STATE OF CALIFORNIA

CONTRACT REQUEST FORM (CRF)

CEC-94 (Revised 12/2019) CALIFORNIA ENERGY COMMISSION

A) New Agreement # 800-20-003 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
800 Energy Assessments Division	Sudhakar Konala	22	916-654-4833

C) Contractor's Legal Name	Federal ID #
Department of Energy - National Renewable Energy Laboratory	26-1939242

D) Title of Project
Modeling DER Growth for Emerging Market Segments in California

E) Term and Amount

Start Date	End Date	Amount
05 / 01 / 2021	03 / 31 / 2023	$ 350,000

F) Business Meeting Information

☐ Operational agreement (see CAM Manual for list) to be approved by Executive Director

☐ ARFVTP agreements $75K and under delegated to Executive Director

Proposed Business Meeting Date 02 / 10 / 2021 ☐ Consent ☒ Discussion

Business Meeting Presenter Sudhakar Konala Time Needed: 5 minutes

Please select one list serve. Transportation (General Trans / Petroleum Issues)

Agenda Item Subject and Description:

DOE-NATIONAL RENEWABLE ENERGY LABORATORY. Proposed resolution approving agreement #800-20-003 with U.S. Department of Energy's National Renewable Energy Laboratory (NREL) for a $350,000 contract to provide technical support to forecast distributed energy resources in emerging market segments and technologies in California for the Integrated Energy Policy Report (IEPR). For this purpose, NREL will make use of a version of its nation-wide distributed generation market penetration model (dGen) adapted specifically for California. NREL will also deliver the adapted dGen model to the Energy Commission and provide direct assistance to staff in setting up and running the model. (COIA funding) Contact: Sudhakar Konala.

G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?

   ☐ Yes (skip to question 2) ☒ No (complete the following (PRC 21065 and 14 CCR 15378)):

   Explain why Agreement is not considered a "Project":

   Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because the contract is for technical assistance where tasks are collection and analysis of data, assessment of forecasting methodologies, and writing reports. None of the tasks in this contract involve physical construction, installation of equipment, or other activities that have potential for resulting in either a direct or indirect physical change in the environment. Rather, the work consists solely of computer-based and document-based activities.

2. If Agreement is considered a "Project" under CEQA:

   a) ☐ Agreement **IS** exempt.

   ☐ Statutory Exemption. List PRC and/or CCR section number:

☐ Categorical Exemption. List CCR section number:

☐ Common Sense Exemption. 14 CCR 15061 (b) (3) Explain reason why Agreement is exempt under the above section:

b) ☐ Agreement **IS NOT** exempt. (consult with the legal office to determine next steps)

Check all that apply

☐ Initial Study
☐ Negative Declaration
☐ Mitigated Negative Declaration
☐ Environmental Impact Report
☐ Statement of Overriding Considerations

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

Legal Company Name:	**Budget**
	$ 0.00
	$ 0.00
	$ 0.00

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

Legal Company Name:

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
COIA	2020-21	800.015	$350,000
Funding Source			$
Funding Source			$
Funding Source			$
Funding Source			$

R&D Program Area: N/A TOTAL: $

Explanation for “Other” selection

Reimbursement Contract #: Federal Agreement #:

K) Contractor’s Contact Information

1. **Contractor’s Administrator/Officer**

Name: Erin Hensley

Address: National Renewable Energy Laboratory

15013 Denver West Parkway

City, State, Zip: Golden, CO 80401

Phone: 303-384-7989

E-Mail: Erin.Hensley@nrel.gov

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2. Contractor's Project Manager

Name: Kevin McCabe

Address: National Renewable Energy Laboratory

15013 Denver West Parkway

City, State, Zip: Golden, CO 80401

Phone: 303-275-3183

E-Mail: Kevin.McCabe@nrel.gov

L) Selection Process Used

☐ Solicitation Select Type Solicitation #: - - # of Bids: Low Bid ☐ No ☐ Yes

☐ Non Competitive Bid *(Attach DGS-GSPD-09-007 https://www.dgs.ca.gov/PD/Forms)*

☒ Exempt Other Governmental Entity

M) Contractor Entity Type

☐ Private Company *(including non-profits)*

☐ CA State Agency *(including UC and CSU)*

☒ Government Entity *(i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)*

N) Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE?

If yes, check appropriate box(es): ☐ SB ☐ MB ☐ DVBE

O)Civil Service Considerations

☐ Not Applicable (Agreement is with a CA State Entity or a membership/co-sponsorship)

☐ Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)

☒ The Services Contracted:

- ☐ are not available within civil service
- ☐ cannot be performed satisfactorily by civil service employees
- ☒ are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system.

☒ The Services are of such an:

- ☐ urgent
- ☒ temporary, or
- ☐ occasional nature

that the delay to implement under civil service would frustrate their very purpose.

Justification:

Based on previous research products, NREL has proven itself to be capable in producing high quality assessments of adoption of distributed energy resources while considering grannular geospatial data such as solar irradiance, load research data, and state and national policy drivers. NREL will directly assess the potential range of adoption of distributed energy resources in Emerging Market Segments and behind-the-meter energy storage for California over the next ten years to support state energy policy analysis. NREL will also share the California adapted version of its distributed generation market penetration model (or dGen), developed specifically for DER Adoption in California. This will enhance Energy Commission's long-term ability to forecast DER adoption in support state energy policy analysis.

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P) Payment Method

1. ☐ Reimbursement in arrears based on:
   ☐ Itemized Monthly ☐ Itemized Quarterly ☐ Flat Rate ☐ One-time
2. ☒ Advanced Payment
3. ☐ Other, explain:

Q) Retention

Is Agreement subject to retention? ☒ No ☐ Yes

If Yes, Will retention be released prior to Agreement termination? ☐ No ☐ Yes

R) Justification of Rates

N/A.

S) Disabled Veteran Business Enterprise Program (DVBE)

1. ☒ Exempt (Interagency/Other Government Entity)
2. ☐ Meets DVBE Requirements DVBE Amount:$ 0 DVBE %:
   a. ☐ Contractor is Certified DVBE
   b. ☐ Contractor is Subcontracting with a DVBE: Name of DVBE Company
3. ☐ Contractor selected through CMAS or MSA with no DVBE participation
4. ☐ Requesting DVBE Exemption (attach CEC 95)

T) Miscellaneous Agreement Information

1. Will there be Work Authorizations? ☒ No ☐ Yes
2. Is the Contractor providing confidential information? ☒ No ☐ Yes
3. Is the contractor going to purchase equipment? ☒ No ☐ Yes
4. Check frequency of progress reports
   ☐ Monthly ☒ Quarterly ☐ Other...
5. Will a final report be required? ☐ No ☒ Yes
6. Is the Agreement, with amendments, longer than three years? If yes, why? ☐ No ☒ Yes

U) The following items should be attached to this CRF (as applicable)

1.	Exhibit A, Scope of Work	☐ N/A	☒ Attached
2.	Exhibit B, Budget Detail	☐ N/A	☒ Attached
3.	DGS-GSPD-09-007, NCB Request	☒ N/A	☐ Attached
4.	CEC 95, DVBE Exemption Request	☒ N/A	☐ Attached
5.	CEQA Documentation	☒ N/A	☐ Attached
6.	Resumes	☐ N/A	☒ Attached
7.	CEC 105, Questionnaire for Identifying Conflicts		☒ Attached

Agreement Manager **Date**

Office Manager **Date**

Deputy Director **Date**

Exhibit A
SCOPE OF WORK

TASK LIST

Task #	Task Name
1	Agreement Management
2	Baseline Assessment of DER Adoption in Emerging Market Segments
3	Forecast of BTM Energy Storage Adoption
4	Transfer of California dGen Modeling Tool

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

Acronym	Definition
BTM	Behind-the-Meter
CAM	Commission Agreement Manager
CEC	California Energy Commission
DER	Distributed Energy Resource
DOE	Department of Energy
IEPR	Integrated Energy Policy Report
PV	Photovoltaic
PSPS	Public Safety Power Shutoffs
SGIP	Self-Generation Incentive Program

BACKGROUND/PROBLEM STATEMENT
The growth of distributed energy resource (DER) adoption over the previous decade has made the forecasting of behind-the meter (BTM) DER adoption an important component of long-term electricity demand forecasting. To address this issue, in 2017, the Energy Commission requested the assistance of the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) to conduct an assessment of distributed energy resource (DER) adoption in California. As part of the project, NREL agreed to develop a baseline assessment of DER adoption in California with a key output being a 10-year forecast of adoption levels. The forecasts were completed using a California adapted version of NREL's distributed generation market penetration model or dGen – a geospatially rich, bottom-up, agent-based market penetration model that simulates the potential adoption of DERs for residential, commercial, and industrial entities.[1] NREL also studied the potential for further DER adoption in emerging market segments where forecasting adoption was not possible due to limited information. Most project-related work was completed by 2019, and the agreement came to a close in early 2020.

Since the original agreement, the landscape for DERs has continued to evolve rapidly. For example, California has adopted building efficiency standards requiring PV on most new residential structures with three floors or less. California utilities have also

[1] https://www.nrel.gov/analysis/dgen/

increased the use of Public Safety Power Shutoffs (PSPS) as a tool to mitigate against wildfire risk. And the Self-generation Incentive Program (SGIP) has been refocused to largely incentivize energy storage. The effect of these policies has been to increase consumer interest and adoption of BTM energy storage and PV in multifamily and renter-occupied housing. Since the Energy Commission has limited ability to model DER adoption in these market segments, and due to a need to better address these issues in the Integrated Energy Policy Report (IEPR), the Energy Commission seeks further assistance from the National Renewable Energy Laboratory to conduct an assessment of DER adoption in rapidly emerging market segments and technologies in California.

GOALS OF THE AGREEMENT

The goals of this project are two-fold. The first goal is to develop a forecast of DER adoption in California for rapidly emerging market segments and technologies. The key outputs will be a long-term forecast of BTM PV adoption in emerging market segments, such as multifamily and/or renter occupied homes, and a long-term forecast of BTM energy storage adoption for all customer segments. The second goal of this project is to enhance the Energy Commission's long-term ability to forecast DER adoption, by providing the Energy Commission access to an up-to-date version of the dGen modeling framework.

FORMAT/REPORTING REQUIREMENTS

Deliverables/Reports

When creating reports, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Agreement Manager (CAM), the latest version of the Consultant Reports Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/consultant_reports/index.html

Each final deliverable shall be delivered as one original, reproducible, 8 ½" by 11", camera-ready master in black ink. Illustrations and graphs shall be sized to fit an 8 ½" by 11" page and readable if printed in black and white.

Electronic File Format

The Contractor shall deliver an electronic copy (CD ROM or memory stick or as otherwise specified by the CAM) of the full text in a compatible version of Microsoft Word (.doc).

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

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

Software Application Development
If this scope of work includes any software application development, including but not limited to databases, websites, models, or modeling tools, Contractor shall utilize the following standard Application Architecture components in compatible versions:

- Microsoft ASP.NET framework (version 3.5 and up) Recommend 4.0
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5
- Visual Studio.NET (version 2008 and up) Recommend 2010
- C# Programming Language with Presentation (UI), Business Object and Data Layers
- 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 Software Application Development requirements above must be approved in writing by the Energy Commission Information Technology Services Branch.

TASK 1- AGREEMENT MANAGEMENT

Task 1.1 Kick-off Meeting
The goal of this task is to establish the lines of communication and procedures for implementing this Agreement.

The Contractor shall:
- Attend a "kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and a representative of the Accounting Office. The meeting will be held via Web-Ex or teleconference. The Contractor shall include their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the CAM in this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting.

- If necessary, prepare an updated Schedule of Deliverables based on the decisions made in the kick-off meeting.

The CAM shall:
- Arrange the meeting including scheduling the date and time.

- Provide an agenda to all potential meeting participants prior to the kick-off meeting.

Deliverables:
- An Updated Schedule of Deliverables (if applicable)

Task 1.2 Invoices

The Contractor shall:
- Prepare invoices for all reimbursable expenses incurred performing work under this Agreement in compliance with the Exhibit B of the Terms and Conditions of the Agreement. Invoices shall be submitted with the same frequency as progress reports (task 1.4). Invoices must be submitted to the Energy Commission's Accounting Office.

Deliverables:
- Invoices

Task 1.3 Manage Subcontractors
The goal of this task is to ensure quality products, to enforce subcontractor Agreement provisions, and in the event of failure of the subcontractor to satisfactorily perform services, recommend solution to resolve the problem.

The Contractor shall:
- Manage and coordinate subcontractor activities. The Contractor is responsible for the quality of all subcontractor work and the Energy Commission will assign all work to the Contractor. If the Contractor decides to add new subcontractors, they shall 1) comply with the Terms and Conditions of the Agreement, and 2) notify the CAM who will follow the Energy Commission's process for adding or replacing subcontractors.

Task 1.4 Progress Reports
The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement.

The Contractor shall:
- Prepare progress reports which summarize all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due within 15 calendar days after the end of the reporting period. The CAM will provide the format for the progress reports.

Deliverables:
- Quarterly Progress Reports

Task 1.5 Final Report
The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work completed under this Agreement. The Final Report shall be prepared in language easily understood by the public or layperson with a limited technical background.

The Final Report must be completed before the termination date of the Agreement in accordance with the Schedule of Deliverables.

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

The Contractor shall:
- Prepare the draft Final Report for this Agreement.

- Submit the draft Final Report for review and comment. The CAM will provide written comments to the Contractor. The Contractor shall review the comments and discuss any issues with the recommended changes with the CAM.

- Prepare and submit the Final Report, incorporating CAM comments.

Deliverables:
- Draft Final Report
- Final Report

TECHNICAL TASKS

Task 2: Baseline Assessment of DER Adoption in Emerging Market Segments

The goal of this task is to develop a state-wide baseline assessment of DER adoption in emerging market segments in California. The assessment will focus on emerging market segments, including (but not necessarily limited to) multifamily and/or renter-occupied buildings. The key outputs of the assessment will include historical as well as forecasts of DER adoption (defined as capacity and customer count) with a primary focus on BTM Solar PV. This information will be used by staff to support long-term energy demand forecasting. The assessment will include a number of scenario assumptions developed jointly with staff and the Contractor.

The Contractor shall:
- Work jointly with CEC staff to identify emerging market segments, including multifamily and renter-occupied buildings.
- In consultation with the CAM, establish a suitable method for identifying historical DER adoption in emerging market segments, and prepare a worksheet of historical DER Adoption in emerging market segments.
    - To support this work, the CAM may provide the contractor with historical DER interconnection data as well as other data or literature from the Energy Commission.
- Develop a plan to forecast DER adoption using the dGen model for each market segment identified in Task 2.
- Work jointly with CEC staff to design specific forecast scenarios and develop appropriate model inputs. Scenarios should cover a range of cost and policy assumptions, including assumptions consistent with the Energy Commission's demand forecast.
- Prepare a **draft Forecast of DER Adoption Data Worksheet**. The worksheet shall contain the following information:
    - A forecast of DER adoption (defined as DER capacity and customer count) in emerging market segments by segment, scenario, technology type, forecast zone, and year.
    - A description of methodology, assumptions, and inputs used in each forecast.
- Submit the draft Forecast of DER Adoption Data Worksheet in Microsoft Excel format to the CAM for review and comment.
- Prepare and submit a **final Forecast of DER Adoption Data Worksheet** based on comments received from the CAM.
- Present forecast results to staff and other stakeholders as requested by the CAM.
- Include a description of methods, assumptions, and results of the Baseline Assessment of DER Adoption in Emerging Market Segments as a chapter in the Final Report.

Deliverables:
- Historical DER Adoption in Emerging Market Segments Worksheet
- Draft Forecast of DER Adoption Data Worksheet
- Final Forecast of DER Adoption Data Worksheet

Task 3: Forecast of BTM Energy Storage Adoption

The goal of this task is to develop a new state-wide forecast of BTM Energy Storage Adoption in California using new improvements made to the base dGen model. The key outputs of the task will include an update to California dGen model and a forecast of BTM energy storage (defined as capacity and number of installations) using the updated model. The task will include a number of scenario and policy assumptions developed jointly with Energy Commission staff and the Contractor.

The Contractor Shall:

- In consultation with the CAM, develop a plan to forecast BTM energy storage adoption using the dGen model and associated energy storage module (PySAM).
- Integrate the PySAM module into the California dGen model.
- Work jointly with CEC staff to design specific forecast scenarios and develop appropriate model inputs. Scenarios will explore various cost and policy assumptions around battery storage and may include varying assumptions around electricity rate structures, deployment of public safety power shutoffs, changes to Self-Generation Incentive Program (SGIP) requirements, and a possible successor tariff to the incumbent net energy metering metering (NEM 2.0) policy.
- Prepare a **draft Forecast of BTM Storage Adoption Data Worksheet**. The worksheet shall contain the following information:
    - A forecast of BTM Storage adoption (defined as storage capacity and customer count) in California disaggregated by scenario, sector, forecast zone, and year. Each forecast should distinguish standalone systems from those paired with other self-generation technologies, particularly PV.
    - A description of methodology, assumptions, and inputs used in each forecast.
- Submit the draft Forecast of BTM Storage Adoption Data Worksheet in Microsoft Excel format to the CAM for review and comment.
- Prepare and submit a **final Forecast of BTM Storage Adoption Data Worksheet** based on comments received from the CAM.
- Present forecast results to staff and other stakeholders as requested by the CAM.
- Include a description of methods, assumptions, and results of the forecast of BTM Energy Storage Adoption as a chapter in the Final Report.

Deliverables:

- Draft Forecast of BTM Storage Adoption Data Worksheet
- Final Forecast of BTM Storage Adoption Data Worksheet

Task 4 – Transfer of California dGen Modeling Tool

The goal of this task is to improve the Energy Commission's ability to forecast long-term DER adoption, by transferring the California dGen model code and the data necessary to run the model.

The dGen modeling framework represents an advancement in modeling capabilities over the CEC's current DER forecasting models, while the California adapted dGen model represents over two years of dedicated development for modeling DERs in the State of California. And with the U.S. DOE-funded Resilient Planning for Distributed Energy Resources (RiDER) project[2], NREL had developed an open-source, no cost release of the base dGen model. This task leverages the RiDER development process, by incorporating the updates made to the base dGen model code into the California dGen model. Once the updates are made to the California model, the source code will be made available to the Energy Commission. Access to the model and the underlying data allows the Energy Commission to fully realize the benefits and the advancements made in the California dGen model and provides an improved long-term option for forecasting DER adoption in California.

The Contractor Shall:

- Incorporate changes and developments to the base dGen model source code, made possible by the RiDER project, into the California dGen model.
- Make the updated California dGen model source code available to the Energy Commission via GitHub.
- Provide a pre-generated data file of customer attributes on an annual basis through the period of performance of this contract. The data file serves as a primary input to running the model.
    - The data file will consist of various adopter (or agent) attributes that provide a comprehensive and representative picture of customers in California, informed by California-specific data provided by the CAM.
- Provide assistance to staff through the transfer process and provide guidance on setting up the model.
    - In order to provide assistance, the contractor may request that the CAM provide a description of available computing infrastructure (such as computing and database resources).
- Provide up to 24 hours of in-person or virtual training that describes the general workflow and any theoretical basis for the model functions and algorithms. Training may involve a walkthrough of a typical model run, instructions on how to specify inputs and model parameters, and how to collect and interpret model outputs.
- Prepare a California dGen Model document that describes the model structure, workflow, and general instructions for completing a model simulation.

Deliverables

- California dGen Model with updated open-source code
- Data file with Consumer attributes
- California dGen Model Documentation

[2] https://www.nrel.gov/analysis/dgen/open-source-development.html

SCHEDULE OF DELIVERABLES AND DUE DATES

Task Number	Deliverable	Due Date
1		
1.1	An Updated Schedule of Deliverables	If applicable
1.2	Invoices	With progress report
1.4	Quarterly Progress Reports	Quarterly
1.5	• Draft Final Report • Final Report	12/5/2022 1/10/2023
2	• Historical DER Adoption in Emerging Market Segments Worksheet • Draft Forecast of DER Adoption Data Worksheet • Final Forecast of DER Adoption Data Worksheet	12/15/2022 6/30/2022 9/15/2022
3	• Draft Forecast of BTM Storage Adoption Data Worksheet • Final Forecast of BTM Storage Adoption Data Worksheet	3/30/2022 9/15/2022
4	• California dGen Model with updated open-source code • Data file with Consumer attributes • California dGen Model Documentation	2/15/2022, 1/10/2023 2/15/2022, 1/10/2023 3/30/2022

RESOLUTION NO: 21-0210-6

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: DOE-NATIONAL RENEWABLE ENERGY LABORATORY (NREL)

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

RESOLVED, that the CEC approves Agreement 800-20-003 with NREL for a $350,000 contract to provide technical support to forecast distributed energy resources in emerging market segments, and forecast energy storage for all market segments in California for the Integrated Energy Policy Report (IEPR). NREL will make use of a version of its nationwide distributed generation market penetration model (dGen) adapted specifically for California. NREL will also deliver the adapted dGen model to the CEC and provide direct assistance to staff in setting up and running the model; and

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

CERTIFICATION

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the CEC held on February 10, 2021.

AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Cody Goldthrite
Secretariat