

**CONTRACT REQUEST FORM (CRF)**

CEC-94 (Revised 5/11)

CALIFORNIA ENERGY COMMISSION


 New Contract 600-11-002     Amendment to Existing Contract:     -    -        Amendment Number:     

Division	Contract Manager:	MS-	Phone	CM Training Date
600 Fuels and Transportation Division	Andre Freeman	27	916-654-4162	12/4/08

Contractor's Legal Name	Federal ID Number
National Renewable Energy Laboratory (NREL)	26-1939342

Title of Project
Cooperative Research and Development Agreement

Term	Start Date	End Date	Amount
New/Original Contract	4 / 13 / 12	3 / 29 / 16	\$ 2,152,273

Line up the Amendment information as best as possible in the following boxes

Amendment #	End Date (mm/dd/yy)	Amount

### Business Meeting Information

Proposed Business Meeting Date	4/11/12	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Andre Freeman	Time Needed:	10 minutes

### Agenda Item Subject and Description

Possible approval of a Cooperative Research and Development Agreement with the National Renewable Energy Laboratory (NREL) to assist in the planning, implementation and evaluation of the Alternative and Renewable Fuel and Vehicle Technology Program (Program). Expert analysis of Program investments and how effective they are in addressing economic, environmental, energy security and petroleum reduction goals will be provided.

**Business Meeting approval is not required for the following types of contracts:** *Executive Director's signature is required in all cases.*

- Contracts less than \$10k (*Policy Committee's signature is also required*)
- Amendment for a no-cost time extension. Must be first extension, less than one year and original contract less than \$100k.
- Contracts less than \$25k for Expert Witness in Energy Facility licensing cases and amendments.

### Purpose of Contract or Purpose of Amendment, if applicable

Under this Contract, NREL will provide technological, environmental and commercialization assessments of the alternative and renewable fuels, vehicle technologies and supportive fueling infrastructures currently in existence and under development. A summary of the most innovative, promising and emergent clean transportation technologies in California is sought as well as strategies for reaching out to clean transportation venture capitalists, sophisticated angel investors, corporate investors and other strategic partners.

Also included are activities related to electric vehicle infrastructure planning, assessing the current status of woody biomass conversion technologies, providing assessments of current and emerging biomethane systems, infrastructure compatible (drop-in) biofuels and the potential of renewable biogas production in California.

NREL technical evaluations of Program project proposals will assist in determining the engineering, economic and financial feasibilities of proposed projects, leading to successfully reaching Energy Commission energy security and petroleum reduction goals. Strategies are sought for strengthening the due-diligence necessary to ensure that grant recipients have the financial and technical ability to perform as declared, and deliver the desired benefits without duplication, fraud, waste and abuse.

Finally, this statement of work will result in an analysis of and recommendations for the current planning, implementation and evaluation methodologies of the Program and the metrics needed to track progress as the legislation approaches its date of renewal in 2016.



**California Environmental Quality Act (CEQA) Compliance**

1. Is Contract considered a "Project" under CEQA?  
 Yes: skip to question 2       No: complete the following (PRC 21065 and 14 CCR 15378):  
 Explain why contract is not considered a "Project":  
 Contract will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because the contract involves an assessment of current activities under the ARFVTP and the outcome of the contract is to report recommendations for its' continuing implementation.

2. If contract is considered a "Project" under CEQA:  
 a) Contract **IS** exempt. (Draft NOE required)  
 Statutory Exemption. List PRC and/or CCR section number: \_\_\_\_\_  
 Categorical Exemption. List CCR section number: \_\_\_\_\_  
 Common Sense Exemption. 14 CCR 15061 (b) (3)  
 Explain reason why contract is exempt under the above section: \_\_\_\_\_

b) Contract **IS NOT** exempt. The Contract Manager needs to consult with the Energy Commission attorney assigned to their division and the Siting Office regarding a possible Initial Study.

