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

A Research Paper submitted to the Department of Engineering and Society

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

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2021

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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This paper includes a case-study driven analysis of a state transitioning to cleaner transportation. In the United States, California has always been a leader in combating climate change. The case-study primarily revolves around a description of the uniqueness of California and an emphasis on the importance of the state's focus on users and producers. The state continues to pass progressive policies such as the recent executive order (EO) N-79-20 which, among other things, states that by the year 2035 there will be no light-duty vehicles with combustion engines sold in California. This ambitious goal was set with the intention of paving the way for innovation in electric vehicles. The multi-level perspective (MLP) theory can be used to analyze the effects of the socio-technical landscape, socio-technical regime, and niche innovation levels on each other. Niche innovation requires the support of its users and producers. Thus, the regime level, in the form of EO N-79-20, will attempt to create space in the private sector for niche innovation and push the users and producers in the direction of electric vehicles. Further, California is an interesting case study for the MLP theory because of its distinctive landscape level as it pertains to climate change. The unique aspects of California's landscape level in conjunction with the recent EO from the regime level is affecting niche level innovation by gaining the support of vehicle users and producers.

Multi-Level Perspective Theory as it Applies to Clean Transportation

The MLP theory suggests that the interplay between the levels of niche innovation, socio-technical regimes, and the socio-technical landscape is critical to understanding and predicting sustained transitions in innovation. The niche innovation level refers to inventions and technological advancements which can be affected by socio-technical regimes and socio-technical landscapes. The socio-technical regime is the governing level that creates rules which

attempt to control or change niche innovation. The socio-technical landscape encompasses broad surrounding factors (Figenbaum, 2017). “The MLP is a heuristic framework requiring substantive empirical knowledge, which guides the analyst’s attention to interesting patterns and mechanisms” (Figenbaum, 2017). Thus, this framework allows for hands-on interaction and for the user to make normative arguments so as to create the best possible analysis.

For the purpose of this analysis, it is necessary to define the MLP levels as they pertain to this topic and explain the general interactions that will be observed. Given the heuristic nature of MLP, the levels do not have to be used in exactly the same way for every analysis. For these purposes, the regime level will be isolated as just the California executive branch. More specifically, the actions of the executive branch in passing EO N-79-20 and the other programs that came out of that order. Nykvist and Nilsson (2014) took parts of the regime level out of the regime such as “economic incentives, policy direction, and visions at different scales” and created a fourth level in the multi-level perspective theory which they termed the “national landscape” (Figenbaum, 2017). In order to best analyze the socio-technical regime as defined above, all of the other aspects that are usually included in the regime have been taken out. Instead of creating a fourth level of MLP, the aspects of the socio-technical regime that have been taken out will be included in the socio-technical landscape. Thus, the socio-technical landscape will be considered existing exterior factors that may have influenced the users and producers in California. The goal is to isolate the executive order in order to fully examine California’s ability to create sustained innovation given such a unique set of exterior factors.

Niche innovation will take the form of electric vehicles or other zero-emissions vehicles. The niche level requires the support of the innovation users and producers, and thus, the regime level must convince and inspire the users and producers (Figenbaum, 2017). The users in this

case are the people of California, and the producers are the car manufacturers. Without having both of these groups onboard, there would be no transition in niche innovation.

The landscape for this topic will take many forms such as California's unique climate of wildfires, droughts, and poor air quality; the politics in the United States; and the general feelings in the motor industry toward electric vehicles. Understanding the socio-technical landscape present in the motor industry, California, and the rest of the country can help depict a baseline of how the users and producers of niche innovation are thinking and thus, determine how effective the socio-technical regime will be in inspiring niche innovation. In other words, the various applicable socio-technical landscapes and their impacts on users and producers need to be fully understood in order to analyze the sustained effects of the regime level.

The Socio-Technical Landscape

Unfortunately, consumers across the country are not taking well to electric vehicles. Dealerships are seeing first hand that Americans are not ready for the transition away from combustion engine cars and trucks. "Last year [2020] battery-powered vehicles made up fewer than 2% of U.S. auto sales" (Naughton, 2021). Electric vehicles are much more expensive and the infrastructure is not at the level it needs to be to support them (Naughton, 2021). Despite the environmental necessity of moving toward zero-emission vehicles, in the United States, there is not yet space for consumers to move toward niche innovation in this area.

Certain aspects of California's socio-technical landscape make the users more receptive to electric vehicles as compared to the rest of the country. The current environment in California is one of the factors that contributes the most to the people's opinions of climate change. California is prone to wildfires, droughts, and poor air quality which means Californians face the

effects of climate change every day. The issue is impossible for them to ignore. In addition, things have only been getting worse, “five of the six largest wildfires in state history ignited in recent weeks [September, 2020]” (Pfeiffer, 2020). Further, August of 2020 was the hottest August California has had yet (Pfeiffer, 2020). The worsening climate in California makes policies the state government wants to pass concerning climate change very popular. “After years of scorching summers, storms of fire and ash, floods, and drought, Californians now rank climate change as their No. 1 political priority” (Johnson, 2019). Further, the state is known for being a Democratic stronghold, and Democrats are more likely than Republicans to support climate change policies.

Californians are also very supportive of their government passing its own policies concerning climate change. In fact, “two in three Californians (65%) favor the state acting independently of the federal government to combat global warming” (Baldassare, Bonner, Dykman, & Lopes, 2018). The fact that the state can pass its own air quality standards is unique to California’s socio-technical landscape. California’s poor air quality was acknowledged by the federal government in the 1960s, and when they created national climate change laws, they made California an exception to the rule (Lavelle, 2020). However, California does have to receive a waiver from the federal government each time they pass a new air standard. “Over the years, California has received hundreds of such waivers. As a result, it has led the nation in control of carbon monoxide, smog-forming pollutants and other tailpipe emissions” (Lavelle, 2020). One of the waivers the Obama administration granted allowing California to control vehicle emissions was revoked by the Trump administration (Lavelle, 2020). The demonstrated lack of concern for climate change from the Trump administration has made the public more reliant on the California state government. Overall, aspects of California’s socio-technical landscape have

made the users more supportive of the socio-technical regime; the environment in California, the Democratic party stronghold, and the apathetic Trump administration have helped to shape the opinions of the public in support of their state's climate change policies.

Successful niche innovation requires the support of both the users and the producers. The car manufactures are, for the most part, embracing electric vehicles. California has a large influence on the automobile market and has won over many major vehicle manufacturing companies such as Ford, Volkswagen, BMW, and Honda; all have agreed to comply with many of California's standards (Hawkins, 2020). California already has a decent electric vehicle market and there is a general understanding across many car companies that the future is electric (Korte & Bollag, 2020). For example, General Motors, BMW, and Stellantis are all releasing new electric vehicles this year and many car manufacturers such as Ford and GM are making huge investments in the electric vehicle industry (White, 2021). For many car manufacturers, California's new laws are in their best interests.

However, the dealerships in California feel differently about the recent executive order. The California New Car Dealers Association, the primary voice for many dealerships in California, has raised some concerns about the ability to sell in California due to the lack of infrastructure for electric vehicles, how expensive electric vehicles are, and the fact that current standards are not being met (Dudikoff, 2020). Because electric vehicles are so much more expensive than combustion engine vehicles, it makes sense that there are issues selling them to a large portion of the population in California. However, the cost of electric vehicles continues to decline, and there are many analysts that predict that their price will be similar to combustion engine vehicles "as soon as 2023 for some sectors of the market" (California Zero-Emission,

2021, p. 18). In addition, as infrastructure continues to grow, their marketability and practicality will only increase.

For the most part, the socio-technical landscape in California seems to suggest that there is space for the users and producers to move toward electric vehicles. It is then the job of the socio-technical regime to fill in the gaps and determine logistically how they will move toward this form of niche innovation. Despite the apparent willingness of the users and producers, there are still issues such as infrastructure that are associated with electric vehicles that the socio-technical regime needs to tackle.

The Socio-Technical Regime

California has been at the forefront of climate change action for a while now and, as a result, they have been able to see what works and what does not. This experience is clearly seen in EO N-79-20 which, among other things, states that in 2035 only zero-emission vehicles can be sold in California (Exec. Order No. N-79-20, 2020). Light-duty combustion engine vehicles which were registered before 2035 will still be allowed and can be resold (John, 2020). The executive order also mandates the creation of a Zero-Emission Vehicle Market Development Strategy which came out in February 2021 (Exec. Order No. N-79-20, 2020). This strategy outlines a concrete plan for how California will reach the goal of having no light-duty vehicle combustion engines in 2035. The executive order is drastic and incredibly pioneering for the United States, but California outlined exactly how they plan on doing it and they appear to be very aware of the challenges they will face when trying to reach their goal.

