground Acceleration and Displacement

The goal of this subtask is to assess the feasibility of using the Community Seismic Network (CSN) to measure ground shaking. This subtask will develop a methodology to transform continuous measurements of acceleration into continuous measurements of displacement.

The Recipient shall:

- Calibrate Measurement of Ground Displacement:
 - Develop a methodology to transform continuous measurements of acceleration into continuous measurements of displacement.
 - Calibrate the CSN accelerometers using dual shake tables.
- Conduct Field Installation and Measurement of CSN Sensors
 - Install CSN sensors at a site at the PG&E Milpitas gas terminal or similar site approved in writing by CAM.
 - Install CSN sensors at a site at the PG&E McDonald Island gas storage field or similar site approved in writing by CAM.
 - Continuously record and transmit ground movements.
 - Develop and submit an *Indirect Measurement Data Collection Report* that will include but not be limited to the following:
 - Methodology for transformation of continuous measurements of acceleration into displacement.
 - Discussion of the CSN calibration.
 - Results of ground acceleration and displacement measurements.
 - Explanation of calibration process and field data collection.
 - Summation of process and results.
- Prepare a CPR Report #1 and participate in CPR Meeting, per subtask 1.3.

Products:

- Indirect Measurement Data Collection Report (draft and final)
- CPR Report #1

TASK 3: EVALUATION OF FIBER OPTICS TO MONITOR REAL-TIME STATUS OF GAS PIPELINES

The goals of this task are as follows:

1. Obtain data on pipeline strain measurements using fiber optic cables connected directly to a pipeline and measurements based upon ground displacement patterns inferred from ground strains measured with buried fiber optic cables. The collected data will allow for a comparison between the two pipeline strain measurement methods.
2. Provide a field location for testing the ability to measure ground displacement using CSN sensors and satellite imagery.
3. Assess the operational reliability of the fielded systems over at least 12 months. This task will then summarize the lessons learned from fiber optic data collection and recommend actions that could improve field installations for long-term monitoring.

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Subtask 3.1 Calibration of Fiber Optics Measurements

The goal of this subtask is to directly compare four separate monitoring methods: visible satellite imagery, direct pipe monitoring with fiber optic cables attached to the pipeline, monitoring of ground displacement using buried fiber optic cables, and real-time monitoring of ground acceleration and displacement by efficient and low-cost accelerometers. Under this subtask, ground displacement testing, fiber optic cable installations, and an assessment of the performance of CSN sensors will occur. Multiple strain gauges will also be installed to correlate the fiber optic data versus those from strain gauges.

The Recipient shall:

- Prepare and submit a *Field Test Plan*:
 - The Field Test Plan shall describe the methodology and work that shall occur on site. Field work consists of, but is not limited to:
 - Burying a pipeline with typical depth of soil cover in the test chamber with a movable “sled” filled with soil near the center of the pipeline. The moveable test section will have front and back walls and soil retaining walls will be constructed at each corner of the sled to allow an actuator to be attached to the sled and provide space for the sled to be moved into.
 - The installation of three types of fiber optic cables:
 - A cable attached to the pipe at the crown and each spring line to directly measure strain of the pipeline,
 - Two sets of directly buried fiber optic cables to capture strains from ground displacement, and
 - Another set of buried cables installed in small polyethylene conduit.
 - The pipeline assembly will remain installed for at least 12 months.
 - The Field Test Plan will also include:
 - Drawings,
 - Designs,
 - Instrumentation descriptions
- Measure pipeline strain and ground strain as function of an imposed ground displacement pattern, as detailed in the Field Test Plan.
- Compare measured pipe strains with strains determined using ground displacement based upon measured ground strain, as detailed in the Field Test Plan.
- Report the results of CSN recording.
- Develop and submit *Field Investigation Report* that will include but not be limited to the following:
 - Discussion of field test design, instrumentation, and execution.
 - Test results for pipeline strain and ground strain.
 - Report results of CSN sensor performance.
 - Summation of results.

Products:

- Field Test Plan (draft and final)
- Field Investigation Report (draft and final)

Subtask 3.2 Fiber Optic Long Term Field Data Collection and Analysis

The goal of this subtask is to review and analyze the data collected from the fiber optic multi-sensor array already installed in a well at the McDonald Island underground gas storage field.

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The Recipient shall:

- Review data from the storage field site's fiber optic multi-sensor array.
- Assess the operational reliability of the systems fielded after 12 months.
- Develop and submit the *Field Data and Analysis of Fiber Optics Report* that will include but not be limited to the following:
 - Summation of storage field site data collected from the fiber optic multi-sensor array
 - Discussion of reliability of the system and way forward.

Products:

- Field Data and Analysis of Fiber Optics Report (draft and final)

TASK 4: UPDATE OF FRAGILITY DATABASE OF GAS PIPELINES

The goal of this task is to expand the fragility (or capacity) database of gas pipelines, and development of an updated fragility model. This task will perform pipe-ground simulations on a supercomputer to expand the already existing fragility database and include parameters such as bends in the pipeline alignment, soil compositions and alternate ground displacement patterns. This task will also include new simulations to create an updated fragility model. The updated fragility model will be included in the software developed in Task 5, to help pipeline operators make decisions from indirect measurements.

Subtask 4.1 Expand Fragility Database

The goal of this subtask is to perform pipe-ground simulations on a supercomputer to expand the already existing fragility database.

