Fostering the Use of Zero and Near Zero Emission Vehicles in Freight Operations Dataset

Dataset available at: https://doi.org/10.25338/B8MC8W

(This dataset supports report **Fostering the Use of Zero and Near Zero Emission Vehicles in Freight Operations**)

This U.S. Department of Transportation-funded dataset is preserved by the University of California in the digital repository Dryad (https://datadryad.org/), and is available at https://doi.org/10.25338/B8MC8W.

The related final report **Fostering the Use of Zero and Near Zero Emission Vehicles in Freight Operations**, is available from the National Transportation Library's Digital Repository at https://rosap.ntl.bts.gov/view/dot/54694.

Metadata from the Dryad Repository record:

Abstract:
California has put forward a number of goals to improve freight efficiency through the introduction and use of zero and near-zero emission vehicles. However, the technical and operational characteristics, market readiness, and other factors related to these technologies can be very different. Therefore, the most appropriate option for different uses (e.g., last mile, long-haul distribution) and users' preferences is not necessarily clear. This study focused on analyzing the factors to foster the adoption of zero and near-zero emission vehicles. Building on previous analyses that showed that besides the intensity of use of the vehicles, purchase price, and maintenance and operational costs, different types of incentives (monetary and non-monetary) could be a determinant factor to foster their adoption and use. Therefore, it is important to understand the behaviors and attitudes of freight stakeholders to define adequate incentives programs.

This study explored different incentives programs in California and reviewed the literature to identify other potential types of incentives to foster a change. Based on the review, the team developed a stated preference survey to collect information from fleets and carrier companies about their economics, and their vehicle purchase preferences, and to test their behavioral perceptions towards those types of incentives. The team deployed the survey in two different waves targeting, first the members of the largest transportation association in California, and second, to a sample of carrier companies. However, the response rate was very small which limited the type of analyses that could be conducted with the data. Alternatively, the team developed a multi-criteria decision making (MCDM) tool using a Spherical Fuzzy Analytical Hierarchy Process based on experts' knowledge. The model provides insights about the most appropriate options for different uses (e.g., last mile, long-haul distribution). This study considered diesel, compressed (renewable) natural gas (CNG/RNG), hybrid electric (HE), battery electric (BE) and fuel-cell hydrogen (H2) vehicles. The model evaluates the alternatives using five criteria: economic; business, incentives & market-related; environmental & regulatory; infrastructure; and safety & vehicle performance factors. It also considers twenty-one sub-criteria, e.g., total cost of ownership, payback period, brand image, financial & non-financial incentives, and public/private fueling/ charging infrastructure availability.

The study highlighted a number of important considerations for study development and for the analysis of incentive programs.

- Data collection: The study evidenced challenges in collecting behavioral data from businesses and fleets. More importantly, the data collection effort was conducted during a period where one of the major regulatory agencies was in the midst of developing the ACT Program, which will have tremendous implications for vehicle manufactures and fleets (small and large). Other ongoing studies in related areas during the same period experienced similar challenges. The California Vehicle Inventory User Survey (CalVIUS) is an exception; however, this survey required very large budgets and resources (of orders of magnitude larger than the current study).

- Companies perceptions towards Zero-emission vehicles: The small sample showed that companies are not necessarily interested in zero emission vehicles, and for the next vehicle purchase the preferred alternative are still diesel vehicles. The results of the MCDM based on expert judgments exhibited similar patterns, with Diesel vehicles being the key alternative.

- Incentives and other vehicle purchase determinant factors: The responses showed that companies, for the most part, are not aware of the various incentives programs available to renew their fleets. Both the sample and the MCDM show that economic and financial factors are the most important factors when making purchase decisions, while environmental and regulatory having less importance. However, the results show that there is an acknowledgement that under a stricter environmental regulatory environment the preferred choices are battery electric and fuel cell vehicles. The MCDM indicated that availability of maintenance and repair shops, and depot charging/fueling infrastructure are also critical factors, even more so than fueling and charging times.

Considering that the preferred alternative are diesel vehicles, incentives do not seem to affect much the ultimate choice. For these vehicles, there are no incentives. If non-financial incentives are to be used, they have a relative weight to be about 25% lower than for financial incentives.

Overall, these results show on one hand the challenges to foster the use of zero emission vehicles, where the CCR values are almost half than for the preferred alternative. On the other hand, well-structured regulatory programs that incentivize environmental metrics, promote the technologies and support industries (repair, charging infrastructure) can have a positive impact over vehicle choices.

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Methods:
1. Stated-Preference Data: Collected through and online (Qualtrics) survey. The data was collected in two deployments during the first semester (1st deployment) and the summer of 2019

(2nd deployment). The team received approval (exemption from IRB). The data has no business identifier.

2. Expert Assessment Data: The team developed a collected data from three experts about pairwise comparisons among determinants and factors for vehicle technology assessment. The data helped implement a Multi-Criteria Decision-Making (MCDM) tool based on a Spherical Fuzzy Analytical Hierarchy Process model.

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Dataset description:
This dataset contains 1 .zip file collection below.

doi_10.25338_B8MC8W_v4.zip:
The .zip file collection contains 3 .xlsx files described below.
- NCST_Zero_Emission_Vehicle_Incentive_Program_Second-Deployment_v2.xlsx
- NCST_Zero_Emission_Vehicle_Incentive_Program_First-Deployment_v2.xlsx
- Expert_Assessments.xlsx

The .xlsx file is a Microsoft Excel file, which can be opened with Excel, and other free available software, such as OpenRefine.

National Transportation Library (NTL) Curation Note:
As this dataset is preserved in a repository outside U.S. DOT control, as allowed by the U.S. DOT's Public Access Plan (https://doi.org/10.21949/1503647) Section 7.4.2 Data, the NTL staff has performed *NO* additional curation actions on this dataset.

NTL staff last accessed this dataset at https://doi.org/10.25338/B8MC8W on 2021-03-10.

If, in the future, you have trouble accessing this dataset at the host repository, please email NTLDataCurator@dot.gov describing your problem. NTL staff will do its best to assist you at that time.