COMMENTS ON:

Proposed Advanced Clean Cars II Regulation

California Air Resources Board
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by the
Natural Resources Defense Council (NRDC)

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I. Executive Summary

The Natural Resources Defense Council (NRDC) strongly supports the California Air Resources Board's (ARB or CARB) Advanced Clean Cars 2 (ACC II) proposal and urges the Board to adopt these regulations quickly. Climate change is an ever increasing threat to California– as exemplified from the increase in wildfires and droughts. As the transportation sector is the largest source of greenhouse gas emissions in California, eliminating emissions from this sector is a key strategy to alleviating and preventing the most adverse effects of climate change, while also improving air quality and health in California communities.

The proposed regulations– which would move the state towards 100% Zero Emission Vehicle (ZEV) sales by 2035 while increasing greenhouse gas and criteria pollutant standards, in line with California climate and air quality goals– are necessary and feasible. California has the opportunity to become a global leader and help to accelerate the transition to a fully zero-emission transportation future. Based on the pace of growth of California's ZEV market (which reached 12% of vehicle sales in 2021), as well as the increase in ZEV makes and models, as well as customer demand, NRDC has concluded that the staff-proposed stringency is appropriate for the initial years of the program, and an even more aggressive 2030 target of 75% ZEV sales—versus the proposed 68% level—is achievable in California and supported by the ARB staff analysis. This more aggressive stringency will add 1.4 million more ZEVs onto the road through 2035, which will further reduce air pollution and improve air quality, while also increasing the number of ZEVs available in the used vehicle market.

ARB should utilize this vital opportunity to ensure that the ZEV requirements, as a part of the ACC II program, are delivering emission reductions to those communities most historically overburdened with transportation emissions, and where the public health needs are among the greatest. NRDC shares the objectives of our equity partners to have a strong proposal that increases the emissions and public health benefits of the ZEV program overall, results in more vehicles being placed in pollution-burdened communities or regions than would otherwise occur, and that maximizes participation by automakers in these programs. Increased participation in or expansion of these equity-centered programs – as driven by the provisions in the ZEV program - could increase overall public health benefits.

The battery labeling and state-of-health requirements proposed in these regulations are also vital pieces that will not only help to improve drive confidence in ZEVs but help increase and facilitate secondary use of batteries after their useful vehicle battery life.

ACC II is feasible– NRDC analysis has found that there is sufficient funding available to support the needed charging infrastructure over the next five years in California, but additional actions and funding will be needed to meet the 2030 and 2035 public and shared private light duty charging infrastructure needs. Further, research shows that ZEVs are able to be integrated onto the electric grid at nominal costs and can in fact put downward pressure on rates for all utility customers.

For these reasons, and those further outlined in these comments, ARB should move to adopt a ACC II program that increases the stringency of the rule to 75% by 2030 no later than August 2022.

II. Introduction

The Natural Resources Defense Council (NRDC) appreciates the opportunity to comment on the proposed Advanced Clean Cars 2 (ACC II) regulation. NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has over 3 million members and online activists. Roughly 400,000 of these members and activists live and work in California. Our members from across the state are impacted daily by the various air quality and climate threats present in California, including the pollution from cars and trucks this rule seeks to address.

The transportation sector is the largest source of greenhouse gas emissions in California, accounting for over 40 percent of total emissions.[1] Over 28 percent of the statewide GHG emissions come from passenger vehicles.[2] As significant portions of the state are in non-attainment with federal Clean Air Act (CAA) ozone and particulate matter standards, reducing air pollution and greenhouse gas emissions from the state's cars and trucks is vital to meet its state and federal requirements

The proposed ACC II program updates the current Advanced Clean Cars program for greenhouse gas emissions, criteria pollutants, and zero-emission vehicle (ZEV) sales mandates. The proposed ZEV sales mandate requires manufacturers to sell an increasingly higher percentage of ZEVs in each subsequent model year, cumulating in 100% ZEV sales by 2035. Through this requirement, ARB is formalizing Governor Newson's Executive Order N-79-20, which mandates that 100% vehicle sales must be electric by 2035.[3] The proposed regulation starts at 35% ZEV sales in model year 2026 with an interim target of 68% sales by 2030. This would ensure that approximately 6 million ZEVs are on California's roads in 2030 and almost 14 million in 2035.[4]

By adopting ACC II, California would become the second jurisdiction globally, after British Columbia, to set legally-binding 100% ZEV standards for passenger vehicles. According to ARB's calculations, the proposed rule will provide significant improvements to air quality and

[1] California Air Resources Board, Current California GHG Emission Inventory Data, https://ww2.arb.ca.gov/ghg-inventory-data (last viewed May 26, 2022)
[2] *Id.*
[3] Executive Department, State of California, "Executive Order N-79-20, September 23, 2020, https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf
[4] Compliance analysis prepared by Shulock Consulting, based on EMFAC 2020 projected total California sales.

greenhouse gas (GHG) reductions, including a cumulative reduction of 69,569 tons NOx, 4.469 tons PM2.5, and 383.5 MMT of CO2 from 2036-2040.[5]

ARB's current proposed regulations are vital for the state to adopt in order to improve air quality and health, reduce climate causing pollution, and to ensure California remains a global clean transportation leader. The proposed ramp up of ZEV sales is feasible in California, and based on projected sales data and manufacturer commitments, the state could in fact be more aggressive in their stringency of ACC II to increase the number of ZEVs on the road through 2035. The current Advanced Clean Cars Program's ZEV mandate levels out ZEV sales at approximately 7-8% starting in model year 2025, in perpetuity. Due to the current level of ZEV sales in California (which reached 12% sales at the end of 2021)[6], across the United States, and globally, it is clear that this 7-8% sales target is far below the current state of the market and does not reflect real-world sales. These data highlight that it is not only feasible, but necessary to set more aggressive sales targets to drive the transition of the market to ZEVs. Having more ZEVs on the road in the near term is important to moving towards zero-emissions from the transportation sector, as ARB says in the 2016 Mobile Source Strategy:

> "It can take decades for a new propulsion system to capture a large fraction of the LDV fleet because new technologies require time for vehicle manufacturers to incorporate them into numerous vehicle models with consumer acceptance. Once new technologies are widely available, it can take over 15 years for these new vehicle models to fully replace existing vehicles in the fleet with natural turnover."[7]

Further, additional ZEV in the market in the near term will allow vehicles to flow into the used secondary market sooner, allowing for ZEVs to be more accessible to lower income drivers.

ARB's staff analysis – together with auto industry statements – has shown that the ramp up in standards is feasible and cost-effective. The standards would not only significantly cut pollution, but also *reduce* transportation costs for the average household in the state, leading to significant economic benefits. California's Advanced Clean Cars 2 standards provide the industry with adequate lead time and in many ways, are consistent with automaker's own commitments and product plans as described more below.

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[5] California Air Resources Board, "Public Hearing to Consider the Proposed Advanced Clean Cars II Regulations, Staff Report: Initial Statement of Reasons", April 12, 2022, at 134, ACC II ISOR

[6] Inside EVs, "California Surpasses 1 Million Plug-In Electric Car Sales", February 26, 2022, https://insideevs.com/news/570116/california-1million-plugin-car-sales/

[7] California Air Resources Board, "Mobile Source Strategy", May 2016, at 64, https://ww3.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf

III. Rationale for Aggressive ZEV Action

A. CARB Has the Authority to Adopt the Standards Pursuant to Federal Law

Under the federal Clean Air Act (CAA), California is eligible to seek and receive a waiver of preemption under the terms of section 209(b)(1) "if the state determines that the state standards will be, in the aggregate, at least as protective of public health and welfare as applicable Federal standards."[8] The U.S. EPA Administrator has consistently interpreted Section 209(b) as requiring the issuance of a waiver unless the Administrator finds that:

(A) the determination of the state is arbitrary and capricious,

(B) the state does not need the state standards to meet compelling and extraordinary conditions, or

(C) the state standards and accompanying enforcement procedures are not consistent with section 202(a) of the Act.

Under the Clean Air Act Amendments of 1977, Congress also permitted States under Section 177 of the Act to adopt California new motor vehicle emission standards, so long as:

(1) such standards are identical to the California standards for which a waiver has been granted for such model year, and

(2) California and such States adopt such standards at least two years before commencement of such model year (as determined by regulations of the Administrator).

The California Air Resources Board's regulatory process, and the Initial Statement of Reason (ISOR) and associated documents, have been conducted through an open, deliberative, and factual manner. The basis for the ACC II regulation has been well reasoned and rational, and in many instances, staff has used conservative assumptions as described below. The process has also allowed for considerable public and stakeholder input through numerous public workshops since September of 2020, with NRDC and other affected stakeholders participating in many of these.

Pollution from motor vehicle engines and vehicle tailpipes continue to harm the public's health, welfare, as well as the broader environment and is a major source of criteria pollutants as well as greenhouse gas emissions. California is home to five of the ten metropolitan centers with the worst ozone pollution in the country (a precursor to smog) as well as seven of the ten centers with the worst year-round particle pollution.[9] Transportation is now the single largest source of greenhouse gas (GHG) emissions as well in the state, contributing 41 percent of the overall inventory in 2019, the latest data available.[10] This figure reflects tailpipe emissions and does not

[8] US Environmental Protection Agency, "Vehicle Emissions California Waivers and Authorizations, https://www.epa.gov/state-and-local-transportation/vehicle-emissions-california-waivers-and-authorizations

[9] American Lung Association (2022), *State of the Air*, https://www.lung.org/research/sota/city-rankings/most-polluted-cities . Last viewed 5/15/2022.

[10] California Air Resources Board, *Current California GHG Emission Inventory Data,*

include the emissions from production and refining of fuels used for transportation, which would make the share even higher. Passenger vehicles comprise 28 percent of the GHG emissions from the transportation sector.[11]

The State of California must enact this next round of Advanced Clean Car Standards to fight against the severe and significant harm tailpipe pollution presents. California already faces compelling and extraordinary conditions with respect to emissions of health-harming criteria pollutants. But the addition of GHGs into the atmosphere, and the corresponding increases in temperatures and extreme heat events suffered across the state, is now exacerbating the impacts from criteria pollutants, as well as creating new climate-related harms and health problems of their own. California's decades of progress tackling smog is now threatened as the rising temperatures from climate change speed up smog-forming chemical reactions between sunlight and pollution from sources such as transportation.[12]

There is a vicious cycle of harm created from the release of these collective pollutants, with a major source being passenger vehicles. In California, the state faces a variety of increasing health problems from GHG emissions and resulting climate change such (1) the alteration of seasonal patterns making hot days hotter, (2) increasing severity of droughts and other extreme events.

