August 3, 2018

Energy Division  
Attn: Tariff Unit  
California Public Utilities Commission  
505 Van Ness Avenue  
San Francisco, California 94102

Re: Withdrawal of Southern California Edison Company’s Advice 3430-E

Dear Energy Division Tariff Unit:

Pursuant to Ordering Paragraph 11 of Decision 18-07-037, Southern California Edison Company (SCE) is requesting the withdrawal of Advice 3430-E.  

SCE submits this request for withdrawal in accordance with General Order 96-B, General Rule 5.3. SCE asks that a confirmation letter be returned regarding this withdrawal.

Should you have any questions, please contact me.

Sincerely,

/s/ Gary A. Stern  
Gary A. Stern, Ph.D.

GAS:dm:cm

Copy: Edward Randolph, Director, CPUC Energy Division  
Franz Cheng, CPUC Energy Division  
Laura Krannawitter, CPUC Energy Division  
Service Lists GO 96-B, I.12-10-013, A.14-04-034, and A.16-04-001

1 Ordering Paragraph 11 references SCE’s Advice 3403-E; however the last two numbers appear to have been inadvertently transposed and reference should be to Advice 3430-E. Advice 3430-E entitled, Utility-Administered University of California Greenhouse Gas Research and Reduction Program Implementation Plan, was submitted July 11, 2016.
August 16, 2016

Advice Letters: SCE 3430-E
SDG&E 2919-E

Russell G. Worden
Managing Director, State Regulatory Operations
Southern California Edison Company
8631 Rush Street
Rosemead, CA  91770

Michael R. Hoover
Director, State Regulatory Affairs
c/o Karyn Gansecki
Southern California Edison Company
601 Van Ness Avenue, Suite 2030
San Francisco, California 94102

Megan Caulson
Regulatory Tariff Manager
San Diego Gas & Electric Company
9305 Lightwave Avenue, SD 1190
San Diego, CA 92123

Subject: Greenhouse Gas Research and Reduction Program Implementation Plan

Dear Mr. Worden, Mr. Hoover and Ms. Caulson:

On July 11, 2016, Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) (herein referred to as the Utilities) re-filed a joint Advice Letter (SCE 3430-E and SDG&E 2919-E) containing the Program Implementation Plan (PIP) and demonstrations for the Greenhouse Gas Research and Reduction Program ordered in Decision (D.)14-11-040.

The purpose of this letter is to inform you that the joint Advice Letter is consolidated within Investigation (I).12-10-013 and will be disposed therein as was directed in the joint Assigned Commissioner’s/Assigned Administrative Law Judge’s ruling issued May 9, 2016 in that proceeding. The joint Advice Letter shall not be disposed of by Energy Division staff and shall not be subject to Advice Letter treatment, because “the relief requested is pending before the Commission in a formal proceeding” and the “Industry Division will reject without prejudice an advice letter whose disposition would require an evidentiary
hearing or otherwise require review in a formal proceeding” (see General Order 96-B General Rule 7.4.2, subdivision 4, and General Rule 7.6.1).

On November 25, 2014, the Commission issued D. 14-11-040 (Decision) in I.12-10-013 adopting the settlement agreement as amended and restated by the settling parties resolving the Commission’s Investigation into the rates, operations, practices, services and facilities of the Utilities associated with the San Onofre Nuclear Generating Station Units 2 and 3. Among other terms, in this Decision the Commission ordered the Utilities to develop a Greenhouse Gas (GHG) Research and Reduction program to be overseen by the Commission’s Energy Division. The Decision specified various program requirements and filing procedures in Ordering Paragraph 5.

The Utilities filed a joint Advice Letter, numbers 3207-E (SCE) and 2727-E (SDG&E), on April 20, 2015, containing the GHG Research and Reduction Program Implementation Plan and elements required in the Decision. Energy Division rejected this initial joint Advice Letter for non-compliance with D.14-11-040 via disposition letter on March 11, 2016. That disposition letter also directed the Utilities to re-file a corrected joint Advice Letter within 120 days. On May 9, 2016 ALJ Bushey’s and Commissioner Sandoval’s joint ruling stated that after being filed, "the Advice Letters are consolidated into this proceeding for resolution through a Commission decision." The Joint Advice Letters were subsequently filed on July 11, 2016. SCE and SDG&E subsequently submitted on July 13, 2016 a Joint Compliance Filing in I.12-10-013 to consolidate the joint Advice Letters SCE AL 3403-E and SDG&E 2919-E into this proceeding and attached a copy of the joint Advice Letters.

The Energy Division hereby rejects, without prejudice, Advice Letters Letters SCE AL 3403-E and SDG&E 2919-E because the matters they concern will be considered within the scope of I.12-10-013.

Sincerely,

/s/ Cynthia Walker
Cynthia Walker, Deputy Director
Energy Division

cc:  Service List for I.12-10-013
Office of Ratepayer Advocates
August 8, 2016

Advice Letter: 3430-E

Russell G. Worden  
Managing Director, State Regulatory Operations  
Southern California Edison Company  
8631 Rush Street  
Rosemead, CA 91770

SUBJECT: Utility-Administered University of California Greenhouse Gas Research and Reduction Program Implementation Plan

Dear Mr. Worden:

As Advice Letter 3430-E has been entered into Investigation (I.) 12-10-013, the Energy Division will take no action. As a result, the disposition will be listed on the Daily Calendar as ‘no action.’

Sincerely,

Edward Randolph, Director  
Energy Division
July 11, 2016

ADVICE 3430-E
(Southern California Edison Company - U 338-E)

ADVICE 2919-E
(San Diego Gas & Electric Company - U 902-E)

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA
ENERGY DIVISION

SUBJECT: Utility-Administered University of California Greenhouse Gas
Research and Reduction Program Implementation Plan

PURPOSE AND INTRODUCTION

In compliance with Ordering Paragraph (OP) 5 of Decision (D.)14-11-040 and the
Energy Division's March 11, 2016 disposition letter regarding Southern California
Edison Company's (SCE) Advice 3207-E and San Diego Gas & Electric Company's
(SDG&E) Advice 2727-E (Disposition Letter), SCE and SDG&E (collectively, the
Utilities) hereby re-submit their respective Program Implementation Plans for the Utility-
Administered University of California (UC) Greenhouse Gas Research and Reduction
Program (Program). The Disposition Letter rejected the advice letters because the
Utilities failed to: (1) explain that the Utilities' administration of the Program will not be
funded with customer funds, and (2) address how the Utilities intend to negotiate
proceeds from intellectual property (IP) that might arise from the directed research.¹
The Energy Division directed the Utilities to file new advice letters within 120 days.

