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Project Title: Review and Analysis of Current and Future Battery Technologies for Transit Electric Vehicles

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Review and Analysis of Current and Future Battery Technologies for Transit Electric Vehicles

Develop a guide to better understand the current and future battery technologies for medium-duty and heavy-duty vehicles and how that translates to transit.

WHAT IS THE NEED?

California Air Resources Board (CARB) mandated the Innovative Clean Transit (ICT) regulation. CARB's ICT regulation requires transit agencies to purchase 100% zero-emission vehicles (ZEV) by 2029, with ZEVs required to comprise increasing percentages of annual new bus purchases until then, and fully convert their fleets to ZEVs by 2040. California transit agencies are therefore spending hundreds of millions of dollars on purchasing such ZEVs, which today cost approximately twice as much as their Compressed Natural Gas (CNG) counterparts. These vehicles are run on battery and hydrogen fueling systems that are constantly evolving, seeing new and exciting technologies invented at a rapid pace. Some of these technologies are steady state batteries and other forthcoming advances could extend vehicle range, lengthen battery life, and shorten charging times sufficiently to make battery-electric buses a feasible option for a broader range of transit services, such as routes that are longer or traverse hilly terrain. At the same time, the cost of hydrogen has plateaued after years of falling prices. Transit agencies therefore are facing a lot of uncertainty as to which type of bus to purchase, with this choice deciding how substantial amounts of funding will be spent and having a significant impact on the future of their services.

WHAT ARE WE DOING?

The research is focusing on three goals to accomplish the goal of providing a guide to better understand the current and future use of battery technologies. The first goal is providing a literature search on the existing and near term (approximately 5 years) medium-duty and heavy-duty vehicles available, the infrastructure support, and costs. The researcher plans on



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comparing the results with the corresponding diesel technology and how all of this can be applied to transit.

The second goal is to focus on the infrastructure support for the electric vehicles. Unlike personal vehicles, medium-duty and heavy-duty vehicles do not have the ability to use the existing charging infrastructure and being able to be charged at “home” at the end of the day. The researchers plan on identifying possible solutions for building charging stations for trucks and transit vehicles. The plan is to focus on truck routes in the Los Angeles County region as an example to identify infrastructure requirements.

The third goal is to focus on the planning, charging, and routing of the medium-duty and heavy-duty vehicles to maximize the benefits of operating electric vehicles over diesel vehicles. The researchers will review heavy duty electric vehicle routing and scheduling approaches which can be used to satisfy the constraints imposed by current and advanced battery technologies to minimize operating costs. The research will identify methods to make changes to routing decisions to minimize overall cost under the constraints of charging station locations, charging times, and range.

WHAT IS OUR GOAL?

The goal of this research is to provide a summary of the role of current and advanced batteries in the design, operation and charging, and cost of heavy-duty trucks from 2025 through 2040. The research will also address how the new advanced battery technologies impact the versatility and costs of each vehicle type, and which types of heavy-duty vehicles will benefit most from and be more suitable for use of the advanced batteries.

WHAT IS THE BENEFIT?

The product will be a report that answers some questions regarding zero-emission vehicles and outlines which types of technologies are more

appropriate in which service environments as compared to others. It will give detailed explanations of the cutting-edge technologies and how they may impact the capabilities of and market for electric buses.

This resulting research report will hopefully give a better understanding of the medium-duty and heavy-duty electric technology that will be able to translate to transit. The benefit might lead to future research and help drive the conversation with policy makers, transit agencies, and the transit research community.

WHAT IS THE PROGRESS TO DATE?

Completed review of current battery technologies which is Task 1 (Literature Review) and part of Task 2 (Infrastructure Support) which is about future projections of advanced battery technologies.