If California's adoption of stricter-than-federal standards were needed in past decades, there is more reason than ever for the state to adopt new standards to meet these compelling and extraordinary conditions.

Thankfully, the technologies to address both air pollution and climate change are here today and are being deployed throughout the world. Cleaner technologies such as electric vehicles (EVs) have already become part of the mass market in Europe and China and are increasingly part of the automakers' product mix in the U.S.

B. ZEVs Improve Air Quality and Health

California has had decades of history adopting stricter-than-federal standards which have helped the state make progress on cleaning up the air. However, due to a mix of geographical and atmospheric conditions– together with population growth and increases in travel– the state remains one of the most polluted states in the country. According to the latest American Lung Association's State of the Air report, 14 counties in California received failing grades for ozone, short term-particle pollution and year-round particle pollution: Butte, Fresno, Imperial, Kern, Kings, Los Angeles, Madera, Merced, Riverside, San Bernardino, San Joaquin, Stanislaus, and Tulare.[13]

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https://ww2.arb.ca.gov/ghg-inventory-data. Last viewed 5/15/2022.

[11] California Air Resources Board, GHG Emission Inventory Graphs. https://ww2.arb.ca.gov/ghg-inventory-graphs

[12] NRDC (2019), *Climate change and health in California*, Issue Brief, February 2019, https://www.nrdc.org/sites/default/files/climate-change-health-impacts-california-ib.pdf.

[13] American Lung Association, State of the Air 2022, "Most Polluted Places to Live", (last accessed May 26, 2022)https://www.lung.org/research/sota/key-findings/most-polluted-places

To combat this pollution from the transportation sector, the American Lung Association has explicitly stated that adopting Advanced Clean Car regulations is an important strategy to clean up air quality.[14]

But cleaning up the transportation sector does more than improve air quality, it can also provide significant health benefits as well. According to the State of the Air report, more than 137 million people in the United States live in counties with unhealthy levels of ozone or particulate pollution.[15] Air pollution, including that from the transportation sector, can cause asthma attacks, lung cancer, shortness of breath, heart attacks and stroke, preterm births, and premature death. By moving towards 100% electric vehicles, which emit zero-tailpipe emissions when driving on electricity, these health concerns will be alleviated.

ARB estimates that in California the proposal will lead to 1,242 fewer deaths, 208 fewer hospitalizations for cardiovascular illness, 249 fewer hospital admissions for respiratory illness, and 639 fewer emergency room visits for asthma.[16] ARB estimates that this will result in $14.52 billion in health benefits.[17] The largest health benefits – approximately 98%-- are expected to be in the South Coast, San Francisco Bay, San Diego, San Joaquin Valley, and South Central Coast areas.[18] It is important that these areas are anticipated to receive the largest health benefits, as they are some of the most polluted in the state.

C. Climate Change is a Major Threat

In addition to improving air quality and health, reducing emissions from the transportation sector is also a key strategy to combating the negative effects of climate change, as the transportation sector–not including upstream emissions from vehicle fueling– accounts for about 40 percent of the state's emissions.[19] California, in particular, is acutely feeling the negative effects of climate change, namely through increased drought and wildfires. As noted by academic researchers and experts at ARB, "some of the weather extremism, such as droughts and heat waves, can exacerbate air pollution episodes and exert severe impacts on human health (increase of morbidity and mortality and losses of work productivity), wildfires, agriculture pollution, and ecosystem productivity."[20]

If California does not take action to drastically cut GHG emissions, in collective action with other jurisdictions, the number of extreme heat days will continue to rise. Sacramento, for example, could see 24 days per year above 103.9 degrees Fahrenheit by the 2070s, compared to

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[14] American Lung Association, "Comments on the Advanced Clean Cars II Workshop", November 5, 2021, ALA ACC II Workshop Comments

[15] https://www.lung.org/research/sota/air-quality-facts

[16] ISOR at135

[17] ISOR at 139

[18] ISOR at 137, Table VI-1

[19] California Air Resources Board, Current California GHG Emission Inventory Data, op. cit..

[20] Zhao, Z., Di, P., Chen, Sh. *et al.* Assessment of climate change impact over California using dynamical downscaling with a bias correction technique: method validation and analyses of summertime results. *Clim Dyn* 54, 3705–3728 (2020). https://doi.org/10.1007/s00382-020-05200-x

4 days per year from 1961 to 1990.[21] Heat already poses a range of threats to California residents, from minor illnesses like heat cramps to potentially deadly conditions such as heatstroke or heat-related heart attacks.[22] During the 2006 California heat wave, Sacramento, Modesto, and Woodland Hills broke records for the longest stretch of days over 100 degrees Fahrenheit.[23] Six locations also set new records for all-time highest temperatures. Woodland Hills, for instance, hit 119 degrees Fahrenheit on July 22, 2006, exceeding its 1985 record by 3 degrees. Over the entire heat wave, there were approximately 655 premature deaths, more than 1,600 excess hospitalizations, and more than 16,000 excess visits to emergency rooms statewide related to the heat.[24] In total, the heat wave generated more than $5.3 billion in health costs.[25]

This is just one example and does not include the recent increases in summer wildfires in California exacerbated by climate change and drought. A study of California's 2018 wildfire season estimated the economic toll at $148.5 billion in that year alone.[26] Last year, California reached a record number of 4,902 wildfires in the first half of the year – more than any time in the last 20 years.[27] This is just one example of the increasing impacts that releasing large amounts of pollution into the atmosphere contributes.[28]

[21] California Energy Commission, "Cal-Adapt: Extreme Heat Days & Warm Nights," 2018, www.cal-adapt.org/tools/extreme-heat/ (accessed August 8, 2018)

[22] Marcus C. Sarofim et al., "Temperature-Related Death and Illness," chapter 2 in The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, USGCRP, 2016, https://s3.amazonaws.com/climatehealth2016/low/ClimateHealth2016_02_Temperature_small.pdf .

[23] Daniel R. Kozlowski and Laura M. Edwards, "An Analysis and Summary of the July 2006 Record-Breaking Heat Wave Across the State of California," Western Regional Climate Center, 2007, www.cnrfc.noaa.gov/publications/heatwave_ta.pdf .

[24] Carmen Milanes et al., Indicators of Climate Change in California. Kim Knowlton et al., "Six Climate Change-Related Events in the United States Accounted for About $14 Billion In Lost Lives and Health Costs," Health Affairs 30, no. 11 (November 2011): 2167-2176, www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2011.0229

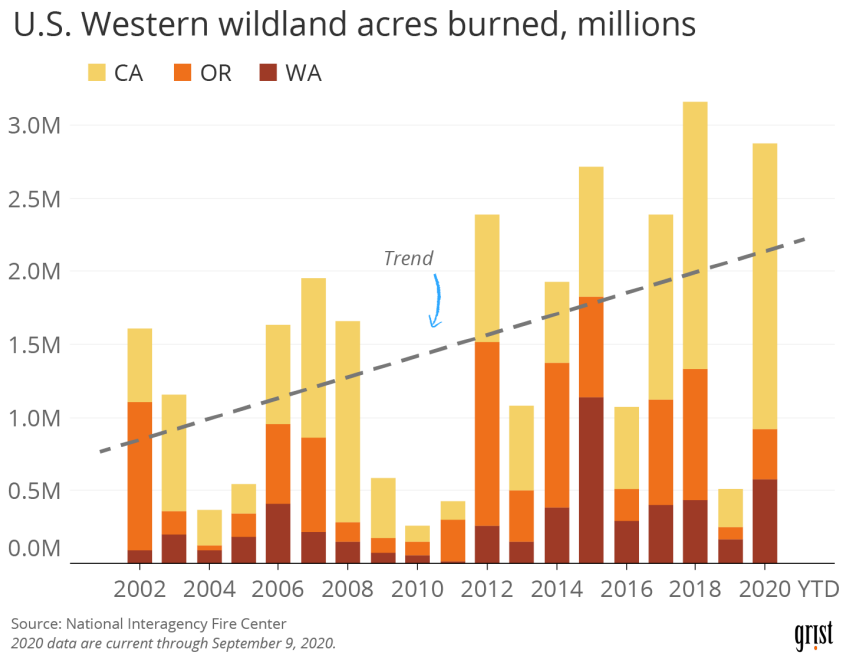
[25] Health costs include mortality costs based on the "value of a statistical life" approach, and morbidity costs calculated from medical expenses ("hospitalization, emergency department visits, outpatient visits, and other medical services") and lost work productivity. Kim Knowlton et al., "Six Climate Change-Related Events in the United States."

[26] Wang, D., Guan, D., Zhu, S. *et al.* Economic footprint of California wildfires in 2018. *Nat Sustain* **4,** 252–260 (2021). https://doi.org/10.1038/s41893-020-00646-7

[27] Paul Rodgers, "How bad is this fire season in California really going to be?" *San Jose Mercury News*, July 11, 2021.

[28] Shannon Osaka, "How apocalyptic this fire season is – in 1 flaming chart," *Grist*, September 10, 2020. https://grist.org/climate/how-apocalyptic-this-california-western-fire-season-is-in-1-flaming-chart/

Figure 1: Number of acres burned annually (in millions) across California, Oregon, and Washington[29]



D. Ensuring Strong Standards, Regardless of Federal Action.

During the Trump Administration, the National Program on GHG tailpipe emissions and fuel economy standards for passenger vehicles faced an unprecedented attack and rollback which Trump agency appointees called "the largest deregulatory initiative" of this administration.[30] As part of those attacks, the prior Administration rescinded CA's waiver in an attempt to undermine California and state authority.[31]

The U.S. EPA, under the Biden Administration, reversed much of the damage to federal and state vehicle emission programs for model years (MY) 2023 through 2026, while National Highway Traffic Safety Administration (NHTSA) updated fuel economy standards for model year (MY) 2024 to 2026 in order to reduce our nation's reliance on oil and harmonize with EPA's program. We wish to see progress and collaboration continue, but we are also cognizant that foundational progress must be made at the state level given the recent history of changing political winds at the federal level.

Therefore, more than ever, California—together with other states—must provide long-term certainty through its programs to protect public health and the environment. States have the

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[29] *Id.*

[30] Washington Post, "Trump administration rolls back rules on mileage standards, dealing a blow to Obama-era climate policy", March 31, 2020 Trump Administration rolls back rules

[31] Environmental Protection Agency and National Highway Traffic Safety Administration, Department of Transportation, "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program", September 27, 2019, https://www.federalregister.gov/documents/2019/09/27/2019-20672/the-safer-affordable-fuel-efficient-safe-vehicles-rule-part-one-one-national-program

obligation and authority to ensure continued progress occurs on reducing GHG and other air pollutants. Providing long-term certainty to the industry, as this proposed rule does, will be important not only today, but in future environments where federal inaction on climate could occur again.

E. Volatile Oil Prices and Prices at the Pump

Although the upfront costs of some electric vehicles are currently higher compared to comparable gas-powered vehicles, many EV owners already see cost savings over the lifetime of their vehicles. This is because operating expenses—including fuel and maintenance costs—are typically lower for electric cars. A recent survey by Consumer Reports found that battery electric vehicle and plug-in hybrid electric vehicle owners pay around half as much to maintain and repair their vehicles compared to owners of conventional cars.[32] The same Consumer Reports study found that fuel savings alone for an EV compared to a gasoline powered vehicle can be $4,700 or more over the first seven years.[33] A U.S. Department of Energy study found that the estimated scheduled maintenance cost for a light-duty battery-electric vehicle totals about 6.1 cents per mile, while a conventional gasoline powered vehicle is around 10.1 cents per mile, which amounts to roughly 40% cost savings on maintenance on a per mile basis.[34]

In addition, EV owners spend 60 percent less on average by charging with electricity rather than filling up with gas. Taking the full cost of ownership into account, for all nine of the most popular EVs on the market below $50,000, lifetime ownership costs were "many thousands of dollars lower than all comparable ICE vehicles' costs, with most EVs offering savings…between $6,000 and $10,000."[35] These savings were even more pronounced for used electric vehicles, which will become increasingly available as EV adoption rates increase in the state. Similarly, in 2021 the Massachusetts Institute of Technology calculated the full lifetime cost of almost every new car model on the market and found that electric cars often had the lowest costs over time.[36] An analysis by Atlas Public Policy found that "total cost of owning the forthcoming electric version of the Ford F-150 (the F150 Lightning) is 17 percent lower than the gas-powered version, the cost of the electric Volkswagen ID.4, an SUV, is 15 percent less than the Honda CRV, a Tesla Model 3 costs almost 5 percent less than a similar Lexus, and the Chevy Bolt costs 6 percent less than a Toyota Corolla."

The price of gasoline is volatile– and with gasoline prices surging, more Americans are considering purchasing EVs, which provide a cleaner, cheaper, and more stable alternative to the oil market and wildly fluctuating gas prices. Unlike gasoline, which varies wildly in price,

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[32] Chris Harto, Consumer Reports, Electric Vehicle Ownership Costs: Today's Electric Vehicles Offer Big Savings for Consumers, October 2020, page 9; https://advocacy.consumerreports.org/wpcontent/uploads/2020/10/EV-Ownership-Cost-Final-Report-1.pdf .

[33] *Id.*

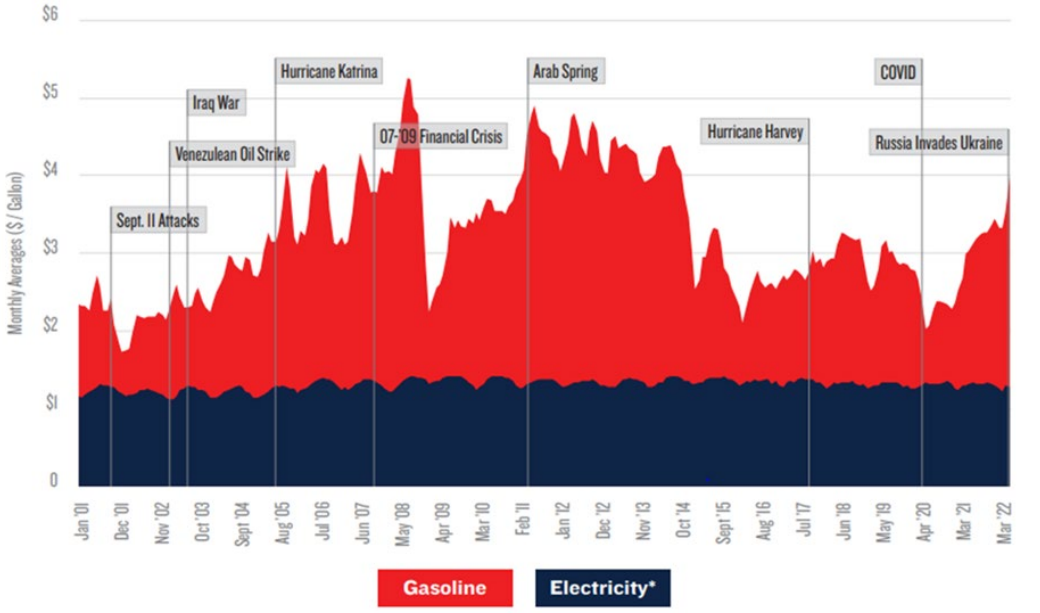
[34] Burnam, Andrew et. al., Argonne National Lab for the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE), Transportation Office. Vehicle Technologies Office, Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains, April 2021; https://doi.org/10.2172/1780970 .

[35] See Note 32.

[36] Veronica Penney, "Electric Cars are Better for the Planet – and Often Your Budget, Too," *The New York Times* 15 January 2021; available at https://www.nytimes.com/interactive/2021/01/15/climate/electric-car-cost.html

the average price of residential electricity throughout the United States, adjusted for inflation, has stayed close to the dollar-a-gallon equivalent mark for over 26 years, as depicted in the chart below.[37] Switching to EVs provides Californians with predictable, stable, and cheaper fueling costs. On May 13, 2022, gasoline prices in California averaged $5.87 per gallon– in some counties rising as high as $6.65 a gallon.[38] In PG&E's service territory, by comparison, the cost to charge an EV during off-peak hours under the EV-B Time-Of-Use Rate is akin to paying $1.96/ gallon of gasoline.[39] In Southern California Edison's service territory, driving a Nissan Leaf would cost approximately $77 per month to "fill-up," which is over $260 cheaper than a comparable gasoline vehicle.[40]

Figure 2: Average Price of Gasoline compared to the Dollars per eGallon price of electricity [41]



*Electricity price is show in "dollars per eGallon," which "represents the cost of driving an electric vehicle (EV) the same distance a gasoline-powered vehicle could travel on one (1) gallon of gasoline."[22]

[37] Max Baumhefner, natural Resources Defense Council, "Fight Fascists & Save Money: go Electric", May 11, 2022 https://www.nrdc.org/experts/max-baumhefner/fight-fascists-save-money-electric

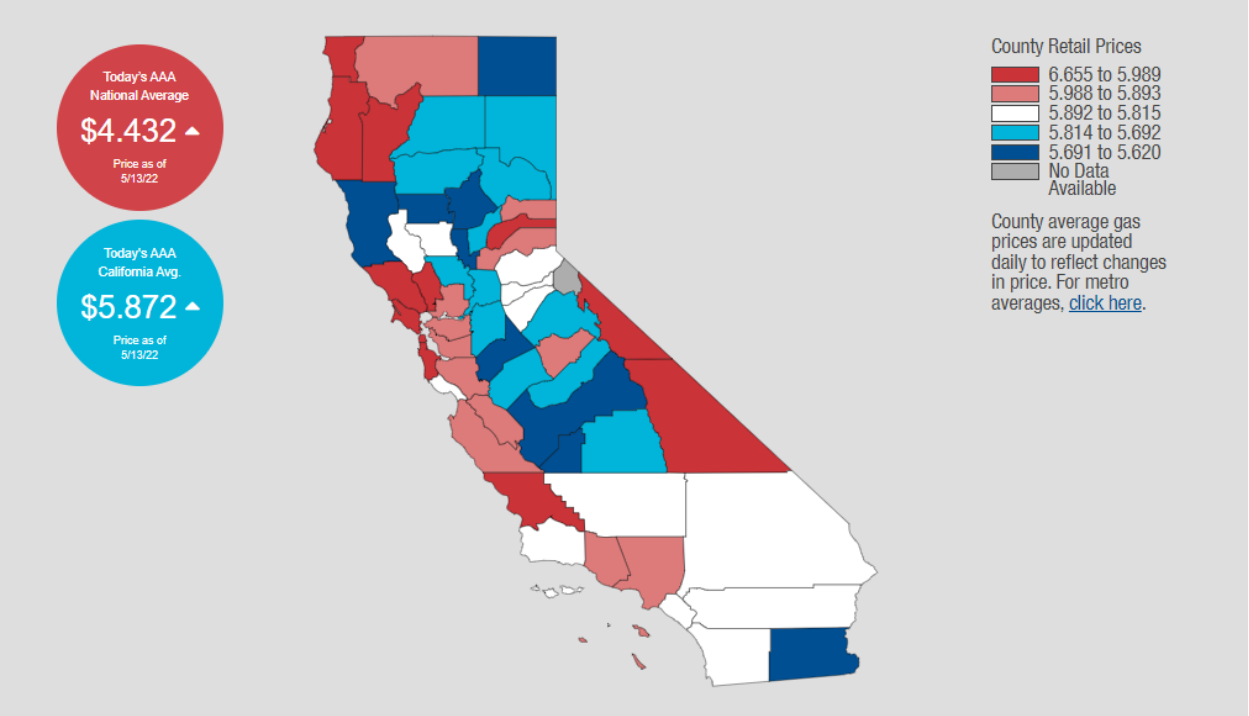
[38] American Automobile Association, "Gas Prices", https://gasprices.aaa.com/?state=CA (Accessed May 13, 2022)

[39] Pacific Gas & Electric, "Electric Vehicle (EV) Rate plans", https://www.pge.com/en_US/residential/rate-plans/rate-plan-options/electric-vehicle-base-plan/electric-vehicle-base-plan.page

[40] Southern California Edison, "Your guide to electric vehicles", https://cars.sce.com/ Accessed on May 19, 2022.

