Electrifying Private Transport in California

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Abstract

With increasing automobile use, electrifying the private transportation sector is a key step in reducing California's environmental impact. This paper examines the viability of this solution, how it has been addressed at a policy level, and determines whether further action is needed to fully deploy electric vehicles. Using criteria generated from interviews with transportation experts, it identifies that all current legislation is productive in some way. Although time will tell which measures have had the most significant impact on vehicle uptake, the data revealed that equity-driven government outreach is one of the only remaining needs.

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Definitions

- (B)EV: (Battery) Electric vehicle
- CARB: California Air Resources Board
- CI: Carbon intensity
- GWP: Global warming potential
- HEV: Hybrid-electric vehicle
- HOV: High occupancy vehicle
- ICE(V): Internal combustion engine (vehicle), runs on gasoline or diesel
- LCA: Life cycle assessment, determines total environmental impact of electric car
- LCFS: Low Carbon Fuel Standard
- LEV: Low emission vehicle
- MPG: Miles per gallon (of fuel)
- PHEV: Plug-in hybrid electric vehicle, combines batteries with ICE technology
- (P)ZEV: (Partial) Zero emission vehicle

1: Introduction

While “three-quarters of all oil consumed and 40% of all greenhouse gases emitted are for the movement of goods and people” in California, the issue of the automobile’s abundant carbon footprint is multifaceted (Sperling and Nichols 2012). Though it is without question that (MacKenzie 18) vehicles contributes to climate change, many measures have been taken to lessen their impact, ranging from tire construction to the introduction of electric cars. Even prior to the electrification movement, trends had already begun to demonstrate a clear decline in vehicle emissions, according to a study from 1996 (Kahn 1996). California specifically has been the heart of this new shift, at least partially because its environmental problems are so severe (Sperling and Nichols 2012). Containing the top five cities with the worst air pollution in America (much of which stems from vehicle use), Southern California produced Tesla, arguably one of the most successful electric vehicle (EV) startups in the world (“Most Polluted Cities” n.d.).

The electric car “revolution,” as some have dubbed it, is something every major auto manufacturer is scrambling to be a part of. Established companies such as Porsche, BMW, Mercedes, and Chevrolet are budgeting millions of dollars for the research and development of the next generation of automobiles (MacKenzie 2018). There has also been an onslaught of new brands, each fighting for the success Tesla has encountered in this new, future-proof industry. Within the past five years Rivian, Bollinger, Lucid Air, Fisker, and many more have each debuted what they promise will be Elon Musk’s first legitix ҿ Mḫ

emissions and fossil fuel use, certain new legislation and policy amendments can help facilitate their role in mitigating the automobile's environmental impact.

The issues preventing consumers from purchasing EVs begin at the manufacturing level and span to a political level. Concerns of whether or not EV use can mitigate the environmental impacts of their production are abundant, and well founded. Moreover, high cost of development leads to prices considered unaffordable to most consumers, a problem that's exacerbated by public uncertainty regarding the new technology's infrastructure, longevity, and other factors. To combat buyer apprehension, state and federal governments have enacted policies that seek to either 1) encourage ownership through direct tax rebates (or a similar subsidy), or 2) penalize companies making vehicles exceeding certain emissions regulations (or related standards). In section three, the Literature Review, this paper will examine research covering the barriers facing EV infiltration of the vehicle market and policy solutions to address said barriers, ultimately determining that command regulation (fines, taxes, etc.) is only a partially effective technique by which to promote EV purchases. Supposing incentives are therefore a more reliable alternative, the logical question is then: how can the government continue to fund incentive programs, particularly for low and middle-income buyers? The paper will then proceed to conclusions resulting from interviews conducted with experts in this field, from which it will evaluate California's current and past policies, finally identifying remaining needs facing full EV deployment.

2: Background

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impending rise in energy use and related greenhouse gases (Ma et al. 2012). Projected numbers show increases in these fields “by nearly 50% by 2030 and by more than 80% by 2050,” demonstrating how crucial sustainable transportation options are to overall environmental health (Ma et al. 2012).

Electric vehicles are one measure in a multitude of auto-based efforts to achieve sustainable transportation. At the industry level, technological innovations such as the shift from carburetion to fuel injection, forced induction, and countless aerodynamic modifications have enabled more efficient energy use over the past century. At the political level, groups like the California Air Resources Board (CARB) are responsible for ensuring minimal air pollution (Sperling and Nichols 2012). At the legislative level, however, the state of California shines for having some of the most comprehensive environmental regulations in the transport sector today.

Since the mid-1960s, the state government has been actively involved in supervising

2.1: Senate Bill 350

Senate Bill 350 (SB 350) is known as the Clean Energy and Pollution Reduction Act. Signed into law on October 7, 2015, it "established California's 2030 greenhouse gas reduction target of 40 percent below 1990 levels" and 2050 target of 80 percent below 1990 levels ("Clean Energy & Pollution Reduction Act (SB 350)" n.d.). To achieve this, the bill specifies numerous goals and requirements. Section 32 outlines the need for "widespread transportation electrification," further prioritizing "increased access for disadvantaged communities, low- and moderate-income communities, and other consumers of zero-emission and near-zero-emission vehicles, and increased use of those vehicles in those communities and by other consumers to enhance air quality, lower greenhouse gases emissions, and promote overall benefits to those

maximizing economic opportunities and benefits for low-income residents from investments in clean transportation and mobility options.

2.2: Senate Bill 1275

Senate Bill 1275 (SB 1275), or the Charge Ahead California Initiative, was approved by the governor on September 21, 2014. It established a state goal of having "at least 1,000,000 zero-emission and near-zero-emission vehicles [in service] by January 1, 2023," and aimed "to increase access for disadvantaged, low-income, and moderate-income communities and consumers to zero-emission and near-zero-emission vehicles" ("Bill Text - SB-1275" n.d.). The bill acknowledges that "California's low-income and disadvantaged populations continue to face disproportionate impacts from substandard air quality in the form of higher rates of respiratory illnesses, hospitalizations, and premature death"

("grants, loans, loan guarantees, revolving loans, or other appropriate measures") for public projects ("public agencies, businesses and projects, public-private partnerships, vehicle and technology consortia, workforce training partnerships and collaboratives, fleet owners, consumers, recreational boaters, and academic institutions") that aimed to "develop and deploy innovative technologies that transform California's fuel and vehicle types" ("Bill Text - AB-118" n.d.). Some of the funding for this program is derived from Assembly Bill 8, which collected extra fees from vehicle registrations, boat registrations, and tire sales ("Bill Text - AB-8" n.d.).

2.4: Assembly Bill 1493 and Related Legislation

Assembly Bill 1493 (AB 1493), the "Pavely" bill, "aimed to reduce GHG emissions [and improve fuel efficiency and reduce motorists' costs] in new passenger vehicles from 2009 through 2016" ("Climate Change for Mobile Sources" n.d.).

discern the challenges facing both auto companies and local, state, or federal governments when promoting EV use.

between fuel extraction and the moving vehicle, or the fuel life cycle (Total 2017); see the following graphic for a rudimentary example:

This study from *Energy Policy* further noted the significance of driving style on energy

In the second part of the study, Hawkins et al. focus on the requirements necessary to balance the negative aspects of EV production. The general consensus was that the longer an individual owns/drives an EV, the lower its global warming potential (GWP) falls (Hawkins et al. 2013):

> Assuming a vehicle lifetime of 200,000 km [125,000 mi] exaggerates the GWP benefits of EVs to 27% to 29% relative to gasoline vehicles or 17% to 20% relative to diesel. An assumption of 100,000 km [62,000 mi] decreases the benefit of EVs to 9% to 14% with respect to gasoline vehicles and results in impacts indistinguishable from those of a diesel vehicle. Improving the environmental profile of EVs requires engagement around reducing vehicle production supply chain impacts and promoting clean electricity sources in decision making regarding electricity infrastructure.

These statistics represent a scenario in which the electricity used to charge the batteries is derived from renewable sources. Should the electricity be generated by coal-powered plants, EVs would lead to a 17-27% increase in GWP as compared to ICEVs (Hawkins et al. 2013). The following map demonstrates how EVs compare to ICEVs (in terms of equivalent miles-per-gallon (MPG) ratings) on a state-by-state basis as of 2017. Though it takes into account how

much of the grid is powered by renewable sources, it does not factor in the GWP from the production phase of EVs.

(Reichmuth 2017)

Hawkins et al. provide an ana BDic.06.17 Tm0 g0 G[(Ha)6(wkins e)3(t al. pr)3(ovide)-7(a)-5(n a)4(na)4

is counteracted by the relatively low operational costs made possible by simpler maintenance (Faria et al. 2013). Regardless, the point at which EV buyers are likely to break even on their investment (compared to buying and owning an ICEV) is estimated to be 9-10 years after the purchase (Faria et al. 2013). Prohibitively expensive prices are one of the leading reasons that EV market penetration is progressing much slower than it could be. Manufacturing optimization can address this problem (Faria et al. 2013).

Using a workshop with expert policy-makers, Sjoerd Bakker and Jan Jacob Trip reviewed limiting factors affecting EV ownership, concluding that more developed charging infrastructure is needed to incentivize purchases. This issue is mentioned in almost every reading pertaining to the subject. Simply put, owning an ICE vehicle is easier than owning an EV. With the vast network of gas stations, *range anxiety* is a phenomenon specific to battery-powered cars. Between relatively young companies like EVgo, Blink, PlugShare, and ChargePoint, plug-in

used a standard battery capacity of 24kWh by which to make comparisons to ICEVs. In August of 2016, that capacity more than quadrupled with the introduction of the 100kWh battery by Tesla Motors (MacKenzie 2018). Since EVs are being so rapidly accepted by consumers, the technology behind their performance and production has improved at a remarkable rate (Randall 2016), meaning that apprehension surrounding their viability five years ago is less relevant today. Bigger batteries lead to longer vehicle lifetimes, thereby lowering the GWP of EVs through continued use. Moreover, as the electricity grid retrieves an increasing proportion of its energy from renewable sources, EVs will become more efficient (Ma et al. 2012; Hawkins, Gausen, and Strømman 2012; Hawkins et al. 2013; Faria et al. 2013).

Even if issues like inadequate charging infrastructure were resolved, what kind of policies would effectively tempt low- and middle-income buyers? Taxes on high-emission vehicles wouldn't work since disadvantaged communities can't justifiably be charged for not being able to afford EVs, but incentives like tax rebates are finite: federal funds must be budgeted appropriately. The following section, 3.2, will present the research regarding government intervention in the private transportation market.

3.2: Policy Debates

EVs will only have a meaningful impact if consumers use them, and the government, whether is local, state, or federal, has the capacity to put forth policies that will encourage their use. The two foremost EV-related policy approaches discussed in the literature were 1) command regulations and 2) incentives. Command regulations, as the name suggests, are strict requirements to be met by a given deadline (Brown et al. 1995). The most direct legislative response to increasing emissions from the private transportation sector in California today is the

Low Emission Vehicle (LEV) program with its Zero Emission Vehicle (ZEV) mandate. The LEV program will be used repeatedly in this section (and 3.2 subsections) because multiple sources cited it as an example with which to discuss the pros and cons of command regulation.

It emerged in 1990 primarily in response to poor air quality and subsequent health-related

According to Daniel Sperling, who was appointed to the automotive engineering seat at CARB in February of 2007, CARB had seen technology-forcing regulations effectively bring catalytic converters (a previous method of mitigating emissions) to the market in the 1970s and thought,

was partially an answer to corporate pushback, it may also be indicative of a weak policy in the first place.

Despite a warm welcome from environmental organizations, the opposition to the LEV regulation from oil companies was more passionate and more forceful. Perceiving the requirements as a direct threat to their monopoly, a wave of strategic political contributions, study funding, and advertising ensued (Calef and Goble 2007).

> BP America, Exxon, Mobil Oil Co., Phillips Petroleum, Shell Oil Co. and Texaco donated a total of $1.1 million to legislative candidates in 1994 and in the first six months of 1995. During the same period, the auto industry donated $276,000. In particular, California's governor Pete Wilson received $325,000 and $76,000 from oil and auto industry groups, respectively. (Calef and Goble 2007).

Furthermore, the same oil companies exhibited deceptive lobbying. Employing tactful rhetoric to mimic grassroots movements, these corporations used names such as “Toward Utility Rate Normalization (TURN),” “Utility Consumer's Action Network,” “Californians Against Utility Company Abuse (CAUCA),” “Californians Against Hidden Taxes (CAHT)” and “the National Institute for Emergency Vehicle Safety” (Calef and Goble 2007). Advertising campaigns were released to reassure the public that the world still had plenty of oil, EV technology was inadequate, and to “stir up economic apprehension” about potential tax increases (Calef and Goble 2007).

Their efforts, however, were not as effective as they may have hoped. The ZEV mandate caused American, French and Japanese car companies to resume their interest in battery technology after neglecting it through the 1970s and ‘80s (Calef and Goble 2007). Moreover,

electric utility companies saw the legislation as an opportunity to expand their markets. Combined, these reactions helped to catalyze the development of hybrid vehicles which are so

Sperling 2008). As far as CARB was concerned, however, the severity of the mandate was needed to accelerate innovation (Collantes and Sperling 2008). Such conflicting ideologies indicate that command regulation can be a very finicky legislative tool with which to govern: too strict and it can lead to litigation, but too lenient and it won't produce meaningful results.

3.2.3: Incentives and Other Alternatives

An article from 2009 detailing the impact of government incentives on the sales of hybrid-electric vehicles (HEVs) highlighted that the level of environmental concern expressed by the buyer and the potential savings on gas are two prominent motivators influencing the purchase of clean cars (Diamond 2009). The piece claimed that states typically associated with high environmental awareness, such as California, Washington, Maine, Oregon, Vermont, and Massachusetts were among the highest ranking in HEV market share, with "large clusters" in neighboring states showing similar trends (Diamond 2009). The cost of refueling, however, had an even stronger effect on the likelihood of purchase: "A 10% increase in average gas prices would result in, on average, a 72–93% increase in state hybrid market share, depending on the vehicle" (Diamond 2009). Since gas use increases in direct proportion to the miles traveled in a car, longer trips also proved to have a positive effect on HEV sales: "a 10% increase in average per-capita miles traveled would result in an 8–15% increase in state hybrid market share, depending on the hybrid model" (Diamond 2009).

As for less influential factors, federal and state monetary incentives vary in their efficacy. Monetary incentives were shown to primarily benefit higher income consumers who were already likely to purchase an HEV (Diamond 2009). In fact, the article found that doubling the average rebate would produce an 18% increase in market share for HEVs, while additional

government expenditures would rise by over one million dollars per state (Diamond 2009). The study concluded by theorizing that such incentives may not have a strong effect because they do not “affect the up-front price that the consumer pays for the vehicle.” This indicates that the psychological impact of an incentive can determine how persuasive it actually is.

Effective environmental regulation is generally very difficult for the US government to produce, particularly when it's up against the increasingly prevalent deregulation sentiment (Brown et al. 1995).

A study from the *Journal of Public Policy and Marketing* that sought to assess consumer preferences for vehicles arrived at a similar claim. Results showed that without government intervention at the industry level, government intervention at the consumer level would be ineffective. Performance characteristics such as range, acceleration and recharging rate make EVs more attractive alternatives to conventional ICEVs than a direct subsidy after purchase (Ewing and Sarigöllü 2000; Levinson 2014). To assist in the production of improved vehicle technology, the government could instead subsidize research and development for EV manufacturers. Regardless of the level at which an incentive is provided, much of the literature agrees that they are more reliable than disincentives (e.g. taxes or fines) when it comes to producing new technology.

3.2.4: Policy Debates--Conclusions

While the LEV program in California was an example of effective command regulation, help from other policies and other factors were instrumental in its success. Overall, the literature specifically points towards market-based mechanisms as the most predictable tools with which to promote EV ownership, while acknowledging that regulatory measures are only circumstantially effective (their efficacy depends on a multitude of external factors) (Gass, Schmidt, and Schmid 2014). Taxes without complementags1 Tgates

what public tolerance allows for (Gass, Schmidt, and Schmid 2014). In the context of green transportation, command regulation can be shortsighted, overlooking the question of how to get EVs into the lives of low-income consumers. To address this issue, incentives are a much more reliable solution than penalizing legislation.