The Recipient shall:

- Perform pipe-ground simulations on a supercomputer augmented with a new Machine Learning (ML) technique.
- Develop an expanded Fragility Database.
- Develop and submit a *Fragility Database Report* that will include but not be limited to the following:
 - Brief history of past work on the database from CEC-funded project PIR-18-002.
 - Discussion of Machine Learning techniques.
 - Discussion of new simulations for the current project.
 - Discussion of database attributes.

Products:

- Fragility Database Report

Subtask 4.2 Develop an Updated Fragility Model

The goal of this subtask is to include the new simulations performed in Subtask 4.1 to create an updated fragility model. The updated fragility model will be included in the software developed in Task 5 to help pipeline operators make decisions from indirect measurements.

The Recipient shall:

- Update the current fragility model from PIR-18-002 with new simulations.
- Validate the model using set of case histories.
- Develop and submit an *Updated Fragility Model*.

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- Develop and submit an *Updated Fragility Model Report* that will include but not be limited to the following:
 - Brief history of past work on the fragility model from CEC-funded project PIR 18-002.
 - Discussion of the fragility model attributes.
 - Discussion of results from using new simulations.
 - Results of using the updated Fragility Model

Products:

- Fragility Model
- Fragility Model Report

TASK 5: DECISION-MAKING COMPUTER TOOL FOR PIPELINE RISK ASSESSMENT

The goals of this task are to enable gas pipeline operators to make decisions from data collected in the field (both direct and indirect measurements). This task will focus on integrating data processing algorithms developed in Task 2, the fiber optic calibration developed in Task 3 and the fragility model developed in Task 4 and to also expand the capabilities of the open-source software developed in project **PIR-18-002**. This task will also train California gas pipeline operators to use software and algorithms developed.

Subtask 5.1 Decision-Making Computer Tool

The goal of this subtask is to integrate the data processing algorithms developed in Task 2, the fiber optic calibration developed in Task 3 and the fragility model developed in Task 4 and expand the capabilities of the open-source software developed in PIR-18-002.

The Recipient shall:

- Define functional features and analysis capabilities of the software.
- Review proposed capabilities with utility partners and incorporate received feedback.
- Integrate information from Task 2, Task 3, and Task 4 into the software from project PIR-18-002.
- Conduct test and verification of software.
 - Test and verification of software shall be discussed during the CPR Report #2 presentation.
- Develop and submit *Open-Source Software Published on Open-Source Platform (e.g GitHub)*.
- Develop and submit *Software User Manual* that will include but not be limited to the following:
 - Discussion of previous User Manual from PIR-18-002
 - Description of the open-source software attributes
 - Step-by-step instructions to use the software
 - Examples of results from the software that users can replicate as practice.
- Prepare a CPR Report #2 and participate in CPR Meeting, per subtask 1.3.

Products:

- Open-Source Software Published on Open-Source Platform
- Software User Manual
- CPR Report #2

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Subtask 5.2 Gas Operator Training of the Decision-Making Computer Tool

The goal of this subtask is to train industry partners to use the software developed through the agreement.

The Recipient shall:

- Develop a training plan.
- Conduct an On-line Workshop to provide details of the platform for end-users and develop and submit *On-Line Workshop Training Materials*
 - On-Line Workshop shall include training materials that include presentation slides, recordings, and handouts
- Develop and submit a *Training Manual* that will include but not be limited to the following:
 - The Software User Manual that includes a Field-Testing Guide
 - Examples specific to end-users
- Develop and submit a *Training Report* that will include but not be limited to the following:
 - Explanation of how the distinct project tasks are integrated into the decision-making computer tool
 - Discussion of the training plan for end-users
 - Description of the on-line workshop
 - Results of training with project or industry partners

Products:

- On-Line Workshop Training Materials
- Training Manual
- Training Report

TASK 6: 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.
- Complete the *Annual Survey* by December 15th of each year. The Annual Survey includes but is not limited to the following information:
 - Technology commercialization progress
 - New media and publications
 - 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

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[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 7 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to conduct activities that will accelerate the commercial adoption of the technology being supported under this agreement. Eligible activities include, but are not limited to, the following:

- Scale-up analysis including manufacturing analysis, independent design verification, and process improvement efforts.
- Technology verification testing, or application to a test bed program located in California.
- Legal services or licensing to secure necessary intellectual property to further develop the technology.
- Market research, business plan development, and cost-performance modeling.
- Entry into an incubator or accelerator program located in California.

The Recipient Shall:

- Develop and submit a *Technology Transfer Plan* that identifies the proposed activities the recipient will conduct to accelerate the successful commercial adoption of the technology.
- Present the *Draft Technology Transfer Plan* to the TAC for feedback and comments.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the *Draft Technology Transfer 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 with and explanation why.
- Submit the *Final Technology Transfer Plan* to the CAM for approval.
- Implement activities identified in *Final Technology Transfer Plan*.
- Develop and submit a *Technology Transfer Summary Report* that includes high level summaries of the activities, results, and lessons learned of tasks performed relating to implementing the *Final Technology Transfer Plan*. This report should not include any proprietary information.
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Products:

- Technology Transfer Plan (draft and final)

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- Summary of TAC Comments
- Technology Transfer Summary Report (draft and final)
- High Quality Digital Photographs

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V. PROJECT SCHEDULE

Complete schedule is in Attachment 6.