CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Medium- and Heavy-Duty Hydrogen Vehicle and Fueling Station Rollout for Riverside County

Prepared for: California Energy Commission

Prepared by: Avina Clean Hydrogen Inc

AVINA CLEAN HYDROGEN INC.

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PREFACE

Assembly Bill 118 (Nuñez, Chapter 750, Statutes of 2007) created the Clean Transportation 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 policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $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.
- 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.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued GFO-20-601, entitled "Medium and Heavy-Duty Hydrogen Vehicle and Fueling Station Rollout Blueprint for Riverside County." In response to GFO-20-601, the recipient submitted an application that was proposed for funding in the CEC's notice of proposed awards on August 16, 2021, and the agreement was executed as ZVI-22-008 on August 10, 2022.

ABSTRACT

The transportation sector across the United States is transitioning towards a sustainable option, and clean hydrogen has emerged as an alternative option for decarbonizing this sector. This report has been developed to support this transition. The report aims to provide a comprehensive blueprint for successfully deploying medium and heavy-duty hydrogen refueling stations across Riverside County in California. It captures the potential demand for hydrogen refueling stations within the region by considering the increase in hydrogen-based fleet adoption rate, available grants and incentives, and supportive regulations at both the state and federal levels. The report identifies strategic locations within the region that are most feasible for expanding the hydrogen refueling station network by considering the necessary infrastructure required, transportation routes, environmental aspects, and community benefits. A comprehensive rollout plan for the hydrogen refueling stations has also been developed to support the adoption of hydrogen-powered vehicles.

Furthermore, the report analyzes potential job creation opportunities, skillsets required, salaries, and benefits for disadvantaged communities, low-income communities, priority populations, and/or tribal lands. It also offers a set of recommendations and best practices for establishing and operating hydrogen refueling stations across California.

This report has been developed through active engagements with regional authorities, industrial players, and educational institutes, which has helped navigate the complexities of setting up an efficient and reliable hydrogen refueling network.

This report will serve as a valuable resource for the stakeholders and decision-makers involved in the sustainable development of California's transportation sector.

While developing this report, we identified some feasible locations in Riverside County and are willing to develop a clean hydrogen production and refueling project. This aligns with our commitment to strengthening hydrogen infrastructure and supporting sustainable transportation in the region.

Keywords: hydrogen refueling station, hydrogen vehicle, mobility, hydrogen, Riverside County, hydrogen production

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EXECUTIVE SUMMARY

This report is to provide a strategic blueprint for successfully deploying medium and heavy-duty hydrogen refueling stations across Riverside County.

Key Findings:

- Manufacturers and suppliers of medium and heavy-duty hydrogen vehicle across United States are identified, with comparison of vehicle performance and financing options explored.
- Fleet operator segments, corporate sustainability goals, and current hydrogen infrastructure are analyzed, resulting in demand estimates and forecasts for hydrogen refueling needs.
- Potential use cases for hydrogen beyond fleet vehicles are explored, including clean hydrogen applications and pilot projects to boost hydrogen production.
- The existing and planned production projects across Riverside County are evaluated, while a development plan for a new hydrogen generation plant is presented.
- The vehicle duty cycles, operating routes, and planned stations are mapped, with stakeholder communication and economic impact projections considered.
- Detailed delivery strategies have been provided with safety plans, job creation potential, economic benefits, and community impacts are addressed, along with recommendations for station setup, project replication, and workforce development.

This blueprint provides a roadmap for stakeholders involved in transitioning Riverside County to clean hydrogen transportation. By following the outlined tasks and recommendations, the County can establish a sustainable and economically beneficial hydrogen ecosystem.

The report makes additional action recommendations in important areas, including:

- Securing partnerships and funds for the development of infrastructure.
- Implementing pilot projects to confirm demand and show that technology is feasible.
- Creating workforce development and training programs to assist the hydrogen economy.
- Advocating for supportive policies and regulations.

By implementing these actions, Riverside County can lead the way in clean hydrogen transportation and pave the road for a more sustainable future.

CHAPTER 1: Introduction

Project Context

The Budget Act of 2021 (AB 128, Ting, Chapter 21, Statutes of 2021, as amended by Senate Bill (SB) 129, Skinner, Chapter 69, Statutes of 2021 and SB 170, Skinner, Chapter 240, Statutes of 2021) appropriated $785,000,000 from the General Fund to support infrastructure deployments and manufacturing projects for zero-emission light-duty and medium- and heavy-duty vehicles.