3.3: Literature Review Conclusions

The research has stated that for EVs to successfully reduce the carbon footprint of private transportation in California, they must be driven correctly (lighter loads, slower speeds, etc.), they must be charged with electricity produced by renewable sources, they must cost less (which

professional insight as to what kinds of private transportation policies best address the needs of low- and middle-income communities, and how to continue and/or expand them.

Of my eight subjects, four had written studies that contributed to the Literature Review for this paper: Mark Brown (teaches political theory at California State University in Sacramento), Troy Hawkins (an energy analyst for Argonne National Laboratory, which is operated by the University of Chicago and owned by the US Department of Energy), Daniel Sperling (currently on the board at CARB), and David Reichmuth (who writes for the Union of Concerned Scientists).

Three of my subjects (including Sperling) were current or former members of CARB. Hector De La Torre is a former California State Assembly member who was appointed to the board at CARB in June of 2018. Eileen Tutt served on the board at CARB for ten years, and is now the executive director at the California Electric Transportation Coalition (CalETC), a group that addresses environmental issues by targeting emissions and fossil fuel use in the transportation sector. My final two subjects also currently work for nonprofit organizations; Bahram Fazeli has been the director of research and policy at Communities for a BetTf1 0 09t

Of the eight interviews completed, two were conducted electronically (via email) on account of time constraints. The others were completed over the phone, as many of my subjects either 1) weren't easily accessible for an in-person interview, or 2) didn't have the time to meet me face-to-face. All interviewees completed the consent form under HSRRC Proposal number Teve-F18120. My questions sought to identify the qualities of effective EV-related policy. The criteria found from each interview will be used later to evaluate the efficacy of past programs in California.

5: Findings--Necessary Components of Effective Policy

The following subsections will be arranged according to the key takeaways from the interview process. They describe three components--incentives, mandates, and infrastructure--of effective policy that each subject mentioned when asked how to address the issue of inadequate EV adoption among low- and middle-income communities in California.

5.1: Incentives Influence Consumer Decisions

All but two subjects (Eileen Tutt and Max Baumhefner), both of whom work for nonprofits and own EVs, referenced some sort of incentivizing technique while explaining California's most effective measures for promoting EV adoption. The following data, collected by the Clean Vehicle Rebate Project (CVRP), reinforces this support for incentives:

("EV Consumer Survey Dashboard" 2016)

Aside from Daniel Sperling and David Reichmuth, the remaining interviewees provided examples. Hector De La Torre specified that the supply and demand model (supply side: manufacturers have to meet corporate fuel economy standards, demand side: incentive programs for the purchase of clean vehicles) has worked particularly well, while Mark Brown only cited the method of "providing financial incentives and tax rebates." Brown concluded his interview by stating "there's a long history of taxes being implemented on the backs of poor people. With rebates of various kinds those effects can be avoided." He proposed that revenue collected from

“There seems to be very little appetite for any kind of tax but if you were going to give an incentive it has to come from somewhere. Incentives are good for first adopters but once you get to a certain share of ownership you have to look for something else.”

Mark Brown and Bahram Fazeli also highlighted the importance of appropriate implementation. Brown stressed how retrogressive “half-hearted” measures can be, claiming “subsidies have to be high enough to make EVs competitive in the market in terms of cost, otherwise people won’t buy them until the price comes down.” Fazeli built off of this point, asserting that “incentives are definitely important, but it’s imperative to consider how you distribute those incentives. One could argue that someone making $300,000 annually probably doesn’t need a $2,500 rebate to incentivize them to buy a $70,000 Tesla. I agree that incentives should continue, but they should be more equitable.” He reiterated that the “trickle down” model, which doesn’t sufficiently prioritize disadvantaged communities when deploying EVs, is “a very slow [and wasteful] process,” one that “is not a good example of public policy. A bottom-up approach is better.”

