

**CONTRACT REQUESTS FORM (CRF)**



New Contract 500-11-019  Amendment to Existing Contract: \_\_\_\_\_ Amendment Number: \_\_\_\_\_

Division	Contract Manager:	MS-	Phone	CM Training Date
Energy Research and Development	Jamie Patterson	43	916-327-2342	1/21/1998

Contractor's Legal Name	Federal ID Number
The Regents of the University of California on behalf of the California Institute for Energy and Environment	94-3067788

Title of Project
Distribution System Field Study with California Utilities to Assess Capacity for Renewables and Electric Vehicles

Term	Start Date	End Date	Amount
New/Original Contract	6/30/2012	3/31/2015	\$ 1,167,380

Line up the Amendment information as best as possible within the following table.

Amendment #	End Date (mm/dd/yy)	Amount

**Business Meeting Information**

Proposed Business Meeting Date	5/9/2012	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Jamie Patterson	Time Needed:	5 minutes

**Agenda Item Subject and Description**

Possible approval of Contract 500-11-019 with The Regents of the University of California on behalf of the California Institute for Energy and Environment for \$1,167,380.00 to conduct a field study to assess the impact of renewable generation and electric vehicles on the distribution circuits of the San Diego Gas and Electric Company, Pacific Gas and Electric Company, and Southern California Edison. The length of this agreement is 33 months.(PIER electricity funding.) Contact Jamie Patterson. (5 minutes).

**Business Meeting approval is not required for the following types of contracts:** *Executive Director's signature is required in all cases.*

- Contracts less than \$10k (*Policy Committee's signature is also required*)
- Amendment for a no-cost time extension. Must be first extension, less than one year and original contract less than \$100k.
- Contracts less than \$25k for Expert Witness in Energy Facility licensing cases and amendments.

**Purpose of Contract or Purpose of Amendment, if applicable**

The purpose of the agreement is to conduct a field study on the impacts of renewable generation and electric vehicles on utility distribution circuits. The proposed work is the first of a multi-phased initiative that will: (1) coordinate the collection of empirical field data by California utilities (including San Diego Gas & Electric Company, Southern California Edison, and Pacific Gas & Electric Company) into a shared data repository that can continue to be expanded; and (2) leverage ongoing distribution circuit monitoring studies, including ARRA-funded projects.

**California Environmental Quality Act (CEQA) Compliance**

1. Is Contract considered a "Project" under CEQA?
  - Yes: skip to question 2
  - No: complete the following (PRC 21065 and 14 CCR 15378):  
 Explain why contract is not considered a "Project":  
 Contract will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because it involves data collection and modeling activities.
2. If contract is considered a "Project" under CEQA:
  - a) Contract **IS** exempt. (Draft NOE required)
    - 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 contract is exempt under the above section:
  - b) Contract **IS NOT** exempt. The Contract Manager needs to consult with the Energy Commission attorney assigned to their division and the Siting Office regarding a possible Initial Study.

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CEC-94 (Revised 5/11)

CALIFORNIA ENERGY COMMISSION



Budgets Information								
Contract Amount Funded		Breakdown by FY			Funding Sources			
Funding Source	Amount	FY	Amount	Approved?	Funding Source	FY	Budget List No.	Amount
ARFVTF	\$	11-12	\$1,167,380	Yes	PIER-E	10-11	501.0271	\$1,167,380
ECAA	\$		\$					\$
State- ERPA	\$		\$					\$
Federal	\$		\$					\$
PIER - E	\$1,167,380		\$					\$
PIER - NG	\$		\$					\$
Reimbursement	\$		\$					\$
Other	\$		\$					\$
<b>TOTAL:</b>	<b>\$1,167,380</b>	<b>TOTAL:</b>	<b>\$1,167,380</b>		<b>TOTAL:</b>			<b>\$1,167,380</b>
Reimbursement Contract #:					Federal Agreement			