Despite the advancement of medium and heavy-duty zero-emission technology, no planning agency or private entity in Riverside County has undertaken the task of developing a blueprint for medium and heavy-duty zero emission infrastructure. Riverside County contains busy interstate highways such as Interstates 15 and 215 and is spanned by Interstate 10 which delivers approximately 10,000 trucks to and from Arizona daily. Due to the massive investment needed to transition to zero-emission transportation at many sites, there needs to be a regional effort to prioritize affordable infrastructure deployments. By identifying those sites that can effectively leverage existing infrastructure, the region can cost-effectively minimize needed capital at the beginning of this transition, and agencies, fleets, and other land use stakeholders can coordinate investments that prioritize immediate deployments, taking advantage of existing infrastructure. This project provides critical support for market adoption for future large fleets of medium and heavy-duty hydrogen fuel-cell electric vehicles by providing a comprehensively analyzed case study that can show best practices for hydrogen fueling infrastructure.

Project Goals and Objectives

The project aimed to develop a blueprint to identify actions and milestones needed to implement medium and heavy-duty hydrogen vehicles and the related hydrogen refueling infrastructure network along Interstate 10, specifically in Riverside County, California.

This project aimed to lower the cost of medium and heavy-duty infrastructure buildout by identifying use cases and spreading the cost of producing green hydrogen over multiple applications.

Specific objectives included:

- Creating a roadmap for hydrogen vehicle and fuel supply opportunities through existing and planned infrastructure.
- Determining future costs, challenges, and feasibility of medium and heavy-duty hydrogen vehicle adoption by different fleets along with other applications and use cases of hydrogen.
- Analyzing medium and heavy-duty vehicle usage and driving patterns to identify optimal locations for hydrogen refueling stations.
- Developing an integrated infrastructure plan that accounts for all feasible use cases and works seamlessly with electric vehicle infrastructure, considering the variability of solar and storage resources.

- Calculating potential carbon savings that could be achieved through the planned development.
- Engaging with local jurisdictions and planning organizations to develop recommendations for implementing the hydrogen vehicle infrastructure plan, including interventions they may require, to minimize the risks and uncertainties surrounding its design, permitting, planning, and financing and ensure it is aligned with user needs.
- Alleviating the concerns of the local community/residents through workshops and other outreach materials to educate them on the potential benefits and planning efforts associated with the hydrogen refueling infrastructure.
- Identifying workforce development opportunities and further funding options for the hydrogen refueling project, including grants and/or financing solutions.

CHAPTER 2:
Analysis and Assessment

Developing the blueprint for deploying medium and heavy-duty hydrogen refueling stations in Riverside County requires rigorous efforts at different levels. This chapter outlines the efforts made by the project team to determine the potential adoption of hydrogen vehicles in the County, as well as the necessary hydrogen refueling stations and associated demands. These projections consider all the opportunities and constraints associated with the project, along with financial assessments.

Meeting with Hydrogen Vehicle Manufacturers, Authorities Having Jurisdiction, and Other Stakeholders

In this phase, the project team conducted meetings with various hydrogen vehicle manufacturers, authorities having jurisdiction, and other relevant stakeholders who are essential to contributing to this report.

In the bilateral meetings with the hydrogen vehicle manufacturers, the team explained about this project and its importance to contributing to developing hydrogen refueling infrastructure in Riverside County. The manufacturers and the fleet operators agreed to share the relevant content with the team. The manufacturers mentioned that the relevant data is confidential and are still working on defining the volume assessment and delivery schedule.

The project team met with the Riverside County Office of Economic Development Specialist. The agenda was to identify potential hydrogen refueling and production sites in Riverside County. The project team provided necessary hydrogen refueling and production site criteria. Based on that, the Riverside County Office of Economic Development team provided relevant utility contacts for Avina to reach out and help assess the viability of these sites.

The project team conducted a meeting with Southern California Edison Planning Supervisor. The agenda was to assess potential hydrogen refueling and production sites in Riverside County from the electric utility perspective. The team provided Southern California Edison with the list of shortlisted refueling station sites to evaluate the interconnection capability and necessary permits. Southern California Edison provided Avina with a list of sites capable of handling high loads for hydrogen production (70 megawatt) in Riverside and surrounding counties.

The project team met with the City of Banning Economic Development Manager & Community Development Director. The agenda was to assess potential hydrogen refueling and production sites in the City of Banning from a zoning and permits perspective. The team provided the Banning Economic Development Committee with a list of refueling sites to be evaluated from a zoning perspective. The development director mentioned that certain proposed zones are permitted for hydrogen refueling stations with a Major Design Review Application, which requires Planning Commission approval.

The project team also conducted a meeting with the Banning Electric Utility Planning Supervisor. The agenda was to assess potential hydrogen refueling and production sites in the City of Banning from the electric utility perspective. The team received positive feedback from the Banning Economic Development Committee on the list of refueling sites to be evaluated.

These inputs from different stakeholders helped in a positive way to understand the important perspectives and incorporate them in the final project report.

Developing the Hydrogen Vehicle Supply Roadmap

The project team performed a detailed analysis of different manufacturers' medium and heavy-duty hydrogen vehicles in this part. The analysis includes a comparison between different features of hydrogen vehicles. The team also connected with hydrogen vehicle manufacturers to understand the expected volume and schedule for delivery of hydrogen vehicles.

While developing the hydrogen vehicle supply roadmap, the team investigated the different vehicle and fuel purchase/lease packages offered by manufacturers. This could ease the offtake of hydrogen vehicles in the market. Based on the overall assessment, the team attempted to develop a hydrogen vehicle supply roadmap but struggled to get appropriate data from the manufacturers due to confidentiality.

Assessing Demand for Hydrogen Vehicles in the County

In this part, the project team analyzed the potential demand for hydrogen vehicles in the County. It starts with identifying different fleet operators, operating routes, duty cycles, refueling patterns, driving cycles, and willingness to shift towards green mobility segments through bilateral meetings. The team mapped all the planned and operating hydrogen refueling stations in the next step. Refueling strategies have been suggested for the fleet operators based on their inputs during the meetings. Considering all the details, demand estimates and forecasts for hydrogen by medium and heavy-duty hydrogen vehicles in 2025 and 2035 have been provided. The forecasts have been done in the base adoption, low adoption, and high adoption level scenarios for hydrogen vehicles to get a clear understanding of variability in the demand of hydrogen in the County.

Identifying Other Potential Applications of Hydrogen

In this part, the project team identified potential hydrogen applications in different sectors along with hydrogen vehicles. This step is important to boost hydrogen production by assessing potential demand in sectors like data centers, warehouses, etc. It has been identified that there is huge potential for hydrogen applications in the County, as many organizations have specified their willingness to adopt hydrogen as an alternative energy source as specified by their corporate emission targets and ongoing pilot projects.

Assessing Hydrogen Supply Opportunities and Constraints

In this part, the project team assessed all the hydrogen supply opportunities and constraints in Riverside County. The assessment includes identifying existing and planned hydrogen production projects through detailed research and finally marking all the potential sites feasible for hydrogen production with capacities based on the initial assessment of hydrogen demand.

The team laid out a plan for the development of a hydrogen generation plant to give clarity on the different phases of the project completion and associated risks & regulatory requirements. The team also highlights certain risks and concerns from an investor's viewpoint that can cause constraints in developing the potential project.

Incorporating Supply and Demand of Hydrogen

In this section, the project team analyzed potential ways to incorporate the supply and demand of hydrogen in the County. This is based on the assessment of potential hydrogen demand in the previous section and with the inputs from the authorities having jurisdiction and other stakeholders.

The team performed a financial assessment of each hydrogen refueling station by detailing the total cost economics to find the dollar impact on California's gross domestic product. To highlight their benefits, the team also assessed carbon savings at the station and fleet level by adopting hydrogen vehicles compared to conventional diesel vehicles.

CHAPTER 3:
Community Engagement and Outreach

Avina's project team engaged with multiple stakeholders to understand the risks and constraints associated with adopting hydrogen vehicles in the County at the community level. This chapter highlights the project team's community engagement and outreach approach to creating awareness and mitigating challenges in adopting hydrogen vehicles. It increases community confidence in hydrogen vehicles and their refueling infrastructure.

Community Awareness

As the first step, the project team compiled a list of stakeholders who can help create awareness among the community and started engaging with the stakeholders. The team worked on detailing the workforce development plan, job creation opportunities, and skills required.

Materials like videos, presentations, and handouts describing the environmental and social benefits of hydrogen fueling infrastructure via online platforms have been developed and shared with local community members.

An important perspective in community awareness is highlighting benefits that can be provided to disadvantaged communities, low-income communities, priority populations, and/or tribal lands within the County. The project team went through all these aspects to ensure an all-round awareness development among the community.

CHAPTER 4:
Project Results

This project aimed to provide medium and heavy-duty hydrogen vehicle and fueling station rollout plan for Riverside County. Significant efforts were required to address all the challenges related to adopting hydrogen vehicles and their refueling infrastructure. The project team analyzed and worked on all the key milestones to achieve a sustainable plan for development.

The project team identified and met with the hydrogen vehicle manufacturers, project developers, authorities having jurisdiction, and relevant stakeholders who are crucial for the development of this project. The team understood key challenges and opportunities for the development of the project. Through internal research and scenario modeling, the project team forecasted the current and future adoption of hydrogen vehicles and their required hydrogen demand. The team also mapped key operating routes by fleet operators to locate potential sites suitable for developing hydrogen refueling stations.

The project team worked on project safety and project deployment strategies to help developers gain a clear understanding of the roadmap. The team also assessed the financial implications and benefits of the project on California's gross domestic product.

The community awareness and workforce development plan developed by the team builds a strong foundation for accomplishing the project. An assessment of job opportunities, skill requirements, salaries, and benefits to the community has supported this.

All these efforts detailed in this report provide a comprehensive rollout plan for the medium and heavy-duty hydrogen vehicle and fueling station. The project team is pleased with these results and looks forward to deploying the rollout plan in Riverside County soon.

Avina’s Vision for Development in Riverside County

Avina stands at the forefront of the clean hydrogen and clean fuels industry, featuring a comprehensive portfolio of ongoing projects and access to proprietary technology solutions.

Our 10 MW clean hydrogen production project, which includes refueling infrastructure in the City of Vernon, is scheduled to launch in October 2024. Avina aims to leverage its expertise to develop a similar-scale project in Riverside County, which aligns with our long-term objective of enhancing hydrogen infrastructure to support medium- and heavy-duty hydrogen vehicles within the region.

Riverside County presents significant potential for the adoption of hydrogen vehicles. Our assessment has identified strategic locations along interstate highways such as I-10, I-15, and I-215, providing optimal opportunities for hydrogen production and refueling infrastructure development.

Avina is committed to realizing this project and is actively pursuing state and federal funding support to facilitate its progression. These grants will play a pivotal role in constructing and establishing hydrogen infrastructure, closely aligning with Avina's vision for Riverside County.

CHAPTER 5:
Conclusions and Recommendations

While working on this project, Avina's team found that participation from some stakeholders is crucial for the project's overall success. The project team draws recommendations for such stakeholders based on learnings while developing this report. The project team believes that adapting to these recommendations can help boost the hydrogen economy in the County.

Recommendations for Workforce Development

The project team recommends developing a comprehensive workforce plan that includes all the skills and knowledge required to meet the job requirements in this sector. The team also recommends taking international courses on hydrogen to keep updated on the latest developments in hydrogen production and refueling.

Recommendations for Setting Hydrogen Refueling Station

Setting up hydrogen refueling stations involves planned efforts at various levels to make the project successful. The project team recommends including a planning review, building review, construction, commissioning, and general practices to ensure the project's success.

Recommendations for Other Fleets and Regions within California

The project team recommends identifying potential fleets with high mileage requirements suitable for transforming to hydrogen fuel cell vehicles. Developing the necessary infrastructure to support the establishment and expansion of the projects will also help this transition. Active knowledge sharing and creating awareness among all the stakeholders can help mitigate all the concerns. Another perspective would be adapting to the regional needs. It can be done by identifying regional infrastructure gaps and considering the local economic impact of the projects.

Encouraging Green Hydrogen Production in California

The project team observed that in California, there is a massive push for adopting hydrogen vehicles and developing the necessary infrastructure for refueling support. While more than 50 hydrogen refueling stations are actively operating in California, the availability of clean hydrogen at these stations and the new ones needs to catch up. The project team recommends a solid push to support hydrogen production projects, explicitly supporting the refueling infrastructure.