

VoICE-MR: Vocation Integrated Cost Estimation for Maintenance and Repair of Alternative Fuel Vehicles (AFV)

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Funding Partners

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- Southern California Gas Company: Michael Lee

Project Partners

- Wale and Associates Corp.: Adewale Oshinuga
- WCROG: Meifung Wu, Taylor York, Tyler Masters
- CFO: Tim Cho, Megan Stein, Andrew Conley
- PRCC: Richard Price
- WV Clean Cities: Kelley Bragg
- PERC: Joe Calhoun, Gokul Vishwanath, Stephen Whaley

The project team would like to extend our appreciation to all the participating fleets, for their enthusiasm and commitment to sharing data.

OVERVIEW

Timeline

Project Start: November 2020

Project End: December 2023

Budget Period 1: Nov 2020-Dec 2021

Budget Period 2: Jan 2022-Dec 2022

Budget Period 3: Jan 2023- Dec 2023

Percent Complete: ~30%

Barriers

1. Lack of detailed maintenance cost (MC) comparison between heavy-duty diesel and alternative fuel vehicles (AFV) across different vocation and geographical regions
2. Gap in knowledge related to the influence of duty-cycle on MC estimates of AFV
3. Gap in knowledge related to MC of AFVs in regions with high seasonal temperature changes

Budget

Budget Period 1: Federal: \$445,947; Cost Share: \$445,867

Budget Period 2: Federal: \$335,045; Cost Share: \$336,076

Budget Period 3: Federal: \$304,690; Cost Share: \$304,609

Total: Federal: \$1,085,682; Cost Share: \$1,090,552

Coalition Partners



Wale & Associates Corp.

Funding Partners



PROJECT OBJECTIVES

	Objectives	VTO TI Goals	Impact
Budget Period 1	<ul style="list-style-type: none">• Conduct an in-depth survey of heavy-duty (HD) fleets operating in various vocations to collect maintenance records for diesel and AFV vehicles• Analyze vehicle telemetry data to discern the effects of duty on MC of AFVs in different vehicle vocations• Understand the impact of extreme seasonal temperature changes on the MC of AFV• Develop the VoICE-MR estimation model to deliver comparative MC estimates between Diesel and AFV as a function of vehicle duty cycle.	<ul style="list-style-type: none">• Improving Fuel Diversity Provide an accurate estimate of MC for AFV in different vocation, that will help offset existing diesel vehicles with domestically sourced alternative fuel options	<ul style="list-style-type: none">• Empower fleets with accurate data to transition from diesel fuel to domestic alternative fuel powertrain technology• Improve fleet decision making related to selection of appropriate AFV technology for a certain vocation/duty-cycle• Illustrate maintenance practices and climate effects that can adversely affect MC of AFV powertrain

PROJECT APPROACH

Budget Period 1

- Task 1.1- Project Initiation, Fleet Identification and Working Agreements
 - Forming steering committee
 - Identify target fleets for data collection
 - Develop data sharing agreements
- Task 1.2- Fleet Maintenance Cost Data Collection
 - Develop a web interface for data gathering
 - Engage coalition partners and subcontractors for data collection activity

Budget Period 2

- Task 2.1- Data Classification and Analysis
 - Analyze telemetry data from archive data and from BP-1 data collection
 - Classify MC data as a function of vehicle vocation
 - Analyze the MC data to study the changes in MC with seasonal temperature changes
 - Assess changes in MC with vehicle aging

Budget Period 3

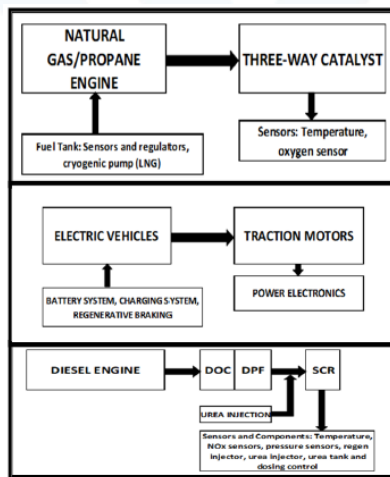
- Task 3.1- VoICE-MR Model Development and Cost Reduction Strategies
 - Develop a machine learning model to estimate MC of AFV as a function of vehicle duty-cycle
 - Provide comparative cost estimates for maintenance between diesel and AFV for different vocations

PROJECT APPROACH

Budget
Period

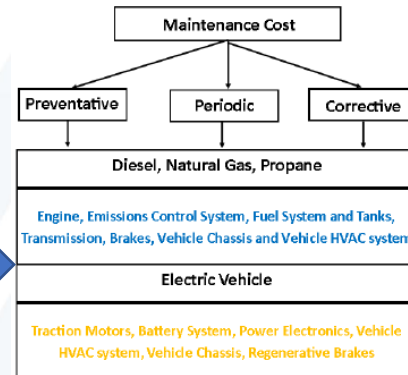
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Vehicle Telemetry Vocation-Based Duty-Cycle Data

1. Data from 100 vehicles (Southern California based) available as part of a South Coast Air Quality Management District (SCAQMD) funded project
2. Additional telemetry data collected from other regions of the country (South Carolina, Pittsburgh, Midwest regions)



PROJECT APPROACH

Budget Period 1	Milestone	Type	Description	Progress
	Steering committee approval for number of fleets (with working agreements), fleet composition, diversity of fleet vocations and range of vehicle model years.	Technical	Steering committee will evaluate if the participating fleets span all major vocations noted in the proposal, cover a wide range of vehicle model years, and it covers all vehicle classes in MD and HD category	Completed
	Collect maintenance information and develop a database for data analysis	Technical	Database should be populated with data from all participating fleets for at least 4 months	Completed
	Collect maintenance information from targeted fleets and develop a database for data analysis	Technical	Every maintenance operation performed by the fleets for at least 12 months is verified.	In-Progress
	Successful collection of maintenance cost data through the web portal	Go/No Go	100% of the maintenance data collected.	In-Progress

PROJECT ACCOMPLISHMENT AND PROGRESS

Task 1.1- Project Initiation, Fleet Identification and Working Agreements

Task 1.1.1- Steering Committee

- Steering committee with representatives from Original Equipment Manufacturer (OEM), regulatory agencies, alternative fuel stake holders was formed.

Due to contractual delays and signing subaward agreements, a No-Cost Extension for a period of 6-months ending **June 30, 2022**, was processed for BP-1

Task 1.1.2- Identify Target Fleets for Data Collection

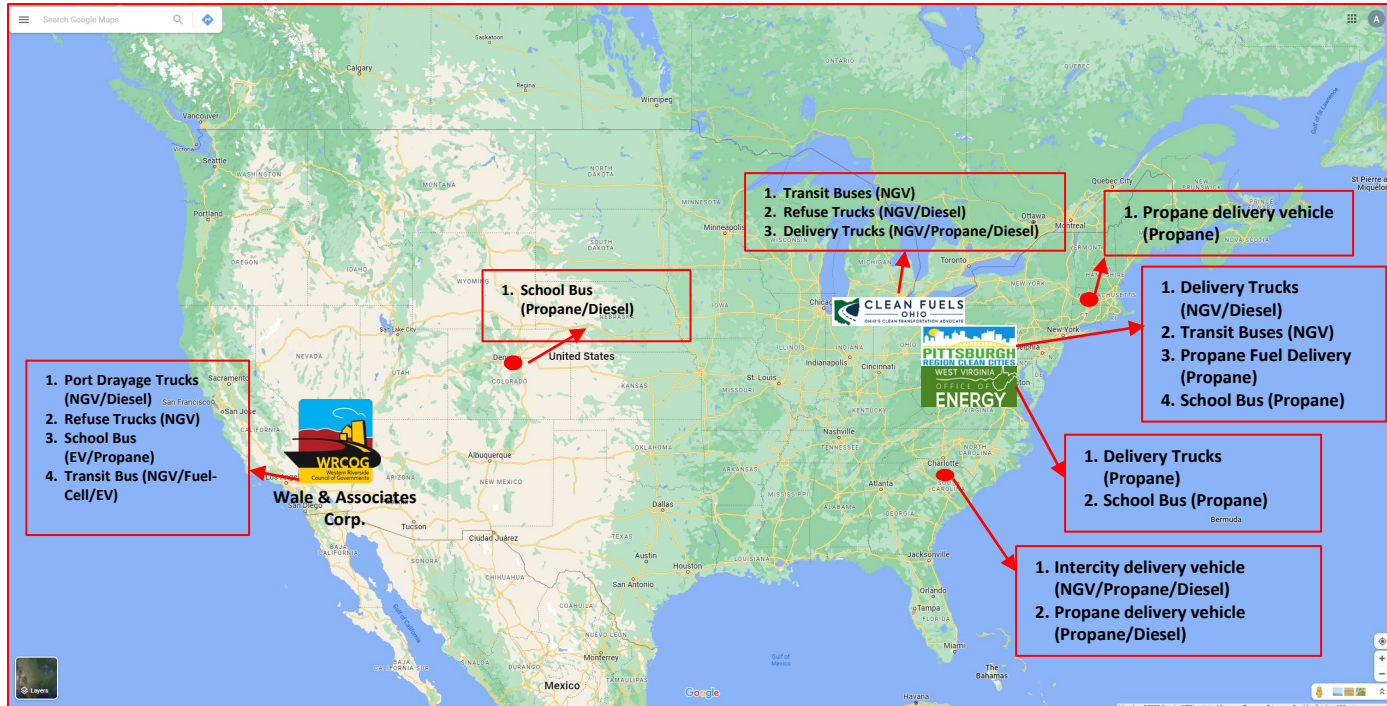
- WVU List of California fleets from a previous project funded by SCAQMD
- Propane Education Research Council (PERC) was engaged to identify a list of propane fleets in different vocations
- Target list attempted to cover all broad vocations (Transit bus, Refuse Truck, Goods Movement, School bus, and Urban Delivery Applications)
- In addition, we have identified Para-Transit as a vocation for Propane Vehicles

Task 1.1.3- Develop Data Sharing Agreements

- The project has developed data sharing agreements with all target fleets
- We are continuously identifying newer fleets to increase the diversity in the maintenance cost data
- Clean Cities Coalition have engaged fleets in their respective geographical location and managing the data collection activity

PROJECT ACCOMPLISHMENT AND PROGRESS

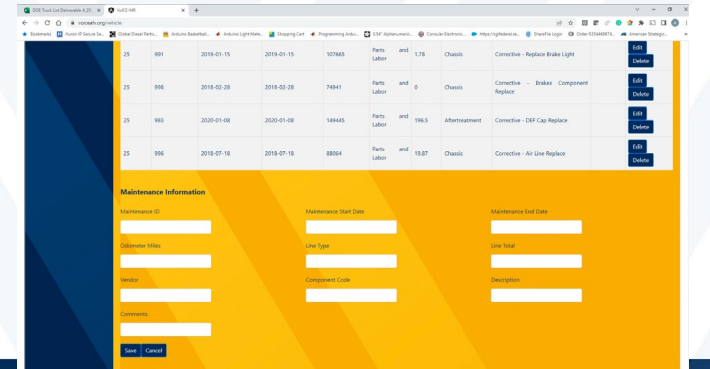
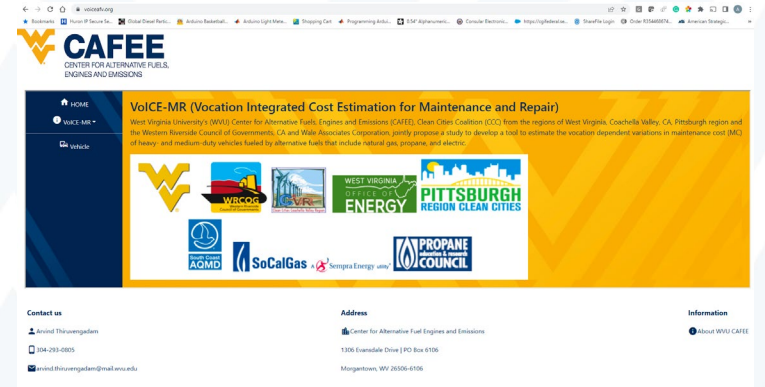
Task 1.1- Project Initiation, Fleet Identification and Working Agreements



PROJECT ACCOMPLISHMENT AND PROGRESS

Task 1.2- Fleet Maintenance Cost Data Collection

- Website for project updates and data input was developed and database hosted on Amazon Web Service
 - <https://voiceafv.org>
- Data collection from 7 fleets across 6 different regions of the country is underway
- We have received maintenance records from a total of 200 vehicles
 - NGV: 13.5%
 - Diesel: 49%
 - Propane: 36%
 - EV:1.5%
- Vocations Covered: Port drayage, urban delivery, intercity delivery, school bus
- Delays in subaward agreements with Clean Cities Partners has resulted in slower participation from coalitions
 - We expect the coalitions to fill the gaps in vocation and AFV technology before the end of BP1
- Telemetry data collection from mail delivery application in South Carolina was completed
- Telemetry data collection from Propane delivery vehicles in South Carolina was completed



COLLABORATION AND COORDINATION AMONG PROJECT TEAM



CONTRIBUTION TO ENERGY EQUITY AND ENVIRONMENTAL JUSTICE

Impact

- The project will address the gaps in knowledge related to wide-scale adoption of AFVs in rural regions of the country
- Increase the use of domestic and cleaner fuels in heavy-duty vocations not restricted to urban locations

Current and Future Project Goals

- The project team plans to continuously expand fleet identification and data collection even beyond BP-1
- The project team will focus on geographical locations with greater potential for AFV penetration.

Challenges

- Collecting sufficient maintenance records for mix of fuel types and vocations
- Sufficient resolution in maintenance activity to discern the impact of seasonal temperature changes

SUMMARY

GOALS

- Address the knowledge gap related to the impact of duty-cycle on MC of AFV
- Develop the VoICE-MR cost estimation model to empower fleets with a tool to help in adoption of AFVs

APPROACH

- In-depth MC data collection from fleets across the country, covering various vocations
- Collect new and use historical telemetry data to link vehicle activity to collected MC data
- Use the relationships to build a machine learning based model to estimate MC as a function of vehicle duty cycle

PARTNERS

- Four Clean Cities Coalitions
- South Coast Air Quality Management District
- Alternative Fuels Stake holders
- Steering committee comprised of public and private sector members

Achievements

- A total of 135,000 maintenance records have been collected
- Vehicle model years range from 2008-2018
- Historical maintenance records span from 2015-2021.
- New telemetry data from vehicle operation in the east coast of US collected