This advice letter addresses the Energy Division’s two concerns. As explained below in
further detail, the Utilities’ administrative costs necessary to implement the Program
(i.e., project selection and annual reporting) will be absorbed by the Utilities. The
Utilities’ absorption of these administrative costs will not result in a rate increase and the
Utilities will not request funds in a GRC or other application proceeding to pay for these
costs. In addition, the Utilities do not intend to own any IP rights except for rights to

¹ See Energy Division Disposition Letter, dated March 11, 2016; see also l.12-10-013, Joint
Ruling of Assigned Commissioner and Administrative Law Judge, dated May 9, 2016
(summarizing Disposition Letter).
Program reports and data needed to comply with D.14-11-040. The UCs will own the IP rights, which will be specified in the funding grant agreements made with the Utilities.

**BACKGROUND**

D.14-11-040 approved the settlement agreement between the Utilities and four other settling parties, resolving Investigation (I.) 12-10-013 (SONGS OII), which addressed rate recovery and other issues related to the shutdown of San Onofre Nuclear Generating Station Units 2 and 3 (SONGS 2&3). OP 5 directed SCE and SDG&E to develop the Program in accordance with the following requirements:

a. As part of their philanthropic programs, the Utilities agree to work with the University of California Energy Institute (or other existing UC entity, on one or more campuses, engaged in energy technology development) to create a Research, Development, and Demonstration program, whose goal would be to deploy new technologies, methodologies, and/or design modifications to reduce GHG emissions, particularly at current and future generating plants in California.

b. The Greenhouse Gas Research and Reduction program will operate for up to five years following the Commission’s approval of the Tier 2 Advice Letter described in 4.16(e) of the Amended and Restated Settlement Agreement.

c. SCE shall donate $4 million annually for five years, and SDG&E shall donate $1 million annually for five years, so that the total amounts donated will be $5 million annually for five years for the program described in OP 5.a. All such donations will be from shareholder funds.

d. Within 60 days of the effective date of D.14-11-040, the Utilities shall host a meeting with University of California representatives and other interested parties with the goal of crafting a Program Implementation Plan. The Commission’s Energy Division shall provide support in coordinating the meeting. On January 8, 2015, SCE and SDG&E received approval to extend the date for compliance with this requirement to February 18, 2015.

e. Within 30 days thereafter, the Utilities shall jointly file, and serve, a Program Implementation Plan via a Tier 2 Advice Letter that describes the process for implementation, a proposed schedule and budget, and expected results, applications, and demonstrations. To the extent possible, University of California shall make available to the program relevant data assembled through University of California-affiliated institutions and entities. On January 8, 2015, the Utilities received approval to extend the date for compliance with this requirement to 60 days after the completion of the OP 5.d. requirement (April 20, 2015).

f. The Utilities will file, and serve, an annual report to the Energy Division to apprise the Commission of the program’s progress towards beta testing of developed technologies, methodologies, and/or design changes.
In compliance with OP 5, SCE and SDG&E filed advice letters (Advice 3207-E and Advice 2727-E, respectively), which included Program Implementation Plans (PIPs) detailing the operations of a proposed utility-administered Program. As noted above, Commission Energy Division staff issued a Disposition Letter rejecting the advice letters because the Utilities failed to: (1) explain that the Utilities’ administration of the Program will not be funded with customer funds, and (2) address how the utilities intended to negotiate proceeds from IP that might arise from the directed research.

DISCUSSION

The Utilities’ Program plans reflect input from several industry stakeholders and address the two concerns outlined in the Disposition Letter.

A. Development of the Program Plan

The Utilities jointly hosted a public meeting on February 18, 2015 in Costa Mesa, California with the objective of receiving input for crafting the required Program Implementation Plan, attached hereto as Appendices A-C. This meeting included representatives and presentations from the Energy Division, SCE, SDG&E, the Universities of California (UC) within or adjacent to the SCE and SDG&E service areas (i.e., UC San Diego, UC Riverside, UC Irvine, UC Los Angeles, and UC Santa Barbara), the California Institute for Energy and Environment (CIEE), and private industry stakeholders.

The Energy Division introduced the Program by providing a brief discussion of the requirements in D.14-11-040 and next steps in the process. SCE and SDG&E presented the Program charter, objectives, administration, the project selection and execution process and their respective focus areas for the initial funding cycle. Each of the UC campuses discussed particular strengths, and the CIEE presented a proposal for its administering the program.

Much of the discussion at the public meeting involved stakeholders seeking clarification regarding certain aspects of the program. The following provides a brief summary of the discussion and the clarifications, many of which were incorporated into the Program Implementation Plan, Appendices A-C.

- The CIEE presented its proposal for managing the Program, rather than having the Utilities manage the program. D.14-11-040, OP 5a, however, directs the Utilities to work with the University of California Energy Institute or other existing UC entities engaged in energy technology development. To comply with this direction, the Utilities will administer the program, working directly with the UC campuses, primarily in southern California.

- The UC representatives requested additional detail regarding administrative expenditures and the type of funding instrument to be used. With respect to the Utilities’ administration needed to comply with OP5, the Utilities intend to
administer the Program as part of their existing technology programs and do not plan to utilize any of the budgeted $25 million for this purpose. Regarding project-level administration by the UC, the competitively selected UC entities will be able to utilize up to 10 percent for project-related administrative expenses.\(^2\) These clarifications, which resulted from discussions at the public meeting, were sent to the UC campuses prior to the project proposal deadline, so they could make any changes to their projected budgets.

- The UC representatives also had questions regarding IP issues. SCE and SDG&E provided the following preliminary guidance to the UC campuses regarding IP prior to the proposal deadline: 1) previously-developed IP would be retained by the developer; 2) the Utilities must have rights to the reports and data needed to comply with D.14-11-040 and any other Federal or State reporting requirements; and 3) the parties will negotiate terms for any IP developed as a direct result of the work funded under this Program.

- The UC Global Climate Leadership Council’s Applied Research Workgroup (UC GCLC) provided written comments recommending that the Utilities consider the research priorities of the UC President’s 2025 Carbon Neutrality Initiative (UC President’s Initiative) in prioritizing the research to be funded under this Program. The UC GCLC also provided a presentation describing the UC President’s Initiative. While the programs differ with respect to scope, the research areas discussed in the presentation (i.e., Alternatives to Natural Gas; Systems Integration, Renewable Power and Storage; Energy Efficiency; and Policy and Economics) are aligned with the Utilities’ UC GHG Focus Areas (Described in Appendices B and C). The Utilities agree that there may be opportunities for additional coordination and collaboration.