[41] *Id.*

Figure 3: Average Gas prices in California as of May 2013, 2022[42]



F. California Has the Opportunity to Maintain Its Clean Car Leadership

California has long been known as a climate and clean transportation leader. In addition to the Clean Cars Program, the state has set aggressive goals and policies to move the state to a zero emission future. In 2006, AB 32– the Global Warming Solutions Act– was signed into law, which set a goal of reducing greenhouse gas emissions by 2020.[43] In 2017, the updated AB 32 Climate Change Scoping plan laid out a plan to achieve at least 40 percent below 1990 levels by 2030, in line with Governor Edmund's Brown Executive Order B-30-15.[44] The draft 2022 Scoping Plan goes even further than this by adding a target of carbon neutrality by 2045 or sooner.[45] As the transportation sector accounted for about 40 percent of greenhouse gas emissions in the state in 2019, reducing emissions from this sector is key to achieve these goals.[46]

To reduce emissions from the transportation sector, in 2021 Governor Newsom signed a groundbreaking Executive Order that directs the state to have 100% ZEV sales by 2035, the first

[42] American Automobile Association, "Gas Prices", https://gasprices.aaa.com/?state=CA (Accessed May 13, 2022)
[43] California Air Resources Board, "AB 32 Global Warming Solutions Act of 2006, https://ww2.arb.ca.gov/resources/fact-sheets/ab-32-global-warming-solutions-act-2006
[44] Office of Governor Edmund G. Brown Jr., "Governor Brown Establishes Most Ambitious Greenhouse Gas Reduction Target in North America, April 29, 2015, https://www.ca.gov/archive/gov39/2015/04/29/news18938/index.html
[45] California Air Resources board, "Draft 2022 Scoping Plan Update", May 10, 2022, https://ww2.arb.ca.gov/sites/default/files/2022-05/2022-draft-sp.pdf
[46] California Air Resources Board, Current California GHG Emission Inventory Data, op. cit.

state in the United States to do so.[47] In the 2020 Mobile Source Strategy, ARB laid out policy pathways and programs the state should consider to achieve these goals.[48]

The original Advanced Clean Cars program helped to accelerate lower-emission and zero-emission vehicles in the United States, with California now having more than 1 million ZEVs on the road, as well as hundreds of thousands more throughout other Section 177 states. As California is the only state that can set standards more stringent than the federal government, other states throughout the country who want to take stronger action against transportation sector pollution rely on California to create the strongest program possible.

The current Advanced Clean Car ZEV requirements level out after Model Year 2025 at about 7-8% sales. However, real world sales data shows that in Q1 of 2022, California is already at about 16.3% ZEV sales,[49] indicating that while the market is performing higher than anticipated, there is still a major adjustment in sales targets needed to stimulate the ZEV market and ensure the state can achieve 100% ZEV sales by 2035. As discussed further below, this also indicates that California's proposed ACC II stringency is feasible and may in fact be able to be strengthened.

IV. The Staff Proposal is Reasonable and Feasible

ARB Staff has proposed a standard starting with 35% (nominal) sales in Model Year 2026, ramping up to 68% sales in 2030 based on the credit requirements, and culminating in 100% sales in 2035. These numbers are an improvement and stronger than what was originally proposed by staff.[50] As highlighted in the sections below, these rules are reasonable and feasible, and they will increase the number of EVs on the road. After reviewing the proposed trajectory, NRDC has concluded that the staff-proposed stringency is appropriate for the initial years of the program, and an even more aggressive 2030 target of 75% ZEV sales—versus the proposed 68% level—is achievable in California and supported by the CARB staff analysis.

The proposed ZEV sales requirements are feasible based on staff's own analysis, prior information and data provided in NRDC's October 2021 letter submitted to ARB,[51] and the publicly available evidence. This evidence - some of which we describe below - includes automakers' own EV targets and investments, current and past EV sale growth rates observed in other jurisdictions and expected baseline sales already being driven by federal GHG emission

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[47] Office of Governor Gavin Newsom, "Governor Newsom Announces California Will Phase Out Gasoline-Powered Cars & Drastically Reduce Demand for Fossil Fuel in California's Fight Against Climate Change", September 23, 2020, https://www.gov.ca.gov/2020/09/23/governor-newsom-announces-california-will-phase-out-gasoline-powered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/

[48] California Air Resources Board, 2020 Mobile Source Strategy, October 28, 2021, https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf

[49] California Energy Commission, "New ZEV Sales in California", https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/new-zev-sales (accessed on May 13, 2022)

[50] California Air Resources Board, advanced Clean Cars II Workshop, May, 6, 2021. https://ww2.arb.ca.gov/sites/default/files/2021-05/acc2_workshop_slides_may062021_ac.pdf

[51] NRDC, "Comments on Advanced Clean Cars II Public Workshop (October, 13, 2021), October 27, 2021, https://www.arb.ca.gov/lists/com-attach/26-accii-comments-w3-ws-VDpdKVYzWWkGXwJh.pdf

standards.[52] In addition, ARB staff also proposes to provide manufacturers with a number of flexibilities to help auto manufacturers comply.

A. ZEV Sales Growth in Other Jurisdictions Show CA's Standards Are Very Achievable

Our prior comment letter submitted to ARB (October 27, 2021) included an extensive section comparing the sales growth rate observed in other jurisdictions (EU countries, China) versus staff's earlier proposal.[53] The observed growth rates from those jurisdictions greatly exceeded the growth rates being considered by ARB at the time. The International Energy Agency's recent report capturing the full 2021 calendar year, together with current 2022 sales data, only strengthens the points we made last October.[54] Since then, we have commissioned further research on Germany's EV sale trends, which we provide below.

Germany has seen rapid growth in ZEV sales over the past several years, far exceeding ZEV sales growth in California. Figure 4 below shows that German ZEV sales went from 3.1% in 2019 to 26.4% in 2021, an increase of more than 23% in two years. That takeoff in German ZEV sales coincided with the "Euro 6" CO_2 emission performance standards taking effect, under which 95% of MY 2020 vehicles and 100% of MY 2021 vehicles must meet a fleet average of 95 g/km of CO2 emissions.[55] The German experience demonstrates that manufacturers can accelerate ZEV sales quickly given a strong policy push. A similar 23% increase over two years, applied to California's 2021 sales level, would result in California ZEV sales of more than 36% in 2023–thus reaching the 35% ACC II sales requirement well ahead of the MY 2026 start date.

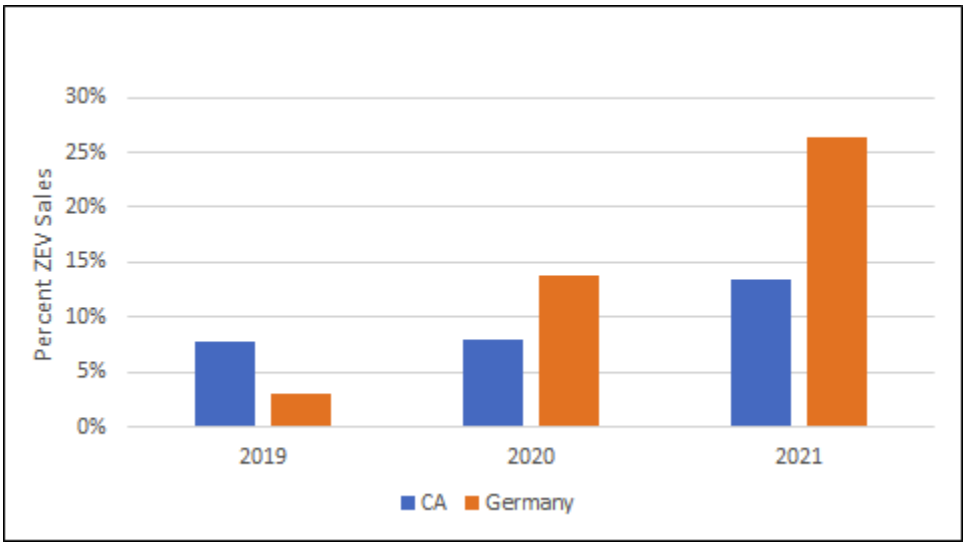
[52] Environmental Defense Fund, "Automakers Worldwide Will Spend More Than Half a Trillion dollars on Electric Vehicles This Decade—New Report", April 7, 2022, https://www.edf.org/media/automakers-worldwide-will-spend-more-half-trillion-dollars-electric-vehicles-decade-new

[53] See Footnote 50.

[54] International energy Agency, "Global electric car sales have continued their strong growth in 2022 after breaking records last year", May 23, 2022, https://www.iea.org/news/global-electric-car-sales-have-continued-their-strong-growth-in-2022-after-breaking-records-last-year

[55] European Commission, "CO2 emission performance standards for cars and vans", https://ec.europa.eu/clima/eu-action/transport-emissions/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en (Accessed May 26, 2022)

Figure 4: 2019-2021 ZEV Sales, California and Germany



We recognize that the California and German vehicle fleets are different, which must be considered in any comparison. For example, small cars, which have been early targets for electrification, accounted for 34% of total 2021 sales in Germany but only 15.4% in California. On the other hand, pickup trucks, which are just beginning to be available in electrified form, made up 15.2% of California 2021 sales whereas German sales of pickup trucks were negligible. There are also differences within each market segment, in particular for small cars. In Germany, about 37% of the small car ZEVs are Class A vehicles, which are considered subcompacts in the US. Subcompacts (e.g. Kia Soul, Honda Fit, or Fiat 500L) are less popular in California and made up only 1.4% of 2021 total sales.[56] Thus there is less potential to achieve large increases in fleetwide California ZEV sales from this segment alone.

