STATE OF CALIFORNIA EDMUND G. BROWN JR., *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

July 9, 2015

Terry O'Day
11390 West Olympic Boulevard, Suite 250
Los Angeles, CA 90064

RE: EV Storage Accelerator project proposal

Dear Mr. O'Day:

I have received NRG's April 22 request to approve the use of CPUC-NRG Settlement funding not to exceed $1 million for the attached EV Storage Accelerator project. This letter approves the use of $1 million of the CPUC-NRG Settlement's Technology Demonstration Program for this project.

In 2012, the Federal Energy Regulatory Commission (FERC) approved the CPUC-NRG Settlement (FERC Docket EL02-60). The settlement includes, among other provisions, that NRG spend $5 million as part of the Technology Demonstration program. This program funds projects related to the "deployment, demonstration, and testing of electric vehicle charging technology." (Section (4)(d)(i) of the settlement). The settlement requires that NRG and CPUC agree on any projects that are funded as part of the Technology Demonstration program.

This letter approves the project described in the document attached to Mr. Fisher's April 22 letter. Consistent with the vision of the settlement, we ask that any vehicle manufacturer with a bi-directional vehicle be allowed to participate in the pilot. Energy Division staff requests that you actively engage Energy Division staff and CAISO staff to complete Task 2, where you will be identifying bi-directional power flow use cases and business models. Coordinating with CPUC and CAISO staff will ensure that Task 2 produces work products that can support the efforts of these agencies to develop market opportunities for this technology.

Sincerely,

Timothy J. Sullivan
Executive Director

NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

April 22, 2015

Adam Langton
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Dear Adam,

The purpose of this letter and accompanying documentation is to assist the CPUC in determining whether NRG's proposal under CEC PON 14-301 ("EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles") can be funded through NRG's settlement (under Technology Demonstration Funds) as opposed to through CEC.

NRG is excited about moving the project forward. As we describe in our proposal, the project represents a highly credible effort to advance bi-directional electric vehicle technologies. The project includes participation from two major automobile manufacturers – Nissan and Honda – and will be based out of University of California San Diego, a leader in hosting commercialization efforts for electric vehicle and energy storage technologies.

Enclosed in this document is our original CEC application (with a few requested modifications), along with a short appendix addressing some of your specific questions about the project. While we do anticipate the project to have a few changes as a result of Technology Demonstration Program funding compared to CEC funding, we look forward to working with the CPUC to identify future modifications that align with the overall project goal.

NRG believes that the Technology Demonstration Program funds would be a good fit for the project. Based on CPUC approval to use $1 million of Technology Demonstration funds to support the EV Storage Accelerator project, NRG is prepared rescind our proposed CEC award under PON 14-301.

Sincerely,

Scott Fisher
Director, EV Solutions

ATTACHMENT 1
Application Form

This form provides the Energy Commission with basic information about the applicant and the project. Each applicant must complete and sign this form. Each form may address only one Project Group (1, 2, or 3). If an applicant submits multiple applications that address the same project group, each application must be for a distinct project (i.e., no overlap with respect to the tasks described in the Scope of Work, Attachment 6).

Applicant's Identification Information		
Legal Name	**NRG Energy, Inc.**	
Status	☒ Private Company ☐ Non-profit ☐ California State Agency *(includes the University of California and California State University)* ☐ Government Entity *(e.g., city, county, federal government, air/water/school district, joint power authority, out-of-state university)*	
Federal Tax ID #	**41 - 1724239**	
Project Manager *(serves as the point of contact for all communications)*	Name	Scott Fisher
	Street Address	NRG Energy, Inc. 211 Carnegie Center
	City, State, and Zip Code	Princeton, NJ 08540
	Phone/ Fax Numbers	Phone: (609) 524 - 4647 Fax: NA
	E-Mail Address	Scott.Fisher@nrgenergy.com

Project Title
EV Storage Accelerator: *Proving Commercial Viability of Energy Storage from Electric Vehicles*

Proposed Term *(must fall within the dates specified in the "Key Activities Schedule" in Part I of the solicitation.)*	
Start Date: 5 / 1 / 2015	**End Date: 3 / 31 / 2018**

Project Groups *(Place a check in the box applicable to the proposed project. **Select only <u>one</u> group per application.** See Part II of the solicitation for an explanation of each project group.)*
☐ **Group 1:** Demonstration of Low Carbon-Based Microgrids for Critical Facilities ☐ **Group 2:** Demonstration of High-Penetration, Renewable-Based Microgrids ☒ **Group 3:** Demonstration of Advanced Smart and Bidirectional Vehicle Charging

Project Location	
Street Address	**University of California, San Diego** **9500 Gilman Drive, #0057**
City, State, and Zip Code	**La Jolla, CA 92093**
Specify the location of the demonstration site(s) below, if different from above. Expand this chart if necessary.	
Street Address	University of California, San Diego 9500 Gilman Drive

ATTACHMENT 1
Application Form

City, State, and Zip Code	La Jolla, CA 92093
Street Address	UCSD Trade Street Warehouse 7835 Trade St., Suite 100
City, State, and Zip Code	San Diego, CA 92121
IOU Service Territory	☐ Pacific Gas and Electric Co. ☐ Southern California Edison ☒ San Diego Gas and Electric Co.

Project Description *(Describe the project in a brief paragraph)*

Under the proposed *EV Storage Accelerator* Project, NRG will locate seven to nine vehicles consisting of Nissan LEAFs and Honda Accord Plug-in Hybrid Electric Vehicles at seven locations on and near the University of California San Diego campus. Both of these vehicle types will have bi-directional capability. The goal will be to test a variety of energy storage use cases, including grid services, building management, and distribution system/microgrid support in an effort to understand the best use cases for California. In doing so, the project will address the technical and practical differences between electric vehicles serving as an energy storage resource (which is not yet a commercial product) and stand-alone behind-the-meter battery systems (which is a commercial product). These differences include automaker acceptance, inverter technology, use cases, and cost. At the end of the project, NRG expects to be able to offer this technology as a commercial product to customers.

Critical Facilities *(As discussed in Part II of the solicitation, eligible projects must include at least one "critical facility," defined as either a public or private facility that provides critical services to its community in times of public emergency such as a natural disaster, power outage, disease epidemic, or chemical emergency. Provide the information requested below.* ***Cut and paste this chart as necessary to identify additional facilities.****)*

Name of Facility	Police Department	
Street Address	9500 Gilman Drive, #0017 Campus Service Complex Building B	
City, State, and Zip Code	La Jolla, CA 92093	
Category	☐ Hospital ☐ Emergency operation center ☐ Care facility ☐ Fire station ☒ Police station ☐ Water or wastewater treatment plant ☐ Facility identified as a source of essential services in a California Local Energy Assurance Plan (CaLEAP)[1] ☐ Fueling facility ☐ Port	☐ Critical federal, state, or municipal facility (e.g., court, jail) ☐ School ☐ Shelter (e.g., facility that provides shelter to humans or animals during public emergencies) ☐ Supermarket ☐ Other *(please specify):*

[1] http://www.caleap.org/index.php.

Explain why the facility identified above falls within the definition of "critical facility":

The Police Station at the Central Campus Complex of UCSD is considered the Critical Facility for the *EV Storage Accelerator* demonstration. The nature of what the police department does is vital to the health of the community in La Jolla and it is imperative that during grid or natural disruptions, the police force maintains mobility and is electrically self sufficient. Currently the UCSD Police Department has two levels of redundancy to protect the station from disruption in the electric grid – the UCSD micro grid and a backup diesel generator for the facilities. With *EV Storage Accelerator* installing a bi-directional EVSE at the facilities it would add an additional layer of strength and protection for not only the police department, but the community at large.

Funding *(See the "Funding" section in Part I of the solicitation)*	
Project Group *(select only **one**)*	☐ **Group 1:** Demonstration of Low Carbon-Based Microgrids for Critical Facilities ☐ **Group 2:** Demonstration of High-Penetration, Renewable-Based Microgrids ☒ **Group 3:** Demonstration of Advanced Smart and Bidirectional Vehicle Charging
Amount Requested **Group 1:** $500,000 to $5,000,000 **Group 2:** $500,000 to $5,000,000 **Group 3:** ~~$500,000~~ **$200,000** to $2,000,000	**$ 1,495,650**
Match Funding *(The amount must be consistent with the amount or dollar value described in any match funding commitment letters. See Attachment 11.)*	**$ 1,299,724** ☒ Cash in hand ☒ Equipment ☐ Materials ☒ Information technology services ☒ Travel ☒ Subcontractor costs ☒ Contractor**/Project Partner** in-kind labor Costs ☐ Advanced practice costs

California Environmental Quality Act (CEQA) Compliance *(for an explanation of CEQA requirements, see Attachment 8, **CEQA Compliance Form** or http://ceres.ca.gov/ceqa/. **Complete and sign Attachment 8 regardless of whether the answers to the questions below are "yes" or "no."**)*

1. Are the proposed activities considered a "project" under CEQA (i.e., do they have the potential to cause a direct or a reasonably foreseeable indirect physical change in the environment)? *See California Public Resources Code Section 21065 and 14 California Code of Regulations Section 15378 for a definition of "project."*

☐ Yes: skip to question 2.
☒ No: complete the sentence below.
The activities funded by the agreement will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment

because the demonstration sites are at existing facilities.

2. If the proposed activities are considered a "project" under CEQA and are not exempt, has the required environmental review been completed?

☐ Yes (provide the documentation required in Attachment 8, CEQA Compliance Form)
☐ No.**(explain why no documentation has been prepared where indicated on Attachment 8)**

Subcontractors *(If subcontractors will perform work for the project, insert the legal name of each subcontractor below.)*
University of California, San Diego
Strategen Consulting LLC
Olivine, Inc
Solarrus

Past Agreements *(Complete the table below if the applicant and/or its subcontractors have any active or past (within the last three years) agreements with the Energy Commission, any other California state agency, California utilities, and/or the U.S. Department of Energy. If the number of agreements for the applicant or subcontractor exceeds ten, list at least ten of the applicant or subcontractor's most recent agreements, in order of date and relevance to the proposed project.)*

Name of Applicant or Subcontractor	**Name of Entity that Issued the Agreement, Contact Name, and Phone Number**	**Description of Project and Status**
NRG Energy, Inc	California Public Utilities Commission & California Electricity Oversight Board Adam Langton Adam.langton@cpuc.ca.gov 415-703-1812	California Electric Vehicle Infrasturcture Build Out Status: In Progress March 2012 – March 2016
NRG Energy, Inc	US Department of Energy Ted McMahon Ted.mcmahon@netl.doe.gov 304-285-4865	"Post-Combustion Carbon Capture Demonstration Project" Status: In Progress March 2010 – March 2016
University of California, San Diego	California Energy Comission 500-10-043 Consuelo Sichon csichon@energy.ca.gov (916) 927 - 2222	Improved Economics of Solar Power Through Resource Analysis, Forrecasting, and Dynamic Systems Modeling. Status: In progress 6/30/2009 – 3/31/2015
University of California, San Diego	California Energy Comission PON-10-003 Hassan Mohammed Hassan.Mohammed@energy.ca.gov (916) 327 - 1442	Improved Modeling Tools Development of High Penetration Solar Status: In progress 12/1/2010 – 2/06/2015
University of Delaware	US Department of Energy DE-EE0005366	Mid-Atlantic Offshore Wind Interconnection and

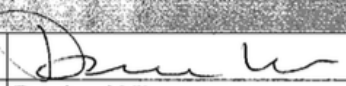
	Bradley Ring Bradley.ring@ee.doe.gov (720) 356-1768	Transmission (MAOWIT) Status: In Progress Oct 2011-Dec 2015
Strategen Consulting, LLC	U.S. Department of Energy Global Energy Storage Database (GESDB) Huff, Georgianne Energy Storage Technology and Systems Sandia National Laboratories 505-844-9855 P.O. Box 5800, MS 1140 Albuquerque, New Mexico 87185-1140	Project Description: Develop and maintain the Global Energy Storage Database (GESDB) Current Status: active execution of contract
Strategen Consulting, LLC	San Diego Gas & Electric DC Power Systems Workshop John Holmes JHolmes@semprautilities.com 8330 Century Park Ct San Diego CA 92123	Develop a microgrid DC power systems stakeholder workshop and report Current Status: Completed 2014Q2
Princeton Power	Southern California Edison Loic Gaillac Loic.Gaillac@sce.com	Demonstration at University of California Irvine. The Irvine Smart Grid Demonstration (ISGD) is a regional smart grid demonstration project funded, in part, by the US Department of Energy. Status: In Progress 12/21/2012 – 10/21/2013
Princeton Power	San Diego Gas & Electric Andy Fridel – project manager afriedl@semprautilities.com	The City of San Diego partnered to complete the Solar-to-EV Project – a one-of-a-kind 90-kilowatt solar canopy in the parking lot shared by the San Diego Zoo and Balboa Park. Status: Operational 9/2012
Princeton Power	San Diego Gas & Electric Andy Fridel – project manager afriedl@semprautilities.com	Del Lago - The project is primarily a technology demonstration for grid-services. 209 kWh of lithium ion storage with San Diego Gas and Electric owned 173 kW solar panel system. Status: Operational

ATTACHMENT 1
Application Form

		7/8/2013

Certifications

1. I am authorized to complete and sign this form on behalf of the applicant.
2. I authorize the California Energy Commission to make any inquiries necessary to verify the information presented in this application.
3. *General Applicants Only:* I have read and understand the terms and conditions contained in this solicitation. I accept the terms and conditions contained in this solicitation on behalf of the applicant, and the applicant is willing to enter into an agreement with the Energy Commission to conduct the proposed project according to the terms and conditions without negotiation.
4. *University of California/ U.S. Department of Energy Applicants Only:* I understand that the terms and conditions applicable to the University of California and the U.S. Department of Energy National Laboratories are in negotiation and will be posted once finalized. If the applicant is not willing to enter into an agreement with the Energy Commission to conduct the proposed project according the terms and conditions without negotiation, it will not receive an award under this solicitation.
5. To the best of my knowledge, the information contained in this application is correct and complete.

Signature of Authorized Representative		Date: 11/11/2014
Printed Name of Authorized Representative Denise Wilson	Denise Wilson Executive Vice President President, Electric Vehicle Solutions NRG Energy, Inc.	

ATTACHMENT 2
Executive Summary Form

1. **Project description:**

Since 2011, NRG Energy – through a joint venture with the University of Delaware – has been working to commercialize technology that allows elective vehicles to provide value as an energy storage resource. The proposed project, called the *EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles,* is designed to prove the viability of this resource for California. (For purposes of this application, "EV storage" means bidirectional power flow, unless otherwise indicated).

The project will leverage a number of recent milestones in "vehicle-to-grid" technology. First, two major automakers, Nissan and Honda, have made commitments to this technology and are partners on this project. Second, through NRG's work to date with automakers and with PJM, the company has proven that it can control an aggregated group of vehicles to meet the requirements of a specific signal with a variety of different communication protocols. Third, because of Princeton Power Systems' work with Nissan at the Los Angeles Air Force Base, there is now a UL-listed way to export power from a vehicle.

With UC San Diego as the host site, NRG, with support from subcontractor Olivine, will aggregate 7-9 bidirectional electric vehicles to test Use Case 4 (V2G), as outlined in the California ISO's *Vehicle Grid Integration Roadmap.* Strategen – a leader in the California energy storage market – will play an important role in determining the individual energy storage use cases that the project will be testing.

2. **Project goals and objectives:**

The project has four primary goals. The first is to work with two major automakers – Nissan and Honda – to test their separate approaches to bidirectional energy storage to prepare them for a further commitment to the technology**.** The second is to reduce the costs and increase the viability of inverter technology for EVs. The third goal is to identify viable energy storage use cases for bidirectional electric vehicles and assess the financial and operational performance of those vehicles against those use cases. Finally, the project aims to leverage data and insights from the project to play a constructive role in the VGI Roadmap process and in other related stakeholder processes, such as energy storage.

The NRG team recognizes that the overall objective of the solicitation is to deliver commercial technologies. The main objective of the proposed project is that at least one major automaker is prepared to support commercialization of bidirectional energy storage from vehicles. A second important objective is that NRG – already a leader in providing innovative energy solutions for home and business customers – is in a position to provide an easy and seamless way for customers in California (and elsewhere) to access such a product. A third outcome is to finalize in-vehicle inverter standards (through SAE and UL) and have those standards be part of a specific utility interconnection process for in-vehicle inverters. A final objective of the project is that electric vehicles will be able to provide storage services beyond backup power. This final objective will happen through a combination of technology development and broader regulatory/policy measures.

3. **Explanation of how project goals and objectives will be achieved, quantified, and measured:**

As with any energy resource, the electric vehicles will have performance metrics, such as availability, resource quality, revenues and costs. (NRG regularly tracks those metrics for

the project at the University of Delaware). In addition, the project's interim report (identified in Task 2.2) will identify barriers to the viability of EV storage. The project team will regularly track progress against those identified barriers. Ultimately, the availability of an NRG bidirectional EV storage product in the market will be a critical metric of a main project objective.

4. Project task description:

Task 1 is the pro forma CEC Project Management that is accepted without any exceptions. In **Task 2**, Strategen, with support from Olivine, will engage with CAISO staff, CPUC staff, and industry stakeholders to identify innovative and commercially relevant business models and use cases as well as to collect operational requirements for bidirectional charging. For **Task 3**, NRG and the University of Delaware will integrate and configure hardware and software from different participants to produce a set of working integrated bidirectional EV charging systems approved by local authorities for operations. **Task 4** will focus on developing inverter-based products required for commercialization of a bidirectional system, including for in-vehicle inverters (Honda) and for off-vehicle inverters (Nissan/Princeton Power Systems). In **Task 5**, project vehicle resource will provide actual and simulated grid services in order to a) demonstrate the viability of bidirectional charging as an energy storage resource and; b) gather information on technical details that will be useful for the CPUC regulatory process. **Task 6** focuses on designing, installing, and operating the charging stations, other site hardware, and vehicles. For **Task 7**, Olivine will achieve approval from the relevant entity (UC San Diego, SDG&E) for grid-tied generation from charging stations so they may provide energy storage services. **Task 8**, led by AESC, will be based on analyzing data from operations in order to produce results showing the benefits of the project as well as bidirectional charging overall. **Task 9**, led by Strategen, will be to detail the overall project and ratepayer benefits. A major focus of the entire team will be **Task 10,** which is to share the results of the project with stakeholders and the general public and will well exceed CEC requirements given the prominence and accessibility of the UC San Diego campus as a storage and EV proving ground. **Task 11** will be the production readiness plan, led by NRG, as per CEC requirements.

5. Agreement management description:

NRG Energy will be the lead contractor, with major subcontractors Strategen, Olivine, UC San Diego, Solarrus. Nissan and Honda will both be prominent project partners. NRG will be assisted by the University of Delaware, with whom the company has been working with successfully to demonstrate the commercial potential of bidirectional electric vehicle storage since 2011. Both Nissan and Honda have been working successfully with NRG and the University of Delaware on bidirectional electric vehicle storage already, meaning technology integration will not be starting from scratch. The project's Principal Investigator will be Scott Fisher, who has been leading NRG's work with the University of Delaware for three years and has been working closely and successfully during that time with Professor Willett Kempton, the project's co-Principal Investigator. Nicole de Leon, who has been working on the NRG/University of Delaware team, will be relocating to San Diego to serve as the project manager. Supporting overall project management efforts will be Byron Washom and a to-be-named UC San Diego Alternative Transportation Director. Finally, given the overall strategic importance of the project, NRG has assembled a first-rate Technical Advisory Committee that includes Jon Wellinghoff, former FERC Chair; Jim Detmers, former VP, Operations, CAISO; Frank Lindh, former General Council of the CPUC; Mike Bourton, VP, Business Development, Grid2Home; and Ryan Harty, Honda Environmental Business Development.

ATTACHMENT 3
Fact Sheet Template

The Issue

The development of viable and inexpensive energy storage resources has long been a challenge for the electricity industry. The recent growth of intermittent resources, especially in California with its 33% RPS mandate by 2020, has only increased the importance of dealing with that challenge. Over the last several years, the emerging energy storage industry has gained noteworthy momentum, with battery costs coming down significantly and important policy incentives – such as California's energy storage mandate – taking shape. Despite this progress, the use of electric vehicles as an energy storage resource has had only modest momentum.

Few would question the potential: one million zero emissions vehicles in California by 2020 (as outlined in the California Zero Emission Vehicle mandate) represent an enormous storage resource. When a customer purchases an electric vehicle, he or she gets with it a battery that is idle most of the day – as well as the enclosure (the vehicle) and the power electronics– that all battery storage systems require. Because they can provide power back to a house or a grid during peak periods, electric vehicles with bidirectional capabilities ("V2G") could represent a significantly more valuable energy storage resource for California than vehicles with modulated charging (i.e., one-directional power flow, or "V1G"). Providing customers with a portion of this value could significantly increase the value of owning an electric vehicle, thereby reducing the overall cost of ownership.

But there are clearly several hurdles to overcome in realizing the potential of bi-directional electric vehicles. Among these hurdles is the level of automaker commitment to the technology, the impact on battery life of bidirectional charging, the incremental cost of adding (and listing to standards) the necessary equipment, and the overall usefulness of a mobile storage device that is not always available.

The California Public Utility Commission recognizes these challenges in its December 2013 "Vehicle Grid Integration" program white paper[1], stating that prior to implementing rules for its Use Case 4: Bi-Directional Flow (V2G) "the commission should determine if automakers are developing commercial technologies in this space."

Project Description

NRG Energy's proposed response to PON 14-301, entitled *EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles*, will specifically engage two prominent automakers, Nissan and Honda, to provide them a proving ground needed to further test and ultimately develop vehicles able to meet Use Case 4.

Through its support of the bidirectional electric vehicle project at the Los Angeles Air Force Base, the California Energy Commission has already provided a valuable foundation for the technology. NRG Energy's proposed project is intended to leverage the work at the Los Angeles Air Force Base – as well as NRG's important related work – to execute a project that will bring the technology to commercialization.

NRG's eV2g partnership with the University of Delaware – in conjunction with BMW and PJM Interconnection – has already developed and executed the world's first project where electric

[1] Energy Division California Public Utility Commission, "Vehicle Grid Integration: A Vision for Zero-Emission Transportation Interconnected throughout California's Electricity System", October 2013

vehicles are aggregated together and have earned revenues by serving as a grid resource. With this, and related work, NRG has built strong partnerships focused on bidirectional electric vehicle charging with Nissan and Honda, in addition to BMW.

Under the proposed *EV Storage Accelerator* Project, NRG will locate six Nissan LEAFs and one to three Honda Accord Plug-in Hybrid Electric Vehicles at locations on and near the University of California San Diego campus. (For purposes of this application, "EV Storage" means bidirectional power flow from vehicles). Both of these vehicle types will have bidirectional capability. The LEAFs will use one of two UL listed bi-directional CHAdeMO charging stations, including a 10kW version of the Princeton Power Systems unit developed for the Los Angeles Air Force based project. The Honda Accords will use an in-vehicle bidirectional charger/inverter that Honda engineers, working closely with NRG and the University of Delaware, have developed and tested over the past two years. This Honda inverter is not currently listed to standards, but NRG and Honda are pursuing a listing, an effort this project would help support.

The goal of the proposed project is different than NRG's previous work in Delaware with PJM. In that project, the focus was to earn revenue from the PJM market. Here, the goal will be to test a variety of energy storage use cases, including grid services, building management, and distribution system/microgrid support in an effort to understand the best use cases for California. In doing so, the project will address the technical and practical differences between electric vehicles serving as an energy storage resource (which is not yet a commercial product) and stand-alone behind-the-meter battery systems (which is a commercial product). These differences include automaker acceptance, inverter technology, use cases, and cost.

At the end of the project, energy storage from electric vehicles will no longer be regarded as an interesting technology for the future, but a technology with immediate short-term commercial opportunities, sponsored by highly credible companies (NRG, Nissan, Honda) with the capabilities and resources to grow the business. The project will also support state policy making by pointing to the kinds of rules that could support significant market growth.

Anticipated Benefits for California
The project will result in the ratepayer benefits of easier and cheaper renewables integration, the resulting GHG reduction, and lower overall cost of electric vehicle ownership. The estimated 2020 Ratepayers Benefits calculated by subcontractor Strategen have provided NRG Energy with clear, plausible, and justifiable quantitative estimates based upon Strategen's modeling. Strategen calculates the annual value of per charging station at $869. With an estimated market penetration of 15,000 vehicles/charging stations with bidirectional capability by 2020, there is $13 million of value created and 67.5 MW of additional capacity. Assuming 25% of that value goes to ratepayers (the rest kept by the consumer and the integrator) there are over $3 million of ratepayer benefits annually. This compares to the $1.495 million of CEC funds requested for the project.

Project Specifics
Contractor: NRG Energy, Inc.
Partners: University of California San Diego, Strategen, Olivine, Nissan North America, Honda, University of Delaware, Princeton Power Systems, IKS USA, Solarrus, AESC, Emerson Electric
Amount: $1,495,650
Co-funding: $817,724 from NRG, $222,000 from UC San Diego, $100,000 from the University of Delaware (through NRG), $80,000 from Olivine, $10,000 from Princeton Power Systems
Term: May 2015 – March 2018

Contents

Introduction

Energy storage from bidirectional-charging electric vehicles[1] has long been an exciting concept. As more renewable resources are added to the electricity grid, electric vehicles could be an especially strong resource for helping to manage this variability. With the ZEV Action Plan targeting 1.5 million of zero-emissions vehicles in California by 2025, these vehicles are storage resources that customers have already purchased that are parked all but a few hours per day. The concept is compelling enough that the *New York Times*[2], the *Los Angeles Times*[3], and the *Wall Street Journal*[4] have all covered the topic in the past 20 months.

Furthermore, this energy storage resource is significantly more compelling when it can provide power in both directions, as compared to controlled charging. As the California Public Utility Commission writes:

> *"Bidirectional capabilities avail a larger capacity and longer duration resource than controlled charging. V1G can only provide grid value during the times that the vehicle is charging...for a typical California residential PEV customer, controlled charging will amount to about 2 hours per day. A vehicle that can discharge its battery to the grid can provide grid services whenever it is plugged-in and able to communicate with the grid."*[5]

Yet, despite the promise of bidirectional electric vehicles, there are several obstacles to realizing this promise. Some of these obstacles are obvious: electric vehicles themselves are only newly commercial, with about 250,000 plug-in vehicles currently on the road in the U.S. out of a total light duty fleet of 200 million. Furthermore, energy storage markets in the U.S. are also new, and viable business models are only starting to emerge.

Aside from these macro issues, there are more specific product-related obstacles. For example, electric vehicle manufacturers are only now beginning to understand battery degradation and many are not yet comfortable with the effect of the incremental wear on the battery from energy storage. Also, for the case of AC bidirectional charging, upgrading the onboard battery charger to a listed bidirectional inverter (to convert the DC power from the battery to grid-quality AC) could bring additional vehicle cost. Finally, the use case for a battery that is not always available (because it is sometimes being driven) could be somewhat different than the use case for a stationary battery system.

However, each of these obstacles are ones that can be overcome by successfully engaging the electric vehicle manufacturers, key inverter makers, and by providing an environment where the technology can be tested against specific energy storage use cases. The goal of the proposed project – *EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles* – is to provide this environment. (For purposes of this application, "EV Storage" means bidirectional power flow).

This project has some distinct advantages. It will be led by NRG Energy, a Fortune 250 company with a strong strategic focus on electric vehicle technology, deep automaker relationships and clear commercialization channels in California. The project will be hosted by

[1]Referred to throughout this proposal as "bidirectional electric vehicle storage", "vehicle-to-grid", "V2G" or "V2X"
[2] Wald, Matthew "In two way Charging, Electric Cars Begin to Earn Money from the Grid" *New York Times* 25 April 2013
[3] Halper, Evan "Electric cars may hold solution for power storage" *Los Angeles Times* 29 Dec 2013
[4]Fitzgerald, Michael "Electric Vehicles Sell Power Back to the Grid" *Wall Street Journal* 28 Sept 2014
[5]Energy Division California Public Utility Commission, "Vehicle Grid Integration: A Vision for Zero-Emission Transportation Interconnected throughout California's Electricity System", October 2013

UC San Diego, which has hosted a range of successful electric vehicle and storage projects and which will provide an open and accessible site for best disseminating project results. The project will also involve two major automakers, Honda and Nissan, who both have a credible path forward for incorporating bidirectional capabilities into their electric vehicles.

1 Technical Merit & Need

1.1 Goals, Objectives, Technological Advancement & Innovation

Goal 1: OEM Engagement

A primary goal of the project is to work with two major automakers – Nissan and Honda – to test their separate approaches to energy storage to prepare them for a further commitment to the technology.

A foundational item for the adoption of bidirectional electric vehicle charging is the availability of vehicles. The CPUC recognized this issue, stating that prior to implementing rules for its Use Case 4: Bidirectional Flow (V2G) "the commission should determine if automakers are developing commercial technologies in this space." [6] No automaker has, of yet, publically sanctioned using their production vehicles as energy storage devices in the U.S. That said, as Nissan writes in its letter of support, the company has commercialized a "LEAF to Home" device in Japan to provide bidirectional charging, and as they further state: Nissan "looks forward to partnering with NRG, UCSD and the rest of the project team on this important technology."

But automakers will not fully proceed in this direction without a strong signal from regulators that they are also willing to proceed in this direction. This CEC PON-14-301 presents a meaningful opportunity to get past this "chicken and egg" problem. Honda and Nissan have both started down the path of bidirectional electric vehicle charging, but the proposed project will help bring them further down that path.

Through its work to date with electric vehicles, NRG and its partners have significant credibility with these automakers. For example, with Honda, the NRG and University of Delaware team spent over two years collaborating on everything from market and cost studies, engineering integration, and communication and control processes. With Nissan, NRG is a primary partner on its "no charge to charge" program. In addition, the two companies have been working together with Princeton Power Systems to develop the 10kW bidirectional inverter for the LEAF proposed for this project.

Goal 2: Advance Bi-directional Inverter Technology

An important goal of the proposed project is to advance the inverter technology related to bidirectional electric vehicle technology. For bidirectional off-vehicle charging stations, the goal is to develop a business case to justify larger production quantities to make the inverter cheaper. For in-vehicle inverters, the goal is to develop relevant listing standards.

A second key technological obstacle for providing energy storage with electric vehicles is the lack of listed products that utilities can approve for interconnection. There are two potential approaches: 1) using a charging station that connects to the DC charging port on the vehicle and converts the power to AC; or 2) using a vehicle with an embedded bidirectional inverter that sends AC power through a bidirectional-supportive charging station (that does not have a DC to AC inverter). The project's Task 4 will focus on commercialization of these approaches.

[6] Energy Division CPUC, October 2013

Nissan Approach

Both approaches have some momentum. With funding from the Department of Defense and the California Energy Commission, Princeton Power Systems, working with Nissan, developed a UL-listed 30 kW bidirectional CHAdeMO charging station. Those charging stations are now being deployed at Los Angeles Air Force Base. NRG has purchased and installed two of these charging stations at the University of Delaware that will be deployed in early 2015 on a separate grant through the New York State Energy Research and Development Authority (NYSERDA). NRG has also commissioned Princeton Power Systems to develop and UL list a 10 kW bidirectional inverter. An initial set of those charging stations will be available in January 2015, and NRG and Nissan are going to be deploying those in a separate pilot project with PJM Interconnection in early 2015.

These 10kW bidirectional charging stations from Princeton Power are currently produced in small quantities at relatively high cost— $15,000 per charging station (compared to a similar-capacity solar inverter at under $5,000). In helping to develop a business case for bidirectional charging, the proposed *EV Storage Accelerator* project will be laying the foundation for a much larger market, and the corresponding inverter cost reductions that higher production volumes would bring.

Honda Approach

Honda has taken a different approach to inverters, having developing an in-vehicle inverter.

Unlike Nissan and others, Honda has not yet been a significant player in the electric vehicle market. Also unlike other car manufacturers, Honda is an active player in the distributed power sector, selling approximately 5 million generators per year.

In 2013, Honda, NRG and the University of Delaware announced a partnership to develop vehicle-to-grid technologies.[7] A key piece of that partnership has been to develop a bidirectional charger for the Honda Accord PHEV. Two of those vehicles are currently in service (one in Delaware and one at Honda's North American headquarters in Torrance, CA).
Honda's inclination to build their own power electronics and inverter partly comes from their power sector roots, but also partly from the opportunity to develop a radically less expensive approach to energy storage.[8] Honda believes that the incremental cost of adding the bidirectional capabilities to an electric vehicle would be approximately $500 (<$100/kW), compared to the much higher costs (~$1,500/kW) of stand-alone battery storage systems currently on the market.[9]

Goal 3: Test Use Cases

Identify viable energy storage use cases for bidirectional electric vehicles and assess the financial and operational performance of those vehicles against those use cases.

The starting point for assessing viable use cases for bidirectional electric vehicles is assessing viable uses cases for behind-the-meter storage as outline in Task 2.2.

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[7] Honda (December 2013). Honda Joins Vehicle-to-Grid Demonstration Project in Partnership with University of Delaware and NRG Energy. Retreived from http://www.honda.com/newsandviews/article.aspx?id=7502-en

[8] All electric vehicles already have valuable power electronics to transform grid AC power to DC power for charging the vehicle's battery. The same power electronics can be used for bidirectional power flow, and so the incremental hardware and software required to add bidirectional capabilities and grid-tied controls is far smaller than building a separate EV charging station with an inverter.

[9] This $100/kW needs further validation under this project

In choosing PJM as the location for its initial demonstration work, NRG and the University of Delaware saw that several battery storage projects (including behind-the-meter projects) had successfully accessed PJM's frequency regulation market. The team then designed the demonstration project to meet the needs of the market. This work required software development, hardware development, and business operations, just as any energy storage project would require. That the vehicles were regularly driven added some complexity to the software algorithms, but didn't fundamentally change the use case.

Figure 1.1 identifies several storage use case and the viability of bidirectional vehicles against those use cases.

Figure 1.1 Viability of Mobile Storage for Energy Storage Use Cases

Energy Storage Use Case	Viability for one vehicle	Viability for aggregated vehicles
Backup Power	Yes*	NA
Peak Shaving	Unlikely – peak shaving depends on storage always being available	Yes – with a large number of vehicles at a site, some number will reliably be available for peak shaving
Grid Services	No – a single vehicle typically has insufficient power to quality for grid services	Yes – aggregator needs to have intelligence to bid appropriate capacity
Load Shifting (eg helping to manage impact of "duck curve")	Possibly - will depend on individual driver uses of EV	Yes – aggregator needs to have intelligence to bid appropriate capacity
Distribution support	Unlikely – use case depends on storage resource being present during all peak times	Yes – depends on utility cooperation

* Will be based on customer's decision on whether vehicle will parked in the garage enough during power outages

The project team recognizes that simply transporting the PJM frequency regulation approach is not viable for California. Frequency regulation in the California ISO is not readily accessible for behind-the-meter resources. However, there is an emerging set of energy storage use cases in the state that the team is ready to assess.

One particular opportunity the project has in working at UC San Diego is to perform microgrid support leveraging the OSI/ESRI tool that the university is donating to the project. The UC San Diego OSI PI historian holds data at thousands of points throughout the microgrid. By using the ERSI geographical information system, NRG will be able to visualize each of the vehicles within the microgrid and understand its impact on the system. This could lead to more intelligent dispatch and, for future projects, more intelligent placement of bidirectional electric vehicles. Future applications not only include microgrid storage, but also broader distribution system intelligence and support.

As the leader in articulating the value of energy storage in California, Strategen will be a particularly valued partner in supporting the broader use case analysis, as part of Tasks 2 and 9.

Goal 4: Regulatory and Policy Support

Leverage data and insights from the EV Storage Accelerator project – and related work in areas outside of California – to play a constructive role in the VGI Roadmap process and in other related stakeholder processes, such as energy storage, that support the commercialization of bidirectional energy storage from electric vehicles.

Notwithstanding the progress that has been made in bidirectional electric vehicle storage technology, there will still be an important policy and regulatory component to support product commercialization, which will be the focus Task 10.

California – through the Self-Generation Incentive Program (SGIP) and the energy storage mandate – has a robust set of incentives for energy storage. The SGIP in particular provides a $1.62/watt incentive for advanced energy storage installations in 2014. Bidirectional electric vehicle storage applications currently do not qualify for these programs. The SGIP 2014 manual states "any indication of portability…will deem the system ineligible."[10]

The CAISO VGI Roadmap lists a variety of activities required to support their "Track 2 program: Develop Enabling Policies, Regulations and Business Processes." Many of these activities will be directly informed by the proposed project, and members of the project team intend to participate in the various policy tracks emanating from the *Roadmap*.

The below table (Figure 1.2) identifies a sample of the Track 2 goals and the ways in which the proposed EV Storage Accelerator project will support those goals.

Ultimately, regulators and policy makers will have to address fundamental questions with respect to bidirectional electric vehicle storage.

Do California's interconnection standards allow vehicles to push power in two directions? The development of a UL-listed inverter for the Nissan LEAF probably means the answer is already yes (there is still some utility discretion). However, emerging standards for in-vehicle inverters (like the Honda Accord PHEV) would need special attention.

Beyond providing back-up power to a home or business, what utility or grid services are available, and what would be required to qualify for those services? This question does not just apply to electric vehicles, but to all behind-the-meter storage devices. For grid services, two features distinguish storage from vehicles from stand-alone devices: 1), for services requiring long-term procurement contracts, there is relative uncertainty in availability of electric vehicle storage resources (analogous to that of demand response resources, handled by clearly identifying the owner of the risk of underperformance); 2), the resource may be identified as either the vehicle or the charging station (though the latter is simpler and more consistent).

What conditions (if any) would allow storage from electric vehicles to access policy support mechanisms like SGIP? There are legitimate reasons mobile storage does not qualify under SGIP. Given the enormous opportunity presented by energy storage from electric vehicles, it would be useful for policymakers to determine if there is an appropriate initial policy support mechanism for this technology.

[10] 2014 Self-Generation Incentive Program Handbook, 4.2.4

Figure 1.2 VGI Roadmap and Proposed Project Activities

Track 2 Goal	Relevance of Project
Define VGI-related projects and programs	• The *EV Storage Accelerator* project will help policymakers and regulators determine appropriate VGI rules by demonstrating "VGI capabilities", especially for bidirectional vehicles
Clarify VGI product and program requirements	• Based on the results of the work at UC San Diego, the project will be in a strong position to inform rulemaking around product and program participation. • For interconnection in particular, the project will be able to help in "distinguishing the needs for V2G using an offboard 2-way inverter versus an onboard 2-way inverter"
Ensure coherence between state policies, programs and national standards	• NRG and the University of Delaware are involved in pursuing V2G activities in a number of jurisdictions -- in PJM and in New York through a recently awarded grant with the New York State Energy Research and Development Authority (NYSERDA) • The team is also actively involved in national standards work, especially with respect to interconnection rules • The team will work to share lessons-learned across these jurisdictions

1.2 Overcoming Technical Barriers to California Statutory Energy Goals

The NRG team recognizes that the overall objective of the solicitation is to deliver commercial technologies. *A main outcome of the proposed project is that at least one major automaker is prepared to support commercialization of bidirectional energy storage from vehicles.*

A second outcome is that *third party aggregators such as NRG – already a leader in providing innovative energy solutions for home and business customers – be in a position to provide an easy and seamless way for customers in California (and elsewhere) to access such a product.* With Nissan already providing a commercial vehicle-to-home product in Japan, and with NRG a strong partner of Nissan in the U.S., both objectives are realistic.[11] The Honda in-vehicle inverter approach presents an opportunity for a radically cheaper form of energy storage. But it requires a certification path (as discussed in Section 1.3 below) – partly supported by members of this project team – before a standard utility interconnection process can be expected. *A third outcome is to finalize in-vehicle inverter standards (through SAE and UL) and have those standards be part of a specific utility interconnection process for in-vehicle inverters.*

With an interconnection process currently viable for the Nissan/Princeton Power Systems approach, the question is only partly whether a commercial product can be created. Further refinements to the Princeton Power Systems inverter—coupled with Nissan permission to use the battery during blackouts (as Nissan has done in Japan)—would allow for a commercial back-up power EV solution. The broader question is whether such a system could be used for other energy storage services besides back-up power. *Thus, a final objective of the project is that electric vehicles would be able to provide storage services beyond backup power.* This final objective would happen through a combination of technology development and broader regulatory/policy measures.

[11] Edelstein, Stephen "Nissan LEAF-to Home Power Tests: More Practical for U.S. with Longer Range Cars?" Green Car Reports. October 30, 2014

Taken together, these objectives would bring technology from a Technology Readiness Level of 7 (system prototype demonstration in an operational environment) to a Technology Readiness Level of 9 (actual system proven through successful operations).

The completion of these objectives would also support the achievement of California's statutory energy goals. By making electric vehicles more valuable, the specific target of 1.5 million zero emission vehicles by 2025 (California Executive Order B-16-2012) becomes that much more realistic. Likewise, the rapid growth in variable-output renewables needed to meet the 80% GHG reduction by 2050 target (Executive Order S-3-05) will necessitate a great deal of storage to ensure electricity supply meets demand at all times, and to avoid costly upgrades to the distribution system.

1.3 Status of Technology and Role of Project in Advancing Technology

This proposal argues that bidirectional electric vehicle storage is closer to reality than is sometimes perceived – and that the technology should be considered a viable behind-the-meter storage resource for the near future. However, unlike other behind-the-meter storage, the technology is not fully technically ready (TRL 7). To help the technology reach a TRL Level 9, the proposed project will need to focus on the end-to-end elements of a successful product. These elements are listed below.

Do production vehicles exist to provide bidirectional power flow? NRG and its partners plan to work with Honda and Nissan to find a viable path for continuing to develop these vehicles (mainly for Honda – the LEAF needs very little modification to allow backfeeding) and provide a warranty for the batteries if used for bidirectional charging (Nissan and Honda). The proposed project will provide real-world results for these auto manufacturers to assess the technology.

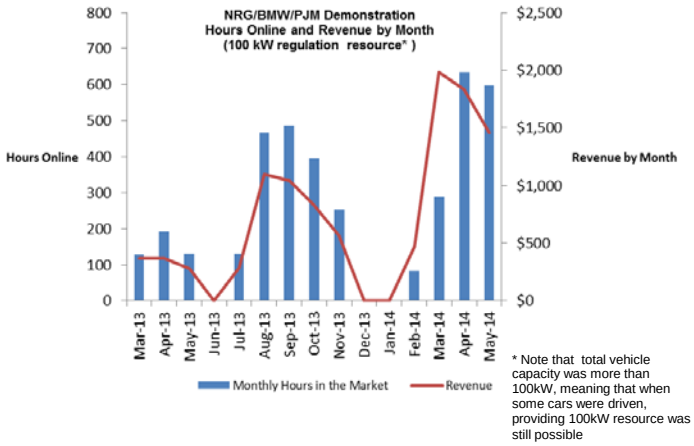
Can vehicles be coordinated and controlled for bidirectional charging? No specific open standard yet exists to perform this function. That said, the technology for coordinating a unified group of vehicles (or an individual vehicle) and controlling their charge and discharge rate is not a significant obstacle. The NRG / University of Delaware team has worked closely with automaker engineers to integrate with the BMW MINI E and the Honda Accord PHEV, and is currently working with Nissan to control the charge and discharge rate of the LEAF. The team's approach has been to be flexible to whatever integration approach each automaker/utility/ISO wants to take. For example, Mike Bourton, Vice President, Business Development for Grid2Home, a leading proponent of the emerging SEP 2 protocol, is a member of the project's Technical Advisory Committee.

No other team has worked as successfully to manage bidirectional power flow from electric vehicles. For the team's PJM project with BMW, the team was able to coordinate and control the charge and discharge rate from 20 MINI Es against a PJM regulation signal after about 4 months of work (see figure 1.3). After another 4 months, the team had completed its registration and performance testing with PJM, becoming an official market participant. The team completed a similar process with Honda soon after. Market performance improved significantly over time as the hardware protocols and control algorithms were refined.

The opportunity to continue to refine the coordination and control processes is a key aspect of the proposed project, especially as part of Task 3. These processes do not come "out of the box". For example, in late 2013, the NRG / University of Delaware team took the vehicles

operating in PJM offline to make some fundamental hardware and software changes that would later improve performance.

Figure 1.3



Once vehicles can be coordinated and controlled, do algorithms exist for the different use cases? A related question is whether the technology exists to control the vehicles against different use cases. The NRG/University of Delaware team has developed and tested algorithms for frequency regulation. The team has also developed algorithms for peak shaving and backup power, which will be tested, starting in early 2015, under a grant awarded to NRG by the New York State Energy Research and Development Authority (NYSERDA). A portion of the funding provided to the University of Delaware (as NRG cost share) will be to work closely with Olivine to develop additional algorithms for California specific use cases (Task 3 and Task 5).

Are there viable ways for interconnecting the technology? As discussed in more detail in Section 1.1.2, the proposed project is testing two interconnection pathways. One is available currently (Nissan/Princeton Power) and the project will work to improve the design and cost of that product pathway. The other (the Honda in-vehicle approach) requires additional standards work in which members of this project team will be involved as part of the project.

Despite the opportunity for breakthrough storage costs from the Honda approach, one of the challenges is that there is no UL listed way to ensure a successful utility interconnection. In fact, the National Electric Code (the source of the UL listing requirement) does not extend to vehicles—"This Code does not cover the following: (1) Installations in ships, watercraft other than floating buildings, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles"[12]. Moreover, vehicle manufacturers would never submit their vehicles to what they see as intrusive UL testing.

The listing path for this in-vehicle approach will involve the Society of Automotive Engineers (SAE, the primary certification body for automobiles), which would be responsible for developing an inverter standard that is acceptable to utilities. In early 2014, SAE J3072 was formed to draft "Interconnection Requirements for Onboard, Utility-Interactive, Inverter Systems" that will conform to the requirements of IEEE 1547 (primarily anti-islanding, power quality, and safety). Honda and other automakers are part of that committee, as are members of the NRG / University of Delaware team.

This listing process is not critical path for interconnecting the Honda vehicles at UC San Diego. The university has its own interconnection processes (and the Honda inverter has been already designed to conform with IEEE 1547 requirements and has been successfully interconnected in Delaware). However, a listing is critical path for any type of commercial approach to in-vehicle inverters. Members of the project team, especially from NRG, Honda, and the University of

[12] NFPA 70, Article 90

Delaware, will be participating in the relevant SAE (and UL committees) as part of the proposed project under Task 4.

How do we know that a large number of vehicles will be an effective resource? Just because bidirectional vehicles can be interconnected – and controlled and coordinated to act as a unified resources against a particular use case – does not necessarily mean that the resource will be effective. One potential concern with mobile resources is that, in contrast to stationary resources, they may not be available when the grid needs them most. However, with enough scale, a certain percentage of all vehicles will be available. Current research suggests that no fewer than 40% of vehicles are parked at home at any given time, and no fewer than 85% of cars are parked either at home or at work during any period during the work week (including "rush hour"). In particular, during early evening hours, after solar resources have become less effective, well over 50% of vehicles are parked at home (see also Figure 3.1). [13]

This characteristic illustrates a fundamental advantage of V2G compared to V1G: bidirectional vehicles can provide value during these early evening peak hours – when solar resources are producing much less – by sending power back to the grid. Members of the project team, led by Strategen, will use data from this project (and from other sources) to better understand the value of this "duck curve" product and the value of other related products.

1.4 Need for EPIC Funding

Just as automakers need to see interest from governments in order for them to proceed with commercialization, so does NRG. Currently, neither competitive nor regulated electricity markets present any short-term monetization opportunities for this technology. NRG is much more likely to continue to invest in and support the technology (beyond $4 million committed to date to the University of Delaware partnership) if it sees the necessary commensurate action from governments. The funding under the EPIC program represents an important commensurate action.

Bidirectional electric vehicle storage technology will receive a significant boost from the EPIC program if the proposed project is selected for funding. Government support for newer technologies brings interest from potential vendors, and it also makes a statement about potential future policy support for the technology. This support is especially important when there are multiple developments (vehicles, inverters, regulatory changes) across both the public and private sector that are required.

The Los Angeles Air Force Base project illustrates this opportunity well. Out of the project came the first UL listed way to bring power from a vehicle back to the grid (Nissan / Princeton Power). The project focused Nissan more specifically on the opportunity. Even though neither NRG nor Honda were involved in it, the project also made it easier for the NRG team to justify to Honda that the technology had potential: not only were NRG and the University of Delaware working on the technology, but the U.S. Department of Defense, the California Energy Commission, and others were also interested. The proposed project, if selected for funding, would have a similar impact. The entire ecosystem, including automakers, inverter manufacturers, standards bodies, and regulatory bodies and others will take significant more interest if an important funding entity also takes interest. The announcement and dissemination of this PON – even though the project

[13] Pearre, Nathaniel S. 2013. *Location, Duration, And Power: How Americans' Driving Habits And Charging Infrastructure Inform Vehicle-Grid Interactions.* PhD dissertation, University of Delaware. Ann Arbor: ProQuest/UMI. (Publication No. 3613054.)

is 6 months away from commencement – has already had a positive impact on the development of this ecosystem.

The specific funding is also necessary to advance the technology to TRL Level 9. NRG has committed $4 million to the development and commercialization of bidirectional electric vehicle storage through the University of Delaware partnership. This funding and associated NRG effort has been necessary, but it is not sufficient to create an entire ecosystem.

1.5 Technical Feasibility

The proposed work is technical feasible and achievable for several reasons.

First, as outlined in more detail in Section 4 of the narrative, the NRG team has a proven track record of implementing successful bidirectional electric vehicle storage projects. The team has also made sure to incorporate a number of California-specific partners to ensure an understanding of state-specific conditions. NRG itself has significant operations in California, including in electric vehicles. The addition of several credible California-based organizations, such as UC San Diego, Olivine, Strategen and AESC, significantly enhance local understanding.

Second, NRG has worked with both Nissan and Honda on technical integration. Thus, the project's timeline will not be at risk because the project team does not know how to coordinate and control the vehicles. The team has worked with Honda for two years and has been controlling the Accord PHEV since the end of 2013. The project team has been working with Nissan and Princeton Power Systems on integration since early in 2014 in preparation for a deliverable for NYSERDA. That deliverable is scheduled to be complete in early 2015, a number of months before the commencement of this proposed project.

Third, by being based at UC San Diego, the project will be working under a significantly more flexible interconnection process than if it were based in a utility territory. The benefit of this location does not mean the project will focus less on how to successfully interconnect in utility territories in the future. It just means that the project schedule will not be put at risk because of significant interconnection delays. (It is also worth noting that the project will be placing one charging station in SDG&E territory.)

1.6 Measurement & Verification Plan

The NRG team has had to conduct extensive measurement and verification to qualify as an official resource on the PJM grid. The project passed the same tests that every demand side resource on the PJM grid has to pass, including total power in and out, by second, and factoring in line losses along the way. The team has also conducted additional analysis to test the economic viability of the resource, including parasitic load tests and battery wear.
For this project, AESC will lead the measurement and verification efforts as part of Task 8.

Unlike conventional energy savings projects, V2X offers benefits beyond simply reducing demand, which is the focus of current M&V practice. Therefore, this M&V plan, while based on the widely accepted IPMVP (International Performance Measurement & Verification Protocol), is modified to account for grid impact benefits not normally covered by IPMVP. In addition, this project is to take place within UCSD's microgrid, which adds a dimension of complexity since both the microgrid and the utility grid will be impacted by the V2X operation. This necessitates additional investigation into the interaction of UCSD's microgrid with the utility grid and how V2X benefits will flow from the microgrid to the utility grid. Modifications to this proposed M&V plan will be made following that investigation.

Technology Description and Intended Result

V2X is a technology that allows electric vehicles to serve as behind-the-meter energy storage devices when they plugged-in and idle. As described earlier, the project will showcase cost-effective V2X technology, but equally important it will draw from the California Vehicle-Grid Integration Roadmap and from engagement with the CPUC to demonstrate both how existing regulatory structures can be leveraged, and highlighting where rule changes are needed to take advantage of the unique strengths of V2X. In addition to an operating V2X system with charging stations at several sites generating valuable operational data, a key output of the project will be a document with suggested rule changes, including the rationale and value of those changes, to be fed back to the CPUC Alternative Fuel Vehicle proceeding (R1311007, tasked with proposing and assessing tariff rule changes that would facilitate V2X).

Measurement Boundary

For this project, there will be two proposed measurement boundaries – one encompassing the V2X enabled EVSE and a second that encompasses UCSD's microgrid. The two measurement boundaries will permit analytical flexibility to determine V2X EVSE power flow to and from the microgrid as well as the interaction between the microgrid and the utility grid.

Proposed M&V Option

For this M&V effort, we propose option A (Retrofit Isolation – key parameter measurement) for the measurements taken at the V2X enabled EVSE with supplemental measurements take at the microgrid PCC.

Option B was selection so that benefits are determined by field measurement of the power flow to and from the V2X EVSE in response to CAISO or other grid operational signals, separate from the energy use of the rest of the facility. Supplemental measurements at the microgrid PCC will provide additional data to help understand how microgrid operation affects V2X impacts to the grid.

All data will be synchronized to an interval between 1-sec to 5-mins to match CAISO dispatch intervals. Pricing signals will be provided from the CAISO. Time stamped data from the V2X enabled EVSE will be provide from on-board meters collected and analyzed daily. Microgrid internal loads and generation to be provided by UCSD DCS. Microgrid to utility grid electric data provided by UCSD or SDG&E metering. EVSE metering to be provided by NRG/UCSD. Data to be provided to AESC for analysis by NRG/UCSD. All electric meters to conform to minimum ANSI C12.20 Class ± 0.2% accuracy.

Base Year

Documentation of base year conditions will include a description of pre-V2X –

- EV, PHEV and other alternative fuel vehicle activities, in-campus counts and EVSE
- Microgrid infrastructure and operation
- Utility grid imports and exports at the microgrid's PCC
- UCSD native electric load profile, schedule, population, weather influences, equipment outages, unusual/temporary loads

Historical data will be gathered through UCSD and SDG&E meters, UCSD databases/logs and local weather stations.

Forecasted changes to the native and utility grid load will be identified and documented. These may be the result of changes in building stock, anticipated population changes, operating schedule changes, changes to microgrid facilities, etc.

Reporting Period Measurements

Once V2X is implemented, power measurements of the V2X enabled EVSE, power measurements at the microgrid's PCC, microgrid operating data and weather conditions will be collected. Other data including campus operating schedule, DER operation and unusual loads will be collected.

It is anticipated that that the post-V2X implementation period of measurement will be two years to cover all potential operating modes of the campus and vehicle operation, as well as grid conditions (on-peak versus off-peak seasons).
M&V reports will be developed for each operational year.

Benefits Analysis

Adjustments to the base year conditions will normalize the comparison of the post-retrofit measurements and base year data. These adjustments will include any changes in microgrid operation, UCSD native electric load profile, schedule, population, weather influences, equipment outages and unusual/temporary loads.

Benefits will be monetized using CAISO pricing signals for frequency regulation, energy arbitrage, spinning reserve and reactive power time synchronized with the measured power outputs from the V2X EVSE. GHG and other energy benefits will be determined using the references in Attachment 12 of the PON.

2 Technical Approach

2.1 Technique, Approach & Methods

Task 1 (Project Management) - NRG will hire and fund a project manager at 50% time to field all administrative requirements and meetings, in addition to supporting the Principal Investigator in coordinating partners and vendors, overseeing site work, making decisions, and supporting synthesis and analysis. Also supporting project management activities will be a UC San Diego hired Alternative Transport Director (person TBD) along with two graduate students.

The Technical Advisory Committee (TAC) will be key to the direction of this project, and the project team has already identified several valuable members: Jon Wellinghoff, former chair of the Federal Energy Regulatory Commission, is an expert on the legal basis for providing grid services from behind-the-meter; Jim Detmers, formerly VP of Operations for the CAISO and current advisor to Stem (a behind-the-meter energy storage company); Mike Bourton, Vice President at Grid2Home and expert on Smart Energy Profile 2.0; Frank Lindh, former General Counsel at the CPUC; and Ryan Harty, who leads Honda's storage efforts in the U.S. The members of the TAC will not only individually guide the project, but they will also collaborate to identify broader strategic paths forward within their organizations, at standards bodies, and as part of open regulatory processes to remove barriers to bidirectional electric vehicle storage.

Task 2 (Business Model) - The goal of this task is to develop the business model and use cases for energy storage from electric vehicles. Strategen will identify business opportunities, requirements, and barriers by surveying key stakeholders through outreach activities and researching documentation on existing behind-the-meter programs. They will also evaluate use cases according to benefits, costs, and suitability given requirements and availability of electric

vehicle resources. Importantly, these results will be summarized in an interim report that the project team will feed into the outreach steps in Task 10. This goal will be to create an interactive process between regulators and the project and provide a forum for automakers and regulators to address first-mover barriers. For instance, as a result of the interim report, regulators may express particular concerns about a use case that might then be addressed in the remainder of the project and documented in the final report.

Task 3 (Technical Integration) - This task consists primarily of achieving an operable system by configuring the various component devices: the vehicles, charging stations, telemetry devices, communications networks, aggregator server, building monitoring system, and grid services system. Through prior efforts, many of these control and communication links have already been established: for instance, the Honda vehicle, the University of Delaware charging station, certified telemetry device, and aggregator all can successfully communicate over a standard internet connection. The Nissan to Princeton Power link also has already been established as part of the Los Angeles Air Force base project (and through additional integration work performed by NRG/University of Delaware). The NRG / University of Delaware team is in the process of establishing a link from their software to the Princeton Power inverter, which will be complete by the time of the start of this project (that integration is required to be complete under a separate grant from NYSERDA).

Several new links will be novel: the interface between the aggregator server and the Olivine grid services server; links to distribution-level dispatch (for example integration with the OSI/ESRI PI tool at UC San Diego) and seasonal demand response dispatch; and new inverters on the project (for example, the IKS inverter). These links are established by the Ms. de Leon as the project manager by first identifying the technical contacts familiar with each device, arranging a meeting, and gathering requirements. The University of Delaware technical team will then implement software (and in some cases hardware) to meet those requirements. Ms. de Leon, as the project manager, will oversee that the system is implemented, tested, and deployed.

One important aspect of this project will be the ability of the NRG/University of Delaware technology to balance among competing interests for driving, providing building services, and providing one of potentially many grid services. The approach to this challenge is to first prioritize driving over all other uses (by always identifying the vehicle and referencing a driving schedule maintained at all times for each vehicle). Any available energy storage services are then prioritized by determining a cost and a benefit for providing the service at a particular point in time. For instance, there might be a value associated with providing ancillary services at any interval of time, as well as a cost associated with the operating losses and battery wear at that time as a function of time-of-use retail prices and temperature. This pair of parameters (value and cost) is evaluated both on a real-time basis and on a projected forward basis in order to schedule the change in state-of-charge required to accommodate different uses.

The NRG/University of Delaware team has already developed, tested and deployed the software to balance among these competing priorities. However, the particular value and cost parameters need to be determined for each use case under study. This will be accomplished by requested value data from Olivine and/or the utility; performing a survey of the literature on battery wear under different dispatch regimes and for the relevant battery chemistries; identifying the relevant electric energy rate and demand charge for each site; and determining the efficiency of each model of inverter in the project.

A final activity on this task will be supporting the site engineering and installation work to be performed under Task 6, especially with respect to electrical inspection. The NRG/University of

Delaware team has extensive expertise with the National Electric Code and will be able to provide an important supporting role in facilitating a successful and safe installation.

Task 4 (Product Development) - Task 4 focuses on readying the products needed for bidirectional charging for large-scale, low-cost commercial availability. This means creating straightforward permitting (with UL listing for permanently installed equipment and a clear interconnection path), available vehicles with typical financial terms, and cost projections reflective of increased scale.

In order both to successfully install AC bidirectional charging stations at UC San Diego (Honda approach), in order to thoroughly understand the UL listing environment for bidirectional charging stations, and in order to move towards providing a commercial bidirectional charging product, the project team will work to list the bidirectional AC charging station to UL standards. Lessons learned as a result of this effort will be drawn up in a report.

For commercial viability, the vehicle warranty and lease will have to accommodate bidirectional charging. The project team (especially NRG) will support any efforts at Nissan to produce such financial terms in the United States (such financial terms supporting bidirectional charging of the Nissan LEAF already exist in Japan).

DC bidirectional charging has a fairly straightforward path to a commercial product: the (stationary) inverter/charging station can be tested to UL 1741 (for grid-tied generation) as well as the relevant UL standards for charging stations. This means it can be approved by a local inspector, and that a utility can approve an interconnection request without the need for testing the device (since UL 1741 implies that the electrical characteristics for interconnection are identical to a conventional small solar inverter). The focus for the DC technology is on understanding and optimizing production costs at scale (with production of the DC Bidirectional Charging Station Cost Reduction Report).

