

GRANTS/CONTINGENT AWARD REQUEST



To: Grants and Loans Office

Date: 3/28/2013

Project Manager: Dustin Davis

Phone Number: 916-327-2223

Office: Energy Efficiency Research Office

Division: Energy Research and Development

MS- 51

Project Title: Demonstrating Scalable Very Energy Efficient Retrofits for Low Income, Multifamily Housing

Type of Request: (check one)

New Agreement: (include items A-F from below) Agreement Number: PIR-12-025

Program: PIER NG / Buildings End-Use Energy Efficiency

PON-12-503-23 (Building Energy Efficiency Research and Technology

Solicitation Name and/or Number: Grant Program

Legal Name of Recipient: EPRI Solutions, Inc.

Recipient's Full Mailing Address: 942 CORRIDOR PARK BLVD

KNOXVILLE, TN 37932-3723

Recipient's Project Officer: Ram Narayanamurthy Phone Number: 650-855-2419

Agreement Start Date: 6/30/2013 Agreement End Date: 3/31/2017

Amendment: (Check all that apply) Agreement Number: _____

Term Extension – New End Date: _____

Work Statement Revision (include Item A from below)

Budget Revision (include Item B from below)

Change of Scope (include Items A – F as applicable from below)

Other: _____

ITEMS TO ATTACH WITH REQUEST:

- A. Work Statement
- B. Budget
- C. Recipient Resolution, if applicable. (Resolution may be requested in Special Conditions if not currently available.)
- D. Special Conditions, if applicable.
- E. CEQA Compliance Form
- F. Other Documents as applicable
 - Copy of Score Sheets
 - Copy of Pre-Award Correspondence
 - Copy of All Other Relevant Documents

California Environmental Quality Act (CEQA)

CEC finds, based on recipient's documentation in compliance with CEQA:

Project exempt: _____ NOE filed: _____

Environmental Document prepared: _____ NOD filed: _____

Other: _____

CEC has made CEQA finding described in CEC-280, attached

Funding Information:

*Source #1: NG Amount: \$ 500,000.00 Statute: 11- FY: 12-13 Budget List #: 501.001F

*Source #2: PIER-E Amount: \$ 851,283.00 Statute: 11- FY: 12-13 Budget List #: 501.027J

*Source #3: _____ Amount: \$ Statute: _____ FY: _____ Budget List #: _____

If federally funded, specify federal agreement number: _____

* Source Examples include ERPA, PIER-E, PIER-NG, FED, GRDA, ARFVT, OTHER.

Business Meeting Approval: (refer to Business Meeting Schedule)

Proposed Business Meeting Date: 6/12/2013 Consent Discussion

Business Meeting Participant: Dustin Davis Time Needed: 5 minutes

Agenda Notice Statement: (state purpose in layperson terms)

Possible approval of a Grant / Contingent Award to...

Possible approval of Agreement PIR-12-025 with Electric Power Research Institute for a \$1,351,283 grant to research, install, measure and evaluate cost effective deep energy efficiency retrofits for the low-income multifamily housing industry. The agreement will include \$1,112,800 in match funding. The length of this agreement is 45 months. (PIER electricity funding) Contact: Dustin Davis (5 minutes)

GRANTS/CONTINGENT AWARD REQUEST



Project Manager	Date	Office Manager	Date	Deputy Director	Date
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Award Number: PIR-12-025

Date: 4 / 8 / 2013

Note: The Energy Commission Project Managers Manual includes detailed instructions on how to complete this section, with examples of grants that are “Projects” and are not “Projects”. When the Project Manager is completing this section, if questions arise as to the appropriate answers to the questions below, please consult with the Energy Commission attorney assigned to review grants or loans for your division.

1. Is grant/loan considered a “Project” under CEQA? Yes (skip to question #2) No (continue with question #1)

Please complete the following: [Public Resources Code (PRC) 21065 and 14 California Code of Regulations (CCR) 15378]:

Explain why the grant/loan is **not** considered a “Project”? The grant/loan will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because grant/loan involves:

2. If grant/loan is considered a “Project” under CEQA: (choose either **IS** or **IS NOT**)

Grant/loan **IS** exempt:

Statutory Exemption: (List PRC and/or CCR section numbers) _____

Categorical Exemption: (List CCR section number) 14 CCR 15306

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

Explain reason why the grant/loan is exempt under the above section:

This project only includes basic data collection, research, experimental management, and resource evaluation activities that do not result in major disturbances to an environmental resource.

Please attach draft Notice of Exemption (NOE). Consult with the Energy Commission attorney assigned to your division for instructions on how to complete the NOE.

Grant/loan **IS NOT** exempt. The Project Manager needs to consult with the Energy Commission attorney assigned to your division and the Siting Office regarding a possible initial study.

Exhibit A WORK STATEMENT

Technical Task List

Task #	CPR	Task Name
1		Administration
2	X	Develop Baseline Current Building Energy Performance, Evaluate Technologies, and Develop Energy Efficiency Packages
3		Testing, Monitoring and Developing Evaluation Plan
4	X	Procurement, Installation, Commissioning and Occupant Education
5		Development of Financial Models for Scalable Implementation
6		Data Acquisition, Analysis and Reporting
7		Technology Transfer and Commercialization Plan

Key Name List

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Senior Project Manager	BIRAenergy; LINC Housing	SCG, SCE, LINC
2	President	BIRAenergy	SCG, SCE, LINC
3	Senior Project Manager	BIRAenergy	SCG, SCE, LINC
4	Senior Project Manager	LINC, BIRAenergy	LINC Housing
5	Senior Project Manager	LINC, BIRAenergy	LINC, SCE, SCG
6	Senior Project Manager	BIRAenergy, LINC	LINC, SCG, SCE
7	Senior Project Manager	LINC, BIRAenergy	SCG, SCE, LINC, HUD