To better understand the status of these markets NRDC obtained sales data from EV Volumes which was then compiled and analyzed by Baum & Associates. Our analysis of the data concludes that only a small portion of the discrepancy in sales rates can be explained by differences in the California and German vehicle fleets. Table 1 provides several metrics for each market segment for California and Germany:

- Market segment sales percent of total sales
- ZEV sales percent of market segment sales
- Market segment ZEV sales percent of total sales
- Market segment ZEV sales percent of total ZEV sales

[56] Carsalesbase, US Car Sales Analysis 2021—Subcompact Cars,https://carsalesbase.com/us-car-sales-analysis-2021-subcompact-cars/ (Accessed May 26, 2022)

Table 1: Sales Fractions by Market Segment, US and Germany, 2021

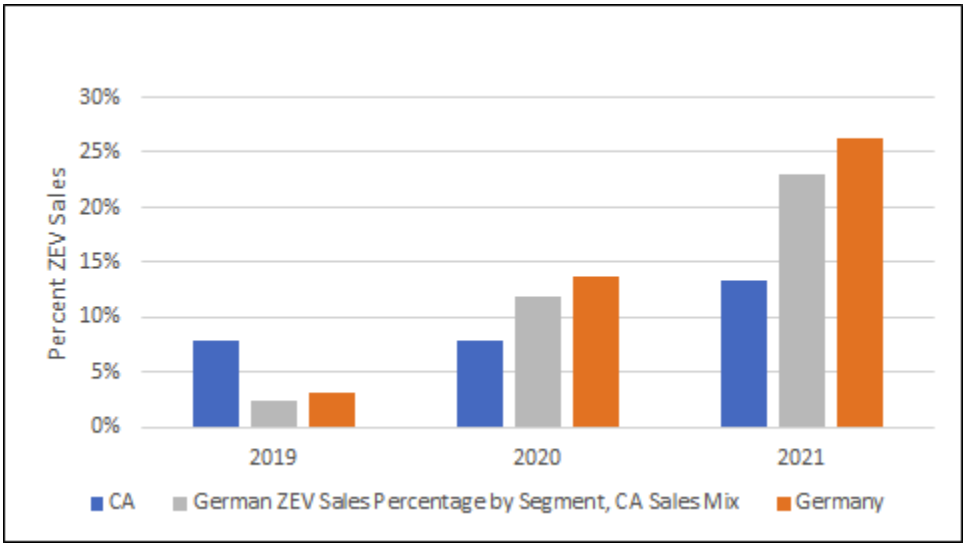
Market Segment		Segment Sales		ZEV Sales Percent of		Segment ZEV Sales		Segment ZEV Sales	
		California	Germany	California	Germany	California	Germany	California	Germany
Car	Small	15.4%	34.0%	31.2%	26.3%	4.8%	8.9%	36.0%	33.9%
	Midsize	9.5%	3.3%	7.9%	22.9%	0.7%	0.8%	5.6%	2.9%
	Luxury	11.4%	16.2%	1.4%	31.7%	0.2%	5.1%	1.2%	19.5%
Crossover	Small	16.7%	18.4%	8.1%	20.5%	1.3%	3.8%	10.1%	14.3%
	Midsize	8.7%	5.3%	63.3%	22.3%	5.5%	1.2%	41.1%	4.5%
	Luxury	12.9%	9.6%	0.0%	46.4%	0.0%	4.5%	0.0%	16.9%
SUV	Midsize	4.6%	0.9%	13.5%	4.6%	0.6%	0.0%	4.7%	0.2%
	Large/Luxury	3.5%	2.9%	0.9%	31.4%	0.0%	0.9%	0.2%	3.5%
Other	Large Van	1.4%	5.3%	0.8%	10.5%	0.0%	0.6%	0.1%	2.1%
	Minivan	2.1%	4.1%	2.0%	14.8%	0.0%	0.6%	0.3%	2.3%
	Pickup	13.7%	0.0%	1.3%	0.0%	0.1%	0.0%	0.8%	0.0%

Even taking the different sales mixes into account, however, a substantial gap remains. As the "ZEV Sales Percent of Segment Sales" columns in Table 1 show, in many market segments a higher percentage of segment sales are ZEVs in Germany as compared to in California.[57] To explore this factor in more detail, Shulock Consulting projected what California ZEV sales would be if the German ZEV sales fractions for each market segment, excluding subcompacts, were achieved here. This analysis applied the German ZEV sales fractions to California sales for the corresponding market segment.[58] Figure 5 shows the results for California ZEV sales, the German ZEV sales percentages applied to the California sales mix, and German ZEV sales. Just achieving the current German ZEV sales percentages in each segment would substantially increase California ZEV sales.

[57] The one notable exception (higher California ZEV sales in the Midsize Crossover segment) is due to large California sales of the Tesla Model Y.

[58] Using the small crossover segment as an example, this projection starts with the 21,9% California small crossover market share, then assumes that the 20.5% German ZEV sales fraction for small crossovers is achieved in California instead of the California ZEV sales fraction of 8.1%. The same calculation is then performed for all segments. The German ZEV sales fraction for small cars was reduced by 9.7% (36.9% of the 26.3% German small car ZEV sales fraction) to account for German Class A ZEV sales that would have no counterpart in the US.

Figure 5: ZEV Sales in California with German Sales Percentages by Segment, and Germany

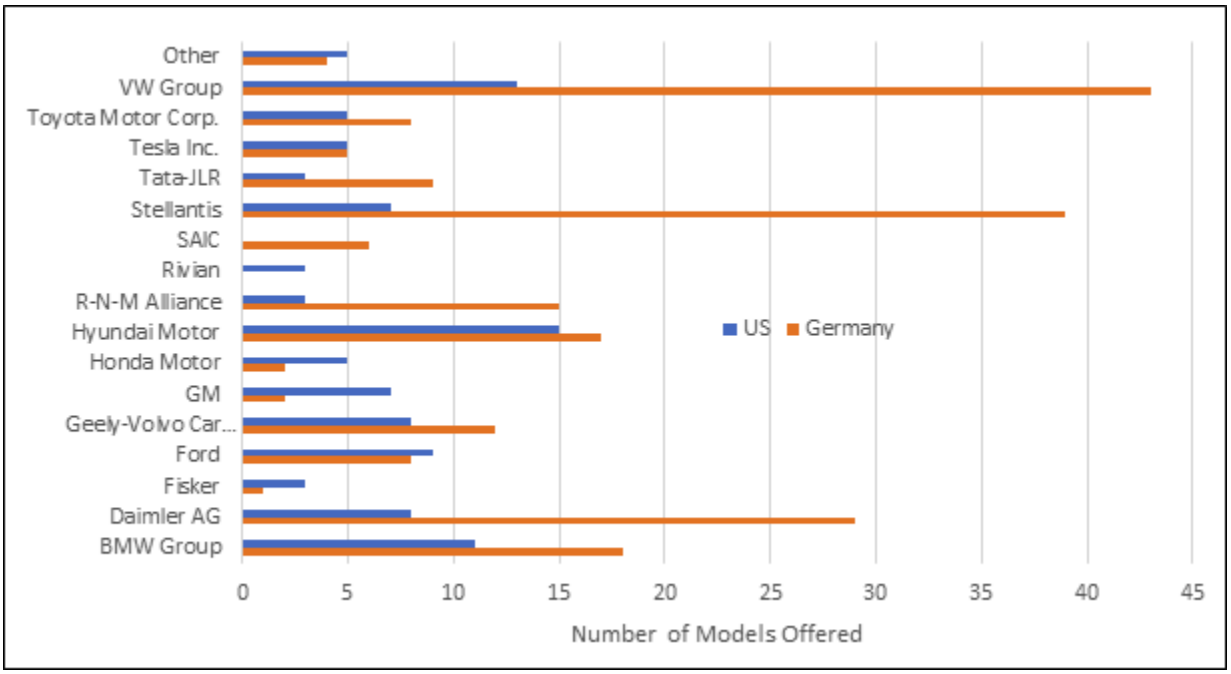


B. Increased Model Availability—Driven by Standard Requirements—Can Cause Large Sale Growth

Another likely reason for the greater ZEV penetration in Germany is the much larger number of ZEV models available. Availability, rather than customer demand, is fast becoming the limiting factor in ZEV deployment. In a special report prepared for COP26, BloombergNEF noted that "A lack of EV models to choose from, combined with weak fuel economy standards, are among the reasons for the U.S. lagging China and Europe in ZEV deployment."[59] Figure 6 shows the number of models offered in Germany and the US by each manufacturer. In most cases many more models are offered in Germany, and the total number of models offered in Germany, at 218, is nearly twice the US total of 110.

[59] BloombergNEF, "Zero-emission Vehicles Factbook", November 10, 2021, slide 27, BNEF Zero-Emission Vehicle Factbook

Figure 6: Model Availability, US and Germany

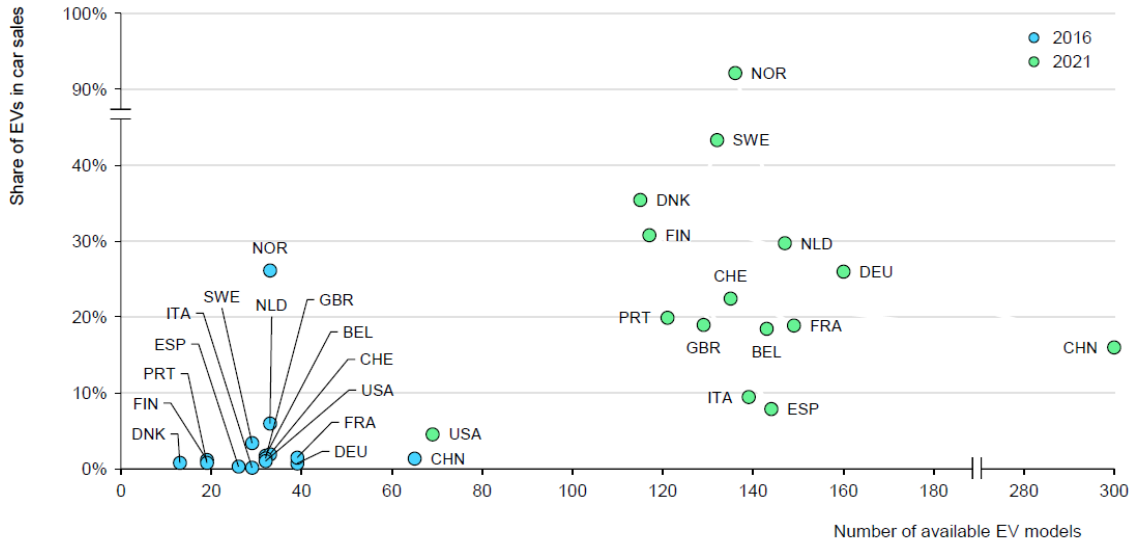


Model availability can also be affected by policy. Baum & Associates noted that US electric volumes have been reduced given the more stringent requirements in Europe and China, with available production being directed to those markets. Thus, we can anticipate that more stringent ZEV requirements in California and Section 177 states would induce manufacturers to provide more supply here and lead to increased sales.

