



STATE OF CALIFORNIA

CONTRACT AMENDMENT REQUEST FORM (CARF)

CEC-276 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

Original Agreement # 600-15-001 Amendment # 5

Division	Agreement Manager:	MS-	Phone
600 Fuels and Transportation Division	Patrick Brecht	6	916-654-4084

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

Revisions: (check all that apply)	Additional Requirements
<input checked="" type="checkbox"/> Term Extension New End Date: 12 / 31 / 2023	Include revised schedule and complete items A, B, C, D, & H below.
<input checked="" type="checkbox"/> Budget Augmentation Amendment Amount: \$ 1,470,000	Include revised budget and complete items A, B, C, D, E, F, & H below.
<input type="checkbox"/> Budget Reallocation	Include revised budget and complete items A, B, C, D, & H below.
<input checked="" type="checkbox"/> Scope of Work Revision	Include revised scope of work and complete items A, B, C, D, & H below.
<input type="checkbox"/> Change in Project Location or Demonstration Site	Include revised scope of work and complete items A, B, C, D, G, & H below.
<input type="checkbox"/> DVBE Replacement	Include revised scope of work and complete items A, B, C, D, F & H below.
<input type="checkbox"/> Novation/Name Change of Prime Recipient	Include novation documentation and complete items A, B, D, & H below.
<input type="checkbox"/> Terms and Conditions Modification	Include applicable exhibits with bold/underline/ strikeout and complete items A, B, C, D & H below.

A) Business Meeting Information

Business Meeting approval is not required for the following types of Agreements:

Minor amendments delegated to Executive Director per December 2013 Resolution

Proposed Business Meeting Date 10 / 14 / 2020 Consent Discussion

Business Meeting Presenter Patrick Brecht Time Needed: 5 minutes

Please select one list serve. Altfuels (AB118- ARFVTP)

Agenda Item Subject and Description:

DOE-NATIONAL RENEWABLE ENERGY LABORATORY. Proposed resolution approving Amendment 5 to contract Agreement 600-15-001 with the U.S. Department of Energy's National Renewable Energy Laboratory to: Augment Task 2, to receive light-duty vehicle attribute forecasts for use in the 2021 Integrated Energy Policy Report (2021 IEPR),



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Augment Task 4, to receive hydrogen price forecasts for use in the 2021 IEPR, Augment Task 3 and Task 5, to include additional EVI-Pro updates and related activities, Augment Task 5, to support new analyses for the Clean Transportation Program Benefits Report within the 2021 IEPR, Add new Task 11 (titled “HyStep 2”), to test hydrogen refueling stations that serve medium-duty fuel cell electric vehicles (FCEVs). The proposed amendment would augment the budget by \$1.47 million and extend the term to December 31, 2023. (Clean Transportation Program funding) Contact: Patrick Brecht. (Staff presentation: 5 minutes)

B) Amendment Justification (For contract amendments only)

- Non Competitive Bid (Attach DGS-GSPD-09-007) <https://www.dgs.ca.gov/PD/Forms>
- Exempt Other Governmental Entity

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

Legal Company Name:	Budget
	\$ 0.00
	\$ 0.00
	\$ 0.00

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

Legal Company Name:

E) Budget Information (only include amendment amount information)

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
Funding Source	FY 19/20	600.1181	\$1,470,000
Funding Source			\$

R&D Program Area: Select Program Area TOTAL: \$

Explanation for “Other” selection

Reimbursement Contract #:

Federal Agreement #:

F) Disabled Veteran Business Enterprise Program (DVBE)

1. Exempt (Interagency/Other Government Entity)
2. Meets DVBE Requirements DVBE Amount:\$_____ DVBE %:_____
 - a) Contractor is Certified DVBE
 - b) Contractor is Subcontracting with a DVBE:



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- 3. Contractor selected through CMAS or MSA with no DVBE participation
- 4. Requesting DVBE Exemption (attach CEC 95)

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 .

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

- c) Agreement **IS** exempt.
 - Statutory Exemption. List PRC and/or CCR section number:
 - Categorical Exemption. List CCR section number: 14 CCR 15301 Minor Alterations to Existing Facilities

For the additional work added by this amendment, Contractor will perform technical evaluations within its existing laboratory facilities and within the guidelines of those facilities. Minor alterations may be needed for these particular technical evaluations, but the proposed use of existing laboratory facilities presents no or negligible expansion of its existing use.

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

- d) 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) The following items should be attached to this CARF (as applicable)

- | | | |
|---|---|--|
| 1. Exhibit A, Scope of Work | <input type="checkbox"/> N/A | <input checked="" type="checkbox"/> Attached |
| 2. Exhibit B, Budget Detail | <input type="checkbox"/> N/A | <input checked="" type="checkbox"/> Attached |
| 3. DGS-GSPD-09-007, NCB Request | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached |
| 4. CEC 95. DVBE Exemption Request | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached |
| 5. CEQA Documentation | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached |
| 6. Novation Documentation | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached |
| 7. CEC 105, Questionnaire for Identifying Conflicts | | <input checked="" type="checkbox"/> Attached |



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CALIFORNIA ENERGY COMMISSION

Agreement Manager

Date

Office Manager

Date

Deputy Director

Date

Exhibit A SCOPE OF WORK

TASK LIST

Task #	Task Name
1	Agreement Management
2	Technology and Market Status Review
3	Plug-In Electric Vehicle (PEV) Infrastructure Assessment
4	Hydrogen Refueling Station (HRS) Network Progress Reports
5	Program Analysis Support
6	Annual Program Review Meeting
7	Technical Evaluation of Project Proposals
8	Real-Time Data Collection for Alternative Fueling Stations
9	Historical Station Data
10	High Power Charging for Commercial Vehicles (HPCCV)
<u>11</u>	<u>Hydrogen Station Equipment Performance 2.0 (HyStEP) Device Final Design</u>

ACRONYMS/GLOSSARY

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

Acronym	Definition
AFDC	US DOE's Alternative Fuels Data Center
AQIP	Air Quality Improvement Program
ARFVTP	Alternative and Renewable Fuels and Vehicle Technology Program
ARB	California Air Resources Board
CAFE	Corporate Average Fuel Economy
CAM	Commission Agreement Manager
CDP	Composite Data Products
CGE	Computable General Equilibrium
CharIN	Charging Interface Initiative
CHTS	California Household Travel Survey
CIB	California Interregional Blueprint
CPR	Critical Project Review
CPUC	California Public Utilities Commission
CSFM	California Statewide Freight Model
CSTDM	California Statewide Travel Demand Model
CTP	California Transportation Plan
CVRP	Clean Vehicle Rebate Project
DCFC	Direct Current Fast Charging
DOE	Department of Energy
E-FAST	Electric-Financial Analysis Scenario Tool

Acronym	Definition
EMFAC	Emission Factor
EPA	Environmental Protection Agency
ETIS	Energy Technology Innovation System
EVCS	Electric Vehicle Charging Station
EVI-PRO Model	Electric Vehicle Infrastructure-Project Model
EVSE	Electric Vehicle Supply Equipment
GHG	Greenhouse gas
GREET Model	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model
H2FAST	Hydrogen Financial Analysis Scenario Tool
HRS	Hydrogen Refueling Station
HRSAM	Hydrogen Refueling Stations Analysis Models
HSCC	Hydrogen Station Cost Calculator
HyStEP	Hydrogen Station Equipment Performance
IMIA	Integrated Market Impact Assessment
LCA	Life Cycle Assessment
LCFS	Low Carbon Fuel Standard
LDV	Light Duty Vehicles
MPO	Metropolitan Planning Organization
NEMS	National Energy Modeling System
NHTSA	National Highway Traffic Safety Administration
NREL	National Renewable Energy Laboratory
PEV	Plug-in Electric Vehicle
PRM	Program Review Meeting
REMI	Regional Economic Models, Inc.
RFS	Renewable Fuels Standard
RPS	Renewable Portfolio Standard
SCS	Sustainable Communities Strategies
SEDS	State Energy Data System
VMT	Vehicle Miles Traveled
ZEV	Zero Emission Vehicle

BACKGROUND/PROBLEM STATEMENT

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). This statute, amended by Assembly Bill 109 (Núñez, Chapter 313, Statutes of 2008) and later by Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013), authorizes the California Energy Commission (Energy Commission) to “develop and deploy innovative technologies that transform California’s fuel and vehicle types to help attain the state’s climate change policies.” Assembly Bill 8 extends funding for ARFVTP until January 1, 2024, as well as for the Air Quality Improvement Program (AQIP) and the Enhanced Fleet Modernization Program, both administered by the California Air Resources Board (ARB).

As stated in Assembly Bill 8, the category of alternative and renewable transportation fuels includes: “electricity, ethanol, dimethyl ether, renewable diesel, natural gas, hydrogen, and biomethane, among others, and their feedstocks that have high potential for long-term or short-term commercialization, including projects that lead to sustainable feedstocks.” Assembly Bill 8 also states that preference will be given to projects with higher benefit-cost scores, which are determined as GHG reductions per program dollar for ARFVTP, and criteria emission reductions per program dollar for AQIP.

OBJECTIVES OF THE AGREEMENT

The Energy Commission requests the assistance of the U.S. Department of Energy’s (DOE’s) National Renewable Energy Laboratory (NREL) in the planning, implementation, and evaluation of the ARFVTP. Phase I of this project was initiated in December 2012. In Phase II, Commissioners continue to seek expert analysis about ARFVTP investments and how effective they are in addressing economic, environmental, energy security and petroleum reduction goals. The guiding, high-level research question for Phase II is the following:

How can ARFVTP funds provide the greatest leverage to accelerate market growth for alternative and renewable fuel technologies, such that by 2024 these markets no longer require significant government support and the state of California is on a trajectory to meet long-term GHG and criteria emission reduction goals?

The tasks outlined in this statement of work will strengthen the administration of the ARFVTP, and will assist in the effective implementation of this program as technologies and markets evolve over time. ARFVTP is a core program within California’s unique transportation sector policy environment, and provide critical support mechanisms for an emerging sustainable transportation innovation system that is international in scope. As discussed by Grubler et al (2013)¹, in their review of an updated framework for understanding technology innovation processes, which they refer to as Energy Technology Innovation System (ETIS), there are different support mechanisms in play during different phases of R&D, market development, and technology diffusion. ARFVTP activities support the following key innovation processes involved in the early phases of market development for sustainable transportation technologies:

1. **Counteract resistance to change.** Overcoming systems inertia and vested interests.
2. **Knowledge development and exchange in networks.** Generating and sharing knowledge to improve the performance, learn from experience, etc.
3. **Market formation.** Creating, protecting of supporting niches for innovations to enter the market.

¹ Grubler, A. et al. (2013). *Policies for the Energy Technology Innovation System (ETIS)*, chapter 24 within Global Energy Assessment - Toward a Sustainable Future, Cambridge University Press, Cambridge, UK and New York, NY, USA.

4. **Guidance of the search.** Strategic innovation to reduce uncertainty.
5. **Entrepreneurial experimentation.** Taking risks, creating variety, “field” testing, developing business opportunities.
6. **Materialization.** Building up production of manufacturing capacity.
7. **Resource mobilization.** Allocating financial, material and human capital to the innovation process.

While direct ARFVTP funding clearly supports the key innovation processes 5, 6 and 7 (which are closely coupled, the program also supports processes 1-4, which play an essential role in earlier phases of technology and market development. This Agreement provides the Energy Commission with direct support for technology innovation processes 2-4 and 6-7, and indirect support for processes 1 and 5.

FORMAT/REPORTING REQUIREMENTS

Deliverables/Reports

When creating reports, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager (CCM), 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 CCM) 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.

ADMINISTRATIVE TASKS

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 Contracts Officer, 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 Monthly Progress Calls and Quarterly 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:

- Schedule monthly conference calls to provide project updates and discuss any outstanding issues.
- Prepare and submit a Quarterly Progress Report which summarizes all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the CAM within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in the terms and conditions of this Agreement.

Deliverables:

- Monthly Progress Conference Calls
- Quarterly Progress Reports

Task 1.5 Final Meeting

The goal of this task is to discuss closeout of this Agreement and review the project.

The Contractor shall:

- Meet with Energy Commission staff prior to the term end date of this Agreement. The meeting will be held via Web-Ex or 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, based on the information included in the Final Report.
- 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

TECHNICAL TASKS

Task 2.0 Technology and Market Status Review

The goal of this task is to build upon the technology and market assessment reports developed in Phase I of NREL's contract, 600-11-002, with the Energy Commission and to update and integrate technology and market status information across multiple scales and subject areas, and with multiple external collaborators, to support analysis in tasks 3.0 and 5.0 below. The market status review activities fall into the four subtasks below:

Task 2.1 Transportation and economic data

A more complete understanding of ARFVTP economic and environmental benefits to the state and market impacts requires analysis conducted in the context of future economic trends, especially with respect to various energy and other policy constraints. Some of these trends are being revealed over time as new technologies and policies are introduced (e.g., PEV market adoption and LCFS credit trading) and others are being explored through surveys or models of future market and technology deployment outcomes

The Contractor shall:

- Collect and analyze the following models and studies to ensure consistency with energy use and GHG emission calculations from SB 375, SB 350, SB 32 activities and the California Transportation Plan 2040 (CTP 2040), relying upon various models supporting ARB and Metropolitan Planning Organization (MPO) analytics of Sustainable Communities Strategies (SCS)² and the California Interregional Blueprint (CIB). This may include data exchange with or calibration to models such as the following:
 - California Statewide Travel Demand Model (CSTDM)
 - California Statewide Freight Model (CSFM)
 - ARB Vision Study updates³
 - Activity trends from the ARB EMFAC (Emission Factor) model
 - Activity and planning models from specific MPOs
- Collect and analyze state and regional energy and transportation data collected by other state energy and transportation agencies and compiled at the national level, including but not limited to:
 - State Energy Data System (SEDS)⁴
 - Detailed data mining of the California Household Travel Survey (CHTS) (made available through the Contractor's Transportation Secure Data

² ARB (2014). *SB 375 Greenhouse Gas Emissions Reduction Target Update Process*, ARB Staff Report, October 2014, available online⁷⁵

http://www.arb.ca.gov/cc/sb375/staff_report_sb375_targets_update.pdf

³ ARB Vision Studies <http://www.arb.ca.gov/planning/vision/vision.htm>

⁴ State Energy Data System (SEDS) website: <http://www.eia.gov/state/seds/>

- Center⁵)
 - Megaregional trends beyond California, including freight activities and highway planning, such as that collected and reviewed through the U.S. DOT, Federal Highway Administration’s megaregion planning activities.⁶
 - Collect and analyze economic data from modeling of energy, air quality, and other municipal, state, or federal policy impacts. Examples of data to be collected and analyzed include but are not limited to:
 - BEAR, CA-TIMES, National Energy Modeling System (NEMS), or other comparable models
 - Job estimation and economic welfare, based upon results from a California-specific Computable General Equilibrium (CGE) model (e.g., BEAR model)
 - Results of CA regional economic analyses, such as the SCAG economic assessment of their 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), which relied upon the Regional Economic Models, Inc. (REMI) TranSight model⁷
 - Collect and analyze credit trading outcomes and simulation methods for specific policies, including but not limited to the ZEV Mandate, CVRP, LCFS, RFS, RPS, CPUC energy storage requirements, and others (to be identified in discussion with Energy Commission staff).
- Task 2.2 ARFVTP project data

This subtask will involve collection of data from Energy Commission project managers, as well as from direct communication between the Contractor’s staff and ARFVTP project awardees. When possible, data validation methods will be employed to ensure consistency across projects.

The Contractor shall:

- Collect data from Energy Commission project managers and communicate with ARFVTP awardees for purposes of data collection, subject to CAM notification and approval.
- Make updates to the ARFVTP benefits database (created under NREL’s contract 600-11-002) on a project level (including Energy Commission award amounts, awardee or other cost share, petroleum reduction estimates, GHG reduction estimates, etc.)
- Collect and analyze data on vehicle operation (VMT per year, length of trips, drive cycle data, routing territories, garaging locations, etc.)
- Collect and analyze data on vehicle specifications (fuel economy, engine type, hybridization, plug-in patterns and kWh usage, costs, etc.)
- Collect and analyze data on fuel production, delivery and fueling station specifications, life cycle assessment (LCA) carbon intensities, efficiencies, capacities, location, resource utilization, equipment utilization, potential for capacity

⁵California Household Transportation Survey, posted on the Transportation Secure Data Center website at NREL: http://www.nrel.gov/vehiclesandfuels/secure_transportation_data.html

⁶FHA (2015). *Megaregions and Multi-Jurisdictional Planning*, Office of Planning, Environment, & Reality, U.S. DOT, Federal Highway Administration, website: <http://www.fhwa.dot.gov/planning/megaregions/>

⁷SCAG, RTP/SCS Economic Analysis, website: <http://economy.scag.ca.gov/Pages/RTPEconomicAnalysis.aspx>

expansion, costs, etc.)

Task 2.3 Technology innovation trends

Trends in alternative fuel and vehicle technology performance and cost are expected to improve over time through the process of innovation, including Research and Development (R&D) improvements, experience gained from pilot projects and demonstrations, learning through generational cycles, and economies of scale. Although studies of technology innovation have a long history, recent literature has focused on informing policies within the context of Energy Technology Innovation Systems (ETIS).⁸

The Contractor shall:

- Collect and evaluate literature and data from relevant Energy Commission or other state agency studies on vehicle attributes from the EMFAC ~~2014-2017~~**or EMFAC 202X** model, or results from the **most recent** Energy Commission's ~~Sierra Research~~ **light-duty** vehicle attributes study and ~~most recent~~ California Vehicle Survey.
- Integrate ARFVTP project data (from Task 2.2) with data collected for other deployment activities and programs, including but not limited to Clean Cities, ARRA transportation projects, and EV Everywhere. This will include but not be limited to:
 - Alternative fuel infrastructure cost estimates, price bids, or realized installation costs
- Collect and evaluate literature and existing studies on consumer stated preferences for vehicles and fuels (revealed through surveys, focus groups, and other sources).
- Collect and evaluate literature and existing studies on consumer and fleet revealed preferences for light, medium, and heavy-duty vehicle technologies (e.g., Polk vehicle registration data at the ZIP code level).
- Collect and evaluate literature and existing studies on new vehicle production capacity for all vehicle technologies and fuels. These will contribute to cost estimation methods relying upon experience curves (global and regional).
- Collect and evaluate literature and existing studies on light and heavy-duty vehicle attributes (fuel economy, range, prices, etc.).
- Collect and evaluate existing data and studies on vehicle driving patterns (e.g., annual VMT).
- Collect and evaluate existing data on California vehicle stock and sales by zip code.
- Provide year-by-year forecasts through ~~2030~~**2032** for the following light-duty vehicle attributes: fuel economy, MSRP, range, 0-60 MPH acceleration, **projected** number of makes/models, and maintenance costs.
 - This forecasted vehicle attribute data shall:

⁸ IIASA (2014), Chapter 24: Policies for the Energy Technology Innovation System, Global Energy Assessment, Cambridge University Press, available online: <http://www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/Chapte24.en.html>

- Be disaggregated into combinations corresponding to Energy Commission specified vehicle classes, **for luxury and standard vehicles**, and the engine/powertrain technologies as described by Energy Commission staff in Table 1 and Table 2 on page 21.
- Incorporate up-to-date information of component vehicle technologies and anticipated technology improvements in relation to the vehicle attributes listed above.
- **Reflect** Consider **adopted** policy- **policies** scenarios-used by the Energy Commission, as determined in discussion with the CAM and Energy Commission staff.
- Analyze the impact of state and federal regulation such as the EPA/NHTSA CAFE standards and California's ZEV program.
- Create and develop deliverables related to vehicle attributes.
 - A draft and final version of the following spreadsheets:
 - *Forecast Vehicle Attributes Data spreadsheet* containing the forecasted vehicle attribute data disaggregated by vehicle class and technology as stated above.
 - *Vehicle Technology spreadsheet* with a list of the component technologies and the assumptions and calculations utilized to forecast vehicle attribute data.
 - The content to be included in these spreadsheets will be determined in discussion with Energy Commission staff. All worksheets shall be formatted to expedite data entry into Energy Commission models.
 - Present results of vehicle attribute trends analysis at a ~~2017~~**2021 IEPR** workshop, **or Demand Analysis Working Group (DAWG) meeting.**
 - A *Forecasted Vehicle Attributes **Methodology Memo** Report* documenting the following items:
 - Documentation of all projected vehicle attribute data.
 - Explanation of all assumptions and data sources used to forecast the attributes.
 - Description of the methodology used to create forecasted vehicle attribute data.
 - A review of the quantitative fuel economy estimates for all **light-duty** vehicle **classes and** technologies. specified by the Energy Commission.
 - A discussion of the expected costs, availability, and market penetration of component technologies described in the Vehicle Technology spreadsheet.
- **Provide a hydrogen retail price forecast for 2020-2032.**

Task 2.4 Status review documentation

On an as-needed basis, and in discussion with Energy Commission staff, technology and market assessment reports material from Phase I will be revised, updated, and combined with appropriate Phase II Task 2 materials for presentation through a web-based deliverable. This will allow for more dynamic updates and collaborative exchange with other research groups.

Contractor shall:

- **Create a Web-based Sustainable Transportation portal.** Data will be made available to the public and for use by collaborative research groups. An NREL-CEC “Sustainable Transportation” information access portal will be created and maintained (by Contractor’s staff) on a website such as the OpenEI energy data portal (to be determined with CAM input).⁹

The exact content of information to be included in the deliverable will be determined in discussion with Energy Commission staff.

- The Contractor shall create and maintain access to Sustainable Transportation information portal.

Task 2 Deliverables:

- Proof of creation and continued access to Sustainable Transportation information portal.
- Draft version of Forecast Vehicle Attributes Data worksheet
- Final version of Forecast Vehicle Attributes Data worksheet
- Draft version of the Vehicle Technologies worksheet
- Final version of the Vehicle Technologies worksheet
- Draft version of Forecast Vehicle Attributes Report
- Final version of Forecast Vehicle Attributes Report
- **Excel spreadsheet of light duty vehicle attributes of gasoline, hybrid, diesel, battery electric, plug-in Hybrid electric, fuel cell electric, and plug-in fuel cell electric vehicles, for 13 classes of light duty vehicles.**
- **Technical memorandum on the attribute forecasting methodology.**
- **Hydrogen Retail Price Forecast for 2020-2032.**

⁹ <http://en.openei.org>

Task 3 PEV Infrastructure Assessment

The goal of this task is to support Energy Commission staff in the rapidly changing area of PEV market adoption and EVSE infrastructure planning and expansion by drawing upon the Contractor's existing knowledge base and interactions with ARFVTP collaborators, including but not limited to the PEV Collaborative, Alternative Energy Systems Consulting (AESC), and Regional PEV Coordinating Councils. In Phase I, under contract 600-11-002, the Contractor helped to develop the Statewide Plug-in Vehicle Infrastructure Assessment report (the "Assessment"), articulating an Assessment Framework to be implemented to inform the Energy Commission on EVSE infrastructure issues as new market dynamics and empirical data are characterized and collected. **This task involves updating and improving the Assessment, examining the electric grid impacts of charging demand, and disseminating new information based upon market and technology updates and content developed through collaborative interactions.**

Task 3.1 Assessment framework updates

Contractor Shall:

By working with Energy Commission staff, the Statewide Plug-in Electric Vehicle Collaborative, the Regional PEV Coordinating Councils and academic institutions, the Contractor shall:

- Assist with electric vehicle charging infrastructure planning, regional travel, as well as and identification of gaps between regions by developing and using models such as Electric Vehicle Infrastructure Projections (EVI-Pro).
- Integrate and assess regional PEV plans within the Assessment Framework. The Contractor's staff will coordinate with regional planners to understand the metrics and rationale behind all regional plan assumptions and inputs.
- Analyze and interpret data generated by Energy Commission PEV infrastructure projects in California, including the National Parks Service, as well as information collected by contractor through the US DOE's Alternative Fuels Data Center (AFDC).
- Develop outreach website materials to facilitate access to Assessment and other information related to PEV market adoption and EVSE network development, building on network of resources available at local, regional, state, and federal levels. These materials shall include:
 - *Outreach to metropolitan planning organizations on regional planning and recharging reliability and Electric Vehicle Charging Station (EVCS) planning.*
 - *Outreach to educate and inform multi-unit dwelling owners and decision-makers on EVCS installations.*

The contractor shall develop a public, web-based version of the *Infrastructure Assessment Framework*, based upon information derived from the following activities:

- Collaborate with existing Energy Commission and regional efforts to review and create tools and strategies for infrastructure planning for PEVs in order to support the deployment of light-duty passenger vehicles and medium- and heavy-duty

vehicles.

- Assist the Energy Commission with the analysis and interpretation of data received from PEV infrastructure grantees to understand utilization rates and develop a comprehensive list of potential sites, including suggested phasing to align with the State's public EVSE deployment plans over the next three years.
- Coordinate research efforts with the various organizations and research groups, including but not limited to the Plug-in Hybrid and Electric Vehicle Research Center at UC Davis and the PEV Collaborative.
- Assist Energy Commission staff in preparing documents or conducting activities (e.g., workshops), which may be conducted in coordination with the Governor's Office or with other state agencies in support of the ZEV Action Plan
- Work with Energy Commission staff, Statewide PEV Collaborative, and Regional Coordinating Councils to periodically update the Infrastructure Assessment Framework created in this task, through January 1, 2018.

Task 3.2 PEV Market adoption and EVSE interactions

Contractor Shall:

Based upon market data collected through Tasks 2.0 and 3.1, the Contractor shall:

- Analyze interactions between EVSE availability, consumer preferences, and resulting impacts on vehicle market adoption trends. This will involve identification of statistical significance of this causal effect, using empirical data, as well as a review of economic or theoretical models on PEV market adoption. If strong empirical correlations are not identified, data gaps will be characterized in anticipation of receiving sufficient data in later years.

Task 3.3 EVSE deployment, reliability and financial analysis strategies

Contractor Shall:

- In response to the 2015 Governor's ZEV Action Plan, the subcontractor shall pursue research related to charging station congestion in areas with high PEV adoption rates, pricing strategies and expansion planning in response to congestion, and non-price mechanisms to increase EVSE utility and availability by developing and using financial analysis models such as E-FAST.

Task 3.4 EVI-Pro Updates

Contractor Shall:

By working with Energy Commission staff and other U.S. Department of Energy national laboratories and academic institutions, and based upon market data collected through Tasks 2.1, 2.3, 3.1, and in support of state's goals for widespread transportation electrification, the Contractor shall:

- **Develop EVI-Pro 2, the successor to the original EVI-Pro model.**
- **Develop EVI-Pro RoadTrip, focused on modeling infrastructure needed to enable electrified long-distance travels.**
- **For both models, assess the existing and future charging infrastructure needed to**

support the levels of electric vehicle adoption required to meet the state's vehicle deployment, greenhouse gas emission reduction, and other policy goals **by the year 2030.**

- Expand **both models** to consider needed the chargers, make-ready electrical equipment, and supporting hardware and software.
- Using **EVI-Pro and EVI-Pro RoadTrip**, analyze how the needed charging infrastructure is affected by factors including but not limited to: updated household and commercial travel survey data; the types of buildings, parking, and electric infrastructure at trip origins and destinations; vehicle and charging equipment technology attributes; operational or business model designs that enable the shared use of chargers; drivers' preferences and behaviors related to charging; electric utility pricing and load management; and transportation sector trends including vehicle automation and shared mobility.
- **Update the EVI-Pro Results Viewer with EVI-Pro 2 results to communicate results and information to the public.**
- **Provide support for the CEC's Assembly Bill 2127 efforts by communicating results and preparing documents.**

Task 3.5 Develop Framework for Modeling Congestion and Communication in EVI-Pro

Contractor Shall:

By working with Energy Commission staff and other U.S. Department of Energy national laboratories and academic institutions, the Contractor shall:

- **Develop capabilities in the EVI-Pro framework, through agent-based modeling and/or other methodologies, to assess and model the behavior of individual drivers and the status of charging stations in the network.**
 - **Identify aspects of driver behavior and potential modifiers from the drivers' perspectives, such as congestion, that would impact charging station use.**
 - **Identify and incorporate charging station network operations and management from the business perspective, such as congestion or underutilization, that would impact the status of the charging stations in the network.**
 - **Identify other aspects of driving and charging behavior that may impact charger use.**
- **Develop methodology to account for and consider existing charging stations and plugs/connectors within the model simulations.**
- **Develop all modeling inputs in close collaboration with Energy Commission staff.**

Task 3.6 Enhance Geographic Resolution of EVI-Pro Modeling

Contractor Shall:

By working with Energy Commission staff, other U.S. Department of Energy national laboratories, academic institutions, and organizations involved with electrical grids and transportation electrification analysis, the Contractor shall:

- **Enhance the geographic resolution of EVI-Pro modeling to improve charging network designs and inform grid impact assessments.**
 - **Develop methodologies to achieve a geographic resolution for charging network design and charging loads at the traffic analysis zone, census tract, or block group level (or others as data is available).**
 - **Develop mechanisms to determine the impacts of smart charging and vehicle grid integration factors on charging network designs and charging loads (and the flexibility of charging loads) at the geographic resolution specified above.**
 - **Work with CEC staff to provide network design and load impact results to use in the CEC's Electric Vehicle Supply Equipment (EVSE) Deployment and Grid Evaluation (EDGE) tool to assess grid impacts.**
 - **Use the findings and results from EDGE to create a feedback loop in EVI-Pro to re-evaluate charging network designs and load flexibility as needed.**

Task 3.7 Integrate Modeling and Results of EVI-Pro 2 and EVI-Pro RoadTrip to create EVI-Pro 3

Contractor Shall:

By working with Energy Commission staff and other U.S. Department of Energy national laboratories and academic institutions, and in support of the state's goals for widespread transportation electrification, the Contractor shall:

- **Link the EVI-Pro 2 and EVI-Pro RoadTrip models to develop EVI-Pro 3.**
 - **Develop methodology to integrate EVI-Pro 2 and EVI-Pro RoadTrip, through co-simulations and/or post-processing/back-end integration, to optimize the outputs and charging network design.**
 - **Build the linkage in a way that can flexibly incorporate other infrastructure analyses in the future, such as the Medium and Heavy-Duty Electric Vehicle Infrastructure Projections (HEVI-Pro) and the Widespread Infrastructure for Ride-hailing EV Deployment (WIRED) model.**
 - **Develop and incorporate a mechanism to analyze co-utilization of chargers within the EVI-Pro linkage.**
- **Using EVI-Pro 3 and the enhancements from Tasks 3.5 and 3.6, assess the existing and future charging infrastructure needed to support the levels of electric vehicle adoption required to meet the state's vehicle deployment, greenhouse gas emission reduction, and other policy goals.**
- **Using EVI-Pro 3, analyze how the needed charging infrastructure is**

affected by factors including but not limited to: updated household and commercial travel survey data; the types of buildings, parking, and electric infrastructure at trip origins and destinations; vehicle and charging equipment technology attributes; operational or business model designs that enable the shared use of chargers; drivers' preferences and behaviors related to charging; electric utility pricing and load management; and transportation sector trends including vehicle automation and shared mobility.

- Update the EVI-Pro Results Viewer to communicate new results and information to the public.
- Provide support for the CEC's Assembly Bill 2127 efforts by communicating results and preparing documents.

Task 3 Deliverables

- Beta review version and final PEV Assessment Portal. Analyses and models used to develop the PEV Assessment Portal. Associated outreach information conveyed in a web-based information portal.
- Draft and final Report on EVSE and PEV adoption. This report will convey results of empirical correlations between EVSE deployment and PEV adoption.
- Draft and final Report on EVI-Pro 2. The report will summarize findings on the sensitivity of charging infrastructure needed under various planning scenarios.
- Draft and final Report on EVI-Pro RoadTrip. The report will summarize the charging infrastructure needed to enable electrified long-distance travel, and the associated load impacts.
- Updated EVI-Pro Results Viewer incorporating new results and information from EVI-Pro 2.
- Monthly progress reports on Tasks 3.4, 3.5, 3.6, and 3.7 in the form of presentations or written reports (no longer than 5 pages).
- EVI-Pro 2 and EVI-Pro RoadTrip models, in such format as the CEC shall specify.
- Inputs, methodologies, models, and outputs used to develop EVI-Pro 2 and EVI-Pro RoadTrip, for example in the form of a Github repository. These will be updated on a regular basis as progress is made on Task 3.4 and communicated to the CEC.
- Draft and final Report on EVI-Pro 3. The report will summarize the improved charging infrastructure projections based on agent-based modeling and harmonization of EVI-Pro 2 and EVI-Pro RoadTrip.
- Case study demonstrating the new model capabilities developed in Task 3.5. This could be integrated into the EVI-Pro 3 report, or as a separate deliverable if appropriate.
- Database of EVI-Pro 3 results, including charger type, location, and power level to be fed into the CEC's EDGE tool.
- EVI-Pro 3 model, in such format as the CEC shall specify.
- Inputs, methodologies, models, and outputs used to develop EVI-Pro 3, for example in the form of a Github repository. These will be updated on a regular basis as progress is made on Tasks 3.5, 3.6, and 3.7 and communicated to the CEC.

- **Updated EVI-Pro Results Viewer incorporating new results and information from EVI-Pro 3.**

Task 4.0 Hydrogen Refueling Station (HRS) Network Progress Reports

The Contractor shall assist the Energy Commission in assessing hydrogen station deployment status by organizing project level data and assessing installation and approval processes. This task will complement the separate but related network assessment conducted by Energy Commission staff. Results from the deployment status may be used to inform AB 8 reporting activities.

The Contractor shall:

- Coordinate with Energy Commission staff, and build upon the annual Energy Commission's AB 8 report (AB 8 report) on hydrogen infrastructure, to be prepared in response to the requirements stated in Assembly Bill 8.
- Report on progress toward establishing a hydrogen refueling network that provides the coverage and capacity to refuel vehicles requiring hydrogen fuel that are being placed into operation in the state.
- Determine the remaining cost and timing to establish a network of 100 publicly available hydrogen refueling stations and whether funding from the Alternative and Renewable Fuel and Vehicle Technology Program remains necessary to achieve this goal.

The contribution of this report to AB8 requirements shall compliment the contents of the annual June report to be prepared by ARB. The contractor shall coordinate with Energy Commission and ARB staff to ensure complimentary pairing of the two reports. Specifically, it is anticipated that the ARB report will contain material in response to AB8 requirements for that report, as stated in Cal. Health & Safety Code sect. 43018.9(c) and (d).

The following interpretations will serve as guidance to the Subcontractor in contributing to the AB 8 Report:

- Overlapping topics between the two reports include:
 - a. ***The number of hydrogen vehicles expected to be deployed.*** The AB 8 report will project deployment rates and trends beyond the estimates for the "next three years" provided in the June report. These trends may be based upon plans and projections provided by multiple sources, and over longer time horizons.
 - b. ***Number of stations and coverage.*** The AB 8 report will examine need for stations and coverage beyond the ARB review for "the subsequent three years", and will not address detailed issues such as operating standards, number of dispensers, filling protocols, and pressures. The report will examine station numbers and coverage out to or beyond the 100 station milestone.

Topics that do not overlap:

- a. **Progress and deployment rates.** The December report will review progress and measure rates of deployment of vehicles, as well as lengths of time required to permit and construct stations.
- b. **Remaining cost and timing.** Establishing metrics on progress and deployment rates will allow for a more accurate projection of future costs and timing associated with meeting the 100 station milestone. The basis for future cost estimates will incorporate recent cost modeling from the suite of hydrogen analysis models (H2A), including the recent U.S. DOE's Hydrogen Refueling Stations Analysis Models (HRSAM) from Argonne National Laboratory (with updated cost estimates completed in early 2015), learning rates and experience curves identified through the Contractor's Hydrogen Station Cost Calculator (HSCC), as well as cost data on actual station deployments reported through the Composite Data Products (CDP) developed for the U.S. DOE's Technology Validation program and administered through the Contractor's National Fuel Cell Technology Validation Center (including data from stations funded by the Energy Commission). Finally, financial metrics associated with program funding, private sector investment trends, and possible finance strategies will be evaluated using the Hydrogen Finance Analysis Scenario Tool (H2FAST). The metrics for progress and remaining costs will therefore leverage the Contractor's ongoing work, relying upon a combination of data from existing station costs, short-term cost estimation modeling methods, financial analyses, and learning rates associated with (national and/or global) hydrogen station deployment progress.

Task 4 Deliverables

- Three Draft Hydrogen Refueling Station (HRS) Network Progress reports (October 31, 2016, September 1, 2017, 2018). The Contractor shall revise draft reports in response to Energy Commission's comments.
- Final reports to be completed one month after receiving Energy Commission review comments on the draft reports.

Task 5.0 Program Analysis Support

The goal of this task is to analyze ARFVTP program and project-level data and assess progress toward achieving the policy goals guiding the ARFVTP. The scope of this analysis and evaluation will become broader over time as additional information is collected on projects funded to date and as analysis capabilities specific to ARFVTP expand. The range of evaluation metrics or topics is potentially as broad as sustainability criteria in general (climate change impacts, petroleum consumption, job creation, energy security, criteria air emissions, water impacts, land use, agriculture impacts, etc.), as well as market transformation, short-term market forecasting and long-term scenario analysis. In general, the scope of these evaluation activities will be limited to empirical data collected on the various projects or relevant studies. In Phase II, the analytic framework underlying the Market Transformation benefits within the Benefits Reports (Task 5.1) will be more fully developed by relying upon a more comprehensive market impact framework (Task 5.2). Results from this framework will feed back into the Benefits Reports (Task 5.1), as well as contribute to a library of future scenario outcomes to explore a range of ARFVTP strategies, priorities, and market support mechanisms.¹⁰ NREL will competitively select subcontractors for any program analysis support subcontracts utilizing a process requiring at least three bids or proposals.

5.1 Benefits Analysis

The goal of this task is to analyze ARFVT Program data to gauge progress toward ARFVT Program **and larger** state goals, relying upon a range of benefits metrics.

The Contractor shall:

- Develop benefit estimates for both Expected and Market Transformation Benefits, relying upon and expanding the benefits analysis framework established in the Phase I CEC-NREL contract. Expected Benefits are benefits directly associated with vehicles and fuels deployed through projects receiving ARFVTP funds. These include, but are not limited to, reductions in petroleum fuel use, criteria and particulate emissions, and GHG emissions, and public health benefits. Market Transformation Benefits are benefits which accrue due to the influence of ARFVTP projects on future market conditions to accelerate the adoption of new technologies. These include increased availability of public electric vehicle supply equipment and hydrogen refueling stations, consumer incentives for zero-emission vehicles (ZEVs), investments in zero-emission vehicle demonstrations and manufacturing facilities, and deployment of next-generation fuel production facilities and advanced medium- and heavy-duty vehicle demonstrations.

¹⁰ <http://www.energy.ca.gov/2014publications/CEC-600-2014-005/CEC-600-2014-005-D.pdf>

- Assess Expected Benefit estimates, by developing a more comprehensive and integrated set of benefit metrics to address program requirements, based on advisory committee members and other expert stakeholder recommendations. This will ensure consistency in how metrics are evaluated across projects and fuel/vehicle categories. For example, the Contractor shall perform time series analysis by drawing from the same electricity grid projections for California and other regions, relying upon the Contractor’s grid modeling capabilities, existing published studies, and baseline suggestions from state agencies. Similarly, the GREET model LCA framework (national, or California GREET) and inputs will be relied upon for fuel carbon intensities. This will involve the following:
 - Metrics framework will exceed anticipated reporting requirements for AB 8 (e.g., will include a broader range of metrics).
 - Compilation of existing publicly-available data, not collected by the Contractor from individuals, related to analysis of social equity issues, including income, race, and age.
 - Publicly-available health impact data from EPA, including criteria emission impacts at the county level and any underlying aggregated data on vehicle operation or usage patterns.
 - Social cost of carbon estimates and guidance on appropriate use for analysis.
 - Social and environmental benefits associated with petroleum use reductions.
 - Jobs and economic benefits associated with ARFVTP projects, market impacts, and fuel savings.
 - Water resource use and impacts data.
- Assess Market Transformation Benefits. The analytic capabilities supporting market transformation benefit estimates in Phase I will continue to be improved upon by leveraging existing NREL transportation analysis models to estimate the market impacts of ARFVTP activities within the context of California’s unique transportation sector policy environment. Improvements to this framework in Phase II will link market influence estimates to a select number of state policies to provide more robust and realistic estimates of the market impacts from ARFVTP activities. The feedback between the two estimation methods (Expected and Market Transformation) will ensure consistency and allow for greater flexibility in assessing market influences and resulting benefits associated with ARFVTP activities. The IMIA will incorporate **and report on** the influence of the following key state and federal policies:
 - Influence of Corporate Average Fuel Economy (CAFÉ), including GHG factors, on national light duty vehicles (LDV) markets
 - Influence of the Zero Emission Vehicles (ZEV) mandate on California vehicle markets
 - Influence of the Low Carbon Fuel Standard (LCFS) on fuel prices **and supply.**
 - Influence of the Clean Vehicle Rebate Program (CVRP) on consumer choices
 - **Influence of the Innovative Clean Transit Regulation and**
 - **Advanced Clean Trucks Regulation**

- Influence of Renewable Portfolio Standards (RPS) on California grid carbon intensity
- Prepare and submit annual draft and final *ARFVTP Program Benefits Reports*, building upon the previous Benefits Report methodology and summarizing the analysis and evaluation results of projects funded to date. This report shall:
 - Synthesize information from the analysis results for project performance and relevant Market Assessment data from Task 2.0.
 - Assess ARFVT Program progress toward the 2020~~30~~**30** goals and beyond.
 - **These include, but are not limited to, measuring progress toward a goal of five million ZEVs on the roads by 2030, and the goal of a carbon neutral economy by 2045.**
- As directed by the CAM, draw from available ARFVTP data to analyze program and project-level performance on the basis of petroleum displacement, GHG reductions, project cost efficiency, job creation, **equity, economic development, or** other key metrics deemed appropriate by the CAM.
- **Provide a retrospective analysis on past program successes where public funding is no longer necessary.**
- **Provide a forward looking analysis of how ARFVTP funding will support the long-term growth of charging infrastructure and hydrogen refueling infrastructure.**

5.2 Scenario Development and Options Analysis

This task will provide the Energy Commission with a scenario development capability to explore a wide range of possible futures, and the resulting market impact outcomes from a range of program options, such as sensitivities around different portfolio funding distributions, strategic investment decisions, and specific market support mechanisms. The resulting analysis by the Energy Commission will assist in the development of more robust program strategies, accounting for market and technology variability and uncertainties, contributing to long-term strategic planning activities and adaptive management responses to external factors to improve the likelihood of meeting program goals.

The Contractor shall:

- Leverage the NREL market assessment models used in Task 5.1 to explore and evaluate the long-term Market Transformation Benefits and a range of theoretical future ARFVTP funding strategies, portfolio distributions, and market support mechanisms. Multiple transportation analysis sub-models will be relied upon using the same Integrated Market Impact Assessment (IMIA), developed in contract 600-11-002, modeling environment used in Task 5.1.
- Tailor modeling to long-term and California-specific market and policy conditions, allowing for more extensive integrated assessments across technology types (biofuels, electric-drive, fuel cell vehicles, and conventional fossil fuel and hybrid

vehicle drivetrains), and energy sectors (electric grid and transportation vehicle-fuel sectors).

Incorporate in the IMIA framework a broad range of data sources, optimized across a wide range of specified metrics and future scenario trends, including total program benefits given priorities or weightings on different assessment criteria (to be provided by the CAM).

- Submit wrapped spreadsheets to the CAM for review and comments.
- Review updates to ARFVTP project data base and benefit estimates (Task 5.1), California transportation market and technology trend performance updates (Task 2.0), and any relevant forecasting mechanisms from the Energy Commission. These will serve as inputs to the IMIA framework, ensuring that ongoing scenario and options analyses are based upon the most recently available technology trends and market data.

Tailor the IMIA model in Task 5.2 to California market conditions and policy environment. The model will address the particular questions related to the ARFVTP (listed below). This information will extend to 2035, and to 2050 where practical, and shall include the following types of information and market influences:

- Evaluation of substitution preferences by vehicle attribute
- Evaluation and projection of alternative fuel costs
- Evaluation of influence of various policies on market dynamics, including:
 - Influence of the ZEV mandate on vehicle markets
 - Influence of the LCFS on fuel prices
 - Influence of the CVRP on consumer choices
 - Influence of RPS on grid carbon intensity
 - Influence of long-term feedstock procurement and offtake contracts on business models for biorefineries
- Answer the key research question, “*Given specified Program Goals, Options, and Constraints, which Option Portfolios achieve the best Metric Outcomes across a set of Possible Futures?*”

Task 5.2.1 Quantifying the Value of Public Charging

Contractor Shall:

By working with Energy Commission staff and academic institutions, and organizations working to support the state’s goals for widespread transportation electrification that is accessible to all, the Contractor shall:

- **Quantify the tangible value of public charging for individuals without access to residential charging.**
 - **Identify important and relevant characteristics of individuals that may require charging but may not have access to residential charging.**
 - **Use survey data and analysis related to residential charging access to**

- inform current and future access to residential charging and how this impacts the tangible value of public charging.
 - Define and evaluate the tangible values and costs, including accessibility, associated with public charging.
 - Build upon existing framework and develop methodology to quantify and assign values to public charging for individuals defined as not able to access residential charging.
 - Quantify the value of different types of charging equipment.
 - Define different types of charging equipment and identify varying usage of plug-in hybrid and battery electric vehicles.
 - Develop methodology to quantify and assign values to the different types of charging equipment.

Task 5 Deliverables:

- **Three Two** draft *Market Impact Reports* for 2018, 2019 **and 2021**, including recommendations for revised Transportation Energy Office Forecasting Model run methodologies, assessment of ARFVTP progress toward stated 2020 and beyond goals of petroleum use and GHG reductions, and recommendations for ARFVTP redirection as needed to meet goals.

These reports will have the following scope: Develop a strategic framework for understanding how ARFVTP funding might best be allocated across the technology development, demonstration and incremental cost offset (or “buy down”) phase of commercialization for each primary alternative vehicle technology platform. This will help alleviate barriers to market acceptance and achieve commercialization and widespread deployment (especially natural gas trucks, electric trucks, and light duty electric vehicles). The strategic framework shall consider early market adopters and “second wave” or more general retail and commercial market adopters, and conclude with an assessment of when the purchase subsidy would no longer be needed.

- Training session on Scenario Development and Options Analysis capabilities, for Energy Commission staff and other stakeholders (e.g., ARFVTP Advisory Committee Members, external reviewers, ARFVTP analysis collaborators, etc.).
- **Three Two** draft and final *Market Impact Reports* (2018, 2019, **and 2021**), completed three months after receiving Energy Commission comments on the draft reports
- Wrapped spreadsheets
- **Four Three** draft annual Program Benefits Draft Reports (2017, 2018, 2019**and 2021**) and **four** revised Draft Reports in response to Energy Commission comments
- **Four Three** final annual Program Benefits Final Reports (2017, 2018, 2019 **and 2021**)
- **Monthly progress reports on quantifying the tangible value of public charging for individuals without access to residential charging in the form of a presentation or written report (no longer than 5 pages) delivered at least on a**

quarterly basis.

- Draft and final Report on quantifying the tangible value of public charging for individuals without access to residential charging.
- Database of inputs, methodologies, and results quantifying the tangible value of public charging and different types of charging equipment.

Task 6.0 Program Review Meetings (PRM)

The goal of this task is to provide a venue for reviewing projects supported by ARFVTP and networking among project participants and sustainable transportation stakeholders. This venue will provide for review of progress on key projects supported through the ARFVTP, collect feedback from expert reviewers on the merits of individual projects, and facilitate general collaboration among technology and policy experts engaged in sustainable transportation efforts within California.

6.1 PRM planning, execution and reporting

The goals of the Program Review meetings are the following:

- Provide a venue for open discussion and collaboration among stakeholders engaged in projects supported through the ARFVTP
- Collect expert review comments on the merits of key projects
- Provide updates on planning activities and project execution at regional and municipal jurisdictions (e.g., ZEV Action Plan)
- Review issues related to the influence and interactions among state and federal policies contributing to sustainable transportation in California

The Contractor shall:

- Consult with the CAM to jointly determine which key activities will be included in PRM. These activities may include but are not limited to project review sessions, parallel sessions by area (e.g., Electric Drive, Natural Gas, Biofuels, Hydrogen), project poster sessions, and expert panel discussions.
- The topics covered in PRMs may include, but are not limited to Lessons Learned, Technology State-of-the-Art, State Policy Interactions, Issues, Alignment, and Progress. The panel experts will be jointly selected by the Contractor and the CAM.
- Manage and oversee a subcontractor to host PRM.
- Administer the review process and generate PRM reports.
- Coordinate a planning committee consisting of technical and policy advisors to assist in planning of each PRM. This committee will provide technical and planning guidance to the events planning subcontractor in the execution of each meeting, in coordination with the CAM.
- Administer and coordinate two PRM and proceedings reports. **6.2 Technical evaluation of projects**

A select number of showcase projects will be evaluated for their technical merits, in coordination with Energy Commission staff, with results to be included in the APRM reports.

Contractor shall:

- Schedule for an PRM, an example of which is shown in Appendix A
- Completion of two Program Review Meetings

Task 6 Deliverables:

- Two annual draft and final reports on results of each of the two meetings cover subjects discussed at meetings, such as lessons learned, state-of-the-art technology, state policy interactions, issues, alignment, and progress of alternative fuel vehicles and technologies

Task 7.0 Technical Evaluation of Project Proposals

The goal of this task is to assist the Energy Commission in evaluating the engineering, and technical, and/or financial merits of hydrogen alternative fuel infrastructure proposals and other proposals submitted for possible funding under the ARFVTP. The evaluation will cover, but is not limited to, market penetration scenarios, potential volumes of fuel used, petroleum displacement, GHG and air and water pollutant emission reductions, and the likely timing of these results (see Task 4.0).

The Contractor shall:

- Review and provide technical assistance (cf. scoring) on ARFVTP project proposals with potential consideration of their technical, market, economic, and financial feasibility.

Task 7 Deliverables

- Final Consultant Report for each proposal reviewed

Task 8.0 Real-Time Data Collection for Alternative Refueling Stations

The goal of this task is to enable an increased frequency of automated real-time data collection and repository of alternative fueling stations in California. NREL will establish new parameters and data points to assess infrastructure usage. The data collected will be shared with the Energy Commission and analysis support will be provided by designated staff at NREL using established protocol. Energy Commission will use the data at a future time for review and analysis of past investments in infrastructure development; and program development for future funding opportunities in California.

The Contractor Shall:

- Aggregate data from networked EVCSs and EVSEs from various EV charging network vendors in California
- Aggregate data from vendors operating hydrogen fueling stations in California
- Negotiate frequency for data updates with the vendors
- Collaborate and develop strategies for data collection techniques with Energy Commission staff
- Coordinate monthly meetings (and as needed) to provide monthly task updates and status (by phone, email, or WebEx) with Energy Commission staff

Task 8 Deliverables:

- Contractor shall provide Energy Commission staff draft and final documentation for data collection, secure storage, and joint analysis protocol
- Contractor shall develop a draft and final guide to data handling routine and analysis protocol, which can be executed by Energy Commission staff for data analysis
- Contractor shall provide Energy Commission staff annual reports on activity summarizing project accomplishments, benefits, and impacts

Task 9.0 Historical Station Data

The goal of this task is to evaluate NREL's historical data on electric vehicle chargers. Energy Commission staff will use the information to conduct predictive modeling of both cumulative and net electric vehicle charger installations. Based on the net number of existing chargers in the Alternative Fuels Data Center database and other sources of information, Energy Commission staff will be able to estimate growth and reductions in California's electric vehicle charger population over time.

The Contractor Shall:

- Analyze all available historical charging station data.
 - Site addresses
 - Installation and removal dates (actual or estimated to month and year) for each charger type/level at each identified site
 - Any information available on the chargers, such as type of access (public, private, or combination by time of day), number of connectors, network, types of payment(s) accepted, etc.
- Evaluate the data,
 - Work with California Energy Commission staff to develop electric vehicle charger groupings by, at a minimum, power level and connector type. Examples of charger types would include legacy Avcon connector chargers, legacy inductive paddle chargers, legacy AC fast chargers, first generation Level 2 J1772, second generation Level 2 J1772, first generation DC fast chargers, etc.
 - Group data to provide information on how electric vehicle and charger technology changes and advancements have

impacted charger installations, population growth and decline, and attrition and probable cause(s).

- Evaluate, identify, and define attrition due to factors such as age, over use, lack of maintenance, or loss of usefulness due to advancements in vehicle technology.
 - Evaluate removals due to events such as safety issues or vandalism should be identified.
- Digitize data collected under this task,
 - Maintain information on both installations and removals of chargers for 2019 and going forward.
 - Provide information to develop predictive models on charger population losses due to attrition or more abrupt occurrences.

Task 9 Deliverables:

- Contractor shall provide a summary to Energy Commission staff on available data sets and data condition, as well as descriptions of data that are unavailable.
- Contractor shall provide Energy Commission staff draft and final documentation for data collection and analysis protocol.
- Contractor shall develop a draft and final guide to data handling routine and analysis protocol, which can be executed by Energy Commission staff for data analysis.

Task 10.0 High Power Charging for Commercial Vehicles (HPCCV)

The goal of this task is to perform proof-of-concept evaluations of charging systems to support high power charging of commercial vehicles that goes beyond currently available commercial charging systems. The primary objective of the work outlined below is to enable proof-of-concept evaluation of charging connections with multiple manufacturers, in coordination with the Charging Interface Initiative's (CharIN) HPCCV taskforce, a non-profit association promoting global adaptation of a standardized battery charging system. NREL will host an "Evaluation Event" for manufacturers that wish to take part in an evaluation of charging connections. The event will first focus on qualitative evaluation of fit and ergonomics between component suppliers. The Evaluation Event will also document preliminary functional evaluations to measure the current carrying capabilities of the connectors. At a subsequent event ("Second Event"), NREL will perform further functional evaluations to analyze vehicle-to-charging equipment interoperability and integrated charging system component operations, including under different grid, ambient, or environmental conditions. The scope of this task is limited to proof-of-concept evaluations and is not a full verification of the technologies.

Task 10.1 – Evaluation Event

The goal of this task is for NREL to prepare for, conduct, and prepare summaries of findings from the Evaluation Event, based on input from the Energy Commission, participant manufacturers, and members of the CharIN HPCCV taskforce on the Evaluation Event schedule and activities. At the Evaluation Event, NREL will conduct evaluations and experiments on participant manufacturers' hardware, and will prepare summaries of the results. After the event, NREL will prepare individualized, proprietary evaluation reports for participant manufacturers, as well as summary reports for broader dissemination.

The Contractor shall:

- Organize Evaluation Event meeting agenda and schedule.
- Schedule conference rooms, laboratory space, and other facility requirements to host the Evaluation Event.
- Conduct individual meetings prior to Evaluation Event with participant manufacturers to confirm NREL's experimental setup, the setup of participant-supplied hardware, and any material or fluid safety data to meet NREL's Environment, Safety, Health, and Quality requirements for experimental setup.
- Support bailment, non-disclosure, and other agreements for participants' hardware to be evaluated at the Evaluation Event.
- Host the Evaluation Event.
- Prepare and conduct fit and ergonomic evaluations of participant manufacturers' connector and inlet systems.
- Prepare and conduct functional evaluations of the thermal performance of participant manufacturers' connector and inlet systems.
- Prepare individualized, proprietary evaluation reports of functional evaluations for each participant manufacturer.
- Prepare non-proprietary summary report on fit and ergonomic evaluations.
- Prepare non-proprietary summary report on functional evaluations.
- Disseminate non-proprietary summary report on functional evaluations, and respond to questions the report.
- Except as indicated in this bullet, the Energy Commission will not have access to or possession or control of any information the participant manufacturers consider proprietary. This bullet takes priority over all other Agreement provisions, even the terms and conditions, that would otherwise allow the CEC such rights to it. The purpose of this restriction is to ensure such information is not accessible through a Public Records Act request or other means in order to ensure confidentiality for manufacturer participants. The Recipient shall prepare and submit a confidential product report containing only relevant "Proprietary Information" from its fit and ergonomic evaluations, its functional evaluations, and responses to any questions about them. For purposes of this bullet, the term "Proprietary Information" means any information exempt from public disclosure under the California Public Records Act (Government Code section 6250 et seq.) or otherwise. This includes, but is not limited to, information that falls within the following:
 1. California Government Code sections 6254(k), 6254.7(d), and 6254.15; and
 2. California Evidence Code section 1060.

It is important that Recipients confidential product only contain Proprietary Information and not be mixed with non-proprietary information to prevent the CEC from having to redact Proprietary Information to disclose non-proprietary information in the same document.

Deliverables:

- Agenda and Schedule for Evaluation Event
- List of participant manufacturers planning to attend the Evaluation Event
- Documentation of Evaluation Event's occurrence
- Non-proprietary summary report on fit and ergonomic evaluations
- Non-proprietary summary report on functional evaluations
- Documentation of dissemination of individualized, proprietary evaluation reports of functional evaluations for each participant manufacturer
- Documentation of dissemination of summary report on functional evaluations
- Confidential Report with relevant Proprietary Information

Task 10.2 – Second Event

The goal of this task is for NREL to prepare for and conduct a second event, building on the results of the Evaluation Event, based on input from the Energy Commission, participant manufacturers, and members of the CharIN HPCCV taskforce on the Evaluation Event schedule and activities.

The Contractor shall:

- Develop event activities and assessment protocols for the Second Event, with input from participant manufacturers, members of the CharIN HPCCV taskforce, and the Energy Commission. The activities may include, but are not limited to:
 - Verification of vehicle-to-charging equipment communication
 - Investigation of integration and performance metrics operating under varying grid or environmental conditions
 - Fit and function evaluation of connector systems for operation under different ambient conditions
 - Measurement of connector-to-inlet ergonomic requirements, or other interface requirements
- Organize Second Event meeting agenda and schedule.
- Schedule conference rooms, laboratory space, and other facility requirements to host the Second Event.
- Support bailment, non-disclosure, and other agreements for participants' hardware to be evaluated at the Second Event.
- Provide engineering and research staff support to conduct the Second Event as defined by the event activities and assessment protocols.
- Host the Second Event.
- Prepare and disseminate summary report on activities and charging system assessments from the Second Event.

Deliverables:

- Agenda and Schedule for Second Event
- List of participant manufacturers planning to attend the Second Event
- Definition of Second Event activities and assessment protocols
- Documentation of Second Event's occurrence
- Summary report on activities and charging system assessments from the Second Event
- Documentation of dissemination of summary report on activities and charging system assessments from the Second Event

Task 11.0 Hydrogen Station Equipment Performance 2.0 (HyStEP) Device Final Design

The goal of this task is to design a specification ("Final Design") for a hydrogen refueling station tester to be used at hydrogen refueling stations in the field, designated as HyStEP 2.0.

The tasks include requesting non-proprietary input from industry stakeholders about the needed technical characteristics and performance of HyStEP 2.0 and collaborating with the CEC and CARB on the stakeholder input on the technical characteristics and performance. The Contractor shall develop, complete, and provide the Final Design for HyStEP 2.0.

CARB will incorporate the NREL Final Design to build HyStEP 2.0 in a competitive Request for Proposal (RFP) and select a builder from the competitive of bidders. Once HyStEP 2.0 is built, CARB will use it to validate the performance of hydrogen refueling stations in the field in California.

Since this work is highly technical and complex, iterative processes with CEC staff and CARB staff are necessary. NREL shall participate in these iterative processes to ensure that HyStEP 2.0, built under a contract between CARB and their subcontractor, incorporates the NREL Final Design.

TASK 11.1 – Convene Meetings to Obtain Stakeholder Input

The goal of this task is for NREL to convene meetings with stakeholders, including the CEC staff and the CARB staff, to request non-proprietary input from stakeholders about the technical characteristics, performance, and expectations of HyStEP 2.0.

NREL shall:

- **Convene and lead the discussion for up to 10 in-person or web-based stakeholder meetings about topics including the following:**
 - **The technical characteristics, performance and expectations of HyStEP 2.0,**
 - **The design and engineering of HyStEP 2.0,**
 - **The off-the-shelf equipment to be used in HyStEP 2.0 and to be reflected in the design of HyStEP 2.0,**

- How to use HyStEP 2.0 in the field at hydrogen refueling stations,
- How to conduct ANSI/CSA HGV 4.3 testing to validate SAE J2601 fueling protocols to meet the required state of charge (SOC) required in the CEC Grant Funding Opportunity (GFO) 19-602 and possibly other future CEC solicitations, and
- How the device will comply with related standards such as the electrical code, pressure vessel code, as appropriate and practicable, for commissioning.
- The location of two existing hydrogen refueling stations located in California where the HyStEP 2.0 device will be validated, in addition to the validation activity at NREL in Golden, Colorado.

Deliverables:

- Agenda for stakeholder meetings
- Presentation slides/notes from the stakeholder meetings
- List of participants in the stakeholder meeting

TASK 11.2 – Develop the Final Design for HyStEP 2.0

The goal of this task is to develop the Final Design for HyStEP 2.0 for CARB to incorporate in a competitive RFP.

NREL shall:

Develop a Final Design for a HyStEP 2.0 that at a minimum will:

- Vent and fuel the hydrogen storage tanks, simultaneously,
- Confirm that hydrogen refueling stations comply with the most recent version of SAE J2601,
- Be capable of testing back-to-back fueling capabilities (at least seven 4 kg H70-T40 fills),
- Be capable of testing hydrogen fuel cell electric vehicle tank sizes of 2-4 kg, 4-7 kg, 7 kg-10 kg, and greater than 10 kg, and
- Achieve accuracy and tolerances of tank and measurement devices that meet the public standards.

Deliverables:

- Documentation about the progress of the HyStEP 2.0 Final Design to be included in Quarter Progress Reports for the CEC

- **Final Design for the building of the HyStEP 2.0 which will include piping and instrumentation diagrams, electrical wiring diagram, mechanical drawings, operational state diagram, and an associated description of system function.**

TASK 11.3 – Validation that HyStEP 2.0 Meets the Final Design

The goal of this task is for NREL to validate that HyStEP 2.0 meets the Final Design. This task will be completed after a CARB Subcontractor builds HyStEP 2.0.

NREL shall:

- **Validate that the HyStEP 2.0 device meets the Final Design at NREL's hydrogen refueling station in Golden, Colorado and confirm HyStEP 2.0 is built according to the Final Design and meets the minimum requirements in Task 11.2.**
- **Validate that the HyStEP 2.0 device meets the Final Design at two hydrogen refueling stations located in California. The locations of the two hydrogen refueling stations in California will be determined in Task 11.1.**

Deliverables:

- **A HyStEP 2.0 Validation Test Report that summarizes the HyStEP 2.0 safety and functionality tests completed by NREL. The HyStEP 2.0 Validation Test Report shall be technically equivalent in content and scope to the HyStEP 1.0 Validation Test Report which includes checkout and device training, general instrument tests, communication capability tests, safety systems tests, dispenser communication tests, table-based fueling tests, leak tests, defueling tests, and purge tests.**
- **A written notification that NREL has validated HyStEP 2.0 and that NREL confirms the HyStEP 2.0 was built according to the Final Design and meets the minimum requirements in Task 11.2. TABLE 1: California Energy Commission Vehicle**

Classes

Numerical Class	Car Classes
1	Subcompact (1-6000 lbs)
2	Compact (1-6000 lbs)
3	Midsize (1-6000 lbs)
4	Large (1-6000 lbs)
5	Sport (1-6000 lbs)
6	Cross Utility - Small (1-6000 lbs) (See Note 1)
	Light Truck Classes
7	Cross Utility - Small (1-6000 lbs) (See Note 1)
8	Cross Utility - Midsize (1-6000 lbs)
9	Sports Utility - Compact (1-6000 lbs)
10	Sports Utility - Midsize (1-6000 lbs)
11	Sports Utility - Large (6001 - 8500 lbs)
11	Sports Utility - Heavy (8501 - 10000 lbs)
12	Van - Compact (1-6000 lbs)
13A	Van - Large (6001-8500 lbs)
13B	Van - Heavy (8501-10000 lbs)
14	Pickup - Compact (1-6000 lbs)
15A	Pickup - Standard (6001-8500 lbs)
15B	Pickup - Heavy (8501-10000 lbs)

NOTE: Cross Utility - Small is bifurcated into "Car" and "Truck" due to CAFÉ differences. Manufacturers vary in their designation of "car" vs. "truck" for cross-utility vehicles to suit their particular CAFÉ needs. CAFÉ regulations apparently provide this latitude based on particular characteristics of the vehicle's floor slant.

TABLE 2: Vehicle Engine / Powertrain Technologies

TYPE
Gasoline
Gasoline Electric Hybrids
Diesel
Diesel Electric Hybrids
Plug-in Electric Gasoline Hybrids
Flexible Fuel (fueled by E85)
Compressed Natural Gas (CNG)
CNG Hybrid
Battery Electric Vehicles
Fuel Cell Vehicles

**Exhibit A, Attachment A-1
Example Schedule for Program Review Meeting (PRM)**

Day One	Time	Room A	Room B	Room C	Atrium/Lobby
Introductory Presentations and Keynote	9:00-10:00 AM	Plenary			
Project Review Session I	10:00-11:30 AM		Biofuels	PEVs / EVCS	
Project Poster Session I	10:00-11:30 AM				NGVs/ H2-FCEVs
Ride-and-Drive / Break	11:30- 12:00 PM				
Lunch Break	12:00- 1:00 PM				
Project Review Session II	1:00-2:30 PM		NGVs	H2 & FCEVs	
Project Poster Session II	1:00-2:30 PM				Biofuels PEVs/EVCS
<i>Networking Break</i>	<i>2:30-3:00 PM</i>				
Expert Panel A	3:00-4:30 PM		Lessons Learned	Tech State-of-Art	
Comments/Presentation	4:30-5:00 PM	Plenary			

Day Two	Time	Room A	Room B	Room C	Atrium/Lobby
Project Review Session III	8:30-10:00 AM		Biofuels	PEVs / EVCS	
Project Poster Session III	8:30-10:00 AM				NGVs/ H2-FCEVs
<i>Networking Break</i>	<i>10:00-10:30 AM</i>				
Project Review Session IV	10:30-12:00 PM		NGVs	H2 & FCEVs	
Project Poster Session IV	10:30-12:00 PM				Biofuels PEVs/EVCS
Lunch Break	12:00- 1:00 PM				
Expert Panel B: Non-CA Policy	1:00-2:30 PM		Other States	International / Federal	
Project Poster Session V	1:00-2:30 PM				All Remaining
<i>Networking Break</i>	<i>2:30-3:00 PM</i>				

Day Two	Time	Room A	Room B	Room C	Atrium/Lobby
Expert Panel C: Program Reviews (non-ARFVTP)	3:00- 4:30 PM		AQIP, ZEV Mandate, etc.	RPS, etc.	
Closing Remarks	4:30-5:00 PM	Plenary			

STATE OF CALIFORNIA

**STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION**

RESOLUTION - RE: DOE-NATIONAL RENEWABLE ENERGY LABORATORY

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 Amendment 5 to contract Agreement 600-15-001 with the U.S. Department of Energy's National Renewable Energy Laboratory. Amendment 5 would include the following: providing light-duty vehicle attribute forecasts and hydrogen price forecasts for use in the 2021 Integrated Energy Policy Report; further developing, refining, and expanding EV infrastructure projections; supporting the assessment of benefits from the Clean Transportation Program; and designing a specification for a hydrogen refueling station tester. The amendment would augment the budget by \$1.47 million and extend the term to December 31, 2023; 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 October 14, 2020.

AYE:

NAY:

ABSENT:

ABSTAIN:

Cody Goldthrite
Secretariat