AC bidirectional charging is potentially lower cost than DC (since it can avoid duplicating costly power conversion equipment), but it is more complex. The inverter generator is in the vehicle, and this mobility introduces a feature of the interconnection request process (which focuses on the characteristics of the inverter generators at a particular site) that does not have any analog in existing distributed generation interconnection processes. This complexity is now being addressed in the SAE J3072 standard, and the NRG/University of Delaware team is participating in the committee. As part of this project, the team will continue that participation. Finally, there is not currently a released listing standard from UL or any other standards body specifically tailored to bidirectional charging stations. The University of Delaware team will support and participate in committees that address this gap. Other gaps (for instance in the National Electric Code) will also be identified, addressed through committee participation, and reported on to the CEC.

Task 5 (Prove Viability of EV Storage) - Task 5 proves that EVs are capable of performing energy storage application by implementing actual and simulated services (such as grid service, integration of photovoltaics, and distribution system and microgrid support). As part of this task, Olivine (supported by the team) will produce a report on revenues and a report on technical requirements. These reports will inform the VGI Roadmap process and provide an input to future VGI-related regulatory processes.

Task 6 (Site Work) - Task 6 involves specifying, designing, and installing electrical infrastructure on site; operating charging stations and vehicles; and maintaining charging stations and

vehicles. The team will implement this task in three stages: first, high-level site plans will be developed among NRG, UC San Diego, and Solarrus. Second, Solarrus will engineer single-line diagrams, installation specifications, and materials specifications. Finally, the team will purchase materials and perform the installation.

As a public university, UC San Diego operates as its own jurisdiction for the purposes of CEQA permitting, electrical and other building permitting, and (as a microgrid), for interconnection as well. UC San Diego's in-house permitting staff are committed to the research mission of the institution, and are available to work closely with project participants to ensure equipment meets all safety and code requirements. This is a significant advantage to the project that cannot be offered in a typical municipal setting – offering substantial benefits in accelerating the timeline for installing pre-commercial equipment and providing the opportunity for longer data collection periods.

Solarrus will maintain the electrical infrastructure will be maintained throughout the project term, and NRG will remove the charging stations at the completion of the project.

UC San Diego staff and faculty will drive the vehicles. The project team will identify and train candidate drivers – and create and document a process for supporting their participation in the project (including contingency plans in case of inoperable equipment). The use of the equipment, together with the energy storage services dispatched in Task 5, shall constitute the basis for much of the data analysis to be conducted in Tasks 2 and 9.

Recognizing the unique electrical characteristics of bidirectional charging stations, and in order to support a smooth commercial roll-out of the technology, Solarrus will also expand their existing training and jobs program (called "Electric Field Service Technician" training) for military veterans to cover the equipment used on this project.

Task 7 (Interconnection) - The goal of this task is to secure permission to generate in parallel with the grid. Olivine will be responsible for this Task. For charging stations on the main campus of UCSD, the "grid" is in fact the microgrid. For sites off-campus, interconnection with be with San Diego Gas & Electric. The interconnection process has multiple steps and can be complex, and so the first task is to do a detailed investigation of requirements and specifications and document the interconnection process and planned approach. The interconnection process will then be started (with documentation provided by Solarrus and equipment providers), and the relevant authority will be engaged as the process continues. There will be close coordination among the engineering teams from all relevant parties. Any testing required may be performed using power testing facilities at the National Renewable Energy Lab (NREL) in Golden, CO. The NRG/University of Delaware team has been closely involved in testing vehicle-to-grid technologies with NREL.

Task 8 (Analysis) - Task 8 encompasses the Measurement and Verification (M&V) Plan as well as a cost analysis of energy storage from EVs, and visualization of local impacts of the bidirectional charging stations on the distribution infrastructure of the UCSD microgrid. The M&V Plan ensures that project benefits are calculated using reliable and high-quality data. It focuses on a technical evaluation of end-to-end data generation, including metering and telemetry, data collection and processing, and analysis of results. These facets are evaluated in the context of the different energy storage services. Historical baseline data will be collected to ensure precise comparison of circumstances before and after for accurate calculation of benefits. AESC will perform the M&V Plan.

The cost analysis will compare capital and operating costs of energy storage services from EVs with the same services from stationary energy storage devices. This will be conducted by AESC as an objective, arms-reach observer. Parameters evaluated will include incremental capital cost, electrical losses, and battery wear. The visualization assessment will combine detailed operational data currently being gathered from the distribution equipment on the UC San Diego microgrid with the operations of the project's bidirectional charging stations for a high-level view of the interaction of the bidirectional charging technology on distribution systems generally.

Task 9 (Evaluation of Project Benefits) - The goal of this task is to report on both benefits realized immediately due to operation of the vehicles on the project, as well as benefits projected from the successful commercialization of energy storage from electric vehicles. Strategen will be model benefits using several inputs, including the EPRI Energy Storage Valuation Tool and Strategen's own tools. Strategen will test cost effectiveness using the Total Resource Cost method. Other metrics will be assessed as per CEC request in the questionnaires outlined in the Scope of Work.

Task 10 (Technology/Knowledge Transfer Activites) - The activities under this task will leverage the substantial publicity, marketing, regulatory, and other outreach capabilities of NRG, Strategen, UCSD, and Olivine to ensure that knowledge from the project will be made widely available to the public and to industry stakeholders. In addition to the mandatory activities required by the CEC in the scope of work template, there will be an interim webinar targeted at regulatory outreach; submission of the interim report into regulatory proceedings; and, given the central role of automakers in the commercialization of energy storage from EVs, an automaker summit to share final results of the project and to invite dialog with invited regulators and governmental decision makers. NRG and University of Delaware will use their extensive relationships with automakers to invite key automaker employees to the table.

Task 11 (Production Readiness Plan) - There are several product components for energy storage from electric vehicles: the vehicle, the charging station, and communications and control networks to coordinate energy storage services and driving needs. Given the established nature of the automakers targeted under this project, production readiness for automakers (when they decide to move forward with bidirectional capabilities) will not be a question. Likewise, NRG and Olivine are both well positioned to immediately implement commercial-scale communications and control networks, as this is already an ordinary part of their businesses. The charging station manufacturers all operate at various scales well beyond that of the prototype, and each will be addressed separately in a Bidirectional Charging Station Production Readiness Plan.

2.2 Execution and Coordination

Task 1 (General Project Tasks) will be led by the NRG Project Manager Nicole de Leon. She will be responsible for meeting the requirements of Task 1 in the Scope of Work and for all communications with the CEC, including arranging meetings as well as collating and delivering invoices, products, and reports. Ms. de Leon will be the primary project contact for all project participants, and will be responsible for ensuring that project participants meet the requirements of their scope, budget, and schedule.

The products of **Task 2** (Business Model for CPUC Use Case #4: Bi-directional Power Flow) will be jointly executed by Strategen and Olivine, with Strategen having lead responsibility for coordination, scope, and delivery schedule. The lead at Olivine will be Beth Reid, and the lead at Strategen will be Janice Lin. The domain expertise of both project participants does overlap some: for instance, both are experts on the business rules, project development process, and market structures for energy storage. Each also brings unique expertise to certain areas. For

instance, Olivine is the leading company in California for identifying a feasible path to accessing CAISO markets from behind the meter, and Strategen has outstanding strengths in facilitating business cases for new clean energy technologies. For written documents, authorship will be joint; for stakeholder engagement, the project team will work together to identify stakeholders for outreach either jointly or by Olivine or Strategen alone. Strategen is responsible for leading coordination of this task and delivery of products. NRG retains oversight of the collaborative approach to this task, and in the event of conflict will reserve the right to final decision.

Task 3 (Technical Integration) will be led by Prof. Willett Kempton of University of Delaware ("UD") with direct support from Olivine. The University of Delaware team will travel to UC San Diego periodically during the configuration stage.

Task 4 (Product Development) will be led by Scott Fisher and Nicole de Leon of NRG in collaboration with leads from Honda, University of Delaware, and Princeton Power. Specific project participants will be assigned responsibility for work items (see SOW), which are performed independently and so do not require intensive coordination.

Task 5 (Prove Viability of EV Storage) will be performed by Olivine under the leadership of Beth Reid. The services to be implemented will reflect the use cases developed in Task 2, and since Olivine is jointly participating on that taskm, there will be no need for further coordination. Meter configuration and telemetry requirements will overlap to some extent with efforts on Task 3, and so the UD team will support Olivine's efforts here.

Task 6 (Site Work) will be performed by Solarrus under the leadership of Rue Phillips with logistical and site support by Kevin Norris at UC San Diego and broad project management oversight by Nicole de Leon of NRG. During key months of engineering and construction, regular phone calls will be led by Nicole de Leon. UC San Diego maintains its own permitting requirements, safety inspectors, and fire marshal. This allows for a unique degree of collaboration between authorities and design engineers from vendors of equipment used in this project, and this is expected to save significant amounts of time in the installation of new technologies relative to other sites.

Task 7 (Interconnection) will be led by Robert Anderson of Olivine. Technical information will be provided by the inverter manufacturers and the UD team will support with additional engineering details. Because UC San Diego is not a utility, it is not regulated by the state Public Utilities Commission. For sites at the microgrid, the interconnection process is governed internally, rather than by San Diego Gas and Electric. This will accelerate the project timeline for those sites. In order to prove viability at scale as well as gather information about gaps, there will also be sites that interconnect to San Diego Gas and Electric; these will take longer, but will provide valuable information about what works for existing interconnection processes for EV storage, and what needs to be addressed..

Task 8 (Analysis) will be led by Ronald Ishii of AESC. Subtask 8.1 (M&V Plan) will involve coordination with the metering configurations that will be designed by UD, installed by Solarrus, and meeting the specifications provided by Olivine. Moreover, the benefits calculations will be consistent with the use cases identified by Strategen and Olivine in Task 2 and the benefits identified by Strategen in Task 9. Subtask 8.2 (Technical Cost Comparison) will be led by AESC with data inputs and support from other team members as required.

Task 9 (Evaluation of Project Benefits) will be led by Giovanni Damato of Strategen, with support from Strategen's team of storage analysis experts.

Task 10 (Technology/Knowledge Transfer Activities) will be a joint effort by NRG, Olivine, Strategen, and UCSD. Strategen will have the lead for coordinating logistics of stakeholder outreach including any events, and UCSD will host. Strategen will also be responsible for the public web site and for producing the webinar, though in all cases authorship for the efforts will be joint, with final decision-making by NRG.

Task 11 (Production Readiness Plan) This work will be led by Scott Fisher at NRG, working closely with Nissan, Honda, and Princeton Power Systems. An important part of this task will be for Mr. Fisher to engage with NRG's customer facing entities, such as eVgo, to determine the best way to package the product in an exciting way for consumers and businesses.

2.3 Factors Critical for Success

There are several critical factors for success, as follows:

Technical integration. The EV Storage system spans automotive, consumer electrical, and bulk grid product domains. Successfully integrating a working system across this complex field requires a broad base of technical expertise. The NRG/University of Delaware team includes uniquely qualified engineers that have proven the ability to successfully achieve this with several vehicle systems in spite of unforeseen technological barriers. The present plan will use the same team to integrate the technology on this project.

Interconnection. Any new grid-tied generating technology will face unpredictable challenges in seeking permission to operate on a utility's distribution system. Utilities are often obligated to pursue the most conservative possible path when processing such requests, which results in a lengthy and costly process. The NRG/University of Delaware team has experienced this with five utilities to date, from small municipally-owned utilities to large investor-owned utilities. Moreover, Olivine (who is responsible for the interconnection on this project) has extensively documented the particular interconnection processes of SDG&E (which will be a part of this project). Finally, the bulk of the charging stations proposed will interconnect to the UC San Diego microgrid, which follows the same standards as any utility but certainly has a different procedural basis for decision-making that lends itself better to emerging technologies. For the DC bidirectional charging systems (which will be UL-listed), the team expects a straightforward interconnection process. For the AC bidirectional charging systems, in which the generating device is mobile and cannot be UL listed, there is the possibility of delays. This risk has been minimized with careful selection of the UC San Diego site. In the event that electrical testing is necessary and cannot be provided by UC San Diego or SDG&E, NRG and University of Delaware have a close relationship with testing facilities at the National Renewable Energy Lab (NREL) and currently have a vehicle and charging station installed there.

Opportunity to provide market value beyond back-up power. As Nissan has done in Japan, it is likely that NRG (working with Nissan) can create a product to provide backup power from electric vehicles to homes. To realize the larger potential of electric vehicles as a storage resource**,** new opportunities from utilities, ISOs, or microgrids will have to emerge. A clear project goal is to demonstrate this value to these entities.

An example of how the project would demonstrate value of the electric vehicle resource is to provide grid services to the CAISO. One potential problem in doing that is that a single utility account can have just one registered behind-the-meter entity with the ISO. The entire UC San Diego microgrid is a single utility account with SDG&E, so the opportunity to have a separate market entity for bidirectional charging is limited, given the multitude of new energy resources

on campus and the intention to also bid these into ISO markets. In the event that a unique ISO resource cannot be created for bidirectional charging, the options are to either coordinate among different projects and set up an accounting system to separate out actions from different devices on the same registered resource (which suffers from complexity), or simulate market access including fulfilling the complete set of ISO technical requirements, without actually activating a live market entity. Since the purpose of this project is principally to prove the viability of bidirectional charging as an energy storage resource, the latter contingency may work better. Still, a study of the feasibility of actual resource value will be an important part of the scope of this project under Task 5.

Regulatory action. The objective of this project is to deliver viable commercial bidirectional charging products by 2018. Certain regulatory outcomes are required to ensure the technical and economic feasibility of this outcome, chiefly: 1) an efficient and fair interconnection process; 2) value for products beyond backup power, which would likely entail some credit for power exports past a meter and value for providing the service from the utility or ISO. The project team plans to systematically engage the regulatory process in order to address these barriers: as stakeholders in the California power industry, NRG participates in the regulatory process, and the interim and final results from this project will be a part of that process. The stakeholder outreach efforts will also explore regulatory barriers and solutions. All of these regulatory items are generic to behind-the-meter storage devices, and so progress in that industry can potentially serve the bidirectional charging industry, as long as it is not explicitly barred (as it is with the SGIP) or logistically precluded from the ordinary processes (as would be the case for a mobile inverter generator). However, notwithstanding the above, the ultimate result of rulemaking is not in the project team's control.

Timing of standards development. The DC case of bidirectional charging requires no new standards in order to operate within today's regulatory frameworks. By contrast, AC bidirectional charging will require a new or modified UL standard for the charging station as well as a new standard (likely at SAE) for the in-vehicle inverter. The UD and NRG teams are currently engaged in the standards development process, and continuing this engagement is an important part of the present scope. However, the timing on standards development is uncertain, and in the event that these standards are not released prior to the conclusion of the project, the AC bidirectional charging product will not be commercial.

2.4 Public Availability of Findings

The accessibility of the UC San Diego host site and the reputation of the university's energy initiatives will both be important elements in making project findings publically available. The university regularly hosts stakeholders of all types for tours of the campus' energy installations, and this project will very much be a part of those tours.

Beyond the prominence of the host site, the project team will provide ongoing status and results of this project through an openly available web site. Interim and Final reports will be submitted to CEC and entered into the record of the relevant CPUC proceedings; a webinar will be held to disseminate the findings of the interim report; and a conference on final results will be held with the entire project team and key decision-makers at UC San Diego at the conclusion of the project. All data generated on the project will be available on request to the CEC, CPUC, CAISO, and other agencies without restriction.

Coordinating closely with the CEC, Mr. Fisher would also be able to leverage NRG's corporate public relations team to disseminate project results through media outlets. To date, the NRG /

University of Delaware work has been described in feature stories in the *Los Angeles Times*, the *New York Times*, and the *Wall Street Journal*.

3 Impacts and Benefits to California Ratepayers

3.1 Benefits to Investor-Owned Utility Ratepayers

This project will lead to greater system reliability in the following ways:

- Increased system, local, and flexible capacity lowers ratepayer costs by deferring or avoiding the requirement for new fuel-burning peaking generating stations and deferring or avoiding upgrades to the transmission or distribution system.
- Increased availability of energy storage to reliably integrate significant additional and accelerating amounts of variable and off-peak renewable generation into the distribution and transmission systems without additional greenhouse gas emissions.
- Decreased likelihood of critical peak events from increasing demand for EV charging.
- PV integration – assist with reduced ramping requirements and over generation ("duck chart" support).
- V2B microgrid reliability.
- Provision of ancillary services otherwise supplied by conventional fossil generation to reduce emissions of carbon dioxide and criteria pollutants as well as lower the cost of ancillary service procurement.
- Capacity to meet system contingencies such as unexpected outages of generation facilities or transmission lines (operating reserves).
- Reduce the need to use inefficient fossil-fuel generation to supply load requirements on peak demand days in order to reduce or avoid use of plants that produce very high greenhouse gas emissions and criteria pollutant emissions.

This project will reduce ratepayer costs in the following ways:

- Lower cost for energy storage procurement.
- Reduce distribution upgrade cost potential for charging station installation.
- Reduce price for system/local/flexible RA, flexi-ramp, frequency response, up/down regulation, and spin/non-spin reserves.
- Ability to manage localized distribution system issues, such as voltage regulation and localized capacity constraints.
- Reduce peak energy pricing (via energy arbitrage).
- Lower total cost of ownership of electric vehicles.

This project will increase safety in the following ways:

- Increased EV penetration from incentives for providing energy storage services will remove internal combustion engine cars from the road that will lead to:
- Reduced GHGs: electric vehicles charging in California produce emissions equivalent to a gas car with 78 mpg (Union of Concerned Scientists. 2012. "State of Charge: Electric Vehicles' Global Warming Emissions and Fuel - Cost Savings across the United States"), and likely even better results in the future as California's electric power system sees progress towards the 33% RPS target achieved.
- A California grid that is more resilient to climate change impacts (e.g. fire, flood).
- Local emissions of SOx, NOx, and PM_{10} reduced to zero per additional electric vehicles. Vehicles contribute 30%-60% of urban NOx and 4%-6% of urban PM_{10} (Wang, G et al, 2009. "Identifying contributions of on-road motor vehicles to urban air pollution using travel demand model data". J. Transportation Research Part D, No. 14, pp. 168-179).

3.2 Cost-Benefit Analysis Timeframe, Assumptions and Calculations

Approach to calculation of benefits

In order to quantity potential benefits from bidirectional charging, multiple steps have been taken, as listed below. The final project scope includes expanding upon this analysis.

Estimation of kW capacity per charging station by hour of the day

For the purposes of this analysis, we have assumed a typical bidirectional charging power of 10 kW for a conservative calculation of the capacity that could be utilized for V2G grid benefits. While 10 kW is higher than the current average onboard charging capability of many of today's electric vehicles, 10 kW fits the charging capacity of the DC charging stations proposed here, and given the higher value that comes with higher power, is a defensible value for onboard AC V2G charging in the future as well. The available amperage in the home is the primary constraint on the charging capacity: 10 kW equates to an approximately 50 amp circuit at 240V (equivalent to an ordinary electric range), which is substantial enough to provide benefits, but small enough not to overwhelm the typical household electrical capacity. In addition, a number of automobile manufacturers are already equipping vehicles with the capability of 10kW charging.[14]

Resource Availability

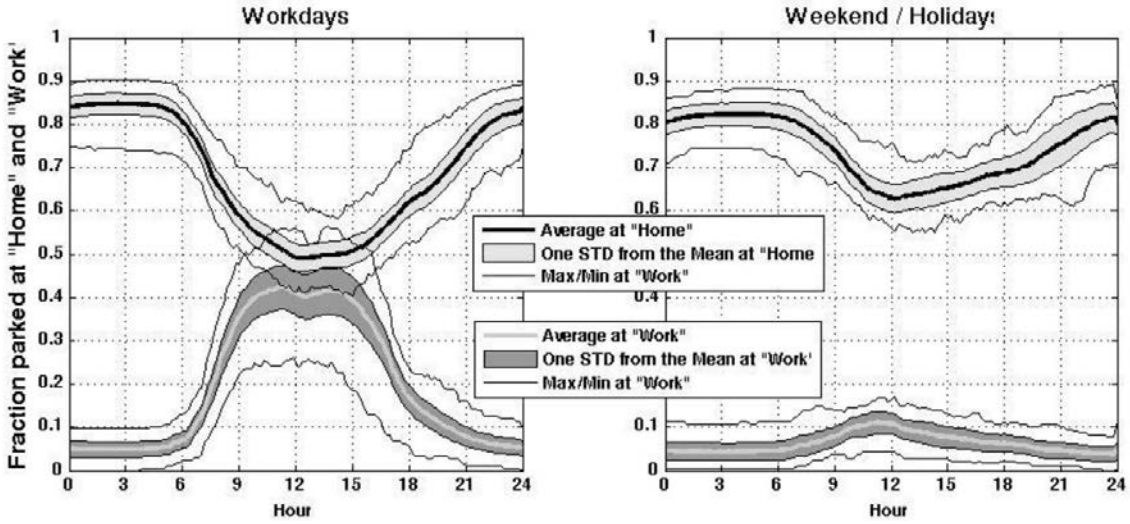
Currently, there is limited data available and such data is based upon early adopters' of EV charging behavior. However, as the goal of the project is to holistically evaluate the combined availability of vehicles at home, work, and plugged in elsewhere, the project can blend the utilization curves of residential, workplace, public, commercial/retail, and mixed use charging stations.[15] The following average utilization curve aligns with the typical location of all vehicles (conventional Internal Combustion Engine vehicles and Plug-in Electric Vehicles), as shown below in the figure depicted at home vs. at work locations of vehicles throughout the day (based on data from Atlanta[16]).

Utilization Estimate

In order to estimate the fraction of fleet-wide charging station power capacity over the course of the day that is connected to a plugged-in electric vehicle, we first assume that 2/3 of charging station power represents home charging and 1/3 represents all other use types, given the significantly higher count of residential charging sites. Combining this assumption with the parking patterns shown in the Atlanta data, we arrive at the overall fraction shown in Figure 3.1, which ranges from 49% -59% of total charging station capacity over the course of the day. Given the relatively flat curve, we make the simplifying assumption that 50% of charging station capacity is connected to an electric vehicle at all times for our calculations.

[14] Toyota Rav4 EV; Tesla Model S; Mercedes B-class electric drive.
[15] Workplace, public, commercial/retail, and mixed use charging utilization data is a random sample of Los Angeles are chargers from 9/2013-1/2014. See the next footnote for the source of residential data
[16] Commute Atlanta Study, Georgia Tech, 2014 http://commuteatlanta.ce.gatech.edu/

Figure 3.1: Average Vehicle Location Throughout the Day[17]



Gross Capacity Estimate

Taking the assumption that the average bidirectional charging capacity is 10 kW for the existing PEV fleet, and the weighted average utilization curve of EV charging stations at 50%, the "gross" capacity per charging station at any point in time can be assumed as 5kW.

Effective Net Capacity

To obtain an effective net capacity per charging station – and the resulting grid benefit potential (e.g. Resource Adequacy) – we must account for the state of charge (SOC) and charging time requirement of a typical vehicle when it arrives at a charging station. To estimate this, we start with the median driving patterns of conventional vehicles for San Diego County:

Figure 3.2: Frequency of Distanced Traveled During Weekdays in San Diego County (CALTRANS 2001 Household Survey)

	Less than 10 miles	10 to 24 miles	25 to 50 miles	Greater than 50 miles	Weighted Average
Representative miles	5	16	37.5	63	20
San Diego	46%	30%	6%	17%	100%
kWh req'd	1.75	5.6	13.125	26.25	7.00
Hours to Charge	0.175	0.560	1.313	2.625	~1
State of Charge	94%	80%	54%	9%	75.6%

We then must factor in the efficiency of an average EV. According to a 2013 Rocky Mountain Institute (RMI) article, the average EV efficiency is 35kWh per 100mi.[18] Assuming PEV drivers have similar travel patterns to those of the general driving population, we can take a weighted average of representative mileages occurring at the above frequencies, resulting in 20 miles average weekday driving. Given these driving patterns, EV efficiency, a San Diego average PEV range of 82 miles, and a typical weekday trip count of 2, the typical SOC of a vehicle when

[17] Pearre, 2013.
[18] Rocky Mountain Institute (March 12, 2013): http://blog.rmi.org/blog_2013_03_11_pain_at_the_pump

it arrives at a charging station is assumed to be 86%, having used 3.5 kWh of charge and with 25 kWh remaining. It is further assumed that a total of 1 hour of plug time will be occupied each weekday for charging the median vehicle to recover the 7.0 kWh used for total daily driving, leaving the remainder of plugged-in hours available for grid services. We therefore discount the above charging station availability of 50% by a further factor of 1/24, (roughly 5%), to arrive at total effective grid services capacity for each charging station of 45%.

The result is a typical charging station power availability of 45%, and a typical lower bound on the state of charge of 86%, or 25 kWh remaining energy.

Next, we select two existing grid services that could be provided by V2G charging. Basing these grid services on CAISO wholesale products available today that are considered most valuable for energy storage in California in general (see 2013 EPRI report Cost Effectiveness of Energy Storage in California), the frequency regulation market and resource adequacy (RA) are realistic market services that could be provided for potential V2G charging stations.

Regulation Market Value Estimate

To calculate the average value of a V2G charging station in the CAISO frequency regulation market, we used the most recent market data available[19], escalating it by 3% per year to 2020 values for the purposes of this analysis.

The following formula was used to calculate the 2020 annual value of REM:

Net Capacity * (RegUpPrice + RegDownPrice) * Time * Mileage Multiplier = Annual Revenue

The mileage multiplier is difficult to establish at this time in the CAISO market, but it is estimated that it will be at least 1.5x.

Figure 3.3: Historical CAISO Regulation pricing (in $/MW-h)

Month	RegUp	RegDown	REM Total	2020 REM Total
Sep-13	$4.39	$2.77	$7.16	$8.55
Oct-13	$5.27	$2.86	$8.13	$9.71
Nov-13	$4.93	$3.13	$8.06	$9.62
Dec-13	$7.42	$4.48	$11.90	$14.21
Jan-14	$4.81	$3.26	$8.07	$9.64
Feb-14	$5.11	$4.26	$9.37	$11.19
Mar-14	$6.59	$3.93	$10.52	$12.56
Apr-14	$6.22	$4.57	$10.79	$12.88
May-14	$7.88	$4.91	$12.79	$15.27
Jun-14	$6.42	$4.70	$11.12	$13.28
Jul-14	$8.09	$3.74	$11.83	$14.13
Aug-14	$5.68	$3.46	$9.14	$10.91
AVERAGE				**$11.83**

Power Capacity (kW)		10
Results		
Hours per year (incl. leap)		8766

[19] Pricing history from periodic recording of data from the website *California ISO – Reports and Bulletins.* http://www.caiso.com/market/Pages/ReportsBulletins/Default.aspx

Annual revenue full rating		$1,037
Total after 1.5x Mileage Factor		$1,555
Average value per charging station @45% capacity value		$699.93

This annual result is estimated to average $699.93 per charging station.

Resource Adequacy Capacity Value Estimate
Calculation of RA standard capacity value for V2G must include consideration of the ability to deliver capacity for four hours. Given the average bidirectional charger capacity of 10 kW and an approximate average SOC of 25 kWh when arriving at a charging station, each car could theoretically provide up to 6.25 kW of sustained power output for 4 hours before depleting the battery in order to meet the 4-hour RA Requirement. However, in order to prevent the available vehicle fleet from being wholly depleted at any time, we conservatively estimate that RA value would be 2.0 kW per charging station for 4 hours, for a total of 8kWh average depleted per charging station. With just 45% of charging stations paired with an idle electric vehicle and available to provide grid services, that corresponds to 17.8 kWh depletion per vehicle, leaving the typical SOC of a vehicle dispatch for RA at a minimum of 7.2 kWh or 25.2%.

RA capacity payments are negotiated bilaterally between the resource owner and the load serving entity (LSE). These negotiations are confidential and there is some uncertainty over how RA pricing will adjust for the introduction of flexible capacity requirements in addition to standard capacity starting in the 2015 RA year. For the purposes of this analysis, we use the CAISO's Capacity Procurement Mechanism or CPM (capacity procured under the reliability backstop mechanism) as a proxy for RA capacity payments. In 2014, the CAISO's CPM is set at $70.88/kW-yr. Utilizing the same 3% escalation rate assumed for regulation, the estimated 2020 RA capacity payment would be $84.63/kW-yr. Taking the earlier assumption that the average effective capacity is 2.0 kW per charging station, the 2020 annual value of RA would be $169 per charging station.

Provision of RA system-capacity dispatch would reduce the number of hours available to perform frequency regulation. We assume system capacity is called infrequently relative to the 8,766 average hours per year, and so disregard this effect as insignificantly small.

Estimation of Per-station Value of EV Storage
Assuming annual value for both frequency regulation ($699.93) and RA ($169) over a 20-year project life at a 10% discount rate and 3% value escalation, the lifetime benefit potential would be $9,083 per charging station.

3.3 Quantitative Estimates of Benefits

Ratepayer Benefits
We calculate the ratepayer benefits expected to accrue in the 2020 timeframe. Candidates for participation in a bidirectional charging program include owners and lessees of plug-in electric vehicles, a growing segment of the car market that: currently comprises ~66,000 vehicles in the three IOU territories (based on Clean Vehicle Rebate Program [CVRP] applications[20]); is now growing at a typical 2,750 units per month 6; and will comprise the bulk of the 1.0 million zero-emissions vehicles targeted statewide for 2020. In order to reach that target,

[20] Center for Sustainable Energy (2014). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated November 3, 2014. Retrieved November 12, 2014 from http://energycenter.org/clean-vehicle-rebate-project/rebate-statistics

electric vehicle sales in California will have to reach a minimum of 150,000 sales per year (up from about 33,000 today).

Commercially-available DC bidirectional charging in Japan – focused on relatively low value emergency backup, without the opportunity to provide higher-value grid-tied services – has anecdotally seen a 5% -10% adoption rate from eligible customers. We can expect that, in California, the share of grid-tied storage benefits that goes to customers will make participation more attractive than in Japan. Moreover, as discussed above, while AC bidirectional charging is more complex, it has the potential to be substantially lower cost than the DC bidirectional charging currently deployed in Japan. We therefore conservatively take 10% as the lower limit for EV storage participation (with the expectation that it would be much higher). Given commercial availability at completion of this project in 2018, we assume 2 years of sales of bidirectional-equipped electric vehicles by 2020, for a total of 300,000 incremental electric vehicle sales of which 30,000 are assumed to be equipped with bidirectional capability. According to the above benefits analysis, these vehicles will enable grid services at 15,000 bidirectional charging stations with annual benefits of $869 per station, totaling $13,033,950 of annual value and with total net capacity of 67.5MW.

In order to create an economic incentive to the end user installing the equipment, we assume that the above benefits must be shared between the ratepayer, end user, and integrator. For simplicity's sake, we assume that the ratepayer receives 25% of the value, $3.26 million annually, with the rest passed on to the end user and integrator as their incentive to participate. This figure compares favorably with the requested CEC funding of $1,495,650.

It should be noted that beyond 2020, as EV sales continue to grow and the EV storage value drives higher participation in bidirectional charging programs well beyond this initial 30,000 vehicles, the total power capacity of the aggregate fleet can be expected to grow to hundreds or thousands of megawatts, potentially providing a significant amount of additional low-cost fast generation to the system. As noted in a study by DNV KEMA[21], while the current CAISO market for frequency regulation is roughly 350MW, the need for fast balancing services like frequency regulation is expected to grow to 3,000 - 5000 MW by 2020 to account for increasing penetration of variable renewable generation.

As part of the Measurement and Verification plan, project benefits will be calculated by AESC, and incremental capital costs for current and projected equipment will be tabulated and compared with other storage resources.

Additional Values Not Estimated

In addition to the direct ratepayer benefits, the project will evaluate additional ratepayer benefits that will likely accrue to a rollout of EV storage on the system. Additional ratepayer benefits include:

- EV storage has the potential to be a lower-cost alternative to many stationary energy storage applications. Assuming EV storage is applicable in future

[21] 2008 CAISO Regulation procurement was ~390MW up and 360MW down. A 2010 KEMA forecast of 2020 Regulation procurement requirements – given increased variable generation – shows a requirement of 3,000 - 5,000 MW of storage and regulation. KEMA (2010). Research Evaluation of Wind Generation, Solar Generation, and Storage Impact on the California Grid. Prepared for the California Energy Commission, Public Interest Energy Research Program

procurement rounds, this could reduce the costs and cost effectiveness of AB2514 compliance as well as future capacity procurement through LTPP.

- Potential emergency backup value for homes and businesses
- Potential for future energy arbitrage capability
- Potential for future ramping support
- Other ancillary services
- Support for distribution system expansion
- Customer bill savings via demand charge reduction
- Innovation with regard to large scale aggregation of the California EV fleet.

3.4 Qualitative and Intangible Benefits

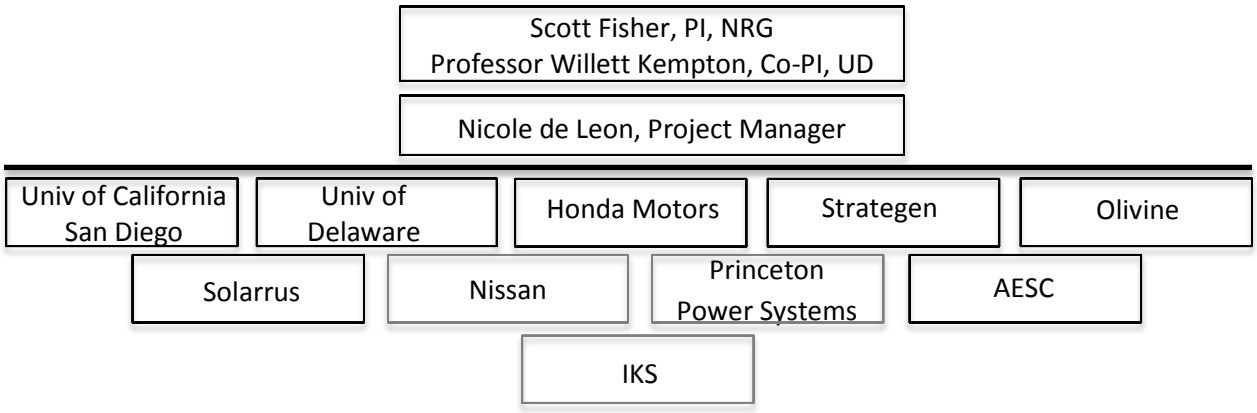
Studies indicate that the low-carbon future for California will require both significant numbers of EVs and energy storage.[22] The EV Storage Accelerator project will enable more cost effective EVs as well as more cost effective energy storage, and is key to California's low carbon future.

4 Team Qualifications, Capabilities, and Resources

4.1 Organizational Structure / Organizational Chart

NRG will serve as the prime contractor with five major subcontractors that include the UC San Diego, Strategen, Olivine, Solarrus and AESC. Other project partners are the University of Delaware, Honda, Nissan and two inverter suppliers: Princeton Power System, and IKS. Scott Fisher, Director, Alternative Energy for NRG, is the PI and Professor Willett Kempton of the University of Delaware is Co-PI. The two have partnered together in the NRG and University of Delaware venture since 2011. The project's management structure will be boosted by project manager, Nicole de Leon, and several UC San Diego contributors, including Byron Washom, Director of Strategic Energy Initiatives and the university's Alternative Transport Director, who will be hired in the beginning of 2015. The Technical Advisory Committee will include Jon Wellinghoff (former FERC Chair), Jim Detmers (former CAISO VP Ops), Frank Lindh (former GC, CPUC), Mike Bourton (Grid2Home) and Ryan Harty (Honda).

Figure 3.4: Organizational Chart



[22] Budischak C, et al. Cost-minimized combinations of wind power, solar power and electrochemical storage, powering the grid up to 99.9% of the time. J Power Sources 2013; 225: 60-74

4.2 Project Team

The project will be led by **NRG Energy, Inc.**, a Fortune 250 energy company with $11 billion in 2013 revenues. NRG is one of the largest power companies in the United States, with 52,000 MW of generation and over 3 million retail electricity customers in Texas and throughout the Northeast US.

Over the last several years, NRG has become a leader in the development of low- and no-carbon energy technologies. NRG Energy, and subsidiary NRG Yield, together own 850 MW of solar and 1900 MW of wind, making the company one of the largest producers of renewable energy in the United States. In early November 2014, Southern California Edison chose NRG to provide 175 MW of demand response and energy efficiency, 500 kW of energy storage, and several hundred MW of peaking resources under SCE's local capacity requirement auction.

No company outside of the auto industry itself has made a bigger financial commitment to the development of electric vehicles. In 2011, NRG launched eVgo, which now owns and operates the country's largest privately-funded electric vehicle infrastructure network. NRG has built – or is in the process of building – public charging networks in Houston, Dallas, Washington DC, and through an agreement with the California Public Utility Commission, in San Francisco, Los Angeles, San Diego, and the San Joaquin Valley. To support recent "no charge to charge" agreements with Nissan and BMW, eVgo is planning to build networks in 25 other cities over the next two years. By 2016, NRG will have invested close to $200 million in electric vehicle networks across the United States.

As part of the company's commitment to the development of electric vehicles, NRG created a joint venture – called eV2g – in 2011 with the University of Delaware to develop and commercialize the vehicle-to-grid technology that Professor Willett Kempton and his team had been developing since the late 1990s. At the time, NRG recognized that the technology was several years away from commercialization, but structured the agreement to provide $4 million worth of funding to conduct demonstration projects to more fully vet the technology, including building partnerships with automakers. NRG's committed cost shared to the *EV Storage Accelerator* project includes funds from that joint venture.[23]

Through the joint venture, NRG has gained a deep understanding of the challenges and opportunities from bidirectional electric vehicles providing energy storage. This experience is described more deeply elsewhere in this application, including in *Attachment 9*, but includes the successful completion of a number of complicated, cross-functional efforts with multiple team members and companies working toward a common set of goals.

NRG's V2X work is highly strategic to the company. NRG's efforts are led by Scott Fisher, who reports directly to Denise Wilson. Ms. Wilson is an NRG Executive Vice President, and President, Electric Vehicle Services and oversees all of NRG's electric vehicle initiatives, including eVgo. Ms. Wilson reports directly to NRG Chief Executive Officer David Crane. NRG's expectation is that V2X services will become an integral part of services offered to future customers.

Among the companies applying to lead a project under this PON to commercialize V2X technology, NRG is unique in the depth of its technical knowledge and experience in the area,

[23] NRG's cost share proposed for this project comes from funds completely separate from any funds that NRG is required to spend in the EV settlement in California.

its ability to commercialize the technology, and in the financial and organizational resources it can bring to ensure a successful project.

NRG's experience to date with this work has underscored the need to create a first-rate team to successfully carry out the project objectives. Moreover, each organization on the proposal has a specific role and responsibility, as indicated in the organization chart above.

Lead by Byron Washom, Director of Strategic Energy Initiative, the **University of California San Diego** has become one of the leading test-beds in the world for energy storage and electric vehicles, making it an ideal site host. Located in the Office of Vice Chancellor's Resource Management and Planning office, Mr. Washom is responsible for the campus' research, development and deployment of quantum innovations in sustainably energy technology. For this project, Mr. Washom is providing NRG with locations both on-campus and off-campus. The on-campus locations, in connecting directly to the University of California San Diego microgrid, come with relatively straightforward interconnection, meaning the project will be able to test V2X use cases right away. The off-campus locations are in San Diego Gas & Electric service territory. While early conversations with SDG&E have indicated that interconnection should also be straightforward (especially since the Princeton Power and IKS USA inverters are UL listed), those sites will allow for more of a "real world" test for interconnection processes.

V2X technologies present a number of opportunities and challenges compared to other energy storage approaches. As the leader of the California Energy Storage Association and a key player in laying out the intellectual case for California's SGIP program and its energy storage mandate, **Strategen** is ideally suited to assess and articulate the ratepayer benefits of bi-directional electric vehicle storage. Led by CEO Janice Lin, Strategen has been a driving force in market and policy development for grid-connected energy storage in California. From successfully advocating for the inclusion of energy storage in California's Self-Generation Incentive Program to playing a leading role in the California Public Utility Commission's Energy Storage Proceeding and the Commission's resulting 1.3 GW energy storage procurement decision, Strategen has deep industry roots in the storage market. Strategen will play an important role in advising NRG, its partners, and the CEC on potential commercialization opportunities.

Behind-the-meter storage resources can perform a number of use cases, including local home or building energy management – such as peak shaving or emergency back-up power – or grid services, such as frequency regulation or demand response. With its knowledge of behind-the-meter use cases in California, and its experience helping its clients understand and approach those opportunities, **Olivine** brings deep, California-centric market knowledge to the project, and will help NRG develop and test against the most appropriate use cases. Led by CEO, Beth Reid, Olivine is the only third party bringing distributed aggregation of behind-the-meter storage into the wholesale market.

A particularly important challenge for this project will be to deploy hardware and software that can control and manage the resources against the required set of use cases. With electric vehicles, that control and coordination is especially complicated. Challenges include communicating with the vehicles' battery management system to understand state of charge; understanding driving patterns to know when the resource will not be available; and controlling each vehicle individually and as a group to respond appropriately to a given command. The research and development team of Dr. Willett Kempton's at the **University of Delaware** will be facilitating the software aggregation and communication intelligence. Starting in the late 1990s – and since 2011, working closely with NRG – Dr. Kempton and the University of Delaware

have been the leading authority in the world on the hardware and software requirements of bidirectional vehicle storage.

As a leader in electric vehicle infrastructure deployment, NRG is very aware of hurdles in developing and installing charging stations. This project will have the added complexity of deploying newer, CHAdeMO 10kW stations for the Nissan LEAFs. NRG has worked extensively with **Solarrus** throughout California to deploy Level 3 Freedom Stations, of which over 80 have been successfully installed as of October 2014. Solarrus has also installed a number of energy storage installations at University of California San Diego, including a battery-backed DC charging station sponsored by NRG and Green Charge Networks.

Solarrus is also closely involved with the Electric Field Service Technician program (see flyer in Figure 3.5), which is based out of Cerritos College and provides free job training for veterans. As part of this project' scope, Solarrus Corp will direct training of local Electric Field Service Technicians for the service and maintenance of electric vehicle charging infrastructure, including bidirectional inverters. Training will include the Princeton Power inverter (as well as additional inverter brands) and will establish a fundamental source for well needed skilled and authorized service and maintenance personnel.

Figure 3.5: EFST Flyer

Based on their extensive work with both University of California San Diego and the California Energy Commission, NRG has selected **AESC** to support the measurement and verification required under the solicitation. The work will be an especially important input to Strategen's ratepayer benefit analysis.

Under its Vehicle Grid Integration white paper,[24] the California Public Utility Commission was clear that it should not develop regulations for Use Case 4 (V2G) until a there was evidence of automaker commitment to the technology. However, automakers will not make a commitment to the technology in a vacuum. They will need hard data on the challenges and opportunities. Because California is the leader in electric vehicles, this project presents an ideal opportunity to provide automakers with that data.

Since 2011, the University of Delaware team has successfully integrated with three different automakers – **Honda**, **Nissan** and **BMW** – to control and manage battery response. With both Honda and BMW vehicles, the team has aggregated those resources and responded successfully to a PJM regulation signal. In fact, in 2013, the NRG/University of Delaware team, working with the PJM Independent System Operator and using BMW and Honda vehicles, successfully executed the world's first project where vehicles are serving as an official grid resource and getting paid to do so. The team is now working with Nissan and BMW vehicles respond to vehicles to home and vehicle to building use cases. Much of that work will be leveraged in the proposed project at University of California San Diego.

[24] Energy Division California Public Utility Commission, "Vehicle Grid Integration: A Vision for Zero-Emission Transportation Interconnected throughout California's Electricity System", October 2013

Both Nissan and Honda have already developed plausible paths forward for providing bidirectional storage from vehicles. In Nissan's case, they have worked with several inverter suppliers, including **Princeton Power Systems** and **IKS,** to develop UL listed ways to bring DC power from the vehicle battery to AC power for the grid (the California Energy Commission, through the Los Angeles Air Force Base project, has provided critical support for this effort). Nissan has already developed a vehicle-to-home product in Japan with several thousand customers. A broader roll-out in the United States depends on battery wear data (Nissan includes a battery warranty in Japan), the cost of the inverter (which is currently produced at low quantities), and on signals from US funding sources and regulators.

Unlike Nissan, Honda does not yet have an "off-the-shelf" way to bring electricity from the vehicle battery to the grid. However, working with NRG and the University of Delaware, Honda built two Accord PHEVs with inverter capabilities inside the vehicle. One of these vehicles has been operating in Delaware, responding to the PJM regulation signal, since late 2013. Because the vehicle already inverts the DC power from the battery to AC for the grid, Level 2 J1172 charging stations can be used. Task 4 under this project includes work to support efforts to list that approach to support official utility interconnection.

Because of their different approaches to bidirectional charging, Honda's role on the proposed project is somewhat different than Nissan's. Nissan has provided software access to Princeton Power and IKS USA to communicate with the LEAF and pull power from the vehicle. As Nissan has stated in their letter of support, they are very interested in reviewing data and gaining insights, but they will not be doing their own technology development on the project. In contrast, in providing 1-3 vehicles to the project, Honda will be refining their own bidirectional technology, which will likely involve significant refinements over the course of the project.[25]

4.3 Key Team Members and Qualifications

An important factor in the success of NRG's V2X work to date has been the quality and experience of its team members. For the *EV Storage Accelerator* project, NRG proposes to use many of the same individuals who have been involved in the project for several years.

The project's **Principal Investigator** will be **Scott Fisher**, Director, Alternative Energy for NRG Energy. Mr. Fisher has been at NRG since 2006 after spending 5 years at PSE&G, New Jersey's largest utility. Mr. Fisher has been involved in technology development and commercialization efforts at NRG since 2008, first as a key member of the team developing a carbon capture and storage project at NRG's WA Parish coal plant in Houston. That $1 billion project received a $167 million grant from the U.S. Department of Energy and began construction in the summer of 2014. *The project is the only one of the six projects given awards under DOE's Clean Coal Power Initiative Round 3 to have started construction – a testament to NRG's commitment to commercializing clean energy technologies by partnering successfully with government funding agencies.*

Mr. Fisher has been leading NRG's work with the University of Delaware since the project's inception in 2011. Mr. Fisher helped negotiate the original agreement with the University of Delaware, led the project team to build the first (and to date only) project where vehicles are earning grid revenues, and formed successful partnerships with Nissan, Honda and BMW.

[25] Honda employees doing these refinements will be working completely outside the proposed project budget. That time will neither be funded through CEC nor through any cost share identified in this application.

Mr. Fisher is also an Adjunct Professor at Columbia University's Earth Institute, teaching "Financing the Green Economy" in the Sustainability Management program and the School of International and Public Affairs. Mr. Fisher has a BA in International Studies from Vassar College and a MBA from Yale University.

The project's **co-Principal Investigator** is **Dr. Willett Kempton** is a professor in the University of Delaware's School of Marine Science and Policy within the College of Earth, Ocean, and Environment. Dr. Kempton is the Research Director for University of Delaware's Center for Carbon-Free Power Integration and he has a joint appointment in the Department of Electric and Computer Engineering. During the Fall 2011 semester, he was Otto Mønsted Guest Professor at the Center for Electric Technology, Department of Electrical Engineering at the Danish Technical University (Lyngby, Denmark).

Dr. Kempton is a pioneer in the bidirectional charging concept and technology, having written the first academic paper on the topic in 1997.[26] In addition to laying out the case for V2X, Dr. Kempton manages a team of hardware, software and control engineers at the University of Delaware working to commercialize the technology. This team, funded with support from NRG, has worked closely with engineers from auto companies and their suppliers to advance V2X technologies.

A third key team member is **Nicole de Leon, Project Manager.** From 2013 to 2014, Ms. de Leon has served as the day-to-day project manager for the partnership between NRG and Dean Kamen's DEKA Labs to commercialize the Beacon 10 sterling engine. This work involved choosing pilot site locations, hiring and managing engineers and contractors, and working with local utilities to shepherd interconnection activities. She also worked closely with Dean Kamen's engineering team to ensure the team's efforts matched overall project goals.

Prior to working for NRG, Ms. de Leon was a research assistant for Dr. Kempton at the Center for Climate-Free Power Integration, working part time to earn a graduate degree and the other part time as project manager for University of Delaware installation of electric vehicle charging stations. Her research focused on V2X technology development, and she also worked with Delaware state regulatory agencies to build strategic plans for EVSE placement on a regional level. In addition to her work with distributed generation technology, Ms. de Leon was an Energy Auditor for the Department of Energy-funded Industrial Assessment Center program conducting over 30 assessments with the University of Delaware Electrical Engineering team and making recommendations for hundreds of thousands of dollars' worth of energy efficiency savings. She holds and MS and BS in Energy and Environmental Policy from the University of Delaware.

Mr. Fisher, Dr. Kempton, and Ms. de Leon have worked closely together for over three years, successfully combining NRG's market and commercialization expertise with the University of Delaware's technology development capabilities. For the *EV Storage Accelerator* project, Ms. de Leon will relocate to San Diego.

As mentioned above, project management will be supported by **Byron Washom**, Director of Strategic Initiatives at UC San Diego. Mr. Washom is the Director of Strategic Energy Initiatives at the University of California-San Diego, where he leads the university's efforts to establish a highly innovative energy plan that will not only ensure that UC San Diego is able to meet both its current and future energy requirements in the most environmentally sustainable, cost-effective manner, but also serve as a premier example to institutions internationally. The project will also

[26] For a full list of Dr. Kempton papers on the topic, see http://www.udel.edu/V2G/ArticlesandPapers.html

receive technical support from UC San Diego's Director of Alternative Vehicles, a person to be hired early in 2015 and from part-time graduate student support.

Working closely with Mr. Washom, NRG has identified a distinguished Technical Advisory Committee that brings a diverse combination of regulatory, ISO, utility, vehicle and software experience. **Jon Wellinghoff** is the former Chairman of the Federal Energy Regulatory Commission and now a partner at Stoel Rives in San Francisco. **Jim Detmers** is the former VP, Operations, CAISO and now a advisor to energy storage company Stem. **Mike Bourton** is VP, Business Development of Grid2Home, a leading developer of SEP 2.0 architecture. **Frank Lindh** is the former General Council of the CPUC and now a partner at Crowell & Moring. **Ryan Harty** is the part of the Environmental Business Group at Honda in Torrance, CA.

4.4 Task Management and Coordination

The NRG/University of Delaware partnership, having been in operation since 2011, has already developed a very successful project and task management approach. That approach includes regular team meetings with all relevant project partners, one-on-one in-person meetings with individual partners, and use of project management tools (task lists, gantt charts, etc). Ms. de Leon, having been closely involved with the project already, bring a familiarity with the people and the technology, and a high degree of project management success.

As important, the members of the project team have all worked together successfully. NRG and the University of Delaware have had their joint venture since 2011. The joint venture has worked closely with Honda and Nissan since 2013. NRG has been a member of the Strategen-led California Energy Storage Association since 2012 and has known Olivine since being introduced to them by the California ISO, also in 2012. Solarrus has been NRG eVgo's main contractor for high speed charging installations in California. Finally, NRG and University of California San Diego have collaborated on a number of electric-vehicle related projects. Currently, NRG eVgo is developing a battery-backed DC fast charging station on the UC San Diego campus.

Each task in the *EV Storage Accelerator* Scope of Work has been assigned a leader to oversee the successful execution of subtasks or coordination with multiple partners. Project team members' communication will be maintained by an Internet based, University of California San Diego maintained website that will provide all on and off-campus team members with password protected access with Files & Discussion, Drafts in Progress, relevant reference, Project Overview, Tasks & Milestones, Assignments, Gantt Chart, Status Report, Calendar, Internal Blog, Subject Matter Forums, and Contact Information. Additionally there will be monthly webinar calls.

4.5 Facilities, Infrastructure & Resources

It would be difficult to find another location in the U.S. as well suited to host this project.

UC San Diego is one of the world's leading locations for energy storage and electric vehicle project. In electric vehicles, the university already has, or is in the process of installing, 50 Level 2 electric vehicle charging stations. The university is also a premier test-bed for energy storage and microgrid projects, and has a battery-backed DC charging station, a used electric vehicle battery storage installation, as well as two 1.4 MW fuel cells. Working with the UC San Diego facilities staff, NRG has already identified the sites for the charging stations for this proposed project. University facilities' staff, working closely with Mr. Washom, have extensive experience with new energy technologies. Solarrus, the subcontractor for this project, also has significant experience working on the campus. Moreover, the university functions as its own utility,

meaning that it can certify interconnection, significantly de-risking the project's schedule and timeline.

Apart from its technical resources, the university also serves as a premier showcase for energy technology innovation in California. Mr. Washom and other university staff regularly provide tours to a variety of stakeholders, and make a strong effort to disseminate data and reports from projects. As outlined in Task 10 of the scope of work, NRG is planning on ensuring that outreach and dissemination of results are an important part of the project.

4.6 History of Successfully Completing Projects

As discussed above, the project team has had a successful track record – both in implementing projects directly applicable to the work proposed here, and in other commercialization efforts. The *Attachment 9* for NRG lists 3 commercialization efforts: NRG's V2X work in Delaware; NRG's carbon capture and storage commercialization efforts; and NRG's roll-out of Level 3 and workplace/multifamily charging stations in California and around the U.S. All three projects are good representations of NRG's ability to bring capital, scale, and commercialization expertise to bring technologies to market.

These are three examples, but there are others. For example, NRG is majority owner and operator of the world's largest solar plant – the Ivanpah project in California. NRG pioneered the concept of a "YieldCo" to finance renewable energy projects. And NRG has been a prominent integrator of solar power at sports stadiums, with innovative installations at the NFL stadiums for the New England Patriots, New York Jets/Giants, San Francisco 49ers, Philadelphia Eagles and Houston Texans.

4.7 References

Partner	Reference 1	Reference 2
NRG	California Public Utility Commission Adam Langton, Energy Regulatory Analyst Phone: 415-703-1812 Email: adam.langton@cpuc.ca.gov	PJM Interconnection Scott Baker, Sr. Business Solutions Engineer Phone: 202-393-1078 Cell: 610-368-4365 Email: Scott.Baker@pjm.com
University of California, San Diego	California Energy Commission Jamie Patterson, Program Manager Phone: 916-327-2342 Email: jpatters@energy.state.ca.us	United States Department of Energy Holly Thomas, Program Officer Phone: 720-356-1796 Email: holly.thomas@go.doe.gov
Strategen	Arup Russell Carr Senior Engineer | Electrical Group Phone: 415-659-4972 Email: russell.carr@arup.com	Minnesota Department of Commerce Lise Trudeau Senior Engineering Specialist | Renewable Energy and Advanced Technologies Phone: 651-539-1861 Email: lise.trudeau@state.mn.us
Olivine	John Hernandez Senior Product Manager Pacific Gas & Electric 415-973-6543, j6h6@pge.com	Randall Nicholson, Regulatory Policy Manager San Diego Gas & Electric 858-654-3567, rnicholson@semprautilities.com

University of Delaware	Jon Wellinghoff Partner, Stoel Rives 415-500- 6515, jon.wellinghoff@stoel.com	Scott Fisher Director, Alternative Energy, NRG 609-524-4647 scott.fisher@nrgenergy.com
Solarrus	NRG / eVgo Terry O'Day, Vice President of California Business Development Phone: 310-458-8411 Email: Terry.O'day@nrgenergy.com	Southern California Edison Edward Kjaer, Director, Plug In Electric Vehicle Readiness Phone: 626-302-1324 Email: edwardkjaer@sce.com
Princeton Power Systems	Tesla Motors Mateo Jaramillo, Director of Stationary Storage Email: mjaramillo@teslamotors.com	Coda Energy Peter Nortman, COO/CTO Cell: 626-533-3606 Email: pnortman@codaenergy.com
IKS	Power Stream Inc. / www.powerstream.com Smart Grid Technologies Mr. John Mulrooney, Director Phone: 905-532-4608 Email: john.mulrooney@powerstream.ca	Osaka City, Japan Kazutaka Domoto, President IKS USA INC Phone: 770-829-0202 Email: tdomoto@iks-us.com
AESC	CEC PIER Energy Innovation Small Grant Program (SDSU Foundation) Dr. David Rohy, Co-Director Phone: 619-594-1116 Email: drohy@mail.sdsu.edu	Southern California Edison Mr. Steven M. Long, P.E. Phone: 626-302-0785 Email: Steven.Long@sce.com

4.8 Collaborations with Utilities, Industries, or Others

Bidirectional electric vehicle charging inherently requires collaborations because no one company or industry can create a successful product on its own. The technology requires expertise and innovation across two industries – automotive and electricity – that have historically not worked closely together. In addition, as with a number of new energy technologies, initial government/ regulatory collaboration will also be important.

Though not a utility, NRG itself is a leading power generation company with 3 million retail customers (in states that allow retail choice), and growing consumer brands in home solar and electric vehicle charging. NRG has worked extensively with utilities and independent system operators across the country. NRG has won numerous utility off-take agreements, and, in November 2014, was chosen by Southern California Edison to provide 175 MW of demand response and energy efficiency, among other capacity-based products.

As discussed above, NRG is partnering with two major automakers, Nissan and Honda, on this proposed project. Critical to the success of bidirectional charging will not only be the automakers themselves, but the vendor community. Princeton Power Systems and IKS USA are both providing bidirectional inverters to work with the Nissan LEAF vehicles.

Finally, the project will be leveraging the resources and expertise of several California companies and institutions that will play a key role in the future success of bidirectional charging – including Strategen, Olivine, Solarrus, AESC, and University of California San Diego, who will be serving as the site host.

4.9 Financial Ability to Complete the Project

NRG is a Fortune 250 company with over $11 billion in 2013 revenues, and $2.6 billion in earnings before interest taxes depreciation and amortization (EBITDA). As of December 31, 2013, NRG had over $3.5 billion of total liquidity.

Has your organization been involved in a lawsuit or government investigation within the past ten years?
NRG holds itself to the highest standards of integrity in all aspects of its business. As with any large company, NRG has been involved in lawsuits and government investigations in the past. All materials investigations and lawsuits are detailed in NRG's regular public filings with the U.S. Securities and Exchange Commission.

Does your organization have overdue taxes?
NRG is current with all taxes, including all income, franchise, property, sales/use, and payroll taxes.

Has your organization ever filed for or does it plan to file for bankruptcy?
In 2002, in the aftermath of the financial collapse of Enron, NRG declared Chapter 11 bankruptcy. It emerged from Chapter 11 in 2003. On April 1, 2014, NRG purchased Edison Mission Energy (the former unregulated subsidiary of Edison International) from its bankruptcy creditors. Edison Mission is now part of NRG Energy.

Has any party that entered into an agreement with your organization terminated it, and if so for what reason?
In 2011, the New Jersey Board of Public Utilities awarded an NRG affiliate a long-term power purchase agreement under the Board's Long-Term Capacity Agreement Pilot Program. In 2013, a federal district court found that the agreement was unconstitutional because it intruded on the power congress gave to the Federal Energy Regulatory Commission under the Federal Power Act. The Board has since terminated the agreement.

For Energy Commission agreements listed in the application that were executed (i.e., approved at a Commission business meeting and signed by both parties) within the past five years, has your organization ever failed to provide a final report by the date indicated in the agreement?
NRG has not been a previous recipient of California Energy Commission funds.

4.10 Support or Sommitment letters

Letter of commitment for NRG and for project subcontractors and partners are included in Attachment 11. NRG has also included letters of support from members of the Technical Advisory Committee, from the CAISO, and from Vision Fleet, a California-based company that is financing fleet conversions, including the purchase of 425 plug-in vehicles for the City of Indianapolis.

5 Budget and Cost Effectiveness

5.1 Funds Justification Relative to Project Goals, Objectives and Tasks

The project team is providing 82% cost share, well above the minimum 25% requirement. Beyond the eligible cost share, NRG, Nissan and Honda are together furnishing 7-9 vehicles for the project, and Honda and Nissan are providing in-kind engineering resources. Neither the vehicles nor the in-kind engineering resources are included as cost share not being requested for CEC funding.

The project also significantly leverages past CEC work. For example, a significant amount of the engineering work for the Princeton Power inverters (and how they integrate with a Nissan LEAF) proposed for the project was done as part of the Los Angeles Air Force base project. A good portion of the energy storage and electric vehicle experience of members of the project team, such as UC San Diego, have come through CEC funding.

NRG itself – along with Honda and Nissan – have strong product commercialization organizations. California Energy Commission funding under this PON will help support technology readiness. *But in providing funding for commercialization to NRG, CEC would not be funding a research organization, a non-profit, or a government agency with limited commercialization abilities.* It would be funding a project lead – NRG – with an existing product development, marketing, sales, and operations organization who has already proven (through eVgo) an ability to work with auto manufacturers to bring a business model to market.

5.2 Direct Labor, Non-Labor and Operating Expense Justification by Task

NRG, as the lead on the project, will not be charging any indirect costs or profit to the project. NRG's overall business focuses on earning revenue from selling electricity and related products to homes, businesses, utilities, and independent system operators – and not from time and materials type contracts. For this reason, NRG does not calculate its indirect expenses or required profit, nor does it apply those costs to any contract. Labor rates are calculated with the direct employee salary, plus (for employees) a fringe rate of 23.8%.