The evidence for this is already observed in a number of EU countries and China, where in 2016 model availability was relatively low. Increasing EV model availability (or supply) led to significantly increased sales by 2021, as implied by the International Energy Agency figure below.[60]

[60] Global EV Outlook 2022, International Energy Agency, https://iea.blob.core.windows.net/assets/e0d2081d-487d-4818-8c59-69b638969f9e/GlobalElectricVehicleOutlook2022.pdf

Figure 7: Number of Available EV Models Relative to EV Sales Shares, 2016-2021[61]



While the U.S. (and California) still are relatively EV model limited, this will be changing by the time ACC II begins. Bank of America's Global Research (BofA) forecasts for the U.S. show that over MY2022 through 2025, 119 out of the 383 nameplate offerings will have an electric powertrain (or 31%) not including fuel cell and hybrid offerings.[62] A number of automakers (e.g., VW, BMW, GM) will have upwards of 35% to 66% of their models with electric powertrains. ARB's standards—together with those of other jurisdictions—will also likely drive some of the laggards (Toyota, Honda, Nissan) to increase their ambition. ARB should set standards to push and reward and reflect growth of the market leaders, rather than to design its standards to accommodate laggards. Staff should also not presume that automakers can only stay with traditional product cadence (design cycles and turnover rates) and product refresh rates. The rapid growth by EV-only manufacturers, changes to design and manufacturing processes, increased competitive pressures, and global regulatory requirements are resulting in fundamental shifts.

[61] *Id.*

[62] John Murphy, "U.S. Automotive Product Pipeline: Car Wars 2022-2025: Electric Vehicles shock the product pipeline, June 10, 2021, BofA Global Securities, https://s3-prod.autonews.com/2021-06/BofA%20Global%20Research%20Car%20Wars.pdf (last viewed 5/25/2022).

Figure 8: Electrification of Powertrains over MY2022-2025.[63]

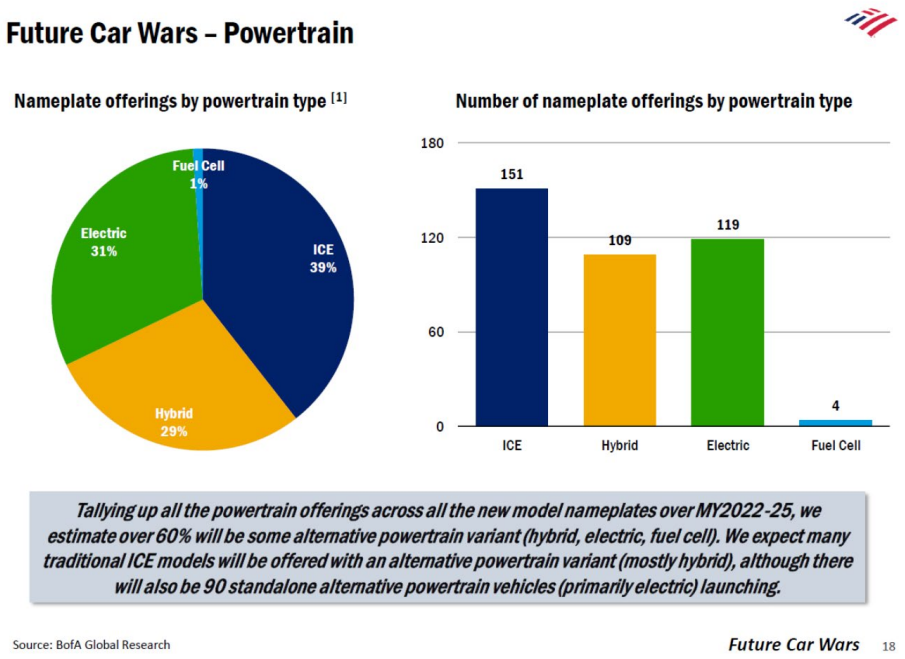
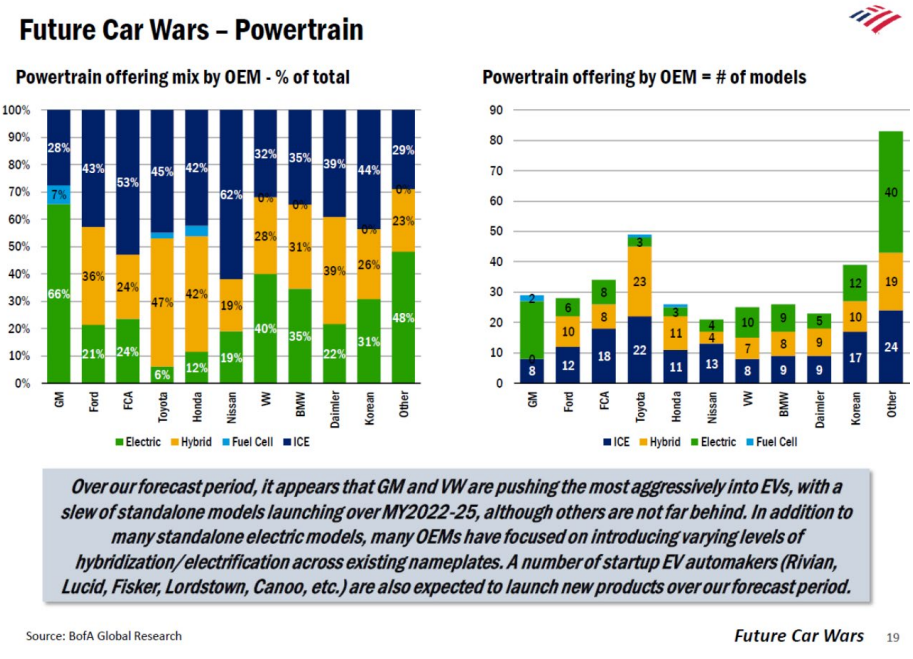


Figure 9: Electrification of Powertrains by OEM over MY2022-2025.[64]



[63] *Id.*
[64] *Id.*

C. The Compliance Flexibilities Provided in the Program Are Generous

As the Staff ISOR reflects, there are a number of provisions that allow each automaker - regardless of their current sales position - great flexibility to comply fully with the program in California (and in other Section 177 states).

Based on independent analysis conducted by Shulock Consulting, NRDC concludes that sales in California will be close to the nominal ZEV requirement, with sales in Section 177 sales being lower as noted below.

The real-world ZEV sales for individual manufacturers and for the state as a whole will vary depending on which manufacturers take advantage of which specific flexibilities. To reliably project the aggregate impact, we would need detailed information on manufacturer long-term compliance strategies both in California and in the Section 177 States. Lacking that, we have used the available data to narrow the range of possible outcomes. Data sources include:

- Manufacturer-specific California ZEV sales projections for MYs 2022 through 2025 from Baum & Associates, LLC
- Staff's projected "business as usual" ZEV sales in California through MY 2025
- ZEV sales history in Section 177 states
- The ZEV market share through 2026 assumed in the recently adopted federal GHG tailpipe standards

Taking all this information into account, our best assessment is that ZEV sales in California will be close to the nominal standard, with lower sales in the Section 177 states as noted below.

D. ARB can Increase Stringency for MYs 2029 through 2034

The ZEV stringency levels, and nominal sales required, in the initial years of the staff proposal are reasonable and achievable. Based on the Alan Baum & Associates data and recent actual ZEV sales we project that in MY 2026, under a business-as-usual approach manufacturers accounting for about one-third of California total sales will have ZEV sales in excess of the 35% requirement, while the remaining manufacturers with about two-thirds of California sales will fall short.[65] Thus, the regulation will require manufacturers with two-thirds of California sales to take additional steps to meet the requirement by placing additional ZEVs, acquiring vehicle values from another source, placing ZEVs in environmental justice applications, and/or utilizing the limited use of converted credits, through the flexibility described above.

In future years, however, the requirement can and should be more aggressive. NRDC recommends that the MY 2030 requirement be set at 75% (rather than 68%), with MYs 2029

[65] In this projection ZEV-only manufacturers account for 6.6% of total California sales in MY 2026.

through 2034 adjusted per that checkpoint. The resulting trajectory is shown in Figure 10 and Table 2.

Figure 10 : Proposed Increased Stringency Compared to Staff Proposal

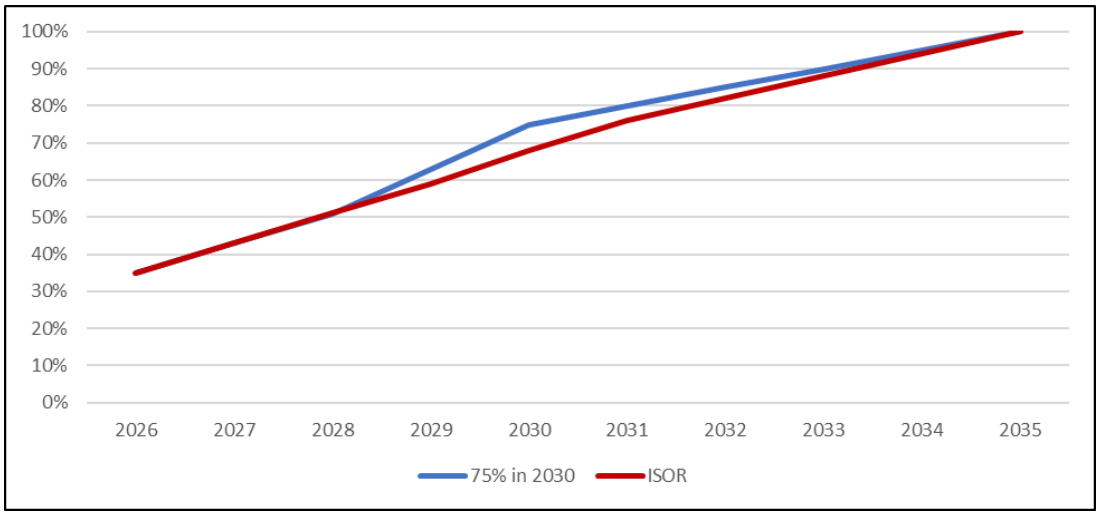
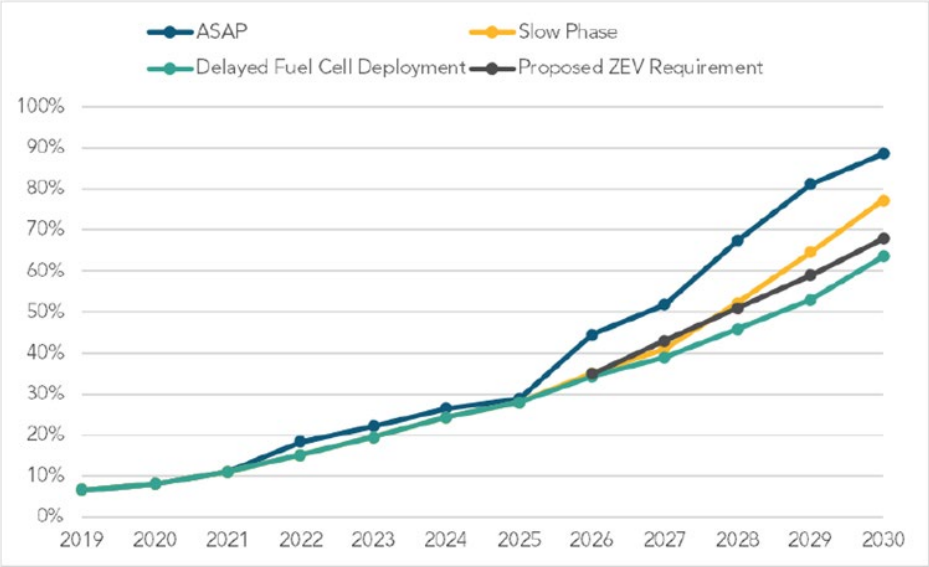


Table 2: Comparison of NRDC's Stringency Proposal vs. Staff's ISOR proposal.

	Percent Sales									
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
75% in 2030	35.0%	43.0%	51.0%	63.0%	75.0%	80.0%	85.0%	90.0%	95.0%	100.0%
ISOR	35.0%	43.0%	51.0%	59.0%	68.0%	76.0%	82.0%	88.0%	94.0%	100.0%

NRDC recommends the 75% by 2030 target for a number of reasons. First, it is necessary. Prior portions of these comments have outlined the rationale for aggressive action. Second, it is achievable. Support for our recommended stringency is provided in the ISOR. In its discussion of feasibility, staff outlines several "model turnover" scenarios which assess how rapidly manufacturers can introduce new ZEV models into the fleet. As shown in Figure 8 of the ISOR, shown below, the "slow phase" scenario closely mirrors the proposed ZEV requirement through MY 2028, after which the current ZEV requirement begins to fall short. Given the urgency of the climate crisis, the ramp rate should not be slower than what staff has concluded to be feasible.

Figure 11: CARB Analysis of Model Turnover Scenarios[66]



Moreover, once again the European experience is instructive. A May 2021 study by Bloomberg New Energy Finance assessed the feasibility of all EU countries reaching 100% ZEV sales by 2035 with appropriate policy support.[67] The study divided the EU into four groups: Nordic, Western Europe, Southern Europe and Eastern Europe. The study concluded that the Nordic group could reach 100% sales as early as 2030, while Western Europe could reach 72% battery electric vehicles (BEVs) sales in 2030. The Southern and Eastern countries lagged behind but EU sales as a whole in 2030 at 67% projected sales. Given California's substantial investment in and support for electrification, the Nordic countries and Western Europe are the best comparisons, and their sales potential can be replicated here.

Finally, experience has shown that if the ZEV requirement turns out to be infeasible, the board can readily make a correction well in advance of the effective date. But it is all but impossible to accelerate an adopted rule given the lead needed by automakers. Past boards adopted groundbreaking technology-forcing ZEV regulations which on several occasions then needed to be relaxed. That was not a failure, but rather an appropriate exercise in decision-making under uncertainty. Given how much more is known today about the urgent need for aggressive action and the inevitability of ZEV technology, this Board likewise should push the envelope.

i. Recommended Increased Stringency Would Increase the Number of ZEVs

Adopting the 75% in 2030 recommendation would increase the number of ZEVs in California and the Section 177 states. Table 3 shows the projected annual and cumulative increase in the

[66] ISOR, p. 41.

[67] Break-up with combustion engines, A briefing by Transport & Environment, study conducted by Bloomberg New Energy Finance. Breakup with Combustion Engines

number of vehicles placed in California, the Section 177 states and nationwide under this proposal.[68] The recommended change has no impact until MY 2029, and similarly has no annual impact in MY 2035 when both trajectories reach 100% sales. But for MYs 2029 through 2034 the NRDC recommendation would result in almost 1.4 million cumulative additional ZEVs nationwide.

Table 3: Additional ZEV Placements, NRDC Recommendation vs. Staff Proposal

California	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual	0	0	0	76,184	134,787	79,114	58,603	39,264	20,218	0
Cumulative	0	0	0	76,184	210,971	290,086	348,689	387,953	408,171	408,171
177 States	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual	0	0	0	162,880	288,420	201,450	156,682	105,723	53,489	0
Cumulative	0	0	0	162,880	451,300	652,751	809,433	915,156	968,645	968,645
Total	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Annual	0	0	0	239,064	423,208	280,565	215,285	144,987	73,707	0
Cumulative	0	0	0	239,064	662,272	942,836	1,158,121	1,303,109	1,376,816	1,376,816

These additional ZEV placements will likewise increase the emission reductions achieved through ACC II. At this time NRDC does not have the capability to directly model the emission impact of additional ZEVs, but to provide a first-cut approximation we started with Table 9 from Appendix D of the Initial Statement of Reasons, which shows total emission benefits for the ZEV and the LEV components of the proposed regulation but does not differentiate between the ZEV and LEV components. To separate out the ZEV contribution to the total reduction we calculated the ZEV fraction of cumulative total sales (ZEV plus ICE) in each model year under the staff proposal and then attributed that fraction of the total emission reduction in that model year to the ZEV component. We then increased the annual ZEV benefit in each model year based on the percent increase in cumulative ZEV sales in that year. The results for MYs 2030, 2040 and 2050 are shown in Table 4.

Table 4: Initial Projection, Additional California Emission Reductions, NRDC Recommendation

	2030	2035	2040
NOx (TPD)	0.18	1.65	4.55
PM 2.5 (TPD)	0.01	0.10	0.29
CO2 (MMT per Year)	0.33	3.16	8.78

As the table indicates, even a relatively small increase in annual ZEV sales has a significant cumulative GHG impact. The reductions in health-damaging PM 2.5 and NOx will also lead to improved public health.

[68] The calculations for Table 3 are based on projected total California sales as used for the Mobile Source Strategy and may not exactly match the total sales projections used in the ISOR.

ii. Ensuring that ZEV Requirements are Delivering Emission Reductions to Disadvantaged Communities

ARB should utilize this vital opportunity to ensure that the ZEV requirements, as a part of the ACC II program, are delivering emission reductions to those communities most historically overburdened with transportation emissions, and where the public health needs are among the greatest. NRDC shares the objectives of our equity partners to have a strong proposal that increases the emissions and public health benefits of the ZEV program overall, results in more vehicles being placed in pollution-burdened communities or regions than would otherwise occur, and that maximizes participation by automakers in these programs. Increased participation in or expansion of these equity-centered programs – as driven by the provisions in the ZEV program - could increase overall public health benefits.

The inclusion of equity provisions that can expand the supply of zero-emission vehicles to car-share programs, Clean Cars 4 All (CC4A), and the Clean Vehicle Assistance Program (CVAP) can deliver additional public health benefits to communities that experience disproportionate emissions. We urge the Board to adopt equity crediting provisions in ways to maximize the potential for these additional public health benefits.

By having more ZEVs placed into programs such as Clean Cars 4 All,[69] where old, internal combustion engine vehicles are scrapped and replaced with ZEVs, additional benefits are expected to be delivered as the vehicles displaced may be older, and more polluting, than the average California vehicle being replaced. As a November 5, 2021, South Coast Air Quality Management District report notes, "The old vehicles [being replaced] have an average of 178,800 miles and an average age of 21 years at the time of retirement" and the program "is achieving the goal to replace the dirtiest vehicles in the region while serving low-income households and disadvantaged communities."[70] This compares against the average replacement age of vehicles in the U.S. being closer to 12 years.[71] The older vehicles replaced by CC4A likely have been certified to less stringent emission standards compared to newer vehicles, together with increased likelihood of emission control systems malfunctioning or degrading.

In the case of EV community car sharing, studies have generally found that these categories of programs reduce the need for vehicle ownership, leading to avoided vehicle miles traveled and the associated reduced pollution. In addition, the use of ZEVs leads to further GHG reduction benefits compared to conventional vehicle carsharing.[72] Introducing ZEVs into community

[69] California Air Resources Board, Clean Cars 4 All, Clean Cars 4 All

[70] South Coast Air Quality Management District, Board Meeting Date November 5, 2021, Agenda No. 8, http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-nov5-008.pdf?sfvrsn=2

[71] United States Department of Transportation, Bureau of Transportation Statistics, Average Age of Automobiles and Trucks in Operation in the United States, https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states

[72] Rodier, C., Randall, C., Garcia Sanchez, J., Harrison, M., Francisco, J., & Tovar, A. (2022). Challenges and Opportunities for Publicly Funded Electric Vehicle Carsharing. UC Davis: National Center for Sustainable Transportation. http://dx.doi.org/10.7922/G29C6VRC Retrieved from https://escholarship.org/uc/item/5nf0m5mc

mobility programs also allows drivers to gain experience with ZEVs and resolve questions about their practicality and capabilities, leading to increased future uptake.