5.2: Mandates Influence Corporate Decisions

The two interviewees who did not emphasize the efficacy of incentives were Eileen Tutt and Max Baumhefner. Tutt got straight to the point. “The Low Carbon Fuel Standard [LCFS, which establishes fuel standards to be met by fuel providers] is the most effective governmental regulation for promoting EV ownership... The LCFS addresses two of the biggest barriers to EVs, the monopoly oil holds on the transportation fuels sector and the cost of EVs in the early

Reichmuth took the opposite stance on the LCFS, describing it as containing a “financial incentive that arrives much too late to influence the purchase decision.” He did mention, however, that this program is changing to a point-of-purchase rebate.)

Baumhefner, alternatively, specified the ZEV mandate and the Charge Ahead California Initiative (SB 1275), both of which target automobile manufacturers. He labeled the mandate as

mandates, Eileen Tutt and Max Baumhefner mentioned bills that establish efficiency standards aimed at auto manufacturers. For infrastructure, subjects highlighted charging stations, lane/road access, ride sharing initiatives, and other measures. The following figure (Figure 1) outlines these examples and uses them to evaluate the bills introduced in section 2 (Background). Each example selected mirrors some concept or program described as effective during the research process; in other words, an example from the interviews was only chosen for the policy analysis if it was corroborated by the literature review. Figure 1 isolates the most and least productive bills, what makes one better than another, and ultimately presents a discrepancy between my literature review and my findings. This section concludes with remaining concerns of policy implementation and this study's limitations.

6.1: CA Policy Analysi

SB 1275, the Charge Ahead California Initiative, was easily the most effective policy reviewed. It established California's goal of having one million zero-emission and near-zero-emission vehicles on the road by 2023, accomplishing this though requirements such as (1) the

areas that are disproportionately impacted by it. These actions include projects aimed at improving medium- and heavy-duty vehicle technology to “create higher fuel efficiencies” (“Bill Text - AB-118” n.d.). SB 350, the Clean Energy and Pollution Reduction Act, set targets for reducing greenhouse gas levels 40% below 1990 levels in 2030 and 80% below 1990 levels by 2050 (“Bill Text - AB-

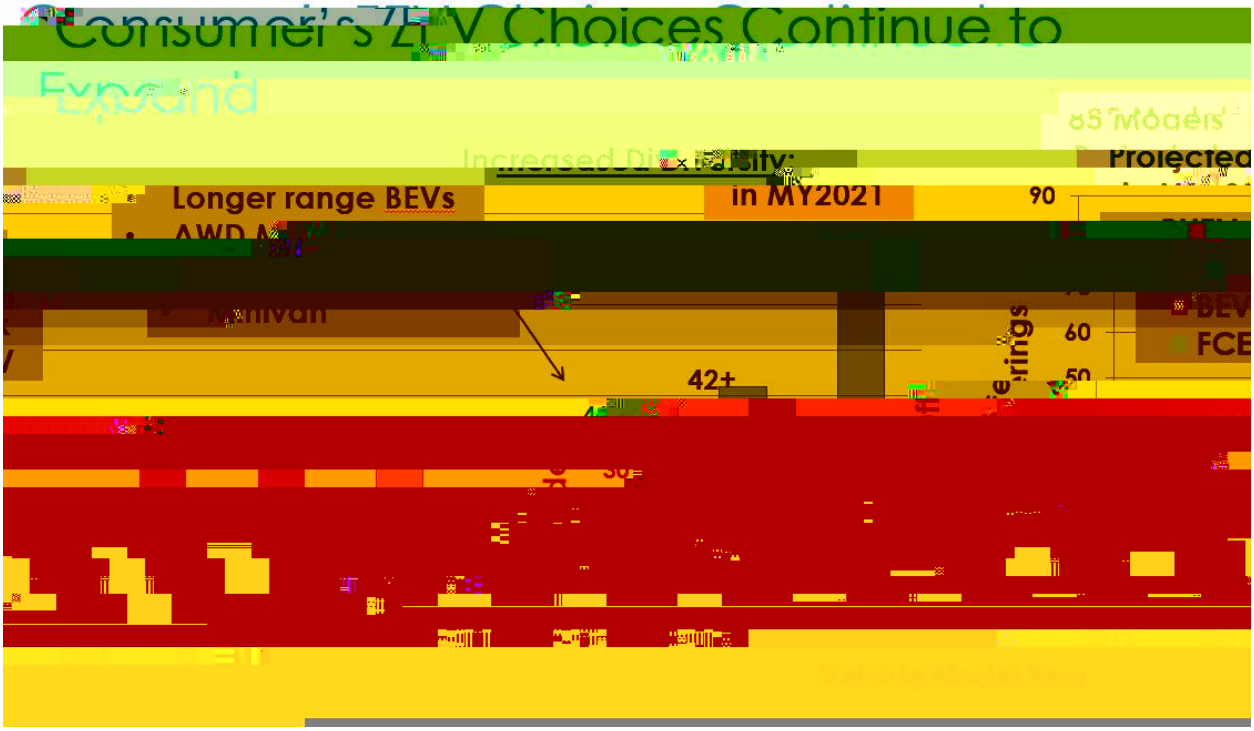
6.2: Literature Review and Findings Discrepancies