Glossary

Specific terms and acronyms used throughout this scope of work are defined as follows:

Term/ Acronym	Definition
CBIA	California Building Industry Association
CDF	Community Development Finance Institutions
CEESP	California Long Term Energy Efficiency Strategic Plan
CPR	Critical Project Review
CTAC	CA Tax Credit Allocation Committee
CUAC	California Utility Adjustment Calculator
DR	Demand Response (Demand Responsive)
EE	Energy Efficiency
EEM	Energy Efficiency Measure
EES	Energy Efficiency Standards

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Term/ Acronym	Definition
EEBUA	Energy Efficiency Based Utility Allowances
EIF	Energy Innovation Fund
ERDD	Energy Research and Development Division
ET	Emerging Technologies
HAN	Home Area Network
HEM, HEMS	Home Energy Management system
HUD	Housing and Urban Development
HVAC	Heating, Ventilation and Air Conditioning
IR	Infrared
IT	Information Technology
LIMF	Low-Income Multifamily (housing)
MASH	Multifamily Affordable Solar Housing
M&E	Monitoring & Evaluation
NILM	Non-Intrusive Load Monitoring
NMESC	National Multifamily Energy Services Collaborative
OFB	On-Bill Financing
PAC	Project Advisory Committee
PACE	Property Assessed Clean Energy financing
PCBC	Pacific Coast Builders Show
PCM	Phase-Change Material
PPA	Power Purchase Agreement
PV	Photovoltaic System (solar electric system)
REC	Renewable Energy Credits
ROI	Return on Investment
SCG	Southern California Gas Co.
SF	Single-Family
TCAC	Tax Credit Allocation Committee
T-Stat	Thermostat
VER	Very Efficient Retrofits – per the PON, those that result in deep reductions in energy use and that significantly exceed the current (2008) building energy efficiency standards
VNM	Virtual Net Metering
ZNE	Zero Net Energy ¹

Problem Statement

Owners of low income multifamily properties frequently fail to invest in energy efficiency and, as a result, often face high energy costs. The two most common reasons are lack of technical expertise, and insufficient capital and/or appropriate financing vehicles.

¹ ZNE buildings produce as much energy from renewable sources as they consume on an annual basis.

Exhibit A WORK STATEMENT

Without in-house technical expertise, currently, an owner wishing to pursue energy efficiency improvements must contract with an energy auditor, a design engineer, a construction manager, one or more contractors, a lawyer or accountant (to handle subsidies and/or debt financing), and a consultant to train residents and maintenance staff.

Each of these separate vendors requires significant time, expertise and focus to identify, validate, and procure. The majority of low income multifamily owners has neither the resources nor the inclination to pursue and implement energy improvements in such a fragmented marketplace, or is unable to take on additional debt to pay for energy efficiency improvements. This leads to either making poorly-informed decisions about how to proceed, or not proceeding at all. Even when good decisions are made, implementation is often sporadic and fails to consider the building as a whole system or engage tenants and/or property maintenance staff.

The technical barriers are exacerbated by financing barriers. Retrofits are financed by the property owner, while the immediate financial benefits of lower energy costs are realized by the tenants who pay the utility bills. This “split incentive” phenomenon affects both the property-owners’ motivation to investigate efficiency retrofits, and their banks’ willingness to lend on such projects. Low income housing owners cannot or will not raise rents to cover such costs resulting in a huge financial barrier for energy efficiency upgrades. Without access to comprehensive financing packages that can bundle efficiency and renovation financing, utility cost over-runs create a downward spiral where increasing energy costs threaten the viability of the property, causing owners to forego routine maintenance, leading to even worse energy efficiency, which threatens the property even further.

The main barriers that low-income property-owners face are also barriers for the larger market of multifamily property owners. The results of this project will be applicable to the entire multifamily market, but this project specifically addresses the low-income multifamily market.

Goals of the Agreement

The goals of this project are: 1) provide and demonstrate to the low-income multifamily housing industry easily replicable technical and financial tools to support and encourage widespread Very Efficient Retrofits (VER) and 2) develop cost effective and replicable VER packages with energy-savings of at least 40% improvement over baseline (at least meeting 2008 Title 24 energy performance standards), to ZNE capable and potentially including photovoltaics (PV) and/or solar thermal for ZNE package(s).

Objectives of the Agreement

- Develop practical, replicable VER packages for low income multifamily housing. This objective will be met by employing the most recent technical advances to improve existing buildings to, at a minimum current (2008) energy efficiency Title

Exhibit A WORK STATEMENT

24 standards, and improve the packages as needed to be Zero Net Energy (ZNE) or ZNE-Capable²;

- Research measures, technologies, and building practices to make the VER packages as close as possible to ZNE Capable and still practical, cost-effective and replicable.
- Demonstrate, measure and evaluate the VER packages in the targeted community and define the financing requirements of, and barriers to VERs in the low-income multifamily housing industry. This information will provide insightful recommendations to the financing industry for specific financing vehicles needed for widespread replication of the VER packages.

TASK 1 ADMINISTRATION

Instructions for Submitting Electronic Files and Developing Software

Electronic File Format

The Recipient will deliver an electronic copy (CD ROM or memory stick or as otherwise specified by the Commission Project Manager (CPM)) of the full text of any Agreement products in a compatible version of Microsoft Word (.doc).

The following describes the accepted formats of electronic data and documents provided to the Energy Commission as products and establishes the computer platforms, operating systems, and software versions that will be required to review and approve all software deliverables.