The Zero-Emissions Vehicle Market Development Strategy shows that the socio-technical regime is focused on supplementing any existing issues in areas such as infrastructure

and having a hands-on approach in getting users and manufacturers onboard. The strategy outlines intermediate goals, infrastructure support, expectations for state agencies and manufacturers, opportunities for job creation, and an explanation for how they will track their progress. The executive order itself also mentions most of these aspects, but does not go into as much specific detail, thus the need for the creation of the development strategy.

The development strategy outlines intermediate goals and methods for changing the strategy every few years, which means that it won't become outdated or obsolete and can be tweaked if the intermediate goals are not being met. For example, California has a goal of having five million zero-emissions vehicles by 2030 which will give them five more years to entirely eliminate the sale of light-duty combustion engine vehicles (California Zero-Emission, 2021, p. 18). They also have infrastructure goals such has "250,000 public and shared charging stations and 200 hydrogen fueling stations by 2025" (California Zero-Emission, 2021, p. 18). The development strategy will be revised and can be changed every three years if interim goals are not being met. This provides a designated time to check to make sure that everything is functioning as expected and that California is on track to achieve the goals that the executive order laid out. Further, the individual parts of the plan can change more frequently if need be (California Zero-Emission, 2021). This executive order could also be considered somewhat intermediary as California has an even more aggressive goal of achieving net neutrality by the year 2045

There is a significant push toward developing infrastructure as a part of EO N-79-20. In order for zero-emission vehicles to be a realistic choice for more people, there needs to be improved fueling infrastructure and vehicle-grid integration. Some of the foci outlined in the vehicle development strategy include: "access to charging/fueling with a focus on priority

communities," "fuel cost competitiveness," "hydrogen production capacity relative to demand," and "charging system resilience" (California Zero-Emission, 2021, p. 21). The California Energy Commission (CEC) and the California Public Utilities Commission (UPUC) are the state agencies which are in charge of leading the infrastructure development, and they will have the help of many other agencies and groups. The CEC is responsible for "infrastructure investment and analysis, fuel consumption tracking, [and] energy system resilience and forecasting" (California Zero-Emission, 2021, p. 33). This includes supporting hydrogen fueling networks and researching possibilities for new innovative technologies relating to vehicle-grid integration (California Zero-Emission, 2021, p. 55). The UPUC focuses on investment opportunities and creating plans to move away from the electric grid and toward hydrogen fuel through research (California Zero-Emission, 2021, p. 34). These are examples of parts of the broad socio-technical regime level continuing to get involved and contributing to the development of infrastructure.

The grid operators, electricity providers, and hydrogen providers will have one of the largest roles in infrastructure. This is an example of the socio-technical regime mandating the support of the producers of niche innovation. While these utility companies are not producing the vehicles themselves, their innovation is what allows zero-emission vehicles to be produced. Several groups are being asked to install electric vehicle charging stations and improve the "user charging experience" (California Zero-Emission, 2021, p. 40). Gas utilities will be tasked with determining if they have the capacity to also have hydrogen fueling, and hydrogen producers will need to start producing large amounts of affordable hydrogen.

Through the development strategy, the California government is also focused on developing the transportation sector as a part of their infrastructure efforts. The hope is that if they can further develop alternative forms of transportation, then low-income communities will

have more options and may not necessarily need to own a vehicle. This goal would help to tackle the implications of the socio-technical landscape issue of the affordability crisis on people's abilities to buy vehicles. In general, the in-depth plans of the development strategy take consumer equity into consideration for every decision and in the goals of every group they mention. They are trying to "ensure that communities suffering most from a combination of economic, health, and environmental burdens are actively prioritized and directly benefit from the public investment through increased zero-emission mobility options, job opportunities, and cleaner air" (California Zero-Emission, 2021, p. 40). By doing this, California is focusing on taking care of the future users of niche innovation in order to gain their support.