Contractor's Administrator/ Officer		Contractor's Project Manager	
Name:	Alexandra von Meier	Name:	Carl Blumstein
Address:	2087 ADDISON ST FL 2	Address:	2087 ADDISON ST FL 2
City, State, Zip:	BERKELEY, CA 94704-1268	City, State, Zip:	BERKELEY, CA 94704-1268
Phone/ Fax:	707-322-3538 / 510-643-9324	Phone/ Fax:	510-643-9321 /510-643-9324
E-Mail:	vonmeier@uc-ciee.org	E-Mail:	Carl.blumstein@uc-ciee.org

Contractor Is
<input type="checkbox"/> Private Company (including non-profits) <input checked="" type="checkbox"/> CA State Agency (including UC and CSU) <input type="checkbox"/> Government Entity (i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)

Selection Process Used
<input type="checkbox"/> Solicitation <u>Select Type</u> Solicitation #: _____ # of Bids: _____ Low Bid? <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Non Competitive Bid (Attach CEC 96) <input checked="" type="checkbox"/> Exempt Interagency

Civil Service Considerations
<input type="checkbox"/> Not Applicable (Contract is with a CA State Entity or a membership/co-sponsorship) <input checked="" type="checkbox"/> Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER) <input type="checkbox"/> The Services Contracted: <input type="checkbox"/> are not available within civil service <input type="checkbox"/> cannot be performed satisfactorily by civil service employees <input type="checkbox"/> are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system. <input type="checkbox"/> The Services are of such an: <input type="checkbox"/> urgent <input type="checkbox"/> temporary, or <input type="checkbox"/> occasional nature that the delay to implement under civil service would frustrate their very purpose. <b>Justification:</b> Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)

**CONTRACT REQUESTS FORM (CRF)**



Payment Method			
<input checked="" type="checkbox"/> A. Reimbursement in arrears based on:			
<input type="checkbox"/> Itemized Monthly	<input checked="" type="checkbox"/> Itemized Quarterly	<input type="checkbox"/> Flat Rate	<input type="checkbox"/> One-time
<input type="checkbox"/> B. Advanced Payment			
<input type="checkbox"/> C. Other, explain:			

Retention			
1. Is contract subject to retention?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
If Yes, Do you plan to release retention prior to contract termination?		<input type="checkbox"/> No	<input type="checkbox"/> Yes

Justification of Rates
The rates charged in this contract by the University of California are U.C. published rates and the overhead rates are the negotiated rates with the Energy Commission.

Disabled Veteran Business Enterprise Program (DVBE)
1. <input checked="" type="checkbox"/> Not Applicable
2. <input type="checkbox"/> Meets DVBE Requirements      DVBE Amount:\$ _____ DVBE %: _____
<input type="checkbox"/> Contractor is Certified DVBE
<input type="checkbox"/> Contractor is Subcontracting with a DVBE: _____
3. <input type="checkbox"/> Requesting DVBE Exemption (attach CEC 95)

Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
If yes, check appropriate box:		<input type="checkbox"/> SB	<input type="checkbox"/> MB <input type="checkbox"/> DVBE

Is Contractor subcontracting any services?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
If yes, give company name and identify if they are a Small Business (SB), Micro Business (MB) and/or DVBE:			

Miscellaneous Contract Information			
1. Will there be Work Authorizations?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
2. Is the Contractor providing confidential information?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
3. Is the contractor going to purchase equipment?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
4. Check frequency of progress reports			
<input type="checkbox"/> Monthly		<input checked="" type="checkbox"/> Quarterly	<input type="checkbox"/> _____
5. Will a final report be required?		<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes
6. Is the contract, with amendments, longer than a year? If yes, why?		<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes
The Department of General Services has agreed to give the Commission blanket authority to execute multi-year contracts to support the Commission's RD&D Programs.			

# CONTRACT REQUESTS FORM (CRF)



The following items should be attached to this CRF			
1. Scope of Work, Attach as Exhibit A.	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
2. Budget Detail, Attach as Exhibit B.	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
3. CEC 96, NCB Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached	
4. CEC 30, Survey of Prior Work	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached	
5. CEC 95, DVBE Exemption Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached	
6. Draft CEQA Notice of Exemption (NOE)	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
7. Resumes	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
8. CEC 105, Questionnaire for Identifying Conflicts		<input checked="" type="checkbox"/> Attached	
9. CEC 106, IT Component Reporting Form		<input checked="" type="checkbox"/> Attached	

\_\_\_\_\_  
 Contract Manager                      Date                      Office Manager                      Date                      Deputy Director                      Date

The following signatures are only required when contract approval is delegated to the Executive Office and not approved at a Business Meeting. See Business Meeting Information Section.