Aside from the conditions under which EVs can successfully reduce the environmental impact of the private transport sector, the major finding from the literature review was that command regulation is not as reliably effective as market-based mechanisms. The interviews, however, revealed that AB 1493 is one of the least effective EV-promoting policies *because* it is not supported by a mandate.

Since the California government has finite resources, certain policies--like rebates upon purchase--are volatile. President Donald Trump has already threatened to eliminate subsidies for EV purchases (*Reuters* 2018). Policies that have a dedicated funding stream (from tax/fee revenue), then, are much more sustainable. SB 1275 uses money from the Greenhouse Gas Reduction Fund (cap-and-trade), AB 118 uses money from AB 8 (which collects money from vehicle registrations, tire sales, etc.), and SB 350 has an entire study that identifies the need for "permanent, long-term funding sources" for equitable EV distribution in disadvantaged communities.

Another measure brought up during the interviews, the Low Carbon Fuel Standard (LCFS), epitomizes self-sustaining legislation in this field. The LCFS was approved to "reduce the carbon intensity (CI) of transportation fuel used in California by at least 10% by 2020 from a 2010 baseline" ("LCFS Basics" n.d.). In doing so, it reduces petroleum dependency and achieves

evidenced by the figure below, ZEV choices have more than quadrupled in the past 7 years alone:



(CARB 2018)

California has done a remarkably good job at promoting EV ownership thus far. Policy makers have taken a relatively bottom-up approach and addressed virtually every component of what this study's interviewees consider effective policy. Incentives, infrastructure, and mandates to fund the incentives have been implemented. The only remaining need, and therefore the only recommendation to make, is for improved government outreach and education.

6.4: Limitations

The primary limitation regarding this research is that there currently is not enough data to know which policies promote a meaningful increase in EV adoption. While there have been

studies detailing EV sales over time, none present the data accounting for factors like vehicle availability. In other words, a bill that caused an increase in EV sales in 2015 is not necessarily more effective than a bill that had a negligible impact on sales in 2003. Moreover, if two bills were introduced simultaneously, how does one determine which measure had a more substantial impact? It's difficult to quantitatively compare the efficacy of, for example, SB 375 and AB 32. The interviews were only able to reveal which type of bill was *generally* more progressive and productive; the subjects reported that 1) there is a remaining need for additional government outreach and education, specifically for low- and medium-income consumers, and 2) that incentive programs can be prolonged if they are amended to favor disadvantaged buyers.

7: Conclusions and Next Steps

As demand for private transport increases, the government must fight to mitigate the automobile's heavy environmental toll, which disproportionately affects disadvantaged communities. EVs present a viable solution to this sector's overwhelming carbon footprint. In response to the question of how to encourage EV adoption in California, this study was able to determine that equity-driven, market-based mechanisms that have a dedicated funding stream are most effective. In other words, incentives for low- and middle-income consumers that are funded by taxes or fees are both reliable and sustainable. While California's existing policies meet this standard through their relatively progressive bottom-up approach, time will tell whether or not full deployment of the technology requires additional measures. Because EVs are a relatively new technology, it is tough to determine how the current legislation will impact/has impacted disadvantaged communities. Sales and usage data must be collected before one is able to recommend ending, continuing, or amending a certain bill. Though the interviews revealed a

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