California is investing in their transportation infrastructure and attempting to limit the distance people will have to travel. In order to limit traveling distance and allow for more people to walk or bike, they are going to try to put more homes and jobs closer to each other. They are not limiting innovation to zero-emission vehicles, but rather looking at out-of-the-box ways to reach the goals outlined in the executive order. Specifically, agencies will research and invest in zero-emission railways and buses, walking and biking lanes in roads, and identifying low-income communities that are especially spread out (California Zero-Emission, 2021, p. 53). The agencies in charge of transportation initiatives are the same ones that are in charge of supporting vehicle infrastructure. The intention is to make people's lives easier and bring all of the possible innovation users on board because right now people other than the wealthy will have a hard time participating in the niche innovation.

California is also developing more jobs for people through this executive order especially for people who worked in the fossil fuel industry. This will contribute to making life easier for some people and not hurting others who may have been at risk of being jobless as a result of this

shift. The Labor and Workforce Development Agency and the Office of Planning and Research will create a Transition Roadmap to find people new jobs and train them (California Zero-Emission, 2021, p. 17). It will also turn many of the future users into producers as they will be mainly working in zero-emission solution jobs. As a result, it may make these people feel they have more input over the process and more invested in wanting to see it work out. From a logistical standpoint, this is necessary so as not to anger any of the users because their support is needed in order for zero-emission solutions to work in the long-term.

Through the development strategy, the socio-technical regime is also giving direct responsibilities to the niche innovation producers such as the zero-emission vehicle manufactures. The niche producers need to take an active role in all of this in order for the state to reach such an ambitious goal. This active role includes trying to obtain consumer support. "California will need vehicle manufacturers to market their ZEVs [zero-emission vehicles] more prominently to build consumer awareness and demand" (California Zero-Emission, 2021, p. 77). Some of the objectives for light-duty manufacturers include: focusing on more affordable vehicles, working on creating vehicles in all sizes and models, and maintaining their used vehicle market (California Zero-Emission, 2021, p. 78). The objectives for dealerships are to highlight zero-emission vehicles as much as possible and provide information to customers about their vehicle options and overall cost (California Zero-Emission, 2021, p. 78). Dealerships and light-duty vehicle manufacturers are going to be key in getting users excited about electric vehicles and educated in why they are important. California is asking that new market entrants focus on bringing in new creative innovative technology (California Zero-Emission, 2021, p. 78). They know that to reach their goal they will need everyone to think outside the box as much as possible and bring in disruptive pioneering technologies and ideas.

The executive order came out in September of 2020 and the Zero-Emissions Vehicle Market Development Strategy came out in February 2021, so there is not much current data to tell how well they are working so far. The development strategy has in-depth metrics for success which outline the specific measurement resources that will be used to track the progress of all of their goals in various sectors such as infrastructure. Many of these sources have already been in use through the years as zero-emission vehicles have been a focus for California for a while now. One of these sites shows data for annual new ZEV sales, infrastructure data on electric vehicle chargers and hydrogen filling stations, and information for vehicle population which compares the number of current zero-emission vehicles to the vehicles that are not zero-emissions (Workbook: DMV data portal, 2021). This data can be used to track and chart large amounts of information to help the socio-technical regime adapt and change as need be.

Most of the resources are updated annually, and because the executive order was passed at the end of the third quarter last year, there is no solid information yet. One of the graphs in the development strategy does show some information about zero-emission vehicles through 2019 and 2020. The fourth quarter of 2020 shows an increase of almost 7,000 electric vehicles sold as compared to the fourth quarter of 2019 and an increase of more than 2,000 electric vehicles sold as compared to the third quarter of 2020 (California Energy Commission, 2021). However, there is only data from one quarter after the executive order so it is not substantial enough to determine if the executive order is helping to move things in the right direction, but it is at least promising.

Conclusion

California's regime level, in the form of EO N-79-20, has worked to create sustained niche innovation in their unique socio-technical landscape. California has a strong understanding of what it takes to make innovation happen, which was evident in their development strategy as

they demonstrated the hands-on role they have taken and will continue to take. Aspects of the landscape level such as the climate in California have shaped willing users and producers. Thus, the job for the socio-technical regime was to fill in the gaps and continue to push both groups toward electric vehicle niche innovation. Although the EO is new and there is very little data, the active support from the users and producers that the regime and landscape gained will likely create long-term niche innovation.

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