- Data sets will be in Microsoft (MS) Access or MS Excel file format.
- PC-based text documents will be in MS Word file format.
- Documents intended for public distribution will be in PDF file format, with The native file format provided as well.
- Project management documents will be in MS Project file format.

Software Application Development

If this Scope of Work includes any software application development, including but not limited to databases, websites, models, or modeling tools, the Recipient will use the following standard Application Architecture components in compatible versions:

- 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.

² ZNE-capable buildings are sufficiently efficient that the addition of a reasonable amount of renewable energy generation will make the building a ZNE.

Exhibit A WORK STATEMENT

- 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 Energy Commission's Information Technology Services Branch.

Task 1.1 Attend Kick-off Meeting

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

The Recipient shall:

- Attend a "Kick-Off" meeting with the Commission Project Manager (CPM), the Grants Officer, and a representative of the Accounting Office. The Recipient shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the CPM to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the CPM will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Discussion of the terms and conditions of the Agreement
- Discussion of Critical Project Review (Task 1.2)
- Match fund documentation (Task 1.6) *No work may be performed until this documentation is in place.*
- Permit documentation (Task 1.7)
- Discussion of subcontracts needed to carry out project (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The CPM's expectations for accomplishing tasks described in the Scope of Work
- An updated Schedule of Products
- Discussion of Progress Reports (Task 1.4)
- Discussion of Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
- Discussion of the Final Report (Task 1.5)

The CPM shall designate the date and location of this meeting.

- Submit an updated Schedule of Products, List of Match Funds, and List of Permits to the CPM.

Exhibit A WORK STATEMENT

Recipient Products:

- Updated Schedule of Products
- Updated List of Match Funds
- Updated List of Permits

Commission Project Manager Product:

- Kick-Off Meeting Agenda

Task 1.2 Critical Project Review (CPR) Meetings

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, products, schedule, or budget.

CPRs provide the opportunity for frank discussions between the CPM and the Recipient. The CPM may schedule CPRs as necessary, and CPR costs will be borne by the Recipient.

Participants include the CPM and the Recipient, and may include the Commission Grants Officer, the Energy Research and Development Division technical lead, other Energy Commission staff and Management, and any other individuals selected by the CPM to provide support to the Energy Commission.

The Commission Project Manager shall:

- Determine the location, date, and time of each CPR meeting with the Recipient. These 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 Commission Project Manager.
- Send the Recipient the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion of both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, and/or budget for the remainder of the Agreement. If the CPM 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 written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more products that were included in the CPR.

Exhibit A WORK STATEMENT

The Recipient shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work on the project. This report shall be submitted along with any other products identified in this Scope of Work. The Recipient shall submit these documents to the CPM and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

Commission Project Manager Products:

- Agenda and a list of expected participants
- Schedule for written determination
- Written determination

Recipient Product:

- CPR Report(s)

Task 1.3 Final Meeting

The goal of this task is to close out this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present the project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

This meeting will be attended by, at a minimum, the Recipient, the Commission Grants Office Officer, and the CPM. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the discretion of the CPM.

The technical portion of the meeting shall involve the presentation of an assessment of the degree to which project and task goals and objectives were achieved, in addition to findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The CPM will determine the appropriate meeting participants.

The administrative portion of the meeting shall involve a discussion with the CPM and the Grants Officer about the following Agreement closeout items:

- Disposition of any equipment purchased with Energy Commission funds

Exhibit A WORK STATEMENT

- Energy Commission's request for specific "generated" data (not already provided in Agreement products)
- Need to document Recipient's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions
- Final invoicing and release of retention
- Prepare written documentation of any agreements made between the Recipient and Commission staff during the meeting.
- Prepare a schedule for completing the closeout activities for this Agreement.

Products:

- Written documentation of meeting agreements
- Schedule for completing closeout activities

Task 1.4 Monthly Progress Reports

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

The Recipient shall:

- Prepare a Monthly Progress Report that summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the CPM within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in the Terms and Conditions of this Agreement.
- In each Monthly Progress Report and invoice, document and verify:
 - Energy Commission funds received by California-Based Entities (CBEs);
 - Energy Commission funds spent in California; and Match fund expenditures
 - Provide synopsis of project progress.

Product:

- Monthly Progress Reports

Exhibit A WORK STATEMENT

Task 1.5 Final Reports

The goal of the Final Report is to assess the project's success in achieving its goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further projects and improvements.

The Final Report shall be a public document. If the Recipient has obtained confidential status from the Energy Commission and will also prepare a confidential version of the Final Report, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

The Recipient shall:

- Prepare an Outline of the Final Report.
- Prepare a Final Report following the approved outline and the latest version of the Final Report guidelines which will be provided by the CPM. The CPM shall provide written comments on the Draft Final Report within 15 working days of receipt. The Final Report must be completed at least 90 days before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.

Products:

- Draft Outline of the Final Report
- Final Outline of the Final Report
- Draft Final Report
- Final Report

Task 1.6 Identify and Obtain Match Funds

The goal of this task is to ensure that the match funds planned for this Agreement are obtained and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the Energy Commission budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of Energy Commission funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient for which the Recipient will request reimbursement.

Exhibit A WORK STATEMENT

The Recipient shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the CPM at least 2 working days prior to the kick-off meeting. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state such 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 each cash match fund, its source (including a contact name, address and telephone number), and the task(s) to which the match funds will be applied.
 - Amount of each in-kind contribution, a description, documented market or book value, its 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 shall identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured. For match funds provided by a grant a copy of the executed grant shall be submitted in place of a letter of commitment.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. 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 letter including the appropriate information to the CPM if during the course of the Agreement additional match funds are received.
- Provide a letter to the CPM within 10 days if during the course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR.

Products:

- A letter regarding match funds or stating that no match funds are provided
- Copy(ies) of each match fund commitment letter(s) (if applicable)
- Letter(s) for new match funds (if applicable)
- Letter that match funds were reduced (if applicable)

Exhibit A WORK STATEMENT

Task 1.7 Identify and Obtain Required Permits

The goal of this task 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. Although the Energy Commission budget for this task will be zero dollars, the Recipient shall budget match funds for any expected expenditures associated with obtaining permits. Permits must be identified in writing and obtained before the Recipient can make any expenditure for which a permit is required.

The Recipient shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the CPM at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies the:
 - Type of permit
 - Name, address and telephone number of the permitting jurisdictions or lead agencies
 - The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule, and copies of the permits. The implications to the Agreement 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 the Progress Reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, provide an updated list of permits (including the appropriate information on each permit) and an updated schedule to the CPM.
- As permits are obtained, send a copy of each approved permit to the CPM.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CPM within 5 working days. Either of these events may trigger an additional CPR.

Products:

- Letter documenting the permits or stating that no permits are required
- Updated list of permits as they change during the term of the Agreement (if applicable)

Exhibit A WORK STATEMENT

- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable)
- A copy of each approved permit (if applicable)

Task 1.8 Obtain and Execute Subcontracts

The goal of this task is to ensure quality products and to procure subcontracts required to carry out the tasks under this Agreement consistent with the terms and conditions of this Agreement and the Recipient's own procurement policies and procedures. This task will also provide the Energy Commission an opportunity to review the subcontracts to ensure that the tasks are consistent with this Agreement, and that the budgeted expenditures are reasonable and consistent with applicable cost principles.

The Recipient shall:

- Manage and coordinate subcontractor activities.
- Submit a draft of each subcontract required to conduct the work under this Agreement to the Commission Agreement Manager for review.
- Submit a final copy of the executed subcontract.
- If the Recipient decides to add new subcontractors, it shall notify the Commission Agreement Manager.

Products:

- Draft subcontracts
- Final subcontracts

TECHNICAL TASKS

Task 2 Develop Baseline Current Building Energy Performance, Evaluate Technologies, and Develop Energy Efficiency Packages

The goals of this task are to:

- 1) Develop an accurate baseline for the target buildings showing current building energy use;
- 2) Identify potential energy efficiency measures (EEMs);
- 3) Develop packages of EEMs, or VERs (also referred to as EE packages) for the buildings to be retrofitted. The VER packages are to be designed to provide the best possible value to the owner (LINC) while strongly considering the occupant's comfort, health, and energy bill savings, and to be replicable at LINC's other properties in California, and by other low-income multifamily building and property owners.
- 4) Develop benefit/cost analysis for identified EEMs or VER packages

Task 2.1 Conduct Energy Audit of Targeted Apartments

The goal of this task is to develop an accurate baseline for the targeted buildings showing current building energy use.

Exhibit A WORK STATEMENT

The Recipient shall:

- Conduct an energy audit of the targeted apartments to determine current energy use. This audit will include, but not be limited to, the following areas:
 - Basic construction, including envelope, fenestration and insulation
 - Heating, Ventilation and Air Conditioning (HVAC) type, model numbers, age, condition, controls (e.g., thermostats), settings and schedules;
 - Lighting fixtures, types, wattages, quantity, controls and where known, usage schedules;
 - Water heater types, model numbers, age, equipment, controls, condition;
 - Miscellaneous permanent energy using appliances, devices and/or equipment, including types, model numbers, age, use, condition.
- Run computer models on targeted apartments to simulate annual energy use to develop a report of the Baseline Energy Use. The energy model must include, but not be limited to:
 - A “true up” with the actual electric and natural gas utility bills. This will verify the accuracy of any assumptions to the operating, schedule and equipment used in the model. The degree of accuracy must be within 5% of the actual bills, or an amount acceptable with the CPM.
 - An energy simulation of at least two building types for baseline energy use assessments: duplexes and eight- or ten-plexes (buildings with 2, 8, or 10 dwelling units each, respectively). This research project targets about 30 dwellings to be retrofitted, such as 3 eight-plexes and 3 duplexes. The minimum number of buildings simulated is a function of the geometries, features and orientation of the buildings chosen for retrofit (“target buildings”). Baseline energy uses will be calculated for all candidate buildings, but some buildings may be identical in geometry, features and orientation, in which case only one baseline would be needed for the identical buildings.
- Prepare an Energy Audit Report for the targeted buildings that includes, but is not limited to:
 - The objective of the energy audit
 - A concise description of the apartment complex, including the following:
 - photographs to clearly show the different building types and energy using systems;
 - the basis for choosing the target buildings;
 - physical descriptions of the target buildings, including all information used to define the physical building within EnergyPro;
 - Description of the baseline energy use for the targeted buildings, including, but not limited to, all information and data developed in the Recipient Shall section of this task, the amount and percentage of electricity and natural gas used for major energy using equipment and systems in the buildings (e.g., lighting, cooling, heating), baseline energy use of each building (actual and modeled data with methodology and assumptions with true up accuracy).
 - The energy-modeling results of EnergyPro simulations of the target buildings must include, but not limited to:

Exhibit A WORK STATEMENT

- EE measures and performance values used in the baseline energy assessments from EnergyPro;
- Annual energy use assessment results from the EnergyPro simulations;
- Assumptions used to generate the simulations.

Products:

Energy Audit Report (for all buildings)

Task 2.2 Identify New, Underutilized and/or Emerging Technologies for VER for the Targeted Apartments

The goal of this task is to identify EE technologies for potential retrofits and to work with utilities to perform laboratory and field testing of the ETs.

