

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION

New Agreement PIR-13-013 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Pilar Magana	43	916-327-2216

Recipient's Legal Name	Federal ID Number
Efficient Drivetrains, Inc.	20-5546260

Title of Project
Parallel-Series Multi-Mode Class-4 CNG-PHEV

Term and Amount	Start Date	End Date	Amount
	6/30/2014	6/30/2016	\$ 900,000

Business Meeting Information
 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	6/18/2014	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
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Business Meeting Presenter	Pilar Magana	Time Needed:	
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Please select one list serve. Research (Energy RDD / PIER program)

Agenda Item Subject and Description

EFFICIENT DRIVETRAINS, INC. Proposed resolution approving Agreement PIR-13-013 with Efficient Drivetrains Inc. for a \$900,000 grant to design, optimize and demonstrate an intelligent plug-in hybrid electric vehicle powertrain (EDI drive) and battery pack with 40 miles of all-electric range integrated with a 6.0-liter Class 4 compressed natural gas engine suitable for medium heavy-duty trucks.

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:
 a) Agreement **IS** exempt. (Attach draft NOE)
 Statutory Exemption. List PRC and/or CCR section number: _____
 Categorical Exemption. List CCR section number: 14 CCR Section 15306
 Common Sense Exemption. 14 CCR 15061 (b) (3)
 Explain reason why Agreement is exempt under the above section:
 The activity is covered by the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA.
- b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 Check all that apply
 Initial Study Environmental Impact Report
 Negative Declaration Statement of Overriding Considerations
 Mitigated Negative Declaration

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

Legal Company Name:	Budget
GREENKRAFT, INC.	\$ 326,000
CALSTART, Inc.	\$ 128,000
California Environmental Engineering LLC	\$ 25,000
Southern California Gas Company	\$ 200,000
	\$
	\$
	\$
	\$
	\$

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Exhibit A SCOPE OF WORK

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I. TASK AND ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	X	Prototype Design
3		Prototype Assembly and Integration
4	X	Validation
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities
7		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
AER	All-Electric Range
CAM	Commission Agreement Manager
BAAQMD	Bay Area Air Quality Management District
CAD	Computer Aided Design
CAO	Commission Agreement Officer
CARB	California Air Resources Board
CCE LLC	California Environmental Engineering LLC
CNG	Compressed Natural Gas
CNG	Compressed Natural Gas
CPR	Critical Project Review
EDI	Efficient Drivetrains Incorporated
EM	Electric Motor
GGE	Gasoline Gallon Equivalent

¹ Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

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Acronym/Term	Meaning
GM	General Motors
MPGe	Miles per Gallon equivalent
M&V	Measurement and Verification
NOx	Nitrogen Oxides
PHEV	Plug-in Hybrid Electric Vehicle
Powertrain	Efficient Drivetrains Incorporated Drive
SCAQMD	South Coast Air Quality Management District
SJVAPCD	San Joaquin Valley Air Pollution Control District
SoCalGas	Southern California Gas Company
TAC	Technical Advisory Committee
US EPA	United States Environmental Protection Act
ZEV	Zero Emission Vehicle

II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this agreement is to fund research and development to design a natural gas engine hybrid-electric vehicle that reduces NOx emissions while improving fuel efficiency through the use of electric hybridization. The recipient will team with Greenkraft, Inc., CALSTART, Southern California Gas Company (SoCalGas), and California Environmental Engineering (CEE LLC) to develop and demonstrate a Compressed Natural Gas (CNG) Plug-in Hybrid Electric Vehicle (PHEV) equipped with an existing 6.0-liter (L) class-4 General Motors CNG engine in a Greenkraft medium-duty truck and with EDI Drive. The proposed research includes design, optimization manufacturing, testing/validation, and demonstration of a PHEV powertrain (EDI Drive) and battery pack with 40 miles of all-electric range (AER) to support integration with an existing United States Environmental Protection Act (US EPA) and California Air Resources Board (CARB)-certified 6.0L class-4 General Motors (GM) compressed natural gas (CNG) engine.

The EDI Drive's compact, lightweight, modular, inline form allows easy optimization for many vehicle types with minimal changes to the original vehicle chassis and frame, making rapid conversions and market introductions possible. One major innovation is its ability to temporarily combine the generator (EM1) and traction (EM2) motors to provide

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the equivalent of two traction motors, which can provide greater EV torque and efficiency when needed, due to this multi-motor configuration. Another significant innovation is the recipient's control software that monitors the drive cycle and available energy and switches seamlessly among the four modes as required maximizing electric range and minimizing fuel consumption and greenhouse gas (GHG) emissions. Finally, because it operates without an oil sump, the EDI Drive is the only "dry" transmission design in existence, delivering more efficiency and greater performance at a lower cost than other two-motor systems. To accommodate charging throughout the day, the CNG-PHEV will also be equipped with an onboard electrical charging system that includes adapter plugs and an extension cord, helping to ensure that the CNG-PHEV can charge at any standard industrial outlet. In addition, to help ensure compatibility with circuitry at remote locations, the CNG-PHEV will also be equipped with an intelligent charging system (patent pending) that can determine the power capability of any standard plug automatically.

B. Problem/ Solution Statement

Problem

Medium and heavy-duty vehicles are critical to California's economy, yet they contribute a significant amount of greenhouse gas GHG emissions and consume much of the fuel used in California fleets. The Energy Commission's 2011 Integrated Energy Policy Report anticipates that diesel consumption will continue to grow by 22.3 percent from 2009 to 2030 due to increased use of diesel in freight.

While hybridization is not a new concept, hybridization combined with the use of natural gas has not been fully explored, and the hybridization technologies and strategies being used do not offer a competitive option for fleets that could benefit from hybridization. Additional research is needed to develop natural gas hybrid-electric systems that provide performance, emissions, and efficiency improvements over the medium-duty vehicles available in commercial markets. Research and development is also needed to address two significant barriers to entry in this market sector: incremental cost and weight.

Further research, development, and demonstration are also needed to address integration, cost, and weight issues with NGV hybridization. The desired approach in research is to explore the duty cycles and applications for which hybrid systems promise the greatest benefits. The proposed project will address the challenge of determining which various duty cycles and applications for CNG-PHEV systems with different configurations promise the greatest benefits.

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Solution

The research project will help solve the problem described above by designing and optimizing an existing 6.0L class-4 GM CNG engine to support the integration of a PHEV EDI Drive and battery pack with 40 miles of all-electric range (AER). Upon completion of design and optimization, the project team will integrate the CNG engine and EDI Drive in a 14,500-pound class-4 medium-duty truck supplied by Greenkraft and then validate, test, and demonstrate the integrated, full-performance, and range-extended CNG-PHEV on the road, both in operations at Greenkraft and in ride-and-drive demonstrations with a variety of regional fleets, including Ryder, Penske, and FOX Transportation.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Develop and optimize a natural gas hybrid-electric system that is suitable for medium-duty vehicle applications
- Achieve approximately 29-percent thermal efficiency improvements compared to the baseline CNG-powered Greenkraft truck, and effectively triple the miles per gasoline gallon equivalent (GGE) of the baseline CNG-powered Greenkraft truck from approximately 9 miles per GGE to 27.
- Determine which duty cycles and applications for medium-duty CNG-PHEV systems promise the greatest benefits—including the possible elimination of the use of CNG and achieving 100-percent all-electric operations in certain cycles.

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Agreement Objectives

The objectives of this Agreement are to:

- Successfully integrate and optimize an existing Greenkraft CNG-powered engine in a Class-4 medium-duty Greenkraft truck (approximately 9 MPG_e) with the intelligent EDI Drive.
- Meet or exceed CARB medium-heavy-duty on-road emission certification requirements for 2016.
- Test and validate the integrated CNG-PHEV under normal operating conditions in the Greenkraft fleet.
- Achieve approximately 29 percent thermal efficiency improvements compared to the baseline CNG-powered Greenkraft truck.
- Effectively triple the miles per gasoline gallon equivalent (GGE) of the baseline CNG-powered Greenkraft truck from approximately 9 miles per GGE to 27.
- Define the duty cycles under which the proposed CNG-PHEV can achieve 100-percent all-electric operations and, therefore, entirely eliminate the use CNG.
- Perform short demonstrations of the proposed CNG-PHEV at various regional fleets, including Penske, Ryder, and Fox Transportation.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**.

Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

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The Recipient shall:

For products that require a draft version

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Submit the final product to the CAM once agreement has been reached on the draft. The CAM will provide written approval of the final product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- If the CAM determines that the final product does not sufficiently incorporate his/her comments, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For products that require a final version only

- Submit the product to the CAM for approval.
- If the CAM determines that the product requires revision, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For all products

- Submit all data and documents required as products in accordance with the following Instructions for Submitting Electronic Files and Developing Software:
 - **Electronic File Format**

Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

 - Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
 - Text documents will be in MS Word file format, version 2007 or later.
 - Documents intended for public distribution will be in PDF file format.

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- The Recipient must also provide the native Microsoft file format.
- Project management documents will be in Microsoft Project file format, version 2007 or later.
 - **Software Application Development**
Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
 - 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 Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take

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place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The administrative portion of the meeting will include discussion of the following:

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an *Updated Project Schedule, List of Match Funds, and List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Updated Project Schedule (*if applicable*)
- Updated List of Match Funds (*if applicable*)
- Updated List of Permits (*if applicable*)

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient, and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made,

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this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.

- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:

- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).

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- Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
-
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
 - Prepare a *Schedule for Completing Agreement Closeout Activities*.
 - Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize all Agreement activities conducted by the Recipient for the preceding month, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and

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- Match fund expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review and approve the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use a Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline and the Style Manual provided by the CAM.
- Submit a draft of the report to the CAM for review and comment. Once agreement on the draft report has been reached, the CAM will forward the electronic version for Energy Commission internal approval. Once the CAM receives approval, he/she will provide written approval to the Recipient.
- Submit one bound copy of the Final Report to the CAM.

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Products:

- Final Report (draft and final)

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.

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- A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter (*if applicable*)
- Match Funds Reduction Notification Letter (*if applicable*)

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
 - The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list,

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schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)
- Copy of each Approved Permit (*if applicable*)

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts (*draft if required by the CAM*)

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TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion.

The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or
 - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members.

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The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.

- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

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IV. TECHNICAL TASKS

TASK 2 PROTOTYPE DESIGN

The goals of this task are for the recipient and Greenkraft to: (1) collaborate on a design and specify the integrated CNG-PHEV, and (2) procure all associated equipment and materials for the assembly of one vehicle, two engines, and a permanent dynamometer powertrain setup.

The Recipient shall:

- Prepare and provide *CAD Schematics* for a 6.0L GM CNG converted engine powered chassis and fuel delivery system.
- Review *CAD Schematics* and design for an Integrated CNG-PHEV using the Greenkraft engine and fuel delivery system; replacing the transmission system with an EDI designed Class 6 PHEV powertrain and battery pack for the projected ZEV miles.
- Prepare and provide *Specifications* for (as determined by Greenkraft, end use customers, and the recipient):
 - Vehicle performance
 - Zero emission vehicle (ZEV) electric range
 - Vehicle display of PHEV operation and CNG and Electric energy use
 - Operation route guidance and energy use data
 - External Charging system for the on-board batteries
- Prepare and provide *Design Drawings* for EDI transmission and battery installation
- Use *Specifications* to prepare and provide *Equipment and Material (BOM) List*.
- Order materials and equipment for a single vehicle and additional engine
 - Electric motors and Power Inverters
 - Vehicle control modules and software
 - Battery packs and BMS
 - Interconnection harnesses
 - Downsized engine
- Prepare a CPR Report in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting

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Products:

- CAD Schematics
- Specifications
- Design Drawings
- Equipment and Material List (BOM)
- CPR Report

TASK 3 PROTOTYPE ASSEMBLY AND INTEGRATION

The goals of this task are to construct: (1) a Greenkraft Baseline CNG-powered Medium Duty truck chassis (2) spare engine (3) a prototype PHEV powertrain based on a previously proven Class 6 similar design. The prototype EDI Drive will then be integrated with the CNG-powered engine on an EDI dynamometer and test the integrated CNG-PHEV engine for performance, emissions changes, and CNG and electricity consumption. After reviewing test results, final engineering changes will be performed and the EDI hybrid-electric drive system will be integrated with the full CNG GM 6.0 L engine in the Greenkraft medium-duty truck chassis.

The Recipient shall:

- Use the Design Drawings from Task 3 to build a prototype PHEV Powertrain based on a previously proven Class 6 similar design.
- Manufacture a Greenkraft Baseline CNG-powered Medium Duty truck chassis and a spare engine.
- Assemble and integrate EDI drivetrain on Greenkraft CNG vehicle.
- Prepare and provide a *Dynamometer Test Plan* that includes testing for:
 - Performance:
 - Launch
 - Gradeability-launch and driving, ZEV, series and parallel hybrid modes
 - Acceleration-0 to 50 and 40 to 65
 - Top speed- ZEV and Hybrid
 - ZEV Range-Driving Cycle and Steady State
 - Emissions:
 - Daily Driving Cycle
 - Representative Composite Annual Driving Cycle
 - CNG and Electric Consumption:
 - Daily Driving Cycle
 - Representative Composite Annual Driving Cycle

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- Integrate prototype with CNG-powered engine and EDI drivetrain on Greenkraft Dynamometer and follow *Dynamometer Test Plan* to verify performance, emissions, and CNG and electric consumption.
- Review and analyze test results and prepare and provide *Dynamometer Test Results Report* including:
 - Drive cycles
 - Performance targets
 - Actual performance test results
 - Design changes – if required
- Perform final engineering changes and provide *Final Design Drawings*.
- Integrate the EDI hybrid-electric drive system with the CNG General Motors 6.0 L engine mated with EDI powertrain and Battery pack with Charger into the Greenkraft Medium Duty Truck Chassis
- Install intelligent battery charger

Product:

- Dynamometer Test Plan
- Dynamometer Test Results Report (draft and final)
- Final Design Drawings

TASK 4 VALIDATION

The goals of this task are for to validate and integrate the completed truck in a series of road tests designed to test drivability and performance, as well as optimal driving cycles. Validation road testing on the completed CNG-PHEV will be conducted to determine actual fuel efficiency, greenhouse gas emissions, vehicle MPG, and optimal power management strategies for the target duty cycle(s). Testing will employ the duty cycle defined below. Testing on a dynamometer will be conducted to determine the vehicle's drive-ability, energy efficiency, AER, CNG use, and emissions in city and highway conditions. Side-by-side comparisons of fuel economy and emissions analysis will be performed with conventional vehicle technology.

The Recipient shall:

- Prepare and provide a *Validation Test Plan* and *Fleet Test Plan* including:
 - Drive cycles
 - Performance targets
 - All electric range
 - Fuel economy

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- Emission targets
- Validate and integrate the vehicle in a series of road tests designed to test:
 - Developed the Daily Driving Cycle
 - Composite Annual Driving Cycle
 - Driver and Fleet operator feedback on driveability. Performance and Energy Infrastructure issues
- Prepare and provide *Validation Test Report* including:
 - *Performance test results*
 - *All electric range*
 - *Fuel economy*
 - *Emission test results*
- Validate and integrate the vehicle in a series of fleet tests designed to test:
 - Daily driving “In-Service” by the fleet partner of this program
 - Composite Annual Driving by the Fleet partner of this program
 - Report driver and fleet operator operational experience on Vehicle behavior and reaction to the use of additional infrastructure for energy.
- Prepare and provide *Fleet Test Report* including:
 - *All electric range multiple vehicles average*
 - *Fuel economy multiple vehicles average*
- Complete analysis of vehicle performance, emissions and fuel economy. Perform a side-by-side comparison with conventional vehicle technology and publish a *Third Party Verification Report*. including:
 - Vehicle performance
 - Fuel economy
 - Emissions test results
- Prepare a CPR Report in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting

Products:

- Validation Test Plan
- Fleet Test Plan
- Validation Test Report (draft and final)
- Fleet Test Report (draft and final)
- Third Party Verification Report (draft and final)
- CPR Report

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TASK 5 EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
 - Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
 - Investment dollars/follow-on private funding as a result of Energy Commission funding.
 - Patent numbers and applications, along with dates and brief descriptions.

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- Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
- For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.
 - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
 - An estimate of energy and non-energy benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

TASK 6 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:

- Prepare and provide an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare and provide a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare and provide a *Technology/Knowledge Transfer Plan* that includes:
 - An explanation of how the knowledge gained from the project will be made

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available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.

- A description of the intended use(s) for and users of the project results.
- Published documents, including date, title, and periodical name.
- Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
- A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
- The number of website downloads or public requests for project results.
- Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop and provide *Presentation Materials* for an Energy Commission- sponsored conference/workshop on the results of the project.
- Prepare and provide a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

TASK 7 PRODUCTION READINESS PLAN

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare and provide a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and

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- support systems needed to produce a commercially viable product.
- Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include “proof of production processes.”
 - The estimated cost of production.
 - The expected investment threshold needed to launch the commercial product.
 - An implementation plan to ramp up to full production.
 - The outcome of product development efforts, such as copyrights and license agreements.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

RESOLUTION NO:

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: EFFICIENT DRIVETRAINS, INC.

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the CEC 94 Contract Request Form or CEC 270 Grant Request Form (as applicable).

RESOLVED, that the Energy Commission approves Agreement PIR-13-013 with **Efficient Drivetrains, Inc.** for a \$900,000 grant to design, optimize and demonstrate an intelligent plug-in hybrid electric vehicle powertrain (EDI drive) and battery pack with 40 miles of all-electric range integrated with a 6.0-liter Class 4 compressed natural gas engine.

FURTHER BE IT RESOLVED, that the Executive Director shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission 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 California Energy Commission held on June 18, 2014.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat