California Energy Commission
June 12, 2024 Business Meeting
Backup Materials for The Regents of the University of California, on behalf of the Riverside Campus

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution
2. Contract Request Form
3. Scope of Work

[PROPOSED]

RESOLUTION NO: 24-0612-03h

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: The Regents of the University of California, on behalf of the Riverside Campus

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 800-23-009 with the Regents of the University of California, on behalf of the Riverside Campus, for up to $400,000. This project will collect and analyze data to improve the electricity demand forecast methods that CEC staff may consider integrating into resource, transmission, and distribution system planning, and leverages a California Air Resources Board (CARB) agriculture vehicle inventory survey. Staff recommends conditional approval of this item based upon funding availability as of the 2024 Budget Act; and

FURTHER BE IT RESOLVED, that the Executive Director or their 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 June 12, 2024.

AYE:
NAY:
ABSENT:
ABSTAIN:

Dated:

_____
Kristine Banaag
Secretariat

STATE OF CALIFORNIA
CALIFORNIA ENERGY COMMISSION

CEC-94 (Revised 04/2023)

CONTRACT REQUEST FORM (CRF)

A. New Agreement Number

IMPORTANT: New Agreement # to be completed by Contracts, Grants, and Loans Office.

New Agreement Number: 800-23-009

B. Division Information

1. Division Name: Energy Assessment
2. Agreement Manager: Quentin Gee
3. MS-"Not Applicable"
4. Phone Number: 916-776-3723

C. Contractor's Information

1. Contractor's Legal Name: The Regents of the University of California, on behalf of the Riverside campus
2. Federal ID Number: 95-6006142

D. Title of Project

Title of project: Electrification Needs for the Agriculture Sector in California

E. Term and Amount

1. Start Date: June 12, 2024
2. End Date: December 31, 2025
3. Amount: $400,000

F. Business Meeting Information

1. Operational agreement to be approved by Executive Director? No
2. Are the ARFVTP agreements $75K and under delegated to Executive Director? No
3. The Proposed Business Meeting Date: June 12, 2024
4. Consent or Discussion? Consent
5. Business Meeting Presenter Name: N/A
6. Time Needed for Business Meeting: N/A
7. The email subscription topic is: Transportation, Electricity Issues, Integrated Energy Policy Report

Agenda Item Subject and Description:

The Regents of The University of California, on behalf of the Riverside Campus

Proposed resolution conditionally approving agreement 800-23-009 with the Regents of the University of California, on behalf of the Riverside Campus, for up to $400,000 and adopting staff's determination that this action is exempt from CEQA. This project will collect and analyze data to improve the electricity demand forecast methods that CEC staff may consider integrating into resource, transmission, and distribution system planning, and leverages a California Air Resources Board (CARB) agriculture vehicle inventory survey. Staff recommends conditional approval of this item based upon funding availability as of the 2024 Budget Act. (ERPA and COIA Funds Funding) Contact: Quentin Gee

G. California Environmental Quality Act (CEQA) Compliance

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

No

If yes, skip to question 2.

If no, complete the following (PRC 21065 and 14 CCR 15378) and 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 work in this contract is providing technical expertise to the Energy Assessments Division, which involves forecasting and analysis done on computers. This contract involves no field data collection and no physical installations or other construction.

2. If Agreement is considered a "Project" under CEQA answer the following questions.

a) Agreement **IS** exempt?

N/A

Statutory Exemption?

N/A

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

PRC section number: "None"

CCR section number: "None"

Categorical Exemption?

N/A

If yes, list CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

CCR section number: "None"

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

N/A

If yes, explain reason why Agreement is exempt under the above section. If no, enter "Not applicable" and go to the next section.

"Not applicable"

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

N/A

If yes, answer yes or no to all that applies. If no, list all as "no" and "None" as "yes".

Additional Documents	Applies
Initial Study	No
Negative Declaration	No
Mitigated Negative Declaration	No
Environmental Impact Report	No

Statement of Overriding Considerations	No
None	Yes

H. Subcontractors

List all Subcontractors listed in the Budget (s). Insert additional rows if needed. If no subcontractors to report, enter “No subcontractors to report” and “0” to funds. **Delete** any unused rows from the table

Subcontractor Legal Company Name	**Budget**
University of California, Davis	$ $200,000
California State University, Fresno	$ $19,976

I. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter “No key partners to report.” **Delete** any unused rows from the table.

Key Partner Legal Company Name
California Air Resources Board
California Public Utilities Commission
California Polytechnic University, San Luis Obispo

J. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter “N/A” for “Not Applicable” and “0” to Amount. **Delete** any unused rows from the table.

Funding Source	**Funding Year of Appropriation**	**Budget List Number**	**Amount**
ERPA	22/23	800.003	$196,000
ERPA	22/23	800.007	$4,000
COIA	22/23	800.005	$200,000

TOTAL Amount: $400,000

R&D Program Area: Enter R&D Program Area. Example: EDMFO: EDMF

Explanation for “Other” selection Enter explanation for "Other"

Reimbursement Contract #: Enter Reimbursement Contract Number

Federal Agreement #: Enter Federal Agreement Number

K. Contractor's Contact Information

1. Contractor's Administrator/Officer

Name: Ursula Prins

Address: Office of Research and Economic Development

245 University Office Building

City, State, Zip: Riverside, CA, 92521

Phone: 951-827-4968

E-Mail: ursula.prins@ucr.edu

2. Contractor's Project Manager

Name: Georgios Karavalakis

Address: CE-CERT

1084 Columbia Avenue

City, State, Zip: Riverside, CA 92507

Phone: N/A

E-Mail: georgios.karavalakis@ucr.edu

L. Selection Process Used

There are three types of selection process. List the one used for this CRF.

Selection Process	Additional Information
Competitive Solicitation #	"Not Applicable"
Non Competitive Bid *(Attach DGS-GSPD-09-007 https://www.dgs.ca.gov/PD/Forms)*	"Not Applicable"
Exempt	"Exemption"

M. Contractor Entity Type

Contractor Entity Type	Yes or No?
Private Company *(including non-profits)*	No
CA State Agency *(including UC and CSU)*	Yes
Government Entity *(i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)*	No

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

The contractor is a certified: N/A

O. Civil Service Considerations

a. Not Applicable (Agreement is with a CA State Entity or a membership/co-sponsorship)? N/A, agreement is with CA state entity.

b. Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER) No

c. The Services Contracted: No

If no, go to the next question. If yes, which of the following applies to the contract? More than one can apply, list each answer choice, and separate them with a comma:

- are not available within civil service
- cannot be performed satisfactorily by civil service employee
- 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 following applies to the contract are not available within civil service.

d. 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:

The agriculture sector has experienced challenges with energizing projects due to grid capacity and has raised concerns about the ability to electrify their vehicle fleets over the next 10-15 years per recent CARB regulations. This study will collect and analyze data to improve the estimates of electrification in the agriculture sector and resulting electricity demand forecast. The forecast is used for resource, transmission, and distribution planning in the state and improved estimates of electrification in this sector will aid utilities in planning and preparing for these new loads. This study's timing leverages a CARB inventory survey of vehicles in the agriculture sector planned for winter of 2024. Without this project, the CEC would miss an opportunity to efficiently use state resources and leverage CARB's inventory survey. CEC would also risk underestimating the electrification for this sector which could impact the ability for these fleets to electrify and jeopardize progress towards the state's GHG emission reduction goals.

P. Payment Method

1. Is the payment method Reimbursement, Advanced Payment, or Other?
   "Reimbursement".
   If Other, explain: N/A.
2. If Reimbursement, is it in arrears based on Itemized Monthly, Itemized Quarterly, Flat Rate, or One-time?

   "Itemized Quarterly".

Q. Retention

Is Agreement subject to retention? Yes.

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

R. Justification of Rates

UC pre-approved rates.

S. Disabled Veteran Business Enterprise Program (DVBE)

Provide requested additional information.

1. Exempt (Interagency/Other Government Entity). Yes
2. Meets DVBE Requirements DVBE N/A.
   Amount: $ 0 DVBE %:
3. Is the Contractor Certified DVBE or Subcontracting with a DVBE? If subcontracting with a DVBE, provide the name of the DVBE company. If none applies, enter “Not Applicable”.

   “Not Applicable”
4. Contractor selected through CMAS or MSA with no DVBE participation N/A.
5. Requesting DVBE Exemption (attach CEC 95) N/A.

T. Miscellaneous Agreement Information

1. Will there be Work Authorizations? No.
2. Is the contractor providing confidential information? No.
3. Is the contractor going to purchase equipment? No.
4. What is the check frequency of the progress reports? Monthly, Quarterly, or Other? If Other, please provide explanation. **Quarterly**
5. Will a final report be required? Yes.
6. Is the Agreement, with amendments, longer than three years? If yes, why?

   No

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

List all items that should be attached to this CRF by entering “Yes” or “No”.

Item Number	Item Name	Attached
1	Exhibit A, Scope of Work/Schedule	Yes
2	Exhibit B, Budget Detail	Yes
3	DGS-GSPD-09-007, NCB Request	No
4	CEC 95, DVBE Exemption Request	No
5	Awardee CEQA Documentation	No
6	Resumes	Yes
7	CEC 105, Questionnaire for Identifying Conflicts	Yes

Approved By

Individuals who approve this form must enter their full name and approval date in the MS Word version.

Agreement Manager:

Approval Date:

Office Manager:

Approval Date:

Deputy Director:

Approval Date:

Exhibit A – Scope of Work

Project Summary & Scope of Work

☒ Contract ☐ Grant

Does this project include Research (as defined in the UTC)?
☒ Yes ☐ No

PI Name: Tom Durbin

Project Title: Electrification Needs for Agriculture Sector in California

Project Summary/Abstract

The transition of the agriculture sector to zero-emission vehicles (ZEVs) will be an important element of the widespread implementation of ZEVs. The goal of this project will be to understand the electrical needs of the agriculture industry were it to be fully electrified. As part of this study, a survey will be conducted of agriculture industry to evaluate and obtain information related to the overall energy use of equipment utilized in the agriculture industry. This will include both formal survey and post-survey interviews. In conjunction with this survey, a comprehensive review of existing and emerging BEV equipment and vehicles that would potentially be applicable to the agriculture sector will be carried out. The survey results will be analyzed to determine the amount of energy needed by the agriculture industry and the geographic extent to which that energy will need to be distributed. In conjunction with this primary analysis, the contract team will also provide a range for the potential electrical needs on equipment, vehicle, local, regional, and statewide levels. Based on the analysis and information from the survey, the project team will update an off-road forecast model for agriculture applications. This project will produce a forecast model of the agriculture industry's electricity usage for off- road vehicles and equipment. In addition, the forecast will estimate avoided petroleum usage due to replacing conventional equipment and vehicles by ZEVs. The forecast will also estimate hydrogen usage. The forecast will extend from the present through 2050.

If Third-Party Confidential Information is to be provided by the State:

☐ Performance of the Scope of Work is anticipated to involve use of third-party Confidential Information and is subject to the terms of this Agreement; ***OR***

☐ A separate CNDA between the University and third-party is required by the third-party and is incorporated in this Agreement as Exhibit A7, Third Party Confidential Information.

Scope of Work

Task 1. Contract Management

The goal of this task is to clarify administrative elements of the agreement. The contractor shall manage a team capable and qualified to complete the tasks identified in the scope of work.

TASK 1.1 - KICKOFF MEETING

The goal of this task is to establish the lines of communication between the administrative and technical project teams of the contractor and the Energy Commission.

The Contractor shall:

- Attend a kick-off meeting with the Energy Commission Agreement Manager (CAM), Contracts Officer, the Accounting Office, and others as determined by the CAM. The Contractor shall include their Project Manager, Contract Administrator, and Accounting Officer, and others as agreed upon with the CAM. The meeting will be held via teleconference. Both the administrative and technical aspects of this contract will be discussed in the meeting.

TASK 1.2 – INVOICES

The goal of this task is to clarify the invoice approval process.

The Contractor shall:

- Prepare an invoice for all reimbursable expenses incurred performing work under this contract in compliance with the Terms and Conditions of the contract. These invoices must be accompanied with monthly progress reports for approval by the CAM.

TASK 1.3 - MONTHLY PROGRESS REPORTS

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the objectives of the project.

The Contractor shall:

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

Deliverables:

- Monthly Progress Report

TASK 1.4 - FINAL MEETING

The goal of this task is to prepare a comprehensive Final Report and to meet for a discussion and review of the project, and to discuss the closeout of this Agreement.

The Contractor shall:

- Meet with Energy Commission staff prior to the term end date of this Agreement. The meeting will be held via teleconference. This meeting will be attended by the Contractor Project Manager and the CAM. The CAM will determine any additional appropriate meeting participants. The administrative and technical aspects of Agreement closeout will be discussed at the meeting.
- Present findings, conclusions, and recommended next steps (if any) for the Agreement.
- Prepare a written document of meeting agreements and unresolved activities.
- Prepare a schedule for completing the closeout activities for this Agreement, based on determinations made within the meeting.

Deliverables:

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

Task 2. Survey of Electrification Needs for Agriculture Sector in California

Under this task, the contract team will develop and implement a survey questionnaire for the agriculture industry. This task includes the development of the survey questions, the execution of the survey, the compilation of the survey data, and interviews to reinforce and clarify any information and answers provided through the survey.

Task 2.1 Development of Survey Questions

Under this subtask, the contract team will develop a survey for the agriculture stakeholder community. This would include both agriculture farms and first line processors. The overall goal of this survey will be to evaluate and obtain information related to the overall energy use of equipment utilized in the agriculture industry. The survey questions will be developed in conjunction with a project advisory committee (PAC) for the project that will include members from CEC, CPUC, CARB, and agriculture stakeholders. This survey will also be conducted in conjunction with an associated project and survey being conducted under funding from CARB by California Polytechnical State University at San Luis Obispo (Cal Poly SLO). The Cal Poly SLO survey will focus more on population characteristics of equipment (e.g., fuel type, engine model year, engine power rating, equipment type) and operational characteristics (e.g., seasonality, time of use per day), as well as characteristics for the farm or first line processing facility and its operation (e.g., location [county of operation], commodities, and associated acres).

The survey for this study will augment and feed into the survey being conducted by CARB/Cal Poly SLO to include a greater emphasis on energy consumption, energy needs, and information related to the distribution needed to meet those needs. This would include, but would not be limited to, questions in the following areas:

1. Characteristics of the equipment – the type of the vehicle, and other questions not included in the initial Cal Poly SLO survey.
    a. To supplement these questions, information about any plans to transition to zero-emission or low carbon equipment/fuels would be gathered.
    b. Energy use of fossil fuel vehicles (e.g., fuel use per hour and per day, vehicle miles traveled (VMT) for transport focused equipment and fuel economy, power take-off (PTO) energy usage, etc.).

c. Operational characteristics not included in the Cal Poly SLO survey, which could include the operating range or time of the equipment/vehicles, and the load profiles of the equipment.
d. Information related to the potential charging needs for a particular farming or first line processor operation, which could include the size of the farm or processing facility, the number of locations operated by the individual farms or processing facilities, the extent to which equipment is dispersed between different farming and processing locations, and whether the locations are connected or disconnected to electrical power.

The questions specific to this study will be designed to be integrated into the survey being conducted by CARB/Cal Poly such that the questions for the two separate studies flow together. For example, the section where the CARB/Cal Poly survey asks about number and type of tractors, we would integrate in questions about miles driven, etc., such that questions with a similar theme are grouped together in one section. The questions developed for this survey would be vetted through the PAC. The survey questions will be modified/augmented to address any feedback/comments from the PAC prior to finalizing the survey. The survey will be designed to amend the Cal Poly SLO survey formats, which will be distributed as an on-line survey, as well as a hard copy template version of the electronic survey.

Deliverables:

- Draft survey questions
- Final survey questions

Task 2.2 Survey Execution, Data Collection, and Compilation

The contract team will work with the PAC, agriculture stakeholders, and the CARB/Cal Poly SLO team on the execution of the survey. This could include coordinated meetings on the distribution of the survey, assistance as needed in the distribution of the survey, alteration of the survey content based on feedback from the survey. This could include modification of the survey formats to meet the needs of the broader CARB/Cal Poly SLO survey.

It is expected that the data from the survey will be made available electronically from the base CARB/Cal Poly SLO survey. It is expected that this data would be formatted in a standard comma separated values (CSV)/Excel format. The survey response information would be compiled into a format that would be amenable to analysis via computer scripts via Python or some other analysis software package.

Deliverables:

- Compiled survey question answers

Task 2.3 Survey Interviews

Qualitative research methods can provide information to guide design of quantitative methods and provide details and contextual information difficult to ascertain in fixed-design questionnaires suitable for large-sample, quantitative studies. In this study of the potential to electrify agricultural vehicles, additional details and context will improve subsequent modeling of potential market development of electrified agricultural equipment and resulting trajectories of electricity demand. We will use interviews with decision makers in agricultural businesses as well as agricultural organizations to accomplish these goals: 1) aid design of the questionnaire to be used to gather

data from a large sample of fleets, and 2) follow-up with selected survey respondents to solicit additional details and context.

The sample is intended to cover a range of possibilities rather than attempt representativeness: 12 pre-survey; 36 post-survey. Pre-survey interviewees to be selected to reflect a range of size of the agricultural firm, i.e., the number of pieces of agricultural equipment they operate, geography, and products. Post-survey interviewees will be selected based on similar criteria as well as survey results.

Pre-survey design interviews

Initial interviews will introduce the idea of electrifying agricultural equipment, get initial self-assessments of interviewee's perception of their ability and propensity to electrify some or all their equipment, as well as of their likeliness to respond to specific questions in a survey questionnaire. Survey question wording affects respondents understanding and willingness to reply (and thus to continue with a questionnaire once they have started). For example, the more willing respondents are to share precise locations, the better able researchers will be to provide location-specific assessments of the viability of charging agricultural equipment and the cost of any necessary infrastructure upgrades. Another example is question framing, such as for questions of propensity to electrify; framing this assessment as an "innovation" on the one hand vs. a solution to existing problems or costs can be expected to elicit different responses. Such framings will be explored in the pre-questionnaire design interviews.

Post-survey interviews

Post-survey interviews will elicit detailed and contextual information about the following topics:

- Agricultural products
- Agricultural equipment in operation
- Company size (in metrics of production (tons and dollars), acreage, personnel, and vehicles/pieces of agricultural equipment)
- Decision making regarding acquiring and retiring agricultural equipment (including operation, maintenance practices, and costs)
- Location of agricultural equipment over time (across scales ranging from daily to seasonally)
- Awareness of policies and programs affecting agricultural fleet electrification
- Awareness of electric agricultural equipment options
- Status of any ongoing efforts to actively engage in electrifying agricultural equipment
- Propensity to engage in future efforts to actively engage in electrifying agricultural equipment

Deliverables:

- Compiled post-survey question answers

Task 3. Literature Survey

Under this task, the contract team will gather information from the literature and other sources that would be needed in the broader characterization of the electrical needs of the agriculture industry. This would include information about the types and extent of battery electric agriculture equipment and vehicles that are available in the near term or longer term, as well as the applicable regulations that will drive the implementation of battery electric agriculture equipment and vehicles.

Task 3.1 Gather information about BEVs for various agriculture equipment types

The contract team will carry out a comprehensive review of existing and emerging BEV equipment and vehicles that would potentially be applicable to the agriculture sector. The team will review published articles and literature, SAE publications and any other studies, and documented BEV technologies related to the scope of investigation. This would also include information that the contract team has acquired through industry and other sources that may not specifically be available in the published literature. This review would build on information sources that the contract team has knowledge of, the team's extensive interaction with industry contracts in the area, and ongoing studies that UCR and UCD have in evaluating the potential for battery electric off-road equipment. This would include a study that UCR is conducting to evaluate the durability and associated performance specifications needed for the commercialization of battery electric equipment in the off-road sector, as well as demonstration programs of off-road equipment in various sectors. This would include equipment being developed and implemented through the Funding Agriculture Reduction Measures for Emission Reductions (FARMER) program supported by the California Climate Investments, which aims to demonstrate lower emissions and zero-emission technology throughout California. This survey would include fully battery electric, zero-emission technologies, plug-in hybrid electric equipment/vehicles, and hydrogen/fuel cell powered equipment/vehicles.

The focus of this review will be to determine the extent and availability of battery electric equipment in both the near and longer term. This would include equipment that is currently available in prototype, semi-commercial or commercial applications in the near term or in demonstration. This would also include a review of longer-term plans from industry sources and the literature to expand battery electric equipment into the sector, and the potential timing for this expansion. The information to be obtained for different pieces of equipment would include performance information and specification. This would include the size ranges of the equipment and potential battery sizes needed to cover the ranges of activity for different sized equipment. This would also include the anticipated energy use for the piece of equipment in typical operation, and the estimated limits of operation the piece of equipment/vehicle might have in terms of hours of operation between charges or per day, or range in terms of on-road operation. This would also include information relevant to the charging needs of the equipment, which could include the type of chargers needed, and the estimated time needed to fully charge the equipment/vehicle.

Deliverables:

- Summary memorandum on BEVs for various agriculture equipment

Task 4. Analyze Survey Results

Under this task, the contract team will analyze the data obtained through the survey. This will include analyses to determine the extent of energy that will be needed by the agriculture industry, the distribution network required to disperse this energy, and any other relevant analyses, including estimates that might be needed where the survey responses did not provide complete information.

The primary analysis will be the amount of energy needed by the agriculture industry and the geographic extent to which that energy will need to be distributed. Based on the data compiled under task 1.2, computer scripts will be developed to perform a series of mathematical calculations to obtain energy use information. These computer scripts will be developed in Python or another analysis software structure. The analyses that will be performed will estimate energy use on a per equipment basis, on a per farm or first line processor facility basis, on a local/regional

basis, and overall energy use for the agriculture industry as a whole. Analyses will also be conducted to estimate the geographical distribution of the energy needed within different regions of the state. This would include the geographic distribution within the San Joaquin Valley (SJV), the primary hub for the agriculture industry within the state, as well as other areas throughout the state. The project team will coordinate and discuss the geographic distribution analysis with the CEC to provide guidance in areas such as the level of geographic granularity that would be optimal, as the geographic information would need to be of use by CEC for their own estimates of geographic power distribution. The analyses will also evaluate the extent to which electrical distribution will be needed within farms or first line processor facilities of various sizes, including farms or first line processor facilities that might have equipment located at multiple connected or disconnected locations. Any scripts developed for this analysis task will be provided to CEC at the completion of the program.

In conjunction with this primary analysis, the contract team will also provide a range for the potential electrical needs on equipment/vehicle, local/regional, and statewide levels. These ranges will account for differences in activity patterns/load profiles that might be seen for different pieces of equipment, for different farm or first line processor facility commodities and sizes, and for localized or regional areas. The estimates of energy use for individual pieces of equipment will be cross compared with activity and load profile information obtained from a recent study of agriculture tractors conducted by UCR, where tractor activity was logged with data loggers. This study gathered data on typical daily and annual hours of use for agriculture tractors, and associate fuel use, loads, and idle times, as a function of tractor size and crop type. This information will also be used to evaluate the robustness of the survey information that is collected in terms of the equipment hours of use and fuel use profiles.

Deliverables:

- Summary task report on survey analysis results

Task 5. Update off-road model for Agriculture Applications

The California Energy Commission produces an Integrated Energy Policy Report (IEPR) which forecasts the energy usage in the state. This project will produce a forecast of the ag industry's electricity usage for off-road vehicles and equipment. In addition, the forecast will estimate avoided petroleum usage due to replacing conventional equipment and vehicles by ZEVs. The forecast will also estimate hydrogen usage. The forecast will extend from the present through 2050.

Task 5.1 Stock, percentage BEV, energy usage, avoided fossil fuel usage, electricity demand, hydrogen usage, etc.

For each off-road ag application, the project team will estimate the present vehicle and equipment stock and project the stock through 2050. The team will use the results of the surveys and interviews along with potential other information to determine the initial baseline population data. The team will work with the CEC and the ag industry and potentially utilize state economic data to project future stock.

The team will use information from CARB regulations, the surveys and interviews, discussions with CEC and CARB personnel, contacts with ag equipment and vehicle manufacturers, and results from Task 2.1 on BEV ag equipment and vehicles to estimate the percentage of vehicles and equipment that will be electrified. The team will then use estimates of the vehicle or equipment

fuel economy and activity (vehicle miles traveled or hours of operation) to project the associated electricity usage. The avoided petroleum usage will be calculated by determining the number of electric vehicles or pieces of equipment that have been substituted for petroleum-fueled vehicles using the fuel economy and activity for those petroleum-fueled vehicles.

The team will create a spreadsheet model to forecast the ag industry's off-road electricity demand and the avoided petroleum usage. The spreadsheet will include all relevant inputs and year-by-year calculations of electricity and avoided petroleum usage. The team will work with the CEC forecast team to ensure that the spreadsheet model can be easily used in their energy forecasts.

Task 5.2 Consider hydrogen as option for applications

The CARB regulations require purchase and use of ZEV equipment and vehicles, but they do not specify which zero emission technologies must be used. Both battery electric and fuel cell equipment and vehicles can meet these regulations. Under this task, the contract team will investigate the potential for fuel cells to meet the requirements of the ag applications and estimate the market penetration for such equipment and vehicles. Any fuel cell equipment or vehicles would not use electricity, and consequently, would not contribute to the ag industry's off-road electricity demand forecast but would contribute to avoided petroleum usage. The updated off-road model will estimate hydrogen usage for the projected hydrogen fuel cell vehicles.

The team will identify manufacturers of fuel cell equipment and vehicles for agricultural applications. The team will contact these manufacturers to understand potential availability, cost, and performance of these products. The team will utilize information gathered from the surveys and interviews to understand which applications could benefit from fuel cell equipment or vehicles. The team will then estimate the percentage of ZEV fleet purchases that are likely to be BEVs and the percentage likely to be fuel cells. Fuel cell equipment and vehicles would require hydrogen stations for refueling, and these stations would use electricity during operation. This electricity usage is considered outside the scope of this project and will not be included in the off-road electricity demand forecast.

Deliverables:

- Final off-road model in spreadsheet form

Task 6. Reporting and Outreach

Under this task, the contract team will conduct the periodic and final reporting, the preparation and dissemination of any electronic data and reports, and outreach associated with the project.

Task 6.1 Periodic reporting and Final report

This subtask covers the reporting and data sharing elements of this project from a broader perspective. Several months prior to the end of the study, the contract team will submit a draft final report (DFR) to CEC. The DFR will also incorporate the results from all aspects of the project, including all the relevant tasks, details related to the development and execution of the survey, the data compilation and analysis methods used, a summary of the results of all metrics that were analyzed as part of this study, and a summary of the development and usage of the updated off-road model for agriculture applications. CEC comments and feedback on the DFR will be addressed in a modified DFR that will be provided to CEC for final approval. The final report will be prepared in a format consistent with CEC final report formatting guidelines. In addition, the

team will deliver an Excel spreadsheet used to calculate the projected electricity usage, hydrogen usage, and displacement of diesel or gasoline by the ag industry's usage of ZEV equipment and vehicles.

The contract team will also provide ongoing updates on the progress of the program through a variety of pathways, including project meetings, progress reports, and quarterly invoices.

Progress reports will be prepared on a quarterly basis and will be completed in conjunction with quarterly invoices.
The contract team will also provide all data to CEC electronically, in a format acceptable to CEC, such as CSV files.

Deliverables:

- Periodic progress reports
- Draft Final Report
- Final report

Task 6.2 Workshops

The contract team will present summaries of their work at two staff workshops, with notice to the CEC's Demand Analysis Working Group and any other interested stakeholder. The first workshop will be an interim workshop where preliminary results will be presented. The second workshop will be scheduled at the end of the project where final results will be presented. The schedule format will be determined by the CAM in consultation with the contractor.

Deliverables:

- Final slide decks for each workshop