\_\_\_\_\_  
 Presiding Policy Committee                      Date                      Associate Policy Committee                      Date                      Executive Director                      Date

**Exhibit A**  
**SCOPE OF WORK**  
**OVERVIEW OF DISTRIBUTION FEEDER CHARACTERISTICS FOR RENEWABLES**  
**INTEGRATION, PHASE I**

**TECHNICAL TASK LIST**

Task #	CPR	Task Name
1	N/A	Administration
2		Establishment of Preliminary Data Inventory
3		Data Repository Creation and Management
4		Feeder Behavior Characterization
5		Validation of Preliminary Distribution System Model
6		Preparation of Advanced Distribution Monitoring Design Plan

**KEY NAME LIST**

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1,2,4,6	Carl Blumstein, Alexandra von Meier, California Institute for Energy and Environment		
3	Natasha Balac, UC San Diego		
5	Keyue Smedley, UC Irvine		

**GLOSSARY**

*Specific terms and acronyms used throughout this work statement are defined as follows:*

Acronym	Definition
CAISO	California Independent System Operator
CPR	Critical Project Review
DG	Distributed Generation
Energy Commission	California Energy Commission
EV	Electric Vehicle
PAC	Project Advisory Committee
PV	Photovoltaic
PIER	Public Interest Energy Research
UCC.1	Uniform Commercial Code (Financing Statement)

## **Background and Problem Statement**

Renewable generation capacity is rapidly growing in California. A significant portion of renewable energy systems will be installed at the distribution level. Governor Brown's goal of 12,000 megawatts of distributed renewable generation envisions significant installations of photovoltaic (PV) generation on state property, in addition to residential and commercial rooftop systems initiated by utility customers. Most of these will be interconnected at various points in the electric distribution system, rather than at the high-voltage transmission level. The population of plug-in hybrids and electric vehicles (EVs) is expected to grow substantially over the coming years. These developments pose unique technical challenges to distribution systems, in addition to concerns at the transmission level.

Technical issues associated with high local penetration of distributed generation (DG) and EVs include a range of impacts on transformers, voltage regulation, circuit protection, and system modeling. To address these issues, it is necessary to specify the conditions under which problems would be expected to occur and to identify solutions. A critical first step in doing so is to gather empirical data about distribution system performance, including measured effects of DG on distribution circuits to date. These empirical data can be used to validate distribution feeder models by comparing the models' predictions to what was actually measured. While existing models provide good characterizations of distribution circuits with little or no DG, their ability to make predictions about the circuits' behavior under high DG penetrations is uncertain. Based on the empirical feeder data and any discrepancies between these data and existing models, modeling updates can be developed to account for any new observed behaviors attributable to renewable integration. Improved distribution feeder models will then be better able to answer questions about what impacts to expect from high penetrations of DG and how to address these impacts in the most cost-effective manner.

Ongoing work of California utilities has focused primarily on voltage profiles and model validation for a small number of individual feeders under high DG penetration. However, since extensive monitoring of distribution circuits was historically not cost-effective given the lack of need for such information, there is little if any comparative data of sufficient quality to provide a baseline or reference for measurements on distribution feeders with and without high penetrations. Furthermore, monitoring systems are not in place for discovering unanticipated distribution system phenomena. Despite considerable design differences, time variation, and many other idiosyncrasies of distribution circuits, operators have little visibility of electrical phenomena resulting from these new sources and users of electricity on distribution circuits. The lack of visibility also applies to transmission operators such as the California Independent System Operator (CAISO), who find it increasingly important to have some knowledge of what happens behind the substation because of effects on the reliability and economic efficiencies of the total interconnected transmission system.

Development of a more comprehensive characterization of distribution feeder behavior requires selecting a larger, more representative sample of diverse circuits for study (including those with little or no DG). Because individual utilities still have only a

relatively small number of distribution feeders exposed to high DG penetrations, it is important to leverage every research effort, including American Recovery and Reinvestment Act projects, by sharing information and creating a collective data repository.

This agreement is Phase I of a two-phased project that will enable the first systematic look at a representative sample of distribution circuits in California. Phase I includes establishment of a collaborative process of sharing data, using the highest resolution measurements available from existing devices. It also involves analysis of available data for characterization of distribution feeders with and without DG, validation of distribution feeder models, identification of gaps in available data, and planning for the implementation of future monitoring for Phase II.

Phase II will involve expansion of the data repository with measurements from new line sensors and substation monitors installed by participating utilities with this project in mind, according to parameters developed jointly in Phase I. With more complete data at higher resolution from a representative sample of distribution feeders across California, Phase II will extend the empirical feeder characterization and the model validation. In addition, data from Phase II will support the correction of circuit models and the development of new models that represent advanced components, such as advanced inverters.

### **Goals of the Agreement**

The goals of this Agreement are to advance electric transmission and distribution science and technology in the public interest in the following ways:

- Support the safe and reliable operation of the electric transmission and distribution system with a substantially increased presence of DG and EVs.
- Characterize the impacts of increasing penetrations of distributed intermittent renewable generation and EVs on electric distribution system operation and performance.
- Provide a better understanding of the need for strategic upgrades and new technologies in the distribution system infrastructure and operational tools to accommodate desired levels of DG.

### **Objectives of the Agreement**

The objectives of the agreement are to:

- Coordinate the collection of empirical data by several California utilities on a representative sample of distribution circuits;
- Analyze the data for critical information about the performance of different distribution circuits at different penetration levels of DG and EV;
- Extract and combine information from prior distribution circuit studies to build on existing knowledge and avoid duplication of effort;
- Test, validate, and develop models of distribution circuits with high penetrations of distributed resources that capture interactive effects at high resolution; and
- Share results and conclusions with California utilities and CAISO.

## **TASK 1.0 ADMINISTRATION**

### **MEETINGS**

#### **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 Contractor shall:**

- Attend a “kick-off” meeting with the Commission Contract Manager, the Contracts Officer, and a representative of the Accounting Office. The Contractor shall bring their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the Commission Contract Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the Commission Contract Manager will provide an agenda to all potential meeting participants.

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

- Terms and conditions of the Agreement
- CPRs (Task 1.2)
- Match fund documentation (Task 1.7)
- Permit documentation (Task 1.8)

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

- The Commission Contract Manager’s expectations for accomplishing tasks described in the Scope of Work;
- An updated Schedule of Deliverables
- Progress Reports (Task 1.4)
- Technical Deliverables (Task 1.5)
- Final Report (Task 1.6)

The Commission Contract Manager shall designate the date and location of this meeting.

#### **Contractor Deliverables:**

- An Updated Schedule of Deliverables
- An Updated Gantt Chart (if included)
- An Updated List of Match Funds
- An Updated List of Permits

#### **Commission Contract Manager Deliverables:**

- Final Report Instructions

## **Task 1.2 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 if it should, are there any modifications that need to be made to the tasks, deliverables, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Contract Manager and as shown in the Technical Task List above and in the Schedule of Deliverables. However, the Commission Contract Manager may schedule additional CPRs as necessary, and, if necessary, the budget will be reallocated to cover the additional costs borne by the Contractor, but the overall contract amount will not increase.

Participants include the Commission Contract Manager and the Contractor, and may include the Commission Contracts Officer, the PIER Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Contract Manager to provide support to the Energy Commission.

### **The Commission Contract Manager shall:**

- Determine the location, date and time of each CPR meeting with the Contractor. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Contractor the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on 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 continuing, whether or not to modify the tasks, schedule, deliverables and budget for the remainder of the Agreement, including not proceeding with one or more tasks. I
- Provide the Contractor with a written determination in accordance with the schedule. The written response may include a requirement for the Contractor to revise one or more deliverable(s) that were included in the CPR.

### **The Contractor 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 of the projects. This report shall be submitted along with any other deliverables identified in this Scope of

Work. Submit these documents to the Commission Contract Manager 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.

**Contractor Deliverables:**

- CPR Report(s)
- CPR deliverables identified in the Scope of Work

**Commission Contract Manager Deliverables:**

- Agenda and a List of Expected Participants
- Schedule for Written Determination
- Written Determination

**Task 1.3 Final Meeting**

The goal of this task is to closeout this Agreement.

**The Contractor shall:**

- Meet with the Energy Commission to present the 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 Contractor, the Commission Contracts Officer, and the Commission Contract Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Contract Manager.

The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the Agreement. The Commission Contract Manager will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following Agreement closeout items:

- What to do with any state-owned equipment (Options)
- Need to file UCC.1 form re: Energy Commission's interest in patented technology
- Energy Commission's request for specific "generated" data (not already provided in Agreement deliverables)
- Need to document Contractor's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions, such as repayment provisions and

- confidential deliverables
- Final invoicing and release of retention
- Prepare a schedule for completing the closeout activities for this Agreement.

**Deliverables:**

- Written documentation of meeting agreements and all pertinent information
- Schedule for completing closeout activities

**REPORTING**

**See Exhibit D, Reports/Deliverables/Records.**

**Task 1.4 Quarterly 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.

**The Contractor shall:**

- Prepare progress reports, which summarize all Agreement activities conducted by the Contractor 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 Commission Contract Manager within 10 working days after the end of the reporting period. Attachment A-2, Progress Report Format, provides the recommended specifications.

**Deliverables:**

- Quarterly Progress Reports

**Task 1.5 Test Plans, Technical Reports and Interim Deliverables**

The goal of this task is to set forth the general requirements for submitting test plans, technical reports and other interim deliverables, unless described differently in the Technical Tasks. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

<http://www.energy.ca.gov/contracts/pier/contractors/index.html>

**The Contractor shall:**

- Unless otherwise directed in this Scope of Work, submit a draft of each deliverable listed in the Technical Tasks to the Commission Contract Manager for review and comment in accordance with the approved Schedule of Deliverables. The Commission Contract Manager will provide written comments back to the Contractor on the draft deliverable within 10 working days of receipt. Once agreement has

been reached on the draft, the Contractor shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

### **Task 1.6 Final Report**

The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work done under this Agreement. The Commission Contract Manager will review and approve the Final Report. The Final Report must be completed on or before the termination date of the Agreement. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

<http://www.energy.ca.gov/contracts/pier/contractors/index.html>

The Final Report shall be a public document. If the Contractor has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Contractor shall perform the following subtasks for both the public and confidential versions of the Final Report.

#### **Task 1.6.1 Final Report Outline**

##### **The Contractor shall:**

- Prepare a draft outline of the Final Report.
- Submit the draft outline of Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments back to the Contractor on the draft outline within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final outline to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final outline within 5 working days of receipt.

##### **Deliverables:**

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

#### **Task 1.6.2 Final Report**

##### **The Contractor shall:**

- Prepare the draft Final Report for this Agreement in accordance with the approved outline.

- Submit the draft Final Report to the Commission Contract Manager for review and comment. The Commission Contract Manager will provide written comments within 10 working days of receipt.

Once agreement on the draft Final Report has been reached, the Commission Contract Manager shall forward the electronic version of this report for Energy Commission internal approval. Once the approval is given, the Commission Contract Manager shall provide written approval to the Contractor within 5 working days.

- Submit one bound copy of the Final Report with the final invoice.

**Deliverables:**

- Draft Final Report
- Final Report

**MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT**

**Task 1.7 Identify and Obtain Matching Funds**

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for 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. While the PIER budget for this task will be zero dollars, the Contractor may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before the Contractor can incur any costs for which the Contractor will request reimbursement.

**The Contractor shall:**

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:
  1. 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.
  2. 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, and 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 Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.
- 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.
- Discuss match funds and the implications to the Agreement if they are significantly 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 the appropriate information to the Commission Contract Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

**Deliverables:**

- A letter regarding Match Funds or stating that no Match Funds are provided
- Letter(s) for New Match Funds
- A copy of each Match Fund commitment letter
- Letter that Match Funds were Reduced (if applicable)

**Task 1.8 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 reimbursable under this Agreement. Permits must be identified in writing before the Contractor can incur any costs related to the use of the permit(s) for which the Contractor will request reimbursement.

**The Contractor shall:**

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:

1. If there are no permits required at the start of this Agreement, then state such in the letter.
2. 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
  - Schedule the Contractor will follow in applying for and obtaining these permits.
- The list of permits and the schedule for obtaining them will be discussed at the kick-off meeting, and a timetable for submitting the updated list, schedule and the copies of the permits will be developed. 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, then provide the appropriate information on each permit and an updated schedule to the Commission Contract Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Contract Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Contract Manager within 5 working days. Either of these events may trigger an additional CPR.

**Deliverables:**

- A letter documenting the Permits or stating that no Permits are required
- Updated list of Permits as they change during the Term of the Agreement
- Updated schedule for acquiring Permits as it changes during the Term of the Agreement
- A copy of each approved Permit

**Task 1.9 Electronic File Format**

The goal of this task is to unify the formats of electronic data and documents provided to the Energy Commission as contract deliverables. Another goal is to establish the computer platforms, operating systems and software that will be required to review and approve all software deliverables.

### **The Contractor shall:**

- Deliver documents to the Commission Contract Manager in the following formats:
  - Data sets shall be in Microsoft (MS) Access or MS Excel file format.
  - PC-based text documents shall be in MS Word file format.
  - Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
  - Project management documents shall be in MS Project file format.
- Request exemptions to the electronic file format in writing at least 90 days before the deliverable is submitted.

### **Deliverables:**

- A letter requesting exemption from the Electronic File Format (if applicable)

## **TECHNICAL TASKS**

The Contractor shall prepare all deliverables in accordance with the requirements in Task 1.5. Deliverables not requiring a draft version are indicated by marking “(no draft)” after the deliverable name.

### **Task 2 Establishment of Preliminary Data Inventory**

The goal of this task is to establish an inventory of distribution system measurements being collected by California electric utilities. These data streams may come from regular operations or specific studies (e.g., for assessing power quality and other impacts of distributed generation to date). The inventory will include technical specifications (e.g., data resolution, format, accuracy, data storage, and communication) of existing measurements of voltage and current in order to ascertain compatibility with the collective data repository and determine eligibility of each data stream for inclusion. The inventory will also identify gaps (such as types of circuits or measurement) where new or enhanced monitoring is especially urgent, to inform Task 6 and Phase II.

### **The Performing Institution shall:**

- Develop a detailed inventory of existing distribution system monitoring efforts by each utility partner.
- Meet with utility partners to discuss data resolution and format, inclusion of specific data streams, and satisfactory handling of privacy/security issues.
- Draft a Memorandum of Understanding for utility partners about terms under which each will contribute data to be shared.
- Prepare and maintain a combined inventory of included data streams from all participating utility partners.
- Distribute completed inventory among partners.
- Prepare a Report on the Preliminary Data Inventory that lists and characterizes

the physical measurements to be used in the project.

**Task 2 Deliverables:**

- Report on the Preliminary Data Inventory (no draft)

**Task 3 Data Repository Creation and Management**

The goal of this task is to produce and maintain a data repository with data streams from various distribution circuits of all utility partners. These data streams will be concatenated into a meaningful data set that can be cross-correlated and indexed by multiple parameters, and thus mined for information about the characteristics of distribution circuits under different conditions. Initially, this data repository will be populated with existing measurements from up to six utilities, as identified in Task 2. The data repository will be designed to expand and accommodate advanced distribution monitoring data to be collected in Phase II of this project.

**The Performing Institution shall:**

- Coordinate the collection of utility distribution monitoring data as they become available.
- Establish and maintain a data repository populated with utility distribution monitoring data.
- Review data compatibility, resolution, and accuracy with individual utility partners on an ongoing basis.
- Estimate measurement errors and their impacts on study results.
- Combine data in a searchable form with time-series in an appropriate resolution.
- Produce a visual display of data with appropriate user interface.
- Prepare a Summary Report on the Distribution Monitoring Data Repository that characterizes the data obtained from multiple measurement streams.

**Task 3 Deliverables:**

- Summary Report on the Distribution Monitoring Data Repository (no draft)

**Task 4 Feeder Behavior Characterization**

The goals of this task are to identify power flow, voltage, and power quality behavior on distribution feeders to the extent possible with existing measurements; and to determine the impacts of different variables, including:

- Feeder characteristics and configuration
- Presence and penetration level of distributed energy resources or EVs
- Operating strategies, such as voltage regulation

To the extent possible with existing data, analysis should aim to identify the temporal and spatial resolution at which significant phenomena occur, or to determine shortcomings of existing data, to inform Task 6 and Phase II.

**The Performing Institution shall:**

- Analyze distribution feeder data from sample circuits included in the data

repository.

- Identify, characterize, and categorize noteworthy events (such as voltage variations, transients, or reverse power flow).
- Categorize distribution feeders according to characteristics and behavior, if possible.
- Associate events with feeder characteristics and penetration levels of DG or other devices, where possible.
- Hypothesize causal relationships where appropriate.
- Meet with utility partners to evaluate results.
- Prepare a Report on Distribution Feeder Behavior that analyzes and discusses implications of the data from multiple distribution circuit measurement streams.

#### **Task 4 Deliverables**

- Report on Distribution Feeder Behavior (no draft)

#### **Task 5 Validation of Preliminary Distribution System Model**

The goal of this task is to validate up to three distribution circuit models to ensure that they yield accurate predictions for the effects of distributed energy resources, including various forms of distributed generation and EVs, and to pinpoint any areas where discrepancies occur. The model predictions for the circuits in the monitoring study can then be compared to each other, as well as to the monitored data for validation. The standard operating procedure established would be applicable for model validation with advanced monitoring data in Phase II, and ultimately extendable to all feeders in California. This task can be performed concurrently with Task 4.

#### **The Performing Institution shall:**

- Meet with utility partners to understand the status of modeling for their distribution systems.
- Identify models to be validated in the study.
- Identify candidate feeders to be used for model validation.
- Establish access procedure to the models with satisfactory privacy/security measures.
- Evaluate the component models of DGs and EVs in the candidate feeders and recommend modification as necessary.
- Design a set of tests to validate the models of the candidate feeders by comparing the model predictions with the measurement data from the monitoring points; record a list of the discrepancies; and make suggestions for adding new monitoring points or increasing monitoring data resolution as necessary.
- Recommend a set of standard operating procedures for the validation process, such as model correction, updating, and maintenance of automatic and standardized data collection, data formatting, data rounding, data comparison with the model, and data presentation.
- Perform model tests to the extent feasible.
- Propose corrections to the models to minimize discrepancies.
- Prepare a Report on Distribution Feeder Model Validation that compares model

**Task 5 Deliverables:**

- Report on Distribution Feeder Model Validation (no draft)

**Task 6 Preparation of Advanced Distribution Monitoring Design Plan**

The goals of this task are to determine the need for additional data collection and to coordinate a collaborative design process with participating electric utilities (up to a total of six) to determine the most instructive and cost-effective design of advanced monitoring of distribution circuits in Phase II of this project. Design parameters will include:

- Selection of distribution feeders to be studied;
- Number and location of monitoring points on each feeder;
- Types of monitoring hardware to be used;
- Specifications for data resolution; and
- Data formats and communication protocols to be used.

The design plan will draw on lessons learned during pilot installation of advanced distribution monitoring units by participating utilities in Phase I.

**The Performing Institution shall:**

- Determine the need (based on a conference with utility partners) for additional data collection designed for the goals of the project.
- Provide utility partners with information about sensing and communications hardware options.
- Assist utility partners in choosing and designing pilot installations of advanced monitoring equipment.
- Conduct meetings with utility partners to discuss lessons learned from data sharing with existing measurements and from pilot installations of advanced monitoring units. Facilitate consensus about advanced monitoring design.
- Prepare an Advanced Distribution Monitoring Design Plan that will outline the activities, process and timeline for Phase II of this project.

**Task 6 Deliverables:**

- Advanced Distribution Monitoring Design Plan (no draft)