Budgets Information								
Contract Amount Funded		Breakdown by FY			Funding Sources			
Funding Source	Amount	FY	Amount	Approved ?	Funding Source	FY	Budget List No.	Amount
ARFVTF	\$2,152,273	10-11	\$1,092,271	Yes	ARFVTF	10-11	600.118	\$1,092,271
ECAA	\$	11-12	\$1,060,002	Yes	ARFVTF	11-12	600.118A	\$1,060,002
State- ERPA	\$		\$	No	Funding Source			\$
Federal	\$		\$	No	Funding Source			\$
PIER - E	\$		\$	No	Funding Source			\$
PIER - NG	\$		\$	No	Funding Source			\$
Reimbursement	\$		\$	No	Funding Source			\$
RRTF	\$		\$	No	Funding Source			\$
Other:	\$		\$	No	Other:			\$
TOTAL: \$2,152,273		TOTAL: \$2,152,273			TOTAL: \$2,152,273			
Reimbursement					Federal Agreement #:			

Contractor's Administrator/ Officer		Contractor's Project Manager	
Name:	Marc W. Melaina, PhD	Name:	Marc W. Melaina, PhD
Address:	National Renewable Energy Laboratory 1617 Cole Blvd.	Address:	National Renewable Energy Laboratory 1617 Cole Blvd,
City, State, Zip:	Golden, CO 80401-3305	City, State, Zip:	Golden, CO 80401-3305
Phone/ Fax:	303/275-3836	Phone/ Fax:	303/275-3836
E-Mail:	Marc.Melaina@nrel.gov	E-Mail:	Marc.Melaina@nrel.gov

**Contractor Is**

Private Company (including non-profits)  
 CA State Agency (including UC and CSU)  
 Government Entity (i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)

**Selection Process Used**

Solicitation    Select Type    Solicitation #: \_\_\_\_\_ - - \_\_\_\_\_    # of Bids: \_\_\_\_\_    Low Bid?     No     Yes  
 Non Competitive Bid (Attach CEC 96)  
 Exempt    Other Governmental Entity



**Civil Service Considerations**

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

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

The Services Contracted:

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

The Services are of such an:

- urgent
- temporary, or
- occasional nature

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

**Justification:**  
 All aspects of the tasks that could have been completed using current civil service workers have been assigned to same. Other aspects require the technical expertise provided by NREL.

**Payment Method**

A. Reimbursement in arrears based on:

- Itemized Monthly       Itemized Quarterly       Flat Rate       One-time

B. Advanced Payment

C. Other, explain:

**Retention**

1. Is contract subject to retention?       No       Yes

If Yes, Do you plan to release retention prior to contract termination?       No       Yes

**Justification of Rates**

Based upon Department of Energy (DOE) MOU

**Disabled Veteran Business Enterprise Program (DVBE)**

1.  Not Applicable

2.  Meets DVBE Requirements      DVBE Amount:\$ \_\_\_\_\_ DVBE %: \_\_\_\_\_

- Contractor is Certified DVBE
- Contractor is Subcontracting with a DVBE: \_\_\_\_\_

3.  Contractor selected through CMAS or MSA with no DVBE participation.

4.  Requesting DVBE Exemption (attach CEC 95)

**Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE?**       No       Yes

If yes, check appropriate box:       SB       MB       DVBE

**Is Contractor subcontracting any services?**       No       Yes

If yes, give company name and identify if they are a Small Business (SB), Micro Business (MB) and/or DVBE:

MorEvents	<input checked="" type="checkbox"/> No	<input type="checkbox"/> SB	<input type="checkbox"/> MB	<input type="checkbox"/> DVBE
	<input type="checkbox"/> No	<input type="checkbox"/> SB	<input type="checkbox"/> MB	<input type="checkbox"/> DVBE
	<input type="checkbox"/> No	<input type="checkbox"/> SB	<input type="checkbox"/> MB	<input type="checkbox"/> DVBE

**Miscellaneous Contract Information**

1. Will there be Work Authorizations?       No       Yes

2. Is the Contractor providing confidential information?       No       Yes

3. Is the contractor going to purchase equipment?       No       Yes

4. Check frequency of progress reports

- Monthly       Quarterly       \_\_\_\_\_

5. Will a final report be required?       No       Yes

6. Is the contract, with amendments, longer than a year? If yes, why?       No       Yes

The contract term is the time required for contractor to research, assess, analyze and report on the ARFVTP

# CONTRACT REQUEST FORM (CRF)



The following items should be attached to this CRF			
1. Scope of Work, Attach as Exhibit A.	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
2. Budget Detail, Attach as Exhibit B.	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
3. CEC 96, NCB Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached	
4. CEC 30, Survey of Prior Work	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached	
5. CEC 95, DVBE Exemption Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached	
6. Draft CEQA Notice of Exemption (NOE)	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached	
7. Resumes	<input type="checkbox"/> N/A	<input type="checkbox"/> Attached	
8. CEC 105, Questionnaire for Identifying Conflicts		<input checked="" type="checkbox"/> Attached	
9. CEC 106, IT Component Reporting Form		<input checked="" type="checkbox"/> Attached	

\_\_\_\_\_  
 Contract Manager                      Date                      Office Manager                      Date                      Deputy Director                      Date

The following signatures are only required when contract approval is delegated to the Executive Office and not approved at a Business Meeting. See Business Meeting Information Section.

\_\_\_\_\_  
 Presiding Policy Committee                      Date                      Associate Policy Committee                      Date                      Executive Director                      Date

## Statement of Work

### Background

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) 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.” Alternative and renewable transportation fuels include electricity, natural gas, biomethane, propane, hydrogen, ethanol, renewable diesel, and biodiesel fuels. State investments are filling the gap to fund the differential cost of these emerging fuels and vehicle technologies.

### Project Goals and Objectives

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 and associated efforts. Commissioners are seeking expert analysis about ARFVTP investments and how effective they are in addressing economic, environmental, energy security and petroleum reduction goals. How much investment is needed to bring the alternative fuel vehicle market to maturity? Can the Energy Commission leverage sufficient funding so the market can develop by 2016? If not, by when?

The activities outlined in this statement of work support the creation of a strong ARFVTP structure and will aid in its effective implementation. These activities include review and evaluation of the State’s AB 32 2020 carbon reduction goals, the current Transportation Energy Office Forecasting Model Methodologies, the Program Benefits Report for the 2011 Integrated Energy Policy Report, and the 2010-2011 and 2011-2012 Investment Plans; all of which define a desirable future mix of vehicles and fuel use and inform ARFVTP funding recommendations.

Under this statement of work, NREL will provide technological, environmental and commercialization assessments of the alternative and renewable fuels, vehicle technologies and supportive fueling infrastructures currently in existence and under development. A summary of the most innovative, promising and emergent clean transportation technologies in California is sought as well as strategies for reaching out to clean transportation venture capitalists, sophisticated angel investors, corporate investors and other strategic partners.

Also included are activities related to electric vehicle infrastructure planning, assessing the current status of woody biomass conversion technologies, providing assessments of current and emerging biomethane systems, infrastructure compatible (drop-in) biofuels

and the potential of renewable biogas production in California.

NREL technical evaluations of ARFVTP project proposals will assist in determining the engineering, economic and financial feasibilities of proposed projects, leading to successfully reaching Energy Commission energy security and petroleum reduction goals. Strategies are sought for strengthening the due-diligence necessary to ensure that grant recipients have the financial and technical ability to perform as declared, and deliver the desired benefits without duplication, fraud, waste and abuse.

Finally, this statement of work will result in an analysis of and recommendations for the current planning, implementation and evaluation methodologies of the ARFVTP and the metrics needed to track progress as the legislation approaches its date of renewal in 2016. The majority of the tasks included in the Technical Task List below will be coordinated with the Energy Commission point of contact, the Commission Contract Manager (CCM), and some topic-specific projects will be executed while interfacing with other Energy Commission staff.

### Technical Task List

Task Number	Description
1.0	Administration
1.1	<ul style="list-style-type: none"> <li>• Kick-off Meeting</li> </ul>
1.2	<ul style="list-style-type: none"> <li>• Critical Project Review Meetings</li> </ul>
1.3	<ul style="list-style-type: none"> <li>• Monthly Progress Reports</li> </ul>
1.4	<ul style="list-style-type: none"> <li>• Final Meeting</li> </ul>
2.0	Technology and Market Assessments
2.1	<ul style="list-style-type: none"> <li>• Advanced Vehicles</li> </ul>
2.2	<ul style="list-style-type: none"> <li>• Fueling Infrastructure</li> </ul>
2.3	<ul style="list-style-type: none"> <li>• Advanced Fuel Production</li> </ul>
2.4	<ul style="list-style-type: none"> <li>• Consumer and Investor Behavior</li> </ul>
3.0	PEV Infrastructure Planning
4.0	Technical Evaluation of Project Proposals
5.0	Program Data Analysis and Evaluation
5.1	<ul style="list-style-type: none"> <li>• Program Data Analysis, Evaluation and Benefits</li> </ul>
5.2	<ul style="list-style-type: none"> <li>• Market Impact Assessment</li> </ul>

### TASK 1 ADMINISTRATION

#### Task 1.1 Attend 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 CCM, the Contracts Officer, and a representative of the Accounting Office. The Contractor shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the CCM to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the CCM will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Discussion of the terms and conditions of the Agreement
- Discussion of Critical Project Review (Task 1.2)

The technical portion of the meeting shall include, but not be limited to, the following:

- The CCM’s expectations for accomplishing tasks described in the Scope of Work
- An updated Schedule of Deliverables
- Discussion of Progress Reports (Task 1.3)

The CCM shall designate the date and location of this meeting. To allow time for preparation, the meeting will occur approximately 2-4 weeks after the recipient has received funds and work on the project has begun.

**Deliverables:**

- Updated Schedule of Deliverables

**CCM Product:**

- Kick-Off Meeting Agenda

**Task 1.2 Critical Project Review (CPR) Meetings**

The goals of this task are to exchange information between Energy Commission staff and NREL staff to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, deliverables, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the CCM and as shown in the Technical Task List above. The frequency is approximately 1-3 CPRs per year. However, the CCM may schedule 1-2 additional CPRs as necessary, and any additional costs will be borne by the

Contractor.

Participants include the CCM and the Contractor and may include the Commission Contracts Officer, the Fuels and Transportation Division (FTD) team lead, other Energy Commission staff and Management as well as other individuals selected by the CCM to provide support to the Energy Commission.

**The CCM shall:**

- Determine the location, date, and time of each CPR meeting with the Contractor. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Contractor the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not modifications are needed to the tasks, schedule, deliverables, and/or budget for the remainder of the Agreement. Modifications to the Agreement may require a formal amendment (please see Terms and Conditions Section 8). If the CCM concludes that satisfactory progress is not being made, this conclusion will be referred to the Transportation Committee for its concurrence.
- Provide the Contractor with a written determination in accordance with the schedule. The written response may include a requirement for the Contractor to revise one or more product(s) that were included in the CPR meeting.

**The Contractor shall:**

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other products identified in this scope of work. The Contractor shall submit these documents to the CCM and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

**CCM Deliverables:**

- Agenda and a list of expected participants
- Schedule for written determination
- Written determination

**Deliverables:**

- CPR Report(s)

**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 research objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

**The Contractor shall:**

- Prepare and submit a Monthly 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 CCM 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.

**Product:**

- Monthly Progress Reports

**Task 1.4 Final Meeting**

The goal of this task is to closeout this Agreement.

**The Contractor shall:**

- Meet with Energy Commission staff to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.
- This meeting will be attended by, at a minimum, the Contractor, the Commission Contracts Office Officer, and the CCM. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the CCM.
- The technical portion of the meeting shall present an assessment of the degree to which project and task goals and objectives were achieved, findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The CCM will determine the appropriate

meeting participants.

- The administrative portion of the meeting shall be a discussion with the CCM and the Contracts Officer about the following Agreement closeout items:
  - What to do with any equipment purchased with Energy Commission funds (Options)
  - “Surviving” Agreement provisions
  - Final invoicing and release of retention
  - Prepare a schedule for completing the closeout activities for this Agreement.

**Deliverables:**

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

**Task 2.0 Alternative and Renewable Fuel and Vehicle Technology Market Assessments**

The goal of this task is to establish baseline information and then a market and technology assessment of each major fuel and vehicle technology area as outlined in sections 2.1, 2.2 and 2.3 below. Baseline information shall include the number and types of vehicles, fueling infrastructure or fuel production facilities, along with key suppliers, technology developers and market end-users. Recent trends shall be described, along with geographic information on distribution of end-users, producers and suppliers.

The market assessments shall include sections describing:

1. Technology status of each particular vehicle, fueling or fuel production technology.
2. Current market share information for each vehicle, fuel or infrastructure technology area.
3. Process conversion technologies and feedstock supply options and issues (fuel production technologies only).
4. Examination of market expansion opportunities and barriers to widespread commercialization and deployment (disaggregated, where applicable, by: vehicle category, duty cycles, key fleets or market sectors, fuel categories, and geographic regions).
5. The role of government regulations for criteria emissions and carbon reductions in shaping or influencing future market growth potential.
6. Completion of a Gap Analysis to identify where funds or resources are being provided to each technology type. These must be identified within and outside California.

## 2.1 Advanced Vehicle Technologies

The contractor shall conduct an advanced vehicle technology market assessment study, which shall include the following technology types:

- Light Duty Plug-in Hybrid and Electric Vehicles
- Medium & Heavy Duty Plug-in Hybrid & Electric Trucks
- Medium & HD Natural Gas Trucks and Buses
- Light Duty Natural Gas Vehicles
- Propane Light, Medium and Heavy Duty Vehicles
- Flex-fuel vehicles (light duty and trucks)
- Hydrogen Fuel Cell Vehicles (light duty, buses and trucks)

The contractor shall prepare and submit a ***Draft Advanced Vehicle Technology Report*** which shall include:

- Baseline information described in Section 2.0.
- Projections to 2020 and beyond of the market potential for each main vehicle type and duty cycle.
- Average petroleum, GHG and air pollution reduction estimates for each alternative fuel vehicle.
- An assessment of the range of public incentives available to advanced technology vehicle developers and consumers.
- An assessment of government or corporate “buy green” policies that influence advanced vehicle procurement decisions.
- A review of technologies that have already achieved, or are likely to soon achieve, market viability without the need for government incentives.
- Technologies that have not yet been identified for Program funding that may yield important petroleum and GHG emissions reductions and air quality benefits.
- An examination of the cost vs. fuel savings benefit for various advanced vehicle technologies (leveraging existing analysis models and on-going evaluations of electrified vehicle technologies where possible).
- Generation of CNG engine and vehicle model methodologies to accurately assess the technology’s carbon benefit over representative real-world drive cycles.
- Leveraging analytic capabilities within NREL’s Medium- and Heavy-Duty (MD/HD) Vehicle Center of Excellence Support, the report will also include:
  - Analysis results and recommendations to match advanced vehicle technologies with the vocations and duty cycles over which they will obtain the largest carbon reduction.
  - Technical support (agreed upon with Energy Commission staff) to leverage NREL’s expertise in MD/HD modeling, fleet data collection, vocation assessment, duty cycle analysis and laboratory testing.

The contractor shall prepare and submit a ***Final Advanced Vehicle Technology Report*** which shall incorporate:

- Information provided in the *Draft Advanced Vehicle Technology Report*

- Comments and input provided by the Energy Commission

### **Deliverables**

- Advanced Vehicle Technology Draft Report
- Advanced Vehicle Technology Final Report
  - Completed 2 months after receiving Energy Commission comments on draft report

## **2.2 Fueling Infrastructure**

The contractor shall conduct a fueling infrastructure market assessment study, which shall include the following technology types:

- Electric Vehicle Supply Equipment/ Electricity Generation and Distribution and Electric Vehicle charging infrastructure
- Natural Gas supply and fueling infrastructure
- Propane fueling infrastructure
- E-85 / Renewable Gasoline fueling infrastructure
- Biodiesel / Renewable Diesel fueling infrastructure
- Hydrogen fueling infrastructure

The contractor shall prepare and submit a ***Draft Fueling Infrastructure Technology Report***, which shall include:

- Baseline data for each fueling infrastructure category (see Section 2.0)
- Assessment of feasibility and utility of developing parallel infrastructures for transitional fuels such as ethanol and biodiesel. How much longer should ARFVTP fund those fueling infrastructure categories?
- An assessment of the issues and barriers to getting more renewable natural gas into fueling systems available to truck fleets converting to natural gas.
- Assessment of the costs and benefits associated with proposed infrastructure investment options, station configurations, delivery options and specific low-carbon or renewable hydrogen pathways.
- Projections of market adoption dynamics (for fuel cell or other hydrogen vehicles) within the context of two factors: 1) an expanding hydrogen infrastructure in California, and 2) adoption of other vehicle technology types, such as CNGVs and PEVs.

The contractor shall prepare and submit a ***Final Fueling Infrastructure Technology Report*** which shall incorporate:

- Information provided in the ***Draft Fueling Infrastructure Technology Report***
- Comments and input provided by the Energy Commission

### **Deliverables**

- Fueling Infrastructure Technology Draft Report
- Fueling Infrastructure Technology Final Report
  - Completed 2 months after receiving Energy Commission comments on draft report

### 2.3 Advanced Fuel Production (Biofuels)

The contractor shall conduct an advanced fuel production market assessment study including the following technology types:

- Advanced Ethanol and Gasoline Substitutes production
- Advanced Diesel Substitutes production
- Renewable Natural Gas or Biomethane production
- Renewable Hydrogen production
- Waste-based and purpose-grown feedstocks
- Algae-Based Biofuels production
- Woody Biomass Conversion Technologies

The contractor shall prepare and submit a ***Draft Advanced Fuel Production Technology Report***, which shall include:

- A market and technology assessment of each main alternative fuel category
- Summary assessments of currently active advanced biofuels companies developing biomass-derived fuel technologies and their timeline for commercialization. Information such as the companies' funding status, their plans for construction and their annual fuel production targets, will be considered. Technologies will include fast pyrolysis (and catalytic fast pyrolysis) with upgrading to produce bio-oil, algal oils, other thermochemical technologies (hydrothermal liquefaction, methanol-to-gasoline (MTG)), and biochemical technologies (fermentative production of hydrocarbons). Known process data will be included in the summary, as will known technical gaps for the research community.
- An assessment of the value of Renewable Identification Numbers (RIN), Low Carbon Fuel Standard (LCFS) credits, and Cap and Trade credits in creating financing and resource streams for in-state production.
- Comparisons of subsidies for petroleum vs biofuels, hydrogen, and electric and other non-petroleum fuels. Compare the subsidies available for the early introduction of gasoline and diesel technologies vs advanced fuels emerging in the market today.
- Information on technologies that are achieving market viability without the need for government incentives.
- Information on technologies that have not yet been identified for ARFVTP funding that may yield greater petroleum and GHG emissions reductions and air quality benefits, such as the potential of fuel production utilizing anhydrous ammonia and diethyl ether.
- A summary of the biomethane production potential in California from various waste sources, including manure, municipal solid waste (MSW), wastewater, and rendering.
- A summary and assessments of renewable drop-in fuels or those that can be processed through existing distribution infrastructure and used in existing internal combustion engines.
- Expert technical recommendations and independent reviews of other life cycle assessment work supported by the Energy Commission or other California

agencies, reviews of recently published literature and how their results could impact California policymaking, or synthesis of ongoing NREL research as it relates to California policymaking.

- A review of existing techno-economic analyses, life cycle assessments, or biomethane resource assessments as defined by the Energy Commission.
- A summary of the woody biomass conversion technologies being developed and commercialized, along with state of development information, industrial participation and context for these technologies, modeled cost of production data (when available), and future research potential.

The contractor shall prepare and submit a ***Final Advanced Fuel Production Technology Report*** which shall incorporate:

- Information provided in the ***Draft Advanced Fuel Production Technology Report***
- Comments and input provided by the Energy Commission

#### **Deliverables**

- Advanced Fuel Production Technology Draft Report
- Advanced Fuel Production Technology Final Report
  - Completed 2 months after receiving Energy Commission comments on draft report

#### **2.4 Consumer and Investor Behavior**

The contractor shall conduct a consumer and investor behavior market assessment study, and submit a Consumer and Investor Behavior Report, which shall include the following topics:

- Influence of consumer or fleet driving patterns on fuel infrastructure requirements.
- Evaluation of data collected on consumer preferences for advanced vehicles, especially in the context of early adopters and discrete choice model attributes.
- Factors influencing investor decisions in relationship to advanced vehicles and fuels.
- Understanding the role of key industry stakeholders in the deployment of fuel infrastructure, including fleet operators for private or public fleets, major oil companies, independent service station owners or petroleum product marketers (e.g. CIOMA), natural gas utilities and electric utilities.
- Understanding the role of investors interested in advanced fuels and vehicles, including venture capitalists, corporate investors, angel investors and others.
- Understanding the potential responsiveness of key industry players to existing or proposed regulations.
  - A variety of sources will be drawn upon to collect market data. In addition, NREL will generate new qualitative and quantitative data by conducting:
  - A series of individual interviews with key players to understand their strategic interests in advanced vehicles and fuels, and their understanding of the investment landscape.

Information collected through this market assessment shall be used to calibrate the

responsiveness of consumers and industry decision makers within the Market Impact model discussed in Task 5.2.

### **Deliverables**

- Consumer and Investor Behavior Report

### **Task 3.0 PEV Infrastructure Planning**

The goal of this task is to support Energy Commission staff in the rapidly changing area of plug-in electric vehicle (PEV) fueling infrastructure by drawing upon the existing NREL knowledge base. By working with Energy Commission staff, the Statewide Plug-in Electric Vehicle Collaborative, the Regional PEV Coordinating Councils and academic institutions, NREL shall:

- 1) Coordinate and help to develop strategies for infrastructure deployment in California.
- 2) Analyze and interpret data generated by Energy Commission PEV infrastructure projects in California.
- 3) Assist the Energy Commission with the adoption of the statewide PEV infrastructure guidance document.
- 4) Track emerging issues on the viability of bi-directional power flow viability and potential PEV ancillary services.

The contractor shall undertake the following activities and prepare and submit a ***Draft PEV Planning and Data Evaluation Report*** documenting the results:

- 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, including ETEC, Coulomb Technologies, Association of Bay Area Governments, Clipper Creek and others.
- Evaluate several GIS tools used to plan charging infrastructure demand due to PEV densities. These GIS tools would include NREL's, PIER's, and others currently under development.
- Conduct a literature review and offer recommendations regarding bi-directional power flow viability and pathways for offering grid stability services.
- Coordinate research efforts with the various academic institutions including the PH & EV Research Center at UC Davis and the PEV Collaborative.
- Assist in staff participation and collaboration with the statewide Plug-In Electric Vehicle Collaborative working groups.
- Assist Energy Commission staff in adopting the PEV infrastructure guidance document *Ready, Set, Charge – a Guide to EV Ready Communities* for statewide use.
- Work with Energy Commission staff, Statewide PEV Collaborative and Regional Coordinating Councils to update the above document periodically through January 1, 2013.

The contractor shall prepare and submit a ***Final PEV Planning Tools and Data Evaluation Report*** which shall incorporate:

- Information provided in the ***Draft PEV Planning Tools and Data Evaluation Report***
- Comments and input provided by the Energy Commission

#### **Deliverables**

- PEV Planning and Data Evaluation Draft Report
- PEV Planning and Data Evaluation Final Report
  - Completed 2 months after receiving Energy Commission comments on draft report

#### **Task 4.0 Technical Evaluation of Project Proposals**

The Contractor shall assist the Energy Commission in evaluating the engineering and technical merits and market penetration scenarios of vehicle technologies, alternative fuel infrastructure, fuel production facilities and other project proposals submitted for possible funding under ARFVTP.

At the direction of the CCM, the contractor shall review and provide technical assistance on ARFVTP project proposals with consideration of the following:

- Technical feasibility, to ensure that the project proposal is viable from an environmental, mechanical, electrical, civil, and chemical engineering standpoint; to assess the proposed approach in terms of the likelihood of achieving its stated goals and objectives.
- Economic and financial feasibility. Recommend to the Energy Commission methodologies for strengthening the due diligence needed during the proposal review process to ensure that ARFVTP contractors can perform financially as declared.
- 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.
- Cost effectiveness of GHG reduction, petroleum reduction, increased alternative fuel supply, air quality improvements, or other benefits proposed by each proposal.

It is anticipated that this effort will focus on medium- and heavy-duty vehicle projects and biofuel solicitations, providing assistance on approximately 20 projects in each of the two areas per year.

## Deliverables

- Reports evaluating proposed project results.

### Task 5.0 Program Data Analysis and Evaluation

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 (Health and Safety Code 44273 (c) ). 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 consumptions, 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.

#### 5.1 Program Data Analysis, Evaluation and Benefits

The goal of this task is to analyze Program data, gauge progress toward Program goals, and redefine Program direction if necessary.

#### The Contractor shall:

- Prepare and submit a ***Draft ARFVTP Program Benefits Guidance Report***, building upon the 2011 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, benefits calculations, program evaluation criteria, and relevant Market Assessment data from Task 2.0.
  - Assess Program progress toward the 2020 goals and beyond.
  - Contribute to the annual or bi-annual Benefits Reports by supporting the assessment of prospective and retrospective benefits associated with new and ongoing projects.
- Prepare and submit a ***Final ARFVTP Program Benefits Guidance Report***, incorporating information provided in the ***Draft ARFVTP Program Benefits Guidance Report*** and comments provided by the Energy Commission. Prepare and submit a ***Draft 2013 ARFVTP Program Evaluation Report***, summarizing analysis of program performance to date, ***organized in a fashion that is consistent*** with the information requirements set forth for the Benefits Report required by Health and Safety Code 44273 (c). This report shall include the following:
  - As directed by CCM, 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, or other key metrics deemed appropriate by the Energy Commission. Where are the ARFVTP investments achieving the greatest impact in terms of reducing petroleum use, creating jobs and other public benefits? The least? How do we avoid investing in projects that go nowhere such as parallel or stranded infrastructure

- investments?
- Recommendations on the Energy Commission methodologies for strengthening the due diligence needed during the proposal review process to ensure that ARFVTP contractors can perform financially as declared.
- Recommendations on the Energy Commission methodologies for reaching out to emergent clean transportation energy companies and small businesses, aligning them with potential clean energy investors, corporate investors and strategic business partners. An example would be to work with the Energy Commission on sponsoring a California-specific Industry Growth Forum similar to NREL's national Industry Growth Forum.
- Prepare and submit a ***Final ARFVTP Program Evaluation Report***, incorporating information provided in the ***Draft ARFVTP Program Evaluation Report*** and input provided by the Energy Commission.

#### **Deliverables**

- Program Benefits Guidance Draft Report
- Program Benefits Guidance Final Report
  - Completed 3 months after receiving Energy Commission comments on draft report
- Program Evaluation Draft Report
- Program Evaluation Final Report
  - Completed 3 months after receiving Energy Commission comments on draft report

#### **5.2 Market Impact Assessment**

This Market Impact Assessment will build upon existing NREL models that address specific issues related to ARFVTP. These sub-models (such as the Battery Ownership Model, or the Hydrogen Analysis (H2A) discounted cash flow models) will be incorporated into NREL's larger Market Impact Assessment model to allow for more integrated assessments across technology and consumer types. The Market Impact Assessment model is a general spatio-temporal optimization model that is capable of running multiple sub-models, such as stand-alone spreadsheet models, and can optimize on a wide range of specified metrics (given sufficient input data and conditions to support the optimization). Having stand-alone spreadsheet models "wrapped" within the larger optimization model becomes a useful means of communicating how sub-models operate; the spreadsheets can be easily shared (e.g., emailed) to interested parties. Various types of information will be acquired or estimated and then integrated to improve the accuracy of this assessment, and an effort will be made to be consistent with and provide parallel analysis to the Energy Commission Transportation Energy Office Forecasting Model. NREL's model will be tailored to California market conditions and policy environment, and will be characterized to address the particular questions related to ARFVTP (listed below). This information will extend to 2035 and to 2050 where practical and shall include the following types of information:

- New vehicle production capacity for all vehicle technologies and fuels. These will contribute to cost estimation methods relying upon experience curves (global and regional)

- Light and heavy duty vehicle attributes (fuel economy, range, prices, etc.)
- Data and evaluation of vehicle driving patterns (e.g., annual VMT)
- California vehicle stock and sales by zip code
- Evaluation of substitution preferences by vehicle attribute
- Evaluation and projection of alternative fuel costs

Over time, results from this input will be incorporated into the Investment Plan Guidance Report (described below). This Report will include or address the following topics:

- Prepare a **Draft 2014-2015 Investment Plan Guidance Report**, 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.
- How can California's transportation sector meet 2020 and 2050 GHG goals, and what role ARFVTP might have in meeting these goals? This effort will draw upon empirical data collected through other project tasks, as well as outside sources. It will employ a consumer choice sub-model and a vehicle stock turnover sub-model embedded within NREL's spatial cost optimization model to focus in on specific effectiveness and market development metrics.
- Assess how different market factors and government policies such as the Federal Renewable Fuel Standard (RFS2), the California Low Carbon Fuel Standard (LCFS) and the ARB's Cap and Trade program will influence private investments, financing ability, production and distribution.
- How should funding be prioritized for addressing short-term-medium term and long-term goals across all fuel and vehicle technology categories?
- What metrics can be used to determine when a technology has reached market maturity and government support is no longer needed? What metrics can be employed?
- Develop a strategic framework for understanding 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 in order to help alleviate barriers to market acceptance and achieve commercialization and widespread deployment (especially natural gas trucks, electric trucks, and light duty electric vehicles). The 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. Preliminary results from the framework will be delivered to CEC for review.
- Prepare a **Final 2014-2015 Investment Plan Guidance Report**, incorporating information included in the **Draft 2014-2015 Investment Plan Guidance Report** and input provided by the Energy Commission.

**Deliverables**

- Status Reports on Market Impact Assessment model
  - Provided quarterly
- 2014-2015 Investment Plan Guidance Draft Report
- 2014-2015 Investment Plan Guidance Final Report
  - Completed 3 months after receiving Energy Commission comments on draft report