Thesis Project Portfolio

University of Virginia Human Powered Vehicle Team

2021 ASME HPVC E-Fest Design Report

(Technical Report)

Examination of California's Recent Efforts to Move Toward Clean Vehicles

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Lauren H. Weis

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Department of Mechanical & Aerospace Engineering

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Sociotechnical Synthesis

The transportation sector accounts for the greatest percentage of greenhouse gas emissions of any sector in the United States and light-duty vehicles are the biggest contributors. The environmental impact of light-duty vehicles is too significant to not take immediate, substantial action. This is a pressing issue that engineers have the power to solve, whether by producing cheaper electric vehicles, building electric vehicle infrastructure, or researching other forms of clean transportation.

The STS paper examines the strides California is making toward cleaner forms of transportation. California is one of the most environmentally progressive states in the country, and they have learned a lot of valuable information through their successes and failures. In September 2020, California passed an executive order mandating that no combustion engine vehicles be sold in California after 2035. California also released a market development strategy to support the executive order by creating a plan to build up electric vehicle infrastructure and bring car companies on board. The strategy includes metrics for success that will help the government visualize which areas are on track to meet their goals and which areas need more help. This paper breaks down exactly how California intends to reach their goals and provides some insight into why California has been so successful.

The technical portion focuses on human powered forms of transportation. My capstone team and I designed and built a human powered vehicle from start to finish, which included everything from conducting finite element analysis to doing all the welding ourselves. The purpose was to compete in the annual Human Powered Vehicle Competition run by ASME. Unfortunately, the in-person competition was canceled due to the coronavirus so we were only able to enter our design. The team placed 3rd in the country and 7th internationally in the design

competition. The coronavirus presented a number of challenges for us, particularly because it limited the time we could spend working on the bike in person. We were able to overcome this challenge by putting in extra time once the restrictions were lifted. Because we were unable to race the vehicle, a team of students will take up where we left off next year. We have made recommendations to them such as investigating the possibility of using under-seat steering. They will race it in the next Human Powered Vehicle Competition.

Overall, with the exception of the coronavirus limitations, I was able to achieve everything I was hoping to. I was able to reach a satisfying conclusion in my STS thesis, and my team and I were able to finish building our human powered vehicle. I gained a lot of great experience both in my ability to analyze different topics using frameworks and in my mechanical design and machining skills.

I would like to thank my advisors Natasha Smith and Sean Ferguson and my capstone team: Ryder Sadler, Riley Roe, Trevor Marchhart, Skyler Moon, Joe Flynn, and Kavi Patel for all of their time and effort.