The project leverages work from UC San Diego and University of Delaware, two institutions that do not charge profit, and benefit from generally lower-priced labor than for-profit institutions.

Justification by Task

Task 1 - General Project Tasks: Nearly all of the project management costs, including time from Mr. Fisher, Ms. de Leon, Dr. Kempton and the fees for the Technical Advisory Committee will be borne as match funding from NRG. As mentioned above, those match funding dollars do not carry any NRG overhead. Of total $452,994 spent on Task 1, $372,994 comes from labor without any NRG overhead. The balance is $50,000 of in-state travel, and project management support from UC San Diego.

Task 2 - Business Model for Use Case 4 and Task 9 – Evaluation of Project Benefits: These tasks will be led by Strategen, with support on Task 2 from Olivine and UC San Diego. This work will be made easier by the extensive experience the partner companies have in working with the relevant stakeholders (Task 2). Strategen, in particular, is widely recognized as a main architect of the energy storage industry in California. Due to the energy storage market's recent successes, Strategen is in extremely high demand by clients right now, and has given the project and CEC a significant reduction in their rates to support this effort. Of Task 2's

total cost of $495,517, there is $131,000 of match funding, requiring $364,517 from CEC funding. Task 9 requires an additional $39,158 from CEC for Strategen.

Task 3 – Technical Integration: This task will be led by the University of Delaware. The costs for this task are $225,000 and require no CEC funding. Nearly all work will be performed by University of Delaware researchers (graduate students and post-docs) with an average labor rate (including fringe and university overhead) of below $40/hour. Also, much of the foundational technical integration work with Honda and Nissan has already been completed and paid for elsewhere. The work proposed under this task is mainly to integrate that work in California.

Task 4 – Product Development: This task will build off the work that Princeton Power Systems did on the Los Angeles Air Force Base project. Moreover, the task will leverage efforts that NRG, Princeton Power Systems, and Nissan – and that NRG and Honda -- have already put into product development. The Princeton Power inverter is, by far, the lowest cost way to export power from a vehicle. A portion of this task will be spent on making that cost much lower. This cost of $100,000 will be entirely borne by NRG match funding. It will also include significant technical work by Nissan and Honda, whose costs are not calculated as part of this project.

Task 5 – Prove Viability of EV Storage and Task 7 – Interconnection: Olivine will be leading these two efforts, which total $175,000 for Task 5 and $100,000 for Task 7, and includes $35,000 in Task 5 of match funding from Olivine. Again, the CEC will not be paying for a new company to gain experience: as discussed in Section 4 of the project narrative, Olivine has been a leader in working with customers and utilities to demonstrate the value of behind-the-meter grid and utility services. Olivine operates with very economic rates: 16% for fringe, 14% for overhead, 10% for G&A and no additional profit.

Task 6 – Site Work: This task will include work by Solarrus, NRG and UC San Diego. As one of the largest contractors for NRG eVgo in California who also has extensive experience at UC San Diego, Solarrus can mobilize efficiently. In addition, because of the experience that UC San Diego has in hosting electric vehicle and storage demonstration projects, getting site work done on campus will be straightforward. As identified in Attachment 7, Solarrus' overhead rates are modest, and in-line with other electric contractors in California. Of the $680,699 of costs for this task, a significant portion, $229,739, comes from match funding from NRG and UC San Diego.

Task 8 – Analysis: This work to show the benefits of the project and of bidirectional electric vehicle charging technology will be performed by AESC. AESC has done a significant amount of work at the UC San Diego campus. This familiarity will make testing and verification steps more efficient and effective. The work will also include integration and analysis of the OSI/ESRI visualization tool. Of the total $184,641 for this task, $86,000 comes from match funding from UC San Diego.

Task 10 – Dissemination: Both the NRG/University of Delaware team and Strategen already focus on disseminating results of their work, meaning project costs on this task will be reasonable because of dissemination infrastructure already in place. For example, Strategen runs the Energy Storage North America conference and has chosen San Diego as the site location. The project will present initial interim results at that conference. Another example is the NRG's media relations group (not charged to the project) who has successfully placed feature stories about the company's work with the University of Delaware in the *New York Times*, *Los Angeles Times*, and *Wall Street Journal*. The total cost of this Task is $222,325,

which includes $50,000 of conference costs (with no overhead) and work from Olivine and UC San Diego with low overhead rates.

Task 11 – Production Readiness Plan: This work will leverage the significant commercialization work that NRG has already done through their partnership with University of Delaware. It will also leverage NRG's existing product development capabilities. This $50,000 will require no CEC funding.

5.3 Hours Justification

A primary justification for the hours proposed for the project is that the team has led projects like this before – at the University of Delaware with over 20 bidirectional vehicles and now at Queens College in New York City under a grant from the New York State Energy Research and Development Authority. NRG knows the time and effort required to undertake a successful project in this area, which will lead to fewer mistakes, rework, and delays.

That said, there have been only a few projects like this ever conducted (eg., NRG/University of Delaware, LA Air Force Base) so there are a significant number of unknowns. The hours presented in this project represent the team's best estimate of the level of work required. One advantage this project team will have over others is that NRG has made a strategic commitment to the development of bidirectional energy storage technology. That commitment, coupled with the financial resources of an $11 billion in revenue per-year company, means that NRG will have the capability to absorb additional hours should these hours not be enough. These hours will come from Mr. Fisher, additional NRG employees in California, or from the company's automaker partners, such as Nissan and Honda, who also have made a commitment to a successful project and product.

5.4 Maximize Funds for Technical Tasks

Program administration expenses will almost entirely come from NRG's cost share, and not from CEC funding. Funding for the project management team, including Mr. Fisher, Dr. Kempton and Ms. de Leon will come from NRG. NRG is also funding the fees for the technical advisory committee, covering all air travel for the entire project, and covering all non-air travel expenses for outside California. Program management fees covered by CEC include an allocated portion of time from the UC San Diego Alternative Transport Director (to be hired).

With total requested CEC program administration fees of $80,000, the ratio of CEC-funded program administration to CEC funded technical tasks is 5.3%.

6 Funds Spent in California

100% of the CEC funds will be spent within California and abiding to the definitions set forth in PON 14-301 and all sub-recipients are California based. All airfare and non-CA hotel expenses will be 100% cost shared. Attachment 7 substantiates the allocation of CEC funds to being spent as 100%, and the cost sharing commitment letters in Attachment 11 affirms the cost sharing for any and all payments for airfare, out of state workers. No other material and equipment purchases, leases, rentals, and contractual work are anticipated for businesses located outside of California, and should the situation arise, they will be 100% cost shared. Therefore, the Project Team has met the 100% level for the Funds Spent in California criteria, and has addressed with the highest degree of confidence in Attachments 7 and 11. The response exceeds the requirements in providing multiple assurances that all minor subcontractors have its workers in CA during the course of this Project.

7 Ratio of Unloaded Labor Rates to Loaded Labor Rates

The Rates Summary (Attachment 7, Sheet Att B7), indicates that NRG's "Average Team (DL+FB)/(DL+FB+Total Indirect) is equal to 0.682, and the Team Score (Out of 5) is 3.412.[27] This amount does not factor in approximately $300,794 of NRG labor, which is provided as match funding, but which does not carry any overhead. Were NRG labor to be included, the weighted average ratio would be 0.72, with a team score of 3.63.

8 Match Funding

NRG and its collaborators have submitted a match funding commitment letter consistent with the requirements of Attachment 11. The total project spending is $2,725,374 detailed in Attachment 7. Of this amount, the total requested CEC funds are $1,495,650 and the total committed match funding is $1,229,724. (Neither total project spending nor match funding amounts include additional NRG, Honda, and Nissan spending on vehicles and in-kind vehicle engineering.) Therefore, the ratio of match funds to CEC funds is 0.82. With $855,811 of match funds beyond the minimum 25% match funds (of $373,912), the ratio of additional match funds to total requested CEC funds is 0.57. This ratio yields the project an incremental 3 points (2.86) for match funding beyond the proposal requirements.

The match is met without reliance on any other funding sources. Based upon the strong expressions of interest, relevance, importance and availability of funding from NRG's partners, NRG Executive Vice President and President, Electric Vehicle Solutions Denise Wilson's commitment letter indicates NRG's strong funding commitment and her offer to fund any deficiencies from partners. This funding commitment is well within Ms. Wilson's delegation of authority and is an indication of the strategic value to NRG of this project.

8.1 Matching Funds Commitment Letters

Match funding commitment letters are included in Attachment 11.

8.2 Matching Funds are Consistent

Match funding in the commitment letters is consistent with match funding pledged in Attachment 1.

[27] Note that the formula provided by CEC in Attachment B7 (we believe) is an unweighted average. A weighted average calculation would equal 0.642, with a team score of 3.26.

ATTACHMENT 5
Project Team Form

Identify all key personnel assigned to the project, using the table below (**one page** maximum per individual, see the formatting requirements in Part III, Section A). "Key personnel" are individuals that are critical to the project due to their experience, knowledge, and/or capabilities. Attach a **resume** for each individual (**two pages** maximum, printed double-sided).

Team Member #_1_ of _29_	
Name of Individual	Scott Fisher
Position Title	Principal Investigator
Employer's Name and Address (street, city, and zip code)	Name: NRG Energy, Inc. Address: 211 Carnegie Center, Princeton, NJ 08540
Individual's Phone Number and Email Address	Phone: 609-524-4647 Email: scott.fisher@nrgenergy.com
Job Description	• Accountability for ensuring that NRG, working with team members, successfully delivers on project goals and objectives. • Turn progress made in the project into a broader energy storage business opportunity for NRG and its partners.
Role and Responsibilities in the Proposed Project	• Ensure overall project organization is set up to successfully execute project, with each partner having clear roles and responsibilities • Responsible for seeing that all required reports and deliverables to the CEC are completed on-time • Work with automaker partners to provide them with data and analysis they need to evaluate market potential of energy storage from electric vehicles • Coordinate with NRG eVgo to identify go-to-market opportunity
Experience, Capabilities, and Credentials	• Significant experience bringing energy technologies to market • Have led NRG's joint venture with the University of Delaware since 2011. • Oversaw development, funding, and execution of demonstration with BMW and PJM to successfully operate vehicles in PJM's frequency regulation market. • Have led several commercialization efforts for NRG in the areas of solar and carbon capture and storage. • Led NRG's efforts to secure $167 million of US Department of Energy funding for a carbon capture facility at NRG Parish coal facility in Texas. This $1 billion project is now under construction • Currently an Adjunct Professor at Columbia University's Earth Institute • MBA, Yale University

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ATTACHMENT 5
Project Team Form

Scott D. Fisher
19 Lenape Lane
West Windsor, NJ 08550
(mobile) 609-651-7061; (home) 609-269-5575; (work) 609-524-4647
scott.fisher@nrgenergy.com

Experience

2006-Present **NRG Energy, Inc,** Princeton, NJ-based Fortune 250 Independent Energy Company.

Director, Alternative Energy Services (2011-Present)
Lead several distributed generation-based initiatives within NRG's New Business Group

- Oversee NRG's vehicle-to-grid joint venture with the University of Delaware (eV2g). In 2013, the venture brought online the world's first vehicle-to-grid project that earned revenue from a power grid (PJM).
- Originated NRG Residential Solar Solutions' community solar initiatives. Led project to bring online NRG's first community solar project, a 150kw array in Rutland, VT

Director, Policy Coordination and Management (2008-2011)
Position created by NRG's CEO to coordinate policy initiatives across the organization.

- Led NRG's efforts to apply for funding from the Department of Energy. Built internal and external teams to respond to grant and loan guarantee solicitations in the areas of concentrating and PV solar, coal with carbon capture and sequestration, geothermal and offshore wind. Lead 5-15 person proposal writing efforts. NRG has received grants and loans for carbon capture, solar, and smart grid projects.
- Key member of team that developed a post-combustion carbon capture project – for which NRG was awarded $167 million Department of Energy grant. Managed proposal response team, led project presentations to Department of Energy, and ran award negotiation process. This 250 MW project is now under construction.

Director, Operations Program Management (2006-2008)
Hired to develop and lead strategic initiatives aimed at bringing value from a set of previously separate regional acquisitions.

- Designed and implemented capital budgeting process covering maintenance capital at all NRG plants – over $250 million in annual spend. Conceived process and proposed it to NRG's CFO, trained regional leadership and finance personnel, and implemented tracking systems.
- Served as business sponsor for and led successful company-wide $10 million implementation of maintenance and procurement ERP system (Maximo) for all NRG plants. System is now implemented at all NRG plants and corporate offices.

2001-2006 **Public Services Enterprise Group (PSEG),** Newark, NJ-based Fortune 200 integrated electric and gas company

Manager, Operations Support (2004-2006)

- Led budgeting and financial management at deregulated Fossil power plant subsidiary of PSEG. Included line responsibility for financial analysts at seven sites and for an SAP integration group serving each company power plant.
- Created a consistently high level of financial discipline across each of the company's

power plants. Made changes through better training, meaningful performance management and standardized procedures.

Manager, Enterprise Strategy (2001-2004)
- Led PSEG's Sarbanes-Oxley 404 compliance efforts during project start-up phase. Identified and managed PSEG and consultant team to support project, created scope of work and oversaw deliverables. Reported to PSEG's CFO.
- Authored and led development of the company's yearly business plan. Significantly improved the quality of energy industry analysis the CEO presented to the Board.
- Led study of strategic options for PSEG's Global business.

1998-2001 **Booz·Allen & Hamilton (now Strategy&) ,** New York, New York
Associate
- Managed a Booz·Allen engagement for PSEG's corporate planning department assessing the relevance to the company of various energy industry business models.
- Led three client teams at a pharmaceutical benefits manager to identify major segmentation trends in managed care drug purchasing.
- Performed due diligence on a potential acquisition target for a global media company.
- Managed Booz·Allen's assistance to the Internal Revenue Service's Northeast Division. Worked with IRS personnel in 5 cities to transition offices from geography-based to customer-based structure.

1997 **Goldman, Sachs & Co.** New York, New York.
Summer Associate, Municipal Finance Department

1993-1996 **Abt Associates, Inc.** Cambridge, Massachusetts.
Analyst, International Economic Development Division

Education

Yale School of Management, New Haven, Connecticut
Masters of Business Administration, Strategy and Finance, 1998
- Teaching assistant for *Organizational Behavior* and *Strategic Environment of Management*
- Managed student pro-bono consulting group

Vassar College, Poughkeepsie, New York
Bachelor of Arts, International Affairs, 1993
- Cum Laude (3.6 GPA); Thesis: "Effects of Economic Liberalization on Chile's Poor"
- Study Abroad in Buenos Aires, Argentina
- Four-year member of crew team

Other

- Teach "Financing the Green Economy" at Columbia's Earth Institute (Fall 2011, Summer 2013, Summer 2014 semesters)
- Strong Spanish speaker
- Member of American Council on Renewable Energy Leadership Council; authored several recent white papers on renewable energy policy available at http://www.uspref.org/white-papers/

ATTACHMENT 5
Project Team Form

Team Member #_2_ of _29_	
Name of Individual	Nicole de Leon
Position Title	Project Manager
Employer's Name and Address (street, city, and zip code)	Name: NRG Energy, Inc Address: c/o Scott Fisher 211 Carnegie Center Princeton, NJ 08540
Individual's Phone Number and Email Address	Phone: (302) 632-5520 Email: niki.deleon@nrgnewventures.com
Job Description	Manage on the ground resources at University of California San Diego site – and other project subcontractors – to ensure that work is completed on time and on budget
Role and Responsibilities in the Proposed Project	• Schedule and oversee physical work at UCSD, including hiring required subcontractors • Coordinate with UCSD personnel and subcontractors to troubleshoot and resolve any hold-ups • Project management over filing and completion of California Energy Commission deliverables • Convene team meetings to ensure everyone is clear on roles and responsibilities – follow up with team members to ensure deliverable dates are met
Experience, Capabilities, and Credentials	• Significant experience working with multiple partners on distributed generation and vehicle-to-grid technology projects • Lead project development of NRG and DEKA joint venture in distributed generation technology • Graduate degree in the field of EVs and V2G technology • Experience with household, commercial and industrial customers

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ATTACHMENT 5
Project Team Form

Nicole de Leon
niki.deleon@nrgnewventures.com
(302) 632-5520

Work Experience

Project Manager for Distributed Generation Pilot Program, Beacon 10 2013 – 2014
NRG Energy, Inc

- Project Lead of alpha-phase distributed generation technology installation
- Provided weekly updates to NRG CEO; Reported directly to Executive VP / COO and President of NRG Retail
- Developed and maintained relationship with DEKA Research & Development – creators of the 10 kW Stirling-engine micro-Combined Heat & Power generator – and facilitated discussions on consumer needs and technical applications to target optimal use cases.
- Collaborated with marketing team to: (1) structure strategic identification of installation sites for six-month pilot and (2) created customer feedback strategiess to capture the operation experience for future value proposition and marketing assessment.
- Analyzed value proposition models to determine areas of improvement.
- Identified target participants reviewed and revised contractual agreements, and served as a liaison between program participants, multiple parties within NRG, DEKA, and outside contractors.
- Selecting and overseeing contractors.
- Administered state and local permitting.

Graduate Research Assistantship
eV2g, NRG Sponsored Project 2012 – 2013

- Project Leader on the assessment and installation of Electric Vehicle Supply Equipment (EVSE) charging infrastructure for the UD campus. Coordinated the engineering, technician and network needs for more than 20 sites, including locations throughout the state of Delaware.
- Designed, administered and analyzed survey to assess the feasibility of leasing EVs to faculty and staff at the university for the purpose of medium scale deployment of technology developed by the V2G Research Group.
- Assigned to Electric Vehicle Fleet Manager for University of Delaware campus, responsible for maintenance, registration and scheduling of the research vehicles and the EVSE charging infrastructure.
- Designed and conducted lab tests on the Power Supply Equipment (PSE) of research vehicles to accommodate high current power flow through the vehicle for the purpose of faster charging and bigger capacity for V2G services.

Energy Auditor 2009 – 2013
Industrial Assessment Center, DOE Sponsored Project

- Conduct energy audits for manufacturing facilities in Delaware, Maryland, New Jersey, and Pennsylvania. This program is funded through the Department of Energy and has received accreditations for the achievements in energy conservation and Greenhouse Gas reduction.
- Awarded 2011 Center of Excellence by the US Department of Energy's Industrial Technologies Program. The UD-IAC is one of 24 centers nationwide.

- Developed practical skills to identify energy saving measures through efficiency improvements in manufacturing processes and waste prevention methods.
- Deliver detailed energy assessment report to client, which is published on the public national Industrial Energy Assessment (IAC) database [http://iac.rutgers.edu/].

Education

University of Delaware
MA in Marine Policy – Electric Vehicles & Energy Policy 2014
Center for Carbon-free Power Integration
Advisor – Willett Kempton
Thesis – Social & Technical EVSE Placement Strategy (STEPS)
for Regional Electric Vehicle Charging Network

Danish Technical University
Visiting Scholar at the Department of Electrical Engineering 2013

University of Delaware
BS in Energy & Environmental Policy – Science & Technology 2011
Center for Energy and Environmental Policy
Advisor – John Bryne
Senior Research – Efficiency and Economics of Dynamic Pricing Structures

US Department of Energy
Certificate in Industrial Energy Assessment 2011

Honors & Awards

City of Newark Bicycle Friendly Community Leader Award 2013
University of Delaware Sustainability Fund Grant
UD Electric Vehicle Charging Network 2013
University of Delaware Sustainability Fund Grant 2012
Newark Bike Project Mechanic Training Class Program
Graduate Assistantship, University of Delaware & NRG Energy 2012
Chair & Founder of the nonprofit Newark Bike Project 2012

ATTACHMENT 5
Project Team Form

Team Member #_3_ of _29_	
Name of Individual	Byron Washom
Position Title	Director, Strategic Energy Initiatives
Employer's Name and Address (street, city, and zip code)	Name: UC San Diego Address: 9500 Gilman Dr. #0057 La Jolla, CA 92093
Individual's Phone Number and Email Address	Phone: 858-869-5805 Email: bwashom@ucsd.edu
Job Description	Campus wide responsibility for RD&D for quantum innovations of sustainable energy technologies in the Office of Vice Chancellor – Resource Management & Planning
Role and Responsibilities in the Proposed Project	Lead on all tasks
Experience, Capabilities, and Credentials	Byron Washom is UC San Diego's founding Director of Strategic Energy Initiatives and is responsible for energy management policy to achieve the campus' goals for quantum improvements in energy management and Greenhouse Gas reductions. Prior to UCSD, Mr. Washom was the CEO for twenty years of a due diligence firm that specialized in CleanTech, and he served as Sr. International Advisor to the World Bank and DOE. He is a four time Rockefeller Foundation Grantee and a former Heinz Endowment Grantee for early commercialization of CleanTech into developing countries. Mr. Washom was also Founder and President of Advanco Corp which in 1984 set the long-standing world records for solar electric conversion efficiency at 29.4% and subsequently achieved an R&D100 Award. He was the 2008 Recipient of UCSD's Citizen of the Year Award for Sustainability, and he was a Visiting Faculty Member at the Rady School of Management while teaching the graduate level course, The Business of Renewable Energy. Fast Company magazine named him to their June cover story, "100 Most Creative Persons in Business, 2010", and he also received the "CleanTech San Diego Leadership Award, 2013". Served as PI on the DOE/CEC grant for Mitigating Measures for High PV Penetration and PI on the UCSD RESCO grant.

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Project Team Form

Byron Washom
Director, Strategic Energy Initiative
Resource Management & Planning
University of California San Diego
9500 Gilman Drive, #0057
La Jolla, California 92093-0057
858-869-5805 (cell phone)
bwashom@ucsd.edu (email)

a. Education and Training

University of Southern California, BS & MBA in Management & Finance 1972

Massachusetts Institute of Technology, Graduate School of Engineering, post graduate, 1976

b. Research and Professional Experience

2008 – Present Director, Strategic Energy Initiative, U.C. San Diego

1989 – 2008 Founder and President, Spencer Management Associates

1980 – 1985 Founder and President, Advanco Corporation

1977 – 1980 Manager of Technology & Policy, Advanced Project Department, Fairchild Industries – Stratos Division

c. Publications Specifically Related to This Project

1) *Enabling Renewable Energy, Energy Storage, Demand Response, and Energy Efficiency with a Community-Based Master Controller Optimizer,* Draft final report under CEC PIER PIR-08-043
2) *Improved Modeling Tools Development for High Penetration Solar,* Final Report, with Jan Kleissl, Anders Nottrott, Ryan Hanna, Handa Yang, DOE Grant EE-0004680
3) *Ivory Tower of Power,* IEEE Power & Energy, 1540-7977/13, July 2013
4) *Energy dispatch schedule optimization and cost benefit analysis for grid-connected, photovoltaic-battery storage systems, with* A. Nottrott, J. Kleissl*, Renewable Energy Journal April 2012
5) *2020 Strategic Analysis of Energy Storage in California* (Contract Number 500-02-004, Work Authorization Number MRA-02-088), conducted by the University of California, Berkeley School of Law; University of California, Los Angeles; and University of California, San Diego, contributes to PIER's Energy Systems Integration program area. November 2011 Co-author with Ethan Elkind and Andris R. Abele.
6) "Solar and the Smart Grid" Solar power International, October 12, 2010.
7) "UCSD Campus Microgrid", 4th Intl Conf on the Integration of Distributed Energy Resources, December 8, 2010.
8) "Microgrid Optimization for Demand Response (Case Study)" 6th Annual Utility Integration Conf Integrating Distributed Energy Resources into Smart Grid, November 13, 2010

9) "Innovations at UCSD's Microgrid", UCLA WinSmartGrid, Third Smart Grid Leadership Forum, November 4, 2009.
10) "Smart Grid for the 21st Century", Distinguished Speaker Series, IEEE Council for Computer Automation, November 3, 2009.
11) Panelist on CPUC workshop on Smart Grid Rulemaking Smart Grid Rulemaking, R.08-12-009, June 5, 2009.
12) "The Implications of the Current Energy and Liquidity Volatility on CA Energy Efficiency Programs", keynote speaker, Emerging Technologies Summit, October 27, 2008.
13) "International and US Perspectives on Low Carbon Energy Pathways", invited paper at California Prosperity Through Technology, Energy and the Environment, UC Irvine 6th Annual Industry Research Symposium, May, 2007.
14) "Opportunities for Business, Academia and Civic Leaders to Address Climate Change and Sustainability", invited speaker to APRU World Institute Workshop, UC San Diego, 2007.
15) "Leveraging Clean Energy Finance" keynote address on behalf of the World Bank-International Finance Corporation to the Ministers of the six nation Asia Pacific Partnership, April 2006.
16) "Comparative Analysis of Six Solid Oxide Fuel Cell Industrial Team Leaders" with Krumpelt, M., presented to senior management of National Energy Technology Laboratory, US Dept of Energy, October, 2005 (Confidential).
17) "Murky Crystal Ball for the US Energy Future", International Colloquium on Environmentally Preferred Advanced Power Generation, UC Irvine, February 2002.
18) "An Autopsy of the California Deregulation", Featured Article, ASME International Gas Turbine Institute's Journal, March 2001.
19) "Parabolic Dish Stirling Module Development and Test Results," Paper No. 849516, Proceedings of the IECEC, San Francisco, CA (1984).
20) Paul K. L. Yu**,** Edward T. Yu, Deli Wang and Byron Washom, "Green Nanotechnology as a campus wide research initiative," presented at the Nano Energy Symposium at National Taiwan University, Taipei Taiwan, May 13, 2014. (Keynote speech)

d. Synergistic Activities

Panel reviewer: Energy Innovative Small Grants Program, CA Energy Commission
Co-Organizer – Solar Forecasting and High PV Penetration Workshop for US DOE and CA PUC (March, 2011), Microgrid Planning Workshop, (August 2011)"Integrated Solar Combined Cycle System (ISCCS) using Solar Parabolic Troughs" with Willrich M, Kearney, D., Schaefer J.C., Renewable Energy in the Americas Conference, 1994.

ATTACHMENT 5
Project Team Form

Team Member #_4_ of _29_	
Name of Individual	Janice Lin
Position Title	Founder & Managing Partner
Employer's Name and Address (street, city, and zip code)	Name: Strategen Consulting, LLC Address: 2150 Allston Way, Suite 210, Berkeley, CA 94704
Individual's Phone Number and Email Address	Phone: (510) 665-7811x101 Email: jlin@strategen.com
Job Description	Manage and oversee all aspects of the firm
Role and Responsibilities in the Proposed Project	Provide high-level steering of value proposition/cost effectiveness analysis and support for public outreach
Experience, Capabilities, and Credentials	More than two decades of experience in clean energy strategy, market development, and corporate strategy. Co-founded the Global Energy Storage Alliance (GESA) and the California Energy Storage Alliance (CESA). Chair of the annual Energy Storage North America conference. Holds an MBA from the Stanford Graduate School of Business, a BS from the Wharton School, University of Pennsylvania, and a BA in International Relations from the University of Pennsylvania's College of Arts and Sciences.

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ATTACHMENT 5
Project Team Form

JANICE T. LIN

2150 Allston Way Suite 210, Berkeley, CA 94704, 415-595-8301, jlin@strategen.com

PROFESSIONAL EXPERIENCE

CALIFORNIA ENERGY STORAGE ALLIANCE
Berkeley, CA

The California Energy Storage Alliance (CESA) is a membership-based advocacy group committed to advancing the role of energy storage in the electric power sector through policy, education, outreach, and research. CESA's mission is to make energy storage a mainstream energy resource which accelerates the adoption of renewable energy technology and promotes a more efficient, reliable, affordable, and secure electric power system
Co Founder and Executive Director
2009-present

- Advocate for level playing field for energy storage in California's electric power system in all key jurisdictions, including: legislature, California Public Utilities Commission (CPUC), California Independent System Operator (CAISO), California Energy Commission (CEC) and the Federal Energy Regulatory Commission (FERC)
- Helped to enact three new California laws supportive of energy storage which resulted in millions of dollars in incentive funding for energy storage and an energy storage rulemaking at the CPUC to develop appropriate energy storage procurement targets for 2015 and 2020 if cost effective and commercially feasible (AB 2514, 2010)
- Grew CESA from 1 member company in January 2009 to more than 45 member companies by January 2013

STRATEGEN CONSULTING LLC.
Berkeley, CA

Strategy consulting firm focused on helping organizations launch profitable, long-term ventures in clean energy markets. Since 2005 Strategen has developed tailored strategies for a range of clients, from global Fortune 100 firms to well-funded startups, empowering them with the insight to tackle critical business issues and develop lasting competitive advantage market development for clean technology and renewable energy firms
Founder and Managing Partner
2005-present

- Manage high growth, 10-person boutique consulting firm
- Develop market entry and market development strategies for a variety of renewable energy and clean technology firms.
- Assist with the implementation of corporate strategy, including project development and regulatory affairs at Federal, State and Agency levels

POWERLIGHT CORPORATION
Berkeley, CA

Leading manufacturer and systems integrator of commercial-scale solar electric systems and services
Vice President of Product Strategy
2005

- Evolved PowerLight's core product strategy based on
  - Economic and regulatory analysis of regional target markets

- Cost and gross margin analysis by product in those key markets
- Thorough competitive product research

Vice President of Business Development
2001-2005

- Participated in five-person Executive Team that set strategic direction for the company. Actively participated in all Board of Directors meetings
- Managed $750K annual budget and staff of three encompassing the following functions: regulatory affairs, channel/partner development, strategic planning, customer finance and investor relations
- Led PowerLight's response to the California Energy Commission's Zero Energy New Homes Request for Proposal, resulting in a $2.7 million grant which was the largest CEC grant to date and was used to spearhead PowerLight's entry into the new home construction market

Director of Business Development
2000-2001

- Raised $5.4M in Series B fundraising. Wrote business plan, helped to negotiate final deal terms
- Established strategic partnerships resulting in $15-$20M in annual new incremental revenue
- Managed corporate marketing and public relations activities including logo/collateral development, organizing dedication/media events

EDUCATION

STANFORD GRADUATE SCHOOL OF BUSINESS
Stanford, CA

Master of Business Administration

THE WHARTON SCHOOL, UNIVERSITY OF PENNSYLVANIA
Philadelphia, PA

BS Economics, BA International Relations

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Project Team Form

Team Member #_5_ of _29_	
Name of Individual	Chris Edgette
Position Title	Senior Manager
Employer's Name and Address (street, city, and zip code)	Name: Strategen Consulting, LLC Address: 2150 Allston Way, Suite 210, Berkeley, CA 94704
Individual's Phone Number and Email Address	Phone: (510) 665-7811x102 Email:cedgette@strategen.com
Job Description	Leads Strategen's energy storage cost effectiveness and flexible capacity work and product development practice
Role and Responsibilities in the Proposed Project	Provide technical support for value proposition/cost effectiveness analysis and public outreach
Experience, Capabilities, and Credentials	Leads CESA's energy storage cost effectiveness and flexible capacity work. Extensive solar product development, engineering and field installation experience. Prior to Strategen, founded and managed the Commercial Projects Division for SolarCity; prior to that, served as SolarCity's Director of Field Engineering. Led Construction Management for PowerLight, directed worldwide installations of over 25MW and brought to market a successful non-penetrating rooftop solar system

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Chris Edgette

4461 View Place
Oakland, CA, 94611
chris.edgette@gmail.com
(415) 424-8475

2008-Current **Senior Director** **Strategen Consulting, LLC.**

- Leads Strategen's product strategy efforts; assists clients with product, process, and market entry strategy
- Advises a range of large, diversified clean energy component manufacturers, new industry entrants and innovative emerging technology companies.
- Directly involved with energy storage policy, strategy, and cost effectiveness modeling at CPUC
- Conducts detailed system costing and value proposition analysis for clean-energy systems
- Product Development Examples:
  - Ground Mount Fixed Tilt Array for major PV mfr.
  - Roof Mount Non-Penetrating Product for major building products mfr.

2007-2008 **Director of Commercial Projects** **SolarCity, Inc.**
Director of Field Engineering

- Developed Lean Production-based processes for entire SolarCity installation team
- Developed Lean-based tracking system for all SolarCity installations
- Participated in development of Canopy Residential Roof Product
- Started Commercial Projects team; grew division to 45 employees, including:
  - Project Managers
  - Project Engineers
  - (2) full electrician teams
  - (3) full installation teams
- Selected Projects:

o Ebay, Inc.	DP&W, Non-Penetrating	650 kW
o Montna Farms	Array Technologies, Single-axis Tracker	394 kW
o Heritage Paper	Custom, Penetrating	528 kW
o GreenWaste Recovery	Custom, Penetrating	300 kW
o GSA, Otay Mesa	SunPower T10, Non-Penetrating	274 kW

2002-2007 **Construction Management Supervisor** **SunPower Systems**
Product Manager **(PowerLight Corp.)**

- Oversaw over 25 MW of projects globally
- Founded Global Construction Management team; grew team to 15 employees
- Acted as company's first product manager; managed T10 Non-Penetrating Rooftop Product

- Project Managed beta and first commercial installations of T10 Non-Penetrating Rooftop Product
- Product Development Work:
  - T0 Single-Axis Tracking System
  - T20 Single-Axis Tracking System
  - PowerGuard Non-Penetrating Rooftop Product
  - T10 Non-Penetrating Rooftop Product

SunPower Systems (Continued)

- Designed and conducted product testing, including UL Standard tests, in the following areas

  Fire || UV || Humidity/Freeze Thaw || Thermal Cycling || Adhesives
  System drainage || Wind Uplift || Corrosion (lab and field testing)

- Selected Projects:
  - Alameda County — Ground & Roof — Multiple
  - Bavaria Solar 1 — Ground — SunPower T0 Tracker — 10 MW
  - Donaghy Sales — Rooftop — SunPower T10 Non-Penetrating — 1 MW
  - GSA, Los Angeles — Rooftop — SunPower PowerGuard Non-Penetrating — 308 kW
  - NV Wine Services Coop — Rooftop — SunPower T10 (1st commercial install) — 428 kW
  - West Basin Municipal — Ground — SunPower T10, Non-Penetrating — 564 kW

Public Engagements

2009	Advantages of low slope solar	BOS/BOP Conference	San Diego, CA
2010	Micro-inverters vs. Central Inverters	Renewable Energy World	Podcast
2012	3M Flexible Solar Workshop – Moderator	3M Hosted Event	San Francisco, CA
2012	Energy Storage: Renewable Grid Integration	Intersolar North America	San Francisco, CA
2013	Storage Opportunities for Solar Developers	Joint Forces 4 Solar	San Francisco, CA
2013	Energy storage cost effectiveness in CA	CNESA Conference	Beijing, China
2013	Worldwide market dev. for grid storage	Intersolar Europe	Munich, Germany
2013	3M Flexible Solar Workshop – Moderator	3M Hosted Event	Munich, Germany
2013	Opportunities in Grid Transformation	Renewable Energy Seminar	Palo Alto, CA
2013	CO2 Impact of Storage – Modeling Results	CA Public Utilities Commission	San Francisco, CA

Education

- University of California, San Diego
- Graduated with Honors

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Team Member #_6_ of _29_	
Name of Individual	Mark Higgins
Position Title	Senior Director
Employer's Name and Address (street, city, and zip code)	Name: Strategen Consulting, LLC Address: 2150 Allston Way, Suite 210, Berkeley, CA 94704
Individual's Phone Number and Email Address	Phone: (510) 665-7811x106 Email:mhiggins@strategen.com
Job Description	Relationship manager with the CAISO and leads renewables project development practice
Role and Responsibilities in the Proposed Project	Provide high-level steering of value proposition/cost effectiveness analysis and support for public outreach
Experience, Capabilities, and Credentials	Mark brings deep wholesale energy market experience to Strategen, and his career has focused on renewables project development and utility regulatory strategy. Mark most recently served as Pacific Gas and Electric Company's lead on electric transmission policy work at the CAISO, where he worked on formulating PG&E policy on energy storage, demand response, generator interconnection and transmission planning issues. Mark also has a strong private equity, venture capital and investment banking background. Mark holds a Master of Pacific International Affairs from the University of California, San Diego, and a Bachelor of Arts in government from the University of Notre Dame.

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Mark Higgins, Strategen
Professional Experience

Pacific Gas & Electric Company **San Francisco, California**
Principal, ISO Relations and FERC Policy (2012 – current)

- Currently lead PG&E's infrastructure planning policy and regulatory strategy work with the California ISO and FERC. Company expert and policy lead on topics including CAISO's transmission planning process, generator interconnection process, energy storage, demand response, and energy efficiency.
- Manage cross-functional PG&E teams to develop internal positions on ISO and FERC regulatory initiatives, and to facilitate ISO board and management engagement. Cross-functional engagement typically includes representatives from Energy Procurement, Electric Generation Interconnection, Transmission Planning, Grid Operations, Legal, ISO Settlements, Regulatory Affairs, and Customer Energy Solutions.
- Educate operational units on ISO processes and issues, including advising energy procurement business units on generator interconnection procedures, and advising transmission planning and transmission project development teams on the changing competitive landscape due to FERC Order 1000.
- Manage relationships and policy advocacy with California ISO management and key stakeholders in the California energy markets, including California Public Utilities Commission staff, Southern California Edison, San Diego Gas & Electric, California municipal utilities, Large-scale Solar Association, California Wind Energy Association, and numerous other key stakeholders in the Western energy market.

SunEdison (previously Fotowatio Renewable Ventures and MMA Renewable Ventures)San Francisco
Director, Utility - West (2007 – 2012)

- Director responsible for California utility project development, with multiple reports, an approximately $40MM annual budget, and project management responsibilities for SunEdison's largest solar project, an approximately 4,000 acre development at Edwards Air Force Base. Responsibilities included all project development activities throughout the development lifecycle, including land acquisition, CEQA and NEPA, PPA negotiation, stakeholder outreach, through close of construction financing.
- Originated and managed development of the majority of the Company's California utility scale development portfolio (approximately 1,030 MW of projects on approximately 10,000 acres of land).
- Strong knowledge of CEQA and NEPA. Managed conditional use permitting and CEQA/NEPA environmental review throughout life cycle for SunEdison's California project portfolio. Experience with Federal and California Endangered Species Act compliance, and with Section 106 Cultural Resources consultations.
- Oversaw the Company's RFO responses in multiple years; secured 5 PPAs totaling 132 MWac with Southern California Edison and Pacific Gas & Electric through the annual procurement processes.
- Acted as the public face of and oversaw all stakeholder outreach for the Company's Southern California projects, including political engagement, community forums, outreach to the CPUC, and Native American tribal outreach.

- Closed the $41 mm acquisition of a portfolio of solar assets including 7,000 acres of environmental mitigation land and 350 MW of transmission interconnection queue positions.
- Developed complex financial models to evaluate highly structured transactions including cash and tax equity, debt, tax credits, preferred return and structures, buyout residuals, and capital accounts.
- Prior to the acquisition by Fotowatio, led MMA's bioenergy strategy, closed its first acquisition in the sector, and oversaw project development efforts for the asset (see below for additional information). Led company's wind energy development efforts in the Pacific Northwest, resulting in 20 MWac of development-stage assets sold after the Fotowatio acquisition. Led company's Hawaii rooftop utility solar program and response to Long Island Power Authority's rooftop solar solicitation.

Vice President, Finance – Hu Honua Bioenergy (Subsidiary, 2008 – 2009)

- Managed strategic direction and financial decisions for Hu Honua Bioenergy, RV's 22 MWac biomass power redevelopment project in Hawaii with an $85 MM development and construction budget.
- Developed and managed the project's financial model and budget; oversaw budget and accounts payable.
- Secured the first bilaterally negotiated renewable energy PPA with Hawaii Electric Light Company.
- Hired the company's management team, staff, consultants and engineering firms.
- Managed public and political outreach for the project.

Roth Capital Partners **San Diego, California**
Investment bank focused on small-cap companies

Associate, Investment Banking (2006 – 2007)

- Closed three follow-on financings valued at approximately $125 million for publicly-traded small cap companies; led M&A advisory projects, including a $50 million acquisition by a $1 billion company.
- Developed and conducted comprehensive due diligence on target companies.
- Created complex Excel-based financial forecasts and shareholder return models.
- Contacted institutional investors and led company road shows to generate interest in offerings.

Education & Credentials

University of California, San Diego

M.P.I.A. (Master of Pacific International Affairs), International Economics

University of Notre Dame
B.A., Government

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Team Member #_7_ of _29_	
Name of Individual	Giovanni Damato
Position Title	Senior Manager
Employer's Name and Address (street, city, and zip code)	Name: Strategen Consulting, LLC Address: 2150 Allston Way, Suite 210, Berkeley, CA 94704
Individual's Phone Number and Email Address	Phone: (510) 665-7811x103 Email:gdamato@strategen.com
Job Description	Lead Strategen's Value Proposition Practice in energy storage and microgrids
Role and Responsibilities in the Proposed Project	Project lead for Strategen, project managing all Strategen tasks and leading the value proposition/cost effectiveness analysis
Experience, Capabilities, and Credentials	Storage technology providers, global solar integrators, leading real estate developers, and public utility commissions have sought out his expertise to make critical strategic decisions about distributed storage markets, including the integration of storage with renewable energy resources. He is currently advising suppliers and developers as well as clean energy end-users to develop the value proposition and strategic implications of photovoltaic, solar thermal, and advanced energy storage systems for a wide range of key stakeholders. Giovanni holds an MBA from the Stanford Graduate School of Business and a B.S. in Civil Engineering from California Polytechnic State University, San Luis Obispo.

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GIOVANNI R. DAMATO

2150 Allston Way Suite 210, Berkeley, CA 94704

gdamato@strategen.com (805) 415-7354

Experience

Strategen Consulting, LLC Berkeley, CA

Clean Energy Management Consulting 2006-Present

Senior Manager

Advising storage technology providers, global solar integrators, leading real estate developers, and public utility commissions to make critical strategic decisions about clean energy markets, including the integration of energy storage with renewable energy resources

- Leads value proposition practice in energy storage for over 8 years
- Currently advising suppliers and developers as well as clean energy end-users to develop the value proposition and strategic implications of photovoltaic and solar thermal systems for a wide range of key stakeholders
- Held Engagement Manager role for dozens of scopes of work—including $200,000+ scopes
- Personally responsible for finding and closing $200,000+ client engagements
- Played an integral role in building the business case for energy storage in California's Self-Generation Incentive Program (SGIP), which led to the Public Utility Commission's (CPUC) favorable ruling to include energy storage in the SGIP program
- Conducted presentation and workshops at several clean tech conferences throughout California and at the Beijing Energy Storage Forum and Barcelona Energy Storage Forum
- Manages Strategen's internal professional development efforts

California Polytechnic State University San Luis Obispo, CA

Consultant for Fresno Area Sky Train Committee, Inc. 2003-2004

Feasibility Study Author

Transformed Fresno's $8.9B mass transit concept into a legitimate and credible feasibility report for 20-year planning and development

- Evaluated regional political climate and critical industries: conducted business council surveys, county development meetings, city council interviews, and focus group planning
- Developed preliminary routes and stations while analyzing traffic patterns, population densities, growth projections, land use models, and major revenue centers
- Forecasted revenue and ridership by building simulation models predicting operation and maintenance statistics for system cost estimates
- Addressed Board regularly with status reports, recommendations, and deliverables

Granite Construction Company Las Vegas, NV

Leading U.S. Transportation Contractor 2002

Field Engineer, Heavy Civil Division: Las Vegas Monorail Project

Responsible for all traffic control related to $650M project; directed work crew ensuring timely and proper placement of roadwork zones

- Spearheaded preliminary design of pedestrian bridges connecting transit stations to casinos resulting in $1.5M decrease in cost estimates
- Prepared bid for future $350M extension

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Education

Stanford Graduate School of Business Stanford, CA

Master of Business Administration 2006

- Elected Career Management Center Committee Co-Chair
- Appointed to Wine Circle Advisory Council

California Polytechnic State University San Luis Obispo, CA

Bachelor of Science in Civil Engineering, ***Summa Cum Laude*** 2003

- President, American Society of Civil Engineers Student Chapter
- Star Student Award, *Civil Engineering News Magazine*
- President's Service Award and Dean's Academic Excellence Award Nominations

Activities & Interests

- Licensed Class B California General Contractor
- Adventure traveler—including Mount Everest, Aconcagua, and Kilimanjaro
- Enjoys piano, carpentry, weightlifting, backpacking, snow skiing, and golf
- Eagle Scout

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Project Team Form

Team Member #_8_ of _29_	
Name of Individual	Robert W. Anderson
Position Title	Chief Technology Officer
Employer's Name and Address (street, city, and zip code)	Olivine, Inc. 2010 Crow Canyon Place, Suite 100 San Ramon, CA 94588
Individual's Phone Number and Email Address	Phone: (510) 545-2556 Email: randerson@olivineinc.com
Job Description	Project Technical Lead
Role and Responsibilities in the Proposed Project	Lead all technical integration activities.
Experience, Capabilities, and Credentials	20 years of professional experience in technology as a computer engineer, project manager/executive and member of IEEE. One of Olivine's founding employees and technical leader for Olivine's market integration projects. Successfully performed similar Project Manager role on critical projects including the integration of energy storage within the CAISO markets as well as the development of award winning software such as Grid Today's Editor Choice Award.

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Robert Anderson

Chief Technology Officer

Olivine, Inc.

Professional Summary:

Mr. Anderson is Chief Technology Officer (CTO) for Olivine. Mr. Anderson is an accomplished software architect and entrepreneur with over twenty years of experience delivering commercial applications, services, and consulting projects. He brings that experience to Olivine leveraging his unique talent in designing for vision and building teams that turn that design into reality. Over his career, his strong entrepreneurial spirit and dedication have helped him within both startups and more established companies to build new systems from scratch and to build out technical partner ecosystems.

Professional Experiences:

Mr. Anderson's work has focused on building software platforms to support complex product suites for the enterprise, and building companies to do so:

- Won large customers against entrenched competition. Our product chosen on feature set, developer productivity, and performance – for example, game changer Countrywide Financial (now B of A).
- Leveraged .NET stack and smart-client application patterns —allowing Digipede to focus on complexity of grid computing and not that of the underlying network stacks and protocols.
- Made and implemented the engineering decisions to support business / marketing vision, not just architectural / technical vision: that the total product be easy to buy, learn, install, and use – supporting the business goal of enabling low-touch sales and a small support staff.
- Built the development practice and team to execute the vision with a focus on sustainable agile practices resulting in getting to market sooner than planned and turning around maintenance releases quickly.
- Architected and built product that garnered favorable reviews and awards, including Software Development Magazine "Great", CRN Test Center 5 star tech-rating, Gridtoday Editor's Choice Award for Best Price-Performance Middleware solution, and Microsoft 2007 ISV Partner of the Year, Innovation.
- Architected .NET and Web services APIs enabling users and system integrators to customize and extend the product.
- Led the technical integration between Energy Interactive and ABB. This included internal evangelizing within the Retail Energy Group as well as to ABB organizations in other countries. This was primarily a function of pitching to resources and management to shift existing ABB resources to Energy Interactive product and project groups.
- Led special project bringing together a major distributed-generation manufacturer, the office of California Governor Gray Davis, and other parties, to bring the Energy Interactive energy curtailment and settlement solutions to bear on the customer supply-side.
- Spun-out Energy Interactive (EI) to better leverage the Quantum Consulting expertise and software tools into newly deregulating energy markets. The EI vision was to help energy service providers differentiate their commodities by providing better information to their customers. Helped raise Series-A funding to achieve this vision, sold EI to ABB on favorable terms in 2000.

- As COO, led EI side of ABB's due diligence process. This included both technical as well as business-information and audit data. Negotiated for and facilitated the resolution of issues that arose through this process.
- As well as building the Engineering team, also built the Product Management team from scratch, bringing together energy experts with software expertise to build an excellent team.
- Architected the Energy Interactive software suite; including the shared entity and interval databases, the data access layer, the business logic layer, and front-and components to share hosting of different products in the solution suite.
- Oversaw – and contributed much code to – the entire EI product suite: Energy Profiler Online, a highly intuitive SaaS offering for delivering usage data to large commercial and industrial customers; E-VEE, a product for validating and estimating customer usage information for delivering accurate billing; Energy BOSS, a back-office billing product to bill the most complex commercial and industrial customers. Other products: Home Energy Audit (SaaS offering), Energy Profiler, RatesBase (database offering).
- Built tiered architecture for processing compute-intensive workloads for large C&I customers.
- Led technical team to tailor the Energy Interactive product suite as the front-end meter-data acquisition system for the now defunct California Power Exchange. This critical component of the California deregulated market was delivered on time during a period of great uncertainty and market chaos.
- Oversaw the development of the Home Energy Audit, the first end-user-facing SaaS offering in the energy vertical.

Employment History

- Digipede Technologies, LLC – CTO/Founder, Grid Computing Platform Vendor to many verticals, including energy and financial services.
- ABB Retail Energy Group, Manager of Technology
- Energy Interactive (now part of Schneider Electric), VP Technology / COO, developers of Energy Profiler Online, Energy BOSS, and E-VEE.
- Quantum Consulting (now part of Itron), Director, Software Development.

Education and Professional Certifications

BA, Computer Science, University of California, Berkeley

Member IEEE

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Team Member _9_ of _29_	
Name of Individual	Spence Gerber
Position Title	Senior Consultant, SME
Employer's Name and Address (street, city, and zip code)	Olivine, Inc. 2010 Crow Canyon Place, Suite 100 San Ramon, CA 94588
Individual's Phone Number and Email Address	Phone: (916) 259-3690 Email: sgerber@olivineinc.com
Job Description	Subject Matter Expert
Role and Responsibilities in the Proposed Project	Support all wholesale market tasks including resource design and registration, operational planning as well as interconnection activities.
Experience, Capabilities, and Credentials	Over 30 years of experience in energy scheduling and wholesale market operations at both the utility and CAISO levels. Having led the transition to a nodal market at the CAISO and assisted numerous resources with market integration to participate in the CAISO wholesale markets.

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Spence Gerber

Professional Summary:

Mr. Gerber is a Senior Consultant with Olivine and is an electricity industry professional with expertise in analyzing complex operational, policy and regulatory issues. He has experience in designing and implementing practical solutions that contribute to the commercial success of the organization or to meet regulatory mandates.

Past Professional Experience:

APX Incorporated (2006 – 2010)

Senior Consultant

- MRTU Readiness Project Manager, oversaw successful transition to the CAISO LMP market
- Engaged with various clients as a management consultant on Scheduling Coordinator transition
- Engaged with various clients on demand response projects

California Independent System Operator (1997 – 2005)

Director, Market Redesign and Technology Upgrade (MRTU) (2002 - 2005)

- Led program team formed to implement market design changes as approved by the Federal Energy Regulatory Commission.
- Develop program strategies, communicate project plan and progress to Board of Governors, senior management, market participants, stakeholders and regulators.
- Oversaw management of multiple projects within the program encompassing company employees, contractors and vendors.
- Presented market design elements to market participants, regulators and stakeholders and discussed and developed modifications necessary to best align with industry practices.
- Oversaw the development and execution of best practices procurement process for major software systems that withstood various audits and inquiries initiated by Executive Management and Board of Governors.
- Transitioned the corporation from an ad-hoc vendor driven design and development process to an industry accepted System Development Life Cycle (SDLC) process derived from business requirements.
- Member of core contract negotiation team for main market software and achieved an under budget base contract while negotiating a long term maintenance agreement.

Director of Settlements (2000 – 2002)

- Oversaw day-to-day operation of the wholesale electric market settlement of the California Independent System Operator.
- Produced initial market re-run activity and appeared as expert witness associated with the California refund case and other disputes before the FERC.
- Produced the first California energy crisis market settlement re-runs within the timeframe prescribed by the Federal Energy Regulatory Commission without interruption to daily settlement and with minimal additional costs.
- Communicated settlement of ad-hoc power transactions to market participants and regulators while assuring compliance with tariff.

- Successfully developed process to consolidate default IOU billings, post energy crisis, that met the requirements established by the state for accessing funds made available through emergency legislation. This effort was crucial in re-establishing financial solvency to the California electricity market despite defaults in excess of two billion dollars due to the bankruptcy of the California Power Exchange and Pacific Gas and Electric.

Director of Scheduling (1997 - 2000)

- Directed day-to-day activity of the pre-schedule, real-time and after the fact interchange accounting business unit. Responsibilities included review input and comment on applicable NERC/WSCC MORC standards and participation on sub-committees.
- Organized the scheduling department during market start-up, including in-house development of an interchange transaction scheduling system. Rapidly acquired and trained staff as well as development of scheduling system in house within 6 months to meet start-up date.

Portland General Electric, (1981 – 1997)

Manager, Power Coordination (1996 – 1997)

- Oversaw the operation of short-term wholesale power supply for retail load and wholesale sales.
- Managed next day and real-time trading and scheduling personnel engaged in the development and delivery of a balanced load and resource plan.
- Represented company's interest in regional and industrial associations through various councils and forums.
- Provided input into long term marketing and resource plans as well as broad based operational input into departmental and company-wide strategic planning.
- Managed the functional separation of merchant and reliability activities as required under FERC Order 889.
- Implemented first version of integrated Power Scheduling and Accounting System in conjunction with Information Services department.

Scheduler and Dispatcher, Power Operations Division (1986 – 1996)

- Assisted in the development of real-time scheduling function and personnel training for the company.
- Monitored and dispatched Portland General Electric generation resources to meet system requirements in the most economical method while meeting all NERC, WSCC and NWPP reliability criteria.
- Participated in the development of hourly load and resource schedule on a preschedule basis.
- Reconciled after the fact interchange scheduling and wholesale billing with regional utilities.
- Mentored staff in transition from plant operations to power scheduling activities necessitated by the addition of a real-time scheduling operation.

Education:

- Harvard Kennedy School of Government, Cambridge, MA -- Executive Program
- Portland State University, Portland, OR – Economics Courses
- Mount Hood Community College, Gresham, OR -- Applied and Social Science transfer courses

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Team Member #_10_ of _29_	
Name of Individual	Elizabeth Reid
Position Title	CEO
Employer's Name and Address (street, city, and zip code)	Olivine, Inc. 2010 Crow Canyon Place, Suite 100 San Ramon, CA 94583
Individual's Phone Number and Email Address	Phone: (415) 294-0575 Email: breid@olivineinc.com
Job Description	Program Coordination Lead
Role and Responsibilities in the Proposed Project	Lead the coordination among project efforts including the collaboration with other team members. Manage Olivine's participation with all outreach efforts, analysis, and reporting of lessons learned.
Experience, Capabilities, and Credentials	Ms. Reid is a proven leader with over 25 years of experience of applicable experience leading commercialization and diversification efforts in the energy industry at both small and multi-national companies. Ms. Reid specializes in developing customized solutions that require the integration of both technical components and policy advancements to achieve success.

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ELIZABETH REID

Professional Summary:

Beth Reid is a proven leader with over 20 years of experience in the energy industry including senior management positions at multi-national corporations such as ABB and VECTRA Technologies. She is a results oriented professional with a record of implementing successful initiatives in the industry including the development of innovative programs, market entry strategies for renewable resources, project finance and acquisition of unique technologies. The breadth of Beth's experience enables her to bring a unique and valuable perspective to client collaborations.

Accomplishments:

- *Managed profit turnaround of utility automation systems provider.*
- *Responsible for strategic business alliances, strategic investments and M&A activities for a worldwide software developer.*
- *Managed Business Planning and Development for global business with operations in UK, Scandinavia, Germany and the US. Developed business plan to achieve 100% revenue growth in 3 years. Achieved 40% growth in first year.*
- *Responsible for meeting revenue growth and earnings targets for multi-national technology business. Achieved 50% earnings growth in first year.*
- *Developed and executed business plan including a redesign of the product portfolio, customer support approach and market image resulting in a 45% profitability improvement.*

Past Professional Experience:

Managing Director, Professional Services at APX, Inc./APX Power Markets, Inc. (2005 – 2010)

- Responsible for leading the Professional Services department including the Demand Response practice.
- Initiatives include product management, market positioning, system implementation and consulting.

General Manager, Oakland Operations at Power Measurement, Inc. (2004)

- Power Measurement acquired ABB's Retail Energy Systems business in early 2004.
- Responsible for executing the sales agreement and managing the transition to Power Measurement, maintaining full profit and loss responsibility for the acquiring company.

Director of Retail Energy Systems, Oakland Operations at ABB Utility Automation/Network Management

(2002-2004)

- Full profit and loss responsibility inclusive of sales, marketing, strategic planning and operations. Revised business approach and executed business turnaround.
- Received ABB Power T&D Company's award for Leadership in 2003.

ABB Utility Automation/Network Management

Director of Retail Energy Systems (2002-2004)

- Full profit and loss responsibility inclusive of sales, marketing, strategic planning and operations. Revised business approach and executed business turnaround.
- Received ABB Power T&D Company's award for Leadership in 2003.

Director of Marketing and New Business Development (2001-2002)

- Managed market planning and communications for Business Management Systems group.
- Initiatives included re-evaluation of market position, redesign of market image as well as realignment of the product portfolio.

Director of Marketing and Strategic Planning (2000-2001)

- Responsible for the update and execution of the strategic plan within the Support and Services arena of the Utility Automation Business Area.
- This global initiative required reviews of markets around the world and the evaluation of mergers, acquisitions and investments.

ABB Energy Information Systems (1999-2000)

- $100 million newly established business with principal locations in Europe, Scandinavia and the US (Systems Control) providing software and services to deregulating energy markets worldwide
- Founding manager for startup business within large multi-national.
- Key responsibilities included market analysis, strategic planning and business development activities as well as the development of related infrastructure and processes.

ABB Systems Control (1996-1998)

- Division of ABB Power T&D Company servicing the power industry focused on the development of software and implementation of system.
- Managed profitability improvements, focusing on diversification of market services and product consolidations, resulting in a turnaround.

Vectra Technologies, Inc. (1994-1996)

- $123 million NASDAQ company with corporate, venture capital and public ownership providing services and technologies primarily to the utility and US government markets.
- Directly responsible for strategic and operations analyses, business plan development and forecasting as well as external reporting and analysis.
- Key liaison for various external relationships including management of M&A activities, press conferences and SEC reporting.

ABB Impell (1991-1993)

- Multinational engineering services subsidiary of Asea Brown Boveri, Inc.
- Responsible for business management activities in assigned business units including operational analyses and review, pricing, contract administration and market assessments.

Education:

Henley College -- International Management Development Program

Duke University – Leadership Management Forum

University of Washington – Master of Business Administration

University of Michigan – Bachelor of Arts in Economics

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Project Team Form

Team Member #_11_ of _29_	
Name of Individual	Erich Huffaker
Position Title	Project Specialist in Demand-side Management
Employer's Name and Address (street, city, and zip code)	Olivine, Inc. 2010 Crow Canyon Place, Suite 100 San Ramon, CA 94583
Individual's Phone Number and Email Address	Phone: 510-214-2814 Email: ehuffaker@olivineinc.com
Job Description	Project Specialist
Role and Responsibilities in the Proposed Project	Responsible for administrative and operational tasks including scheduling and settlement processing and data collection.
Experience, Capabilities, and Credentials	Mr. Huffaker is a specialist in demand-side management, working extensively in retail demand side programs and wholesale market resource administration. He is also skilled at the quantitative elements of energy analysis, policy analysis and market-driven, needs-based research.

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Project Team Form

Erich Huffaker

Professional Summary:

Mr. Huffaker is a Project Specialist in Demand-side Management at Olivine, supporting a wide variety of projects. He has worked extensively with retail demand response programs in California. His skills in project management, knowledge and experience of the regulatory landscape, and passion to work towards a greener economy make him a great fit. With a background in web design, economics and instruction, Mr. Huffaker has extensive experience distilling complex subject matter into digestible pieces for training, communication and other purposes. He is also skilled at the quantitative elements of energy analysis, policy analysis and market-driven, needs-based research.

Areas of Expertise:

- Web Database System Design: Creation/Administration of Drupal and Joomla! projects, CSS, HTML, Infographic Design, Proficiency in Adobe Photoshop, Premiere Pro & Dreamweaver
- Stata Regression Analysis Software Package: Significance Testing, Multiple Regression Models and Analysis
- Microsoft Office Suite: Word, Excel, PowerPoint
- General IT Maintenance, Support & Problem-Solving

Past Professional Experience:

Intern/Research Associate @ California Public Utilities Commission - Energy Division (2010 – 2012)

- Collected, organized and analyzed data from local AQMDs, CEC, EPA and EIA to model the GHG and criteria pollutant emissions potential of backup generators (BUGs) enrolled in PG&E demand response (DR) program
- Researched the patchwork of overlapping national, state and local regulation on backup diesel generators in DR
- Disseminated research findings through presentations and meetings to policymakers at multiple levels of influence
- Identified colleagues in ISO's, RTO's and Utility Commission's nationwide and conducted outreach efforts by phone to discover best practices regarding regulation of DR aggregators in CA wholesale markets

Graduate Student Research Assistant @ Goldman School of Public Policy (2011 – 2012)

- Supported Professor Lee Friedman with independently-conducted research on national DR policy, DR baseline methodologies, dynamic pricing tariffs, DR program evaluation and classification
- Distilled research and data from numerous academic and government sources into a concise, jargon-free report on market and regulatory barriers to the development of a smarter grid

Graduate Student Research Assistant @ Lawrence Berkeley National Laboratory (2010 – 2011)

- Conducted a market review of software analysis tools for commercial and industrial (C&I) customers that facilitate DR and EE program involvement
- Managed the search for a web design firm to create a user-friendly, searchable online database of Open Automated DR (OpenADR) compliant buildings

- Assisted in authoring and editing a scoping study on utilizing fast time-scale DR to facilitate intermittent renewable generation
- Performed evaluation of thermal energy storage systems for integrating energy produced by wind and solar

Education:

University of California, Berkeley – Master of Public Policy / Master of Science in Energy & Resources
Environmental Protection Agency Star Fellow *(see Research Associate position w. CPUC above)*

University of California, Santa Cruz – BA Global Economics

Highest Honors

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Project Team Form

Team Member #_12_ of _29_	
Name of Individual	Willett Kempton
Position Title	Professor, College of Earth, Ocean and Environment and Department of Electrical Engineering
Employer's Name and Address (street, city, and zip code)	Name: University of Delaware Address: 374 ISE Lab Newark, DE 19716
Individual's Phone Number and Email Address	Phone: (302) 831 – 0049 or (302) 831 – 2336 Email: willett@udel.edu
Job Description	Co-Principle Investigator
Role and Responsibilities in the Proposed Project	Lead scientist and engineer responsible for overseeing technical aspects of the project
Experience, Capabilities, and Credentials	PI on many technical projects. Wrote first initial paper proposing V2G in 1997 and considered the world's leading authority on the technology.

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Willett Kempton - Principal Investigator
Abbreviated Curriculum Vitae
Professor, College of Earth, Ocean and Environment
Professor, Department of Electrical and Computer Engineering
University of Delaware, Newark, DE 19716
phone: (302) 831-0049, e-mail: willett@udel.edu
http://www.carbonfree.udel.edu
rev. 21 Jan 2011

a) **Education and Training**

University of California, Berkeley. Postdoctoral training in quantitative anthropology with public policy emphasis, 1977 - 1978.
University of Texas at Austin. Ph.D. in anthropology, 1977.
University of Virginia, Charlottesville. B.A. in sociology and anthropology, with strong background in electrical engineering and computer science, 1972.

b) Professional Experience(recent)

- Otto Mønsted Gaest Professor, Department of Electrical Engineering, Danish Technical University 2011-2012
- Professor 2009-present; Associate Professor, 1999-2009; Assistant Professor, 1995-1999; College of Earth, Ocean, and Environment, University of Delaware. Professor, Department of Electrical and Computer Engineering, 2010 - present.
- Director, Center for Carbon-free Power Integration, U Delaware, 2008-present.
- Research Anthropologist, Center for Energy and Environmental Studies, Princeton University, 1985 - 1992.

c) **Publications**

1) W. Kempton, Felipe M. Pimenta, Dana E. Veron, and Brian A. Colle, 2010, "Electric power from offshore wind via synoptic-scale interconnection." Proceedings of the National Academy of Sciences (published online April 5, 2010) doi:10.1073/pnas.0909075107
2) J. Tomic and W. Kempton, 2007 "Using Fleets of Electric-drive Vehicles for Grid Support" Journal of Power Sources 168 (2): 459-468, doi:10.1016/j.jpowsour.2007.03.010.
3) Kempton and Jasna Tomic, 2005 "Vehicle to Grid Fundamentals: Calculating Capacity and Net Revenue" J. Power Sources Volume 144, Issue 1, 1 June 2005, Pages 268-279. doi:10.1016/j.jpowsour.2004.12.025".
4) "Large CO2 reductions via offshore wind power matched to inherent storage in energy end-uses", (Kempton, W., C. L. Archer, A. Dhanju, R. W. Garvine, and M. Z. Jacobson) Geophys. Res. Lett., (2007) 34, L02817, doi:10.1029/2006GL028016.
5) Letendre, Steven and W. Kempton, 2002. "The V2G Concept: A New Model for Power?" Public Utilities Fortnightly 140(4): 16-26.
6) Kempton, W. and J. Tomić. 2005. "Vehicle to Grid Fundamentals: Calculating Capacity and Net

Revenue" J. Power Sources Volume 144, Issue 1, 1 June 2005, Pages 268-279. doi:10.1016/j.jpowsour.2004.12.025.
7) Kempton, W. and J. Tomić. 2005. "Vehicle to Grid Implementation: from stabilizing the grid to supporting large-scale renewable energy". J. Power Sources Volume 144, Issue 1, 1 June 2005, Pages 280-294. doi:10.1016/j.jpowsour.2004.12.022
8) "Using Fleets of Electric-drive Vehicles for Grid Support" (J. Tomic and W. Kempton) Journal of Power Sources 168 (2): 459-468, doi:10.1016/j.jpowsour.2007.03.010. (2007)
9) "Integration of renewable energy into the transport and electricity sectors through V2G" (Henrik Lund, W. Kempton) Energy Policy 36 (9): 3578-3587. doi:10.1016/j.enpol.2008.06.007 (2008)

d) **Related Patents**

1) "SYSTEM AND METHOD FOR ASSESSING VEHICLE TO GRID (V2G) INTEGRATION" filed on May 1, 2007 as Application No. 11/742,882. (Kempton and Tomic)
2) "Hierarchical Priority and Control Algorithms for the Grid-Integrated Vehicle", (final patent application filed March, 2009, based on provisional application 61/033,116) (Kempton)

e) Synergistic Activities

- The University of Delaware Energy Institute, Steering Committee. 2008-present
- NSF Panel, Site Review, 2007, NSF Center for Decision-making under Uncertainty, Climate Change, at Carnegie Mellon University.
- Workgroups on State Energy Plan, "Reducing the Environmental Footprint of Generation" (2) and "Economic Development" (5). Developed analysis behind state energy planning. Sept 2008 - Jan 2009.
- Written and verbal testimony before the Delaware Public Service Commission, August - April 2008. Regarding RFP for new long-term power contract, docket 06-241. Oral testimony given at approximately 8 hearings, plus approximately 10 items of written testimony submitted to this docket

ATTACHMENT 5
Project Team Form

Team Member #_13_ of _29_	
Name of Individual	Rodney Magee
Position Title	
Employer's Name and Address (street, city, and zip code)	Name: University of Delaware Address: 374 ISE Lab Newark, DE 19716
Individual's Phone Number and Email Address	Phone: 302-831-6548 Email: tmcgee@udel.edu
Job Description	Chief Engineer
Role and Responsibilities in the Proposed Project	• Electrical engineer • Configuration of technical programming
Experience, Capabilities, and Credentials	• Lead System Engineer, Hardware design for UD's Vehicle to Grid effort

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Rodney T McGee

Chief Engineer

Education and Training

Doctorate, Electrical Engineering, University of Delaware, 2014

Masters of Electrical Engineering, University of Delaware, 2010

Bachelors of Computer Engineering, University of Delaware, 2008

Bachelors of Computer Science, University of Delaware, 2007

Research and Professional Experience

2013 – 2009: Lead System Engineer, Hardware design for UD's Vehicle to Grid effort, Dept. of Electrical and Computer Engineering, Univ. of Delaware

- Lead of team of engineers to design, future develop, productize the components needed for advanced EVSE and EV system capable of bidirectional information and power flow.

2013 – 2008: Lead System Engineer, SLEDs Program, CVORG Labs, Dept. of Electrical and Computer Engineering, Univ. of Delaware.

- Lead a team of researchers to take a technology from a high risk proof-of-concept research focused project and developed into the product that exceeded specifications and meet customer/end-user expectations
- Project involved custom IC design, power control electronics, cooling system, advanced cryogenic package, PCB design, and FPGA based support electronics.
- Managed the interactions between technology partners to reduce risk and mitigate issues.

2012 – 2011: Researcher, Cyber-security in Tactical Environments

- Research advanced topics in hardware and embedded software security.

2009 – 2008: Hardware Design focused Engineering, Univ. of Delaware

- Implement a series of test-benches and hardware test harness for an infrared superlattice LED in the form of an interactive test program on an FPGA

2007 – 2008: Software Design focused Engineering, Univ. of Delaware

- Designed an automated network testing software. Software measured packet shaping, bandwidth constrictions, and intermittent connectivity.

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Project Team Form

Team Member #_14_ of _29_	
Name of Individual	Sachin Kamboj
Position Title	
Employer's Name and Address (street, city, and zip code)	Name: University of Delaware Address: 374 ISE Lab Newark, DE 19716
Individual's Phone Number and Email Address	Phone: 302-566-5477 Email: skamboj@udel.edu
Job Description	Chief Software Architect
Role and Responsibilities in the Proposed Project	- Software & Computer engineer - Support for Configuration of technical programming
Experience, Capabilities, and Credentials	- Formally modeled and simulated the behavior of a multiagent coalition capab k - Developed the complete software stack for: aggregating several hundreds of cars, bidding in the regulation energy market run by PJM, dispatching energy from vehicles in response to requests, allowing non-technical users to interact with the system

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Project Team Form

Sachin Kamboj

Education & Training

Doctor of Philosophy, Computer and Information Sciences, University of Delaware, 2010 Master of Science, Cor
2005 Bachelor of Engi
University, 2002

Research and Professional Experience

2009 – Present: Computer Scientist, Center for Carbon-free Power Integration, Univ. of DE

- Formally modeled and simulated the behavior of a multiagent coalition capable of aggregating several hundreds of cars.
- Developed the complete software stack for:
  - aggregating several hundreds of cars
  - bidding in the regulation energy market run by PJM
  - dispatching energy from vehicles in response to requests
  - allowing non-technical users to interact with the system

2006 – 2009: Research Assistant, Dept. of Animal & Food Sciences, Univ. of DE

- Re-implemented the pipeline for building small RNA signatures, which resulted in a speed-up of the build process from one week to ten hours.
- Developed and maintained a website for mapping known microRNAs to potential targets in chicken 3'UTRs: http://mdvmicrorna.dbi.udel.edu

2005 – 2006: Research Assistant, Dept. of Electrical & Computer Engineering, Univ. of DE

- Rewrote the configuration process for the reference implementation of the Network Time Protocol (NTP) using a phrase structure grammar.
- Developed a test plan for testing protocol conformance for NTP

Relevant Publications

Vandael, S., Kamboj, S., Kempton, W., Holvoet, T., and Deconinck, G., "*A comparison of two GIV mechanisms for providing ancillary services at the University of Delaware*", to appear in the Fourth IEEE International Conference on Smart Grid Communications, Symposia on Demand Side Management, Demand Response and Dynamic Pricing (IEEE SmartGridComm 2013)

Kamboj, S., Decker, K. and Kempton, W., *"Deploying Power Grid-Integrated Electric Vehicles as a Multi-Agent System"*, In Proceedings of the Tenth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS 2011), pp 13 – 20 (2011). **Nominated for best paper**. *(Acceptance Rate: 22.1%)*

Kamboj, S., Decker, K., Trnka, K., Pearre, N., Kern, C. and Kempton, W., *"Exploring the formation of Electric Vehicle Coalitions for Vehicle-To-Grid Power Regulation"*, In 2010 AAMAS workshop on A

Kamboj, S., *"Analyzing the tradeoffs between breakup and cloning in the context of organizational self-design"*, In Proceedings of the Eighth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS 2009), pp 829 – 836 (2009). *(Acceptance Rate: 22.3\%)*

Kamboj, S. and Decker, K., *"The use of Organizational Self-Design for generating organizations in worth-oriented domains"*, To appear in Handbook of Research on Multi-Agent

Systems: Semantics and Dynamics of Organizational Models, edited by Virginia Dignum, IGI Global Publications, pp. 541–568 (2009).

ATTACHMENT 5
Project Team Form

Team Member #_15_ of _29_	
Name of Individual	Rue Phillips
Position Title	President SOLARRUS CORP. CEO True South Renewables inc.
Employer's Name and Address (street, city, and zip code)	Name: Solarrus Corp Address:5406 Bolsa Ave. Huntington beach. CA. 92649
Individual's Phone Number and Email Address	Phone: 714-908-5266 Email: RuePhillips@solarrus.com
Job Description	Oversee company projects, standards, processes and business development including new technologies, engineering and services
Role and Responsibilities in the Proposed Project	Oversee the design and engineering protocols and deliverables. Oversee project managers, and keep contact with customer and host. Ensure all deliverables are met and standards and kept.
Experience, Capabilities, and Credentials	Eighteen Years of Electric Vehicle infrastructure design and implantation. Managed renewable energy engineering projects of $50M+ including EVSE projects. Worked on previous CEC EV grant projects in CA. Advised and consulted UL for adaptation of EVSE training programs. Designed and installed several thousand EVSE across CA

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Rue Phillips Bio

- Active in Industrial and commercial Electrical contracting since 1985 (family UK contracting business)

- Since 1994 a US pioneer and veteran of Electric Vehicle infrastructure implementation technologies (design, installation and service support). Installed the first GM EV1 private EVSE from the production line and for ten years designed, installed and serviced hundreds of public,

- private, municipal and commercial EVSE's. Upon noticing that most EV drivers owned a solar system migrated over towards solar.

- From 2003 active in the development, engineering & design and installation of over 350MW of commercial solar systems in the USA and Canada (including 1MW of residential).

- Co-founded a successful US Operations and maintenance company now considered the largest independent Solar O&M company in the USA. Identified dysfunctional maintenance practices which were negatively impacting solar assets and adopted and implemented new process controls, testing standards and maintenance processes now widely accepted used within the US increasing revenues and reducing risks on assets.

- Currently sits on the industry expert advisory committee for the development of codes and standards in the US solar industry contributing to white paper studies distributed by ASTM, IEC, EPRI, NREL. Contributions include toe insertion of battery energy storage codes and standards considerations when implemented with solar PV systems across the USA.

- Currently active in the design and implementation of battery energy storage systems 'BESS' and infrastructure development within Solar, Electric Vehicles, Emergency off grid, peak demand shaving and microgrid support. Working on developing training and implementation support of solar/ battery storage system development in third world countries as a humanitarian effort.

- Considered an industry pioneer in the development of a standardized and comprehensive commissioning protocol now widely used as a standard throughout the solar industry today.

- Advised and consulted multi-billion dollar EPC's in the development of installation standards, design and installation techniques, as well as efficient system modeling.

- Consultant to Underwriters Laboratories 'UL' university on the standardization of Electric Vehicle Service Equipment installation techniques and protocols.

- Consulted to multi Billion dollar EPC's towards the implantation and design of EV infrastructure within large scale solar car port facilities.

- Senior technical advisor to large developers and EPC's within systems from 10-250MW.

- Formed a successful engineering company and designed and engineered 250MW of projects (schools, FIT plants, international stores and small DG)

- Developed a unique solution towards the operations and maintenance of solar PV systems focusing on higher outputs using unique preventative (versus reactive) maintenance protocol.

- Developed a construction integrated commissioning protocol 'CISC' whereby the utility scale solar plant is being commissioned (under load and current whilst in construction (before the substation comes on line).

- Developed a nationwide OEM technical 24 Hr response support infrastructure in Electric Vehicle and solar technologies.

- Frequent speaker and technical advisor at international Seminars and symposiums for Electric vehicles and Solar O & M

- As an active program organizer, currently active in a first of a kind Vets training course with a focus on renewable technologies Electrical Field Service Technician training 'EFST'. My contribution towards the unique three month EFST class involves working with the local college dean along Advanced transportation and Renewables ATR to develop the credited curriculum which a focus on Electric vehicle Service Equipment and related technologies along with Solar PV and battery energy storage devices. I have also rallied support in the program from large US corporations for program participation and job recruitment opportunities. It is expected that the first program will result in above 90% job enrollment. The curriculum is expected to roll out across community colleges the USA with a constant recruitment interest from USA largest EV, Solar and BESS market leaders. The curriculum is in constant adjustment to suit market drivers and technology advancements and is focused on the long term service criteria of all leading renewable technologies.

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Project Team Form

Team Member #_16_ of _29_	
Name of Individual	Robert Forster
Position Title	Vice President Business Relations SOLARRUS CORP
Employer's Name and Address (street, city, and zip code)	Name: Solarrus Corp Address:5406 Bolsa Ave. Huntington beach. CA. 92649
Individual's Phone Number and Email Address	Phone: 714-908-5266 Email: RobertForster@solarrus.com
Job Description	• Lead the integrated insights and strategic planning group in a way consistent with the agency's goal • Partner with creative and account management peers to develop disruptive ideas at all points of customer contact.
Role and Responsibilities in the Proposed Project	• Manage Solarrus resources to optimize the application of funds in the most effective way • Address customer needs for the successful deployment of technology.
Experience, Capabilities, and Credentials	Forward-thinking, outcome-oriented executive management professional with strong expertise in carious technologies. Rapidly identify, define, and solve business problems, levraging technology for a competitive advantage. Broad understanding of today's business environments. Acute skills in analyzing business operations for need, organizing for results, planning for controlled changes and administering effectively.

ATTACHMENT 5
Project Team Form

ROBERT A. FORSTER
2 Rimrock, Irvine, California 92603
(949) 679-3495 r.forster@cal.berkeley.edu

Profile

Forward-thinking, outcome-oriented executive management professional with strong expertise in various technologies • Rapidly identify, define, and solve business problems, leveraging technology for a competitive advantage • Broad understanding of today's business environments • Acute skills in analyzing business operations for need, organizing for results, planning for controlled changes, and administering effectively

Experience

Solarrus Corporation *August 2011 to Present*
Vice President, Strategic Planning *Irvine, CA*

- Executive leader at newly formed solar energy startup, directing strategic development, merger and acquisition, and capital fundraising activities targeting $5 million
- Developed business plan for new distressed 'Legacy' model, targeted acquisition of first underperforming 20MW portfolio of projects, estimated value of $30 million, and negotiated terms with equity partners
- Crafted protocols and launched Insured Service Maintenance Agreement (ISMA) program, industry's first performance-based solar production guarantee underwritten by an A-rated insurance company
- Implemented evaluation procedures for evaluating economic savings for new distributed generation solar projects with Penick-SI, joint venture between Solarrus and TB Penick & Sons

Ingram Micro, Inc. *August 2006 to August 2011*
Director, Business Development & Marketing *Santa Ana, CA*

- Key member of team brought to Ingram Micro to establish Ingram Micro Private Label (IMPL), the company's first truly global trading company; built infrastructure to support $50M revenue worldwide
- Established and hired sales team of internal associates and external managed resource organizations (MROs), and directed all IMPL sales programs in North America, resulting in year-over-year growth in average daily sales by 15% across all VAR, SMB, Government, Education, and Retail/E-tail channels
- Responsible for North America P&L, and grew business from negative contribution margin to positive for eight consecutive quarters, the first time since the division was established
- Directed all sales trainings for both internal Ingram Micro Sales Associates and customer sales forces, designed sales incentives for Sales, and oversaw trade shows and customer-facing events
- Created new framework in order to propose "private label" services to key Ingram Micro customers, resulting in new partnerships with Staples, Dell, and other strategic accounts

Director, Product Marketing & Market Communications

- Launched 36 different product categories globally, responsible for packaging and collateral design, localization requirements, standardized new product introduction procedures to cover all product launches, executed press releases and marketing communications to coincide with all product launches
- Lead inventory control and forecasting management, and created new programs to reduce excess and obsolete inventory reserves by 80%
- Designed and established new pricing strategy across entire IMPL portfolio in order to reduce channel conflict between different customer segments
- Oversaw implementation of end-user facing website in six different languages across twelve different countries, integrated social media to connect with customers, and developed new branding guidelines to standardize global application

Senior Manager, Worldwide Operations

- Established supply chain logistics from multiple factories to customers in 34 different countries worldwide, and created policies and procedures to standardize purchase order processes
- Standardized quality control and regulatory compliance requirements for all product categories, and oversaw factory audit procedures in Asia, Europe, and Americas
- Developed customer care business requirements and implemented worldwide post-sales service and support infrastructure for all IMPL categories globally

Gateway, Inc. *September 2003 to August 2006*

Program Manager, International Service Operations *Irvine, CA*

- Developed, implemented, and managed post-sales support infrastructure for Europe, including call centers, depot repair, and onsite services
- Directed negotiations with manufacturers in order to reduce service costs by 15%; implemented continuous improvement evaluation in order to ensure vender support remains competitive
- Restructured the professional and consumer take-back, asset recovery, and recycling programs for the United States and Europe
- Led negotiations with onsite installation/repair partners for consumer and professional services; negotiated 22% savings for in-home repair activities

Partner Manager, Customer Care Operations

- Partner manager for Business and Consumer Services teams, representing Operations organization responsible for driving annualized cost savings of over $400 million
- Oversaw warranty service partners and negotiated contracts to expand service plan coverage for new consumer electronics and computer products, representing over $200 million in service revenue
- Restructured customer service and technical support model and negotiated agreements with venders to integrate Gateway and eMachines call center operations

Business Analyst, Supply Chain Management

- Managed manufacturing partner structure for warranty support and reverse logistics for new alternative form factor and media center PCs
- Reorganized reverse logistics support model for Mexico and Canada alternative sales channels representing $40 million revenue

Independent Consulting Projects *August 2001 to September 2003*

- **Anthem Venture Partners** (VC firm – financial analysis in alternative energy market) *Los Angeles, CA*
- **Real Energy** (distributed power generation provider – competitive market assessment)
- **EV Rental Cars** (rental car company – electric car marketing research)
- **AeroVironment** (alternative energy technology developer – business development EV charging)
- **Solartech Sun Illumination Systems** (daylighting design/installation startup – business plan)

URS Corporation (Formerly Dames & Moore) *October 1996 to August 2001*

Project Manager *Los Angeles, CA*

- Provided environmental consulting services and coordinated cross functional teams for investigations of properties during construction or renovation of new hospitals, schools, and commercial developments
- Negotiated remediation and closure requirements for contaminated sites based on potential human-health risks with local, state, and federal regulatory agencies

Education

University of California, Los Angeles – Anderson School of Management *M.B.A., June 2003*
Center for Management in the Information Economy; Price Center for Entrepreneurial Studies

University of California, Santa Barbara – Bren School *C.E.M., June 2003*
Emphasis in Corporate Environmental Management; Focus on Science, Public Policy, and Business

University of California, Berkeley – Department of Geology & Geophysics *M.A., 1996; B.A., 1995*

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Project Team Form

Team Member #_17_ of _29_	
Name of Individual	Raoul Wood PE
Position Title	Senior Engineer of record SOLARRUS CORP
Employer's Name and Address (street, city, and zip code)	Name: Solarrus Corp Address:5406 Bolsa Ave. Huntington beach. CA. 92649
Individual's Phone Number and Email Address	Phone: 909-477-1474 Email: RaoulWood@solarrus.com Raoul.wood@verizon.net
Job Description	Senior Electrical Engineer for Solarrus Corp and its wholly owned subsidiary True South Renewables.
Role and Responsibilities in the Proposed Project	Technical Advisor and consultant in all aspects of Engineering for all engineering activities for the project including system design, Fire, safety and AHJ code enforcement. Respond, co-ordinate and administer constructional Request For information 'RFI' forms and dialogue. Perform as needed any and all existing electrical system inspections, periodical site inspections, host and customer engineering dialogue. OEM installation criteria, safety and AHJ code application. As built drawing compilation.
Experience, Capabilities, and Credentials	Have worked on multiple renewable projects across the nation including multimillion dollar Solar/EV school projects. Fluent in all aspects of International engineering codes and standards in AC and DC systems as well as high voltage substation projects. Currently an active licensed PE in CA, TX, NV,AZ,CO Have design electronics and control systems for aerospace and pretrochemical applications. Snr advisor and code writer for NFPA and IEEE. Currently working on Microgrid projects in Guam, and Puerto Rico. Active engineer on NRG's CA Freedom station infrastructure. Familiar with all CA utilities codes and standards as well as college and university facilities engineering requirements.

RESUME ATTACHED

ATTACHMENT 5
Project Team Form

Raoul L. Wood, P.E., LEED AP, CEM
583 East Bonita Avenue, Suite C, San Dimas, CA 91773, 909-477-1474,
raoul.wood@verizon.net

Professional Experience

Solarrus/True South Renewables Inc. - Huntington Beach, CA
Senior Electrical Engineer of Record
Aug 2010 - present

- Act as Engineering Division Senior Electrical advisor and engineer on multiple EV, Solar and BESS projects
- Advise and council on Renewal Projects in EV,PV, Wind, BESS and Microgrids
- Designed, Project Managed and Installed Over 500 MW of Photo Voltaic Systems
- Worked as Engineer on large utility scale grid emulation systems
- Worked on schematics for battery energy storage systems
- Worked on developing standards and codes for fire safety systems
- Working on development and implementation of international Micro grid projects
- Working on humanitarian projects in Africa for the development of solar PV and BESS
- Active Engineer of record for PV system design, electric vehicle design and BESS nationwide
- Continual dialogue and training with Multiple AHJ and local utilities for EV infrastructure implementation and cod standards dialogue
- System analytics for battery sizing, equipment sizing and procurement in PV, EV and BESS systems.
- Overseer for CAD designs and plan submittals on all Engineering projects.

Chevron Energy Solutions Company – Pasadena, CA
Senior Development Engineer - Project Manager
Sep 2001- Aug 2010

- Managed Native American Renewable Project Development Program Complex Offering
- Developed Large Scale Renewal Projects PV, Wind
- Designed, Project Managed and Installed Over 200 MW of Photo Voltaic Systems
- Educational Show Case Winner East Los Angeles Community College 1 MW Solar PV Carport
- EPA Project of the year Winner Solid Waste Authority of Central Ohio Landfill Gas GNG Project
- Implemented Demand Side Management for ten (10) Campus Community College District: Comprehensive Energy Audit, Lighting Retrofit, HVAC Upgrades, Enterprise Wide EMS Controls, Utility Rebates, Measurement and Validation, Performance Guarantee and Complex Project Financing.
- Managed Complete MEP Energy Modernization Project for Twenty (28) District K-12
- Designed over Ten (10) Central Plants with Co-Generation, Thermal Storage, WEB Base EMS Controls, Absorption Chillers

Honeywell – Van Nuys, CA
Business Development Manager Food and Beverage
Mar 1998 – Aug 2001

- Developed Adaptive Energy Saving Compressed Air Systems
- Installed over 100 Microturbine Distributed Generation Systems
- Designed Advanced Large Scale Energy Efficient Ammonia Refrigeration Systems
- Designed Small Gas Separation Plant for Industrial Customers Liquid Nitrogen, Carbon Dioxide and Helium. (Cost Saving Meas

Edison Source – City of Industry, CA
Senior Engineer Performance Contracting
Jan 1196 – Feb 1198

- Implemented Energy Efficiency Performance Contracts: Con-generation, Thermal Storage and Distributed Generation and Conventional Energy Efficiency Measures, Lighting, EMS Controls, Replacement of Boilers, Chillers, Air Handlers and Package Units

XEROX Electrical-Optical - Chino, CA
Manager Engineering Power Electronics
June 1995 – Jan 1996

- Developed and Marketed Switched Mode Power Supplies for ION Lasers
- Basic research Gene Splicing Deep UV Laser Scissors –ARCO Products C Los Angeles, CA –Engineering Manager Energy Sector Apr 1989 – Jun 1995
- Development Engineering Large Energy Scale Projects
- Design and Installation of Energy Efficient Electrical Infrastructure Santa Pacific Pipelines – Los Angeles, CA Senior Project Engineer – Apr 1980 – Apr 1989
- First use of Large 1000-5000 HP Adjustable Speed Drives on Pipeline Pumping Applications
- Implemented Energy Efficient Motor Standards & Specifications
- Design of Energy Saving Variable Frequent Drive Pump System for Petroleum Terminal Truck Loading
- Developed Power Optimization Dispatching Program for Inter-State Pipeline Pumping System (11,000 Pipeline Stations – Long Beach, CA –Manager Engineering Division Sep 1979 – Apr 1980 ug Rotating Equipm
- Down Hole Telemetry
- Sub-Surface Safety Systems
- Microprocessor Based Machinery Protection

Education & Licensing

California State University Los Angeles BSEE -1977 Electrical Engineering
Stanford University MSME – 1979 Aerodynamics
Registered Professional Engineer (CA, AZ, IL, NV, OR, WA)
LEED AP, CEM (Certified Energy Manager), CDSM (Certified Demand Side Manager)
Senior Member NFPA (National Fire Protection Association)
Senior Member ISA (International Society of Automation)
Former NEC (National Electrical Code) Code Panel Fourteen Member (Hazardous Locations)
OSHA 30 Trained (Both Construction and General Industry)
Certified (NFPA 70E) Electrical Safe Work Practices Trainer
Author IEEE Bronze Book, IEEE/ANSI Standard 739 “IEEE Recommended Practices Energy Management in Industrial and Commercial Facilities”

ATTACHMENT 5
Project Team Form

Team Member #_18_ of _29_	
Name of Individual	Kelly Fishback
Position Title	VP of Solarrus EVS
Employer's Name and Address (street, city, and zip code)	Name: Solarrus Corp Address:5406 Bolsa Ave. Huntington beach. CA. 92649
Individual's Phone Number and Email Address	Phone: 949-330-3303 Email: kellyfishback@solarrus.com
Job Description	Divisional operations manager for Solarrus EVS division.
Role and Responsibilities in the Proposed Project	Oversee EV division activities from site specific conceptual design and engineering thru permitting and construction of all EV projects and activities. Oversee and supervise PM's, subcontractors, vendors and enforce project safety criteria on multiple projects in multiple cities and states. Scheduling, ordering of materials, equipment and safety materials for a multitude of ongoing and simultaneous projects interacting with Host, customer and all activities within the project.
Experience, Capabilities, and Credentials	Have successfully managed and completed over fisty NRG EV Freedom station across the State of CA, developing new cost efficient methods and strategies for design, construction and equipment procurement on multiple projects. Presently working on CEC EV projects in both levelI and level II systems. Years of construction experience on renewable systems.

RESUME ATTACHED

ATTACHMENT 5
Project Team Form

Kelly Fishback

Solarrus Corp.
VP of Operations in EVS services
2010 – Present

- 15 years' experience in the installation of solar, EVSE, and electrical systems
- Strong expertise in the layout, design, maintenance of thermal and photovoltaic solar projects
    - CA Licenses B, C10 and C-12
    - NABCEP certified technician
    - Solarrus Corporation – VP of installation services for solar, Level 2 and DC Fast Charger electric vehicle service equipment
    - Sunscape Solar – private ownership of solar installation company
    - Morningstar Solar Systems – sales, service, and installation of solar thermal systems
    - Suntech Industries – Manager and crew leader, system layout and design responsibilities
    - Mohr Power – Apprentice

ATTACHMENT 5
Project Team Form

Team Member #_19_ of _29_	
Name of Individual	Darren Hammell
Position Title	Co-Founder and Chief Strategy Officer
Employer's Name and Address (street, city, and zip code)	Name: Princeton Power Systems Address: 3175 Princeton Pike, Lawrenceville, NJ 08648
Individual's Phone Number and Email Address	Phone: 609-955-5390 x103 Email: dhammell@princetonpower.com
Job Description	Business development, management of strategic accounts, management of technology and product roadmap
Role and Responsibilities in the Proposed Project	Technical and corporate oversight of project activities for Princeton Power subcontract
Experience, Capabilities, and Credentials	Microgrids Information Technology Power Electronics Architecture and Design Energy Storage Systems B.S.E/2001/Computer Science Engineering; Princeton University

ATTACH RESUME

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Project Team Form

Darren Hammell, B.S.E

Chief Strategy Officer & Co-Founder, Princeton Power Systems

TECHNICAL EXPERIENCE

Microgrids

Information Technology

Power Electronics Architecture and Design

Energy Storage Systems

YEARS OF EXPERIENCE

With Princeton Power Systems: 13

EDUCATION

B.S.E/2001/Computer Science Engineering; Princeton University

PROFESSIONAL AFFILIATIONS

NJ Technology Council

PRESENTATIONS/PUBLICATIONS

Retrofitting and Older Motor for Variable Speed Operation Using a Clean Power AC-link Drive

AC-link: Innovative MW-scale Clean Power SCR Converter for Direct Drive Generators

Generator Control and Utility Interaction with a Scaleable 50kW AC-link converter

Reliable, Low-cost Wind Turbine Power Converter

Turbine Converter

Low-Cost, SCR-based Premium Power Quality Variable Speed Drive Technology

Common Problems Caused by PWM Inverters with High Switching Frequencies and a Unique Solution

New AC-Link Variable Speed Drive Solves Power Quality Problems in Textile Manufacturing

Harmonics and dV/dt Solutions from a New, AC-link™ Variable Speed Drive

Darren took home top honors in the Princeton University business plan contest and co-founded Princeton Power Systems in 2001. He served as President and CEO until March 2009, when he took on the responsibility of Executive Vice President of Business Development. Darren also serves on the Princeton Power Systems Board of Directors. Darren graduated with honors from Princeton University with a B.S.E. in Computer Science.

Darren was named one of Red Herring Magazine's "Young Moguls" in 2005 and New Jersey-BIZ's "Forty Under 40" business leaders in the state the same year. He is also on the Board of Directors of the NJ Technology Council and the Einstein's Alley Collaborative. Darren Hammell is a frequent speaker in the Energy Technology space and has been a key contributor at nearly 75 speaking events 2011-2014.

Representative Projects

Alcatraz Island, San Francisco, CA, Director of Microgrid Engineering- Princeton Power Systems completed a Commercial scale Microgrid System on Alcatraz Island as a solution to high diesel fuel costs, pollution in the bay area, and high carbon emissions. When a ship's anchor ruptured the underwater power lines in 1950, that linked the island to San Francisco, Alcatraz was forced to turn to diesel fuel and coal as its source of power.

In 2010, when approached to take on the project, Princeton Power was excited to take on the challenge of enabling the historic landmark and tourist attraction, "The Rock", to become its own clean and efficient independent power source.

San Diego Zoo, CA, EVP Business Development – As part of SDG&E's sustainable communities program, a 100kW/100kWh Lithium Ion Battery Energy Storage system energy was installed at the San Diego Zoo. The system is coupled with a 90kW

solar system which generates electricity for 5 EV chargers and 59 homes. The energy storage system balances the solar power to provide smooth energy output.

Scripps Ranch, San Diego, CA, EVP Business Development– The Scripps Ranch community was searching for a way to ensure sustainable back-up power for the community and surrounding area in case of a power outages caused by brown-outs, wildfires, or grid failure. After carefully selecting the most practical location, Princeton Power provided an Optimized Energy Management solution, turning this Recreation Center into an "Emergency Command Center."

The Energy Storage System utilizes existing renewable resources at the facility, such as a roof-mounted solar array, to allow a seamless transition of power from the electric grid to the local microgrid in the case of power outages. Princeton Power Systems is proud to have manufactured and provided Southern California's first Energy Management system of this size and with these capabilities.

EaglePicher, Joplin, MO, System Engineer – At the end of 2010, EaglePicher Technologies entered into Grid Energy Management, offering turnkey energy storage solutions. In order to complete these systems, EaglePicher combined Princeton Power Systems GTIB-100 Inverters with various battery technologies to satisfy different facility loads and energy needs.

The Princeton Power Systems Energy Storage Systems utilize the best of both lead-acid and lithium-ion battery technologies for baseline power needs as well as transient power needs. The system is able to power facility loads and perform other functions, including peak demand shaving, frequency regulation, and other grid services. The batteries and inverters are dispatched intelligently by EaglePicher's Power Pyramid Technology.

ATTACHMENT 5
Project Team Form

Team Member #_20_ of _29_	
Name of Individual	Martin Becker
Position Title	Chief Technical Officer
Employer's Name and Address (street, city, and zip code)	Name: Princeton Power Systems Address: 3175 Princeton Pike, Lawrenceville, NJ 08648
Individual's Phone Number and Email Address	Phone: 609-955-5390 Email: mbecker@princetonpower.com
Job Description	Manage and coordinate corporate product development and R&D activities
Role and Responsibilities in the Proposed Project	Technical oversight of charging station development and production, including Factory Acceptance Testing
Experience, Capabilities, and Credentials	Microgrids Power Electronics Architecture and Design Energy Storage Systems

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Project Team Form

Martin Becker
97 Garfield Road
Kenilworth, Cape Town
South Africa
martn@gmx.net
+27 83 464 3297

Education

2005 Siemens PLC S7-200 S7-300 two week advanced PLC programming course

2004, MSc Eng cum laude (Electrical Engineer) in the field of power electronics, Thesis title:
Transforerless Dig/Sag Compensation using Ultracapacitors
University of Stellenbosch

2002, BEng (Electrical and Electronic), passed all courses on 1st examination; Thesis done on ultra high frequency circuit analysis
University of Stellenbosch

Work Experience

2005 – Present, Research & Development, Director at MLT Drives
Chief engineer at MLT Drives and responsible for all research and development – both in-house and contract work

Contract work with MLT Drives:
Wind Generator Power Interface – 2011 (Montana, USA)
High speed gas turbine power interface – 2009 (California, USA)
UL Certification of 500KVA PC Grid Tied Inverter from Siemens (Princeton – USA)
PV Grid Tied Inverters – 2010 (India)
Hybrid Inverter Control Design and Implementation – 2005 to 2011 (Malaysia)
Voltage Balancing on MV Transmission Lines – 2006 (University of Cape Town)
Locomotive Air-conditioning Power Supply – 2006 (Spoornet – Centra Rand)

2006 – 2007, Dept Electrical Engineering Technical Officer, University of Cape Town
Coordinated honours and masters projects for UCT and foreign exchange students. Focused on different areas including load compensators using capacitors. Capacitors get dynamically asserted onto the utility supply to minimize the unbalance, or negative sequence. Signal processing and monitoring of power electronic devices using mobile networks.

Publications

"Transformerless Series Dip/Sag Compensation with Ultracapacitors using a new Multilevel Boost DC-to-AC Topology". *Power Electronics Specalist Conference.* 2005. PESC apos;05 IEEE36th

ISBN: 0-7803-9033-4

Available:
http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?tp=&arnumber=1581946&isnumber=33408

ATTACHMENT 5
Project Team Form

Team Member #_21_ of _29_	
Name of Individual	Paul Heavener
Position Title	Applications Engineering Manager
Employer's Name and Address (street, city, and zip code)	Name: Princeton Power Systems Address: 3175 Princeton Pike, Lawrenceville, NJ 08648
Individual's Phone Number and Email Address	Phone: 609-955-5390 x103 Email: pheavener@princetonpower.com
Job Description	Manager of Applications Engineering Group
Role and Responsibilities in the Proposed Project	Coordinate on-site commissioning schedule and logistics
Experience, Capabilities, and Credentials	Program/Project Management and Technology Resource Management professional. Proven organizational and people skills to lead, motivate, direct a successful team. Strong background in Drafting/ Design and Document Control Management with specific skill as Printed Circuit Board Designer.

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Project Team Form

PAUL R HEAVENER

SUMMARY:

Program/Project Management and Technology Resource Management professional. Proven organizational and people skills to lead, motivate, direct a successful team. Strong background in Drafting/ Design and Document Control Management with specific skill as Printed Circuit Board Designer.

EXPERIENCE:

Princeton Power Systems, Inc., Princeton N.J. **2009-Present**

Applications Engineering Manager, Quality Assurance Manager

- Manage and coordinate logistics for Applications Engineering and Field Service functions
- Coordinate Quality Assurance for power electronics production

Sarnoff Corp. , Princeton N.J. **2005-2008**

Director of Engineering Technology

- Reported to General Manager of Sarnoff Imaging Group.
- Program Manage 1.2M to 4.5M Government and Commercial programs.
- Development and Manufacture of a commercial Line Array CCD.
- Development and Manufacture of a commercial High Speed TDI Camera system for semiconductor inspection.
- Development and Manufacture of an InSb Refrigerated Dewar Unit for an International Government client.
- Resource manager with 18 reports from development to manufacturing.
- Develop manufacturing team for CCD camera production.
- Develop and implement Document Control process and procedure.
- Member of ISO 9001 implementation steering team.
- Oversee key production programs. Generated discipline approach for handing off products from engineering to manufacturing.

Initially hired as **Program Manager** in March 2005.

- Responsibilities included program management of custom CCD and camera system development for commercial and government programs.
- Customer interface from proposal through delivery.
- Cost, Schedule, and resource planning.
- Responsible to execute plan to meet cost, schedule and delivery goals.
- Promoted to Director of Engineering Technology January 2006.

Princeton Instruments., Trenton N.J. **1989-2005**

Engineering Manager

January 2001 to March 2005.

- Reported to VP of Operations.
- Responsibilities included managing all new product development.
- Managing all hardware, software, and mechanical design / drafting resources.

- Manage development of custom product requests.
- Review and cost estimate custom engineering requests.
- Key engineering liaison to Marketing, Manufacturing, and Customer service.

Engineering Services Manager / Project Engineer.
May 1997 to December 2000

- Managed the Engineering Services group, which included all mechanical design / drafting and electrical drafting, as well as document control, machine shop, and engineering purchasing.
- Managed a key electronics group in engineering that develops the analog electronics to operate the CCD sensors in scientific cameras.
  Promoted to Engineering Manager January 2001.

Engineering Services Manager
October 1989 to April 1997

- Managed all aspects of electrical and mechanical drafting and documentation.
- Specific skill set as a printed circuit designer with 18 years of experience in printed circuit design including multi-layer, surface mount and flexible circuit design.
- Key liaison between Engineering and Manufacturing,
- Responsible for coordination of design review and production sign-off meetings.
- Promoted to Project Engineer while maintaining Engineering Services Manager role.

Flexible Circuits Inc., Warrington Pa. 1981-1989
Design Group Manager

- Start up a Printed Circuit Design service bureau to support Printed Circuit and Flexible Circuit manufacturing capabilities.
- Printed circuit and flexible circuit design.
- Conduct flexible circuit design seminars at customer locations.
- Sales, application engineering, hiring, training, procuring equipment.
- Manufacturing responsibilities included management of the photo-tooling department for manufacturing engineering.
- Pioneering CAM photo tooling for panelization to increase manufacturing yields as complexities, densities, and layer counts increased.

EDUCATION

Currently Enrolled
Colorado Technical University Online.
BS Business Administration in Project Management.
Completed
Bucks County Community College Newtown Pa.
Associates degree in Computer Systems Technology.

ADDITIONAL TRAINING:

Introduction to Scientific CCD's – James Janesick
Six Sigma Executive Symposium – Stat-A-Matrix
Writing Winning Proposals, Capturing Federal Business – Shipley Assoc.
Printed Circuit Board and Wiring Design for EMI Control – Condon & Assoc.
Various IPC and ISO classes.

ATTACHMENT 5
Project Team Form

Team Member # _22_ of _29_	
Name of Individual	Kazutaka Domoto
Position Title	Representative of IKS CO LTD, and CPE Power Systems, INC.
Employer's Name and Address (street, city, and zip code)	Name: IKS USA, INC Address: 4306 N Shallowford Rd., STE 1108 Atlanta, GA 30341 USA
Individual's Phone Number and Email Address	Phone: 770-829-0202 Email: tdomoto@iks-us.com
Job Description	Business and technical liaison between IKS (Japan) and CPE Power Systems (Canada)
Role and Responsibilities in the Proposed Project	• Keep IKS (Japan) informed any progress/problem/delay/change of basic standard specification as a result of CPE/End User meeting. • Procurement of parts and system from IKS CO LTD (Japan). • Project schedule control and communication between Japan and Canada. • Technical (including Hardware and Software) communication Liaison between IKS (Japan) and CPE team.
Experience, Capabilities, and Credentials	• Multi national project experience (Japan, Canada, US, Sweden): - 2014 Power Steam Inc. / Microgrid system with V2G network. - 2013 Technology transfer and localized manufacturing in Sweden. - 2011 Conducting JV contract between IKS (Japan) and AlOx Catalyst Mfg. Company (USA) (Identified partner, and closed deal for nano precious metal manufacturing joint venture company in USA. • Identify manufacturing partners and support development of 10KW ~ 100KW DC//AC bidirectional Hybrid PCS (PAT) for smart grid applications in Europe. (Sweden) • Working with NISSAN (Japan, Europe and North America) and make collaborations in marketing events: - 2013 NISSAN V2X Forum in New Castle, UK - 2014 NISSAN V2X Forum in DTU, Roskilde, DK - 2014 NISSAN / IKS V2X Certification Testing in Japan - 2014 NISSAN / IKS V2X Certification Testing in Europe

ATTACH RESUME

ATTACHMENT 5
Project Team Form

Kazutaka Domoto

4306 N Shallowford Rd. #1108 ♦ Atlanta, GA 30341 ♦ tdomoto@iks-us.com

Key Areas of Expertise

- Multi national project experience (Japan, Canada, US, UK, Sweden, India, Korea, China)
- Negotiate and close sales/contract multi-million dollar Battery Manufacturing System Project
- Identify partner, and close deal for nano precious metal manufacturing joint venture (USA)
- Identify manufacturing partners and support development of 10KW ~ 100KW DC//AC bidirectional Hybrid PCS (PAT) for smart grid applications. (Canada, Sweden, Germany)
- Market research and business development for Japanese machine manufacturers.
- Support R&D company while technology transfer and process development in Atlanta, GA.
- Startup of small business corporation in USA.
- Development of materials procurement, and establishing supply chain.
- Support PAT applications based on the new product/application development for IKS CO., LTD (Japan)
- Sales of machinery/materials including battery production system.

Experience

President, IKS USA, INC, Charlotte, NC. 2005 to present

- Established startup of technology joint venture
- Created Sales/Marketing of nano Pt, nano Rh catalyst to automotive industry through partnership with Canadian automotive exhaust filter manufacturer
- Created Sales/Marketing of Battery R&D machinery product lines (Electrode Slitter, Battery Cell Assembly Machinery, Battery Cell Charge/Discharge System, Battery Electrolyte Injection System)
- Trade Shows:
    - o InterSolar Expo 2012 San Francisco
    - o EV27 at Barcelona 2013
    - o NISSAN V2X Forum in Europe (New Castle UK 2013, Roskilde DK 2014)
    - o Smart City Expo 2014 at Barcelona (Nov.18 ~ Nov. 20)

Product Manager, TEXMAC, INC (ITOCHU Corporation), Charlotte, NC. 1990 to 2005

Manager, Japan Airlines Corporation, Japan. 1974 - 1988

Education and Training

- MBA, Wake Forest University, Winston Salem, NC - 1990
- BS Mechanical Engineering, Ritsumeikan University, Kyoto, Japan - 1974
- Member of SAE (Society of Automotive Engineers) 2006 – Present
- KARRASS Negotiation Seminar 1996

ATTACHMENT 5
Project Team Form

Team Member # _23_ of _29_	
Name of Individual	Les Mac
Position Title	President
Employer's Name and Address (street, city, and zip code)	Name: CPE Power Systems Inc. Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4
Individual's Phone Number and Email Address	Phone: (905) 764-1548 x2669 Email: lmac@cpegroup.ca
Job Description	President of CPE Power Systems Inc.
Role and Responsibilities in the Proposed Project	• Overall project management and establishment of supply chain in consideration of more efficient way of cost control. • Establishment of maintenance service from Canada.
Experience, Capabilities, and Credentials	• Design of Power Management and Hybrid renewable system. • Design and Installation of large scale solar and hybrid off-grid systems, and custom roof top solar systems. • Design and Installation of Municipal Renewable buildings/ facilities. and off-grid community systems.

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ATTACHMENT 5
Project Team Form

Les Mac

CPE Power Systems Inc.
Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4

Mr. Les Mac is the President of CPE Power Systems Inc. Mr. Mac holds a master's degree in Power Electronics from the Warsaw University of Technology, one of the leading institutes of technology in Poland.

Mr. Mac has over 30 years of experience as a design engineer with a history of designing power management and hybrid renewable systems for large solar and hybrid farms, off-grid systems, custom rooftop solar systems, municipal renewable buildings/facilities, and complete community off-grid systems.

Mr. Mac is the President and Founder of CPE Division "L" Inc., a Toronto based engineering company specialized in the design of solar and wind turbine systems. In 2000, Mr. Mac designed the first "Peak Power Shaving" system in Canada using wind turbines, solar and battery storage to reduce energy consumption during peak hours. And in 2006, he designed the first North American green-energy powered computer room for Pizza Pizza Canada. In 2014, CPE Div "L" Inc changed its name to CPE Power Systems Inc.

ATTACHMENT 5
Project Team Form

Team Member # _24_ of _29_	
Name of Individual	Roman Szwec
Position Title	Engineering Manager, & Senior Project Leader
Employer's Name and Address (street, city, and zip code)	Name: CPE Power Systems Inc. Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4
Individual's Phone Number and Email Address	Phone: (905) 764-1548 x2669 Email: rszwec@cpegroup.ca
Job Description	Design and Engineering, Project Leader
Role and Responsibilities in the Proposed Project	• Overall design and engineering key person, with project management and implementation. • Establishment of maintenance service from Canada.
Experience, Capabilities, and Credentials	• Design of Power Management and Hybrid renewable system. • Design and Installation of large scale solar and hybrid off-grid systems, and custom roof top solar systems. • Design and Installation of Municipal Renewable buildings/ facilities. and off-grid community systems. • Design and Installation of "Peak Power Shaving" system with wind turbine system.

ATTACH RESUME

ATTACHMENT 5
Project Team Form

Kazutaka Domoto

CPE Power Systems Inc.
Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4

Mr. Roman Szwec is the Engineering Manager and Senior Project Leader at CPE Power Systems Inc. Mr. Szwec is a graduate of Ryerson University, with a Bachelor of Engineering Degree Electrical Engineering.

Mr. Szwec has been with CPE since 1991, worked in a number of positions over the years, most recently as the Lead Project Engineer designing power management and hybrid renewable systems. Mr Szwec also has over 15 years of Harmonic mitigation and power quality experience.

Mr. Szwec is the co-designed the first “Peak Power Shaving” system in Canada using wind turbines, solar and battery storage to reduce energy consumption during peak hours and first North American green-energy powered computer room for Pizza Pizza Canada

ATTACHMENT 5
Project Team Form

Team Member #_25_ of _29_	
Name of Individual	Andrew Henriques
Position Title	Senior Service Technologist
Employer's Name and Address (street, city, and zip code)	Name: CPE Power Systems Inc. Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4
Individual's Phone Number and Email Address	Phone: (905) 764-1548 x2669 Email: ahenriques@cpegroup.ca
Job Description	Service and Installation & Start ups, Maintenance
Role and Responsibilities in the Proposed Project	• Manage and organize installation and maintenance service works. • Coordination of project implementation including budget, design, engineering application, schedules and due date.
Experience, Capabilities, and Credentials	• Service and maintenance of Power Management and Hybrid renewable system. • Service and maintenance of large scale solar and hybrid off-grid systems, and custom roof top solar systems. • Service and maintenance of Municipal Renewable buildings/ facilities. and off-grid community systems.

ATTACH RESUME

ATTACHMENT 5
Project Team Form

Andrew Henriques

CPE Power Systems Inc.
Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4

Mr. Andrew Henriques is a graduate of DeVry Institute of Technology, with a Diploma in Electronic Engineering Technology.

Mr. Henriques has worked for over thirty (30) years as an Electronic Engineering Technician. He has provided emergency service and troubleshooting technical support for clients in both commercial and industrial sectors.

Mr. Henriques joined CPE in 1989 and worked as Senior Service Technologist. He has started-up, commissioned and maintained power systems including UPS, High power battery charging systems, active harmonic systems, renewable energy systems including solar, wind and hybrid "Peak Power Shaving".

Since 2006 Mr. Henriques has worked as Project Coordinator at CPE where he is responsible for the technical review and coordination of any new project which includes budget, design, engineering application, schedules and completion date.

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Project Team Form

Team Member # _26_ of _29_	
Name of Individual	Xin Hu
Position Title	Senior Software Engineer
Employer's Name and Address (street, city, and zip code)	Name: CPE Power Systems Inc. Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4
Individual's Phone Number and Email Address	Phone: (905) 764-1548 x2669 Email: xhu@cpegroup.ca
Job Description	Software development and maintenance
Role and Responsibilities in the Proposed Project	• Design and establishment of communication protocol between V2X PCS and customer higher level EMS controls. • Establishment of maintenance service from Canada.
Experience, Capabilities, and Credentials	• System Design of Power Management and Hybrid renewable system. • System Design and Installation of large scale solar and hybrid off-grid systems, and custom roof top solar systems. • System Design and Installation of Municipal Renewable buildings/ facilities. and off-grid community systems.

ATTACH RESUME

ATTACHMENT 5
Project Team Form

Xin Hu

CPE Power Systems Inc.
Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4

Mr. Xin Hu is a senior Software Engineer for CPE Power Systems Inc.

Mr. Hu holds an advanced diploma in Electronics Engineering Technology from Seneca College.

Mr. Hu has over 7 year experience in the development and maintenance of an atmosphere and water quality remote monitoring network in Nanchang, China. Since joining CPE, Mr. Hu has designed a variety of systems including an operating system for a 10kW Micro Grid solution, a programmable and remote controlled load bank for Power Stream Inc, a remote controlled module supporting DNP3 protocol from Hydro One, and a controlling system for a hybrid power solution at the Pizza Pizza headquarters.

ATTACHMENT 5
Project Team Form

Team Member #_27_ of _29_	
Name of Individual	John Clint
Position Title	Program Manager
Employer's Name and Address (street, city, and zip code)	Name: Alternative Energy Systems Consulting, Inc. Address: 8555 Aero Drive, Suite 205, San Diego, CA 92123
Individual's Phone Number and Email Address	Phone: (858) 560-7182 x107 Email: jclint@aesc-inc.com
Job Description	Provides day-to-day management of individual programs and projects, directing activities, providing quality control, managing budgets, schedules and deliverables.
Role and Responsibilities in the Proposed Project	Provide project management of M&V effort and reporting to prime and CEC.
Experience, Capabilities, and Credentials	Over 24 years combined experience as a Senior Engineer/Analyst executing research and developing engineering solutions in the energy field and as a Senior System Engineer directing the planning, design, development, and installation of large-scale, multi-level software systems. Mr. Clint received his Bachelor of Science degree in Information Systems in 1990 from San Diego State University. Mr. Clint has co-authored numerous reports and presented research involving thermal energy storage systems, fuel cells, advance toll collections systems, and electric / CNG vehicles.

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ATTACHMENT 5
Project Team Form

John T. Clint

Mr. Clint is a Program Manager for AESC. Mr. Clint has over 24 years combined experience as a Senior Engineer/Analyst executing research and developing engineering solutions in the energy field and as a Senior System Engineer directing the planning, design, development, and installation of large-scale, multi-level software systems. Mr. Clint has evaluated many energy systems including fuel cells, electric vehicles, diesel emissions, CNG vehicles, cool storage systems, cogeneration, compressed air, thermal oxidizers and others. Mr. Clint has worked on Energy Efficiency programs assisting with the design and implementation and performing technical reviews of individual applications.

Mr. Clint is the prime contractor project manager for the CEC's ARV-12-13 Fleet Level II Charger, ARV-12-20 Workplace Level II Charger, and ARV-12-27 DC Fast Charger demonstration projects. Mr. Clint has led a team of subcontractor towards successful contracting, procurement, installation, and commissioning of the chargers on the campus of the University of California, San Diego. AESC is currently in the process of writing final reports for these programs.

Mr. Clint is currently managing Southern California Edison's (SCE) Integrated Demand Side Management - Online Application Tool development effort. The IDSM Online Application Tool is a critical asset used in support of SCE's core Commercial, Industrial, and Agricultural Program, the Partnership Programs, On-Bill Financing, Field Engineering, Business Customer Division, and external customers and users. It contains sophisticated energy engineering tools for the calculation of kWh savings, kW reduction, DR potential, and customer incentives. The tool guides the user in generating an energy efficiency application using a wizard, flags mandatory fields, utilizes electronic signature, and submits applications electronically.

Prior to joining AESC, Mr. Clint worked for the Transcore Division of Science Applications International Corporation (SAIC). Mr. Clint was the Lead Systems Engineer for the development of the Crescent City Connections Division (New Orleans) Toll Bridge System, the Virginia Department of Transportation's Dulles Toll Road (Phase IIa), the Coleman Bridge Toll Collection Systems, and the Powhite Parkway Extension Project. These projects involved the systems integration of multiple hardware devices, software development for multiple platforms (DEC, Windows NT, and UNIX), development of Oracle and Microsoft SQL Server databases, and network integration of all components. Mr. Clint responsibilities include systems/requirements engineering, network design and development, test management, configuration management and software and database development teams management. The systems/requirements engineering functions that Mr. Clint performed include the development of software requirements with users, analysis and specification of requirements, and implementation of new software requirements. Mr. Clint provided hands-on direction and made key decisions concerning the development of the software, databases and hardware.

Before joining Transcore, Mr. Clint worked for the Advanced Energy Systems Division of Science Applications International Corporation (SAIC). Mr. Clint was a Project Engineer/Analyst in support of a multitude of energy related projects. These programs included data monitoring and acquisition, analysis of data, a statistical study of the results, and data reporting. Mr. Clint used DOEII, Statistical Analysis Software (SAS) and Excel spreadsheets to assist with many of the studies. Mr. Clint performed detailed statistical analysis of utility data as a precursor for neural network system utilized in Utility theft of service programs. Software employing neural networks was developed to detect theft of utility services based on behavioral indicators. Mr. Clint has developed, implemented, and maintained numerous data acquisition systems. Mr. Clint has worked with various models of data acquisition and control systems including

Campbell Scientific, Opto22, National Instruments (LabView), Accurex, Battelle, Rustrak, and other PC based dataloggers (Visual Basic). Mr. Clint has taken many courses involving system theory and design and is well versed in this area. Mr. Clint has combined knowledge from these two areas of expertise to develop critical analysis skills necessary for data review.

Mr. Clint was involved with the Massachusetts Division of Energy Resources Electric Vehicle Monitoring Program. This program involved the monitoring of twenty vehicles that had been retrofitted with electric drive trains. It was a portion of the larger ARPA Electric Vehicle Monitoring Program. Mr. Clint's responsibilities included the selection and procurement of data acquisition equipment and sensors, the development of monitoring system including cellular communications, the installation and testing of DAS equipment, and the collection of data. The data provided the customer with valuable insights to the performance and reliability of electric vehicles under typical operating conditions.

The Electric Vehicle Research Network (EVRN) and The Salt River Project (SRP), through EPRI, contracted with SAIC to collect and maintain data from electric vehicles in the project. Mr. Clint developed reports using Microsoft Excel and Query to access the divisions DADM database. These reports detailed the operation of the EVRN/SRP vehicles so that data can be compared and evaluated. Mr. Clint interfaced with the DAS installation personnel in order to increase the data availability and accuracy.

Mr. Clint managed the Electric Power Research Institutes (EPRI) Electric Bus Monitoring Project. The purpose of this project was to collect data on the efficiencies and viability of an electric bus transit system in every day conditions. Mr. Clint developed and built a data acquisition system to exacting standards required by the contract. The contract requires one second output data with over 70 instruments. Mr. Clint used a PC-MCIA type data acquisition card coupled with a powerful notebook computer to achieve this requirement. Mr. Clint interfaced with an electronics company to build and test a multiplexer capable of meeting the requirements. Mr. Clint worked with the electric bus manufacturer and various vendors in the pursuit of installation of the instruments. Mr. Clint successfully interacted with the customers to solve a multitude of problems.

The Cummins Catalyzed Soot Filter project involved the testing of six transit busses fitted with a Cummins emissions reduction system. Mr. Clint was involved with DAS design and development, the instrumentation selection and procurement, DAS installation, DAS testing and calibration, data collection, and data analysis. After initial cellular communication problems, Mr. Clint was able to work with a manufacturer to develop an innovative antenna that was appropriate for transit busses. Data collection was drastically improved.

Mr. Clint worked on the Virginia Department of Mines, Minerals, and Energy's Compressed Natural Gas Vehicles program. His responsibilities included data acquisition system development and assembly, DAS installation and calibration, and reporting and database storage. Five vehicles were monitored over the course of a year.

Mr. Clint worked on the Gas Research Institutes (GRI) Dearing Gas-Fired Air Compressor project. John designed the project to benchmark a gas air compressor against an electric powered air compressor. Mr. Clint was responsible for developing standardized reports, developing instrumentation schemes, pre-building data logger equipment, installing instrumentation, testing data collecting system, performing error checking, processing data through reports, and analyzing performance of the system.

Mr. Clint received his Bachelor of Science degree in Information Systems in 1990 from San Diego State University.

ATTACHMENT 5
Project Team Form

Team Member #_28_ of _29_	
Name of Individual	Ronald K. Ishii, P.E., DGCP
Position Title	Principal Engineer
Employer's Name and Address (street, city, and zip code)	Name: Alternative Energy Systems Consulting, Inc. Address: 5927 Balfour Court, Suite 213, Carlsbad, CA 92008
Individual's Phone Number and Email Address	Phone: (760) 931-2641 x112 Email: rishii@aesc-inc.com
Job Description	Technical principal supporting a variety demand-side management, distribution generation and energy storage efforts.
Role and Responsibilities in the Proposed Project	Technical consultant and M&V subject matter expert.
Experience, Capabilities, and Credentials	Thirty years of subject matter expert in EM&V, industrial energy efficiency, distributed generation, energy storage, advanced energy technology evaluation, power generation, energy markets, utility and technology experience. BSME San Diego State University. He is currently a member of the CEC's Energy Innovations Small Grant Program Technical Review Board and the California Technical Forum. Previously Mr. Ishii has served on the National Fuel Cell Research Center Technical Advisory Committee and on the board of directors for California Manufacturing Technologies Consulting. Mr. Ishii is a member of ASME, AEE and AESP. He is a Professional Engineer in the State of California, and is an AEE Certified Cogeneration Professional as well as a Distributed Generation Certified Professional. Mr. Ishii has authored numerous articles on topics including distributed generation, intelligent energy systems, thermal energy storage performance testing, fuel cell testing and energy systems modeling.

ATTACH RESUME

ATTACHMENT 5
Project Team Form

Ronald K. Ishii, P.E., DGCP, CCP

Mr. Ishii is Principal and Chairman at AESC. He has over 30 years of consulting experience in residential, commercial and industrial demand side management and on-site power generation technologies for utilities, energy technology developers and large energy users.

Besides managing company-wide operations, Mr. Ishii currently leads several efforts at AESC. These include California Solar Initiative (CSI) and Self-Generation Incentive Program (SGIP) technical and policy support for the California IOUs; management of AESC's support of Southern California Edison's (SCE) Ag/Food Processing pilot program; development of an energy audit screening tool, P.E. review of customized calculation project verification; and management of the energy efficiency Customized Calculation Guideline effort for SCE.

Previously at AESC, Mr. Ishii managed several investment grade energy audits; the development of the CSI EPBB calculator and CSI trigger websites; the design and development of the 1999 Small Business Standard Performance Contract (SBSPC) program for California's investor owned utilities including the development of an energy savings estimation tool as well as the measurement and verification (M&V) protocol for motors and boilers; and energy savings verification of over 200 energy efficiency measures installed in SCE's service territory as part of the Measurement and Evaluation of the Energy Management Hardware Rebate Program.

Prior to joining AESC, Mr. Ishii was a Program Manager in the Advanced Energy Systems Division of Science Applications International Corporation (SAIC). Mr. Ishii was responsible for technical service to electric and gas utilities as well as the California Energy Commission (CEC), Electric Power Research Institute (EPRI) and GRI performing work on fuel cell testing, gas cooling technologies, thermal energy storage, advanced refrigeration systems, industrial electrotechnologies, residential heat storage, intelligent energy diagnostics and control, and distributed generation technologies.

Prior to joining SAIC, Mr. Ishii was employed by San Diego Gas & Electric (SDG&E). At SDG&E, Mr. Ishii worked in Gas Turbine Maintenance, Research and Development, Gas Operations and the Power Plant Performance Testing Section. His primary responsibilities included performance testing at the 700 MW South Bay Power Plant and 900 MW Encina Power Plant; gas turbine performance testing; engineering support of the liquefied natural gas and gas compressor plants; steady-state and transient power plant simulations; electric production cost model assessments; and monthly development of power plant parameters for SDG&E's economic dispatching system.

Mr. Ishii earned his Bachelor of Science degree in Mechanical Engineering from San Diego State University. He is currently a member of the CEC's Energy Innovations Small Grant Program Technical Review Board and the California Technical Forum. Previously Mr. Ishii has served on the National Fuel Cell Research Center Technical Advisory Committee and on the board of directors for California Manufacturing Technologies Consulting. Mr. Ishii is a member of the American Society of Mechanical Engineers (ASME), Association of Energy Engineers (AEE) and the Instrument Society of America. He is a Professional Engineer in the State of California, and is an AEE Certified Cogeneration Professional as well as a Distributed Generation Certified Professional. Mr. Ishii has authored numerous articles on topics including distributed generation, intelligent energy systems, thermal energy storage performance testing, fuel cell testing and energy systems modeling.

ATTACHMENT 5
Project Team Form

Team Member #_29_ of _29_	
Name of Individual	Brandon Henzie
Position Title	Staff Engineer
Employer's Name and Address (street, city, and zip code)	Name: Alternative Energy Systems Consulting, Inc. Address: 5927 Balfour Court, Suite 213, Carlsbad, CA 92008
Individual's Phone Number and Email Address	Phone: (760) 931-2641 x139 Email: bhenzie@aesc-inc.com
Job Description	Staff Engineer
Role and Responsibilities in the Proposed Project	Implement M&V plan, perform analysis and develop reports.
Experience, Capabilities, and Credentials	Mr. Henzie is a Staff Engineer and joined AESC in August 2009 to provide support for SCE's Customized Offering, Retrocommissioning (RCx), SGIP, and CSI programs. Mr. Henzie also provides support for PG&E's Customized Offering and RCx programs. Mr. Henzie received his Bachelor's Degree in Chemical Engineering from the University of California, San Diego. He is a Professional Engineer in the state of California and a Certified Measurement and Verification Professional (CMVP) as designated by the Association of Energy Engineers (AEE).

ATTACH RESUME

ATTACHMENT 5
Project Team Form

Brandon Henzie, P.E., CMVP

Mr. Henzie is a Staff Engineer and joined AESC in August 2009 to provide support for SCE's Customized Offering, Retrocommissioning (RCx), SGIP, and CSI programs. Mr. Henzie also provides support for PG&E's Customized Offering and RCx programs.

In support of the Customized Offering and RCx programs, Mr. Henzie reviews submitted incentive applications to ensure program requirements are met. This includes conducting pre- and post-installation site inspections, verifying the submitted technical analysis, and performing measurement and verification when required. Mr. Henzie has experience working with and evaluating a variety of industrial and commercial systems.

Mr. Henzie has performed several energy audits for commercial buildings and private schools through the SDG&E Energy Assessment & Solutions Program and at various government facilities through the SCE and SoCalGas Local Government Partnership Programs. The gas and electric integrated audits include site evaluation, energy-use modeling, savings calculations, report creation and presentation.

Mr. Henzie has performed several energy audits at various types of government facilities through the SCE and SoCalGas Local Government Partnership Programs. The gas and electric integrated audits include site evaluation, energy-use modeling, savings calculations and report creation.

Mr. Henzie supports the SGIP and CSI programs by providing technical application review and conducting site inspections. He verifies that all submitted documents are complete, accurate, and comply with program guidelines. As a final step in the application process, Mr. Henzie inspects randomly selected sites to verify consistency between reported and installed equipment.

In addition to his work on the statewide energy efficiency programs, Mr. Henzie assists Southern California Gas Company's engineering department by designing support systems for new natural gas pipelines being installed on bridges. On occasion, Mr. Henzie performs safety assessments for natural gas pipelines that will be subjected to unique conditions impacting pipeline safety.

Mr. Henzie was the primary engineer on two photovoltaic feasibility studies for the City of Carlsbad. He provided a full report on the technical and economic feasibility of the proposed projects.

Prior to employment with AESC, Mr. Henzie was an Environmental Engineering Intern at ECO:LOGIC Engineering in Rocklin, California. He was involved in several aspects of the design and implementation of new wastewater treatment plants. His responsibilities consisted of creating cost estimates for new projects, assisting in laboratory work, editing design submittals, and providing technical assistance with design calculations.

Mr. Henzie specialized in modern energy technology with studies in solar thermal and photovoltaic systems, wind generation, fuel cells, biofuels, geothermal energy generation, nuclear fission and fusion, and general energy management and resources.

Mr. Henzie received his Bachelor's Degree in Chemical Engineering from the University of California, San Diego. He is a Professional Engineer in the state of California and a Certified Measurement and Verification Professional (CMVP) as designated by the Association of Energy Engineers (AEE).

ATTACHMENT 6
Scope of Work

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2	X	Business Model for CPUC Use Case 4: Bidirectional Power Flow
3		Technical Integration
4		Product Development
5		Prove Viability of EV Storage
6		Site Work
7		Interconnection
8	X	Analysis
9		Evaluation of Project Benefits
10		Technology/Knowledge Transfer Activities
11		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
AC	Alternating Current
CAISO	California Independent System Operator
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
CPUC	California Public Utilities Commission
DC	Direct Current
Energy Commission	California Energy Commission
EV	Electric Vehicle
GHG	Greenhouse Gas Emissions
TAC	Technical Advisory Committee
UCSD	University of California San Diego
V2G	Vehicle-to-Grid
VGI	Vehicle-Grid Integration

[1] Please see Subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

ATTACHMENT 6
Scope of Work

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

A. Purpose of Agreement

The purpose of this Agreement is to prove that vehicle-to-grid (V2G), which the California Public Utilities Commission (CPUC) staff whitepaper "Vehicle-Grid Integration: A Vision for Zero-Emission Transportation Interconnected throughout California's Electricity System" outlines as Use Case 4: Bidirectional Flow, is a viable and low cost energy storage resource. The project, to be led by NRG Energy and hosted by the University of California San Diego (UCSD), will include two major automakers, Honda and Nissan, interested in integrating V2G technology.

B. Problem/ Solution Statement

Problem

Despite recent commercial progress in the energy storage sector, the use of electric vehicles (EVs) as an energy storage resource has had only modest momentum. Hurdles to the development and commercialization of the technology include automaker acceptance, impact on EV battery life, and the incremental cost of adding an inverter to bring power from the vehicle to the grid, buildings or homes.

Two major automakers, Nissan and Honda, along with NRG Energy, a Fortune 250 energy company, have been developing bidirectional EV storage technologies. (Throughout this document, the term "EV Storage" refers to bidirectional storage from electric vehicles). Funding from the California Energy Commission will provide a clear signal to these (and other) companies that California -- the United States' largest EV market and largest emerging storage market -- intends to support highly credible efforts to commercialize this technology.

Solution

The proposed project will operate 7 to 9 vehicles based on or near the UCSD campus to demonstrate the commercial potential of bidirectional EV storage. For the project, NRG plans to use existing off-the-shelf products, including Nissan LEAF vehicles and Princeton Power Systems inverters. Where off-the-shelf products are not available, NRG will work with highly credible prototypes, including bidirectional Honda EV specifically developed by Honda for energy storage use cases. NRG's aggregator software, built by the University of Delaware, has demonstrated its effectiveness in a recent successful demonstration with PJM Interconnection.

With support from Strategen, Olivine and others, NRG will develop a set of use cases to show that bidirectional EV technology can be an effective energy storage resource for California. These use cases will include vehicle to building, microgrid support, distribution support, and products related to the California Independent System Operator (CAISO) such as regulation and demand response. By the end of the project, NRG will have demonstrated that Use Case 4 is a commercially viable and comparatively inexpensive energy storage option for California ratepayers.

ATTACHMENT 6
Scope of Work

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Create a test environment for two major automakers, Nissan and Honda, to gain experience with bidirectional EV technologies and prepare them for a further commitment to the technology.
- Advance product readiness for bidirectional inverters, including listing standards and product costs.
- Identify use cases for bidirectional EV storage and test vehicles against those use cases.
- Leverage data and insights from the project to play a constructive role in the Vehicle-Grid Integration (VGI) Roadmap process and in related regulatory processes.

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety. The project will lead to enhanced system reliability by increasing system, local, and flexible capacity, by increasing the availability of energy storage, by decreasing the likelihood of critical peak events, and by assisting with reduced ramping requirements for solar photovoltaic integration ("Duck Chart" support). The project will reduce ratepayer costs by lowering the costs for energy storage procurement, reducing distribution upgrade costs, reducing peak energy pricing (via energy arbitrage) and lowering total cost of EV ownership. Finally, the project will increase safety by supporting a California grid that is more resilient to climate change impacts and by removing internal combustion engine vehicles from the roads, thus leading to reduced greenhouse gas (GHG) and point source emissions.

The estimated 2020 Ratepayers Benefits calculated by subcontractor Strategen provided NRG Energy with clear, plausible, and justifiable quantitative estimates based upon Strategen's customer-sited resource optimization model. Strategen calculated the annual ratepayer benefits per charging station at $869. With an estimated market penetration of 15,000 vehicles/charging stations with bidirectional capability by 2020, there is over $13 million of yearly value and an additional 67.5 MW of storage capacity. We assume value is split between the end use customer and the ratepayer, with the ratepayer receiving 25% of the value, or $3.26 million annually[3]. This compares favorably to the $1.495 million of Energy Commission funds requested for the project.

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

[3] We note that the benefit split will be dependent on the wholesale market products, retail rate structures, and incentive programs in place.

Technological Advancement and Breakthroughs:[4]
This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating the value of distributed localized energy storage, which has the potential to reduce the costs of energy and EV ownership. The rapid growth in variable-output renewable generation needed to meet the 80% GHG reduction by 2050 target (Executive Order S-3-05) will necessitate a great deal of energy storage to ensure that electricity supply meets demand at all times, and to avoid costly upgrades to the distribution system. One of the main goals of this project is to demonstrate the value of bidirectional EVs as an energy storage resource. Likewise, creating value by using EVs as a storage resource will also make EVs more valuable and will contribute to meeting the target of 1.5 million zero emission vehicles by 2025 (California Executive Order B-16-2012).

Agreement Objectives
The objectives of this Agreement are:

- At least one major automaker is prepared to support commercialization of bidirectional energy storage from their EVs.
- NRG creates an easy and seamless way for customers in California to access a bidirectional EV based product
- Finalize listing standards for the in-vehicle inverters used by Honda
- EVs are able to provide storage services beyond backup power to homes or buildings

[4] California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

ATTACHMENT 6
Scope of Work

II. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products
The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V).** Products that require a draft version are indicated by marking **"(draft and final)"** after the product name in the "Products" section of the task/subtask. If "(draft and final)" does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, **"days"** means working days.

The Recipient shall:

For products that require a draft version

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

For products that require a final version only

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

For all products

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

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

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

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

- ***Software Application Development***
  Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
  - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
  - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
  - Visual Studio.NET (version 2008 and up). Recommend 2010.
  - C# Programming Language with Presentation (UI), Business Object and Data Layers.
  - SQL (Structured Query Language).
  - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
  - Microsoft SQL Reporting Services. Recommend 2008 R2.
  - XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting
The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

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

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

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

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

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
- An updated Project Schedule;
- Technical products (subtask 1.1);
- Progress reports and invoices (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

- Provide an *Updated Project Schedule, List of Match Funds,* and *List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not

increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

- CPR Report(s) Due: 9/18/16 CPR Mtg 1 and 4/16/17 CPR Mtg 2
- Task Products (draft and/or final as specified in the task) Due: 9/18/16 CPR Mtg 1 and 4/16/17 CPR Mtg 2

CAM Products:

- CPR Agenda Due: 9/28/16 CPR Mtg 1 and 4/26/17 CPR Mtg 2
- List of Expected CPR Participants Due: 9/28/16 CPR Mtg 1 and 4/26/17 CPR Mtg 2
- Schedule for Providing a Progress Determination Due: 10/18/16 CPR Mtg 1 and 5/16/17 CPR Mtg 2
- Progress Determination

Subtask 1.4 Final Meeting 1/31/18

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

The Recipient shall:

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

Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

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

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
    - Disposition of any state-owned equipment.
    - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
    - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
    - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
    - "Surviving" Agreement provisions such as repayment provisions and confidential products.
    - Final invoicing and release of retention.

- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary *(if applicable) 2/7/18*
- Schedule for Completing Agreement Closeout Activities *2/7/18*
- All Draft and Final Written Products *2/7/18*

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
    - Summarize all Agreement activities conducted by the Recipient for the preceding month, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.

- Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.

- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions. In addition, each invoice must document and verify:
  - Energy Commission funds received by California-based entities;
  - Energy Commission funds spent in California *(if applicable)*; and
  - Match fund expenditures.

Products:

- Progress Reports 10 days after the 1st of each month
- Invoices 10 days after the 1st of each month

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

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

Recipient Products:

- Final Report Outline (draft and final) Draft 9/15/17, final TBD

CAM Product:

- Style Manual 2 months prior to final report outline

Subtask 1.6.2 Final Report

The Recipient shall:

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

Products:

- Final Report (draft and final) Draft 11/15/17, Final 1/3/18

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

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

Products:

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

Subtask 1.8 Permits
The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

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

  The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

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

Subtask 1.9 Subcontracts
The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.

- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

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

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

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

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

ATTACHMENT 6
Scope of Work

The Recipient shall:

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

Products:

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

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

Products:

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

ATTACHMENT 6
Scope of Work

III. TECHNICAL TASKS

TASK 2 Business Model for CPUC Use Case 4: Bidirectional Power Flow (STRATEGEN, OLIVINE, UCSD)
The goal of this task is to develop the business models and use cases for EVs as energy storage, also known as bidirectional EV charging.

Subtask 2.1 Outreach (STRATEGEN LEAD, JOINT STRATEGEN AND OLIVINE EFFORT)
The goal of this subtask is to engage with CPUC staff, CAISO staff, and industry stakeholders to identify innovative and commercially relevant business models and use cases as well as to collect operational requirements for EV storage.

The Recipient shall:

- Hold early meetings with CPUC and CAISO staff to get feedback on the use case development and project structure.
- Interview key stakeholders, including automakers, site hosts, end-use customers, investors, utilities, and regulators, with the following objectives:
    - Determine how EV storage will affect end-use customer behavior and needs, with special emphasis on how EV storage affects EV adoption, and
    - Collect detailed technical and business rule definitions for operational stakeholders such as the CAISO, utilities, regulators, charging networks, and charging station manufacturers.

Subtask 2.2 Business Model and Use Case (STRATEGEN LEAD, JOINT STRATEGEN AND OLIVINE AUTHORSHIP)
The goal of this subtask is to develop a clear and compelling use case analysis for the proposed project to demonstrate the scenarios in which bidirectional charging provides enhanced functionality, resilience and operating value to end users.

The Recipient shall:

- Identify existing business models where bidirectional charging is compatible and potentially value-additive; propose new business models as necessary to fit the unique needs of the proposed project's bidirectional charging technology:
    - Formulate bidirectional charging use cases and necessary product offerings to support such use cases (including CAISO market-based products, utility demand response programs, and other products such as alternative utility rate structures or incentives) that align grid, ratepayer, and stakeholder needs with viable business models that promote EV adoption;
    - Isolate key regulatory and market barriers and recommend mitigation alternatives for the proposed use cases and market products.
- Construct a framework for evaluating the value proposition for each of the use cases:
    - Identify the potential benefit streams, including benefits to the end customers, utilities, and local and system-wide benefits to the grid and to ratepayers;
    - Identify the uses cases that appear to be the most compatible with existing grid operations, utility business models, industry business models, and consumer behavior;

  - Categorize the operational modes of each use case, and analyze the potential benefits of each operational mode;
  - List the required data inputs and outputs for the value proposition analysis;
  - Prioritize the primary benefits for the detailed value proposition analysis outlined below and list secondary, intrinsic benefits for future study.
- Utilize OSISoft PI ESRI integrator (or other software deemed appropriate by CAM) together with continuous University of California San Diego OSI PI historian data to visualize each of the EVs within the microgrid, understand their impacts on the system, and look for opportunities to optimize operations.
- Summarize the findings from the outreach activities in Subtask 2.1, and from the business model identification and use case analysis in this subtask, into a *Business Model and Use Case Report Module* that will support the comprehensive proposed project report with the following outline:
  - Summary of outreach activities
  - Summary of interviews and the identified technical and business rule definitions
  - Resultant business model innovations and considerations
  - Use case identification, categorization, and prioritization.
- Produce an *Interim Report on Viability of EV Storage* including:
  - A summary of findings from key stakeholders, preliminary findings on the Value Proposition, Business Models, and Use Cases;
  - A preliminary report on the technical features of bidirectional charging that are relevant for regulatory consideration (such as telemetry, availability of the resource, interconnection, aggregation);
  - Preliminary findings of the incremental cost of EV storage per Subtask 8.2 Technical Cost Comparison below.

  The intention of this *Interim Report on Viability of EV Storage* will be to serve as a public reference to help inform stakeholders about the value of bidirectional grid-integrated EV charging in various regulatory proceedings, both in California and elsewhere throughout the United States.
- Participate in a CPR meeting per Task 1.3.

Products:
- Business Model and Use Case Report Module 9/15/15
- Interim Report on Viability of EV Storage 9/15/16
- CPR Report DATES TBD

TASK 3 Technical Integration (NRG, UD)
The goal of this task is to integrate and configure hardware and software from different participants to produce a set of working integrated bidirectional EV charging systems approved by local authorities for operations.

The Recipient shall:
- Integrate controls and communication for each inverter model to the NRG Aggregator.
- Support a safe energy storage system that meets University of California, San Diego requirements for installed electrical equipment by working with inverter manufacturers, inspector(s) from University of California, San Diego Facilities, and where necessary other parties (such as testing facilities or UL field test providers).

- Configure individual charging station controllers and validate operational communications with the NRG Aggregator.
- Support electrical inspectors in assessing installed charging stations for compliance.
- Acquire appropriate fleet dispatch control for the relevant grid services (e.g. frequency regulation dispatch signal), as well as a signal to indicate value of each grid service over the appropriate interval.
- Configure already-existing prediction algorithms in the NRG Aggregator for commitment requirements for system capacity dispatch.
- Document the development of cost parameters for various grid services in a *Cost Parameter Report.* These parameters will be used in the NRG Aggregator to model the marginal cost of providing each grid services (e.g. electrical losses and battery wear cost for providing one hour of ancillary services). For battery wear, this will consist of a survey of the literature on battery wear for different chemistries, to be informed by the results of current collaborations with automakers and a national lab investigating battery wear for grid services. For electrical losses, it will be based on direct measurement.
- Integrate NRG Aggregator controls and communication (or other system deemed appropriate by CAM) to Olivine market dispatch and simulation systems.
- Integrate building metering system to Aggregator for peak demand reduction.
- Configure NRG Aggregator controls to balance driving needs, building services, and grid services.
- Produce an *Energy Storage Application Test Plan and Report* documenting the test parameters and results of the energy storage functionality and applications specified in Task 2.

Products:

- Cost Parameter Report 11/16/15
- Energy Storage Application Test Plan and Report 9/15/16

TASK 4 Product Development (NRG, Princeton Power, UD)

The goal of this task is develop products required for commercialization of a bidirectional EV charging systems, including direct current (DC) and alternating current (AC) systems.

The Recipient shall:

- Produce a *DC Bidirectional Charging Station Cost Reduction Report* which will include methods to reduce costs of DC bidirectional charging station.
- Produce a *Report on Efforts to complete UL Listing of AC Bidirectional Charging Station*.
- Work with standards bodies and committees (such as UL, National Electric Code, SAE J3068, and SAE J3072) to fill in gaps for AC bidirectional charging.
- Produce a *Report on Standards for AC Bidirectional Charging* outlining initial gaps for AC bidirectional charging as well as new and in-progress standards to address those gaps.
- Support any efforts at Nissan and possibly other automakers to amend the warranty and lease of EV models to accommodate bidirectional charging.

Products

- DC Bidirectional Charging Station Cost Reduction Report 8/15/16

- Report on Efforts to Complete UL Listing of AC Bidirectional Charging Station 2/15/17
- Report on Standards for AC Bidirectional Charging 8/15/16

TASK 5 Prove Viability of EV Storage (OLIVINE)
The goal of this task is to provide actual and simulated grid services in order to a) demonstrate the viability of bidirectional charging as an energy storage resource and b) gather information on technical details that will be useful for the CPUC regulatory process (e.g. telemetry requirements, rate impacts and technical impacts of power exports from bidirectional charging, options for aggregation rules, etc).

The Recipient shall:

- Design a resource makeup and wholesale bidding strategy.
- Study the feasibility (in light of additional activities with Distributed Energy Resources on the UCSD campus) of representing bidirectional charging resources as a CAISO Scheduling Coordinator and Demand Response Provider and registering available bidirectional EV charging resources as a Proxy Demand Resource with the California Independent System Operator for dispatch in wholesale energy markets and other markets as available.
- Meet CAISO / Demand Response Provider requirements for telemetry systems for resources.
- Manage all (real or simulated) market integration activities, including maintenance of registrations, master file, ancillary services certification tests, etc.
- Manage operational market aspects (real or simulated), including bidding, awards, dispatch, meter data aggregation and submission, settlements, outages, and dispute processes.
- Configure a system to simulate energy storage services that are currently unavailable from behind the meter.
- Produce a *Report on Actual and Simulated Revenue from EV Storage.*
- Produce an *Assessment of Technical Features of EV Storage,* an assessment, based on project lessons learned, of different approaches to the following:
    - Telemetry
    - Aggregation in market and telemetry
    - Interconnection
    - Power exports

Products:

- Report on Actual and Simulated Revenue from EV Storage 2/15/17
- Assessment of Technical Features of EV Storage 5/15/17

TASK 6 Site Work (UCSD, SOLARRUS, NRG)
The goal of this task is to design, install, and operate the charging stations, other site hardware, and vehicles.

ATTACHMENT 6
Scope of Work

Subtask 6.1 Engineering (SOLARRUS)
The goal of this subtask is to design the specifications for installation of bidirectional charging stations and associated electrical systems, based on site conditions and equipment characteristics.

The Recipient shall:
- Develop a one-page *Location Plan* for each of up to nine locations on the campus site (or other site deemed appropriate by CAM). Between seven and eleven bidirectional EV charging stations are planned to be deployed at each location.
- Deliver signed *Engineering, Procurement, and Construction Contract* covering all locations.
- Produce and deliver to the Energy Commission *1-line Diagrams* for each location according to the *Location Plans*.
- Support Interconnection efforts in Task 7.
- Support permitting efforts per Subtask 1.8.

Products:
- Location Plans for each location with charging station installations 8/28/15
- Engineering, Procurement, and Construction Contract 10/5/15
- 1-line Diagrams for each location 12/15/15

Subtask 6.2 Installation (SOLARRUS)
The goal of this subtask is to install the bidirectional charging stations and associated electrical infrastructure in accordance with engineering specifications and local requirements.

The Recipient shall:
- Install charging stations and associated electrical infrastructure.
- Support electrical inspector in assessment of plans and installed equipment.
- Provide *Documentation Of Completed Installation Inspected And Approved* by the appropriate Authority Having Jurisdiction.
- Direct training of local Electric Field Service to ensure expertise in the unique combination of generation and transport attributes of the various models of bidirectional EV charging stations to support a commercial market.
- Upon completion of the project, if necessary, remove charging stations (which are experimental prototypes and do not meet the NEMA 4X enclosure requirements for permanently installed equipment at UCSD). Otherwise, take actions deemed appropriate by CAM to secure the charging stations as permanent installations.

Products:
- Documentation Of Completed Installation Inspected And Approved 9/15/16

Subtask 6.3 Operations (SOLARRUS)
The goal of this subtask is to smoothly operate and maintain the equipment and vehicles on site.

The Recipient shall:
- Develop a *Driver Plan* identifying drivers, contact information, and the terms of their participation in the project. (NRG and UCSD)
- Develop an *Operating Plan for Maintenance and Customer Support. (*NRG, SOLARRUS, and UCSD)

- Perform maintenance of installed EVSEs according to the above plan. (SOLARRUS)
- Provide customer support for drivers according to the above plan. (NRG and UCSD)

Products:
- Driver Plan 10/5/15
- Operating Plan for Maintenance and Customer Support 2/10/16

TASK 7 Interconnection (OLIVINE)
The goal of this task is to achieve approval from the relevant entity (e.g. San Diego Gas & Electric) for grid-tied generation from the charging stations so they may provide energy storage services.

The Recipient shall:
- Perform a detailed investigation of the requirements and steps in the multi-month interconnection process.
- Identify opportunities to streamline this process for mass-market deployment.
- Produce an *Interim Report on the Process of Utility Interconnection* to document the multi-month interconnection process and opportunities to streamline the process.
- Submit interconnection requests (one for each location or electrical account, as required) and work with the relevant entity to process the request.
- Obtain authorization for *Approved Interconnection Agreements* with the appropriate entity (e.g. SDG&E).

Products:
- Interim Report on the Process of Utility Interconnection 6/15/16
- Approved Interconnection Agreements 9/15/16

TASK 8 Analysis (AESC)
The goal of this task is to analyze data from operations and other data to produce results showing the benefits of the demonstration project as well as bidirectional charging overall.

Subtask 8.1 M&V Plan
The goal of this subtask is to describe how actual project benefits will be measured and quantified as an input to the project benefits calculated in Task 9.

The Recipient shall:
- Execute the M&V Plan included in the Project Narrative, Section 4, by collecting base year data and operating data and calculating benefits.
- Produce *Annual M&V Reports*. These will be inputs to *Task 9: Evaluation of Project Benefits*.

Products:
- Annual M&V Reports 10/30/15, 10/30/16. 10/30/17

Subtask 8.2 Technical Cost Comparison
The goal of this subtask is to compare the cost of providing energy storage services from AC bidirectional charging, DC bidirectional charging, and stationary storage.

The Recipient shall:

- Create a *Preliminary Findings Report* of the incremental cost of EV storage for incorporation into Task 2.2 Product: Interim Report on Viability of EV Storage.
- Produce a *Cost Comparison of Bidirectional EV Charging and Stationary Storage* report.
    - Issue data request for the required inputs, including data output from UCSD deployment.
    - Input data will include incremental cost per kW, cost per kWh, time availability for storage to participate in market services, battery wear of storage options, parasitic load of storage options, and Technology Readiness Level.

Products:

- Preliminary Fndings Report 8/1/16
- Cost Comparison of Bidirectional EV Charging and Stationary Storage 4/13/17

Subtask 8.3 Visualization

The goal of this subtask is to leverage the OSISoft PI-ESRI Integrator (or other software deemed appropriate by CAM) together with the extensive monitoring of the UCSD microgrid and the bidirectional charging resources to produce a visual assessment of the interaction of bidirectional charging on the electrical distribution infrastructure at the UCSD microgrid.

The Recipient shall:

- Configure the OSISoft PI-ESRI Integrator (or other software deemed appropriate by CAM) with the UCSD PI system.
- Gather PI data, bidirectional charging data, and electrical characteristics of the microgrid to generate maps visualizing power flows, utilization, and critical events on the electrical distribution equipment at UCSD.
- Produce a *Report on Visualization of Bidirectional Charging on the Distribution System*.
- Participate in a CPR meeting per Task 1.3

Products:

- Report on Visualization of Bidirectional Charging on the Distribution System 4/13/17
- CPR Report DATES TBD

TASK TO BE ADDED: Non-mandatory Knowledge Transfer Items (NRG, Olivine, Strategen, UCSD)

The goal of this subtask is to conduct a value proposition and cost effectiveness analysis.

The Recipient Shall:

- Develop a matrix of operational benefits to the customer, both quantitative and qualitative, based on the use cases and business models. Benefits may include:
    - Annual electricity savings
    - Peak load reduction and/or shifting,
    - Energy cost reductions,
    - Other market product or benefit streams, such as wholesale market participation
- Evaluate benefits to California Investor-Owned Utility (IOU) electricity ratepayers with respect to the EPIC goals of greater reliability, lower costs, and/or increased safety
- Evaluate the benefits that align with other state policy objectives, including:
    - Greenhouse gas emission reductions,

    - Air emission reductions
- Summarize the above benefits in a *Benefits Analysis of Bidirectional EV Charging Module* report.
- Issue a data request for the required inputs identified in the value proposition framework identified in Task 2.
- Set up the use cases and corresponding data inputs in the appropriate models, which will include Strategen's proprietary customer-sited optimization model and/or EPRI's Energy Storage Evaluation Tool (ESVT)
- Run the model(s) for the use cases based on the categories of operational modes identified in the framework above
- Collect key output data from the model(s), including key metrics to understand the value proposition from the perspectives of the host, end customers, investors, utilities, and the grid
- Apply cost effectiveness tests, using the modeling output data above, including but not limited to Total Resource Cost (TRC)
- Utilize the value proposition modeling and cost effectiveness testing to support the impacts and benefits for California ratepayers identified in Section 3 of the Project Narrative
- Summarize the findings of the value proposition analysis into a *Value Proposition Report Module* that will support the comprehensive proposed project report with the following outline:
    - Description of the value proposition methodology and frameworks
    - Review of the assumptions and modeling limitations
    - Summary of the value proposition modeling results, cost effectiveness, and ratepayer impacts, including all benefits outlined in section 9.2 below
    - List of conclusions and recommendations

Products:
- Benefits Analysis of Bidirectional EV Charging Module DATES TBD
- Value Proposition Report Module DATES TBD

TASK 9 Evaluation of Project Benefits (STRATEGEN LEAD, NRG SUPPORT)
The goal of this task is to report the benefits resulting from this project.

The Recipient shall:
- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:

    o <u>For Product Development Projects and Project Demonstrations:</u>
        - Published documents, including date, title, and periodical name.

- Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
- Greenhouse gas and criteria emissions reductions.
- Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Additional Information for Product Development Projects:
    - Outcome of product development efforts, such copyrights and license agreements.
    - Units sold or projected to be sold in California and outside of California.
    - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
    - Investment dollars/follow-on private funding as a result of Energy Commission funding.
    - Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
    - Outcome of demonstrations and status of technology.
    - Number of similar installations.
    - Jobs created/retained as a result of the Agreement.

o For Information/Tools and Other Research Studies:

- Outcome of project.
- Published documents, including date, title, and periodical name.
- A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
- The number of website downloads.
- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.

  - A discussion of project product downloads from websites, and publications in technical journals.
  - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

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

Products:
- Kick-off Meeting Benefits Questionnaire DATES TBD
- Mid-term Benefits Questionnaire 5/1/17
- Final Meeting Benefits Questionnaire 1/31/18

TASK 10 Technology/Knowledge Transfer Activities (NRG, OLIVINE, STRATEGEN, UCSD)

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

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

Products:

- Initial Fact Sheet (draft and final) Draft 8/30/15, final 9/31/15
- Final Project Fact Sheet (draft and final) Draft 9/15/17, final 10/16/17
- Presentation Materials (draft and final) Draft 9/15/17, final 10/16/17
- Technology/Knowledge Transfer Plan (draft and final) Draft 2/10/16, final 3/10/16
- Technology/Knowledge Transfer Report (draft and final) Draft 9/15/17, final 10/16/17

TASK 11 Production Readiness Plan (NRG)

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
  - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
  - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
  - The estimated cost of production.
  - The expected investment threshold needed to launch the commercial product.
  - An implementation plan to ramp up to full production.
  - The outcome of product development efforts, such as copyrights and license agreements.
  - Patent numbers and applications, along with dates and brief descriptions.
  - Other areas as determined by the CAM.

Products:

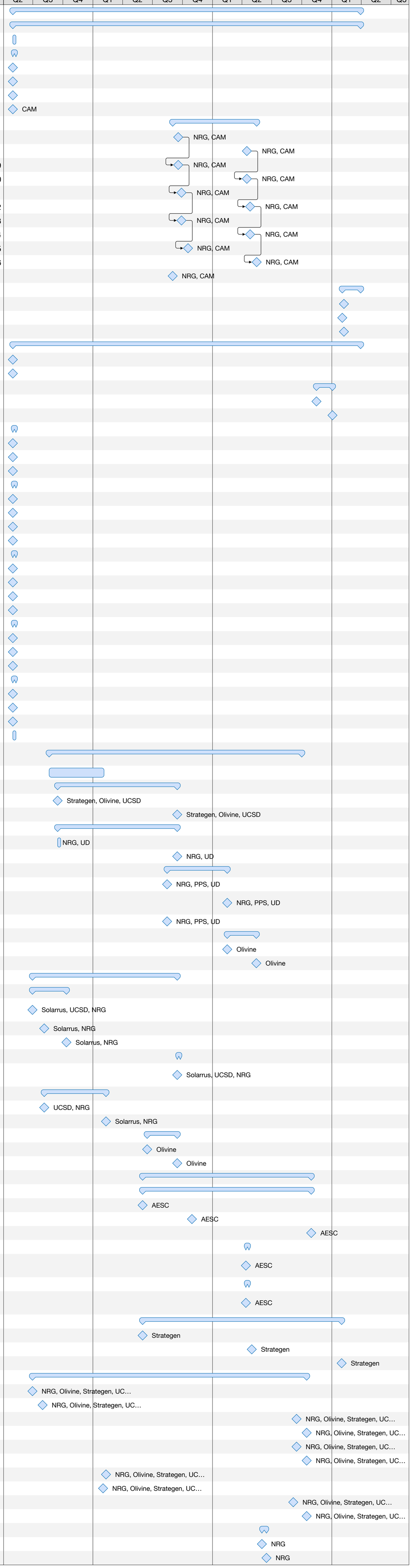
- Production Readiness Plan (draft and final) Draft 4/17/17, final 6/15/17

ATTACHMENT 6
Scope of Work

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

#	Traits	Title	Given Work	Given Earliest Start	Resources	Predecessors
0		**PON 14-301**		**May 1, 2015**	**CAM; NRG, C…**	
1		**Task 1: General Project Tasks**		**Mar 1, 2015**	**CAM; NRG, C…**	
2		1.1 Products	1 day ?			
3		**1.2 Kick-off Meeting**	**60 days**	**May 1, 2015**	**CAM**	
4		Update Project Schedule				
5		Update List of Match Funds				
6		Update List of Permits				
7		Kick-off Meeting Agenda			CAM	
8		**1.3 Critical Project Review Meetings**		**Sep 1, 2016**	**NRG, CAM**	
9		CPR Report 1		Sep 18, 2016	NRG, CAM	
10		CPR Report 2		Apr 16, 2017	NRG, CAM	
11		Task Products 1			NRG, CAM	9
12		Task Products 2			NRG, CAM	10
13		CPR Agenda 1		Sep 28, 2016	NRG, CAM	11
14		CPR Agenda 2		Apr 26, 2017	NRG, CAM	12
15		List of Expected CPR Participants 1			NRG, CAM	13
16		List of Expected CPR Participants 2			NRG, CAM	14
17		Schedule for Providing a Progress Determination 1		Oct 18, 2016	NRG, CAM	15
18		Schedule for Providing a Progress Determination 2		May 16, 2017	NRG, CAM	16
19		Progress Determination			NRG, CAM	
20		**1.4 Final Meeting**		**Jan 1, 2018**		
21		Final Meeting Agreement Summary		Feb 7, 2018		
22		Schedule for Completing Agreement Closeout Activities		Feb 2, 2018		
23		All Draft & Financial Written Products		Feb 7, 2018		
24		**1.5 Progress Reports & Invoices**		**Mar 1, 2015**		
25		Progress Report				
26		Invoices				
27		**1.6 Final Report**				
28		Final Report Draft		Nov 15, 2017		
29		Final Report Final		Jan 3, 2018		
30		**1.7 Match Funds**				
31		Match Funds Status Letter				
32		Supplemental Match Funds Notification Letter				
33		Match Funds Reduction Notification Letter				
34		**1.8 Permits**				
35		Permit Status Letter				
36		Updated List of Permits				
37		Updated Schedule for Acquiring Permits				
38		Copy of each Approved Permit				
39		**1.9 Subcontracts**		**Mar 1, 2015**		
40		UCSD Subcontract				
41		Strategen Subcontract				
42		Olivine Subcontract				
43		Solarrus Subcontract				
44		**1.10 Technical Advisory Committee (TAC)**		**Mar 1, 2015**		
45		List of Potential TAC Members				
46		List of TAC Members				
47		Documentation of TAC Member Commitment				
48		**1.11 TAC Meetings**				
49		TAC Meeting Schedule (draft and final)				
50		TAC Meeting Agendas (draft and final)				
51		TAC Meeting Back-up Materials				
52		TAC Meeting Summaries	1 day ?			
53		**Task 2: Business Model for CPUC Use Case 4: Bidirectional Power Flow**		**June 1, 2015**	**Strategen, Olivine, UCSD**	
54		**2.1 Outreach**		**Aug 20, 2015**		
56		**2.2 Business Model & Use Case**		**May 1, 2015**	**Strategen, Oli…**	
57		Business Model & Use Case Report Module		Sep 15, 2015	Strategen, Olivi…	
58		Interim Report on Viability of EV Storage		Sep 15, 2016	Strategen, Olivi…	
59		**Task 3: Technical Integration**		**June 1, 2015**	**NRG, UD**	
60		Cost Parameter Report	1 day ?	Sep 15, 2015	NRG, UD	
61		Energy Storage Application Test Plan & Report		Sep 15, 2016	NRG, UD	
62		**Task 4: Product Development**		**June 1, 2015**	**NRG, PPS, UD**	
63		DC Bidirectional Charging Station Cost Reduction Report		Aug 15, 2016	NRG, PPS, UD	
64		Report on Efforts to Complete UL Listing of AC Bidirectional Charging Station		Feb 15, 2017	NRG, PPS, UD	
65		Report on Standards for AC Bidirectional Charging		Aug 15, 2016	NRG, PPS, UD	
66		**Task 5: Prove Viability of EV Storage**		**June 1, 2015**	**Olivine**	
67		Report on Actual & Simulated Revenue from EV Storage		Feb 15, 2017	Olivine	
68		Assessment of Technical Features of EV Storage		May 15, 2017	Olivine	
69		**Task 6: Site Work**		**June 1, 2015**	**Solarrus, UCS…**	
70		**6.1 Engineering**		**Feb 27, 2015**	**Solarrus, UCS…**	
71		Location Plans for each location w/ charging station Installation		Jun 30, 2015	Solarrus, UCSD, NRG	
72		Engineering Procurement & Construction Contract		Aug 5, 2015	Solarrus, NRG	
73		1-Line Diagrams for each location		Oct 12, 2015	Solarrus, NRG	
74		**6.2 Installation**		**Feb 27, 2015**	**Solarrus, UCS…**	
75		Documentation of Completed Installation Inspection & Approval		Sep 15, 2016	Solarrus, UCSD, NRG	
76		**6.3 Operation**		**Feb 27, 2015**	**UCSD, NRG; S…**	
77		Driver Plan		Aug 5, 2015	UCSD, NRG	
78		Operating Plan for Maintenance & Customer Support		Feb 10, 2016	Solarrus, NRG	
79		**Task 7: Interconnection**		**June 1, 2015**	**Olivine**	
80		Interim Report on the Process of Utility Interconnection		Jun 15, 2016	Olivine	
81		Approved Interconnection Agreement		Sep 15, 2016	Olivine	
82		**Task 8: Analysis**		**June 1, 2016**	**AESC**	
83		**8.1 M&V Plan**		**Feb 27, 2015**	**AESC**	
84		Annual M&V Report		Oct 30, 2015	AESC	
85		Annual M&V Report		Oct 30, 2016	AESC	
86		Annual M&V Report		Oct 30, 2017	AESC	
87		**8.2 Technical Cost Comparison**		**Feb 27, 2015**	**AESC**	
88		Cost Comparison of Bidirectional E Charging and Stationary Storage		Apr 13, 2017	AESC	
89		**8.3 Visualization**		**Feb 27, 2015**	**AESC**	
90		Report on Visualization of Bidirectional Charging on the Distribution System		Apr 13, 2017	AESC	
91		**Task 9: Evaluation of Project Benefits**		**June 1, 2016**	**Strategen**	
92		Kick-off Meeting Benefits Questionnaire		May 15, 2015	Strategen	
93		Mid-term Meeting Benefits Questionnaire		May 1, 2017	Strategen	
94		Final Meeting Benefits Questionnaire		Jan 31, 2018	Strategen	
95		**Task 10: Technology / Knowledge Transfer Activities**		**June 1, 2015**	**NRG, Olivine,…**	
96		Initial Fact Sheet (Draft)		Jun 30, 2015	NRG, Olivine,…	
97		Initial Fact Sheet (Final)		July 31, 2015	NRG, Olivine,…	
98		Final Project Fact Sheet (Draft)		Sep 15, 2017	NRG, Olivine,…	
99		Final Project Fact Sheet (Final)		Oct 16, 2017	NRG, Olivine,…	
100		Presentation Materials (Draft)		Sep 15, 2017	NRG, Olivine,…	
101		Presentation Materials (Final)		Oct 16, 2017	NRG, Olivine,…	
102		Technology/Knowledge Transfer Plan (Draft)		Feb 10, 2016	NRG, Olivine,…	
103		Technology/Knowledge Transfer Plan (Final)		Feb 1, 2016	NRG, Olivine,…	
104		Technology/Knowledge Transfer Report (Draft)		Sep 5, 2017	NRG, Olivine,…	
105		Technology/Knowledge Transfer Report (Final)		Oct 16, 2017	NRG, Olivine,…	
106		**Task 11: Production Readiness Plan**		**June 1, 2017**	**NRG**	
107		Production Rediness Plan (Draft)		April 7, 2017	NRG	
108		Production Rediness Plan (Final)		Jun 15, 2017	NRG	



EV Storage Accelerator
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IV. PROJECT SCHEDULE

Agreement Term: 5-1-2015 to 3-31-2018

*Within this Scope of Work, **"days"** means working days. Changes to due dates must be approved in writing by the CAM, and may require approval by the Energy Commission's Executive Director or his/her designee.*

Task/ Subtask #	Task/Subtask Name	Meeting Name	Product(s)	Due Date
1	General Project Tasks			
1.1	Products			
1.2	Kick-off Meeting	Kick-off Meeting		[Date to be inserted by the CAM]
			Updated Project Schedule *(if applicable)*	7 days after determination of the need to update the documents
			Updated List of Match Funds *(if applicable)*	
			Updated List of Permits *(if applicable)*	
			CAM Product	
			Kick-off Meeting Agenda	7 days prior to the kick-off meeting
1.3	CPR Meeting	CPR Meeting #1		[Date to be inserted by the CAM]
		CPR Meeting #2 *(to be deleted by the CAM if inapplicable)*		[Same as above]
			CPR Report	15 days prior to the CPR meeting
			Task Product(s)	
			CAM Products	
			CPR Agenda	5 days prior to the CPR meeting
			List of Expected CPR Participants	
			Schedule for Providing a Progress Determination	15 days after CPR meeting
			Progress Determination	As indicated in the Schedule for Providing a Progress Determination
1.4	Final Meeting	Final Meeting		[Date to be inserted by the CAM; must be the last date in the schedule]
			Final Meeting Agreement Summary *(if applicable)*	7 days after the final meeting
			Schedule for Completing Agreement Closeout Activities	
			All Draft and Final Written Products	
1.5	Progress Reports and Invoices		Progress Reports	10 days after the first of each month
			Invoices	10 days after the first of each month or quarter
1.6	Final Report			
1.6.1	Final Report Outline		Draft Final Report Outline	15-Sep-17
			Final Report Outline	As determined by the CAM
			CAM Product	
			Style Manual	At least **2 months** prior to the final report outline due date
			Comments on Draft Final Report Outline	10 days after receipt of the Draft Final Report Outline
			Approval of Final Report Outline	10 days after receipt of the Final Report Outline
1.6.2	Final Report		Draft Final Report	15-Nov-17
			Final Report	31-Jan-18
			CAM Products	
			Comments on Draft Final Report Outline	30 days after receipt of the Draft Final Report

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Task/ Subtask #	Task/Subtask Name	Meeting Name	Product(s)	Due Date
1.7	Match Funds		Match Funds Status Letter	2 days prior to the kick-off meeting
			Supplemental Match Funds Notification Letter *(if applicable)*	10 days after receipt of additional match funds
			Match Funds Reduction Notification Letter *(if applicable)*	10 days after any reduction of match funds
1.8	Permits		Permit Status Letter	2 days prior to the kick-off meeting
			Updated List of Permits *(if applicable)*	10 days after determination of the need for a new permit
			Updated Schedule for Acquiring Permits *(if applicable)*	
			Copy of Each Approved Permit *(if applicable)*	7 days after receipt of each permit
1.9	Subcontracts		Draft Subcontracts *(if required by the CAM)*	As determined by the CAM
			Final Subcontracts	
1.10	Technical Advisory Committee (TAC)		List of Potential TAC Members	2 days prior to the kick-off meeting
			List of TAC Members	7 days after finalization of the TAC
			Documentation of TAC Member Commitment	7 days after receipt of the documentation
1.11	TAC Meetings	TAC Meeting #1		[Date to be inserted by the CAM]
		TAC Meeting #2 *(to be deleted by the CAM if inapplicable)*		[Same as above]
			Draft TAC Meeting Schedule	20 days after the kickoff meeting
			Final TAC Meeting Schedule	10 days after the first TAC meeting
			Draft TAC Meeting Agendas	20 days prior to each TAC meeting
			TAC Meeting Back-up Materials	
			Final TAC Meeting Agenda	7 days prior to each TAC meeting
			TAC Meeting Summaries	10 days after each TAC meeting

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Task/ Subtask #	Task/Subtask Name	Meeting Name	Product(s)	Due Date
Technical Tasks				
2	Business Model for CPUC Use Case #4: Bidirectional Power Flow		Business Model & Use Case Report Module	15-Sep-15
			Interim Report on Viability of EV Storage	15-Sep-16
3	Technical Integration		Cost Parameter Report	15-Sep-15
			Energy Storage Application Test Plan and Report	15-Sep-16
4	Product Development		DC Bidirectional Charging Station Cost Reduction Report	15-Aug-16
			Report on Efforts to complete UL Listing of AC Bidirectional Charging Station	15-Feb-17
			Report on Standards for AC Bidirectional Charging	15-Aug-16
5	Prove Viability of EV Storage		Report on Actual and Simulated Revenue from EV Storage	15-Feb-17
			Assessment of Technical Features of EV Storage	15-May-17
6	Site Work			
6.1	Engineering		Location Plans for each location with charging station installations	30-Jun-15
			Engineering, Procurement, and Construction Contract	5-Aug-15
			1-line Diagrams for each location	12-Oct-15
6.2	Installation		Documentation Of Completed Installation Inspected And Approved	15-Sep-16
6.3	Operations		Driver Plan	5-Aug-15
			Operating Plan for Maintenance and Customer Support	10-Feb-16
7	Interconnection		Interim Report on the Process of Utility Interconnection	15-Jun-16
			Approved Interconnection Agreements	15-Sep-16
8	Analysis			
8.1	M&V Plan		Annual M&V reports	30-Nov-15
8.2	Technical Cost Comparison		Cost Comparison of Bidirectional EV Charging and Stationary Storage	13-Apr-17
8.3	Visualization		Report on Visualization of Bidirectional Charging on the Distribution System	13-Apr-17
9	Evaluation of Project Benefits			
9.1	Non-mandatory Items		Benefits Analysis of Bidirectional EV Charging Module	10-Feb-16
			Value Proposition Report Module	10-Feb-16
9.2	CEC Mandatory Items		Kick-off Meeting Benefits Questionnaire	[Insert date that is no more than 10 days after the kick-off meeting]
			Mid-term Benefits Questionnaire	[Date to be inserted by the CAM]
			Final Meeting Benefits Questionnaire	[Insert date that is no more than 10 days after the final meeting]
10	Technology/Knowledge Transfer Activities			
10.1	Non-mandatory Items	Webinar on Viability of EV Storage		16-May-16
		EV Storage Summit		15-Jun-16
10.2	CEC Mandatory Items		Draft Initial Fact Sheet	30-Jun-15
			Final Initial Fact Sheet	31-Jul-15
			Draft Final Project Fact Sheet	15-Sep-17
			Final Project Fact Sheet	16-Oct-17
			Draft Presentation Materials	15-Sep-17
			Final Presentation Materials	16-Oct-17

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Task/ Subtask #	Task/Subtask Name	Meeting Name	Product(s)	Due Date
			Draft Technology/Knowledge Transfer Plan	10-Feb-16
			Final Technology/Knowledge Transfer Plan	10-Mar-16
			Draft Technology/Knowledge Transfer Report	15-Sep-17
			Final Technology/Knowledge Transfer Report	16-Oct-17
11	Production Readiness Plan		Draft Production Readiness Plan	17-Apr-17
			Final Production Readiness Plan	15-Jun-17

I	General Instructions
1	As the budget forms have been updated, please read these instructions before completing the forms. Input information for appropriate non-colored cells. All colored cells, with the possible exception of red-highlighted cells, are automatically filled from other information in the workbook. These automatic cells are locked and cannot be edited.
2	This workbook includes automatic checks for some common sources of inconsistencies. If one of these inconsistencies is detected, the relevant cells will be highlighted red. Refer to the notes and instructions for the sheet on which the highlighting occurs for information on the inconsistency. This highlighting is only a visual warning, and will not affect your ability to enter information in the workbook. In some cases, the highlighting is temporary while you are entering information and will be resolved once all information is entered. These warnings are only a tool to help you avoid some common errors, and should not be used as a substitute for manually ensuring that the entire workbook is accurate and adheres to the requirements described in all related documents prior to submission. Please make sure all inconsistencies, including those indicated by red highlighting, are corrected before submitting the budget forms with your proposal.
3	**Never delete rows, columns or sheets.** Use the "hide" option to remove unwanted information to avoid formula errors. To hide a column, right click on the column letter and select hide. To unhide a column, highlight the columns to the left and right of the hidden column, right click and select "unhide".
4	This workbook contains worksheets for up to 15 major subcontractors. Hide unwanted sheets but do not delete. In the event that more major subcontractors are necessary, contact your Commission Agreement Officer to add more major subcontractor sheets. To hide a sheet, right click on the tab for that sheet and select "hide". To unhide a sheet, right click on any tab and select "unhide" and select the sheet that you wish to unhide. **Never copy or insert sheets from outside of the workbook** as other sheets may need to pull information.
5	A **"major subcontractor"** is any subcontractor receiving at least 25% of the Commission funds or $100,000 (whichever is less). A **"minor subcontractor"** is any subcontractor receiving less than 25% or $100,000 (whichever is less). Major subcontractors are required to provide detailed budgets including rates and other direct operating costs. Minor subcontractors are only detailed by the total to be spent with that company.
6	All unit costs and labor rates may be carried out to two decimal places. Non-labor rates may be carried out to five decimal places. All line item totals are rounded up to the next whole dollar amount. All other budgeted amounts must be in whole dollars.
7	**Never** use formulas in the tables as they cause rounding discrepancies

II	Attachment B-1 Task Summary
1	This sheet identifies costs by task and by the prime recipient and major subcontractors.
2	Insert the company names for the prime and all major subcontractors.
3	Identify if a Company is a certified Small Business (SB), Micro-Business (MB), Disabled Veteran Business Enterprise (DVBE) or None. These types of entities may be eligible for preferences or incentives in certain solicitations. The Energy Commission will verify certification status at the following website: http://www.bidsync.com/DPXBisCASB
4	Insert task names exactly as they are titled in the Scope of Work (Exhibit A). Hide or unhide rows as necessary. **DO NOT DELETE!**
5	Insert total Task Costs for the prime recipient and all major subcontractors.
6	This sheet contains columns for 15 major subcontractors. Hide or unhide columns as necessary. **DO NOT DELETE**!
7	The totals (blue cells) will automatically calculate from information provided in the non-colored cells.
8	All totals on this attachment **must match** the corresponding totals on Attachment B-2 Category Summary. The Commission Reimbursable Grand Totals must match the amount that you are requesting.
9	Cells will highlight red if the following conditions are not satisfied: Prime Recipient and Major Subcontractor Grand Totals must match the same totals in Att B-2; Match Funding Grand Totals must match those in Att B-2 and Att B-6; Project Grand Total must match that on B-2.
10	The Budget must allow for participation in and presentation at an annual Energy Commission-sponsored public conference/workshop on the funded project. This can be included as part of the "technology transfer plan" task (see Task TBD-2 in the Scope of Work)

III	Attachment B-2 Category Summary
1	This sheet identifies costs by category and by prime recipient and major subcontractors for all tasks combined. The Company Names will automatically fill from Att B-1 Task Summary.
2	Enter category totals for the prime recipient and all applicable major subcontractors (for all tasks combined). a. **Direct Labor (DL)** - This category identifies the total amount of direct labor costs (for all tasks) for the prime and each major subcontractor. This category is based on labor hours and unloaded labor rates. b. **Fringe (FB)** - This category identifies the total amount of Fringe Benefits costs (for all tasks) for the prime and each major subcontractor. This category must be consistent with how you describe your calculations on Att B-4 Non-Labor Rates. c. **Travel (T)** - This category must identify all anticipated travel costs (for all tasks) for the prime and each major subcontractor. The travel budget on this form must equal or exceed the total amount listed on Att B-5 Direct Operating Expenses, Pre-Approved Travel. (See Section IX for more information) d. **Equipment (EQ)** - This category must equal the totals (for all tasks) for the prime and each major subcontractor for the equipment category on Att B-5 Direct Operating Expensese. e. **Materials/Miscellaneous (M)** - This category must equal the totals (for all tasks) for the prime and each major subcontractor for the materials/miscellaneous category on Att B-5 Direct Operating Expenses. f. **Minor subcontractors (S)** - This category must equal the totals (for all tasks) for the prime and each major subcontractor for minor subcontractors on Att B-5 Direct Operating Expenses. A minor subcontractor is any subcontractor receiving less than $100,000 or 25% (whichever is less) of the award. g. **Indirect Overhead (IOH)** - This category identifies the total amount of Indirect Overhead costs (for all tasks) for the prime and each major subcontractor. This category must be consistent with how you describe your calculations on Att B-4 Non-Labor Rates. h. **General and Administrative (GA)** - This category identifies the total amount of GA costs (for all tasks) for the prime and each major subcontractor. This category must be consistent with how you describe your calculations on Att B-4 Non-Labor Rates. i. **Profit (P)** - This category identifies the total amount of Profit costs (for all tasks) for each major subcontractor. The Prime Recipient cannot claim profit. Subcontractor profit is allowable, though it may not exceed 10% of the subcontractor's project expenses. This category must be consistent with how you describe calculations on Att B-4 Non-Labor Rates.
3	The totals (blue cells) will automatically calculate from information provided in the non-colored cells.
4	All totals on this attachment must match the corresponding totals on Attachment B-1 Task Summary.
5	Indicate the amount of Energy Commission funds that will be spent in California. **"Spent in California"** means that: **(1)** Funds in the "Direct Labor category and all categories calculated based on direct labor in the B-4 budget attachments (Prime and Subcontractor Labor Rates) are paid to individuals that pay California state income taxes on wages received for work performed under the agreement. Payments made to out-of-state workers do not count as “funds spent in California.” However, funds spent by out-of-state workers in California (e.g., hotel and food) can count as “funds spent in California.”; AND **(2)** Business transactions (e.g., material and equipment purchases, leases, and rentals) are entered into with a business located in California. **Airline ticket purchases are not considered funds "spent in California."**
6	The total percentage for your proposal will automatically calculate from the information provided in the non-colored cells.
7	Attachment B-7 Rates Summary, located at the end of this workbook, automatically populates from information on this sheet to calculate the Average Loaded Rate.
8	Cells will highlight red if the following conditions are not satisfied: Prime Recipient and Major Subcontractor Grand Totals must match the same totals in Att B-1; Match Funding Grand Totals must match those in Att B-1 and Att B-6; Project Grand Total must match that on B-1; Project percentage of funds going to CBEs and Project percentage of funds being spent in California must each be greater than or equal to 60%, without rounding; Pre-approved Travel totals must be greater than or equal to those in Att B-5; Equipment, Material(s)/Miscellaneous Costs, and Minor Subcontractors totals must equal those in Att B-5.

IV	Attachment B-3 Prime Labor Rates
1	This sheet identifies the maximum unloaded labor rates (that is before fringe or any other non-labor costs) for the prime recipient. This is the highest salary or wage rate that is actually paid to the employee. The name of the company will be automatically generated from Att B-1 Task Summary.
2	Insert the name and classification for each of the prime recipient's personnel that may be billed to this Agreement. All personnel billed must fit within a classification identified in the Agreement. To be determined or TBD is acceptable in the place of a name for clerical personnel. TBD must not be used for personnel performing a significant role in the Agreement. TBD is never acceptable in the place of a classification.
3	Identify the maximum unloaded hourly rate for each Classification. This is the highest salary or wage rate that is actually paid to the employee. **Actual billable rates cannot exceed the maximum rates identified in this attachment**. Example: Two employees, Emp1 and Emp2, have the same classification, which pays between $100 and $150 per hour. Emp1 makes $125/hour and Emp2 makes $140/hour. You should enter $140/hour as the maximum rate for this classification, unless you anticipate that members of this classification will be paid the full rate,- in which case enter $150/hour. In either case, the actual billable rates cannot exceed the maximum rate you specify.
4	If rates will increase by fiscal year, identify the fiscal years and each rate. The first "From" is the start of the Agreement. All subsequent "From's" must be the beginning of the company's fiscal year. "To" is the end of the company's fiscal year. The last "To" must be the end date of the Agreement. (Hide or unhide columns as necessary for each fiscal year)
5	Identify the maximum total hours to be worked for each employee or job classification, even for those individuals listed as TBDs. All job classifications **must** provide a maximum for Total Hours Worked.
6	**Actual billable rates cannot exceed the maximum rates identified in this attachment.** A formal amendment will be necessary to increase rates or add classifications.
7	Cells will highlight red if the following conditions are not satisfied: For each employee (including TBDs), you must enter a classification, at least one rate, and the Total Hours Worked. Any row that does not satisfy these three conditions will be highlighted red in the Total Hours Worked cell. Classifications must be given numeric rates and hours – responses such as "TBD" are not allowed.

V	Attachment B-3a Sub #1-15 Labor Rates
1	This sheet identifies the maximum unloaded labor rates (that is before fringe or any other non-labor costs) for major subcontractor #1. This is the highest rate that is actually paid to the employee. The name of the company will be automatically generated from Att B-1 Task Summary.
2	See section IV, instructions for Attachment B-3 Prime Labor Rates, for instructions on completing this form.
3	Complete for each major subcontractor. (See Section I, General Instructions, item 4)

VI	Attachment B-4 Prime Non-Labor Rates
1	This sheet identifies non-labor rates for the prime recipient, how non-labor rates are charged, and what is included in non-labor rates. The name of the company will be automatically generated from Att B-1 Task Summary.
2	Insert the Fiscal Year Start and End Dates similar to Attachment B-3 in the first section.
3	Identify the maximum percentage rate for each non-labor rate. Organizations may or may not have both Indirect Overhead (IOH) and General and Administrative (GA) costs.
4	The second section identifies how each non-labor rate will be calculated for billing purposes. Check the boxes for DL, M, EQ, T, S, FB, IOH and GA. Once the boxes are checked the Base Calculation will identify your selections. Abbreviations: DL= Direct Labor, FB= Fringe Benefits, M= Materials/Miscellaneous, EQ= Equipment, T= Travel,S= Subcontracts, IOH= Indirect Overhead, GA= General & Administrative **Example 1** - If the Fringe Benefits percentage is applied to Direct Labor expense, you would check the DL box on the Fringe Benefits line. When billing, the DL expense will be multiplied by the FB percent to arrive at the FB amount. **Example 2** - If the Indirect Overhead percentage is applied to Direct Labor, Fringe Benefits, Materials/Miscellaneous, and Travel; you would check the DL, FB, M and T boxes on the Indirect Overhead line. When billing, the sum of DL, FB, M, and T will be multiplied by the IOH percent to arrive at the IOH amount.
5	The third section identifies what is included in each non-labor category. List **items** you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within or between columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote. Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state, local, and tribal governments). **Failure to properly complete this section will result in the delayed execution of the agreement.** Profit cannot be included in this section.
6	**The Recipient is not allowed to charge profit in Energy Commission Grants**. **Actual billable rates cannot exceed the maximum rates identified in this attachment.**
7	If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.

VII	Attachment B-4a Sub#1-15 Non-Labor Rates
1	This sheet identifies non-labor rates for major subcontractors, how non-labor rates are charged, and what is included in non-labor rates. The name of the company will be automatically generated from Att B-1 Task Summary.
2	Complete for each major subcontractor. (See Section I, General Instructions, item 4)
3	Note: Actual billable rates cannot exceed the maximum rates identified in this attachment.
4	Insert the Fiscal Year Start and End Dates similar to Attachment B-3 in the first section.
5	Identify the maximum percentage rate for each non-labor rate. Organizations may or may not have both Indirect Overhead (IOH) and General and Administrative (GA) costs.
6	The second section identifies how each non-labor rate will be calculated for billing purposes. Check the boxes for DL, M, EQ, T, S, FB, IOH and GA. Once the boxes are checked the Base Calculation will identify your selections. Abbreviations: DL= Direct Labor, FB= Fringe Benefits, M= Materials/Miscellaneous, EQ= Equipment, T= Travel,S= Subcontracts, IOH= Indirect Overhead, GA= General & Administrative Example 1 - If the Fringe Benefits percentage is applied to Direct Labor expense, you would check the DL box on the Fringe Benefits line. When billing, the DL expense will be multiplied by the FB percent to arrive at the FB amount. Example 2 - If the Indirect Overhead percentage is applied to Direct Labor, Fringe Benefits, Materials/Miscellaneous, and Travel; you would check the DL, FB, M and T boxes on the Indirect Overhead line. When billing, the sum of DL, FB, M, and T will be multiplied by the IOH percent to arrive at the IOH amount.
7	The third section identifies what is included in each non-labor category. List items you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within or between columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote. Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state, local, and tribal governments). **Failure to properly complete this section will result in the delayed execution of the agreement.** **Profit can be included in this section.**
8	Actual billable rates cannot exceed the maximum rates identified in this attachment.
9	If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.

VIII	Attachment B-5 Direct Operating Expenses
1	This sheet identifies the direct operating expenses for the prime and all major subcontractors. Direct Operating expenses include Pre-Approved Travel, Equipment, and Materials/Miscellaneous Expenditures.
2	For all expenses, identify the task associated with the expense, a description of the expense, and name of the prime recipient or major subcontractor that will incur the expense.
3	**Pre-Approved Travel** is travel that can be detailed including who is travelling (person or classification), the purpose of the trip (which must tie in with the Scope of Work), the departure and destination, and the budgeted amount. If the person travelling or departure and/or destination are TBD, then travel cannot be included on the pre-approved travel list but must be included in the travel amounts identified on Attachment B-2 Category Summary and included in the total Task Costs for Attachment B-1 Task Summary.
4	The prime recipient and subcontractors may budget for travel (on Attachment B-2) that is not identified in Att B-5, but all travel that is not identified must be pre-approved in writing prior to travel in accordance with the terms and conditions of the agreement.
5	**Equipment** is defined as: having a useful life of at least one year, having an acquisition unit cost of at least $5,000, and purchased with Energy Commission funds. Equipment means any products, objects, machinery, apparatus, implements or tools purchased, used or constructed within the Project, including those products, objects, machinery, apparatus, implements or tools from which over thirty percent (30%) of the equipment is composed of Materials purchased for the Project.
6	**Materials** are any tangible project items to be purchased with Energy Commission funds that do not fit the description of Equipment.
7	**Miscellaneous items** are those items that are not labor, materials, equipment, or non-labor rate costs. Examples of Miscellaneous items are: Web-Meeting or Teleconference Expenses, Laboratory or Facility Rental, etc. Services that involve labor are subcontracts, not miscellaneous.
8	**Minor Subcontractors** are those subcontractors that are not defined as a Major Subcontractor (see Section I, General Instructions, item 5).
9	NOTE: Cells will highlight red if the following conditions are not satisfied: Pre-approved Travel totals must be less than or equal to those in Att B-2; Equipment, Material(s)/Miscellaneous Costs, and Minor Subcontractors totals must equal those in Att B-2; In Equipment and Material(s)/Miscellaneous sections, the amounts listed under Commision Funds and Match Funds must add up to the product of the Unit # and Unit Cost - **rounded up to the nearest whole dollar** - for each item. For example, if an equipment item is listed with 3 units and a $1.50 unit cost, then the Commission and Match Funds listed for this item must add up to $5.00. 3 x $1.50 = $4.50, which rounds up to $5.00.

IX	Attachment B-6 Match Funding
1	This sheet identifies the match funding by each contributor.
2	Identify each match contributor in the Match Contributor columns. If the contributor is the Prime Recipient or a Major Subcontractor, enter the company name exactly as it appears in Att B-1. Hide, Unhide or add columns as necessary.
3	Insert the amount of match funding by task for each match funding contributor. The match funding amounts should be equal to the amounts in Att B-1 and Att B-2
4	Cells will highlight red if the following conditions are not satisfied: The Match Funding Grand Total must equal those from Att B-1 and Att B-2.

X	Attachment B-7 Rates Summary
1	This sheet will automatically calculate based on information provided in Attachment B-2.
2	The ratio (Direct Labor + Fringe Benefits)/(Direct Labor+ Fringe Benefits + Total Indirect) at the bottom of this sheet is the average team rate. The ratio is multiplied by 5 to obtain the team score.

ATTACHMENT 7

Summary Task Budget		Prime Recipient Reimbursable Costs	Major Subcontractor #1 Reimbursable Costs	Major Subcontractor #2 Reimbursable Costs	Major Subcontractor #3 Reimbursable Costs	Major Subcontractor #4 Reimbursable Costs	Commission Reimbursable Totals	Match Funding Totals	Grand Totals
		NRG Energy	UC San Diego	Strategen	Olivine	Solarrus			
Company Types * :		☐ DVBE ☐ SB ☐ MB ☑ None	☐ DVBE ☐ SB ☐ MB ☑ None	☐ DVBE ☑ SB ☐ MB ☐ None	☐ DVBE ☑ SB ☐ MB ☐ None				
1.0	General Project Tasks	$ 50,000.00	$ 30,000.00				**$ 80,000.00**	**$ 372,994.00**	**$ 452,994.00**
2.0	Business Model for CPUC Use Case #4: Bi-directional Power Flow			$ 324,517.00	$ 40,000.00		**$ 364,517.00**	**$ 131,000.00**	**$ 495,517.00**
3.0	Technical Integration						**$ -**	**$ 225,000.00**	**$ 225,000.00**
4.0	Product Development						**$ -**	**$ 100,000.00**	**$ 100,000.00**
5.0	Prove Viability of EV Storage				$ 140,000.00		**$ 140,000.00**	**$ 35,000.00**	**$ 175,000.00**
6.0	Site Work	$ 7,700.00	$ 195,000.00			$ 248,269.00	**$ 450,969.00**	**$ 229,730.00**	**$ 680,699.00**
7.0	Interconnection				$ 100,000.00		**$ 100,000.00**	**$ -**	**$ 100,000.00**
8.0	Analysis	$ 98,681.00					**$ 98,681.00**	**$ 86,000.00**	**$ 184,681.00**
9.0	Evaluation of Project Benefits			$ 39,158.00			**$ 39,158.00**	**$ -**	**$ 39,158.00**
10.0	Technology / Knowledge Transfer Activities	$ 50,000.00	$ 75,000.00	$ 57,325.00	$ 40,000.00		**$ 222,325.00**	**$ -**	**$ 222,325.00**
11.0	Production Readiness Plan						**$ -**	**$ 50,000.00**	**$ 50,000.00**
	Grand Totals	**$ 206,381.00**	**$ 300,000.00**	**$ 421,000.00**	**$ 320,000.00**	**$ 248,269.00**	**$ 1,495,650.00**	**$ 1,229,724.00**	**$ 2,725,374.00**

PLEASE SEE THE INSTRUCTIONS SHEET FOR DETAILED INFORMATION ON COMPLETING THIS FORM.
If the budget forms are not filled out completely your bid/proposal may be rejected.

For these boxes, be sure to include all costs: labor (unloaded rates) and non-labor costs (fringe, overhead, general & administrative, and other direct operating costs).

NOTE: Cells will highlight red if the following conditions are not satisfied: Prime Recipient and Major Subcontractor Grand Totals must match the same totals in Att B-2; Match Funding Grand Totals must match those in Att B-2 and Att B-6; Project Grand Total must match that on B-2.

(*) Indicate which of these categories apply to each prime and subcontractor by selecting the appropriate checkboxes. The categories are Disabled Veteran Business Enterprise (DVBE), certified Small Business (SB), and Micro-Business (MB). Refer to the Instructions page for explanation and definition of each company type.

ATTACHMENT 7
Exhibit B
Att B-2 Category Summary

Summary Category Budget	Prime Recipient Reimbursable Costs	Major Subcontractor #1 Reimbursable Costs	Major Subcontractor #2 Reimbursable Costs	Major Subcontractor #3 Reimbursable Costs	Major Subcontractor #4 Reimbursable Costs	Commission Reimbursable Totals	Match Funding Totals	Grand Totals
	NRG Energy	UC San Diego	Strategen	Olivine	Solarrus			
Direct Labor		$ 174,242.00	$ 134,672.00	$ 164,883.00	$ 113,723.00	**$ 587,520.00**	**$ 286,374.00**	**$ 873,894.00**
Fringe Benefits		$ 44,626.00	$ 54,498.00	$ 26,381.00	$ 5,118.00	**$ 130,623.00**	**$ 88,773.00**	**$ 219,396.00**
Travel	$ 50,000.00		$ 4,875.00	$ 12,170.00		**$ 67,045.00**	**$ 40,740.00**	**$ 107,785.00**
Equipment			$ -		$ 24,745.00	**$ 24,745.00**	**$ 179,730.00**	**$ 204,475.00**
Materials/ Misc.	$ 50,000.00	$ 26,415.00	$ -	$ 77,000.00	$ 14,522.00	**$ 167,937.00**	**$ 135,000.00**	**$ 302,937.00**
Minor Subcontractors*	$ 106,381.00		$ 5,000.00		$ 23,500.00	**$ 134,881.00**	**$ 482,000.00**	**$ 616,881.00**
Total Direct	**$ 206,381.00**	**$ 245,283.00**	**$ 199,045.00**	**$ 280,434.00**	**$ 181,608.00**	**$ 1,112,751.00**	**$ 1,212,617.00**	**$ 2,325,368.00**
Indirect Overhead		$ 54,717.00	$ 138,427.00	$ 23,083.00	$ 9,080.00	**$ 225,307.00**	**$ 14,146.00**	**$ 239,453.00**
General & Administrative			$ 46,153.00	$ 16,483.00	$ 41,770.00	**$ 104,406.00**	**$ 2,961.00**	**$ 107,367.00**
Profit**			$ 37,375.00		$ 15,811.00	**$ 53,186.00**		**$ 53,186.00**
Total Indirect	**$ -**	**$ 54,717.00**	**$ 221,955.00**	**$ 39,566.00**	**$ 66,661.00**	**$ 382,899.00**	**$ 17,107.00**	**$ 400,006.00**
Grand Total	**$ 206,381.00**	**$ 300,000.00**	**$ 421,000.00**	**$ 320,000.00**	**$ 248,269.00**	**$ 1,495,650.00**	**$ 1,229,724.00**	**$ 2,725,374.00**
Amount of funds to be Spent in California***	**$ 206,381.00**	**$ 300,000.00**	**$ 421,000.00**	**$ 320,000.00**	**$ 248,269.00**	**$ 1,495,650.00**		
Percentage of Funds to be spent in California	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**		

ATTACHMENT 7
Exhibit B
Att B-2 Category Summary

PLEASE SEE THE INSTRUCTIONS SHEET FOR DETAILED INFORMATION ON COMPLETING THIS FORM.
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NOTE: Cells will highlight red if the following conditions are not satisfied: Prime Recipient and Major Subcontractor Grand Totals must match the same totals in Att B-1; Match Funding Grand Totals must match those in Att B-1 and Att B-6; Project Grand Total must match that on B-1; Project percentage of funds going to CBEs and Project percentage of funds being spent in California must each be greater than or equal to 60%, without rounding; Pre-approved Travel totals must be greater than or equal to those in Att B-5; Equipment, Material(s)/Miscellaneous Costs, and Minor Subcontractors totals must equal those in Att B-5.
(*) A "Minor Subcontractor" is any subcontractor receiving less than $100,000 or 25% (whichever is less) of the Commission Funds.
(**) Subcontractor profit is allowable, though it may not exceed 10% of the subcontractor's project expenses.
(***) "Spent in California" means that:
(1) Funds in the "Direct Labor category and all categories calculated based on direct labor in the B-4 budget attachments (Prime and Subcontractor Labor Rates) are paid to individuals that pay California state income taxes on wages received for work performed under the agreement. Payments made to out-of-state workers do not count as “funds spent in California.” However, funds spent by out-of-state workers in California (e.g., hotel and food) can count as “funds spent in California.”; AND
(2) Business transactions (e.g., material and equipment purchases, leases, and rentals) are entered into with a business located in California.

ATTACHMENT 7

NRG Energy

Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)		Projected Hourly Unloaded Rates ($)* <If Contractor is a UC or DOE entity, salary identified will be unloaded Monthly>								Total Hours Worked
		From:	5/1/15	From:	1/1/16	From:	1/1/17	From:	1/1/18	
		To:	12/31/15	To:	12/31/16	To:	12/31/17	To:	3/31/18	
Name	Job Classification/Title	($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		
Fisher, Scott	Principal Investigator	$	95.00	$	97.85	$	100.79	$	103.81	784
De Leon, Nicole	Project Manager	$	60.00	$	60.00	$	60.00	$	60.00	3000

ATTACHMENT 7

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* Actual billable rates cannot exceed the rates specified in this exhibit.

* Rates listed must be unloaded rates (that is, before fringe benefits, overhead, G&A or Profit). These rates must reflect the highest salary or wage rate that is actually paid to the employee.

NOTE: Cells will highlight red if the following conditions are not satisfied: For each employee (including TBDs), you must enter a classification, at least one rate, and the Total Hours Worked. Any row that does not satisfy these three conditions will be highlighted red in the Total Hours Worked cell. Classifications must be given numeric rates and hours – responses such as "TBD" are not allowed.

ATTACHMENT 7

UC San Diego

Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)		Projected Hourly Unloaded Rates ($)* <If Subcontractor is a UC or DOE entity, salary identified will be unloaded Monthly>								Total Hours Worked
		From:	5/1/15	From:	1/1/16	From:	1/1/17	From:	1/1/18	
		To:	12/31/15	To:	12/31/16	To:	12/31/17	To:	3/31/18	
Name	Job Classification/Title	($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		
Washom, Byron	Director	$	94.64	$	99.36	$	95.63	$	95.63	575
TBN	Alternative Transportation Director	$	63.22	$	66.38	$	63.89	$	63.89	608
Norris, Kevin	Associate Engineer	$	39.63	$	41.61	$	40.05	$	40.05	683
TBN	Grad Student	$	18.16	$	19.61	$	18.82	$	18.82	3132
TBN	Grad Student	$	6.05	$	6.54	$	7.06	$	7.06	3132

ATTACHMENT 7

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* Rates listed must be unloaded rates (that is, before fringe benefits, overhead, G&A or Profit). These rates must reflect the highest salary or wage rate that is actually paid to the employee.

NOTE: Cells will highlight red if the following conditions are not satisfied: For each employee (including TBDs), you must enter a classification, at least one rate, and the Total Hours Worked. Any row that does not satisfy these three conditions will be highlighted red in the Total Hours Worked cell. Classifications must be given numeric rates and hours – responses such as "TBD" are not allowed.

Unhide additional subcontractor worksheets as necessary.

ATTACHMENT 7

Strategen

Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)		Projected Hourly Unloaded Rates ($)* <If Subcontractor is a UC or DOE entity, salary identified will be unloaded Monthly>								Total Hours Worked
		From:	5/1/15	From:	1/1/16	From:	1/1/17	From:	1/1/18	
		To:	12/31/15	To:	12/31/16	To:	12/31/17	To:	3/31/18	
Name	Job Classification/Title	($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		
Damato, Giovanni R	Senior Manager	$	82.61	$	86.74	$	91.08	$	95.63	820
Edgett, Christopher S	Senior Director	$	128.00	$	134.40	$	141.12	$	148.18	0
Herter, John E	Senior Associate	$	55.44	$	58.21	$	61.12	$	64.18	285
Higgins, Mark	Senior Director	$	128.00	$	134.40	$	141.12	$	148.18	120
Lin, Janice T	Senior Partner	$	141.30	$	148.37	$	155.78	$	163.57	159
Coggins, Amanda	Associate	$	41.10	$	43.16	$	45.31	$	47.58	115
Christensen, Cedric	Director	$	69.31	$	72.78	$	76.41	$	80.23	46
Randy Fish	Senior Analyst	$	33.07	$	34.72	$	36.46	$	38.38	0

ATTACHMENT 7

PLEASE SEE THE INSTRUCTIONS SHEET FOR DETAILED INFORMATION ON COMPLETING THIS FORM.
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* Actual billable rates cannot exceed the rates specified in this exhibit.

* Rates listed must be unloaded rates (that is, before fringe benefits, overhead, G&A or Profit). These rates must reflect the highest salary or wage rate that is actually paid to the employee.

NOTE: Cells will highlight red if the following conditions are not satisfied: For each employee (including TBDs), you must enter a classification, at least one rate, and the Total Hours Worked. Any row that does not satisfy these three conditions will be highlighted red in the Total Hours Worked cell. Classifications must be given numeric rates and hours – responses such as "TBD" are not allowed.

Unhide additional subcontractor worksheets as necessary.

ATTACHMENT 7

Olivine

Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)		Projected Hourly Unloaded Rates ($)* <If Subcontractor is a UC or DOE entity, salary identified will be unloaded Monthly>								Total Hours Worked
		From:	5/1/15	From:	1/1/16	From:	1/1/17	From:	1/1/18	
		To:	12/31/15	To:	12/31/16	To:	12/31/18	To:	3/31/18	
Name	Job Classification/Title	($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		
Beth Reid	Principal/CEO	$	110.00	$	110.00	$	110.00	$	110.00	250
Robert Anderson	Principal/CTO	$	105.00	$	105.00	$	105.00	$	105.00	580
Spence Gerber	Sr. Consultant/SME	$	75.00	$	80.25	$	80.25	$	85.87	560
Erich Huffaker	Project Specialist	$	40.00	$	42.80	$	42.80	$	45.80	420
TBD	Project Specialist		$ 40.00		$ 42.80		$ 42.80		$ 45.80	200

ATTACHMENT 7

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If the budget forms are not filled out completely your bid/proposal may be rejected.

* Actual billable rates cannot exceed the rates specified in this exhibit.

* Rates listed must be unloaded rates (that is, before fringe benefits, overhead, G&A or Profit). These rates must reflect the highest salary or wage rate that is actually paid to the employee.

NOTE: Cells will highlight red if the following conditions are not satisfied: For each employee (including TBDs), you must enter a classification, at least one rate, and the Total Hours Worked. Any row that does not satisfy these three conditions will be highlighted red in the Total Hours Worked cell. Classifications must be given numeric rates and hours – responses such as "TBD" are not allowed.

Unhide additional subcontractor worksheets as necessary.

Exhibit B
Att B-3d Sub #4 Labor Rates

Solarrus

Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)		Projected Hourly Unloaded Rates ($)* <If Subcontractor is a UC or DOE entity, salary identified will be unloaded Monthly>								Total Hours Worked
		From:	5/1/15	From:	1/1/16	From:	1/1/17	From:	1/1/18	
		To:	12/31/15	To:	12/31/16	To:	12/31/17	To:	3/31/18	
Name	Job Classification/Title	($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		($) Unloaded Maximum Rate		
TBN	Electrician	$	27.50	$	27.50					1110
TBN	Engineering Support (PE, CAD Design, Onsite)	$	150.00	$	150.00					97
TBN	Admin Support	$	120.00	$	120.00					20
TBN	Project Manager	$	57.00	$	57.00					158
TBN	Service Technician					$	32.00	$	32.00	650
TBN	Senior Trainer					$	55.00			280
TBN	Junior Trainer					$	44.00			280

Exhibit B
Att B-3d Sub #4 Labor Rates

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If the budget forms are not filled out completely your bid/proposal may be rejected.

* Actual billable rates cannot exceed the rates specified in this exhibit.

* Rates listed must be unloaded rates (that is, before fringe benefits, overhead, G&A or Profit). These rates must reflect the highest salary or wage rate that is actually paid to the employee.

NOTE: Cells will highlight red if the following conditions are not satisfied: For each employee (including TBDs), you must enter a classification, at least one rate, and the Total Hours Worked. Any row that does not satisfy these three conditions will be highlighted red in the Total Hours Worked cell. Classifications must be given numeric rates and hours – responses such as "TBD" are not allowed.

Unhide additional subcontractor worksheets as necessary.

ATTACHMENT 7

NRG Energy

Percentage Rates for Non-Labor Categories*

Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)				Fringe Benefits (FB)	Indirect Overhead (IOH)	General & Administrative (GA)
From:	5/1/15	To:	12/31/15	23.83%	0.00%	0.00%
From:	1/1/16	To:	12/31/16	23.83%	0.00%	0.00%
From:	1/1/17	To:	12/31/17	23.83%	0.00%	0.00%
From:	1/1/18	To:	3/31/18	23.83%	0.00%	0.00%
From:		To:				

Base Calculation for Non-Labor Categories

Non-Labor Rate Category	Check the budget expense items to which the indirect costs or fees are applied. Use the following abbreviations: DL = Direct Labor, FB = Fringe Benefits, M = Materials/ Miscellaneous, EQ = Equipment, T = Travel, S = Subcontracts, IOH = Indirect Overhead, GA = General & Administrative								
	Base Calculation	DL	M	EQ	T	S	FB	IOH	GA
Fringe Benefits	DL	☑	☐	☐	☐	☐			
Indirect Overhead		☐	☐	☐	☐	☐	☐		☐
General & Administrative		☐	☐	☐	☐	☐	☐	☐	
Additional Notes**	<This section is for Government Entities Only>								

Items Included in Non-Labor Categories

List **items** you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote.
Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, Part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state and local governments, Indian tribes, institutions of higher education, and nonprofit organizations).

Fringe Benefits	Indirect Overhead	General & Administrative
Long Term Disability Insurance		
Medical Insurance		
Dental Insurance		
401k match		
Vacation		

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If the budget forms are not filled out completely your bid/proposal may be rejected.

(*) Actual billable rates cannot exceed the rates specified in this exhibit.
(**) Additional Notes apply to Government Entities Only. In this section, enter any additional comments on base calculations and overhead. For example: if FB is applied to only the first $25K of a subcontract, then you should select the Subcontract box for Fringe Benefits, and make a note in the Additional Notes section indicating that this applies only to the first $25K.

NOTE: If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.
.

ATTACHMENT 7

UC San Diego

Percentage Rates for Non-Labor Categories*							
Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)				**Fringe Benefits (FB)**	**Indirect Overhead (IOH)**	**General & Administrative (GA)**	**Profit****
From:	5/1/15	To:	12/31/15	44.70%	25.00%	0.00%	0.00%
From:	1/1/16	To:	12/31/16	44.70%	25.00%	0.00%	0.00%
From:	1/1/17	To:	12/31/17	44.70%	25.00%	0.00%	0.00%
From:	1/1/18	To:	3/31/18	44.70%	25.00%	0.00%	0.00%
From:		To:					

Base Calculation for Non-Labor Categories									
Non-Labor Rate Category	Check the budget expense items to which the indirect costs or fees are applied. Use the following abbreviations: DL = Direct Labor, FB = Fringe Benefits, M = Materials/ Miscellaneous, EQ = Equipment, T = Travel, S = Subcontracts, IOH = Indirect Overhead, GA = General & Administrative								
	Base Calculation	DL	M	EQ	T	S	FB	IOH	GA
Fringe Benefits	DL	☑	☐	☐	☐	☐			
Indirect Overhead	DL+FB	☑	☐	☐	☐	☐	☑		☐
General & Administrative		☐	☐	☐	☐	☐	☐	☐	
Profit		☐	☐	☐	☐		☐	☐	☐
Additional Notes***	<This section is for Government Entities Only>								

Items Included in Non-Labor Categories

List **items** you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote.
Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, Part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state and local governments, Indian tribes, institutions of higher education, and nonprofit organizations).

Fringe Benefits	Indirect Overhead	General & Administrative
Old Age, Survivors, and Disability Insurance	OMB Circular A-21	
Medicare		
Retirement Plan		
Workers Compensation		
Unemployment		
Health/Dental/Optical Insurance		
Life Insurance		
Non-Industrial Disability Insurance		

PLEASE SEE THE INSTRUCTIONS SHEET FOR DETAILED INFORMATION ON COMPLETING THIS FORM.
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(*) Actual billable rates cannot exceed the rates specified in this exhibit.

(**) Subcontractor profit is allowable, though it may not exceed 10% of the subcontractor's project

(***) Additional Notes apply to Government Entities Only. In this section, enter any additional comments on base calculations and overhead. For example: if FB is applied to only the first $25K of a subcontract, then you should select the Subcontract box for Fringe Benefits, and make a note in the Additional Notes section indicating that this applies only to the first $25K.

NOTE: If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.

ATTACHMENT 7

Strategen

Percentage Rates for Non-Labor Categories*							
Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)				**Fringe Benefits (FB)**	**Indirect Overhead (IOH)**	**General & Administrative (GA)**	**Profit****
From:	5/1/15	To:	12/31/15	37.40%	69.92%	13.46%	10.00%
From:	1/1/16	To:	12/31/16	40.57%	73.50%	14.13%	10.00%
From:	1/1/17	To:	12/31/17	44.62%	77.18%	14.84%	10.00%
From:	1/1/18	To:	3/31/18	49.09%	81.03%	15.58%	10.00%
From:		To:					

Base Calculation for Non-Labor Categories									
Non-Labor Rate Category	Check the budget expense items to which the indirect costs or fees are applied. Use the following abbreviations: DL = Direct Labor, FB = Fringe Benefits, M = Materials/ Miscellaneous, EQ = Equipment, T = Travel, S = Subcontracts, IOH = Indirect Overhead, GA = General & Administrative								
	Base Calculation	DL	M	EQ	T	S	FB	IOH	GA
Fringe Benefits	DL	☑	☐	☐	☐	☐			
Indirect Overhead	DL+FB	☑	☐	☐	☐	☐	☑		☐
General & Administrative	DL+FB+IOH	☑	☐	☐	☐	☐	☑	☑	
Profit	DL+FB+IOH+GA	☑	☐	☐	☐		☑	☑	☑
Additional Notes***	<This section is for Government Entities Only>								

Items Included in Non-Labor Categories

List **items** you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote.
Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, Part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state and local governments, Indian tribes, institutions of higher education, and nonprofit organizations).

Fringe Benefits	Indirect Overhead	General & Administrative
Long Term Disability Insurance	Unreimbursed subcontractors	Bank Service Charges
Medical Insurance	Unreimbursed project expenses	Business License & Fees
Dental Insurance	Management overhead labor	Insurance
401k match	Marketing Overhead labor	Payroll Service Fees
Vacation	ncompensated Proposal writing lab	Business Development
Holiday	Professional development labor	Postage and Delivery
Sick time	Website project management labor	Printing and Reproduction
Workers compensation Insurance	Budgeting labor	Professional Development
	Operations labor	Rent
	Human Resources labor	Office Supplies
		Phone, internet & software
		Professional fees
		Accounting

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(*) Actual billable rates cannot exceed the rates specified in this exhibit.
(**) Subcontractor profit is allowable, though it may not exceed 10% of the subcontractor's project expenses.
(***) Additional Notes apply to Government Entities Only. In this section, enter any additional comments on base calculations and overhead. For example: if FB is applied to only the first $25K of a subcontract, then you should select the Subcontract box for Fringe Benefits, and make a note in the Additional Notes section indicating that this applies only to the first $25K.

NOTE: If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.

ATTACHMENT 7

Olivine

Percentage Rates for Non-Labor Categories*							
Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)				**Fringe Benefits (FB)**	**Indirect Overhead (IOH)**	**General & Administrative (GA)**	**Profit****
From:	5/1/15	To:	12/31/15	16.00%	14.00%	10.00%	0.00%
From:	1/1/16	To:	12/31/16	16.00%	14.00%	10.00%	0.00%
From:	1/1/17	To:	12/31/17	16.00%	14.00%	10.00%	0.00%
From:	1/1/18	To:	3/31/18	16.00%	14.00%	10.00%	0.00%
From:		To:					

Base Calculation for Non-Labor Categories									
Non-Labor Rate Category	Check the budget expense items to which the indirect costs or fees are applied. Use the following abbreviations: DL = Direct Labor, FB = Fringe Benefits, M = Materials/ Miscellaneous, EQ = Equipment, T = Travel, S = Subcontracts, IOH = Indirect Overhead, GA = General & Administrative								
	Base Calculation	DL	M	EQ	T	S	FB	IOH	GA
Fringe Benefits	DL	☑	☐	☐	☐	☐			
Indirect Overhead	DL	☑	☐	☐	☐	☐	☐		☐
General & Administrative	DL	☑	☐	☐	☐	☐	☐	☐	
Profit		☐	☐	☐	☐		☐	☐	☐
Additional Notes***	<This section is for Government Entities Only>								

Items Included in Non-Labor Categories		
List **items** you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote. Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, Part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state and local governments, Indian tribes, institutions of higher education, and nonprofit organizations).		
Fringe Benefits	Indirect Overhead	General & Administrative
Health & dental insurance	Non-billable project support	Office lease
Vacation and sick days	Shared IT Costs	Utilities
		General accounting
		Insurance
		Non-billable executive salary

PLEASE SEE THE INSTRUCTIONS SHEET FOR DETAILED INFORMATION ON COMPLETING THIS FORM.
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(*) Actual billable rates cannot exceed the rates specified in this exhibit.
(**) Subcontractor profit is allowable, though it may not exceed 10% of the subcontractor's project expenses.
(***) Additional Notes apply to Government Entities Only. In this section, enter any additional comments on base calculations and overhead. For example: if FB is applied to only the first $25K of a subcontract, then you should select the Subcontract box for Fringe Benefits, and make a note in the Additional Notes section indicating that this applies only to the first $25K.

NOTE: If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.

ATTACHMENT 7
Exhibit B
Att B-4d Sub#4 Non-Labor Rates

Solarrus

Percentage Rates for Non-Labor Categories*							
Time intervals from the start of the project through the Contract Term End Date. (Use your organization's Fiscal Year start / end dates.)				**Fringe Benefits (FB)**	**Indirect Overhead (IOH)**	**General & Administrative (GA)**	**Profit**
From:	5/1/15	To:	12/31/15	4.50%	5.00%	23.00%	10.00%
From:	1/1/16	To:	12/31/16	4.50%	5.00%	23.00%	10.00%
From:	1/1/17	To:	12/31/17	4.50%	5.00%	23.00%	10.00%
From:	1/1/18	To:	3/31/18	4.50%	5.00%	23.00%	10.00%
From:		To:					

Base Calculation for Non-Labor Categories									
Non-Labor Rate Category	Check the budget expense items to which the indirect costs or fees are applied. Use the following abbreviations: DL = Direct Labor, FB = Fringe Benefits, M = Materials/ Miscellaneous, EQ = Equipment, T = Travel, S = Subcontracts, IOH = Indirect Overhead, GA = General & Administrative								
	Base Calculation	DL	M	EQ	T	S	FB	IOH	GA
Fringe Benefits	DL	☑	☐	☐	☐	☐			
Indirect Overhead	DL+M+EQ+S+FB	☑	☑	☑	☐	☑	☑		☐
General & Administrative	DL+M+EQ+S+FB	☑	☑	☑	☐	☑	☑	☐	
Profit	DL+M+EQ+FB	☑	☑	☑	☐		☑	☐	☐
Additional Notes**	<This section is for Government Entities Only>								

Items Included in Non-Labor Categories

List **items** you include in each non-labor category (e.g., vacation, 401K plan, telephone, rent/lease, insurance). **Clearly describe** each item. **Do not**: (1) use vague descriptions; (2) use acronyms; (3) use "etc.", "for example", or "such as"; (4) repeat items within columns; or (5) include rate calculations. If an explanation of an item is required, include it in a footnote.
Some items may be **prohibited**, such as: (1) food; (2) beverages; and (3) printing expenses other than in-house expenses. Please refer to the following federal cost principles for guidance regarding allowable expenses: 48 Code of Federal Regulations (CFR) Chapter 1, Subchapter E, Part 31, Subpart 31.2 (commercial organizations) and 2 CFR Part 200, Subpart E (Sections 200.400 et. seq.) (state and local governments, Indian tribes, institutions of higher education, and nonprofit organizations).

Fringe Benefits	Indirect Overhead	General & Administrative
Long Term Disability Insurance	Unreimbursed project expenses	Bank Service Charges
Medical Insurance	Management overhead labor	Business License & Fees
Dental Insurance	Professional development labor	Insurance
401k match		Payroll Service Fees
Vacation		Business Development
Holiday		Postage and Delivery
Sick time		Printing and Reproduction
Workers compensation Insurance		Professional Development
		Rent
		Office Supplies
		Phone, internet & software
		Professional fees
		Accounting

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(*) Actual billable rates cannot exceed the rates specified in this exhibit.
(**) Additional Notes apply to Government Entities Only. In this section, enter any additional comments on base calculations and overhead. For example: if FB is applied to only the first $25K of a subcontract, then you should select the Subcontract box for Fringe Benefits, and make a note in the Additional Notes section indicating that this applies only to the first $25K.

NOTE: If the Base Calculation cells turn red, you have entered an invalid circular reference between IOH and GA. IOH is used as a base for GA, which is in turn used as a base for IOH. This will invalidate the budget workbook. Do not proceed if the Base Calculation cells are highlighted red.

ATTACHMENT 7

Pre-approved Travel List *								
Task No.	Prime / Sub Name	Trip #	Who	Departure and Destination	Trip Purpose	Amount Commission Funds	Amount Match Funds	
2	*Prime*	*2-1*	***Bob Williams & Jane Condor***	*Los Angeles to Sacramento*	***Kickoff Meeting***	*$ 100.00*		**EXAMPLE**
3	*UC Berkeley*	*e*	***Principal Investigator & Research Assistant***	*Los Angeles to Mobile, AL*	***Four trips for PAC Meetings @ $300 per trip***	*$ 1,200.00*		**EXAMPLE**
1	NRG Energy	*9*	***PI & NRG Employees***	Newark, NJ to San Diego	3person x Annual Meetings (3 years)	$ 7,200.00	$ 6,826.00	
10	NRG Energy	*3*	***PI***	Newark, NJ to San Diego	3persons x Conference Attendance	$ 2,500.00	$ 2,272.00	
1	NRG Energy	*3*	***PI***	Newark, NJ to San Diego	3persons x TAC Meeting	$ 2,500.00	$ 2,272.00	
3	NRG Energy	*4*	***UD Techs***	Philadelphia to San Diego	2techs x 2trips UD Tech Intigration	$ 3,130.00	$ 3,130.00	
10	NRG Energy	*6*	***CO PI & Student***	Philadelphia to San Diego	2persons x Annual Conference Attendance (3 years)	$ 4,645.00	$ 4,800.00	
3	NRG Energy	*3*	***UD Techs***	Philadelphia to San Diego	UD Trouble Shooting Trips	$ 2,373.00	$ 2,400.00	
1	NRG Energy	*2*	***Grad Student***	Philadelphia to San Diego	UCSD Site Trip	$ 1,615.00	$ 1,600.00	
1	NRG Energy	*15*	***5 TAC Members***	Flights w/in California	Technical Advisory Committee Annual Meetings (3 years)	$ 12,401.00	$ 6,000.00	
2	NRG Energy	*6*	***Janice Lin, Giovanni Domato***	San Francisco to San Diego	Strategen Annual Travel	$ 4,545.00	$ 2,400.00	
10	NRG Energy	*6*	***Janice Lin, Giovanni Domato***	Flights w/in California	Strategen Conference Attendance	$ 4,545.00	$ 2,000.00	
2	NRG Energy	*3*	***Strategen***	Flights w/in California	Strategen travel for Interviews	$ 4,546.00	$ 3,500.00	
5	Olivine	*2*	***Beth Reid***	San Ramon to Sacramento	Trip to CAISO	$ 1,516.00		
	Olivine	*1*	***Beth Reid***	San Ramon to San Diego	Trip to UCSD	$ 758.00	$ 400.00	
	Olivine	*2*	***Beth Reid, Robert Anderson***	San Francisco to San Diego	Trip to UCSD	$ 1,516.00	$ 800.00	
5	Olivine	*4*	***Beth Reid, Robert Anderson***	San Ramon to Sacramento	4 trips to CAISO	$ 3,032.00		
	Olivine	*2*	***Beth Reid, Robert Anderson***	San Francisco to San Diego	One week at UCSD	$ 3,075.00	$ 740.00	
2	Olivine	*2*	***Beth Reid, Robert Anderson***	Flights w/in California	Olivine travel for Interviews	$ 2,273.00	$ 1,600.00	
					Total:	$ 62,170.00	$ 40,740.00	

* Travel is reimbursed at state rates.

Equipment**							
Task No.	Prime / Sub Name	Description	Purpose	# Units	Unit Cost	Amount Commission Funds	Amount Match Funds
6	NRG Energy	Princeton Power Inverters	EVSE Charging Station	9	$ 15,000.00		$ 135,000.00
6	NRG Energy	IKS Inverters	EVSE Charging Station	1	$ 44,730.00		$ 44,730.00
6	Solarrus	Electrical Switchgear	Site Installation	1	$ 17,245.00	$ 17,245.00	
6	Solarrus	Electrical Transformer	Site Installation	1	$ 7,500.00	$ 7,500.00	
					Total:	$24,745	$179,730

** Equipment is defined as having an acquisition unit cost of at least $5,000. See instructions for more details.

Material(s)/ Miscellaneous Costs							
Task No.	Prime / Sub Name	Description	Purpose	# Units	Unit Cost	Amount Commission Funds	Amount Match Funds
1	NRG Energy	Meeting Facilities	Meetings	multi	$ 50,000.00	$ 50,000.00	
1	NRG Energy	University of Delaware UL Listing	Compliance	1	$ 100,000.00		$ 100,000.00
5	Olivine	CAISO Operating Expense	Market Participation	multi	$ 112,000.00	$ 77,000.00	$ 35,000.00
6	Solarrus	Bulk Material	Conduit, Wire, Fasteners	multi	$ 14,522.00	$ 14,522.00	
10	UCSD	Graduate Student Remission	Grad Student	1	$ 26,415.00	$ 26,415.00	$ -
					Total:	$ 167,937.00	$135,000

Minor Subcontractors							
Task No.	Subcontractor Legal Name	Purpose	Company Types * DVBE	SB	MB	Amount Commission Funds	Amount Match Funds
8	AESC	Measurement & Verification				$ 98,681.00	
6	Emerson Electric	Electrical Permit & Site Inspection				$ 7,700.00	
3 & 4	University of Delaware	Technical Integration					$ 250,000.00
1	Technical Advisory Committee	CEC Requirement					$ 60,000.00
10	GridScape	Website Coding		Yes		$ 5,000.00	$ -
6	Howard Construction	Civil & Underground		Yes		$ 23,500.00	
2 & 8	OSIsoft	visualization of microgrid & EV storage operations					$ 172,000.00
					Total:	$134,881	$482,000

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ATTACHMENT 7

NOTE: Cells will highlight red if the following conditions are not satisfied: Pre-approved Travel totals must be less than or equal to those in Att B-2; Equipment, Material(s)/Miscellaneous Costs, and Minor Subcontractors totals must equal those in Att B-2; In Equipment and Material(s)/Miscellaneous sections, the amounts listed under Commision Funds and Match Funds must add up to the product of the Unit # and Unit Cost - **rounded up to the nearest whole dollar** - for each item. For example, if an equipment item is listed with 3 units and a $1.50 unit cost, then the Commission and Match Funds listed for this item must add up to $5.00. 3 x $1.50 = $4.50, which rounds up to $5.00.

(*) Indicate which of these categories apply to each minor subcontractor by selecting 'Yes' from the dropdown menu. If the category does not apply, you may either select 'No' or leave it blank. The categories are Disabled Veteran Business Enterprise (DVBE), certified Small Business (SB), and Micro-Business (MB). Refer to the Instructions page for explanation and definition of each company type.

ATTACHMENT 7

Task Match Funding Budget		Match Contributor #1	Match Contributor #2	Match Contributor #3	Match Funding Totals
	Contributor Name:	NRG Energy	UC San Diego	Olivine	
1.0	General Project Tasks	$ 372,994.00			**$ 372,994**
2.0	Business Model for CPUC Use Case #4: Bi-directional Power Flow		$ 86,000.00	$ 45,000.00	**$ 131,000**
3.0	Technical Integration	$ 225,000.00			**$ 225,000**
4.0	Product Development	$ 100,000.00			**$ 100,000**
5.0	Prove Viability of EV Storage			$ 35,000.00	**$ 35,000**
6.0	Site Work	$ 179,730.00	$ 50,000.00		**$ 229,730**
7.0	Interconnection				**$ -**
8.0	Analysis		$ 86,000.00		**$ 86,000**
9.0	Evaluation of Project Benefits				**$ -**
10.0	Technology / Knowledge Transfer Activities				**$ -**
11.0	Production Readiness Plan	$ 50,000.00			**$ 50,000**
	Grand Totals	**$ 927,724**	**$ 222,000**	**$ 80,000**	**$ 1,229,724**

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NOTE: Cells will highlight red if the following conditiones are not satisfied: The Match Funding Grand Total must equal those from Att B-1 and Att B-2.

ATTACHMENT 7

Company		DL+FB	Total Indirect	DL+FB+Total Indirect	(DL+FB)/(DL+FB+Total Indirect)
Prime	NRG Energy	$ -	$ -	$ -	
Major Sub #1	UC San Diego	$ 218,868.00	$ 54,717.00	$ 273,585.00	0.8
Major Sub #2	Strategen	$ 189,170.00	$ 221,955.00	$ 411,125.00	0.460127698
Major Sub #3	Olivine	$ 191,264.00	$ 39,566.00	$ 230,830.00	0.828592471
Major Sub #4	Solarrus	$ 118,841.00	$ 66,661.00	$ 185,502.00	0.640645384
		$ 718,143.00	$ 382,899.00	$ 1,101,042.00	2.73
Average Team (DL+FB)/(DL+FB+Total Indirect)			**0.682**		
Team Score (Out of 5)			**3.412**		

ATTACHMENT 8
California Environmental Quality Act (CEQA) Compliance Form

All applicants must complete and sign this form, regardless of whether the proposed activity is considered a "project" as defined below.

The California Environmental Quality Act (CEQA) (Public Resources Code §§ 21000 et seq.) requires public agencies to identify the significant environmental impacts of their actions and to avoid or mitigate them, if feasible.[1] Under CEQA, an activity that may cause either a direct or reasonably foreseeable indirect physical change in the environment is called a **"project."**[2] Approval of a contract, grant, or loan may be a "project" under CEQA if the activity being funded may cause a direct or reasonably foreseeable indirect physical change in the environment. Agencies must comply with CEQA before they approve a "project." This may require preparing one or more of the following documents:

- A Notice of Exemption (if the project is exempt from CEQA);[3]
- An Initial Study (if the project may have a significant effect on the environment);[4]
- A Negative Declaration (if the Initial Study shows that the project will not have a significant effect on the environment) or a Mitigated Negative Declaration (if any significant effects identified by the Initial Study can be avoided or mitigated to a level of insignificance);[5] or
- An Environmental Impact Report (if there is substantial evidence that the project will have significant effects).[6]

The **Lead Agency** is the public agency that has the greatest responsibility for preparing environmental documents under CEQA, and for carrying out, supervising, or approving a project. Where the award recipient is a public agency, the Lead Agency is typically the recipient. Where the award recipient is a private entity, the Lead Agency is the public agency that has greatest responsibility for supervising or approving the project as a whole.[7] When issuing contracts, grants, or loans, the Energy Commission is typically a **"Responsible Agency"** under CEQA, which means that it must make its own CEQA findings based on review of the Lead Agency's environmental documents. If the Energy Commission is the only public agency with responsibility for approving the project, then the Energy Commission must act as the Lead Agency and prepare its own environmental documents before approving the project.

This form will help the Energy Commission determine what type of CEQA review, if any, is necessary before it can approve the award, and which agency will perform that review as Lead Agency. It may also help to the applicant determine the CEQA process necessary for the proposed project. Please answer all questions as completely as possible. The Energy Commission may request additional information in order to clarify responses provided on this form.

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[1] For a brief summary of the CEQA process, visit http://ceres.ca.gov/ceqa/summary.html.
[2] California Public Resources Code § 21065.
[3] 14 California Code of Regulations (CCR) §§ 15061 and 15062.
[4] 14 CCR § 15063.
[5] 14 CCR §§ 15070 et seq.
[6] 14 CCR §§ 15080 et seq.
[7] 14 CCR §§ 15050 and 15051. The Lead Agency typically has general governmental powers (such as a city or county), rather than a single or limited purpose (such as an air pollution control district).

ATTACHMENT 8
California Environmental Quality Act (CEQA) Compliance Form

1. What are the physical aspects of the project? (Check all that apply and provide a brief description of work, including the size or dimensions of the project).

Type of Project	Yes	No	Project Description
Construction (including grading, paving, etc.)	☐	☒	No grading or paving as part of installation of EV chargers
Trenching	☒	☐	Some trenching is planned as part of installation of EV chargers
New or replaced pipelines	☐	☒	No pipeline replacement as part of installation of EV chargers
Modification or conversion of a facility	☒	☐	Exchange of some existing EV chargers for upgraded EV chargers – disconnection/reconnection of circuits and mounting of hardware in parking areas
New or modified operation of a facility or equipment	☐	☒	Physical installation of EV chargers in existing parking lots and parking structures
On-road demonstration	☐	☒	All work confined to existing parking lots and structures
Paper study (including analyses on economics, feedstock availability, workforce availability, etc.)	☐	☒	Physical installation of EV chargers in existing parking lots and parking structures
Laboratory research	☐	☒	Physical installation of EV chargers in existing parking lots and parking structures
Temporary or mobile structures (skid-mounted)	☐	☒	Physical installation of permanent EV chargers in existing parking lots and parking structures
Design/Planning	☐	☒	Physical installation of EV chargers in existing parking lots and parking structures
Other (describe and add pages as necessary)	☒	☐	Physical installation of EV chargers in existing parking lots and parking structures

2. Where is the project located or where will it be located? (Attach additional sheets as necessary.)

Street Address	City/ County	Type of Work to Be Completed at Site
UC San Diego 9500 Gilman Drive	La Jolla, CA	Physical installation of EV chargers in existing parking lots and parking structures. Electrical panels installed in existing electric rooms or at location of existing electrical facilities; dedicated circuits provided for each EV charger, conduit run (surface mounted in parking garage/use of existing conduit in parking lots), mounting of EV chargers on ground and walls.
Pangea Parking Structure	La Jolla, CA	Installation of two ground-mounted bi-directional electric vehicle charging stations in existing parking structure.
P703 South	La Jolla, CA	Installation of two ground-mounted bi-

		directional electric vehicle charging stations in existing parking lot.
Scripps Forum	8610 Kennel Way, La Jolla, CA 92037	Installation of one bi-directional electric vehicle charging station.
Trade Street Warehouse	7835 Trade St., Suite 100, San Diego 92121	Installation of one bi-directional electric vehicle charging station.
Birch Aquarium	2300 Expedition Way, La Jolla, CA 92037	Installation of one bi-directional electric vehicle charging station.
Mail Room	La Jolla, CA	Installation of one bi-directional electric vehicle charging station.
Police Station	La Jolla, CA	Installation of one bi-directional electric vehicle charging station.

3. Will the project potentially have environmental impacts that trigger CEQA review? (Check a box and explain for each question.)

Question	Yes	No	Unsure	Explanation
Is the project site environmentally sensitive?	☐	☒	☐	All physical installation work will occur in existing parking structures, parking lots, or electrical rooms. There will be no disturbance of any natural areas directly or indirectly.
Is the project site on agricultural land?	☐	☒	☐	All physical installation work will occur in existing parking structures, parking lots, or electrical rooms.
Is this project part of a larger project?	☐	☒	☐	This is a standalone project.
Is there public controversy about the proposed project or larger project?	☐	☒	☐	The project is to install standard electrical vehicle chargers in existing parking structures and parking lots, and is not controversial in any way.
Will historic resources or historic buildings be impacted by the project?	☐	☒	☐	All locations for new EV chargers are newer than 50 years of age, and those in areas of structure that are approximately 50 years of age are simply replacement of existing older EV chargers with upgraded EV chargers.
Is the project located on a site	☐	☒	☐	No part of the UCSD campus

ATTACHMENT 8
California Environmental Quality Act (CEQA) Compliance Form

Question	Yes	No	Unsure	Explanation
the Department of Toxic Substances Control and the Secretary of the Environmental Protection have identified as being affected by hazardous wastes or cleanup problems?				is located on such a site**.**
Will the project generate noise or odors in excess of permitted levels?	☐	☒	☐	Electric Vehicle charging stations produce no odors, and very minimal noise (e.g. closing of contactors) typically less than existing ambient noise found in the built environment of parking lots and parking structures.
Will the project increase traffic at the site, and by what amount?	☐	☒	☐	Electric vehicle chargers are an ancillary facility and do not generate traffic.

4. Will the project require discretionary permits or determinations, as listed below?

Type of Permit	No	Modified	New	Approving Public Agency	Reason for Permit, Summary of Process, and Anticipated Date of Issuance
Air Quality Permit	☒	☐	☐		
Water Quality Permit	☒	☐	☐		
Conditional Use Permit or Variance	☒	☐	☐		
Building Expansion Permit	☒	☐	☐		
Hazardous Waste Permit	☒	☐	☐		
Rezoning	☒	☐	☐		
Authority to Construct	☒	☐	☐		
Other Permits (List types)	☒	☐	☐		

5. Of the agencies listed in #4, have you identified and contacted the agency that will be the lead CEQA agency on the project?

☒ **Yes**. Provide the name of and contact information for the lead agency.
University of California, San Diego
9500 Gillman Drive, La Jolla, CA
Catherine Presmyk, (858) 534-3860, CPresmyk@ucsd.edu

_____
_____
_____

☐ **No.** Explain why no contact has been made, and/or a proposed process for making contact with the lead agency.

_____
_____
_____
_____

6. Has the agency prepared environmental documents (e.g., Notice of Exemption, Initial Study/Negative Declaration/Mitigated Negative Declaration, Environmental Impact Report, Notice of Determination) under CEQA for the proposed project?

☒ **Yes**.
Please complete the following and attach the CEQA document to this worksheet. (For "Not a project," the title of the document may be an e-mail, resolution, or letter.)

Type of Environmental Review	**Title of Environmental Document**	**State Clearinghouse Number**	**Completion Date**	**Planned Completion Date (must be prior to approval of award)**
"Not a project"		N/A		N/A
Exempt (Resolution of public agency or Agenda Item approving Exemption)		N/A		N/A
Exempt (Notice of Exemption)		N/A		
Initial Study				
Negative Declaration				
Mitigated Negative Declaration				
Notice of Preparation				
Environmental Impact Report				
Master Environmental Impact Report				
Notice of Determination				
NEPA Document (Environmental Assessment, Finding of No Significant				

ATTACHMENT 8
California Environmental Quality Act (CEQA) Compliance Form

Type of Environmental Review	Title of Environmental Document	State Clearinghouse Number	Completion Date	Planned Completion Date (must be prior to approval of award)
Impact, and/or Environmental Impact Statement)[8]				

☐ **No**. Explain why no document has been prepared. Propose a process for obtaining lead agency approval and the estimated date for that approval (must occur before the Energy Commission will approve the award).

_____

_____

_____

Certification: I certify to the best of my knowledge that the information contained in this form is true and complete. I further certify that I am authorized to complete and sign this form on behalf of the proposing organization.

Name: _____

Title: _____

Signature: _____

Phone Number: _____

Email: _____

Date: _____

[8] For additional information about NEPA (the National Environmental Policy Act, 42 U.S.C. 4321 et seq.), see: http://www.epa.gov/compliance/basics/nepa.html.

UNIVERSITY OF CALIFORNIA **ENVIRONMENTAL IMPACT CLASSIFICATION**

Campus or Other Unit SAN DIEGO **Project Account No.** NA

Project Title Electric Vehicle Storage Accelerator

For purposes of compliance with the California Environmental Quality Act of 1970 (CEQA), and Amended University of California Procedures for implementation of CEQA, this project has been reviewed and initially classified as indicated below. Please check (X) as appropriate. Include project description and appropriate local map.

____ **I. EXEMPT FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT OF 1970**

When it can be seen with certainty that there is no possibility the action will result in physical change to the environment or the action is specifically exempted by statute, the project is classified as exempt from CEQA.

X II. CATEGORICALLY EXEMPT

This project falls under the indicated Class of Exemption 15300 and there is no significant effect on the environment:

- x Class 1: Existing Facilities
- ____ Class 2: Replacement or Reconstruction
- ____ Class 3: New Construction of Small Structures
- ____ Class 4: Minor Alterations to Land
- ____ Class 5: Minor Alterations in Land Use Limitations
- ____ Class 6: Information Collection
- ____ Class 7: Regulatory Protection of Natural Resources
- ____ Class 8: Regulatory Protection of the Environment
- ____ Class 9: Inspections
- ____ Class 10: Loans
- ____ Class 11: Accessory Structures
- ____ Class 12: Surplus Government Property Sales
- ____ Class 13: Acquisition for Wildlife Conservation
- ____ Class 14: Minor Additions to Schools
- ____ Class 15: Minor Land Divisions
- ____ Class 16: Transfer of Ownership of Land in Order to Create Parks
- ____ Class 17: Open Space Contracts or Easements
- ____ Class 18: Designation of Wilderness Areas
- ____ Class 19: Annexation of Existing Facilities and Lots
- ____ Class 20: Changes in Organization of Local Agencies
- ____ Class 21: Regulatory Enforcement Actions
- ____ Class 22: Educational or Training Programs Involving No Physical Changes
- ____ Class 23: Normal Operation of Facilities for Public Gatherings
- ____ Class 24: Regulations of Working Conditions
- ____ Class 25: Transfer of Interest in Land to Preserve Existing Natural Conditions …..
- ____ Class 26: Acquisition of Housing for Housing Assistance Programs
- ____ Class 27: Leasing New Facilities
- ____ Class 28: Small Hydroelectric Projects at Existing Facilities
- ____ Class 29: Cogeneration Projects at Existing Facilities
- ____ Class 30: Minor Actions to Prevent the Release of Hazardous Materials
- ____ Class 31: Historical Resource Restoration/Rehabitation
- ____ Class 32: In-Fill Development Projects

____ **III. INITIAL STUDY**

This project is not Exempt from CEQA or Categorically Exempt; an Initial Study is to be prepared to determine if the project may have a significant effect on the environment that has not been substantially and adequately analyzed in a certified program EIR.

____ **IV. ENVIRONMENTAL IMPACT REPORT (EIR)**

It is known that the project will have a significant effect on the environment and has not been adequately and substantially analyzed in a certified program EIR.

PROJECT DESCRIPTION

The project proposes to obtain funding from the California Energy Commission for the "Electric Vehicle (EV) Storage Accelerator" project. The goal of the project is to prove the bi-directional charging of electrical vehicles as a way to provide low-cost energy storage, as well as revenue to electrical vehicle owners. There would be a total of nine (9) bi-directional charging stations at seven (7) sites. Each bi-directional charging station comprises an isolation transformer, inverter, switches and control electronics. All charging stations would be mounted on a concrete pad on the ground. The number of charging stations and their locations would be as follows: 1) two (2) charging stations inside Pangea parking garage, 2) two (2) charging station within parking lot P703 located on the East Campus, 3) one (1) charging station in the parking lot adjacent to the Scripps Forum at the Scripps Institution of Oceanography (SIO) at 8610 Kennel Way, La Jolla, 4) one (1) charging station at the Trade Street Warehouse located at 7835 Trade Street, San Diego; 5) one (1) charging station at the Birch Aquarium parking lot at 2300 Expedition Way, La Jolla; 6) one (1) charging station adjacent to the mail room at the Campus Services Complex and 7) one (1) charging station would be installed adjacent to the UCSD Police Station

V. DOES THIS PROJECT CONFORM TO AN APPROVED LRDP? **X** Yes ____ No

VI.

Alison Buckley — Prepared by Alison Buckley — 11/12/14 Date

Catherine Presmyk — Approval by Catherine J. Presmyk — 11/12/14 Date

VII. OFFICE OF THE PRESIDENT COMMENT

____ Concur with Classification _____

____ Do not concur _____

_____ _____

Signed Date

FORM DATE 5/991 (form EIC

ATTACHMENT 9
Reference and Work Product Form

1a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _3_ for ☒ Recipient ☐ Subcontractor	
Name of Recipient/ Subcontractor	NRG Energy, Inc.
Name of Reference Firm/Organization	California Public Utilities Commission
Address (city, state, and zip code)	505 Van Ness Avenue San Francisco, CA 94102
Contact Name and Title	Adam Langton, Energy Regulatory Analyst
Contact Phone Number and Email Address	Phone: 415-703-1812 Email: adam.langton@cpuc.ca.gov
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	In 2012, NRG and the California Public Utilities Commission signed an agreement that committed NRG to invest $100 million in electric vehicle infrastructure in California. The agreement, which included an additional $20 million of cash from NRG, settled a lawsuit between several California state entities and a company that NRG acquired in 2006 for that company's actions during the California energy crisis (NRG assumed liability for the lawsuit upon acquisition). Among other goals, the calls for NRG's eVgo subsidiary to construct and operate at least 200 DC fast charging station (using both SAE Combo and CHAdeMO standards) and construct 10,000 "make ready" charging station stubs at California business and multi-family dwellings. NRG eVgo is currently in the middle of executing this 4 year agreement, which is scheduled to conclude in 2016.

ATTACHMENT 9
Reference and Work Product Form

Reference # _2_ of _3_ for ☒ Recipient ☐ Subcontractor	
Name of Recipient/ Subcontractor	NRG Energy, Inc.
Name of Reference Firm/Organization	PJM Interconnection
Address (city, state, and zip code)	1200 G Street NW, Suite 600 Washington, DC 20005
Contact Name and Title	Scott Baker, Sr. Business Solutions Engineer
Contact Phone Number and Email Address	Phone: 202-393-1078 Cell: 610-368-4365 Email: Scott.Baker@pjm.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	NRG is one of the largest power generation companies in the PJM Interconnection territory, which covers 13 states and over 50 million people. In 2011 NRG and PJM, with support from BMW, University of Delaware and others, committed to developing the world's first project where vehicles serve as an official market resource on a power grid. The resulting project came online in 2013 and is still operating successfully. Currently, approximately 20 BMW all-electric MINI Es and Honda Accord PHEVs are responding to PJM's frequency regulation signal, and earning revenues for doing so. In this project, PJM is not a customer of NRG's, but rather a partner. PJM had made several rule changes to allow for behind-the-meter storage projects to access ancillary service markets. NRG was the first and (only) company to access these markets through electric vehicles. The success of this project is a good illustration of NRG's commitment to setting – and subsequently achieving – a goal. NRG committed the necessary financial and human resources to making the project a success. NRG's size and credibility also helped draw the right partners, including BMW.

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Reference and Work Product Form

Reference # _3_ of _3_ for ☒ Recipient ☐ Subcontractor	
Name of Recipient/ Subcontractor	NRG Energy, Inc.
Name of Reference Firm/Organization	United States Department of Energy
Address (city, state, and zip code)	P.O. Box 880, Mail Stop P03C Morgantown, WV 26507
Contact Name and Title	Ted McMahon, Project Manager
Contact Phone Number and Email Address	Phone: 304-285-4865 Cell: 304-807-4916 Email: ted.mcmahon@netl.doe.gov
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	In 2010, the U.S. Department of Energy, under the Clean Coal Power Initiative (CCPI) program, selected NRG to receive a $167 million grant to construct a post-combustion carbon capture and storage project at NRG's WA Parish coal plant outside of Houston. In August 2014, after having procured an additional $850 million in financing for the project, NRG began construction on the 250 MW unit, which, when complete in 2016, will be by far the world's largest carbon capture and storage unit at an existing coal plant. The CO2 will be captured, compressed, and sent via pipeline to an oil field for enhanced oil recovery. Of the other five awardees under the DOE's Recovery Act's CCPI program, no other company has been able to obtain financing or start construction on a project.

ATTACHMENT 9
Reference and Work Product Form

1b. Section Two: Work Product

Past Project: NRG eVgo

Background
NRG eVgo is currently the largest privately funded electric vehicle infrastructure provider in the U.S. NRG owns and operates the country's largest fleet of DC fast chargers (currently 120) and has launched operations in a number of large metropolitan areas, including San Diego, Los Angeles, San Francisco, Houston, Dallas, and Washington DC. In addition, NRG has announced the development and construction of additional networks in Denver, Boston, Atlanta, and Chicago. NRG eVgo currently has 65 employees around the United States.

Market Ready Technology/Advancement in Codes/Standards/Advancement of Energy Policy
NRG eVgo has made a number of market advances. These include:

- eVgo owns and operates the country's largest network of Level 3 DC chargers
- eVgo installed the first charging stations that charge with the SAE DC Combo Connector. Now all DC fast charging stations have both CHAdeMO and SAE Combo cordsets (in cities where cars with combo connectors aren't yet sold, NRG's charging stations have the ability to add the Combo cable in the future).
- Unlike any company before it, eVgo has formed national relationships with a number of national retailers to serve as charging station host sites. These retailers include Simon Properties, Walgreens, Cracker Barrel, and many others.
- Of particular relevance to NRG's proposed project are the relationships that NRG eVgo has built with the major automobile manufacturers. Together, NRG and Nissan launched the pioneering "no charge to charge" program. Under this project, new Nissan LEAF customers receive a 2 year free eVgo subscription. This subscription can be used at NRG stations, or at stations of other companies participating in the no charge to charge network

NRG eVgo as a Business
It should be noted that NRG views eVgo as less of a "project" and more of a business. While the number of U.S. electric vehicle drivers is too small currently to make eVgo a profitable business, NRG has made a significant commitment to making the business successful over the medium- and long- term. One of the opportunities that the California Energy Commission has in awarding a project to NRG is that the company's goal is typically not only to make a project successful, but also turn that successful project into a business. That philosophy will hold true on the proposed *EV Storage Accelerator* project.

ATTACHMENT 9
Reference and Work Product Form

Past Project: NRG – University of Delaware (eV2g)

Background
In 2011 NRG and PJM, with support from BMW, University of Delaware and others, committed to developing the world's first project where vehicles serve as an official market resource on a power grid.

The resulting project came online in early 2013 and is still operating successfully. Currently, approximately 20 BMW all-electric MINI Es and Honda Accord PHEVs are responding to PJM's frequency regulation signal, and earning revenues for doing so.

In this project, PJM is not a customer of NRG's, but rather a partner. PJM had made several rule changes to allow for behind-the-meter storage projects to access ancillary service markets. NRG was the first and (only) company to access these markets through electric vehicles.

The success of this project is a good illustration of NRG's commitment to setting – and subsequently achieving – a goal. NRG committed the necessary financial and human resources to making the project a success. NRG's size and credibility also helped draw the right partners, including BMW.

Market Ready Technology/Advancement in Codes/Standards/Advancement of Energy Policy
The project has resulted in a number of advances in the concept of electric vehicles serving as energy storage devices. These include:

- First time in the world that vehicles have earned revenue as a resource on an electric grid. This included setting up the vehicle control and coordination hardware and software to present the 20 vehicles as one power plant resource to PJM.
- The NRG / University of Delaware team has successfully integrated that control and coordination software with 3 automakers, Honda, BMW and Nissan, in each case adapting to unique automaker requirements. No other project/ organization has equaled that achievement for bi-directional charging.
- For the project, Honda created 2 Honda Accord PHEVs purpose-built for bi-directional charging and for the project. This was the first time that an automaker created a new vehicle for testing and developing the bi-directional charging concept.
- NRG and University of Delaware team members are participating in the SAE J3072 to bring IEEE 1547 standards to mobile storage devices, like the Honda Accord. (Historically, UL has had no purview over vehicles).
- Aside from work done at the LA Air Force base and at other military bases, no other project has put as much funding into research for bi-directional electric vehicle charging. Prior to the start of the NRG/University of Delaware relationship in 2011, the University of Delaware had received approximately $1.5 million in funding from a variety of sources including the US Department of Energy, Pepco Holdings (now part of Exelon),and various state sources. NRG has since added more than $2 million of funding with additional funding continuing as part of the joint venture. In addition, other organizations, including BMW, PJM, Honda, Nissan and other have added several million dollars' worth of in-kind labor and equipment.
- The project succeeded in amending, through legislation, Delaware's net metering law to allow for net metering from electric vehicles. (Although this solution may not always be appropriate for energy storage, it does show the ability of the project team to advance legislative and regulatory initiatives.

ATTACHMENT 9
Reference and Work Product Form

Past Project: NRG / City University of New York V2X Project

Background
In 2014, the New York State Energy Research and Development Authority (NYSERDA) selected NRG to receive a grant under Program Opportunity Notice 2755 (called "CUNY V2X"). As part of the project, which is set to commence in November 2014, NRG will deploy 7 electric vehicles on the campus of Queens College in New York City. These vehicles will include both Nissan LEAFs and BMW MINI-Es, which will provide bi-directional vehicle to building and emergency backup services.

Like the University of California system, the City University of New York system – the third largest University system in the United States – has made a significant commitment to advancing new energy technologies, including storage technologies. Queens College, which is one of the flagships schools in the 17 school system, has two emergency shelters on campus, near where the vehicles are going to be parked and to which the vehicles will provide backup power. As in California, New York City utility bills have a fixed component to the rate for commercial and industrial customers, meaning there is a value to the peak shaving component that the vehicles will be able to provide.

Because the project is set to begin in November 2014, the project will be testing in advance a number of the concepts that NRG has proposed for the *EV Storage Accelerator* project.

- NRG and University of Delaware have been testing Nissan LEAFs in combination with the Princeton Power Systems 30kW inverter at a test location in Newark, DE. But this project will mark the first time NRG has deployed those charging stations outside a test environment. (For the *EV Storage Accelerator* project, NRG is proposing the 10kW Princeton Power System inverter, not the 30kW).

- As part of the project, NRG and the University of Delaware will be deploying vehicle aggregator software for local storage services, not for frequency regulation. The University of Delaware technology team has been adapting its existing aggregator approach to allow for these new services, and will be testing and deploying this software as part of the CUNY V2X Project.

- The project will also provide insight to interconnection requirements. To date, NRG and the University of Delaware have interconnected successfully with utilities in Delaware. However, NRG anticipates significant lessons-learned from successful interconnection with Con Edison, which operates one of the most complicated utility grids in the world. To be fair, on the *EV Storage Accelerator Project,* NRG has mitigated interconnection risk by only proposing to use UL listed inverters, and installing some of the vehicles into UCSD's microgrid.(and some with SDG&E). Still dealing with interconnection challenges is a significant part of any energy storage project.

ATTACHMENT 9
Reference and Work Product Form

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

NA

ATTACHMENT 9
Reference and Work Product Form

2a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Byron Washom, University of California, San Diego
Name of Reference Firm/Organization	California Energy Commission
Address (city, state, and zip code)	1516 Ninth Street, Sacramento, CA 95814
Contact Name and Title	Jamie Patterson, Program Manager
Contact Phone Number and Email Address	(916) 327-2342 jpatters@energy.state.ca.us
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Enabling Renewable Energy, Energy Storage, Demand Response and Energy Efficiency with a Community Based Master Controller-Optimizer

ATTACHMENT 9
Reference and Work Product Form

Reference # _2_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Byron Washom, University of California, San Diego
Name of Reference Firm/Organization	United States Department of Energy
Address (city, state, and zip code)	1617 Cole Blvd., Golden, CO 80401-3393
Contact Name and Title	Holly Thomas, Program Officer
Contact Phone Number and Email Address	Phone: (720) 356-1796 Email: holly.thomas@go.doe.gov
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Improved Modeling Tools Development for High Penetration Solar

ATTACHMENT 9
Reference and Work Product Form

2b. Section Two: Work Product

Past Project: Total Sky Imager Forecasting

PAST PROJECT: TOTAL SKY IMAGER FORECASTING	
Assignment name: **Solar resource forecasting with total sky imagers**	Approx. value of the contract (in current US$): **US$ 175,000**
Country: **USA** Location within country: **California**	Duration of assignment (months): **2 years**
Name of Client: US **National Renewable Energy Lab. California Energy Commission.**	Total No. of staff-months of the assignment: 24 **months**
Contact Person, Title/Designation, Tel. No./Address:	Byron Washom, Director Strategic Energy Initiatives. (858) 822-0585
Start date (month/year): **Jan 2012** Completion date (month/year): **February 2014**	No. of professional staff-months provided by your consulting firm/organization or your sub consultants: **24 months**
Name of associated Consultants, if any: **None**	Name of senior professional staff of your consulting firm/organization involved and designation and/or functions performed (e.g. Project Director/Coordinator, Team Leader): **- Jan Kleissl – Principal Investigator** **- Bryan Urquhart – Graduate Student Researcher** **- Iman Gohari – Graduate Student Researcher**
Description of actual services provided: Two sky imagers were deployed at a utility-scale 48 MW solar power plant for one year. One to fifteen-minute ahead solar resource forecasts were generated and validated against ground data. In particular the following was accomplished: • Deployment, maintenance, and data analysis of sky imagery. • Solar resource forecast generation and analysis. • Public report.	

ATTACHMENT 9
Reference and Work Product Form

Outcome:

- Market-ready sky imaging system for solar forecasting, consisting of the sky camera hardware and forecasting algorithms.
- Three licensees for the hardware: CSIRO (Australia), EPRI (Tennesee), University of Hawai'i.
- Two licensees for the software: Schreder-CMS (Austria), University of Hawai'i
- Currently in licensing negotiations with three scientific and energy instrumentation companies.

Past Project: Department of Energy DE-EE0004680

Performance Period: 7/01/2009-12/31/2013
Title: Improved Modeling Tools Development for High Penetration Solar

Project: Objective of the High Penetration solar research is to help the DOE understand, anticipate, and minimize grid operation impacts as more solar resources are added to the electric power system. For an effective, reliable approach to predicting solar energy availability for energy generation forecasts using the University of California, San Diego (UCSD) Sky Imager technology has been demonstrated. Granular cloud and ramp forecasts for the next 5 to 20 minutes over an area of 10 square miles were developed. Sky images taken every 30 seconds are processed to determine cloud locations and cloud motion vectors yielding future cloud shadow locations respective to distributed generation or utility solar power plants in the area. The performance of the method depends on cloud characteristics. On days with more advective cloud conditions, the developed method outperforms persistence forecasts by up to 30% (based on mean absolute error). On days with dynamic conditions, the method performs worse than persistence. Sky Imagers hold promise for ramp forecasting and ramp mitigation in conjunction with inverter controls and energy storage. The pre-commercial Sky Imager solar forecasting algorithm was documented with licensing information and was a Sunshot website highlight.

Past Project: California Energy Commission PIR-08-043

Performance Period: 6/20/2009-3/31/2013
Title: Enabling Renewable Energy, Energy Storage, Demand Response, and Energy Efficiency with a Community-Based Master Controller-Optimizer

Project: The Goal of this Agreement is to develop a fully integrated, future proofed master controller and optimizer that will provide intelligence driven solutions that enable multiple and individual customers and RE generators not only to reduce their electricity costs and carbon impact through increased awareness and better efficiency, but also to extract additional economic value by direct participation in the electricity markets. This will enable the system to independently determine which sources of power to employ, and when, in order to ensure optimal performance, energy efficiency and overall reliability for the facility. In such a scenario, a smart grid's directives can be singular in nature or a combination of prioritized directives, such as achieving multiple objectives (for examples, reliability, minimized environmental impact, optimum utilization of indigenous RE resources, and optimized economics for a microgrid). To achieve this highly advanced level of reasoning, intelligence must be encoded in the system in all stages through the power system's life cycle.

ATTACHMENT 9
Reference and Work Product Form

The objectives of this Agreement are to develop and implement a replicable demonstration of semi-autonomous microgrid master controller and for real-time optimization and management of community scale smart grid infrastructures. Through the coupling of the master controller's real-time power analytics capabilities with the optimization and scheduling software that will leverage UCSD's Advanced Metering Infrastructure (AMI), a communications and installed RE generation and thermal and electricity energy storage (TEES) assets. The output of this effort will lay the critical foundation necessary for a commercialized master controller, optimizer/scheduler and AMI product developed specifically for community based smart grid planning.

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

Washom, B., Dilliott, J., Weil, D., Kleissl, J., Balac, N., Torre, W., Richter, C.: Ivor Tower of Power, IEEE Power & Energy Magazine., 10.1109/MPE.2013.2258278, June 2013.

Washom, B., Kleissl, J., Nottrott, A., Hanna, R., Yang, H., Torre, W.: Improved Modeling Tools Development for High Penetration Solar. DOE EE-0004680, March 2014.

Washom, B.: Enabling Renewable Energy, Energy Storage, Demand Response, and Energy Efficiency with a Community-Based Master Controller-Optimizer. CEC-500-2014-069. March 2013.

ATTACHMENT 9
Reference and Work Product Form

3a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Strategen Consulting, LLC
Name of Reference Firm/Organization	Arup
Address (city, state, and zip code)	560 Mission Street Suite 700 San Francisco CA 94105
Contact Name and Title	Russell Carr Senior Engineer | Electrical Group
Contact Phone Number and Email Address	+1 415 659 4972 russell.carr@arup.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Strategen has worked with Arup from 2012 to the present on a variety of microgrid projects that include value proposition and cost effectiveness analysis for the microgrid project owner. Microgrids included integration of large amounts of solar PV, fuel cells, energy storage, and building automation

ATTACHMENT 9
Reference and Work Product Form

Reference # _2_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Strategen Consulting, LLC
Name of Reference Firm/Organization	Minnesota Department of Commerce
Address (city, state, and zip code)	85 7th Place East, Suite 500 Saint Paul, MN 55101-2198
Contact Name and Title	Lise Trudeau Senior Engineering Specialist | Renewable Energy and Advanced Technologies
Contact Phone Number and Email Address	651-539-1861 lise.trudeau@state.mn.us
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	In 2013, Strategen was awarded the prime contract for managing and producing the Department of Commerce's *White Paper Analysis of Utility-Managed, On-Site Energy Storage in Minnesota*

ATTACHMENT 9
Reference and Work Product Form

3b. Section Two: Work Product

Past Project: Minnesota Department of Commerce's *White Paper Analysis of Utility-Managed, On-Site Energy Storage in Minnesota*

Pursuant to legislation passed in 2013[1], the Minnesota Department of Commerce (Commerce) contracted with Strategen and the Electric Power Research Institute (EPRI) to investigate the potential costs and benefits of grid-connected electrical energy storage technology located at the utility customer in the State of Minnesota. The investigation included standalone storage and storage integrated with solar PV, and it considered both residential and commercial customer sites. Four different general operational use cases for energy storage were identified and investigated, including:

1. Customer controlled for bill savings;
2. Utility controlled for distribution system benefits;
3. Utility controlled for distribution and market benefits; and
4. Shared customer and utility controlled for bill savings and market revenue.

The project team modeled each use case to calculate project lifetime costs and benefits, performed an analysis of key barriers to implementation, and provided recommendations to address key gaps to energy storage implementation. EPRI's role in this investigation was limited to modeling and objective technical support, and as such did not play a role in providing specific recommendations for regulatory or policy action.

To determine the analysis inputs, the project team utilized publicly available reports in Minnesota as well as data provided by Xcel Energy and other Minnesota utilities. Where data gaps existed, they were estimated using information gathered during the California Public Utility Commission's (CPUC) Energy Storage Rulemaking proceeding in 2013, particularly those related to energy storage cost and performance.

Across the four use cases, approximately fifty different energy storage cases were modeled and simulated using the EPRI Energy Storage Valuation Tool (ESVT), spanning a range of input assumptions and benefit stream combinations. For each case, a benefit-to-cost (B/C) ratio was generated to show the direct, quantifiable fixed and variable costs and benefits, incorporating the time value of money, for the modeled project over its lifetime.

Key conclusions from the study include the following:

- Energy storage has the potential to provide multiple sources of value for customers and utilities. These values can come in the form of economic value and in terms of grid reliability. As such, the results are subject to change based upon federal and state tax policy changes, tariff changes, expansion the use of time-of-use (TOU) energy prices, or substantive changes in energy storage, renewable energy, or conventional energy resource prices.
- Utility controlled, customer-sited storage in Minnesota has the potential to provide benefits to the grid greater than the system's cost. Several different combinations of benefits were required to achieve benefit to cost ratios greater than one. While a number of different value streams were investigated, the value of each use case was

[1] Pursuant to legislation passed in 2013 (Value of On-Site Energy Storage: MN Laws 2013, Chapter 85 HF 729, Article 12, Section 5),[1] the Minnesota Department of Commerce was required to contract with a qualified contractor to produce a white paper analysis of the potential costs and benefits of installing utility-managed, grid-connected energy storage devices in residential and commercial buildings in Minnesota

primarily driven by the following grid services and incentives: 1) distribution upgrade deferral; 2) frequency regulation, 3) system capacity, and 4) Federal Investment Tax Credit (FITC) for solar and favorable accelerated depreciation schedules (MACRS).

- In order to achieve a benefit to cost greater than one, the modeling results showed the importance for the storage project to capture value from at least three of these four key benefits. Accessing the key benefits with a single storage resource requires a certain energy storage dispatch (i.e. charging and discharging) behavior and project structuring, as outlined below:
    - Distribution upgrade deferral benefits are dependent upon the need for an upgrade of a local distribution asset such as a substation or transformer and ability to defer it with storage, and thus are highly site and time-specific. The highest deferral values are associated with low load growth rates of (~1%/yr), which is consistent with the Minnesota average load growth rate.
    - Participation in frequency regulation requires bidding into the Midcontinent Independent System Operator (MISO) frequency regulation market. Capturing this benefit would require additional creation of MISO rules for customer-sited storage system market participation.
    - The system capacity benefit is based around supporting a utility's long-term Resource Adequacy requirements. Availability of this benefit is based on regional need at specific times. Additional tools and methods may be required to incorporate energy storage into the integrated resource planning (IRP) process that defines the need and potential solutions.
    - To capture the FITC and accelerated MACRS depreciation, the storage system must be linked to a solar PV system and receive 75% or more of its charging energy from solar. The utility must also be able to monetize the Investment Tax Credit and accelerated MACRS depreciation value, either directly or through a third-party ownership structure.
- Customer sited commercial and residential storage that relies upon customer tariffs were not able to achieve a benefit to cost greater than one. The customer tariffs evaluated do not provide sufficient price signals to customers to procure energy storage or operate it in optimal ways to benefit the electric system. Residential tariffs, due to lack of demand charges and lack of TOU pricing spreads, are most challenging for attaining cost-effective energy storage value propositions.
- Reliability (backup power) and voltage support service benefits of energy storage, while conceptually attractive, have not been found to be materially sufficient to significantly impact the cost-effectiveness of energy storage. However, these requirements and resulting benefits vary widely depending on customer need.

Certain storage benefits can vary by utility type. Rural cooperative utilities (co-ops) generally have more electric water heaters. Some cooperative utilities have load shapes with peaks in early morning during the winter, rather than the more typically observed hot summer afternoon. Energy storage should be modeled according to the benefits within a specific utility and to best suit each utility's characteristics.

The full report can be downloaded here:

http://mn.gov/commerce/energy/images/MNStorageStudy-2014-01-03-final.pdf

ATTACHMENT 9
Reference and Work Product Form

Past Project: Department of Energy (DOE) Global Energy Storage Database (GESDB)

Strategen is currently the primary contractor responsible for the creation and maintenance of the Department of Energy (DOE) Global Energy Storage Database (GESDB) released to the public in June 2012. As of March 2014, it contained over 850 projects representing 185 gigawatts of energy storage from 57 countries. The GESDB was developed as a free online resource of energy storage projects, as well as related state and federal legislation/policies. It is a multi-faceted tool for the energy storage industry. This tool was designed to be accessible to a wide variety of stakeholders and has tremendous potential to help grow the energy storage industry, ultimately making the electricity grid more sustainable, reliable, robust, and secure. The GESDB was the first and is currently the only freely accessible database of this information.

The GESDB website is located at: http://www.energystorageexchange.org.

The database is freely accessible online and ultimately achieves these key objectives:

- The database shall become a go-to-source for up-to-date energy storage market developments in the following areas: Current grid storage projects in the U.S.(both installed and announced projects)
- Energy storage research being conducted at universities, national laboratories and other research institutions; including easy-access web links to the source information where possible
- Current state and federal legislation/policies surrounding energy storage, including easy-access web links to the source information where possible
- The database shall be accurate, up-to-date, and reference-grade
- The database shall be easy to use, particularly for entry of new data, searching for data, and exporting data. Administration of the site will be possible by non-technical personnel.
- Key stakeholders and intended users may include: energy storage and renewable energy manufacturers and technology companies, utilities, independent system operators, project developers, universities, federal and state policy makers, government agencies, technical consultants, financial analysts, end-use customers, investors, journalists, and interested advocacy groups.

For the purposes of this project, energy storage is defined as any thermal, chemical, mechanical, or gravitational means of storing energy in which the storage system is connected to and charged/discharged to and from the grid. This includes storage systems at the residential, commercial, industrial, and utility scale. This scope excludes vehicular energy storage such as PEVs or PHEVs—even when being charged from the grid.

The original scope was geared toward prioritizing key stakeholders for the International Energy Storage Database, developing a functional specification for the site based on their requirements, and establishing a robust architecture that would serve as the foundation for the energy storage database tool and web portal going forward.

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Reference and Work Product Form

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

Edgette, C., Damato, G., Lin, J.: White Paper Analysis of Utility-Managed, On-Site Energy Storage in Minnesota. COMM-20130722-69155. December 2013.

Lin, J., Damato, G., Hand, P,: Energy Storage – A Cheaper, Faster & Cleaner Alternative to Conventional Frequency Regulation. California Energy Storage Alliance. February 2011.

Lin, J., Damato, G.: Energy Storave – A Cheaper and Cleaner Alternative to Natural Gal-Fired Peaker Plants. California Energy Storage Alliance. February 2011.

ATTACHMENT 9
Reference and Work Product Form

4a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _2_ for Olivine ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Olivine, Inc.
Name of Reference Firm/Organization	San Diego Gas & Electric
Address (city, state, and zip code)	8330 Century Park Ct San Diego, CA 92123
Contact Name and Title	Randall Nicholson, Regulatory Policy Manager, Federal Regulatory Affairs
Contact Phone Number and Email Address	858-654-3567, rnicholson@semprautilities.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Olivine provides market expertise and operational services including real-telemetry solutions to the Optimized Pricing and Resource Allocation ("OPRA") project. The project is designed to aggregate modulated EV charging load and stationary storage assets for participation in the CAISO' energy and A/S markets.

Reference # _2_ of _2_ for Olivine ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Olivine, Inc.
Name of Reference Firm/Organization	California Independent System Operator
Address (city, state, and zip code)	250 Outcropping Way, Folsom, CA 95630
Contact Name and Title	Heather Sanders Director, Regulatory Affairs, Distributed Energy Resources
Contact Phone Number and Email Address	916-608-5850, hsanders@caiso.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Olivine developed a unique report identifying and summarizing the challenges and barriers that exist for distributed energy resources (DERs) to provide grid services defining realistic scenarios.

4b. **Section Two: Work Product**

Past Projects: Pacific Gas & Electric – Intermittent Renewables Management Phase 2 ("IRM2")

The Intermittent Renewable Management Pilot Phase 2 (IRM2) is a unique project designed to develop and test a model to provide demand- side resources with access to the CAISO market while receiving capacity payments from the utility.

The Pilot enables participants to earn capacity and wholesale payments through direct participation using the Proxy Demand Resource (PDR) product. Olivine acts as both the Pilot administrator, Demand Response Provider and CAISO Scheduling Coordinator. In addition to using Olivine's software platform to interface with the CAISO, Olivine is responsible for acting as the interface between the CAISO Wholesale Market and the participant customers, performing the necessary market activities:

- Ongoing bidding and rules enforcement (including Pilot rules and NBT compliance)
- Monitor and disseminate awards CMRI
- Manage wholesale settlements and all invoicing activity with the ISO
- Meter data management, aggregation, and submittal
- Credit and collateral risks
- Participant certification procedures.

Developed as a real world test environment to provide a bridge to the future, the IRM2 tests the construct for direct participation with flexible resources providing resource adequacy based on Must Offer Obligation (MOO) principles. The pilot provides infrastructure for participant bidding, capacity payments and direct exposure to the wholesale market, bridging the gap between the current construct of utility-administered programs and a future where demand response and other grid services are provided by third parties to both the distribution and transmission grids. Pilot rules entail participants making frequent, economic bids in blocks into the ISO in a manner that is similar to what is required of generators that qualify for resource adequacy.

Providing an ideal platform for new technologies and distributed resources, this project marks the first participation of energy storage in the wholesale markets. Storage resources under various configurations include behind-the-meter, have been bid into the market via Olivine since February 2014.

Past Project: San Diego Gas & Electric Company Demand Response Wholesale Market Integration Pilot (DRWMP)

The Demand Response Wholesale Market Integration Pilot (DRWMP) was implemented in 2011 with the completion of the CAISO market model for Proxy Demand Resource (PDR). Unresolved issues regarding the treatment of IOU/LSE under-collection of revenue and customer protections resulted in a prohibition on Utility participation in PDR. Olivine implemented and operated the pilot, designed to be dynamic operating in a contained environment and acting as a vehicle to transition programs and processes to support integration of retail DR programs with the wholesale market. The DRWMP provided for Participating Load (PL) & Proxy Demand Response (PDR).

The pilot project provided the opportunity to potential participants, including demand response aggregators to create a wholesale market compatible resource in any of the designed product categories. Using Olivine systems and services the participants were able to provide bid nominations that were provided to the CAISO.

This marked the first demand response resources to be certified for the CAISO ancillary services market. In order to address expensive telemetry required for this market, Olivine developed the first software based Remote Intelligent Gateway (RIG). This project was able to provide insights into the barriers for market integration resulting in a number of significant business process changes. Most notably a problem with the mechanism for clearing demand side awards in the ancillary services market was identified which would make it extremely difficult for a resource to obtain an economic award/dispatch. As a result the system at the CAISO was upgraded. The software based RIG, a market ready product, is able to provide an alternative to traditional telemetry solutions to support the aggregation of dispersed resources. Additionally, standard APIs for providing telemetry were developed to allow for a cost effective total solution.

Key elements of the pilot:

- Alignment of retail and wholesale demand response products and capabilities
- Cost-benefit assessment of ancillary services
- Portfolio maintenance and registration processes
- Development of special handling meter data processes to submit disaggregated data to meet real time requirements and subsets of hourly data

Past Project: CAISO Distributed Energy Resources Challenges and Barriers

At the CAISO's request, Olivine developed a report identifying challenges and barriers associated with the integration of distributed energy resources into the CAISO markets. The report developed use-cases and employed a methodology to evaluate barriers across the landscape covering technical, business and regulatory barriers both in and outside of the CAISO's jurisdictional control. Focusing on the advancement of California' Energy Plan, the content of this report has been input into subsequent activities such as the current development of an Energy Storage Roadmap and other CAISO initiatives to reduce barriers. Specific barriers that have been or are in the process of being addressed include the completion of metering and telemetry initiatives (providing for internet access and alternative measurement mechanisms), the re-evaluation of Sub-LAP and LSE aggregation boundaries and most recently the relaxation of the single RIG-single Sub-LAP rule.

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

Olivine and LBNL.: Los Angeles Air Force Base Vehicle to Grid Pilot Project. LBNL6154E. June 2013

Reid, B., Anderson, R., Gerber, S.: Distributed Energy Resources Integration: Summarizing the Challenges and Barriers. 2013-2014.

ATTACHMENT 9
Reference and Work Product Form

5a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Willett Kempton, University of Delaware
Name of Reference Firm/Organization	Jon Wellingnoff, Stoel Rives LLP
Address (city, state, and zip code)	Three Embarcadero Center, Suite 1120 San Francisco, CA 94111
Contact Name and Title	Jon Wellinghoff, Partner
Contact Phone Number and Email Address	(415) 500-6515 jon.wellinghoff@stoel.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Interacted with Mr. Welloinghoff when he was Chairman of FERC, made presentations at FERC, provided information in response to requests from him

Reference # _2_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Willet Kempton, University of Delaware
Name of Reference Firm/Organization	Scott Fisher, NRG Energy
Address (city, state, and zip code)	211 Carnegie Center Princeton, NJ 08540
Contact Name and Title	Scott Fisher
Contact Phone Number and Email Address	Phone: 609-524-4647 Email: Scott.Fisher@nrgenergy.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Kempton is running a multi-year R&D program using electric vehicles to provide grid services to PJM and to qualify on the PJM market

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Reference and Work Product Form

5b. Section Two: Work Product

Past Project: Grid on Wheels – Vehicle to Grid Demonstration
Over the past decade, the University of Delaware has pioneered a promising new technology called Vehicle-To-Grid. The concept is based on the use of batteries in electric vehicles to:

1. Provide energy for driving the vehicle.
2. Serve as an important energy storage resource for the electricity grid.

The University of Delaware's work was validated in September 2011, when NRG Energy, Inc, a $9 billion/year energy company based in Princeton, NJ, signed a joint venture agreement with UD to form a new company called eV2g. eV2g's goal is to commercialize the University's vehicle aggregation software. The software has the capabilities of electronically combining many different vehicle batteries that are housed in different locations and present them as a standalone single energy storage plant. These batteries provide PJM with a service called frequency regulation, which helps the grid operator make small adjustments to overall electricity supply and demand.

A pilot study was successfully conducted by the University of Delaware in 2008, using seven vehicles connected with PJM. Starting in fall 2012, eV2g expanded the University's original pilot project to including several dozen vehicles with enough combined energy storage to officially qualify as a power plant with PJM. This was the first time in the world that electric vehicles have connected to a power grid with the opportunity to earn revenues.

The primary partners involved are:

University of Delaware - Vehicle to Grid developed and tested at the University through the Center for Carbon-Free Power Integration

NRG - NRG Energy, Princeton, NJ, is a fortune 250 company with $9 billion in revenues with its major operations in the Northeast, Texas and California.

eV2G - A joint venture partnership between NRG Energy and the University of Delaware to commercialize Vehicle-To-Grid technology.

PJM - Regional power grid operator for 13 states in the eastern U.S. who has created new markets for storage technologies and has supported the University of Delaware's V2G research.

AutoPort - Located in New Castle, Delaware is involved in the conversion and service of the BMW project in the tri state area.

Milbank - Milbank Manufacturing Co., Kansas City, MO. Licensee ofthe V2G technology and invested in the manufacturing and development of the EVSE for use in the project.

EVGrid - Partner with BMW for the implementation of V2G using the MINI E in the US. EV Grid has offices in Palo Alto, CA and New Castle, DE.

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Reference and Work Product Form

Past Project: Mid-Atlantic Grid Interactive Car Consortium (MAGICC)

A valuable industrial consortium, MAGICC, facilitated early demonstrations and planning for V2G and what we now call Grid Integrated Vehicles from 2007 to 2009. MAGICC interconnected an AC Propulsion "eBox" (a converted Toyota Scion xB, fitted with an AC induction motor, AC-150 electronics and a custom built battery) to the PJM grid and used the control center of PJM to dispatch the battery-stored electricity as a regulation resource. Main consortium members included University of Delaware, Pepco Holdings, Inc. (and their subsidiary, Delmarva Power and Light), PJM, AES Corp, AC Propulsion, Comverge, and Atlantic County Utilities Authority. This effort was funded by DOE Office of Electricity and Pepco Holdings, with additional or prior support from Delaware Green Energy Fund, Delaware Economic Development Office and Google.org.

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

Vandael, S., Kempton, W., Kamboj, S., Holvoet, T., Deconinck, G.: Comparison of two GIV mechanisms for providing ancillary services at the University of Delaware. Proceedings of the 4th IEEE International Conference on Smart Grid Communications (SmartGridComm 2013), Vancouver, 21-24 October 2013.

Codani, P., Kempton, W., Levitt, A.: Critical Rules of Transmission System Operators for Grid Integrated Vehicles Providing Frequency Control.

Kempton, W., Marra, F., Bach Anderson, P., and Garcia-Valle, R.: "Business Models and Control and Management Architectures for EV Electrical Grid integration" IEEE *Innovative Smart Grid Technologies Europe. 2013*.

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Reference and Work Product Form

6a. Section One: References

Reference # _1_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Rue Phillips President for Solarrus Corp
Name of Reference Firm/Organization	NRG / eVgo
Address (city, state, and zip code)	11390 West Olympic, Ste. 250 Los Angeles, CA 90064
Contact Name and Title	Terry O'Day
Contact Phone Number and Email Address	310-458-8411 Terry.O'day@nrgenergy.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Provided Engineering and design services for a Electric Vehicle infrastructure for level I,II & III including battery energy storage system (BESS) including upgrades of existing electrical equipment to cater for new technologies.

Reference # _2_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Rue Phillips. President for Solarrus Corp
Name of Reference Firm/Organization	Southern California Edison
Address (city, state, and zip code)	515 S Figueroa Street, Suite 950 Los Angeles. CA 90071
Contact Name and Title	Edward Kjaer, Director, Plug In Electric Vehicle Readiness
Contact Phone Number and Email Address	626-302-1324 EdwardKjaer@sce.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Designed and installed hundreds of level Two EVSE stations through southern California for use within publicly accessible EVSE infrastructure.

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Reference and Work Product Form

6b. Section Two: Work Product

Past Projects: Load sharing Electric System for Multi-Level EVSE Installations

Designed and implemented Load sharing electrical systems for use in multiple level EVSE installations using timed A/B switching and demand ALMS controls. System was used in up-to forty level two installations reducing electrical infrastructure costs by up to 50%.

Designed and implemented multiple standalone battery energy storage systems for residential commercial and hospital emergency and off grid power.

Currently working on designing and implementing micro grid power for hospitals and schools in Uganda as a humanitarian mission with US churches and Local Uganda missions.

Currently actively involved in the design of a modular solar PV, electrical vehicle canopy structure with battery local battery energy storage. System in both R&D and commercial applications are currently in planning and design stage.

Currently working on Peak Demand load control technology specifically for use of demand of electric vehicle infrastructure.

Since 1995 Have been active and directly involved in the design and installation of thousands of level two and three EVSE's in public, private, municipal, commercial and fleet electric vehicle infrastructure projects in active EV areas in the US.

Designed and implemented unique grid emulation technology system, designed to bring large scale solar PV projects forward to commissioning months before connection to the utility grid. The 12/26KV Construction Integrated System Commissioning system CISC uses a carefully controlled and monitored collection of medium voltage transformers, load banks and generators to emulated the grid to enable full testing of the power plant and has been successfully utilized on multiple large scale projects bring months of construction time. The process is now widely used throughout the solar industry.

Currently sits on the industry expert advisory committee for the development of codes and standards in the US solar industry contributing to white paper studies distributed by ASTM, IEC, EPRI, NREL. Contributions include toe insertion of battery energy storage codes and standards considerations when implemented with solar PV systems across the USA.

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

N/A

ATTACHMENT 9
Reference and Work Product Form

7a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Princeton Power Systems, Inc.
Name of Reference Firm/Organization	Tesla Motors
Address (city, state, and zip code)	3500 Deer Creek Road | Palo Alto, CA 94304
Contact Name and Title	Mateo Jaramillo, Director of Stationary Storage
Contact Phone Number and Email Address	mjaramillo@teslamotors.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Power conversion systems, 10kW, 30kW, 100kW, 200kW, on-site commissioning services, engineering services

Reference # _2_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Princeton Power Systems, Inc.
Name of Reference Firm/Organization	Coda Energy
Address (city, state, and zip code)	2340 S. Fairfax Avenue Los Angeles, CA 90016
Contact Name and Title	Peter Nortman, COO/CTO
Contact Phone Number and Email Address	pnortman@codaenergy.com Cell: +1 626 533 3606
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Power conversion systems, 10kW, 30kW, 100kW, on-site commissioning services, engineering services

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Reference and Work Product Form

7b. Section Two: Work Product

Past Project: Alcatraz Island Micro-grid (*Alcatraz Island, San Francisco, CA*)

Princeton Power Systems completed a Commercial scale Microgrid System on Alcatraz Island as a solution to high diesel fuel cost, pollution in the bay area, and high carbon emissions. When a ships anchor ruptured the underwater power lines in 1950, that linked the island to San Francisco, Alcatraz was forced to turn to diesel and coal as its source of power.

In 2010, when approached to take on the project, Princeton Power Systems was excited to take on the challenge of enabling the historic landmark and tourist attraction, "The Rock," to become its own clean and efficient independent power source.

This project reflects the National Park Service's initiative to find an alternative way of powering the island in order to reduce fuel cost and pollution. A microgrid system, comprised of Princeton Power Systems inverters, a solar array, advanced batteries, a Princeton Power Systems Site Controller, and back-up generators, was selected as a way to independently power the island. Designing and building the system on one of California's and the US's most well known historic landmarks with over 1 million visitors per year, created many challenges.

Component Placement: Preserving the island in pristine condition while completing the installation was the greatest challenge. Given that a system of this size requires a large construction effort, component placement was key. To prevent the solar array from being visible from San Francisco, it was placed on the roof of the prison in a flat configuration rather than a traditional angled configuration. The inverters, battery rack and generators were placed in the old generator room, as this space is isolated and not accessible for tourist. The room was also protected from the harsh salt water environment.

Commissioning: The fragile natural environment and wildlife, particularly the birds (Alcatraz is an old Spanish word for pelican) added to the challenge. Extra attention was given to the solar panels after being damaged by rocks and shells dropped from overhead birds. Despite the coarse conditions of the generator room, engineers were able to insulate the room to prevent future problems and ensure reliable long-term operation.

Highlights	
System Size	400kW PV, 400kW Battery ,1900kWh
Components	(8) 100kW Princeton Power System Grid-tied inverters (GTIB-100), 350kW PV Array, Princeton Power Systems Size Controller, (2) Diesel Generators, and Lead-Acid (AGM) Battery Rack
Loads	50 to 80kW per day
Installation Date	August 2012
Location	San Francisco, CA
Annual Savings	Reduces approximately 80% of the island's carbon emissions

While the majority of the island's power is produced by solar, batteries provide additional help when the sun is not present, as does the generator when both solar and battery storage are not available. The generator is automatically turned on and run at maximum efficiency to recharge the battery, then turns off for 3-4 days at a time.

The total island load caries typically between 50 and 80kw. The PV array produces a peak power each day of roughly 175kW. The net sum of these two is supplied by the Princeton Power Systems ESS system at all times. The batteries absorb all the excess PV when PV exceeds the load requirement, and they deliver whatever load the PV does not cover at all other times.

The batteries' power absorption diminishing to zero as the batteries become fully charged. The excess PV power in this case is fed back into the generator, and the generator power will become negative. When the generator is shut down, since the batteries are fully charged, there is no room to absorb PV power that exceeds the load, therefore the system automatically limits the PV production at the time to be equal only to what the load and the batteries can absorb.

This is managed using a frequency-shifting control strategy that requires zero communication among the microgrid inverters. Once the PV production is less than the island loads, the batteries again resume supplying the balanced of required power.

Past Project: EaglePicher Energy Storage System (*Joplin, MO*)

At the end of 2010, EaglePicher Technologies entered into Grid Energy Management offering turnkey energy solution storage solutions. In order to complete these systems, EaglePicher combined with Princeton Power Systems GTIB-100 Inverters with various battery technologies to satisfy different facility loads and energy needs.

The Princeton Power Systems Energy Storage Systems utilize the best of both lead-acid and lithium-ion battery technologies for baseline power needs as well as transient power needs. The system is able to power facility loads and perform other functions, including peak demand shaving, frequency regulation, and other grid services. The batteries and inverters are dispatched intelligently by EaglePicher's Power Pyramid Technology.

Challenges: At the time of the project's completion, this was the largest microgrid the Princeton Power Systems team had designed using multiple advanced battery chemistries. First the containers themselves required special air-handling considerations to ensure proper cooling of the different battery types, as well as efficient placement of the inverters and other components.

Second, the system was integrated with EaglePicher's Power Pyramid Technology to allow the dispatch of different battery banks at different times. To address this, the system was designed with one or more GTIB-100 inverters connecting each battery type to a Princeton Power Systems Site Controller that aggregated communications and monitoring.

How it Operates: The system charges at low-cost energy times, such as overnight, and discharges selected battery banks at peak times to reduce power demand, and to manage local loads. They system can operate as a microgrid when disconnected from utility service.

The system now functions as EaglePicher's "Power Pyramid Demonstration Project," at their Cross Roads Facility in Joplin, MO. It is offered as an integrated system to other customers on a commercial scale.

Past Projects: San Diego Zoo and SDG&E Collaborate on Solar-to-EV Project (*San Diego, CA)*

The City of San Diego and Clean Tech San Diego partnered to complete the Solar-to-EV project – a one-of-a-kind 90kW solar canopy in the parking lot shared by the San Diego Zoo and Balboa Park. Unveiled by Major Jerry Sanders Tuesday, November 27th, the system used a Princeton Power Systems DRI-100, an inverter specifically modified for SDG&E's purpose of allowing fast charger of electric vehicles from renewable sources. The first of its kind in the country, the Solar-to-EV Project allows electric vehicles to operate directly from renewable solar energy, and could prove to be the platform for future sustainable energy solutions.

Operation Capabilities & Benefits:

- Solar power Electrical Vehicle Charging
- The system consists of (1) Princeton Power Systems 100kW Demand Response Inverter (DRI-100) a 100kW battery rack, a 90kW PV array, and a DC fast charge plug
- Reduces peak demand with solar batteries and provides advanced grid functionality
- 59 homes worth of solar energy generation at peak production
- Enables Fast Charging, as little as 30 minutes for recharge for electrical vehicle capable of CHAdeMO charging such as the Nissan Leaf.

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

N/A

ATTACHMENT 9
Reference and Work Product Form

8a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _1_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	IKS CO LTD. (partner with CPE Power Systems Inc.)
Name of Reference Firm/Organization	Power Stream Inc. / www.powerstream.com Smart Grid Technologies
Address (city, state, and zip code)	161 Cityview Boulevard, Vaughan, Ontario L4H 0A9 Canada
Contact Name and Title	Mr. John Mulrooney, Director
Contact Phone Number and Email Address	905-532-4608 john.mulrooney@powerstream.ca
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Manufacturing, delivery and commissioning of V2G Hybrid PCS with bidirectional EV Charge/Discharge system for Power Stream Inc. Microgrid System located in Vaughan, ON Canada. (September 18, 2014)

ATTACHMENT 9
Reference and Work Product Form

Reference # _2_of _2_for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	IKS CO LTD.
Name of Reference Firm/Organization	(METI) Ministry of Economy, Trade and Industry of Japan: • Next-generation energy technology demonstration projects: "OBP (Osaka Business Park) V2X" project
Address (city, state, and zip code)	Osaka City, Japan (Reference visit and/or meeting can be arranged by IKS CO LTD, Kyoto, Japan as one of member company of this project.)
Contact Name and Title	Yuichi Kimura, Senior Manager IKS Co., Ltd.
Contact Phone Number and Email Address	Phone: +81 75-251-8511 e-mail: kimura@applecener.co.jp
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	• July 01, 2014 opening and press released OBP V2X Testing. • Demonstration Operators: MID Urban Development Co., Ltd., TAKENAKA, IKS CO., LTD., NIKKEN SEKKEI RESEARCH INSTITUTE, OBP (Osaka Business Park), KEPCO (The Kansai Electric Power CO., Inc.) • 50kW Power Supply to Building from "5EV + 50kWh Battery Storage": 1) Peak cut during a normal time, 2) Supply power to the critical load (including elevator and lightings) at a time of emergency situation., 3) Testing and development of EMS with billing/charging and payment system, 4) 50kW V2G PCS with five (5) V2G Charging Point (10kW ea) and networking through higher level EMS for management of EV power charge/discharge.

ATTACHMENT 9
Reference and Work Product Form

8b. Section Two: Work Product

Past Project: V2G testing by Kanagawa Prefecture, Japan / Furukawa Electric / IKS Co., Ltd.

On July 26, 2012, Furukawa Electric announced with Kanagawa Prefecture in Japan titled "Demonstration test of grid tied power management system with Li battery storage and EV as a source of power supply". This project was commissioned due to chronic power shortage in Japan after March 11, 2011 Tohoku region Pacific Ocean earthquake. There had been two ways tested to control peak power; i) peak cutting, and ii) peak shift. Peak cutting can be done by user's "Demand Control" program or using renewable energy to reduce load for grid system during the peak time. Peak shift is more convenient for users and creates less impact on grid system. Furukawa's system is feasible for user to shift power using energy supplied by battery storage (not only using stationary type battery, but also using V2G for EV onboard battery).

- Duration and location of the project; August 1, 2012 - March 31, 2013 at Industrial Technology Center in Ebina city, Kanagawa, Japan.

- System Overview: System target to cut 15% of Electricity Bill (15% of 160KW) by shifting stored electrical power during the night for using peak time of the day.
    - Power conditioning system (DC/AC and AC/DC conversion bidirectional)
    - Internal Battery: Li-ion Battery storage
    - Power conditioning system for electric vehicle battery charge / discharge (DC/AC conversion bidirectional)
    - Energy Management System (using power source from battery storage / electric vehicle for controlling grid peak load.)

Past Project: V2G EV Charging/Discharging Point / Hibikinada, Wakamatsu-ku, Kita-Kyushu, Japan

On October 8, 2014, "Zero Emission Transportation System and Solar PV Energy Power Plant" completed and performed its inauguration ceremony in the west area of Hibikinada, Wakamatsu-ku, Kita-Kyushu city, Japan. The main feature of this system is electrical city bus service in the Hibikinada area using Solar PV energy stored in large scale batteries. City of Kita-Kyushu foresaw its future and invested to this system development including installation of solar power plant and electrical bus operation in order to create a new industry in the future.

- Kita-Kyushu City's "Zero Emission Transportation System" is the first electrical bus service using 100% power generated by mega solar power plant in the region. City anticipates creating new industry in the city including electrical bus import/export center, bus assembly and maintenance service related industries. The bus developed for this project was developed and manufactured with collaboration of Japan and overseas.

- HKK & TEK is a joint venture company created between HKK (Hibikinada Co., Ltd.) and TEK (Toray Engineering Co., Ltd.). HKK & TEK is in charge of system development and installation. The city of Kita-Kyushu runs the bus operating company with cooperation of Mitsubishi Heavy Industry who supplies electrical bus. Mitsubshi also implements bus operation system maintenance and optimization engineering. Mitsubishi's system is to

use large-scale battery storage which stores solar energy, and electrical bus can be charged from larger battery at charging point.

- IKS V2G system had been installed in the area for testing EV (non bus) and V2G impact to the system, in order to test more efficient way of using excessive solar energy for E_Mobility in the area.

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

N/A

ATTACHMENT 9
Reference and Work Product Form

9a. Section One: References

Identify **three** references for the recipient and **two** for each subcontractor, using the table below for each reference. Use additional pages as needed. References must be current (within the past three years). Please ensure that contact information is current.

Reference # _2_ of _2_ for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Alternative Energy Systems Consulting, Inc.
Name of Reference Firm/Organization	CEC PIER Energy Innovation Small Grant Program (SDSU Foundation)
Address (city, state, and zip code)	5250 Campanile Drive, MC1858 San Diego, CA 92182-1858
Contact Name and Title	Dr. David Rohy, Co-Director
Contact Phone Number and Email Address	(619) 594-1116 drohy@mail.sdsu.edu
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	Dr. Rohy is currently the Co-Director of the CEC's EISG program. Formerly he was a California Energy Commissioner and Sr. Vice President of the Caterpillar/Solar Turbine Corporation. AESC has participated as voting member of the EISG's Program Technical Review Board (PTRB) since the program's inception in 1998. The EISG provides grant funding for early and emerging technology development up to $100,000 for energy efficiency, renewable energy, transportation and building energy technology research and development. AESC provides technology and proposal evaluation and has authored Independent Assessment Reports that critique completed researched funded under EISG. As part of the PTRB, AESC scores various proposals for technical feasibility, market impact and program eligibility. AESC is one of fifteen PTRB members from industry, utilities and academia.

ATTACHMENT 9
Reference and Work Product Form

Reference # _2_of _2_for ☐ Recipient ☒ Subcontractor	
Name of Recipient/ Subcontractor	Alternative Energy Systems Consulting, Inc.
Name of Reference Firm/Organization	Southern California Edison
Address (city, state, and zip code)	1515 Walnut Grove Avenue Rosemead, CA 91770
Contact Name and Title	Mr. Steven M. Long, P.E.
Contact Phone Number and Email Address	(626) 302-0785 Steven.Long@sce.com
Describe the services or products the Recipient/subcontractor provided to the reference firm/organization.	AESC provides software tool development, including SCE's on-line application system, initiation and development of the customized calculation guidelines, and develop of various work papers supporting energy saving and demand reduction calculation estimates for several commercial and industrial projects, and M&V for large energy efficiency projects.

ATTACHMENT 9
Reference and Work Product Form

9b. Section Two: Work Product

Past Project Description: UCSD EVSE Expansion
Period: 1/1/2013 - Present
Description: Under a grand with the CEC (10 Ports ARV-12-13 Fleet Level II Charger, 16 Ports ARV-12-20 Workplace Level II Charger, and 3 ARV-12-27 DC Fast Charger demonstration projects) AESC is expanding EVSE at UC San Diego's campus. AESC is leading a team of subcontractors towards successful installation, commissioning and performance testing of the electric vehicle chargers on the campus. AESC is currently in the process of writing final reports for these programs. This project highlights the installation of advanced RWE ISO/IEC 15118 EV charging standards operating within UCSD's micro grid environment. These electric vehicle chargers provide communications to identify and authenticate a vehicle, coordinate the charging and discharging process, handle the billing and support any additional services such as remote diagnostics, navigation system updates, and entertainment.

Past Project Description: Customized Calculated Savings Guidelines for Non Residential Programs
Period: 1/1/2010 - Present
Description: AESC developed and maintains a Customized Calculated Savings guidelines for SCE, its contractors, customers and other California Investor Owned Utilities (IOUs). The purpose of these guidelines is to establish standardized electric energy savings and demand reduction estimation, measurement and verification methods to determine grid impacts that are compatible with existing California energy efficiency policy as well as to document lessons learned and interpretations from past program cycles. AESC and SCE intend that the guidelines are to be used by IOU internal reviewers, IOU field engineers, third party implementers and third party technical reviewers. While the guidelines are focused primarily on the California statewide-customized program, they are meant to be general enough to apply to all non-residential retrofit custom programs. These guidelines will cover many of the typical situations. AESC developed and maintains the guideline's structure and details for over sixty measures in the 400 page document.

Past Project Description: Technical and Policy Assistance for California's Statewide Zero-Emission Vehicle (ZEV) Infrastructure Plan
Period: 1/1/2014 - Present
Description: AESC is providing technical and policy assistance to the California Energy Commission (CEC) in implementation of the action items in the Governor's 2013 Zero Emission Vehicle (ZEV) Action Plan ("Action Plan"). Within the action plan, ZEVs include hydrogen fuel cell electric vehicles (FCEVs) and plug-in electric vehicles (PEVs). PEVs include both pure battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). AESC will be developing a plan to guide deployment and funding of electric vehicle and hydrogen fuel cell charging infrastructure, preparing a statewide DC fast charger analysis, creating a communications plan to support ZEV (including PEV and FCEV) deployment and infrastructure, and advising the CEC on strategy and action items in the Pacific Coast Collaborative. In addition, AESC -

- Develop a Statewide Strategic Plan to guide deployment and funding of zero emission vehicle infrastructure

- Work with Energy Commission staff and Plug-in Vehicle Regional Readiness grantees to develop a statewide DC Fast Charger Analysis
- Create a communications plan to expand consumer awareness and demand for ZEV's
- Compile relevant information from the CEC's Regional Readiness Grants
- Prepare summary communication materials in the form of a report, white paper, brochure, webpage, or other appropriate media
- Advise the CEC on the Pacific Coast Collaborative

Recent Publications

Include copies of **up to three** of the applicant or project team member's recent publications in scientific or technical journals related to the proposed project, as applicable.

NA

ATTACHMENT 10
Contact List

Complete the information in the "Recipient" column.

California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Scott Fisher NRG Energy, Inc. 211 Carnegie Center Princeton, NJ 80540 Phone: (609) 524 - 4647 Fax: (XXX) XXX -XXXX e-mail: scott.fisher@nrgenergy.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Scott Fisher NRG Energy, Inc. 211 Carnegie Center Princeton, NJ 80540 Phone: (609) 524 - 4647 Fax: (XXX) XXX -XXXX e-mail: Scott.Fisher@nrgenergy.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Marc Kline NRG Energy, Inc 211 Carnegie Center Princeton, NJ 80540 Phone: (609) 524 - 4895 Fax: e-mail: marc.kline@nrgenergy.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

ATTACHMENT 10
Contact List

California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS - 51 Sacramento, CA 95814 Phone: (916) 327- Fax: (916) 327- e-mail:	**Project Manager:** Byron Washom The Regents of the University of California; University of California, San Diego 9500 Gilman Dr. MC 0057 La Jolla, CA, 92093-0057 Phone: (858) 822-0585 Fax: (858) 534-9836 e-mail: bwashom@ucsd.edu
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS - 1 Sacramento, CA 95814 Phone: (916) 654-xxxx Fax: (916) 654-xxxx e-mail:	**Administrator:** Lynell Gehrke The Regents of the University of California; University of California, San Diego 9500 Gilman Dr. MC 0934 La Jolla, CA, 92093-0934 Phone: (858) 534-0243 Fax: (858) 534-0280 e-mail: lgehrke@ucsd.edu
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS - 2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** TBN The Regents of the University of California; University of California, San Diego 9500 Gilman Dr. MC 0934 La Jolla, CA, 92093-0934 Phone: (858) XXX -XXXX Fax: (858 XXX -XXXX e-mail:
Legal Notices: Tatyana Yakshina Grants Manager 1516 9th Street, MS-1 Sacramento, CA 95814-5512 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Giovanni Damato Strategen Consulting, LLC 2150 Allston Way Suite 210 Berkeley CA 94704 Phone: (510) 665-7811 x103 Fax: (888) 453-0018 e-mail: gdamato@strategen.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Janice Lin Strategen Consulting, LLC 2150 Allston Way Suite 210 Berkeley CA 94704 Phone: (510) 665-7811 x101 Fax: (888) 453-0018 e-mail: jlin@strategen.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Dana Talise Strategen Consulting, LLC 2150 Allston Way Suite 210 Berkeley CA 94704 Phone: (510) 665-7811 Fax: (888) 453-0018 e-mail: dtalise@strategen.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Olivine, Inc. Robert W. Anderson 2010 Crow Canyon Place Suite 100 San Ramon CA 94583 Phone: (510) 545-2556 e-mail: randerson@olivineinc.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Olivine, Inc. Beth Reid 2010 Crow Canyon Place Suite 100 San Ramon CA 94583 Phone: (415) 294 -0575 e-mail: breid@olivineinc.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Olivine, Inc. Beth Reid 2010 Crow Canyon Place Suite 100 San Ramon CA 94583 Phone: (415) 294 -0575 e-mail: breid@olivineinc.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Willett Kempton University of Delaware 374 ISE Lab Newark, DE 19716 Phone: (302) 831 -0049 Fax: (XXX) XXX -XXXX e-mail: willett@udel.edu
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Joan Roseman University of Delaware 374 ISE Lab Newark, DE 19716 Phone: (302) 831 -2336 Fax: (XXX) XXX -XXXX e-mail: jnrosman@udel.edu
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Joan Roseman University of Delaware 374 ISE Lab Newark, DE 19716 Phone: (302) 831 -2336 Fax: (XXX) XXX -XXXX e-mail: jnrosman@udel.edu
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Rue Phillips (PRESIDENT) Solarrus Corp 5406 Bolsa Ave Huntington Beach, CA. 92649 Phone: (714) 908 -5266 Fax: (714) 908 -5264 e-mail: RuePhillips@solarrus.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Robert Forster (VP Business relations) Solarrus Corp 5406 Bolsa Ave Huntington Beach, CA.92649 Phone: (714) 908 -5266 Fax: (714- 908-5264) e-mail:RobertForster@solarrus.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Richard C. Davis (CFO) Solarrus Corp 5406 Bolsa Ave Huntington Beach, CA. 92649 Phone: (714) 908 -5266 Fax: (714) 908 -5266 e-mail: RichardDavis@solarrus.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Paul Heavener Princeton Power Systems 3175 Princeton Pike, Lawrenceville, NJ 08648 Phone: (609) 955-5390 Fax: (609) 751 -9225 e-mail: pheavener@princetonpower.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Matt Rosner Princeton Power Systems 3175 Princeton Pike, Lawrenceville, NJ 08648 Phone: (609) 955-5390 Fax: (609) 751 -9225 e-mail: accounting@princetonpower.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Carol Klein Princeton Power Systems 3175 Princeton Pike, Lawrenceville, NJ 08648 Phone: (609) 955-5390 x137 Fax: (609) 751 -9225 e-mail: accounting@princetonpower.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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Contact List

California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** Roman Szwec CPE Power Systems Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4 Phone**:** (905) 764-1548 x2669 e-mail: rszwec@cpegroup.ca CC: tdomoto@iks-us.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Andrew Henriques CPE Power Systems Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4 Phone**:** (905) 764-1548 x2669 e-mail: ahenriques@cpegroup.ca CC tdomoto@iks-us.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Eva Mac CPE Power Systems Address: 200 West Beaver Creek, Rd, Unit #11, Richmond Hill, ON, Canada, L4B 1B4 Phone**:** (905) 764-1548 x2669 e-mail: eva.mac@rogers.com CC tdomoto@iks-us.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

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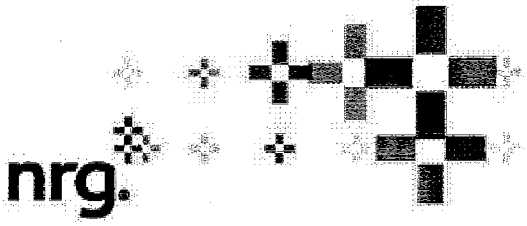
California Energy Commission	Recipient
Commission Agreement Manager: (TBD) California Energy Commission 1516 Ninth Street, MS-51 Sacramento, CA 95814 Phone: (916) 327-XXXX Fax: (916) 327-XXXX e-mail:	**Project Manager:** John Clint Alternative Energy Systems Consulting, Inc. 8555 Aero Drive, Suite 205 San Diego, CA 92123 Phone: (858) 560-7182 x107 Fax: (858) 560 -7185 e-mail: jclint@aesc-inc.com
Commission Agreement Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Administrator:** Mary Kruse Alternative Energy Systems Consulting, Inc. 5927 Balfour Court, Suite 213 Carlsbad, CA 92008 Phone: (760) 931-2641 x121 Fax: (760) 438-5020 e-mail: mkruse@aesc-inc.com
Accounting Officer: (TBD) California Energy Commission 1516 Ninth Street, MS-2 Sacramento, CA 95814 Phone: (916) 654-XXXX Fax: (916) 654-XXXX e-mail:	**Accounting Officer:** Mary Kruse Alternative Energy Systems Consulting, Inc. 5927 Balfour Court, Suite 213 Carlsbad, CA 92008 Phone: (760) 931-2641 x121 Fax: (760) 438-5020 e-mail: mkruse@aesc-inc.com
Legal Notices: Tatyana Yakshina Grants and Loans Manager 1516 9th Street, MS-1 Sacramento, CA 95814 Phone: (916) 654-4204 Fax: (916) 654-4076 e-mail: tatyana.yakshina@energy.ca.gov	

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _1_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☒ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding *(if applicable)*	☒ Cash in hand ☒ Travel ☒ Equipment ☒ Subcontractor costs ☐ Materials ☒ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Denise Wilson Executive Vice President President of Electric Vehicle Solutions NRG Energy, Inc
Phone Number and Email Address of Author	Phone: 609-524-4532 Email: Denise.Wilson@nrgenergy.com
Address of Author (city, state, and zip code)	NRG Energy, Inc 211 Carnegie Center Princeton, NJ 08540



NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

November 11, 2014

Hon. Robert Weisenmiller, Chair
California Energy Commission
Sacramento, CA

re: NRG Energy commitment letter for PON 14-301

Dear Chair Weisenmiller:

As NRG's Executive Vice President and President, Electric Vehicle Solutions, I wish to provide our commitment letter to the California Energy Commission for our response to PON 14-301.

This NRG commitment equals $817,724 of eligible cash and in-kind services. As indicated in Attachment 11, several project partners are also providing cost share, an amount totaling $412,000. This total project cost share of $1,229,724 does not include provision of Honda and Nissan vehicles and significant in-kind labor and additional equipment provided by both Nissan and Honda.

Because we are confident in the importance of this project to our partners, NRG additionally commits to fund any deficiencies from partners. NRG's funding commitment level and that of its partners is within my delegation of authority and is an indication of the strategic value of this project to NRG's CEO, David Crane, and the company's board of directors. I also wish to note that this funding commitment is separate and incremental to NRG's settlement with the California Public Utility Commission to fund electric vehicle infrastructure in the state.

NRG's funding commitment for the *EV Storage Accelerator* project is a testament to the progress we have been making in our vehicle-to-grid partnership with the University of Delaware. In 2013, the project successfully registered approximately 20 all-electric BMW MINI Es in the PJM regulation market, representing the first time in the world that vehicles earned revenue as a grid resource. Over the past two years, our partnership has made steady technical and business progress with both Honda and Nissan. A funding award under this PON would validate that progress, and would represent a platform for both auto companies to continue their advancements in bidirectional vehicle storage.

As the NRG executive overseeing eVgo, I am responsible for the $200 million in existing and committed capital dollars that NRG is investing in electric vehicle infrastructure. Outside the auto industry itself, no other company has made as significant a financial commitment to the future of vehicle electrification. Although nearly all of this commitment focuses on today's technology, such as public DC charging stations, NRG is keenly interested in bringing new innovations, such as vehicle-to-grid, to our customers. We see the California Energy Commission – with support from important California institutions such as UC San Diego – as an important partner in that effort.

Sincerely,

Denise Wilson
Executive Vice President and President, EV Solutions

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _2_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Steve Center, Vice President, Environmental Business Development Office Project Manager: Ryan Harty, Manager, Environmental Business Development Office
Phone Number and Email Address of Author	Steve Center Phone: 310-783-3082 Email: Steven_Center@ahm.honda.com Project Manager Phone: 310-783-3962 Email: Ryan_Harty@ahm.honda.com
Address of Author (city, state, and zip code)	American Honda Motor Co., Inc 1919 Torrance Blvd Torrance, CA 90501

HONDA

American Honda Motor Co., Inc.
1919 Torrance Boulevard
Torrance, CA 90501-2746
Phone (310) 783-2000

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Support – CEC PON 14-301, Group 3**

Dear Mr. Fisher.

American Honda Motor Co., Inc (hereinafter "Honda") located in Torrance, California is pleased to express its support for NRG's proposed project "EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles" in response to the California Energy Commission's funding opportunity PON 14-301, Group 3.

Honda has a long history of engaging with California's new technology development goals. In 1997 Honda introduced the all-electric Honda EV PLUS in response to California Air Resources Board mandate and in 2002, Honda became the world's first automaker to market a fuel cell vehicle certified by the U.S. EPA and the state of California. In 2007, Honda introduced the zero-emission FCX Clarity – awardee of the World Green Car award in 2009 – which was first leased to customers in Southern California. Now that the Accord Plug-in Hybrid is available to the US market, Honda is excited to engage in a number of projects aimed at accelerating vehicle-to-grid integration, which has the potential to reduce the total cost of EV ownership while enabling higher concentrations of renewable energy.

Honda believes bi-directional charging has the potential to substantially accelerate electric vehicle sales by improving the economics of electric vehicle ownership. In 2013, Honda announced that it was working with NRG Energy and the University of Delaware to participate in a revenue-generating demonstration project for Vehicle-to-Grid technology. Honda supplied an Accord Plug-In Hybrid with bi-directional on-board charger to the University of Delaware's Science, Technology and Advanced Research (STAR) Campus. In conjunction with the university and NRG Energy, Honda was investigating the potential of bi-directional charging technology to benefit EV owners, the electrical grid, and society. This multi-faceted project not only demonstrates the technical controls and interconnection capabilities, but also engages regulatory requirements and market participation rules for selling energy storage from EVs.

Contingent on executing the proper Agreements covering the terms and conditions of this project, Honda is willing to support NRG's *EV Storage Accelerator* Project. During the proposed 35 month duration of the project, Honda is willing to provide in-kind support which will include staff expertise, facilities, and between one to three Plug-in Hybrid vehicles available to use during EV Storage Accelerator project. Honda is looking forward to gathering data and gaining insights to support a more robust business plan for bi-directional electric vehicle charging.

Honda's commitment of these resources depends on negotiation of appropriate terms between the partner companies to cover such issues as IP ownership and licensing

HONDA

American Honda Motor Co., Inc.
1919 Torrance Boulevard
Torrance, CA 90501-2746
Phone (310) 783-2000

rights and usage of equipment and/or related technology development in this program. It is anticipated that these details will be established after notification of successful award.

Honda believes that bi-directional charging technologies have significant potential – both to serve as an inexpensive energy storage resource and to reduce the cost of electric vehicle ownership. Honda wishes NRG success in its proposal and is looking forward to potentially partnering with the rest of the project team on this important technology.

If you have any questions, please contact myself or my Project Manager, Ryan Harty at 310-783-3962 or by email at Ryan_Harty@ahm.honda.com.

Sincerely,

Steven Center
Vice President, Environmental Business Development Office
American Honda Motor Co., Inc
310-783-3082
Steven_Center@ahm.honda.com

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _3_ of _18_ for NRG Energy, Inc	
Type of Letter	☐ Commitment ☒ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☐ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Ken Srebnik Senior Manager, Corporate Planning Nissan North America
Phone Number and Email Address of Author	Phone: 615-725-5856 Email: ken.srebnik@nissan-usa.com
Address of Author (city, state, and zip code)	Nissan North America, Inc One Nissan Way, PO Box 685001 Franklin, TN 37067

NISSAN

NISSAN NORTH AMERICA, INC.
One Nissan Way. PO Box 685001
Franklin, TN 37067

October 22, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Support – CEC PON 14-301, Group 3**

Dear Mr. Fisher:

Nissan North America, Inc., headquartered in Franklin, Tennessee supports NRG's proposed project "EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles" in response to the California Energy Commission's funding opportunity PON 14-301, Group 3.

Nissan has worked closely with NRG since the launch of its eVgo network in 2011. Earlier this year, Nissan announced its "No Charge to Charge" program, which provides new Nissan LEAF owners two years of free public charging in selected markets on the NRG eVgo network, as well as other networks.

Nissan believes bidirectional charging has the potential to add value for its customers and could eventually help increase electric vehicle sales. Nissan launched "LEAF to Home" technology in Japan that enables emergency backup power and valuable support for the grid. Nissan is excited to work with NRG to further commercialize bidirectional charging technologies in the United States. Nissan has worked closely with the U.S. Department of Defense and the California Energy Commission to provide 13 LEAF vehicles capable of bidirectional charging for the Los Angeles Air Force Base project. Over the past several months, Nissan has worked with NRG and Princeton Power Systems to further refine this technology, including developing the 10kW inverter/charger proposed for this project. Nissan intends to continue working with NRG on this and other bidirectional charging projects.

For the 35 month duration of the project beginning in May 2015, Nissan will enable the bidirectional charging capability of the Nissan LEAF vehicles used at UC San Diego and will support integration with the NRG/University of Delaware aggregation technology. During this period, Nissan will gather data and insights to support a more robust business plan for bidirectional electric vehicle charging for the North American market.

We view California as the most logical state and NRG as the most credible company to help us realize this opportunity.

In North America, Nissan's operations include automotive styling, engineering, consumer and corporate financing, sales and marketing, distribution and manufacturing. Nissan is dedicated to improving the environment under the Nissan Green Program and has been recognized as an ENERGY STAR® Partner of the Year in 2010, 2011, 2012, 2013 and 2014 by the U.S Environmental Protection Agency. In 2010, Nissan introduced the Nissan LEAF, the first mass-market, pure electric vehicle launched globally, and continues to lead in zero emission mobility.

Nissan believes that bidirectional charging technologies have significant potential – both to serve as an inexpensive energy storage resource and to reduce the cost of electric vehicle ownership. We look forward to partnering with NRG, UCSD and the rest of the project team on this important technology.

Sincerely,

Ken Srebnik
Senior Manager, Corporate Planning
Nissan North America, Inc.

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _4_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☒ Match Funding ☒ Project Partner ☒ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☒ Subcontractor costs ☐ Materials ☒ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Gary C Matthews Vice Chancellor University of California, San Diego
Phone Number and Email Address of Author	Phone: 858-534-6820 Email: bwashom@ucsd.edu
Address of Author (city, state, and zip code)	University of California, San Diego 9500 Gilman Drive La Jolla, CA 92093

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9500 GILMAN DRIVE
LA JOLLA, CA 92093-0057
(858) 534-6820 / 534-9836 FAX
http://www-vcrmp.ucsd.edu

November 12, 2014

TO:
Mr. Scott Fisher
Director of Alternative Energy Services
NRG Energy, Inc
211 Carnegie Center
Princeton, NJ 08540

SUBJECT: UC San Diego's Demonstration Site Host, Project Partner, Match Funding Source and Stakeholder Support Letter of Commitment to NRG Energy, Inc for PON 14-301-Group 3, Demonstration of Advanced Smart and Bidirectional Vehicle Charging

Dear Mr. Fisher:

As an individual authorized to act upon the behalf of UC San Diego, we are committed to offer this letter of commitment as a Site Host, Project Partner, Match Funding Source and Stakeholder to NRG's application in response to the California Energy Commission's (CEC) PON 14-301-Group 3 entitled "EV Storage Accelerator: Proving Commercial Viability of Energy Storage from Electric Vehicles".

UC San Diego provides an unqualified (i.e., without reservation or limitation) commitment to serve as a site host to integrate NRG's V2G charging systems into the UCSD 42 MW microgrid and provide the individual drivers that will be necessary to acquire operational data for the term of the CEC grant. In preparation of this project, UCSD has already prepared, signed and delivered to NRG the CEQA Compliance Form as Attachment 8 to the proposal. As a state entity and a microgrid, UCSD is the Authority Having Jurisdiction for installations, and has its own permitting and interconnection process, building inspectors, and fire marshal—UCSD is committed to working closely with NRG to expeditiously achieve installations that are safe and meet all electrical and other requirements. In our experience our in-house permitting capability has cut the timeline for installations of new technologies by 1 – 2 years. UCSD has extensive experience form the existing forty-one uni-directional, Level II and three DC Fast Chargers integrated with the microgrid, and we anxiously await the expansion to V2G.

UC San Diego provides an unqualified (i.e., without reservation or limitation) commitment that guarantees the availability of the following match funds for the NRG bidirectional charging project. The first source of matching funds in the amount of $172,000 is from OSIsoft, a long-term strategic partner with UCSD. Martin Otterson, Senior Vice President and an individual authorized to act upon the behalf of OSIsoft, has committed to UCSD an "in kind" contribution to support this bid of their newly released product "ESRI Integrator" which would allow UCSD and NRG to bring PI Data

into UCSD's ESRI environment for geospatial perspective. This represents a justified retail market value of $172,000 for the license. This would qualify as "Equipment" since it has a unit cost of at least $5,000 and a useful life of at least one year. The software is commercially available, so there is no question that the match funding will materialize. The details of OSIsoft's offer are attached.

The second source of matching funds is in the amount of $50,000 of in-kind labor of our Facilities Management personnel that will help facilitate as a Project Partner the installation and operations of the planned bidirectional charging equipment on campus. The sources of funds would be from the continuous operating funds at UCSD to which my Vice Chancellor's office has the authority and responsibility.

UC San Diego provides an unqualified (i.e., without reservation or limitation) commitment to serve as a Project Partner under a Major Subcontract in the amount of $300,000. As detailed in the submitted cost proposal and SOW, UCSD will provide part-time the services of Byron Washom, Director of Strategic Energy Initiatives; the forthcoming new hire in a Program Director for Alternative Transportation; and a full-time graduate student. Match funds will be spent only during the agreement term, either before or concurrently with EPIC funds, and match funds will be reported in invoices submitted to the CEC.

UC San Diego additionally serves as a project stakeholder—an entity or individual that will benefit from and be involved in the project on several accounts. UCSD is the single largest demand response and critical peak pricing participant in the SDG&E service territory, and thus it is keenly interested in the flexible charging and discharging operational and economic value that the bidirectional charging technology represents. As a research university with numerous critical loads that are currently served by over sixty diesel standby generators representing more than 30 MW of capacity, the bidirectional charging capability would represent an additional, cleaner source of emergency generation that would provide greater reliability, survivability and resiliency in case of a grid disruption. Finally, UCSD is a fleet operator of over 900 vehicles, and would benefit from the compelling improvement in total cost of ownership represented by EV storage. In all of these respects, UCSD represents a model for future university, military, municipal and community microgrids.

Given UCSD's key role in energy storage, decarbonization of the transportation sector, microgrid advancement, and the outstanding team assembled, I am prepared to make the comments contained within this correspondence.

Respectfully Submitted,

Gary C. Matthews
Vice Chancellor
Resource Management & Planning

Attachments

Cc: Byron Washom, Director Strategic Energy Initiatives
Mason Willrich, Chair, UCSD Strategic Energy Initiatives Advisory Council

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _5_ of _18_ for NRG Energy, Inc		
Type of Letter	☒ Commitment	☐ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☐ Match Funding ☐ Pilot Test/Demonstration/ Deployment Site	☒ Project Partner
Type of Match Funding *(if applicable)*	☐ Cash in hand ☐ Equipment ☐ Materials ☐ Information technology services	☐ Travel ☐ Subcontractor costs ☐ Contractor in-kind labor Costs ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Janice Lin Founder & Managing Partner Strategen Consulting, LLC	
Phone Number and Email Address of Author	Phone: 510-665-7811 x101 Email: jlin@strategen.com	
Address of Author (city, state, and zip code)	Strategen Consulting 2150 Aliston Way, Suite 210 Berkeley, CA 94704	

November 12, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Commitment – CEC PON 14-301**

Dear Mr. Fisher,

Strategen Consulting, LLC (Strategen) of Berkeley, CA is pleased to provide this letter indicating our commitment to supporting NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles.*

Since 2005, Strategen has been and continues to be a driving force in market and policy development for grid-connected energy storage, especially in California. From successfully advocating for the inclusion of energy storage in California's Self-Generation Incentive Program since 2008 to playing a leading role in the California Public Utility Commission's Energy Storage Proceeding and the Commission's resulting 1.3GW energy storage procurement decision, Strategen has deep industry roots in the storage market. Strategen was also the cofounder and lead co-organizer of the Energy Storage North America (ESNA) conference, which is the largest in the US with over 1500 attendees in San Jose on Oct 1-2, 2014. The October 2015 ESNA conference will be held in San Diego, and there is a planned tour of the UC San Diego microgrid that will include operating energy storage systems from electric vehicles.

On the consulting front, Strategen has significant related cost effectiveness and value proposition modeling experience on several government contract projects including the California's *Statewide Joint IOU Study of Permanent Load Shifting* in 2010 and the Minnesota's Department of Commerce *White Paper Analysis of Utility-Managed, On-Site Energy Storage in Minnesota* in 2014.

Electric vehicles with bi-directional charging present an enormous opportunity to provide California with a significant – and potentially inexpensive – energy storage resource and to reduce the cost of overall electric vehicle ownership. To date, commercialization of the technology has been challenging, with innovation and coordination required across two industries – electric and automotive – that haven't historically worked together.

This NRG proposal presents the California Energy Commission with a highly credible partnership to make significant progress towards commercialization of the technology. NRG has already completed a successful demonstration of the technology in Delaware, and with that work, NRG has built strong relationships with several automakers, including Nissan and Honda, which are included in this proposal. By also including the University of California San Diego, Olivine, Strategen, and others, NRG has chosen partners with a deep understanding of and experience in California energy storage markets.

If the California Energy Commission funds the NRG project, Strategen would participate as a subcontractor to provide the following services for the 35 month period starting in May 2015:

- Leverage Strategen's extensive experience in innovative energy project market adoption strategies to identify existing business models and propose new business models as necessary to fit the unique needs of the proposed project's V2G pilots
- Construct a framework for evaluating the value proposition for each of the use cases, including the CPUC Use Case #4

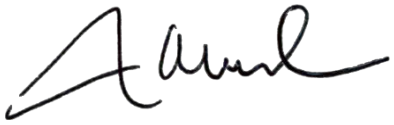
- Summarize the findings of the stakeholder interviews, business model identification, and use case analysis into a *Business Model & Use Case Report Module*
- Conduct the value proposition analysis
- Summarize the findings of the value proposition analysis into a *Value Proposition Report Module*

Strategen has submitted a proposed budget of $421,000 to compensate Strategen for its related expenses.

As founder and managing partner of Strategen Consulting, I give our unqualified commitment (i.e., without reservation or limitation) to providing consulting services to support the EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles* project. The total cost of Strategen's participation shall not exceed $421,000 over the three year period.

We are excited by this project's potential to show that bi-directional electric vehicle charging presents a viable – and potentially inexpensive way – to bring a large energy storage resource to California.

Sincerely,



Janice Lin

Managing Partner, Strategen Consulting, LLC

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _6_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☒ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☒ Contractor in-kind labor Costs ☒ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Elizabeth Reid CEO Olivine, Inc
Phone Number and Email Address of Author	Phone: 415-294-0575 Email: breid@olivineinc.com
Address of Author (city, state, and zip code)	Olivine, Inc 2010 Crow Canyon Place, Suite 100 San Ramon, CA 94583

October 31, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Commitment – CEC PON 14-301, Group 3**

Dear Mr. Fisher,

Olivine, Inc. of San Ramon, CA is pleased to provide this letter indicating our commitment to supporting NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles.*

We are excited for the opportunity to participate in this project, responding to PON 14-301 and believe it will directly benefit California, its ratepayers, utilities and all stakeholders.

Olivine brings unique experience to the project team with a real-world operationally perspective. Olivine has authored the Challenges and Barriers Report for Distributed Energy Resource for the CAISO and is currently working with the joint agencies to provide the CA Energy Storage Roadmap planned for completion at the end of 2014. Olivine works with a variety of parties in various stages of grid implementation such as having worked with the LA AFB via LBNL in SCE's territory and working with both PG&E and SDG&E to enable integration and develop interconnection processes. As the only third party bringing distributed aggregations of behind-the meter storage into the wholesale market Olivine has a unique prospective and proven capabilities to address the identified use cases and demonstrate the full potential these systems have to address grid needs. Electric vehicles with bi-directional charging, Use Case 4, present an enormous opportunity to provide California with a significant – and potentially inexpensive – energy storage resource and to reduce the cost of electric vehicle ownership. To date, commercialization of the technology has been challenging, with innovation and coordination required across two industries – electric and automotive – that haven't historically worked together.

This NRG proposal presents the California Energy Commission with highly credible experienced team partnering to make significant progress towards commercialization of the technology. All members of the core team, including NRG who has demonstrated technology, have deep domain experience in California. Coupling that with several key automakers creates a complete team with unparalleled capabilities.

If the NRG project is funded by the California Energy Commission, Olivine would participate as a subcontractor to provide the services outlined in the program narrative for the 35 month period starting in May 2015.

Olivine has submitted a proposed budget of $320,000 to compensate Olivine for its related expenses totaling $400,000. Thus, Olivine commits to providing match funding as a subcontractor to this project in the form of reduced fees at a discount of 20%, equating to a dollar value of $80,000.

Olivine unconditionally commits to provide the reduction as detailed above as "Contractor in-Kind Labor Costs" (i.e., contractor labor costs that are not charged to the Energy Commission) and IT Services. Olivine attests that these Sub-Contractor in-kind costs are directly relevant to the scope of work, concurrent with the contract period and are not otherwise committed as cost sharing to any other project. We understand that match funds may be spent only during the agreement term, either before or concurrently with EPIC funds. Match funds also must be reported in invoices submitted to the Energy Commission.

Should the V2G proposal by NRG and the V1G proposal by UC San Diego be selected for award by the CEC; Olivine anticipates approximately a 12% reduction in the budget to reflect the synergies and commonalities of the two proposals.

We are excited by this project's potential to show that bi-directional electric vehicle charging presents a viable – and potentially inexpensive way. We intend to play an integral role in unlocking the entire potential value chain for advanced vehicle-grid integration.

Please contact me at 408.759.0360 or breid@olivineinc.com if you have any questions or if there is any other way that we can be of assistance.

Sincerely,

Elizabeth (Beth) Reid
CEO
Olivine, Inc.
2010 Crow Canyon Place Suite 100
San Ramon CA 94583

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _7_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☒ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding *(if applicable)*	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☒ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	David Weir Director Office of Economic Innovations & Partnerships University of Delaware
Phone Number and Email Address of Author	Phone: 302-831-7140 Email: dsweir@udel.edu
Address of Author (city, state, and zip code)	University of Delaware Office of Economic Innovation & Partnerships One Innovation Way Newark, DE 19711

Office of Economic
Innovation & Partnerships
One Innovation Way
Newark, DE 19711
Phone: 302-831-7140
Fax: 302-831-7240

November 7, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Commitment – CEC PON 14-301**

Dear Mr. Fisher:

The University of Delaware, in a partnership with NRG, will commit matching funds to support NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles.*

The proposed project represents an opportunity to bring bi-directional electric vehicle technology significantly closer to commercialization. Perhaps more than any other institution in the world, the University of Delaware understands the challenges and opportunities from using electric vehicles as an energy storage resource. Decarbonizing the nation's energy system by combining increased renewable penetration with the storage inherent in electric vehicles would be a major achievement. Moreover, as we have shown through our demonstration projects, the fundamental technology is highly feasible.

But, as we speak to and work with automakers, they look for a signal from governments in the U.S. that the technology is going to receive early support. In providing funding for the *EV Storage Accelerator* project, the California Energy Commission – representing a state with the nation's largest EV market – would be sending a strong signal.

The University of Delaware has long been a leader in developing bi-directional electric vehicle technology. Professor Willett Kempton, the co-Principal Investigator for the proposed project, was the first to propose the concept in a 1997 research paper. Professor Kempton and his research team have been advancing the technology since then, including our current joint venture agreement with NRG Energy. This partnership, in which NRG is providing $4 million in funding to commercialize the technology, is a testament to the significant advances we have made in the technology and the credibility of Professor Kempton's work. That credibility is further demonstrated by the quality of the partners – including Honda, Nissan, BMW, PJM Interconnection, and others – that we have worked with since 2011.

Should the V2G proposal by NRG be selected for funding by the California Energy Commission, the University of Delaware will participate as a subcontractor to provide services on Task 4, the technical demonstration component of this project. Engineers at UD will support integration and configuration of hardware and software from various participants to produce a working bi-direction EV charging system that is approved by local authorities for operation. NRG V2X Aggregator configurations will include emergency back

up, frequency regulation and vehicle-to-building mode for peak demand reduction. The aggregator controls will be further configured to balance user-driving needs with new dispatch use cases of integration of photovoltaic and energy market time shifts.

The University of Delaware is committed to providing $100,000 in unconditional cost share. This $100,000 will come from two sources. The first is cash that the University of Delaware is investing to obtain a UL listing for a Level 2 J1772 charging station for the Honda Accord PHEV proposed on the project. This UL listing will be necessary both for some locations used in the project, and subsequent commercialization efforts. The second source of cost share is tuition assistance funding for graduate students supporting Dr. Kempton's work.

We are fully supportive of this project and its potential to demonstrate that bi-directional electric vehicle charging, presents a viable and potentially inexpensive route to bring a large energy storage resource to California.

Sincerely,

David S. Weir
Director

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _8_ of _18_ for NRG Energy, Inc	
Type of Letter	☐ Commitment ☒ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☐ Match Funding ☐ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding *(if applicable)*	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Jon Wellinghoff Energy Law Attorney Former FERC Chairman
Phone Number and Email Address of Author	Phone: 415-500-6515 Email: jon.wellinghoff@stoel.com
Address of Author (city, state, and zip code)	Stoel Rives Three Embarcadero Center, Suite 1120 San Francisco, CA 94111

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JON B. WELLINGHOFF
Direct (415) 500-6515
jon.wellinghoff@stoel.com

November 5, 2014

VIA EMAIL

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

RE: Letter of Support/Technical Advisory Committee – CEC PON 14-301, Group 3

Dear Mr. Fisher:

I will be pleased to serve as a member of the Technical Advisory Committee for the EV Storage Accelerator project should the California Energy Commission choose NRG's proposal under CEC PON 14-301, Group 3.

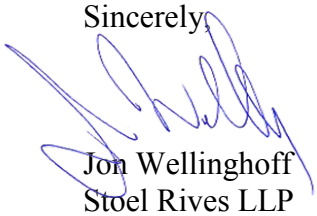
Throughout my career, including as a Federal Energy Regulatory Commissioner starting in 2006, and subsequently as Chairman starting in 2009, I have worked to make the U.S. power grid cleaner and more efficient. Under my chairmanship, the FERC focused extensively on integrating emerging resources such as renewable energy and demand response, including energy efficiency and local storage systems such as those in plug-in hybrid and all electric vehicles.

The proposed NRG project represents an important opportunity for California to simultaneously lower the cost of electric vehicle ownership, and create an important, inexpensive, and potentially plentiful energy storage resource. By involving two major automakers, Honda and Nissan, the NRG team brings the necessary credibility to build a viable pathway towards commercialization.

I have been following the vehicle-to-grid work at the University of Delaware for several years, and am particularly excited about the technology that Professor Willett Kempton, working with NRG, has developed. I was present when this technology was first demonstrated (at FERC headquarters in 2007) and, given the urgent need to both provide low-cost energy storage and improve the economics of electric vehicles, the commercialization that will be facilitated as a result of this project cannot be realized soon enough.

I look forward to contributing to the success of this important project by participating as a member of the technical advisory committee.

Sincerely,



Jon Wellinghoff
Stoel Rives LLP

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _9_ of _18_ for NRG Energy, Inc		
Type of Letter	☐ Commitment	☒ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☐ Match Funding ☐ Pilot Test/Demonstration/ Deployment Site	☐ Project Partner
Type of Match Funding *(if applicable)*	☐ Cash in hand ☐ Equipment ☐ Materials ☐ Information technology services	☐ Travel ☐ Subcontractor costs ☐ Contractor in-kind labor Costs ☐ **Partner in-kind labor Costs** ☐ Advanced practice costs
Author of Letter (name and title)	Petar Ristanovic Vice President, Technology CAISO	
Phone Number and Email Address of Author	Phone: 916-608-1104 Email: PRostampvoc@casio.com	
Address of Author (city, state, and zip code)	California ISO 250 Outcropping Way Folsom, CA 95630	

California ISO
Shaping a Renewed Future

California Independent System Operator Corporation

Petar Ristanovic
Vice President, Technology

October 30, 2014

Scott Fisher, Director of Alternative Energy Services
NRG Energy Inc.
211 Carnegie Center
Princeton, NJ 08540

Subject: NRG proposal to the California Energy Commission Program Opportunity Notice PON-14-301 ("Demonstrating Secure, Reliable Microgrids and Grid-Linked Vehicles to Build Resilient, Low-Carbon Facilities and Communities")

Dear Mr. Fisher:

The California Independent System Operator Corporation (ISO) offers this letter in support of the NRG proposal to demonstrate electric vehicle energy storage use cases in California.

The ISO supports investigation of the potential benefits of grid capable storage systems that contribute toward system reliability. Electric vehicle technology is one of many storage technologies that have the potential to assist the ISO by acting as a grid-scalable flexible resource, capable of smoothing generation intermittencies that can materialize with wind and solar generation resources.

The ISO intends to cooperate with the NRG project team, including UC San Diego, Nissan North America, Honda, as well as other subject experts and technology providers, and act as a technical advisor for the purpose of testing and advancing electric vehicle energy storage use cases within California.

The ISO's support of this proposal is subject to several legal requirements, including but not limited to the ISO's ability to recover any necessary costs through its Grid Management Charge as well as confirming that the ISO's support of this proposal will not adversely affect the tax-exempt status of interest on its bonds or the ISO's status as a 501(c)(3) supporting organization.

While the ISO cannot contribute funding or receive funding as part of this project, and cannot release non-public data, we are committed to supporting the project with our expertise and resources for the evaluation of work and overall concepts.

Sincerely,

Petar Ristanovic
Vice President, Technology

cc: P. Klauer

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _10_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☒ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding *(if applicable)*	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☒ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Darren Hammell Co-Founder & Chief Strategy Officer Princeton Power Systems
Phone Number and Email Address of Author	Phone: 609-955-5390 x103 Email: dhammell@princetonpower.com
Address of Author (city, state, and zip code)	Princeton Power Systems 3175 Princeton Pike Lawrenceville, NJ 08648

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Commitment -- CEC PON 14-301**

Dear Mr. Fisher:

Princeton Power System of Lawrenceville, NJ, is pleased to provide this letter indicating our commitment to partnership to NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles.* We are also please to contribute $10,000 in in-kind commissioning services labor to the project.

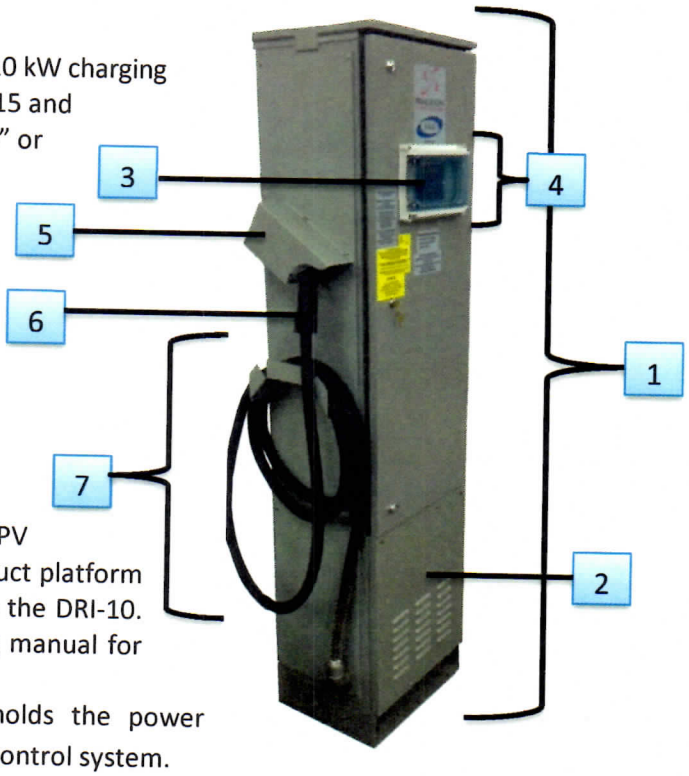
As a designers and manufacturers of technological solutions to energy management and microgrid operations, Princeton Power believes demonstrations in the field of bi-directional EV fast-charging to be an important step to expanding commercial opportunities. We believe that California's support behind the commercialization of these cutting-edge commercial products will lead to acceleration of market adoption for both these technologies as well as electric vehicle deployment in general.

This NRG proposal presents the California Energy Commission with highly credible partnership to make significant progress towards commercialization of the technology. NRG has already completed a successful demonstration of the technology in Delaware and, with that work, has built strong relationships with several automakers, including Nissan and Honda, which are included in this proposal. By also including University of California San Diego, Olivine, Strategen and others, NRG has chosen partners with deep understanding of and experience in California energy storage markets, and Princeton Power is proud to be a part of this distinguished team.

Princeton Power has completed a number of pioneering EV and battery projects in California, including the Alcatraz Island microgrid (400 kW PV and 400 kW / 2 MWh battery), solar powered electric vehicle charger system at the San Diego Zoo (90 kW PV and 100 kW battery), and North America's first V2G EV fleet installation at the Los Angeles Air Force Base in partnership with Nissan, the Department of Defense, and other partners.

Princeton Power's UL-certified CA-15 and CA-30 DC fast-charging stations provide unprecedented capabilities for fleet operators. The charging stations can interface with a variety of fleet-management software applications, including the common Open Charge Point Protocol (OCPP). The CA-15 and CA-30 are a kiosk-style charging station including a touch panel for user control and CHAdeMO-compliant hose and connector. CHAdeMO-compliant vehicles, such as the Nissan LEAF, can recharge in less than 20-30 minutes, while the charging station also enables bi-directional discharging capabilities for advanced "Vehicle-to-Grid" or "Vehicle-to-Building" operations. The V2X Fast-Charging Electric Vehicle Stations are the world's only bi-directional fast-chargers certified to UL 1741 and UL 2202 for safe operation, electric grid connectivity and power export, and ease of permitting and installation.

Princeton Power commits to provide NRG with six 10 kW charging stations . The DRI-10-Chademo is based on the CA-15 and CA-30 products and is verified to operate in a "V2G" or "V2X" bi-directional manner with Chademo V0.9 EVPS-002 2013 Version 1.0 May 17, 2013 Nissan LEAFS. DRI-10-Chademo is a "Pilot" unit, based on the DRI-10 Product combined with the Chademo controls and connector from the CA-15/30 product line; the DRI-10-Chademo will be tested to UL 1741 Compliance by Princeton Power Systems.



DRI-10-Chademo Summary

The DRI-10-Chademo DC Charging Station and PV Converter is based on the DRI-10 Commercial Product platform and in many specifications is identical or similar to the DRI-10. Please refer to the DRI-10 data sheet or operating manual for more information.

(1) **Inverter Cabinet**: The inverter cabinet holds the power electronics of the inverter and the charger control system.
(2) **Transformer Cover**:
(3) **Display Screen**: The graphical display screen provides user feedback on the status of the system.
(4) **Screen Cover**: provides environmental protection for the Display Screen.
(5) **Plug Holster**:
(6) **Charge Plug**: The charge plug mates with the receptacle in the car.
(7) **Charge Hose**

Princeton Power believes that bi-directional charging technologies have significant potential to serve as a valuable energy storage resource, improve the owner/operator experience, and reduce the cost of electric vehicle ownership. We are looking forward to partnering with NRG and the rest of the project team on this important demonstration.

Sincerely,

Darren Hammell
Co-Founder and Chief Strategy Officer

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _11_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Kazutaka Domoto President IKS USA Inc.
Phone Number and Email Address of Author	Phone: 770-829-0202 Email: tdomoto@iks-us.com
Address of Author (city, state, and zip code)	IKS USA, Inc 4306 N Shallowford Road, Suite 1108 Atlanta, GA 30341

IKS USA

IKS USA INC
P.O. Box 81685, Atlanta, GA 30366
PH. 770-829-0202, FAX. 704-943-1570

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Commitment – CEC PON 14-301**

Dear Mr. Fisher:

IKS USA, Inc of Atlanta, GA is pleased to provide this letter indicating our commitment to supporting NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles.*

IKS USA, Inc. is a IKS CO., LTD company in Atlanta GA, and representing of its mother company IKS CO., LTD ("IKS"). IKS has been working with leading Japanese companies based on contributing its V2X bidirectional EV charge/discharge PCS (Power Conditioning System) technology for METI (Ministry of Economy, Trade and Industry of Japan), and accomplished demonstration of "Next Generation Energy Technology" in Osaka Business Park project. IKS's V2X 10kW bidirectional EV charger had been commercialized and tested/certified by NISSAN MOTOR CO., LTD as a first V2G bidirectional in the market. It is important for our energy society to start using EV power sources not only for primary purpose of transportation, but also for a source of massive power storage enabling power shift throughout the Grid system. We are pleased to contribute our V2X technology and experiences into CEC PON 14-301 project.

IKS has been developing highly efficient and safe battery management system since of its start in 1995. Based on such long term R&D efforts and experience, V2X EV bidirectional technology had been commercialized in 2013, and been tested/certified by i) UL Japan for S-Mark (Japanese Industrial Commercial Product Certification), as well as by ii) NISSAN MOTOR CO., LTD certification test criteria and iii) CHAdeMO compliance testing. The unit has been already sold in Japan approximately 50 units by the end of 2014. IKS is now under process of CE-Marking for European market, and UL/CSA certification for North American market. Based on our efforts till today, IKS is confident to be able to provide qualified product for NRG and CEC PON 14-301 project.

IKS is contracted with CPE Power Systems, Inc. ("CPE") for license manufacturing in North America. IKS will support NRG Energy, Inc. in terms of providing qualified V2X product and service for successful CECC PON 14-301 project through contracted relationship between IKS and CPE.

IKS commits to provide the services rendered under the commission of the CEC. NRG has requested the purchase of one 10kW 3-phase bidirectional charging station with vehicle-to-grid functionality for the price of $39,819 USD. This system has bidirectional power

management which enables charging EVs to use grid power input and discharging EVs to supply power to loads using vehicle-to-grid functionality. This system can be used for “Peak Shaving” purposes by supplying power to the load from EV battery storage during the power-high-demand period through higher level control system networking with this system.

The system is called "IKS V2G I_DENCON", and manufactured by CPE Power Systems Inc. in Canada under License agreement with IKS. General description of the system:

10kVA-PCS (3Phase or 1 Phase available) including V2H functionality. This system is bidirectional type power management device that enables, i) charging EV using Grid power input, and ii) discharging EV and supply power to loads using V2H functionality. This system can be used for "Peak Cut" purposes by supplying power to the load from EV battery storage during the power-high-demand period. During an emergency situation (Grid Power Failure), this unit can be operated independently and enable to supply to the load. This system consists of PCS Tower which contains PCS and control circuits. The maximum output of charge/discharge is 10Kva. This system is operated by Touch Panel which is installed on the PCS Tower.

Specification of Main Body:
Dimensions: PCS Tower: W 720 mm x H1220mm x D430mm
Weight: Aprox 400kg

IKS and CPE can support NRG in terms of engineering, training through telephone as well as dispatching engineer(s) by separate contract as quoted.

IKS believes that bi-directional charging technologies have significant potential – both to serve as an inexpensive energy storage resource and to reduce the cost of electric vehicle ownership. We are looking forward to partnering with NRG, UC San Diego, and the rest of the project team on this important technology.

Sincerely,

Kazutaka Domoto
President
IKS USA, INC.

ATTACHMENT 11
Commitment and Support Letters

Letter of Support # _12_ of _18_ for Vision Fleet		
Type of Letter	☐ Commitment	☒ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☐ Demonstration Site	☐ Project Partner
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Equipment ☐ Materials ☐ Information technology services	☐ Travel ☐ Subcontractor costs ☐ Contractor in-kind labor costs ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Joshua Lake Chief Operating Officer Vision Fleet, Inc	
Phone Number and Email Address of Author	Phone: 717-860-4742 Email: josh@visionfleet.us	
Address of Author (city, state, and zip code)	Vision Fleet 1600 Main Street Venice, CA 90291	

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Vision Fleet Stakeholder Letter of Support – CEC PON 14-301, Group 3**

Dear Mr. Fisher:

On behalf of Vision Fleet, I would like to express my support as a stakeholder for NRG's response to CEC PON 14-301 *–EV Storage Accelerator*: *Proving Commercial Viability of Energy Storage from Electric Vehicles*.

An important but largely unmet opportunity for electric vehicle adoption is the fleet vehicle market. In 2013, only three out of 1,000 fleet vehicles purchased in the fleet market were electric. Vision Fleet is set up to overcome the obstacles to large-scale alternative fuel vehicle purchases that are preventing broader adoption. Vision Fleet accomplishes this through its innovative "Clean Miles Solution," which combines financing innovations from the solar and energy efficiency markets (Vision Fleet Capital) with comprehensive technological capabilities (Vision Fleet iQ) and operational support (Vision Fleet Assist) that are designed specifically for alternative fuel vehicles.

Vision Fleet's first project, announced on October 28, 2014, consists entirely of electric vehicles and is the largest ever deployment of electric vehicles in a public fleet – 425 plug-in hybrid electric vehicles and battery electric vehicles for the City of Indianapolis. With our main office in Venice, California, Vision Fleet very much sees California as one of our critical markets.

Vision Fleet is currently exploring opportunities to partner with NRG to bring NRG eVgo's electric vehicle infrastructure expertise to our customer base. In the short-term, that means using existing, market-ready technologies. But we are also excited about providing fleet customers with a vehicle-based energy storage solution, such as what NRG will be developing under the proposed project. An important reason for Vision Fleet working with NRG is their access to important technologies like this.

Sincerely,
Michael Brylawski

Michael Brylawski
CEO

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _13_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Rue Phillips President Solarrus Corp
Phone Number and Email Address of Author	Phone: 949-333-0899 Email: rue@truesouthrenewables.com
Address of Author (city, state, and zip code)	Solarrus Corp 5406 Bolsa Avenue Huntington Beach, CA 92649

Mr. Scott Fisher

Director, Alternative Energy Services

NRG Energy, Inc.

211 Carnegie Center

Princeton, NJ 08540

Re: **Letter of Commitment – CEC PON 14-301**

Dear Mr. Fisher:

Solarrus Corporation of Huntington Beach, CA is pleased to provide this letter indicating our commitment to supporting NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator *Proving Commercial Viability of Energy Storage from Electric Vehicles.*

Solarrus is an alternative energy development, installation and operation company that has created a national footprint but find its headquarters home in southern California. Solarrus has developed strengths in the EV and solar market and the future of these technologies is very important to the future of Solarrus.

Electric vehicle technologies and implementing infrastructure has been a key focus of our company and its founders since 1994 and since California has led the US in its focus toward clean highways and renewable technologies, our company continues to design systems and develop strategies in support towards large OEM's IPP's and renewable developments across the State. On a daily basis across the nation our technicians are dispatched to maintain, repair and service this exciting new and growing infrastructure.

Since the early efforts of EV mandates in early ninety's, CA drivers have been itching for new environmentally friendly emissions free vehicles and has led the nation in the number of ZEV drivers. Our company and its founders are passionate towards mitigating ZEV driver range anxiety by being one of the largest and most prominent EV infrastructure installation and support companies. Each week we install and commission multiple level one, two and three stations up and down the state and each day we service maintain and repair such infrastructure across the nation so that EV drivers can enjoy trouble free public charging for decades to come.

5406 Bolsa Avenue•Huntington Beach, California 92649
Phone•949-333-0899•CA License#942587

Solarrus is dedicated to developing, maintaining, and operating infrastructure that support alternative energy technologies.

Should the V2G proposal by NRG be selected for funding by the California Energy Commission, Solarrus will participate as a subcontractor to provide services to install EV charging stations, meters, and other site hardware that will be configured as part of Task 4 for the Technical Demonstration. Engineers at Solarrus will also support the continued successful operation of all charging stations for the duration of the 35 month award period with trained and certified technicians. Solarrus has committed to send X number of technicians to Princeton Power Systems, IKS, and University of Delaware in order to become certified technicians in trouble shooting and repair of the installed charging stations.

We are truly excited by this project's potential to show that bi-directional electric vehicle charging presents a viable – and potentially inexpensive way – to bring a large energy storage resource to California.

Sincerely,

Rue Phillips

President. Solarrus Corp

5406 Bolsa Avenue•Huntington Beach, California 92649
Phone•949-333-0899•CA License#942587

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _14_ of _18_ for NRG Energy, Inc	
Type of Letter	☒ Commitment ☐ Support
Commitment Letter Subject Matter *(select one or more as appropriate)*	☐ Match Funding ☒ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding *(if applicable)*	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Ronald Iskii P.E., DGCP, CMVP Principal/Chairman AESC
Phone Number and Email Address of Author	Phone: 760-931-2641 Email: rishii@aesc-inc.com
Address of Author (city, state, and zip code)	AESC 5927 Balfour Court, Suite 213 Carlsbad, CA 92008

October 31, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: AESC Letter of Commitment – CEC PON 14-301

Dear Mr. Fisher:

Alternative Energy Systems Consulting (AESC) of Carlsbad, CA is pleased to provide this letter indicating our partnerships and commitment to support NRG's response to CEC PON 14-301, Group 3 proposal: EV Storage Accelerator Proving Commercial Viability of Energy Storage from Electric Vehicles.

As California is entering an age of decarbonizing the energy and transportation sector, the use of electric vehicle batteries as storage and energy management resources will play an important role in both divisions. California faces unique challenges to electric energy supply and distribution, the loss of the San Onofre Nuclear Generating Station, the impending shutdown of several legacy coastal once through cooling power plants, challenges in siting and construction of new transmission infrastructure and the intermittency of central as well as customer sited renewable energy systems. As a leading consulting engineering firm in California who possesses specialized experience in the area of modulated electric vehicle charging benefits, we see the bi-directional project that NRG proposes as a way to further expand energy management resources and strengthen the energy future of California.

The EV Storage Accelerator project will showcase cost-effective V2X technology (in smart vehicles, charging stations, and control systems), but equally important it will draw from the California Vehicle-Grid Integration Roadmap and from engagement with the CPUC to demonstrate both how existing regulatory structures can be leveraged, and highlighting where rule changes are needed to take advantage of the unique strengths of V2X. In addition to an operating V2X system with charging stations at several sites generating valuable operational data, a key output of the project will be a document with suggested rule changes, including the rationale and value of those changes, to be fed back to the CPUC Alternative Fuel Vehicle proceeding (R1311007, tasked with proposing and assessing tariff rule changes that would facilitate V2X).

AESC is uniquely qualified to provide the measurement and verification services for this effort. Founded in 1994, AESC is a certified California small business (SB) and minority business enterprise (MBE). We have a long history of service to California IOU's and regulators as the go-to source for objective, unbiased energy technology evaluation, assessment, measurement and verification, which gives us an experienced

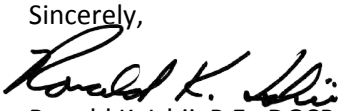
based understanding that verification of program results and quantified performance is crucial to the on-going success of any innovative program.

- AESC has been the core consultant for the statewide energy efficiency, distributed generation and renewable energy utility programs since the mid-1990's.
- AESC personnel have conducted measurement and verification of thousands of solar systems, distributed generators and energy efficiency projects.
- AESC is a key contractor for the field assessment of emerging energy technologies for several of the California investor owned utilities.
- For the statewide Self-Generation Incentive Program, AESC has provided key policy implementation support for Advanced Energy Storage technologies since 2008.
- In addition, AESC is the prime contractor installing three publicly accessible DC fast chargers by RWE and eight dual RWE Level 2 eStation Smart Systems on UCSD's campus.

AESC is committed to providing the EV Storage Accelerator project with developing and implementing a Measurement and Verification Plan that goes beyond ex post analysis. By clearly defining how results will be quantified, the M&V plan can have a positive impact on the project from concept to completion. Unlike conventional energy savings projects V2X technology offers benefits beyond simply reducing demand, which is the focus of current M&V practice. Therefore, this M&V plan, while based on the widely accepted IPMVP (International Performance Measurement & Verification Protocol), is modified to account for grid impact benefits not normally covered by IPMVP. Energy and GHG impact benefits will be calculated using the References for Calculating Electricity End-Use, Electricity Demand, and GHG Emissions described in Attachment 12 of the PON. Additional grid benefits will be calculated using the California ISO (CASIO) pricing for specific time dependent services.

Energy storage is key to a more flexible, responsive and reliable electric grid that can facilitate new ultra-clean distributed generation and GHG mitigating loads. We are excited by this project's potential to show that bi-directional electric vehicle charging presents a viable – and potentially inexpensive way – to bring a large energy storage resource to California.

Sincerely,



Ronald K. Ishii, P.E., DGCP, CMVP
Principal/Chairman

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _15_ of _18_ for NRG Energy, Inc		
Type of Letter	☐ Commitment	☒ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☐ Pilot Test/Demonstration/ Deployment Site	☐ Project Partner
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Equipment ☐ Materials ☐ Information technology services	☐ Travel ☐ Subcontractor costs ☐ Contractor in-kind labor Costs ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Frank Lindh Lawyer, General Council to CPUC	
Phone Number and Email Address of Author	Phone: 415-365-7363 Email: flindh@crowell.com	
Address of Author (city, state, and zip code)	Crowell Moring 275 Battery Street, 23rd Floor San Francisco, CA 94111	

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crowell moring

Frank R. Lindh
Flindh@crowell.com

November 12, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Support/Technical Advisory Committee – CEC PON 14-301, Group 3**

Dear Mr. Fisher:

I would like to thank you for your invitation to serve on the Technical Advisory Committee for the *EV Storage Accelerator* project. I would be honored to help support the project as an expert advisor, should the California Energy Commission choose NRG's proposal under CEC PON 14-301, Group 3.

As we have discussed, I will not be employed as an attorney, and my serving as a Technical Advisor to the project will not create an attorney-client relationship between Crowell & Moring LLP and your company.

Having recently completed nearly six years of service as General Counsel of the California Public Utilities Commission, and as a current partner in the Energy Group at Crowell & Moring, I believe I have a good understanding of the steps new technologies need to take in order to successfully serve California's electricity customers. With the growing penetration of electric vehicles in California, the proposed NRG project represents an exciting opportunity to start to unlock the inherent storage value of those vehicles.

The NRG proposal represents a particularly credible response to this CEC PON. The company has a strong business platform in California, including electric vehicle services, conventional generation, solar, wind and demand response, and the company has a strong strategic rationale for supporting vehicle-to-grid technology. For this project, the company will partner with two major auto manufacturers, Honda and Nissan, to better ensure a viable commercialization pathway.

I look forward to contributing to the success of this important project by participating as a member of the Technical Advisory Committee, and I sincerely appreciate the opportunity to do so.

Sincerely,

Frank R. Lindh

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _16_ of _18_ for NRG Energy, Inc	
Type of Letter	☐ Commitment ☒ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☐ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Jim Detmers, Consultant
Phone Number and Email Address of Author	Phone: 916-350-4317 Email: jdetmers@live.com
Address of Author (city, state, and zip code)	Power System Resources, LLC PO Box 1845 Folsom, CA 95763

Power System Resources, LLC
Completing Renewable Integration

PO Box 1845, Folsom, CA 95763-1845
(916) 350-4317 Off.

November 12, 2014

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Support/Technical Advisory Committee – CEC PON 14-301, Group 3**

Dear Mr. Fisher:

I would like to thank you for your invitation to serve on the Technical Advisory Committee for the *EV Storage Accelerator* project. I am looking forward to working on the project should the California Energy Commission choose NRG's proposal under CEC PON 14-301, Group 3.

As a former Vice President of Operations at the California Independent System Operator (CAISO), I am aware of the requirements for operating a successful bulk power system. More recently, I have served as an advisor to several firms designing and developing technology and resources to successfully serve that system. Electric vehicles with energy storage capabilities are a promising resource that over time will provide value to customers and to the grid.

The proposed project represents a great opportunity for California to further develop that resource. With NRG as project lead, and the involvement of Nissan, Honda, UC San Diego, Olivine and others, the California Energy Commission will have the opportunity to choose an especially credible project team.

I look forward to contributing to the success of this important project by participating as a member of the Technical Advisory Committee.

Sincerely,

James Detmers

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _17_ of _18_ for NRG Energy, Inc	
Type of Letter	☐ Commitment ☒ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☐ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Mike Bourton Co Founder & VP of Business Development Grid2Home
Phone Number and Email Address of Author	Phone: 408-489-1655 Email: mikebourton@grid2home.com
Address of Author (city, state, and zip code)	Grid2Home 3760 Convoy Street San Diego, CA 92111

3760 Convoy Street
San Diego CA 92111

Mr. Scott Fisher
Director, Alternative Energy Services
NRG Energy, Inc.
211 Carnegie Center
Princeton, NJ 08540

Re: **Letter of Support/Technical Advisory Committee – CEC PON 14-301, Group 3**

Dear Mr. Fisher:

I would like to thank you for your invitation to serve on the Technical Advisory Committee for the *EV Storage Accelerator* project. I am looking forward to working on the project should the California Energy Commission choose NRG's proposal under CEC PON 14-301, Group 3.

Grid2Home is a technology company at the forefront of Smart Energy Protocol 2.0 (SEP 2.0). As co-founder and Vice President of Business Development, I have also been involved in several standards efforts related to vehicle grid integration, including SAE J2931/4 (Broadband PLC Communication for Plug-in Electric Vehicles) and contributions to the SEP2.0.

With partners Honda, Nissan, UC San Diego, Strategen, Olivine and others, NRG has put together a very credible project team. Should the project be chosen by the CEC, NRG and its partners have a great opportunity to leverage the SEP 2.0 protocol that have been developed. I look forward to working with the project team to support that process.

Yours sincerely

Michael Bourton
Co-Fonder and VP of Business Development

ATTACHMENT 11
Commitment and Support Letters

Letter of Commitment/Support # _18_ of _18_ for NRG Energy, Inc	
Type of Letter	☐ Commitment ☒ Support
Commitment Letter Subject Matter ***(select one or more as appropriate)***	☐ Match Funding ☐ Project Partner ☐ Pilot Test/Demonstration/ Deployment Site
Type of Match Funding ***(if applicable)***	☐ Cash in hand ☐ Travel ☐ Equipment ☐ Subcontractor costs ☐ Materials ☐ Contractor in-kind labor Costs ☐ Information technology services ☐ Partner in-kind labor Costs ☐ Advanced practice costs
Author of Letter (name and title)	Martin Otterson Sr. Vice President, Sales & Marketing OSIsoft
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November 17, 2014

Mr. Gary C Matthews
Vice Chancellor – Resource Management & Planning
UC San Diego
9500 Gilman Dr., MS 0057
La Jolla, CA 92093

Re: UC San Diego Project Partner, Match Funding Source and Stakeholder Support letter for PON 14-301-Group 3 V2G: Smart Bi-directional Vehicle Chargers.

Dear Vice Chancellor Matthews:

OSIsoft is pleased to provide this letter of commitment as a Match Funding Source and Project Stakeholder offering match funding to the University of California, San Diego (UCSD) application in response to the California Energy Commission's (CEC) PON 14-301-Category 3: V2G: Smart Bi-directional Vehicle Chargers.

As an individual authorized to act upon the behalf of OSIsoft, we are unconditionally committed to license our newly released product "ESRI Integrator, as an "in kind" contribution to support your bid. The "ESRI Integrator" will allow you to bring PI Data into your ESRI environment for geospatial perspective. This represents a retail market value of $172,000 in license fee savings. The software is commercially available so there is no question that the match funding will materialize.

UCSD and OSIsoft enjoy an ongoing relationship that was originated with the RESCO project in 2010. We realize that the proposed project is designed to benefit CA IOU ratepayers with respect to the EPIC goals by offering multiple, creative features that will provide greater reliability, lower costs, and increased safety, particularly to economically disadvantaged and "At Risk" communities. It is my understanding that the Project will pursue the key principle of electricity ratepayer benefits including societal benefits; GHG emissions mitigation and adaptation in the electricity sector at the lowest possible cost; the loading order; low-emission vehicles/transportation; economic development; and efficient use of ratepayer monies.

OSIsoft wishes to provide UCSD with the ability to pinpoint communities candidates for microgrids since they are located entirely within a 2010 census tract with the poorest environmental quality as defined by a CalEnviroScreen 2.0 in the 81 or greater percentile range;" Being an ESRI licensee, UCSD would also have access to the census tracts that are candidates for lowest income and thus eligible for New Market Tax Credits. When SCE announces their constrained T&D circuits, UCSD could also add that as a layer. Thus, you will explore how with three layers of the poorest environment, income and T&D infrastructure can be used to pinpoint where project developers should focus. UCSD having access to the seven counties and 191 municipalities through Southern California Association of Governments (SCAG) would be an immense advantage.

The ESRI Integrator software would also permit you to record, analyze and visualize usage patterns of the two Smart Vehicle Fleets on campus. UCSD can overlay this data with actual charging events and energy requirements at the beginning of each charging event to develop load forecasts for each transformer serving the charging station clusters on campus. UCSD has indicated that these load forecasts are an essential ingredient to deliver to the charging stations in each cluster as they enable the charging station to provide dynamic "Pmax" limit to the charge profile of each connected Smart vehicle. Further, UCSD can use the software to better understand driver behavior during each hour of the day and predict the length 'vehicle downtime' when it can charge.

OSIsoft, LLC is a privately held software company based in California. The proposed software is developed and made in California. Our main product, the PI System, is used extensively throughout the power industry, by power generation (fossil fuel, nuclear and renewables) as well as by many Transmission & Distribution companies. The system is used by major ISOs and IOUs, including PG&E, SDG&E, CAISO, PeakRC and many of the other organizations throughout California, North America and globally. The PI System is reliable, commercial software that is used to monitor and mitigate grid disruptions during events caused by wildfires, earthquakes, high demand, intermittent supply, or equipment failure. OSIsoft is a participant in numerous industry initiatives, including smart city and smart grid research programs. In addition, PI System software is used by many industrial customers with independent power production, meaning that the PI System plays a role on "both side of the meter".

OSIsoft supports the UCSD team's goals that are highly relevant to our corporate interests:

- UCSD will be demonstrating numerous low carbon-based distributed energy resources within its flagship microgrid in San Diego.
- UCSD shares the vulnerabilities of power supply issues caused by lack of transmission line capacity and the retirement of the San Onofre Nuclear Generating Station. UCSD's purpose is to demonstrate that microgrids can provide energy savings, integrate renewable generation, reduce fossil fuel use, and efficiently manage resources with automation provided by an energy management system/microgrid controller for the continuous operation of critical municipal infrastructures during grid disruptions.
- UCSD's dual emphasis on technology demonstration and resolving barriers to deployment of low carbon-based microgrids would be of keen importance to other counties and municipalities interested in replicating the UCSD microgrid model by developing lessons learned and best practices. More importantly, this project is additionally targeting the Disadvantaged, At-Risk Communities throughout the Southern California region.

Sincerely,

Martin Otterson, Sr. VP. Sales and Marketing
Cc OSIsoft legal

EV Storage Accelerator

Proving Commercial Viability of Energy Storage from Electric Vehicles

NRG Energy, Inc

Program Opportunity Notice PON-14-301

Appendix – Specific CPUC Questions

The below summary is intended to answer specific CPUC questions about the proposed "EV Storage Accelerator" project.

Put documents in one PDF. Our CEC proposal is in the same PDF as this letter. This is the original CEC proposal, with a few scope changes requested by the CEC over the last 10 weeks, and with a few additional minor changes that we note below.

Clarify the term "EV Storage" to mean bi-directional capability. We have added clarifying statements to the executive summary, the fact sheet, the narrative, and the scope of work to make that clarification. We also agree that, as we map out use cases, we will include V1G use cases.

Describe source of University of Delaware funding. An important part of the CEC scoring criteria is to ensure that no funds are spent on out-of-state sources. As such, all funding to the University of Delaware was part of NRG's cost share and separate from the $1.5 million of CEC funding. (See budget tab B-2 and B-7, and well as page 38 of the narrative for a more specific detail.)

If the project is funded through the Technology Demonstration Program, NRG's funding of the University of Delaware will come from a separate source of funding, and will be incremental to the $1 million project budget that NRG has proposed to the CPUC.

Include CPUC and CAISO engagement early in the process. We believe that early CPUC and CAISO input will be an important factor in the overall success of the project. We have added specific language in Task 2 of the scope of work to specify that engagement.

OEM participation. In general, the more light-duty OEMs that participate, the better. That said, NRG – together with our partners – has worked closely with Honda, Nissan and BMW to ensure bi-directional capability on vehicles. This work has included extensive engineering work on the part of the OEMs. (BMW has currently not committed to participating in the project, but we are working with them on bi-directional technology development and hope to include them in the project). NRG is open to additional OEM participation on the project provided these OEMs are open to technical collaboration to develop a workable bi-directional solution. To the extent the CPUC would like us to work with any OEMs in particular, please let us know.