B. Program Implementation Plan

In compliance with OP 5, Appendix A proposes a Program Implementation Plan, which includes the process, schedule, and budget, under which the Program will be administered. Appendices B and C discuss the expected results, applications, and demonstrations associated with the selected UC proposals. The Program will be funded as part of SCE and SDG&E shareholder-funded, philanthropic programs.

C. Energy Division Issues

To address the issues described by Energy Division in its Disposition Letter, the Utilities provide the following additional information:

\(^2\) The 10 percent cap is similar to the 10 percent administrative cap instituted on the California IOUs and the CEC for Electric Program Investment Charge (EPIC) programs. See, e.g., D.12-05-037 at 67.
The projected costs associated with the Utilities' administration of the Program (i.e., the labor attributable to project selection, annual reporting and project/program meetings with University of California representatives) are nominal and will not result in any incremental cost to customers, nor reduce the amount of funding provided to the UCs. Unlike other programs, the CPUC in D.14-11-040 specifically directs the scope (GHG reduction), the vendors (the UCs), the funding source (shareholder philanthropic budget), the budget ($25 million) and the Utilities’ role, which is to work with the UCs by providing a limited amount of program administration. Specifically, the Utilities will each allocate a portion of a project manager’s time to oversee program administration and utilize a limited amount of subject-matter-expert resources (e.g., engineers, managers, and technical specialists) to review the proposals and select the projects. The Utilities do not expect administrative expenditures to exceed $100,000 per year in direct labor charges. The Utilities will absorb their administrative costs and will not request additional funding in future GRCs for administration of the Program. If needed, the Utilities can track and report the costs associated with administering the Program as part of the required annual report.

With respect to IP rights, the Utilities will have the rights to the reports and data needed to comply with D.14-11-040 and any other Federal or State reporting requirements, and do not intend to own the IP developed as part of this Program. In its Disposition Letter, the Energy Division described its internal discussions with the Commission’s Legal Division, confirming that IP rights associated with grant funding typically accrue to the research institution receiving the grant. The Utilities agree with this reasoning and intend that ownership of the IP rights will be retained by the UCs, subject to the specific terms of the grant agreement between the Utilities and the UCs.

No cost information is required for this advice filing.

This advice filing will not increase any rate or charge, cause the withdrawal of service, or conflict with any other schedule or rule.

**TIER DESIGNATION**

Pursuant to OP 5 of D.14-11-040, this advice letter is submitted with a Tier 2 designation.

**EFFECTIVE DATE**

This advice filing will become effective on August 10, 2016, the 30th calendar day after the date filed.

**NOTICE**

Anyone wishing to protest this advice filing may do so by letter via U.S. Mail, facsimile, or electronically, any of which must be received no later than 20 days after the date of this advice filing. Protests should be submitted to:
CPUC, Energy Division  
Attention: Tariff Unit  
505 Van Ness Avenue  
San Francisco, California 94102  
E-mail: EDTariffUnit@cpuc.ca.gov

Copies should also be mailed to the attention of the Director, Energy Division, Room 4004 (same address above).

In addition, protests and all other correspondence regarding this advice letter should also be sent by letter and transmitted via facsimile or electronically to the attention of:

For SCE

Russell G. Worden  
Managing Director, State Regulatory Operations  
Southern California Edison Company  
8631 Rush Street  
Rosemead, California 91770  
Telephone: (626) 302-4177  
Facsimile: (626) 302-4829  
E-mail: AdviceTariffManager@sce.com

Michael R. Hoover  
Director, State Regulatory Affairs  
c/o Karyn Gansecki  
Southern California Edison Company  
601 Van Ness Avenue, Suite 2030  
San Francisco, California 94102  
Facsimile: (415) 929-5544  
E-mail: Karyn.Gansecki@sce.com

For SDG&E

Attn: Megan Caulson  
Regulatory Tariff Manager  
9305 Lightwave Avenue, SD 1190  
San Diego, CA 92123  
E-mail: MCAulson@semprautilities.com

There are no restrictions on who may file a protest, but the protest shall set forth specifically the grounds upon which it is based and must be received by the deadline shown above.

In accordance with General Rule 4 of GO 96-B, SCE and SDG&E are serving copies of this advice filing to the interested parties shown on the attached GO 96-B and the
A.14-04-034 service lists. In addition, in accordance with OP 5 of the Joint Ruling Of Assigned Commissioner And Administrative Law Judge Reopening Record, Imposing Ex Parte Contact Ban, Consolidating Advice Letters, And Setting Briefing Schedule, issued May 9, 2015, in I.12-10-013 and related proceedings, SCE is timely serving copies of this advice letter on the I.12-10-013 service list, as well as filing the advice letter in that same proceeding.³

Address change requests to the GO 96-B service list should be directed by electronic mail to AdviceTariffManager@sce.com or at (626) 302-3719. For changes to all other service lists, please contact the Commission’s Process Office at (415) 703-2021 or by electronic mail at Process_Office@cpuc.ca.gov.

Further, in accordance with Public Utilities Code Section 491, notice to the public is hereby given by filing and keeping the advice filing at SCE’s corporate headquarters. To view other SCE advice letters filed with the Commission, log on to SCE’s web site at https://www.sce.com/wps/portal/home/regulatory/advice-letters.

For questions, please contact John Minnicucci at (714) 895-0159 or by electronic mail at John.Minnicucci@sce.com.

Southern California Edison Company

/s/ Russell G. Worden
Russell G. Worden

RGW:jm:cm
Enclosures

³ The service and filing of this advice letter in I.12-10-013 timely fulfills the compliance filing requirement of OP 5 of the May 9 Ruling and thus, consolidates the advice letter into I.12-10-013 for resolution through a Commission decision in that proceeding.
**Company name/CPUC Utility No.:** Southern California Edison Company (U 338-E)

**Utility type:**
- [☐] ELC
- [□] GAS
- [□] PLC
- [□] HEAT
- [□] WATER

**Contact Person:** Darrah Morgan
**Phone #:** (626) 302-2086
**E-mail:** Darrah.Morgan@sce.com

**E-mail Disposition Notice to:** AdviceTariffManager@sce.com

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## EXPLANATION OF UTILITY TYPE

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<th>ELC = Electric</th>
<th>GAS = Gas</th>
<th>PLC = Pipeline</th>
<th>HEAT = Heat</th>
<th>WATER = Water</th>
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<td><strong>ELC</strong></td>
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<td><strong>PLC</strong></td>
<td><strong>HEAT</strong></td>
<td><strong>WATER</strong></td>
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**Advice Letter (AL) #:** 3430-E
**Tier Designation:** 2

**Subject of AL:** Utility-Administered University of California Greenhouse Gas Research and Reduction Program Implementation Plan

**Keywords (choose from CPUC listing):** Compliance

**AL filing type:**
- [☐] Monthly
- [□] Quarterly
- [□] Annual
- [☑] One-Time
- [□] Other

If AL filed in compliance with a Commission order, indicate relevant Decision/Resolution #:

**Decision 14-11-040**

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL:

Summarize differences between the AL and the prior withdrawn or rejected AL:

Confidential treatment requested?
- [□] Yes
- [☑] No

If yes, specification of confidential information:

Confidential information will be made available to appropriate parties who execute a nondisclosure agreement.