The Recipient shall:

- Enlist utility partners to provide information, data and recommendations on new, under-used, and/or emerging technologies (ET).
- Work with utilities to perform laboratory and field testing and evaluation of ETs including but not limited to:

<u>Measure type</u>	<u>Assessment / Research Objectives</u>
Ducts	Eliminate with ductless minisplits
Ducts	Automated aerosol sealing
Envelope air sealing	Automated aerosol sealing
Exterior paint	Infrared (IR) reflective paint
Household appliances	High Efficiency
Hot water	On-demand hot water plumbing
HVAC	High efficiency air conditioning
HVAC	High efficiency heating
HVAC	Residential economizers for Healthy Home:
HVAC	Smart Communicating Thermostats
HVAC/Demand Response (DR)	Smart Thermostat with 4°F offset capability
Home Energy Management System	Reduce Miscellaneous Electric Loads
Home Energy Management System	With remote Plug Load Control
Home Energy Management System	Virtual Submetering
Home Energy Management System	Increase energy awareness and reduce energy use
Home Energy Management System	Protocol independent DR capability
Lighting	100% LED
Phase-Change Materials (PCMs)	Internal mass to reduce peak cooling
PCMs	Reduce heat flow through walls, attic and/or roof
Renewable energy systems	Hybrid PV and Solar Thermal
Windows	High-R windows

- Obtain laboratory and field test results from utility partners. Utility partners will perform short-term field tests and evaluations of new/emerging technologies as

Exhibit A WORK STATEMENT

needed for any new, innovative, technology or measure that has promise as an EEM in low-income multifamily VER projects.

- Where appropriate, perform initial field testing and evaluation of the practicality of installing ETs. Such ETs include automated aerosol-sealing of the envelope, innovative applications of PCMs, IR paints.
- Prepare an Emerging Technologies Evaluation Report which will include but not limited to technologies evaluated and recommended, data compiled from laboratory and field testing on each technology, and other information considered in the evaluation of emerging and/or under-utilized technologies.

Products:

- Emerging Technologies Evaluation Report (no draft)

Task 2.3 Develop Method to Rank EEMs

The goal of this task is to develop a methodology and criteria to rank and select the EEMs identified from Task 2.2.

The Recipient shall

- Research and develop a method and criteria to rank EEMs based on their ability to improve VER package energy performance, including efficiency impacts, cost, practicality, availability and other benefits and potential barriers, with benefit/cost being the highest weighted factor
- Develop a Ranked List of EEMs report. The report shall include, but is not limited to, the following:
 - The objective for developing the list of EEMs;
 - A description of each EEM, including analysis of benefits/costs and why selected.
 - A description of the methods used to evaluate each EEM;
 - A brief summary of the evaluation results for each EEM;
 - A list of the EEMs, ranked from most promising to least, according to the method developed in this Task.

Products

- Draft Ranked list of EEMs report
- Final Ranked list of EEMs report

Task 2.4 Develop and Determine VER Packages

The goal of this task is to develop criteria to evaluate and select the VER packages for installation at the targeted apartments.

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The Recipient shall

- Develop criteria to evaluate the VER Packages, including factors such as benefit/cost, availability, practicality, additional benefits (e.g., comfort, durability, etc.).
- Develop, refine and choose several EE packages for the two different building types that would result in VERs for installation at the targeted apartments. Where possible, the packages will incorporate emerging technologies, new or under-used technologies. Evaluate the packages using the broad expertise of the project team to determine optimal VER benefit/cost, practicality, replicability, construction materials, project goals and budgets. The range of VERs is intended to address cost, practicality, and replicability issues that may arise in the most efficient packages. The final packages should be as close to ZNE as possible.
- Develop accurate cost estimates for the packages to ensure desired benefit/cost, including documentation and justification for the estimates.
- Choose VER-packages to be installed, demonstrated and evaluated. The team may choose a single, outstanding package that should provide the best combination of energy savings, cost, practicality, and ancillary benefits. If there is not a clearly best package, the team may decide to install a few different packages on different buildings to compare the overall performance of the different packages. To the extent possible within funding from this and other programs, solar hot water systems, and PVs will be installed to achieve ZNE status.
- Determine and document any existing or needed installation best-practices; collect existing best-practices information and develop additional information as needed. The installation best-practices will be used to train the installing subcontractors.
- Develop VER Package Report that will include, but not be limited to:
 - Description of the packages for each building type, or use of multiple packages, if there is not a clear best package
 - Description of the individual EEMs, the evaluation criteria and factors used to select the EEMs,
 - Evaluation criteria and factors used to select each package,
 - Estimated energy savings and the percentage energy savings improvement over baseline
 - Estimated cost for each package including documentation and references and analysis of costs/benefits
 - Discussion of whether the goals and objectives as identified in the Agreement section were met.
 - Discussion of installation best practices to assist in the training of subcontractor installers
- Develop Package Data Sheets, one for each final VER package. Each Package Data Sheet, shall include, but not be limited to:
 - The performance goal for the final EE packages
 - Descriptions and performance metrics of the EE measures in the package;

Exhibit A WORK STATEMENT

- The simulated VER performance metrics for the package, including baseline and projected energy use and costs;
- Advantages and disadvantages of the included measures and of the whole package (e.g., availability of measures, special construction issues, permitting issues, etc.).
- The estimated cost for each package, including documentation and justification and analysis of benefits/cost
- Participate in CPR Meeting and prepare a CPR report as per Task 1.2.

Products:

- VER Package Report (no draft)
- Data Sheets for Each Package
- CPR Report

Task 3 Develop Testing, Monitoring and Evaluation Plan

The goals of this task is to develop a test plan for laboratory and field testing of ETs, EEMs, and EE packages and a plan for monitoring and evaluating performance of both whole building and individual measures and compare actual performance against models.

Task 3.1 Develop a Test Plan

The goal of this task is to develop a test plan, identify test objectives and test matrix, and discuss the data analysis, quality assurance procedures and contingency measures if test objectives are not met.

The Recipient shall:

- Develop a Test Plan for laboratory and field testing of ET, EEMs and EE packages. The test plan will include, but not be limited to:
 - A description of the overall test plan and the rationale for why the tests are required
 - Predicted performance based on calculations or other analyses
 - Test objectives and technical approach including methodology
 - A test matrix showing the number of test conditions and replicated runs
 - A description of the facilities, equipment, instrumentation required to conduct the tests
 - A description of test procedures including parameters to be controlled and how they will be controlled
 - A description of the data analysis procedures
 - A description of the quality assurance procedures
 - Contingency measures to be considered if test objectives are not met

Exhibit A WORK STATEMENT

- Develop a Lab and Field Test Plan Report. The report will include, but not be limited to, the information discussed in the Recipient shall section of this task.

Products:

- Draft Lab and Field Test Plan Report
- Final Lab and Field Test Plan Report

Task 3.2 Develop Data Acquisition Plan

The goal of this task is to develop a plan to collect data to evaluate the energy performance of the EE packages.

The Recipient shall:

- Develop a data acquisition plan to collect the data necessary to evaluate whole home energy performance for the EE packages. The plan will include, but not be limited to:
 - Obtain data in 15 minute increments on electric and natural gas energy use, or other increments with CPM approval
 - Utilize devices such as Smart Circuit Panels or Non-Intrusive Load Monitoring (NILM) to enable submetering of energy uses
 - Monitor through at least one summer season and one winter season
 - Monitor a control sample in the same complex as the targeted apartments (e.g., two duplexes and one eight-plex)
 - Determine whole home energy performance and compare utility bills before and after measures
 - Compare buildings with measures against control sample
 - Use statistical distribution analysis to remove impact of consumer behavior and obtain median behavior
- Prepare a Data Acquisition Plan Report that will include, but not be limited to, all the information contained in the Recipient shall section of this task

Product:

- Draft Data Acquisition Plan Report
- Final Data Acquisition Plan Report

Exhibit A WORK STATEMENT

Task 3.3 Develop Plan for Monitoring EE Measure Performance

The goal of this task is to develop a plan for monitoring performance of each measure in both the control and test home.

The Recipient shall:

- Develop a plan for monitoring performance of each EEM being adopted in both the control and test home. The plan will include, but not limited to:
 - For HVAC systems:
 - Measure coil discharge, and zone air temperatures
 - Measure power usage of compressor, and indoor and outdoor fans
 - For solar domestic hot water systems;
 - Measure load carried by solar thermal system using hot water temperatures, and boiler energy use
 - Evaluate performance of solar thermal system for water heating using incoming, tank and mixing valve water temperatures; as well as draw flow rates
 - For lighting systems, measure power and illumination density
 - Evaluate energy use reduction using integrated occupancy sensors
- Utilize a Home Energy Management System (HEMS) to provide an integrated home controls platform and understanding of occupant preferences and energy behavior and implement the following:
 - Obtain 15 minute or shorter time period data on home energy use
 - Install integrated plug load controls to enable easier remote control of loads
 - Obtain information on occupant preferences for temperature control and track benefits of pre-programmed strategies
- Develop an analytics platform to obtain large data sets and perform automated analysis and implement the following:
 - Develop an IT client-server framework to enable high speed large data sets to be gathered on building and occupant energy use
 - Develop and install an in-home data gateway for sensing and control with remote connectivity
 - Develop a central data repository to gather data
 - Develop software programs to analyze large volumes of incoming data and prepare daily, weekly and monthly reports on system performance
- Prepare a Plan for Monitoring Performance Report. The report will include, but not be limited to, a discussion of all the information contained in the Recipient shall section of this task, including any key findings.

Product:

- Plan for Monitoring Performance Report (no draft)

Exhibit A WORK STATEMENT

Task 4 Procurement, Installation, Commissioning and Occupant Education

The goals of this task are to install the selected EE package(s) and the monitoring system, to commission new equipment, retro-commission existing equipment, to verify proper installation of all package measures and to provide Best Practice guides.

Task 4.1 Procurement of EE Packages

The goal of this task is to select minor subcontractors to install the EE packages, review package costs and schedule installation of retrofit measures.

The Recipient shall:

- Determine and select trade/subcontractors based on a competitive bid process to perform installation of each EE measure/technology in the packages.
- Obtain final cost estimates for EE packages including new or emerging technologies. Re-examine package costs based on bids from installing subcontractors – conduct any value engineering as necessary to be within budget while maintaining VER goals.
- Perform initial field testing and evaluation of the practicality of installing ETs, if directed by the CPM. Such ETs include, but are not limited to, innovative HVAC (or subcomponent systems) systems including Variable Refrigerant Flow heatpumps for the larger multifamily buildings, ductless minisplits to eliminate ducts while maintaining airflows and outside air ventilation.
- Schedule installation of retrofit measures and of monitoring equipment. Identify and resolve any foreseeable scheduling, procurement, technical or code-related problems. Record problems and solutions for later analysis and future avoidance.
- Research and find all available and appropriate Best Practice Guides for installations, testing, and commissioning measures and/or buildings. Where possible, obtain permissions to include these guides in the Technology Transfer and Product tasks. Extend or develop Best Practice Guides as needed for training and quality assurance purposes.
- Train subcontractors/installers on all elements of retrofit, including goals and objectives of the project. Integrate Best Practice Guides into the training programs/process. Revise schedule if necessary based on feedback from subcontractors.
- Obtain required building permits
- Procure equipment and materials needed for installation of the selected EE Packages.
- Prepare a Procurement Report. The report will include, but not be limited to, the results and information for all the items listed in the Recipient shall section of this task, such as lists and names of subcontractors, the package cost for each EEM and EE package by building type, installation schedule, copies of best practice guides, results of any field test and evaluations on ETs, and building permits obtained.

Exhibit A WORK STATEMENT

Product:

- Procurement Report (no draft)

Task 4.2 EEM and Monitoring Equipment Installation, Commissioning and Building Occupant Training

The goal of this task is to install the EE packages, monitoring equipment, commission the EEMs and provide training to building occupants.

The Recipient shall:

- Manage installation of retrofit measures and of monitoring equipment.
- Monitor and evaluate the installation of the EE packages; identify and resolve any problems, technical or code-related. Record problems and solutions for later analysis and future mitigation.
- Inspect and test all retrofit EEMs during/following installation to ensure proper function. Record problems and solutions to avoid them in future installations. Commission EE package equipment and appliances. Retro-commission existing equipment (if applicable).
- Monitor and collect data regarding each EEM and EE package costs and compare with original estimates. Determine the causes of any significant increases in EE package costs and mitigate if possible.
- Install monitoring equipment concurrent with EEM and EE Package installations. Commission monitoring and data collection, storage, and transmission system.
- Install and commission HEM/HAN.
- Develop and provide voluntary training of building occupants on use of HEM/HAN, DR/Communicating appliances and T-Stat, and proper operation and care/maintenance of high-efficiency/new technologies
- Prepare Retrofitting Task Report that shall include, but not be limited to:
 - The goals of the retrofits;
 - The EE Packages (referencing Package Data Sheets for details);
 - Any variances from the original EE Package designs and reasons for the variances;
 - Descriptions of the EE package installations and any important variants from the anticipated installation processes;
 - Descriptions of any installation variants encountered and how they were mitigated or otherwise handled;
 - Any anticipated impacts on EE package performance due to any installation variants;
 - Any significant differences in EEM and/or EE package costs, the reasons for the differences, and the impacts of those differences on the effectiveness and ranking of the impacted EE package(s).
 - A discussion of the overall retrofit process, and any implications on the remainder of the project resulting from any installation problems and/or variants.
 - Photographs as appropriate.
- Participate in CPR Meeting and prepare a CPR report as per Task 1.2.

Exhibit A WORK STATEMENT

Products:

- Retrofitting Task Report (no draft)
- CPR Report

Task 5 Development of Financial Models for Scalable Implementation

The goal of this task is to develop financial models and tools that overcome the common barriers to retrofitting low-income multifamily properties as described in the Problem Statement.

The Recipient shall:

- Summarize the barriers to retrofit financing. Engage in discussion with members of NMESC and other Housing and Urban Development (HUD) Energy Innovation Fund grantees to identify the most common and significant barriers and potential solutions. Financing for the spectrum of multifamily retrofits will be considered including renovation, VER, solar PV and solar domestic hot water/space heating.
- Summarize financing lessons learned from previous Low income Multifamily Retrofit Programs in California (in which LINC Housing participated in design and implementation) and identify potential solutions. Examples LINC Housing to be studied include:
 - Enterprise-low income multifamily Bay Area Multifamily Pilot which tested the viability of a stand-alone retrofit loan program using private capital and stimulus funding (2009-2011)
 - Housing Authority of the County of Los Angeles Sustainable Retrofit Program funded from local housing dollars (2010-2011)
 - Los Angeles Housing Department Affordable Multifamily Retrofit Program funded by Energy Conservation Block Grant dollars (2010-2011)
 - Sacramento Municipal Utility District MF Retrofit Program funded with stimulus dollars (2010-2011)
- Critique existing retrofit products and vendors including power-purchase agreements and lease programs and ways they can be improved and used for the low income multifamily properties.
- Develop strategies and financial tools to retrofit low-income multifamily properties so that the split incentive barrier is overcome resulting in equitably shared savings between the property owner and residents. Identify the benefits and disadvantages and barriers to each strategy.
- Work with the utilities to establish a protocol for Virtual Net Metering (VNM) in existing low-income multifamily property. This work would be conducted at LINC's Seasons at Ontario property or other LINC property with concurrence from CPM. VNM has been implemented in new construction but not existing low income multifamily properties.
- Work with the California Tax Credit Allocation Committee (TCAC) to allow Energy Efficiency Based Utility Allowances (EEBUA) to be implemented after retrofits have been completed. Currently TCAC allows the use of building simulation

Exhibit A

WORK STATEMENT

software, the California Utility Allowance Calculator (CUAC), to calculate EEBUAs for new construction projects. Use of the CUAC can be tested at LINC properties including Beechwood.

- Evaluate the SCG-LINC on-bill financing (OBF) repayment pilot. Review the results of other OBF programs that NMESC members, HUD EIF grantees and others are working on across the US. Identify lessons learned and best practices. Engage SCG and SCE in discussions and planning for the use of OBF to fund VERs in low income multifamily properties. Research other capital sources that would be interested in funding OBF programs.
- Engage IOUs in designing and developing multi-family financing pilots
- Engage funding and finance entities including banks, foundations, Community Development Finance Institutions (CDFIs), New Market Tax Credit investors and Federal Energy Tax Credit investors and present results and data from this pilot that could help improve existing and develop new financial products.
- Research and develop ways that carbon market financing could be integrated into the financing of low-income multifamily retrofits. This includes cap and trade financing under California's AB 32 legislation, Renewable Energy Certificates (RECs) and Voluntary Emissions Reductions.
- Evaluate the ability of community-based energy services companies as operated by the members of NMESC including LINC and other HUD EIF grantees to attract financing. Identify advantages and any disadvantages that these companies have in their pursuit of financing.
- Write Financing Task Report. This Financing Task Report shall include, but not be limited to, all analysis completed under the Recipient shall section of this task, including:
 - Summary of barriers to retrofit financing
 - Summary of financing lessons from previous low income multifamily retrofit programs
 - Describe currently available financial products along with their advantages, disadvantages and limitations in the low-income multifamily market;
 - Suggest ways that current financial vehicles can be improved and scaled up;
 - Describe strategies and financial tools and models that overcome the split incentive challenge, include advantages, disadvantages and limitations, to include, but not be limited to;
 - OBF: Evaluate the OBF repayment program offered by utilities and the potential for scaling up and funding VERs and applicability to the low income multifamily property owner;
 - VNM: Evaluate implementation of VNM at LINC's Seasons at Ontario property and potential applicability for existing low income multifamily properties, such as Beechwood;
 - TCAC: Discuss the results of the effort to get TCAC to approve use of the California Utility Allowance Calculator in determining Energy Efficiency Based Utility Allowances for retrofitted properties;
 - IOUs: Discuss the results of efforts to develop multi-family financing pilots

Exhibit A WORK STATEMENT

- Carbon market financing: Discuss the results of research associated with using cap and trade financing for low income multifamily retrofits
- Community based energy services companies: Discuss the ability of these companies to attract financing and the advantages and disadvantages.
- Summarize the status of finance entities' current appetite for engagement in the low-income multifamily retrofit market. Identify ways to encourage expanded participation by banks, foundations, investors and utilities.

Products:

- Draft Financing Task Report
- Final Financing Task Report

Task 6 Data Acquisition, Analysis and Reporting

The goals of this task are to collect operational data for at least 12 months, analyze the data and include the data and analysis in the Final Report.

The Recipient shall:

- Prepare a Data Collection and Analysis Plan. The plan will be based on input from the CPM and include, but not limited to, a discussion of the methods and analyses to be used to determine:
 - Energy savings and estimated cost savings from the VERS
 - Greenhouse gas reductions
 - Other non-energy benefits, focusing on those developed in Task 2 to be the metric for rating EEM and EE packages for different building types
- Prepare a Data Analysis Report. The report will include, but not be limited to:
 - Analysis of the data collected from the approximately 30 retrofitted units to evaluate the EEM and EE packages for different building types, as defined in Tasks 2 and 3.
 - An estimate of the project's energy savings and other benefits and potential statewide energy savings once market potential has been realized.
 - Analysis of EEM and EE packages for each building type, by each unit with error analysis
 - Comparison of project performance and expectations provided in the proposal to actual project performance and accomplishments.
 - The actual benefit/cost analysis for the 30 retrofitted units in total and by EE package.

Exhibit A WORK STATEMENT

- Discussion on whether the energy performance goal indicated in the Goals of the Agreement Section have been achieved in the targeted apartments. Include any successes, limitations and barriers and recommendations.
- Discussion of whether the goal of ZNE or ZNE capable is practical, cost effective and replicable, including successes, limitations, barriers and recommendations.
- Discussion and data on potential job creation, market potential, economic development, and increased state revenue as a result of expected future expansion.

Products:

- Data Collection and Analysis Plan (no draft)
- Data Analysis Report (no draft)

Task 7 Technology Transfer and Commercialization Plan

The goals of this task are to perform technology transfer/commercialization activities as the project progresses, and to develop a guide to low-income multifamily VERS for publishing.

The Recipient shall:

- Prepare a Technology Transfer Plan that summarizes the information transferred in this research project. Key elements from this report will be included in the Final Report. This Technology Transfer Plan shall include, but not be limited to:
 - A summary of the outreach and transfer activities performed in this Task, and the relative effectiveness of each (Including but not limited to meeting minutes, attendees and organizations present for each gathering).
 - The preferred financing approach to minimize the effects of split incentives on lending and the cost-effectiveness of the VER to all involved
 - The key technical information that this project disseminated
 - Weblink provided to web-based library and interactive forum
 - The team's evaluation of market acceptance and uptake of key project findings, technologies, and documents.
 - Identification of workshops/meetings/forum materials and/or proceedings attended and presented

Exhibit A WORK STATEMENT

- Prepare a Commercialization Plan which includes the development of a low income multifamily VERs Guide to help owners of low income multifamily properties. The plan will include, but not be limited to, the following areas:
 - Description of Best Practices, including:
 - Audits
 - Integrated Design Team and Process
 - VERs packages
 - Construction management
 - Measurement and verification
 - Ongoing operations and maintenance
 - Resident engagement and training
 - Financial products and strategies that can help fund multifamily retrofits on a broad scale. An implementation plan to scale up these financing mechanisms efficiently will be addressed. Products and strategies to be addressed include:
 - Implementation plan to scale up financing mechanisms
 - Discussions on-bill financing, tax credit investment and bond financing
 - Projected “should cost” for VER packages covering a range of savings for a few of the most common low income multifamily building types.
 - Projected “should cost” based on per unit expenditure for percentage savings achieved for subject housing stock.
 - Projected investment threshold to launch the commercialization of low-income multifamily retrofits on a wider scale.
 - Service delivery models for the most efficient and cost-effective retrofit of low-income multifamily properties including community-based energy service companies. Provide an implementation plan to ramp up the delivery models to full production.
 - A list of resources for more information and, where possible, any needed tools, such as financial tools.

Products:

- Draft Technology Transfer Plan
- Final Technology Transfer Plan
- Draft Commercialization Plan
- Final Commercialization Plan