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Moving Towards the Electrification of Medium- and Heavy-Duty Vehicles in the Inland Empire

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Introduction

The Inland Empire (IE) in Southern California, comprising San Bernardino and Riverside counties, is a significant logistics hub critical to both the state and national economies. Known for its extensive transportation and warehousing industries, the IE supports goods movement from the nearby ports of Los Angeles and Long Beach, facilitated by a vast network of freeways. However, the region faces severe environmental challenges due to the high concentration of medium- and heavy-duty vehicles (MDHDVs), which contribute significantly to air pollution and greenhouse gas emissions. The transition to a zero-emission vehicle (ZEV) MDHD fleet in the IE is essential for more sustainable and equitable growth in the region. This study provides a blueprint for planning the transition of MDHDVs in the IE, considering factors such as infrastructure development, technological advancements, economic impacts, and social equity to ensure a sustainable and inclusive transformation.

Study Methods

This study employs a mixed-methods approach to explore the transition to zero-emission MDHDV within the IE, focusing on the development of EV charging infrastructure. This methodology integrates a systematic literature review and policy analysis, geospatial analysis, big data analytics, and interviews to provide an overview of the interactions between government policy, market dynamics, and social equity considerations. The literature review and analysis scrutinize federal, state, and regional policies that influence the ZEV transition in order to delineate policy landscape, helping to contextualize the infrastructural and regulatory frameworks affecting MDHD EV adoption in the IE. The geospatial analysis, conducted with ArcGIS Pro, maps the 27,000 square mile area of the IE. Hexagonal tessellation ensures uniform analysis units across the region, facilitating a detailed examination of traffic patterns, infrastructure capabilities, and optimal locations for EV charging stations based on logistical needs and spatial equity.

This study also utilizes big data from several sources to analyze traffic flows, vehicle dwell times, and the spatial distribution of industries and businesses. This analysis identifies strategic points for EV

charging facilities. Finally, interviews with 16 regional experts from government and business validate the quantitative data and offer insights into stakeholder perspectives on economic impacts, social equity, and practical challenges in implementing MDHD EV infrastructure. By synthesizing these methodologies, the study offers a robust analytical framework that captures the complex dynamics of the transition of the MDHD fleet to electric vehicles.

Findings

The transition to ZEVs in the Inland Empire illustrates the complex interplay of market creation, where both supply and demand are nurtured simultaneously through strategic initiatives. Findings reveal that understanding vehicular traffic and usage patterns across different regions is pivotal for effective infrastructure development. This study's regional analysis shows distinct disparities in readiness and needs across various subregions. For example, areas with dense logistics activities require robust charging networks to manage high volumes of MDHDVs. In contrast, more suburban and rural areas need strategic placement of fewer, but critical, charging points to cater to long-haul routes that traverse these regions.

Furthermore, the findings stress the importance of incorporating social equity considerations into the transition. Currently, there is a significant risk of exacerbating socio-economic disparities through uneven access to the emerging ZEV infrastructure. Areas with higher economic activity and better initial infrastructure are positioned to transition more smoothly, but economically disadvantaged areas could be further burdened if a concerted effort to bring them along is not made. This highlights the requirement for policies that ensure equitable distribution of resources and infrastructure development, and a strong outreach campaign that educates and provides needed resources.

Policy Recommendations

Our findings lead to several policy recommendations. First, we advocate for targeted financial incentives for small and independent MDHDV operators to alleviate the economic hurdles of acquiring ZEVs and setting up charging infrastructure. Also, clear, consistent, bilingual messaging in English and Spanish will ensure community members are well-informed about the ZEV transition and promote an inclusive and equitable shift. Second, forming public-private partnerships will expedite the establishment of EV charging stations. The strategic placement of these stations in high-traffic areas and logistics hubs will maximize their utility and accessibility. Moreover, regional policies should encourage integrating renewable energy into the power grid to accommodate the additional demands from EV charging stations, enhancing environmental benefits and ensuring energy sustainability. Finally, continuous support and training programs are essential for workforce development in the ZEV sector. Workers need to be equipped with skills to foster economic resilience in the region. By addressing these multifaceted challenges through targeted policy interventions and inclusive planning, the Inland Empire can ensure a balanced and equitable transition to a sustainable zero-emission transportation ecosystem.

About the Authors

Dr. Kimberly Collins, an expert in regional planning, equity, and sustainability, leads our research team with a focus on innovative transportation solutions. Dr. Raffi Der Wartanian specializes in data analytics and policy impact assessments. Dr. Francisca Beer brings expertise in the economic implications of environmental policies, and Dr. Yunfei Hou contributes with his deep knowledge of data analysis and technological applications in transportation.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2305.1

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