

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-14-016 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Jeffrey Doll	51	916-327-1713

Recipient's Legal Name	Federal ID Number
BIRAenergy	46-0767594

Title of Project
Cost- and Energy-Efficient Attic Designs for CA Homes

Term and Amount	Start Date	End Date	Amount
	6/29/2015	6/30/2018	\$ 1,000,000

Business Meeting Information
 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	2/25/2015	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Jeffrey Doll	Time Needed:	5 minutes

Please select one list serve. Select

Agenda Item Subject and Description

Proposed resolution approving Agreement EPC-14-016 with BIRAenergy for a \$1,000,000 grant to fund research and development of two new approaches to home attic design with novel construction and materials to perform similarly to ducts in a conditioned space, but with low incremental cost compared to current accepted methods for sealed, insulated attics. (EPIC funding) Contact: Jeff Doll. (5 minutes)

California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
 Yes (skip to question 2) No (complete the following (PRC 21065 and 14 CCR 15378)):
 Explain why Agreement is not considered a "Project":
 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:
 a) Agreement **IS** exempt. (Attach draft NOE)
 Statutory Exemption. List PRC and/or CCR section number: _____
 Categorical Exemption. List CCR section number: _____
 Common Sense Exemption. 14 CCR 15061 (b) (3)
 Explain reason why Agreement is exempt under the above section:
 The activity is covered by the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA.
- b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 Check all that apply
 Initial Study Environmental Impact Report
 Negative Declaration Statement of Overriding Considerations
 Mitigated Negative Declaration

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

Legal Company Name:	Budget
DOE- Oak Ridge National Laboratory	\$ 400,000
Electric Power Research Institute, Inc.	\$ 99,000
Oak Ridge Associated Universities	\$ 4,800
Michael L Dalton, CPA Inc	\$ 5,000
byVAVA	\$ 43,000

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

Legal Company Name:

Budget Information

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	13-14	301.001A	\$1,000,000
R&D Program Area:	EERO: Buildings	TOTAL:	\$1,000,000

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Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	
Recipient's Administrator/ Officer		Recipient's Project Manager	
Name:	Valerie Hogan	Name:	Robert Hammon
Address:	6257 Foppiano Ln.	Address:	6257 Foppiano Ln.
City, State, Zip:	Stockton, CA 95212	City, State, Zip:	Stockton, CA 95212
Phone:	209-482-1363 /	Fax:	209-931-3816
E-Mail:	admin@biraenergy.com	E-Mail:	rob@biraenergy.com

Selection Process Used			
<input checked="" type="checkbox"/>	Competitive Solicitation	Solicitation #: PON-13-301	
<input type="checkbox"/>	First Come First Served Solicitation		

The following items should be attached to this GRF			
1. Exhibit A, Scope of Work		<input checked="" type="checkbox"/>	Attached
2. Exhibit B, Budget Detail		<input checked="" type="checkbox"/>	Attached
3. CEC 105, Questionnaire for Identifying Conflicts		<input checked="" type="checkbox"/>	Attached
4. Recipient Resolution		<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
5. CEQA Documentation		<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached

Agreement Manager_____
Date_____
Office Manager_____
Date_____
Deputy Director_____
Date

Exhibit A Scope of Work

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Attic Moisture Management
3		Air Sealing with Focus on the Junction of Exterior Wall and Attic
4		Optimize Insulation and Guidelines for Netting Permeance in Sealed Insulated Attic
5	X	Optimal Insulating Materials for Above the Roof Deck
6		Attics Field Demonstration and Instrumentation
7		Field Test Attics: Energy and Moisture Impacts: Monitored Results, Simulation and Benchmarking
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CHF	California Housing Foundation
CO _{2e}	Equivalent units of CO ₂ emissions
CPR	Critical Project Review
CPUC	California Public Utilities Commission
CZ	California Title 24 Climate Zone
Energy Commission	California Energy Commission
HVAC	Heating, ventilation and air conditioning (equipment)
MOU	Memorandum of Understanding
ORNL	Oak Ridge National Laboratory
TAC	Technical Advisory Committee
TWh	TeraWatt-hour (10 ¹² Watt-Hrs)

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.

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

A. Purpose of Agreement

The purpose of this Agreement is to fund research and development of two new approaches to home attic design with novel construction and materials attributes to make them perform similarly to ducts in a conditioned space (e.g., in a sealed, insulated attic), but with low incremental cost compared to current accepted methods for sealed, insulated attics. This would replace the typical, energy wasteful practice of putting ducts in uninsulated, vented attics. This RD&D program should produce two cost-effective roof deck insulation systems specifically for, but not limited to, homes with ducts in the attic. The project has both analytical and experimental components that lead to development of test systems for field evaluation and demonstration by 2016, and will be market-ready by 2017.

B. Problem/ Solution Statement

Problem

According to the California Housing Foundation (CHF), California housing starts totaled 85,310 in 2013, 36,878 single family and 48,432 multifamily. An estimated 90% of the single-family homes had the HVAC and ductwork in the temperature extremes of ventilated attics. California homes place the HVAC and ductwork (ducts) in the attic to avoid using valuable living space. Placing ducts in the attic makes duct installations easier and therefore less expensive. However, this practice results in large amounts of energy wasted and unnecessarily large carbon emissions, estimated² for the entire residential market at about 4.8 TWh of source energy and about 1.2 million metric tons of equivalent units of carbon dioxide emissions (CO_{2e}) each year.

Solution

Three different design approaches are proposed to be refined, tested, evaluated, and demonstrated in new homes. The best of these approaches will be selected for recommendation to builders for solving the problem stated above based on their cost-effectiveness and energy-efficiency. The basis for comparison will be the typical construction approach for single-family homes: ventilated, uninsulated attics containing Title 24 inspected ducts. Prior to field evaluation, the three new design approaches will be assessed in the analytical phase. Construction approaches to be assessed include methods to produce sealed, insulated attics, as well as, vented attics, both of which have been demonstrated and are in limited use in the market today. However, as currently implemented, they add considerable cost to construction. In this project, the team will employ new and novel installation methods and materials that, based on pilot work, are believed to provide energy savings performance on a par with ducts in conditioned space, but at a cost close to that of the current, energy-wasteful practice of ducts in an uninsulated, vented attic. In addition to being substantially more cost-effective than current attic sealing and insulating techniques, based on building science, , the proposed approaches should improve durability through use of material-driven moisture management, including underlayment and membrane materials that will be climate tuned for vapor permeability. Pilot work has demonstrated these approaches as almost cost neutral and thereby puts no major cost burden on the homeowner. A market penetration of 73% of the current single-family, new construction market would recoup the costs of this project to homeowners and/or ratepayers in a single year.

² Attachment 13 of the Solicitation *Developing a Portfolio of Advanced Efficiency Solutions: Technologies and Approaches for More Affordable and Comfortable Buildings* (PON-13-301) <http://www.energy.ca.gov/contracts/PON-13-301/>

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this project is to provide production builders with practical, cost-effective attic design and construction practices that allow ducts in the attic by eliminating major energy losses that result from using current design and installation practices.

Ratepayer Benefits:³ This project will result in ratepayer benefits of lower utility costs, improved comfort, and reduced carbon emissions by reducing the energy consumed, and electricity-demand-peak produced by space conditioning in new, as well as existing homes. Energy losses from HVAC ducts in attics are at least triple the energy losses crossing the typically well-insulated attic floor. The losses are more pronounced on hotter days, which leads to greater burdens on the utility and, to meet demand, the utility must increase its output yielding higher emissions. Pilot studies and preliminary results from pilot studies show that a 73% market penetration of the residential single-family new construction market would produce energy cost savings to homeowners and/or ratepayers equal to the cost of this RD&D work.

Another more difficult to quantify, but important benefit, is the improved durability of the attic because it will be more resistant to moisture intrusion than current approaches to sealed, insulated attics.

Technological Advancement and Breakthroughs:⁴ This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by improving the energy efficiency and durability of homes as compared to homes with ventilated attics housing the HVAC and ducts in the attic. If all new California homes employed one of these attic assemblies then, using current CHF market forecast for single-family homes and the electricity consumption values provided in the solicitation that this agreement was born out of⁵, the homes would use about 15 GWh less site-energy per year. Additionally, if all California homes, including the 12.3 million existing California homes, also employed one of these assemblies, then the potential savings increases to over 4.8 TWh. Therefore, this technology will significantly contribute to reducing overall energy consumption and peak demand. The technology will allow California to meet its goal of requiring all new residential construction to be zero net-energy by 2020. Finally, the technology will help California attain its goals for developing a comprehensive program to achieve cost-effective energy savings in the existing residential sector by 2020 as set forth in Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009). The existing residential sector consists of about half the buildings market

³ California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

⁴ 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.

⁵ Attachment 13 of the Solicitation *Developing a Portfolio of Advanced Efficiency Solutions: Technologies and Approaches for More Affordable and Comfortable Buildings* (PON-13-301) <http://www.energy.ca.gov/contracts/PON-13-301/>

sector, and the green-house-gas emission from the buildings sector exceeds each of the industrial and transportation sectors.

Agreement Objectives

The objectives of this Agreement are to:

- Develop simple, cost effective and replicable designs for high-performance attics, evaluating both sealed insulated and insulated-vented designs, conduct whole house field studies to field-test and demonstrate prototype attic designs, including impacts on energy losses from ducts in the attics
- Benchmark and document whole-house energy savings using building-heat and mass-transfer computer tools
- Confirm whole-house energy savings magnitudes in demonstration homes
- Develop, design and implement guides for air-sealing the external-wall/attic junction, for proper materials and construction of sealed, insulated attics with ducts, and for proper materials and construction of insulated, vented attics with ducts
- Develop training course materials from lessons learned and target California builders to foster adoption of the new attic design concepts.

II. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

The Recipient shall:

For products that require a draft version

- 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.
- Submit the final product to the CAM once agreement has been reached on the draft. The CAM will provide written approval of the final product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- If the CAM determines that the final product does not sufficiently incorporate his/her comments, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For products that require a final version only

- Submit the product to the CAM for approval.
- If the CAM determines that the product requires revision, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For all products

- Submit all data and documents required as products in accordance with the following Instructions for Submitting Electronic Files and Developing Software:
 - **Electronic File Format**

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

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

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

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

 - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
 - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
 - Visual Studio.NET (version 2008 and up). Recommend 2010.
 - C# Programming Language with Presentation (UI), Business Object and Data Layers.
 - SQL (Structured Query Language).
 - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
 - Microsoft SQL Reporting Services. Recommend 2008 R2.
 - XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

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

The administrative portion of the meeting will include discussion of the following:

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an *Updated Project Schedule*, *List of Match Funds*, and *List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Updated Project Schedule (*if applicable*)
- Updated List of Match Funds (*if applicable*)
- Updated List of Permits (*if applicable*)

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

CAM Products:

- CPR Agenda
- List of Expected CPR Participants

- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

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

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

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize all Agreement activities conducted by the Recipient for the preceding month, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and
 - Match fund expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline and the Style Manual provided by the CAM.
- Submit a draft of the report to the CAM for review and comment. Once agreement on the draft report has been reached, the CAM will forward the electronic version for Energy Commission internal approval. Once the CAM receives approval, he/she will provide written approval to the Recipient.
- Submit one bound copy of the Final Report to the CAM.

Products:

- Final Report (draft and final)

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, and then state this in the letter.

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

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
- A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

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

Subtask 1.8 Permits

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

The Recipient shall:

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

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

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

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

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

- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or
 - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

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

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.

- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

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

Subtask 1.11 TAC Meetings

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

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

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

III. TECHNICAL TASKS

TASK 2 Attic Moisture Management

The goal of this task is to conduct simulations using computer tools (WUFI and WUFI Plus)⁶ to judge the moisture management issues, if any, of sealed, insulated attics in the cooler climate areas of northern California, where major homebuilding is occurring. It is of paramount importance that moisture management be an integral part of the design and implementation of the attics.

The Recipient shall:

- Run attic simulations to document the air-tightness performance characteristics needed in an insulated, sealed attic in in 3 – 4 California climate zones in which substantial new residential construction is occurring and that will test the range of temperatures and moisture for areas of the state where substantial new residential construction is occurring
 - Conduct simulations for ventilated and sealed attics equipped with HVAC and ducts
 -

⁶ <http://web.ornl.gov/sci/ees/etsd/btrc/wufi/software.shtml>

- Determine the optimal maximum air leakage for different California Title 24 Climate Zones (CZs)
- Prepare *Attic Moisture Impacts in Sealed Attics Report* on the attic moisture analyses and potential impacts of sealed attics in new and retrofit homes

Products:

- Attic Moisture Impacts in Sealed Attics Report

TASK 3 Air Sealing with Focus on the Junction of Exterior Wall and Attic

The goal of this task is to identify best practices for sealing the top plate of the exterior walls to the attic and how to minimize it as a potential leakage path for outdoor ambient moisture to enter the attic.

The Recipient shall:

- Determine key literature on air-sealing homes, and best practices guides
 - Resources: ORNL, UCD Western Cooling Efficiency Center, Air Barrier Association
- Verify best practices with mock wall systems: build and test for air leakage at the top of the wall using tracer gas techniques.
 - Approach will be tested in thermal testing chambers
 - Demonstrate techniques that most reliably and simply seal the top plate.
 - Make recommendations for current practices
 - Apply technique to whole-house demonstrations
 - Document material and labor charges for setup in semi-conditioned attic
- Prepare *Air-Sealing the Exterior-Wall to Attic Junction Report*

Products:

- Air-Sealing the Exterior-Wall to Attic Junction Report

TASK 4 Optimize Insulation and Guidelines for Netting Permeance in Sealed Insulated Attic

The goal of this task is to determine the optimal materials and methods for insulating the underside of the roof deck which improves the thermal resistance of the deck, and allows for the movement of water vapor to avoid moisture being trapped in the insulation or the roof deck.

The Recipient shall:

- Evaluate and demonstrate in the field a unique spacer that improves the netting design and eliminates thermal bridging from the rafters (potentially different materials for different CZs):
 - Netting approach will be instrumented in the field to measure the thermal and moisture performance in California CZ 12
 - Attempt to qualify longevity of insulation and supporting netting
 - Evaluate different failure conditions
 - Estimate expected lifetime of netting support
 - Document material and labor needs and costs for setup in semi-conditioned attic
- Conduct a heat and mass transfer analyses to assess the required permeance of the netting needed so that moisture does not accumulate in the OSB roof deck.
 - Conducted for the 16 California CZs
 - Selection of air barrier and or vapor barrier materials for the netting
 - Study to include review of permeance requirements for roof underlayment

- Prepare *Guidelines for Permeance Requirements of Roofing Underlayment and Netting Materials for the Diverse California Climate Zones Report*

Products:

- Guidelines for Permeance Requirements of Roofing Underlayment and Netting Materials for the Diverse California Climate Zones Report

TASK 5 Optimal Insulating Materials for Above the Roof Deck

The goal of this task is to identify the optimal (cost and performance) insulation and binding techniques to build a foundational “deck-sandwich” consisting of insulation layered between the top of the roof-deck, and a second, additional roof-deck over the insulation that will provide a solid foundation for mounting a ventilated roof.

The Recipient shall:

- Determine key properties of potential insulating materials for foam for deck sandwich
 - Likely candidates: Expanded polystyrene foam, extruded polystyrene foam, polyethylene foam, rock wool
 - Resources: Owens Corning (OC), ORNL, Dow and other foam manufacturers,
- Determine key materials for binding agents in deck sandwich and methods for their application
 - Resources: ORNL, Lawrence Livermore National Lab, Western Wood and Plywood Association, Weyerhaeuser
- Test and verify construction of deck sandwich; perform accelerated aging testing of test samples
 - Laboratory testing to include heat and cold cycling, humidity cycling, moisture testing
 - Document findings, focusing on best material choices, materials and labor costs, estimated functional life of sandwich, failure mechanisms
- Prepare *Recommendations for Materials and Methods to Insulate Above-Roof Decks on Ventilated Attics Report*
- Prepare CPR Report “Review of Proposed High Performance Attic Designs, including Attic Moisture Management, Thermal Performance, and Impacts on Duct Losses”
- Attend a CPR Meeting

Products:

- Recommendations for Materials and Methods to Insulate Above-Roof Decks on Ventilated Attics Report
- CPR Report

TASK 6 Attics Field Demonstration and Instrumentation

The goal of this task is to provide four field-test homes for evaluation of three different approaches to high-performance attic assemblies, and to showcase these demonstrations. Four test homes with different attic test-assemblies will be instrumented to monitor, evaluate and document the performance of three different approaches to high-performance attics compared to each other and to the control test home. The final designs for the three high-performance attic assemblies will be determined by the team based on the results of earlier analytical tasks, and contingent upon approval by the CAM. The attics of the four test homes will all be highly instrumented and are anticipated to be:

- 1) Current practice control-attic: vented attic with insulation meeting Title 24 requirements on the attic floor.
- 2) Sealed insulated attic: box netting holds blown-in fiberglass insulation up against the underside of roof deck. The vapor permeability characteristics of the box netting will be determined in preceding research tasks. The attic will be considered “semi-conditioned” due to the HVAC system in the attic and the lack of any insulation between the attic and the conditioned space below.
- 3) Sealed, double-insulated attic. Sealed attic with insulation blown-in to cover the floor of the attic and insulation attached to the underside of the roof deck. The duct system will be very well sealed and well insulated. The insulation materials, R-values and application techniques will be determined in earlier analytical tasks.
- 4) Hybrid insulated vented-attic. Normal attic venting with insulation blown-in to cover the floor of the attic (depth and R-value TBD) and insulation applied to the top of the roof-deck, and covered to be appropriate for application of the roof. The duct system will be very well sealed and well insulated. The insulation materials, R-values and application techniques will be determined in earlier tasks.

The test homes will be instrumented, and data will be collected from the builder and from the multiple sensors in multiple locations in the attic and home. Data-loggers will be used for remote acquisition and recording of field data. In addition to the attic and roof performance monitoring, whole-house air conditioning energy and power will be monitored at a proposed resolution of at least 15 minutes to evaluate home air conditioning energy and demand. Construction cost, time, and other relevant data will be provided by the builder. The instrumentation and test plan will provide data appropriate to evaluate and compare the performance of each test attic in Task 7. This data will include: heat and moisture flows, and energy losses from ducts and attics in the four test homes. In addition, data collected regarding material and labor costs for the different attic assemblies, including approaches to sealing and insulating the attics and the ducts will provide the bases to calculate savings and simple payback for the four attics described above.

The Recipient shall:

- Work with partners KB Home and Shea Homes to determine testing sites and to use existing data from homes with sealed attics that are minimally instrumented
 - Review existing data and other preliminary field-test results to potentially provide insights into the instrumentation and test plan
 - Develop detailed *Test Plans* for conducting the Field Study
 - Develop *MOUs* for communicating responsibilities of all participants.
 - Submit *Test Plan and MOUs Report* to Energy Commission
- Acquire data acquisition systems and instrumentation.
 - Thermistor, relative humidity, specific humidity and moisture pin instruments
 - Procure power transducers, differential pressure transducers, heat flux, pyranometer, pyrgeometer and anemometer instruments
- Coordinate with builders momentary work stoppage after rough-in are complete and install instrument wiring and most sensors
 - Setup weather station for each demonstration site to record dry bulb temperature relative humidity, wind speed, irradiance, infrared radiation

- Coordinate with builder second momentary stoppage once house interior is finished for finalizing placement of all instruments and for installing micro-loggers
 - Develop working schematics showing location and description of all sensors
 - Develop Excel macros for reducing and storing weekly reports for the two sites
 - Develop two secure data storage sites one each at ORNL and BIRAenergy
- Measure the air tightness of the attics, the ducts and the whole house once the houses have been finalized by the builder.
 - Inspections by Energy Inspectors to certify that house plans meet California Title 24 code
 - Inspections by Energy Inspectors and calculations to provide HERS rating to builders
 - Prepare *Field Data Reduction and Assessment of Demonstration Homes Report*

Products:

- Test Plans (no draft)
- MOUs (no draft)
- Test Plan and MOUs Report
- Field Data Reduction and Assessment of Demonstration Homes Report

TASK 7 Field Test Attics: Energy and Moisture Impacts: Monitored Results, Simulation and Benchmarking

The goal of this task is to evaluate and benchmark attic field data using the AtticSim computer tool and the whole house model WUFI plus. California’s residential compliance software [CBECC-Res 2013 3.0 or latest] will be included in support of formulation and/or modification of California’s building energy efficiency standards.

The Recipient shall:

- Collect and analyze data from the attic monitoring of the four homes
- Field results will be used to model the homes as-built, so that the simulations can be directly compared to the field results testing sites.
 - Benchmark AtticSim/EnergyPlus for attic heat flows and duct heat gains/losses
 - Benchmark WUFI + for attic heat flows and duct heat gains/losses
 - Benchmark EnergyPLUS whole-house energy performances with the different attics housing the ducts
 - Benchmark CBECC-Res 2013 3.0 for attic heat flows and duct heat gains/losses
 - If occupied, collect home operational and miscellaneous and electrical loads (MELs) info from homeowners
- Survey occupants to determine information for simulation calibrations: Thermostat setpoint temperatures, occupancy schedules, MELs equipment and usage patterns
- Develop models of homes in EnergyPLUS including Survey data; calibrate simulations to produce energy baselines
- Conduct simulations to develop claims for whole house performance and moisture management in the different attics for several of the CA CZs.
- Prepare Final Report as required by Task 1.6.

Products:

- Final Report

TASK 8 Evaluation of Project Benefits

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

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
 - Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
 - Investment dollars/follow-on private funding as a result of Energy Commission funding.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
 - For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.

- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

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

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 9 Technology/Knowledge Transfer Activities

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

The Recipient shall:

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

Products:

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

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: BIRA ENERGY, INC.

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

RESOLVED, that the Energy Commission approves Agreement EPC-14-016 with BIRA Energy, Inc. for a \$1,000,000 grant to develop new approaches to home attic design using novel construction and materials that have lower incremental cost compared to current accepted methods for sealing and insulating attics; and

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

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on February 25, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat