



STATE OF CALIFORNIA

# GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

## A) New Agreement # ZVI-21-008 (to be completed by CGL office)

<b>B) Division</b>	<b>Agreement Manager:</b>	<b>MS-</b>	<b>Phone</b>
600 Fuels and Transportation Division	Alex Wan	27	916-804-7477

<b>C) Recipient's Legal Name</b>	<b>Federal ID #</b>
Rail Propulsion Systems LLC	47-0988636

<b>D) Title of Project</b>
Wireless Power Transfer Charging System for Battery-Electric Locomotive

## E) Term and Amount

<b>Start Date</b>	<b>End Date</b>	<b>Amount</b>
12/08/2021	10/1/2025	\$270,000

## F) Business Meeting Information

ARFVTP agreements \$75K and under delegated to Executive Director  
 Proposed Business Meeting Date 12 / 08 / 2021  Consent  Discussion  
 Business Meeting Presenter Alex Wan Time Needed: 5 minutes  
 Please select one list serve. AltFuels (AB118 – ARFVTP)

### Agenda Item Subject and Description:

RAIL PROPULSION SYSTEMS LLC. Proposed resolution approving Agreement ZVI-21-008 with Rail Propulsion Systems LLC for a \$270,000 grant to demonstrate a wireless power transfer locomotive charging station to allow a battery-electric locomotive to be charged wirelessly, by stopping the locomotive at any position along a short length of track for static charging at the rail yard and adopting staff's determination that this action is exempt from CEQA. (General Fund funding) Contact: Alex Wan. (Staff Presentation: 5 minutes)

## G) California Environmental Quality Act (CEQA) Compliance

- Is Agreement considered a "Project" under CEQA?
  - Yes (skip to question 2)  No (complete the following (PRC 21065 and 14 CCR 15378)):
- If Agreement is considered a "Project" under CEQA:
  - Agreement **IS** exempt.
    - Statutory Exemption. List PRC and/or CCR section number:
    - Categorical Exemption. List CCR section number: 15301 & 15303
    - Common Sense Exemption. 14 CCR 15061 (b) (3) Explain reason why Agreement is exempt under the above section:
 

14 CCR § 15301 provides for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of existing or former use. This project involves installation of a wireless power transfer (WPT) locomotive charging station, temporary power electronics, and battery system at an existing railyard, using existing cable and tracks. No new, modified, expanded operation of the facility or equipment is necessary. This project entails the conversion of an existing locomotive charging



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system to a wireless charging system and will not require major alteration of existing structures, facilities, mechanical equipment, or topographical features. For these reasons, this project will have no significant impact on the environment and is categorically exempt under 14 CCR section 15301.

14 CCR § 15303 provides for the construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure. This project will install small new equipment between rails on existing track; the estimated footprint of the project is 18 inches by 48 inches. Thus, only minor modifications are made, only small structures will be installed, and no new grading, paving, or construction is necessary. For these reasons, this project will have no significant impact on the environment and is categorically exempt under 14 CCR section 15303.

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

Check all that apply

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

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

<b>Legal Company Name:</b>	<b>Budget</b>
The University of North Carolina at Charlotte	\$ 60,000
Dr. Stan Zurek	\$ 2,000
	\$ 0.00

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

<b>Legal Company Name:</b>
Coast Rail Services, Inc.



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## J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
General Funding	FY 21/22	601.129ZEV	\$270,000.00
Funding Source			\$
Funding Source			\$
Funding Source			\$
Funding Source			\$

R&D Program Area: Select Program Area      TOTAL: \$ 270,000.00

Explanation for "Other" selection

Reimbursement Contract #:                      Federal Agreement #:

## K) Recipient's Contact Information

### 1. Recipient's Administrator/Officer

Name: Dave Cook  
Address: 310 East Walnut Ave.,  
Unit A  
City, State, Zip: Fullerton, CA  
92832  
Phone: (248) 880 - 8018  
E-Mail:  
dave.cook@railpropulsion.com

### 2. Recipient's Project Manager

Name: Dave Cook  
Address: 310 East Walnut Ave.,  
Unit A  
City, State, Zip: Fullerton, CA  
92832  
Phone: (248) 880 - 8018  
E-Mail:  
dave.cook@railpropulsion.com

## L) Selection Process Used

- Competitive Solicitation      Solicitation #: GFO-20-605
- First Come First Served Solicitation      Solicitation #:      -      -

## M) The following items should be attached to this GRF

- |   |   |  |
|---|---|--|
| 1. Exhibit A, Scope of Work                         | <input checked="" type="checkbox"/>     | Attached                                     |
| 2. Exhibit B, Budget Detail                         | <input checked="" type="checkbox"/>     | Attached                                     |
| 3. CEC 105, Questionnaire for Identifying Conflicts | <input checked="" type="checkbox"/>     | Attached                                     |
| 4. Recipient Resolution                             | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached            |
| 5. CEQA Documentation                               | <input type="checkbox"/> N/A            | <input checked="" type="checkbox"/> Attached |

\_\_\_\_\_  
**Agreement Manager**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Office Manager**

\_\_\_\_\_  
**Date**

\_\_\_\_\_  
**Deputy Director**

\_\_\_\_\_  
**Date**

## Exhibit A SCOPE OF WORK

### TECHNICAL TASK LIST

Task #	CPR	Task Name
1		Administration
2	X	Sub-Scale Wireless Power Transfer System
3		Full-Scale Wireless Power Transfer System
4	X	Wireless Power Transfer Integration into Locomotive
5		Data Collection and Analysis
6		Project Fact Sheet

### KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Dave Cook	N/A	N/A
2	Dave Cook	The University of North Carolina at Charlotte	
3	Dave Cook	The University of North Carolina at Charlotte	
4	Dave Cook	N/A	Coast Rail Services, Inc
5	Brian Yanity	N/A	N/A
6	Brian Yanity	N/A	N/A

### GLOSSARY

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

Term/ Acronym	Definition
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
Clean Transportation Program	Formerly known as Alternative and Renewable Fuel and Vehicle Technology Program
CPR	Critical Project Review
FTD	Fuels and Transportation Division
WESS	Wayside Energy Storage System
WPT	Wireless Power Transfer

## Background

Assembly Bill (AB) 118 (Núñez, Chapter 750, Statutes of 2007), created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change, clean air, and alternative energy policies. AB 8 (Perea, Chapter 401, Statutes of 2013) re-authorizes the Clean Transportation Program through January 1, 2024. The Clean Transportation Program has an annual budget of approximately \$100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and non-road vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

In the event of any conflict or inconsistency between the terms of the Solicitation and the terms of the Recipient's Application, the Solicitation shall control. In the event of any conflict or inconsistency between the Recipient's Application and the terms of CEC's Award, CEC's Award shall control. Similarly, in the event of any conflict or inconsistency between the terms of this Agreement and the Recipient's Application, the terms of this Agreement shall control.

## Problem Statement:

In the U.S. and California, there has been no demonstration of wireless power transfer (WPT) charging for powering locomotives. The U.S. railroad industry is unfamiliar with both battery-electric locomotives and WPT charging technology. The industry has not yet demanded WPT charging, as they are not yet using battery-electric locomotives on a commercial basis. Around the world, there is limited experience with the scale of WPT charging needed for locomotives, and no adopted standards. There also is currently no available WPT technology that can offer uninterrupted WPT for rail vehicle without creating electromagnetic radiation outside of the vehicle.

A technical disadvantage of WPT charging is its lower overall energy efficiency in electric power transfer to the rail vehicle compared to well-established technology of overhead catenary wire contact system for electric rail. The technology of WPT charging for battery-electric locomotives, and its costs, are unknown to the railroad industry. There is thus a great need for demonstration and testing of WPT in real-world heavy-rail applications, to establish acceptable performance, costs, reliability and safety practices for the industry.

### **Goals of the Agreement:**

The goal of this Agreement is to demonstrate a WPT locomotive charging station to allow the battery-electric locomotive to be charged wirelessly, by stopping the locomotive at any position along a short length of track for static charging at the rail yard. This will be the first step in a longer term demonstration of higher-power dynamic (or in-motion) WPT relevant to continuous battery switcher locomotive operations.

### **Objectives of the Agreement:**

The objectives of this Agreement are to build and test a working railyard WPT charging station that will successfully charge a battery-electric locomotive, and to provide data and analysis from extensive tests of the system in real-world railyard operating conditions.

## **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 Commission Agreement Manager (CAM) shall designate the date and location of this meeting and provide an agenda to the Recipient prior to the meeting.

#### **The Recipient shall:**

- Attend a “Kick-Off” meeting with the CAM, the Commission Agreement Officer (CAO), and a representative of the California Energy Commission (CEC) Accounting Office. The Recipient shall bring their Project Manager, Agreement Administrator, Accounting Officer, and any others determined necessary by the Recipient or specifically requested by the CAM to this meeting.
- Discuss the following administrative and technical aspects of this Agreement:
  - Agreement Terms and Conditions
  - Critical Project Review (Task 1.2)
  - Match fund documentation (Task 1.6) No reimbursable work may be done until this documentation is in place.
  - Permit documentation (Task 1.7)
  - Subcontracts needed to carry out project (Task 1.8)
  - The CAM’s expectations for accomplishing tasks described in the Scope of Work
  - An updated Schedule of Products and Due Dates
  - Quarterly Progress Reports (Task 1.4)
  - Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
  - Final Report (Task 1.5)

#### **Recipient Products:**

- Updated Schedule of Products
- Updated List of Match Funds
- Updated List of Permits

**Commission Agreement Manager Product:**

- Kick-Off Meeting Agenda

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

CPRs provide the opportunity for frank discussions between the CEC and the Recipient. The goal of this task is 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, products, schedule or budget.

The CAM may schedule CPR meetings as necessary, and meeting costs will be borne by the Recipient.

Meeting participants include the CAM and the Recipient and may include the CAO, the Fuels and Transportation Division (FTD) program lead, other CEC staff and Management as well as other individuals selected by the CAM to provide support to the CEC.

**The CAM shall:**

- Determine the location, date, and time of each CPR meeting with the Recipient. These meetings generally take place at the CEC, but they may take place at another location or remotely.
- Send the Recipient 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. Prepare 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, products, and/or budget for the remainder of the Agreement. Modifications to the Agreement may require a formal amendment (please see section 8 of the Terms and Conditions). If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Lead Commissioner for Transportation for his or her concurrence.
- Provide the Recipient with a written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more product(s) that were included in the CPR.

**The Recipient 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 Recipient shall submit these documents to the CAM 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.

**CAM Products:**

- Agenda and a list of expected participants

- Schedule for written determination
- Written determination

**Recipient Product:**

- CPR Report(s)

**Task 1.3 Final Meeting**

The goal of this task is to closeout this Agreement.

**The Recipient shall:**

- Meet with CEC 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 Recipient, the Commission Grants Office Officer, and the CAM. 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 CAM.

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 CAM will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the CAM and the Grants Officer about the following Agreement closeout items:

- What to do with any equipment purchased with CEC funds (Options)
  - CEC request for specific “generated” data (not already provided in Agreement products)
  - Need to document Recipient’s disclosure of “subject inventions” developed under the Agreement
  - “Surviving” Agreement provisions
  - Final invoicing and release of retention
- Prepare a schedule for completing the closeout activities for this Agreement.

**Products:**

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

**Task 1.4 Quarterly Progress Reports**

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement 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 Recipient shall:**

- Prepare a Quarterly Progress Report which summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the CAM within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in Section 6 of the Terms and Conditions of this Agreement.
- In the first Quarterly Progress Report and first invoice, document and verify match expenditures and provide a synopsis of project progress, if match funds have been expended or if work funded with match share has occurred after the notice of proposed award but before execution of the grant agreement. If no match funds have been expended or if no work funded with match share has occurred before execution, then state this in the report. All pre-execution match expenditures must conform to the requirements in the Terms and Conditions of this Agreement.

**Product:**

- Quarterly Progress Reports

**Task 1.5 Final Report**

The goal of the Final Report is to assess the project's success in achieving the Agreement's goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further projects and improvements to the FTD project management processes.

The Final Report shall be a public document. If the Recipient has obtained confidential status from the CEC and will be preparing a confidential version of the Final Report as well, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

**The Recipient shall:**

- Prepare an Outline of the Final Report.
- Prepare a Final Report following the latest version of the Final Report guidelines which will be provided by the CAM. The CAM shall provide written comments on the Draft Final Report within fifteen (15) working days of receipt. The Final Report must be completed at least 60 days before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.

**Products:**

- Outline of the Final Report
- Draft Final Report
- Final Report

### **Task 1.6 Identify and Obtain Matching Funds**

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the CEC budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of CEC funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient will request reimbursement.

#### **The Recipient shall:**

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the CAM at least 2 working days prior to the kick-off meeting. If no match funds were part of the proposal that led to the CEC awarding this Agreement and none have been identified at the time this Agreement starts, then state such in the letter. If match funds were a part of the proposal that led to the CEC awarding this Agreement, then provide in the letter a list of the match funds that identifies the:
  - Amount of each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
  - Amount of each in-kind contribution, a description, documented market or book value, and its 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 shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.
- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured. For match funds provided by a grant a copy of the executed grant shall be submitted in place of a letter of commitment.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the CAM if during the course of the Agreement additional match funds are received.
- Notify the CAM within 10 days if during the course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR meeting.

#### **Products:**

- A letter regarding match funds or stating that no match funds are provided
- Copy(ies) of each match fund commitment letter(s) (if applicable)
- Letter(s) for new match funds (if applicable)

- Letter that match funds were reduced (if applicable)

### **Task 1.7 Identify and Obtain Required Permits**

The goal of this task 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. Although the CEC budget for this task will be zero dollars, the Recipient shall budget match funds for any expected expenditures associated with obtaining permits. Permits must be identified in writing and obtained before the Recipient can make any expenditure for which a permit is required.

#### **The Recipient shall:**

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the CAM at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
  - A list of the permits that identifies the:
    - Type of permit
    - Name, address and telephone number of the permitting jurisdictions or lead agencies
  - The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule and the copies of the permits. The implications to the Agreement 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 the Progress Reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, provide the appropriate information on each permit and an updated schedule to the CAM.
- As permits are obtained, send a copy of each approved permit to the CAM.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 working days. Either of these events may trigger an additional CPR.

#### **Products:**

- Letter documenting the permits or stating that no permits are required
- A copy of each approved permit (if applicable)
- Updated list of permits as they change during the term of the Agreement (if applicable)
- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable)

- A copy of each final approved permit (if applicable)

### **Task 1.8 Obtain and Execute Subcontracts**

The goal of this task is to ensure quality products and to procure subcontractors required to carry out the tasks under this Agreement consistent with the Agreement Terms and Conditions and the Recipient's own procurement policies and procedures. It will also provide CEC an opportunity to review the subcontracts to ensure that the tasks are consistent with this Agreement, and that the budgeted expenditures are reasonable and consistent with applicable cost principles.

#### **The Recipient shall:**

- Manage and coordinate subcontractor activities.
- Submit a draft of each subcontract required to conduct the work under this Agreement to the CAM for review.
- Submit a final copy of the executed subcontract.
- If Recipient decides to add new subcontractors, then the Recipient shall notify the CAM.

#### **Products:**

- Letter describing the subcontracts needed, or stating that no subcontracts are required
- Draft subcontracts
- Final subcontracts

## **TECHNICAL TASKS**

### **TASK 2 SUB-SCALE WIRELESS POWER TRANSFER DESIGN AND TEST**

The goal of this task is to design and fabricate a 'scaled prototype' WPT system that will be tested in a laboratory environment. The design process will involve computer simulations, circuit board designs and required iteration of subsystems.

#### **The Recipient shall:**

- Design a rolling test fixture to simulate locomotive chassis and rails for system testing at workshop and generate a bill of materials.
- Develop a *Sub-scale Simulation and Preliminary Design Report*. Provide a copy to the CAM.
- Develop model and run simulations of the reduced scaled WPT system, including, but not limited to, the power electronics system and magnetic coil simulations.
- Determine appropriate magnetic core layout and materials for the reduced scale system.
- Design high frequency inverter, inductance network tuning, capacitance tuning network, and transmitter interface circuit schematics and their printed circuit board manufacturing files for the reduced scale system.

- Order materials and fabricate the workshop based rolling test fixture.
- Order printed circuit boards and electronics material for the reduced scale WPT power electronics.
- Order conductors, core materials and structural materials for transmitter and receiver assemblies for the reduced scale WPT system.
- Build up reduced scale power electronics and bench test sub systems.
- Build up reduced scale transmitter and receiver assemblies.
- Assemble reduced scale WPT system to rolling test fixture.
- Function and performance test the reduced scale WPT system at the Fullerton workshop, or other appropriate location. Any change in location from the Fullerton workshop must be approved in advance by the CAM, in writing.
- Draft a *Sub-scale Performance Test Report*. Provide a copy to the CAM.
- Draft a *Final Sub-scale Test Report*. Provide a copy to the CAM.

**Products:**

- Sub-Scale Simulation and Preliminary Design Report
- Sub-Scale Performance Test Report
- Final Sub-scale Test Report

**TASK 3 FULL-SCALE WIRELESS POWER TRANSFER SYSTEM DESIGN AND TEST**

The goal of this task is to iterate the sub-scale WPT system into a full-scale WPT system that is capable of operating outdoors and being mounted underneath a locomotive. The system will be tested on a rolling test fixture at the Fullerton workshop to verify it can transfer 75kW of power., The test may be conducted at another appropriate location. Any change in location from the Fullerton workshop must be approved in advance by the CAM, in writing.

**The Recipient shall:**

- Develop a *Full-Scale Simulation and Preliminary Design Report*. Provide a copy to the CAM.
- Develop model and run simulations of the full size 75kW WPT system, including the power electronics system and magnetic coil simulations.
- Determine appropriate magnetic core layout and materials for the 75kW system.
- Design high frequency inverter, inductance network tuning, capacitance tuning network, and transmitter interface circuit schematics and their printed circuit board manufacturing files.
- Order conductors, core materials and structural materials for transmitter and receiver assemblies for the 75kW WPT system.
- Build 75kW power electronics and bench test sub systems.
- Build 75kW scale transmitter and receiver assemblies.
- Assemble 75kW WPT system to rolling test fixture.
- Temporarily install wayside energy storage system at workshop.

- Function and performance test the scale WPT system at Fullerton workshop demonstrating continuous power transfer of at least 40kW for 15 minutes (time is limited by available battery energy storage). The test may be conducted at another appropriate location. Any change in location from the Fullerton workshop must be approved in advance by the CAM, in writing.
- Draft a *Full-Scale Performance Test Report*. Provide a copy to the CAM.
- Draft a *Final Full-Scale Test Report*. Provide a copy to the CAM.

**Products:**

- Full-scale Simulation and Preliminary Design Report
- Full-scale Performance Test Report
- Final Full-scale Test Report

**TASK 4 INTEGRATION OF WPT SYSTEM ONTO BATTERY LOCOMOTIVE**

The goal of this task is to integrate the full scale WPT system onto a battery locomotive, install ground-based equipment to support the system, and then test and evaluate the prototype WPT charging station at railyard under real-world locomotive service conditions.

**The Recipient shall:**

- Design and Fabricate a mounting structure to mount the 75kW WPT receiver to a suitable test locomotive.
- Design and install required power electronics and modified control system to receive WPT receiver power and charge the locomotive battery system.
- Install 75kW WPT receiver unit on locomotive and connect to high voltage system.
- Install required Wayside Energy Storage System (WESS) at test track location.
- Install 75kW WPT transmitters in track section at Coast Rail Services in Anaheim or other appropriate test location. Any change in test location from Coast Rail Services must be approved by the CAM, in writing.
- Submit an AB 841 Certification that certifies the project has complied with all AB 841 (2020) requirements specified in Exhibit C or describes why the AB 841 requirements do not apply to the project. The certification shall be signed by Recipient's authorized representative.
- Submit EVITP Certification Numbers of each Electric Vehicle Infrastructure Training Program certified electrician that installed electric vehicle charging infrastructure or equipment. EVITP Certification Numbers are not required to be submitted if AB 841 requirements do not apply to the project.
- Conduct a function and performance test on the 75kW system demonstrating continuous power transfer for an hour (time limited by wayside battery storage).
- Complete a Locomotive Control System and Charging System Update Report and provide a copy to the CAM.

- Prepare Testing and Evaluation Reports for Laboratory and Railyard Testing of the WPT Charging System. The Testing and Evaluation Reports shall include, but is not limited to, the following:
  - The Test Plan
  - Test results
  - Analysis
  - Conclusions
  - Recommendations
  - Graphics and photographs as appropriate
- Provide photos of the locomotive receiver installation and railyard charging station upgrade to the CAM.

**Products:**

- Locomotive Control System and Charging System Update Report
- AB 841 Certification and EVITP Certification Numbers
- Testing and Evaluation Reports for Laboratory and Railyard Testing of the WPT Charging System
- Photos of Locomotive Receiver Installation
- Photos of Railyard Charging Station Upgrade

**TASK 5 PROJECT FACT SHEET**

The goal of this task is to develop an initial and final project fact sheet that describes the CEC-funded project and the benefits resulting from the project for the public and key decision makers.

**The Recipient shall:**

- Prepare an Initial Project Fact Sheet at start of the project that describes the project and the expected benefits. Use the format provided by the CAM.
- Prepare a Final Project Fact Sheet at the project's conclusion that describes the project, the actual benefits resulting from the project, and lessons learned from implementing the project. Use the format provided by the CAM.
- Provide at least (6) six High Quality Digital Photographs (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

**Products:**

- Initial Project Fact Sheet
- Final Project Fact Sheet
- High Quality Digital Photographs

## Task 6 DATA COLLECTION AND ANALYSIS

The goal of this task is to collect operational data from the project, to analyze that data for economic and environmental impacts, and to include the data and analysis regular progress reports and the Final Report.

### The Recipient shall:

- Collect and provide the following data:
  - Number, type, date and location of chargers installed
  - Nameplate capacity of the installed equipment, in kW for chargers
  - Number and type of outlets per charger.
  - Location type, such as street, parking lot, hotel, restaurant or multi-unit housing
  - Total cost per charger, the subsidy from the CEC per charger, federal subsidy per charger, utility subsidy per charger, and privately funded share per charger
- Collect and provide 12 months of throughput, usage, and operations data from the project including, but not limited to:
  - Number of charging sessions
  - Average charger downtime
  - Peak power delivered (kW)
  - Duration of active charging, hourly
  - Duration of charging session, hourly (e.g., vehicle parked but not actively charging)
  - Average session duration
  - Energy delivered (kWh)
  - Average kWh dispensed
  - Types of vehicles using the charging equipment
  - Applicable price for charging, including but not limited to: electric utility tariff, EVSP service contract, or public charger price.
  - Payment method for public charging
  - Energy delivered back to grid or facility if a bidirectional charging use case (kWh)
  - Maximum capacity of the new fueling system
  - Normal operating hours, up time, downtime, and explanations of variations
  - Gallons of gasoline and/or diesel fuel displaced (with associated mileage information)
  - Expected air emissions reduction, for example:
    - Non-methane hydrocarbons



- Oxides of nitrogen
- Particulate Matter
- Formaldehyde
- Duty cycle of the current fleet and the expected duty cycle of future vehicle acquisitions
- Identify any current and planned use of renewable energy at the facility.
- Identify the source of the alternative fuel.
- Describe any energy efficiency measures used in the facility that may exceed Title 24 standards in Part 6 of the California Code Regulations.
- Provide data on potential job creation, economic development, and increased state revenue as a result of expected future expansion.
- Provide a quantified estimate of the project's carbon intensity values for life-cycle greenhouse gas emissions.
- Compare any project performance and expectations provided in the proposal to CEC with actual project performance and accomplishments.

**Products:**

- Data collection on charging events will be submitted electronically in data collection reports as specified in Item 6 on Exhibit A-1 – Schedule of Products and Due Dates.
- Data collection information and analysis will be included in the Final Report.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: RAIL PROPULSION SYSTEMS LLC

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

**RESOLVED**, that the CEC approves Agreement ZVI-21-008 with Rail Propulsion Systems LLC for a \$270,000 grant to demonstrate a wireless power transfer locomotive charging station to allow a battery-electric locomotive to be charged wirelessly, by stopping the locomotive at any position along a short length of track for static charging at the rail yard; and

**FURTHER BE IT RESOLVED**, that the Executive Director or their designee shall execute the same on behalf of the CEC.

**CERTIFICATION**

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the CEC held on December 8, 2021

AYE:

NAY:

ABSENT:

ABSTAIN:

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Liza Lopez  
Secretariat