Name and contact information to request nondisclosure agreement/access to confidential information:

Resolution Required?
- [□] Yes
- [☑] No

**Requested effective date:** 8/10/16
**No. of tariff sheets:** -0-

**Estimated system annual revenue effect:** (%):

**Estimated system average rate effect:** (%):

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

**Tariff schedules affected:** None

**Service affected and changes proposed:**

**Pending advice letters that revise the same tariff sheets:** N/A

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1 Discuss in AL if more space is needed.
Protests and all other correspondence regarding this AL are due no later than 20 days after the date of this filing, unless otherwise authorized by the Commission, and shall be sent to:

CPUC, Energy Division
Attention: Tariff Unit
505 Van Ness Avenue
San Francisco, California 94102
E-mail: EDTariffUnit@cpuc.ca.gov

Russell G. Worden
Managing Director, State Regulatory Operations
Southern California Edison Company
8631 Rush Street
Rosemead, California 91770
Telephone: (626) 302-4177
Facsimile: (626) 302-4829
E-mail: AdviceTariffManager@sce.com

Michael R. Hoover
Director, State Regulatory Affairs
c/o Karyn Gansecki
Southern California Edison Company
601 Van Ness Avenue, Suite 2030
San Francisco, California 94102
Facsimile: (415) 929-5544
E-mail: Karyn.Gansecki@sce.com
Appendix A
SCE and SDG&E University of California
Greenhouse Gas Research and Reduction Program
Program Implementation Plan

Charter

The charter adopted for the utility-administered University of California Greenhouse Gas Research and Reduction Program is to support California’s GHG goals by partnering with the UC system to fund a five-year effort that will provide usable information and deployable solutions to safely, reliably and affordably incorporate a portfolio of reduced or zero emissions generation and preferred resources, particularly at current and future generating plants in California.

Objectives

In addition to a common charter, the Utilities developed program objectives, based upon the guidance provided in D. 14-11-040 and the tenets of their respective philanthropic programs, which are the required funding source for the University of California Greenhouse Gas Research and Reduction Program.

1. Develop a Research, Development and Demonstration (RD&D) program focused on the near-term deployment of new technologies, methodologies, and/or design modifications to reduce or avoid greenhouse gas emissions.

2. Administer the program as part of existing utility technology portfolios to better ensure path to deployment, coordinate with other RD&D entities and limit non-project expenditures.

3. Work with the University of California campuses, with a preference for those within or proximal to SCE and SDG&E service territories, focusing the effort on benefits to customers and developing the human resources needed to support State energy policy objectives into the future.

4. Create opportunities for underserved communities via supplier diversity contracts, internships and (where appropriate) localized demonstrations and pilots.

Administration

SCE and SDG&E will develop and manage the Program as part of existing utility technology programs. SCE will manage its portion of the program as part of its Advanced Technology portfolio and SDG&E will manage its portion of the program as part of its Advanced Technology Integration portfolio. This approach capitalizes on established policies, procedures (e.g., contracting, portfolio management and reporting)
and relationships with a variety of research and technology entities (e.g., the California Energy Commission, the U.S. Department of Energy and the Electric Power Research Institute). This ensures coordination with EPIC and other technology efforts, avoids unnecessary duplication and maximizes the potential to leverage financial and technical resources. Most importantly, it maximizes funding available for the actual projects by significantly reducing the amount of administrative costs to only those required by the UC campuses for the projects.

This approach will also enable SCE and SDG&E to create, refine and prioritize a coordinated list of program areas that supports the goals of the settlement and broader California GHG Utilize established objectives, to provide a framework for development of project ideas and requests for proposals.

In compliance with OP No. 5c of the Decision, SCE will commit $4 million and SDG&E will commit $1 million annually from their respective shareholder philanthropic programs over a period of five years to fund the Program.

Project Selection & Execution

SCE and SDG&E collaborated to develop efficient and effective approach to projection and program execution. This approach is made up of four distinct phases: Guidance, Screening, Awards, and Execution. For the first year of the program, each of the projects described in Appendices B and C will have gone through the Guidance and Screening phases and will have entered into the Awards phase. SCE and SDG&E will finalize the grant agreements upon approval of this Advice Letter and each of the successful projects will enter into the Execution phase. The following describes each of the phases and provides a schedule for the 2017-2020 funding allocations. The dates are intended to coincide with the UC fiscal year.

1. The Guidance phase was developed to provide information and seek input from the various UC campuses. The goal is to have this phase completed by March 1, during the program timeframe. The following are key elements of the Guidance phase:
   a. SCE and SDG&E will provide the universities with technology areas of interest and updated guidelines regarding the annual selection process.
   b. SCE and SDG&E will publish or otherwise communicate refinements (e.g., a utility-hosted meeting) to the submission requirements to the universities, including general criteria for reviewing and selecting project proposals.

2. The Screening phase provides a standard approach for reviewing and screening the proposals submitted by the UCs. The goal is to have this phase completed by May 31, during the program timeframe. The following are key elements of the Screening phase:
   a. Following existing processes within their respective technology programs, SCE and SDG&E will initially screen proposals to ensure those that are
submitted for subject-matter expert (SME) review meet program and submission criteria.

b. Proposals that pass the initial screening are submitted to SMEs, who will score the proposals.

c. If needed, SCE and/or SDG&E will host discussions with UC principal investigators/project managers to address any questions.

d. After consolidating the numeric scores, utility personnel will convene to discuss the scoring and other aspects of the proposals, as needed, and develop a consensus recommendation for final approval.

3. The Awards phase describes the steps that SCE and SDG&E will undertake to fund the projects, enabling the UCs to begin executing on the projects. The goal is to have this phase completed by July 1, during the program timeframe. The following are key elements of the Awards phase:

a. SCE and SDG&E will contact potential awardees for their respective portfolios.

b. The parties will negotiate terms and conditions, which should be fairly standard after the completing the first year of the program.

c. The grant agreement is documented by the respective corporate philanthropy organization and funding is allocated. Edison International, SCE’s parent company, is responsible for corporate philanthropy and will execute the grant agreements for SCE. SDG&E will fund its donations from corporate philanthropic funds. In the event one or more parties are unable to come to agreement in a given year, associated funds will carry over into the following year’s budget, except in the final year.

d. SCE and SDG&E will notify the Commission of selected projects for the upcoming year as part of a Tier 1 Advice Letter.

4. The Execution phase describes the steps that SCE, SDG&E and the UCs will undertake to execute on the projects and (in some cases) plan for the following year. The following are key elements of the Execution phase:

a. UC project managers commence work on approved projects upon execution of the agreement[s]. SCE, SDG&E and the UCs discuss technology transfer and leverage opportunities.

b. UC project managers provide annual reports to SCE and SDG&E by July 15 of the year following a funding allocation.

c. SCE and SDG&E prepare annual report and submit it to the CPUC by September 15 until the end of the program.

The Annual Report
Ordering Paragraph 5f of D.14-11-040 requires the following: “The Utilities will file, and serve, an annual report to the Energy Division to apprise the Commission of the program’s progress towards beta testing of developed technologies, methodologies, and/or design changes.” SCE and SDG&E propose the following format for the annual report, the components of which are generally consistent with other technology programs.

I. Executive Summary
   1. Overview of Projects / Plan Highlights
   2. Overview of Previous Year Projects

II. Background
   1. Program Requirements
   2. Charter and Objectives

III. Budget and Allocations Summary
   1. SCE
   2. SDG&E

IV. Project Updates
   1. Scope Summary
   2. Allocated Funding
   3. Status Report

V. Upcoming Year Projects
   1. SCE
   2. SDG&E

VI. Conclusions

Sample Individual Project Update Template

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Budget:  $XXX,XXX</th>
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<td>Project Manager/University:</td>
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<td>Scope Summary:</td>
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<tr>
<td>Expected Results:</td>
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<td>Status Update:</td>
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Appendix B
SCE Program Areas and Selected Projects

2016 Program Focus Areas
- Facilitating Integration of Renewables and DER
- Energy Storage Sizing/Deployment/Optimization
- Advanced Demand Response Capabilities
- Transportation Electrification
- Smart Inverter Control Strategies
- Grid Operations and Visualization Tools
- Distribution System Operator Concepts
- Integrated System Planning
- Remedial Action Scheme Optimization for Bulk Power System Renewables Integration
- Future Systems Workforce and Public Safety

Key Selection Criteria
- The potential to produce quantifiable reductions and/or avoidance of GHG emissions by the 2022 timeframe;
- The potential for funding to be expended and/or results to be realized within SCE’s service territory;
- The potential for leveraging talent and financial resources with other universities, research entities and funding resources; and
- The potential to create opportunities for underserved communities via supplier diversity contracts, internships and (where appropriate) localized demonstrations and pilots.

2016 Project Selections (Subject to Grant Negotiations)

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Port Electrification Microgrid Design and Analysis</th>
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<tbody>
<tr>
<td>Project Manager/University:</td>
<td>Jack Brouwer, Ph.D. / UCI</td>
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<tr>
<td>Request:</td>
<td>$240,000</td>
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**Project Scope:** The goal of this Project is to develop and apply a Port Electrification Microgrid Design and Analysis tool. The objectives established to meet this goal are:
1. Identification/analysis of targets and applicable technology alternatives in the goods movement sector for electrification,
2. Develop physical models (in Simulink® and/or ETAP®) for analyses of integrated use of electrification technology alternatives in port electrification microgrids,
3. Assess the GHG emissions impacts of various port electrification scenarios, and
4. Assess the air quality impacts of various port electrification scenarios.

**Expected Results:** The project will first establish an advisory committee to identify and analyze electrification technology options in the goods movement sector. The project team will develop port electrification microgrid models and assess the greenhouse (GHG) gas and air quality impacts under a number of scenarios. The
developed knowledge will be captured and incorporated into a user friendly port electrification microgrid analysis tool. This effort and deliverables will assist in identifying optimal strategies for achieving GhG reductions and air quality benefits from deploying advanced technologies and methodologies to the goods movement sector in California.

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Evolving and Managing Microgrids in the Southern California Edison Territory with a High Penetration of Renewables</th>
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<tr>
<td>Project Manager/University:</td>
<td>Scott Samuelsen, Ph.D. / UCI</td>
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<tr>
<td>Request:</td>
<td>$325,000</td>
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**Project Scope:** The goal of the proposed project is to establish the role of microgrids to (1) facilitate the integration of local renewable resources, (2) operate at peak efficiency and reliability, and (3) provide ancillary services to the grid utility. HiGRID2 will be used in conjunction with the grid microgrid controller (to be developed as part of a DOE funded effort) to design microgrids of different types (e.g., commercial, residential) that will help achieve Renewable Portfolio Standard (RPS) and GhG reduction goals. For existing and new microgrids, this approach will provide a roadmap to a higher penetration of renewables.

**Expected Results:** The project (phased over three years) will result in a strategy for existing microgrids to reduce their GhG emissions, a recommended resource mix for existing and future microgrids (high renewable content), an assessment of demand response strategies in supporting microgrid GhG emission reduction/avoidance and a study regarding the potential for ancillary services market participation. Microgrids equipped with judiciously designed energy storage, high-resolution metering, and high-performance controls have the potential to manage and facilitate a high-penetration of local and intermittent renewable generation resources. While the reduction in or avoidance of GhG depends on various factors (e.g., microgrid size and type, and the number of microgrids), microgrids in the commercial sector can contribute 15-27% to the California Air Resources Board goal in 2020.

<table>
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<tr>
<th>Project Name:</th>
<th>Development and Evaluation of Smart Inverter Control Concepts</th>
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<tr>
<td>Project Manager/University:</td>
<td>Jack Brouwer, Ph.D. / UCI</td>
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<tr>
<td>Request:</td>
<td>$370,000</td>
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**Project Scope:** The goal of this Project is to develop smart inverter control concepts, to experimentally and theoretically evaluate the concepts and to demonstrate functionality in a high penetration distribution circuit. The objectives are as follows: (1) purchase and evaluate vendors of smart inverters for compliance with Institute of Electrical and Electronics Engineers (IEEE) 1547(a) interconnection standards; (2) develop a test plan for evaluating 1547(a) features and developing other novel control strategies; (3) evaluate inverters on the laboratory scale at the UCI Connectivity Laboratory and SCE Distributed Energy Resource Laboratory; (4) and assess the effectiveness of various communications and control strategies between the inverters, the inverters and the utility, and the inverters and the user.

**Expected Results:** The project (phased over four years) will result in the development of smart inverter testing protocols and control concepts, facilitate technology advancement, and provide valuable and verifiable information to further inform the development of standards/methods (i.e., IEEE 1547 and California’s Rule 21). These contributions have the potential to reduce renewable resource integration costs and
increase the value of distributed photovoltaic (PV) generation by enhancing its contributions to grid safety and reliability, leading to increased PV adoption and reducing/avoiding greenhouse emissions from conventional generating resources.

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Systematic Planning for the Integration of Renewables and DER in the Southern California Edison System</th>
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<tr>
<td>Project Manager/University:</td>
<td>Scott Samuelsen, Ph.D. / UCI</td>
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<tr>
<td>Project Scope:</td>
<td>The goal of this project is to determine renewable and distributed energy resource deployment strategies for the SCE territory to support state energy goals, while maximizing cost effectiveness and minimizing greenhouse emissions. The analysis will address goals such as renewable portfolio standards, zero net energy mandates, and distributed generation capacity targets. This project leverages a highly-adaptable electricity system model called Holistic Grid Resource Integration and Deployment (HiGRID), in conjunction with the PLEXOS commercial software platform.</td>
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<tr>
<td>Expected Results:</td>
<td>The project (phased over two years) will develop scenarios for compliance with current and emerging state energy goals, evaluate the GhG and electricity cost performance of the compliance scenarios, evaluate the impacts of the scenarios on transmission power flows and develop a stand-alone version of HiGRID as a resource for determining future research needs. This project contributes towards the reduction of GHG emissions by characterizing resource deployment and procurement pathways. Depending on factors such as the mix of renewable resources, the types of distributed generation technologies, and how the aforementioned impact the operation of other grid resources, the GhG emissions for different grid configurations will vary. This study will provide a tool to determine the preferred procurement and deployment of grid resources that minimize GhG emissions in a cost-effective manner. The results and tools from this study will be applicable for resource planning and meeting state energy goals.</td>
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<tr>
<th>Project Name:</th>
<th>Optimal Energy Storage Deployment in California with Energy Storage Valuation and Optimization Tool</th>
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<tr>
<td>Project Manager/University:</td>
<td>Nanpeng Yu, Ph.D. / UCR</td>
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<tr>
<td>Project Scope:</td>
<td>To facilitate optimal energy storage deployment in California, advanced analytics tools are needed for performing energy storage system valuation and optimization based on location, size, technology and potential revenue streams. Existing analytics tools are not adequate in addressing the unique challenges in California, specifically they are designed for screening and evaluating a user-defined energy storage system rather than performing energy storage deployment optimization. Moreover, existing tools fail to consider revenue-generating streams that are often unique yet crucial for the grid (e.g., regulation mileage payment, flexible resource adequacy payment and flexible ramping product). The goal of this project is to expand upon the functionality of the beta version Energy Storage Valuation and Optimization Toolbox (ESVOT), which was completed in 2014. This enhanced ESVOT will include capabilities for addressing the 18 energy storage system functions in transmission/wholesale market, distribution and microgrid/consumer applications: Electric Supply Capacity, Day-Ahead Energy Time Shift, Real-Time...</td>
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**Expected Results:** This project will result in a usable tool to support optimal energy storage deployment in California. Increased and optimized deployment of energy storage resources have the potential to mitigate the uncertainties in renewable resources outputs and facilitate further renewable penetration in California. The research results could also demonstrate and confirm that the energy storage systems and renewable energy resources can function in an integrated manner with the potential to defer or eliminate the need for new gas-fired generation plants.

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Advanced Plug-In Electric Vehicle (PEV) Charging Strategies and Enhanced Electric Fleet Deployment</th>
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<tr>
<td>Project Manager/University:</td>
<td>Matthew Barth, Ph.D. / UCR</td>
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<tr>
<td>Request:</td>
<td>$150,000</td>
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**Project Scope:** This project has two general phases. First, UCR will expand the testbed from the current 2 PEVs to a fleet of 20 to better characterize the intermittent loads that PEVs impose on the local grid. Similar to the existing monitoring and characterization of stationary building loads, UCR will develop specific “mobile” PEV load models based on the vehicle fleet activity. The team will then use the models (along with the stationary load models) as part of real-time microgrid operations, optimizing energy efficiency and reducing GhG. The team will also investigate the impacts of V1G and V2G participation on PEV battery depreciation and aging.

**Expected Results:** This effort develop will develop a model for smart charging PEVs to minimize impact on the grid. The main goal of this research is to develop a system that makes it possible for PEVs to be deployed in large numbers without compromising grid stability and without increasing peak loads. If the algorithms and models developed on this research testbed are successful, they can be propagated to other electric vehicle fleets, including those operated by SCE, AQMD and a number of other entities. In five years, this could lead to the reduction of up to 650,000 tons of GHG emissions per year from fleet electrification and 3 million tons of GHG emissions per year from reduced operation of peaking power generation. This project is an extension of an existing $8 million project with the South Coast Air Quality Management District (SCAQMD) and multiple private, public, and utility partners.
<table>
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<tr>
<th>Project Name:</th>
<th>High Renewable Penetration Circuit Design, Control and Operation</th>
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<tr>
<td>Project Manager/University:</td>
<td>Jack Brouwer, Ph.D. / UCI</td>
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<tr>
<td><strong>Project Scope:</strong></td>
<td>The goal of this Project is to collaboratively develop physical modeling and analyses tools for high renewable penetration distribution circuit design and operation. The following are objectives established to meet this goal: (1) form a collaborative team of engineers and scientists comprised of SCE and UCI personnel and including SCE contractors responsible for distribution circuit design and construction; (2) develop advanced concepts and control algorithms for the design and operation of distribution circuits with high renewable penetration; (3) develop physical models for analyses of the power flow in distribution circuits with high renewable penetration based upon existing simulation capabilities; (4) apply the circuit models to representative SCE circuits throughout the service territory with various levels of renewable penetration and various design and control algorithms applied; and (5) develop recommended design criteria, monitoring and control algorithms for distribution circuits with high renewable penetration.</td>
</tr>
<tr>
<td><strong>Expected Results:</strong></td>
<td>The distribution circuit design, control and operation tools developed in this project will enable higher renewable power use in distribution circuits and assist in the design and robust operation of circuits with high renewable power use to avoid disruptions, power quality issues, and/or other disturbances.</td>
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<tr>
<th>Project Name:</th>
<th>Identifying High Utilization/Low Cost Locations for the Electric Vehicle Charging Stations</th>
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<tr>
<td>Project Manager/University:</td>
<td>J.R. DeShazo, Ph.D. / UCLA</td>
</tr>
<tr>
<td><strong>Project Scope:</strong></td>
<td>Since this market for electric vehicle charge stations began in 2010, installers have struggled to identify the locations where plug-in electric vehicle (PEV) drivers will actually use charging stations. This project proposes a methods of identifying locations for charging stations that maximizes the likelihood of high levels of utilization. The team will utilize data on actual PEV registrations by census tract within the SCE territory from 2010 to the present, combined with PEV registration data with the Southern California Associate of Governments (SCAG) Travel Model to describe how the density of PEVs varies by neighborhood by time of day. The objectives of this project are to understand: (1) how charge station installation costs vary across locations and building types; (2) identify where demand of PEVs is highest among residents and workplaces; and (3) identify high priority charge station siting and installation demonstration or pilot projects based on locations that exhibit high PEV demand and low installation costs among other conditions.</td>
</tr>
<tr>
<td><strong>Expected Results:</strong></td>
<td>The systematic approach to identifying the placement of charging facilities, developed under this effort, will help to increase their utilization. This will facilitate customer adoption of PEV technologies, which reduces the number of GhG producing vehicles on the road and the amount of GhG emitted by such vehicles.</td>
</tr>
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</table>
Project Name: Development and Application of an Energy Storage Sizing and Dispatch Optimization Tool for Grid Support Applications

Project Manager/University: Jack Brouwer, Ph.D. / UCI
Request: $215,000

Project Scope: The goal of this Project is to develop and apply an energy storage sizing and dispatch optimization tool for grid support applications. The objectives established to meet this goal are: (1) gather field test data of energy storage systems integrated with renewable power in the grid, utilizing Advanced Power and Energy Program and SCE experience; (2) garner information about the various energy storage technological features required to provide various services to the utility grid network, in particular to increase renewable power use; (3) develop the energy storage sizing and dispatch optimization tool for rapid analyses of grid support applications on the basis gathered information; (4) detailed analyses of GHG emissions reductions that can be attributed to each energy storage technology in each utility application; (5) integrate various types and scales of energy storage in various applications for utility grid network integration of renewable energy sources for overall GHG reduction impacts; (6) integrate energy storage analyses into dispatch models and develop dispatch strategies for optimizing grid operations and GHG emissions impacts; (7) apply the tool to evaluate and compare the performance and GHG reduction potential of various types of energy storage technologies when integrated in the electric grid at various scales/sizes; and (8) provide the tool to various end-users for beta-testing of the tool and its graphical user interface.

Expected Results: This project will result in an automated energy storage sizing and dispatch optimization tool. The proposed project will achieve GHG reduction primarily by using various emerging energy storage technologies to support a greater integration and use of renewable power generation throughout the utility network. While the energy storage technology itself always includes an energy efficiency penalty, appropriate sizing, appropriate technology selection for the various grid applications, and optimal dispatch of energy storage technologies can significantly manage and complement renewable power to enable significantly higher renewable power use. Comparisons of the overall GHG emissions with and without the optimized sizing, use, and dispatch of energy storage will include the different levels of renewable power that are enabled as determined by use of proven grid dynamic models with and without energy storage.

Project Name: Buildings to Grid System Infrastructure Enabling Precision Demand Response

Project Manager/University: Igor Mezic, Ph.D. / UCSB
Request: $425,000

Project Scope: This effort presents a solution to the need for more advanced control algorithms, operations and visualization tools to manage the buildings/grid interaction, so that buildings do not have to revert to extremes in energy usage. Rather, buildings can employ targeted reductions that maintain efficient grid operation, while also maintaining the comfort of occupants. The goal of this project is to develop operational tools for buildings-grid complex networked system dynamics and control that will enable precise demand control algorithms and lead to reduced energy use.
Expected Results: This project will provide the following deliverables: 1) Determine how the buildings, when aggregated and controlled, can be deployed to provide services contributing to address specific reliability problems; 2) Develop algorithms for buildings to provide storage on different time scales; 3) Provided aggregated building controls to provide inertia or damping to the grid; 4) Develop new visualization tools for grid operation and grid-buildings interaction; 5) Demonstrate that aggregated building controls can be used in conjunction with other operator actions or controls; and 6) Verify impact by grid measurements and relate to the costs of instability and environmental benefits.

This project expects the overall energy savings in the range of 30% over traditional demand response methods, based on estimates on system integration benefits from PNNL and other national laboratory sources. UCSB will utilize existing management systems in buildings and provide software that utilizes data (for example thermal data much more granular than just current total electricity usage) from them for demand-response purpose. This will lead to design and prototyping of middleware that couples the building management system with the power grid for demand elasticity across multiple time scales with guaranteed levels of energy savings, comfort, security and grid stability.

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Control and Optimization for the Power Grid</th>
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<tr>
<td>Project Manager/University:</td>
<td>L. Vandenberghhe, Ph.D. / UCLA</td>
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<tr>
<td>Request:</td>
<td>$160,000</td>
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Project Scope: The project will build on recent advances in large-scale and distributed optimization algorithms, real-time optimization methods, model-predictive control, and stochastic optimization to address the changing requirements placed upon the grid. The overall goal of the project is to exploit existing computing resources and sensing capabilities and provide algorithmic solutions for improved operation and control of the existing infrastructure, while supporting flexibility for future deployments. This project will specifically address power flow optimization for central voltage control and smart inverter controls for distributed energy resources.

Expected Results: This project will develop algorithms capable of solving power flow issues in real time, leading to the development of hierarchical voltage control methods by applying decomposition techniques from large-scale optimization. This project will also develop advanced inverter controls for distributed energy resource grid connections that can be deployed to existing or future inverter technologies. These developments will culminate in an approach to control and optimize the smart energy systems needed to incorporate increasing amounts of renewable and distributed energy resources.
### Project Name: **Smart Air-Conditioner Vent Registers for Advanced Demand Response**

**Project Manager/University:** Lei He, Ph.D. / UCLA  
**Request:** $300,000

**Project Scope:** The overall goal of the project is to develop and prototype an electroactive Smart Air Conditioner Vent Register (eSAVER). During summer and winter, HVAC is arguably the largest knob for demand response in buildings. Recent developments in smart thermostats (e.g., Nest Lab) provide the ability to turn off HVAC when there are no occupants in a zone. Smart thermostats can also expand temperature setpoints or perform pre-cooling/heating to support peak power reduction. The eSAVERS will allow homeowners to replace their conventional vents with this plug and play sensor device that will control the air flow, providing air only when programmed to do so or when a room is occupied.

**Expected Results:** HVAC (heating, ventilating, and air conditioning) contributes to 13% of domestic energy dissipation and 13% GhG emission for US. It also adds peak load. UCLA will develop and prototype a “plug and play” solution with the potential to reduce annual HVAC energy, and therefore, HVAC associated GhG by 30% in the southern California area. This may lead to 3.9% total GhG reduction if the solution is widely deployed in SCE service area.

This project has secured $2.1M from the US Department of Energy to develop a variation of the eSAVER technology that beams cooled or heated air onto individual occupants, and to demonstrate a full-functional, proof-of-concept eSAVER device in early 2016.

### Project Name: **Energy Storage with Isothermal Gas Compression**

**Project Manager/University:** Igor Mezic, Ph.D. / UCSB  
**Request:** $950,000

**Project Scope:** UCSB has been working on high efficiency isothermal gas compressors since 2003. Based on this work, UCSB will use isothermal air compression, which is a practical method of storing energy produced by electrical generation that is scalable from household to grid levels, does not use rare or expensive materials, is not electrochemical, has essentially unlimited cycle life for the critical infrastructure components, has low maintenance and is extremely reliable. The primary goal of this effort is to provide a demonstration that is scalable, cost-effective, and instantaneously dispatchable. It can be networked in a manner similar to UCSB’s existing automated demand response system, capable of 1MW of load reduction from a single IOU command.

**Expected Results:** Energy storage is critical to the deployment of large renewable energy resources. The ability to store large amounts of energy would enable grid stability as larger renewable resources are developed. A storage system that has virtually zero environmental impact, except for land use, with no recycling issues would be an enormous boost to this end. Combining isothermal air compression with UCSB’s extremely high efficiency hydraulic compressors, with high efficiency electric motors and power electronics, allows this project to offer a unique, low cost, effective and scalable solution that would assist with the increasing need for renewables resources. Importantly, this project will provide actual benefits at the UCSB campus.
Appendix C
SDG&E Program Areas and Selected Projects

2016 Program Focus Areas
- Facilitating Integration of Renewables and DER
- Energy Storage Sizing/Deployment/Optimization
- Carbon capture to Algae Systems

Key Selection Criteria
- Applicability to the objectives of the Decision to reduce greenhouse gas emissions at current and future generation plants in California.
- Proposal realism – scope, timeline, costs and qualifications.
- Benefits cited by the proposal that have the potential to be realized and scale within by 2022.

2016 Project Selections (Subject to Grant Negotiations)

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Imperial Valley Hours-Ahead Solar Forecasting</th>
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<tr>
<td>Project Manager/University:</td>
<td>Prof. Kleissl and Coimbra / UCSD</td>
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<td>Request:</td>
<td>500,000</td>
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**Project Scope:** UCSD, in collaboration with SDG&E and CAISO, will develop a comprehensive forecast system using a numerical weather prediction model (NWP), satellite observations, and local sky imaging observation-based forecast that will be hybridized by a stochastic-learning forecast engine. This forecast system will make use of SDG&E’s new weather forecast compute cluster, field-leading sky imager forecasting research developed by Professor Jan Kleissl, and the powerful forecast engine developed by Professor Carlos Coimbra. These technologies will be integrated and applied to the southern Imperial Valley region that is in the process to surpass 1 GW of solar power projects spanning multiple power conversion technologies.

**Expected Results:** UCSD and SDG&E will directly work with CAISO to improve unit commitment, scheduling, and dispatch decisions so that the transmission lines running to San Diego from the Imperial Valley and load following and regulation power plants will be used as efficiently as possible, thereby reducing GHG emissions.

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Power Plant CO2 Capture and Algal Biofuel Production</th>
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<tr>
<td>Project Manager/University:</td>
<td>S. Paulson, PhD, D. Rajagopal, PhD / UCLA</td>
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<td>Request:</td>
<td>500,000</td>
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**Project Scope:** UCLA in conjunction with T2e Energy Holdings of Vista, CA (“T2e”) will set up a 12,000 liter portable algae grow tank system (AGTS) at the Palomar Power Plant in Escondido, CA. Once setup the AGTS will process and remove approximately 3500 pounds of CO2 daily from the flue gas at the stack and deliver it via pipeline to an agreed upon location on the power plant property.
Inside a closed-loop algae grow tank system, controlled LEDs will simulate and extend the photosynthetic day and a ballast tank grate system will continually mix the water, flue gas, algae and other materials. Daily harvesting will produce approximately 7,500 kg per day of algal biomass. On site we will process the biomass separating the lipids from the cell wall, and the lipids will be transesterfied to biodiesel, and the glycerol re-introduced to the grow tank as an additional carbon source.

To conduct a life cycle assessment (LCA), we will gather data on embodied fossil energy, carbon and water associated with each of the inputs to our system. Aggregating each type of burden across all inputs and all stages of the production will allow us to derive metrics such as the net energy ratio, net fossil fuel displacement per MJ of energy delivered, total life cycle CO2 per MJ of energy delivered, and total life cycle water consumed per MJ of energy delivered.

Scale up and success of biofuel products in the market, especially in California, further depends on their air quality impacts. The proposed project will expend a modest amount of effort to address these issues in several end-use applications. For the first phase of the project, a comparison of algal biodiesel with in-use commercial diesel as the control will be performed in which end-use emissions of CO2, black carbon, and tropospheric o-one precursors will be measured.

**Expected Results:** Success can be defined on how much flue gas is processed (and carbon captured) by the AGTS, the quality and quantity of the produced algal biomass, the oil profile, as well as the cell wall profile.

The system we propose to construct will take the effluent flue gas directly from the host power plant in Escondido for processing through a portable 12,000 liter AGTS. The amount of flue gas that will be removed during the 4-6 month pilot is estimated to be approximately 432,000 - 648,000 pounds of CO2 plus all other contaminants present in the flue gas. A scaled up AGTS is designed for complete emissions capture of the host power plant. In this envisioned model, a 632 MW power plant emitting 1.9 million tons of CO2 would produce 4.5 million barrels of oil annually.