Similarly, the inclusion of credits for the Clean Vehicle Assistance Program, which targets clean mobility access for low- and moderate- income (LMI) households, can allow for increased expansion of that program and allow for this market-segment to convert to ZEVs faster than might otherwise occur. This is especially true if consumer adoption is expected to be slower in LMI households, and as higher-income households reach 100% ZEV market saturation.

We anticipate that directionally there may also be additional local benefits from avoided PM2.5 and other air toxics, especially in non-attainment communities through the described mechanisms above. We also recognize that there are important ancillary, co-benefits of increasing ZEVs in these communities, such as increasing mobility and access to clean cars in environmental justice and other pollution-impacted communities.

Analysis by Shulock Consulting estimates that if the proposed equity provisions are used by all manufacturers, in 2026 over 11,000 ZEVs could go into Community Car-Share Programs, increasing to over 50,000 vehicles in 2030– when the equity provisions are set to expire. Additionally, over 7,400 ZEVs could be added to the Clean Cars For All Program in 2026, increasing to 11,024 in 2028. This would effectively double the number of available vehicles in the Clean Cars for All Program.[73]

As proposed, the equity credit provisions are specifically tailored towards California's current programs, and it is important that ARB also consider the ability of Section 177 states to implement these same provisions to accelerate public health and air quality benefits across Section 177 states. Since all Section 177 states may not have specific equity programs akin to California, such as Clean Cars for All, ARB should incorporate language that identifies the primary objectives for state programs to qualify, such as accelerating ZEV deployment particularly in overburdened communities or air basins. State agency officials or the equivalent Executive Officer counterparts, subject to their state administrative procedures, could identify those specific programs that meet the objectives of the equity provisions.

iii. The ZEV Assurance Measures Will Increase Transparency and Support Second Life Battery Applications

In addition to the emissions and ZEV standards proposed in ACC II, CARB has also proposed ZEV assurance measures related to the vehicle's batteries to increase transparency, ensure that the vehicles continue to retain value in the long-term and remain viable options for consumers, provide support for second-life battery applications and importantly, to provide used ZEV purchasers with peace of mind about the vehicle they are purchasing.

NRDC is supportive of these measures to provide assurance to drivers–especially in the used vehicle market– that the ZEVs they purchase will last and that the technology is manageable

[73] EFMP Retire and Replace Program Statistics, https://ww2.arb.ca.gov/sites/default/files/2022-04/EFMP%20Website%20Statistics%20Tables%20Cumulative%202021_Q4_0.pdf

and safe. We are especially supportive of the on-vehicle data standardization to provide drivers and mechanics the ability to understand the battery's state of health, and battery labeling to improve recyclability.

In regard to data standardization, ARB notes that "access to data has been an important cornerstone of CARB regulations for gasoline vehicles…"[74] but thus far, there have not been similar requirements for access to data for ZEV vehicles. The proposed On-Vehicle Data Standardization measures– particularly the battery state of health provisions– would help to ensure that technicians and ZEV drivers are able to diagnose and understand how their vehicle's battery is operating and functioning. This data can also be used for appraisals in the used vehicle market and to assist in transitioning batteries into secondary life applications.

As the number of ZEVs increase, there will be additional need for battery recycling and second life applications for the batteries after their useful life in vehicles has ended. Requiring labeling of the vehicle batteries that includes important information on the battery system, including the chemistry, voltage, capacity, and safety information are key pieces of information to not only increase driver's confidence in their ZEV, but to also help facilitate greater battery reuse and recycling. ARB notes that improved recycling through battery labeling could provide savings of more than $200 billion through 2040.[75]

Together, these proposed assurance measures will increase confidence of ZEV drivers in the new and used vehicle markets that the vehicles they purchase are "healthy," while also facilitating greater use of battery recycling and other end-of-life battery technologies. For these reasons, NRDC supports these proposals.

E. ZEV Requirement– Section 177 States

i. Section 177 States Look to California's Leadership

As of May 2022, eighteen other states have adopted California's Advanced Clean Cars program, accounting for an additional 29% of the United States' light-duty vehicle market beyond California's 11%.[76] Thus, the emission impact of California's rules is almost tripled when the Section 177 states are taken into account. As California is the only state that can set more stringent standards than the United States Environmental Protection Agency for transportation sector emissions, these "Section 177" states look to California to lead and develop strong programs that will help states move faster to reduce transportation sector emissions, which are often the largest source of emissions in these states.

States such as New York and Washington have already set aggressive goals to achieve 100% electric vehicle sales by 2035 and 2030 respectively but need strong Advanced Clean Cars standards to achieve these goals, and have expressed their intent to move forward with ACC II

[74] ISOR at 71

[75] ISOR at 88

[76] California Air Resources Board, States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act, Section 177 States. In addition, Virginia (2.3% of US sales), Nevada (0.8%) and New Mexico (0.5%) have adopted ACC I but are not included in the CARB table.

as soon as California has adopted it. Other states, such as Massachusetts, have also indicated that they will move forward with the regulation this year as well.

However, it is important to note that not all current Section 177 states will be able to adopt the regulation this year, and therefore some states will miss the first compliance year for ACC II– likely having to start the regulation in MY2027 or later. The flexibilities in the regulation are applicable to all states, including California, but one provision is more relevant to these "delayed" Section 177 states– the Early Compliance Credit mechanism. This flexibility allows states that may need to start adoption in later model years to still utilize credit flexibility mechanisms in the 2 previous model years prior to joining the program. In addition, the flexibilities available to all states, including California, are structured such that they can help states with lower current ZEV sales achieve the aggressive ACC II standards. As noted in the discussion of California stringency above, our best assessment is that ZEV sales in California will be close to the nominal standard, with lower sales in the Section 177 states. Figure 12 and Table 5 show ZEV sales for a typical Section 177 state for both the staff proposed requirement and the NRDC increased stringency recommendation. This projection is based on California sales reaching the nominal regulatory requirement. Under that scenario, and with the proposed flexibilities approved, Section 177 states will be able to comply with ZEV sales levels.

Figure 12: Projected ZEV Sales in Section 177 States

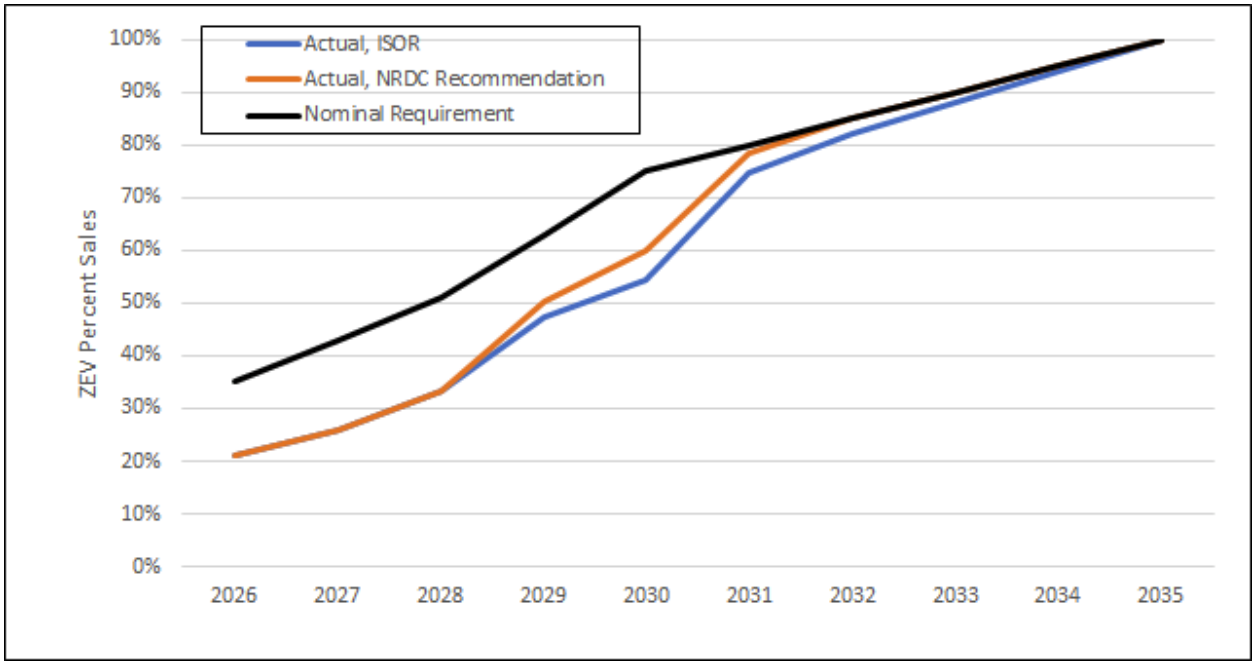


Table 5: Projected ZEV Sales in Section 177 States with Flexibilities Utilized

	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Actual, ISOR	21%	26%	33%	47%	55%	75%	82%	88%	94%	100%
Actual, NRDC Recommendation	21%	26%	33%	51%	60%	79%	85%	90%	95%	100%
Nominal Requirement	35%	43%	51%	63%	75%	80%	85%	90%	95%	100%

F. Feasibility of Advanced Clean Cars 2

i. Funding Available to Support Infrastructure Over the Next Five Years, but More is Needed in the Future

As part of NRDC's assessment of the feasibility of the ACC II standards, we commissioned two consultancies, Atlas Public Policy and Dean Taylor Consulting (Consultants), to evaluate the EV charging infrastructure needed to support the EVs expected to be on the road. The Consultants utilized the National Renewable Energy Laboratory's Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite to evaluate the charging infrastructure needs under ACC II and also overlaid cost estimates based on the type of infrastructure needed. Four scenarios were run using EVI-Pro, with the most conservative (in terms of charging infrastructure needs) presented here.

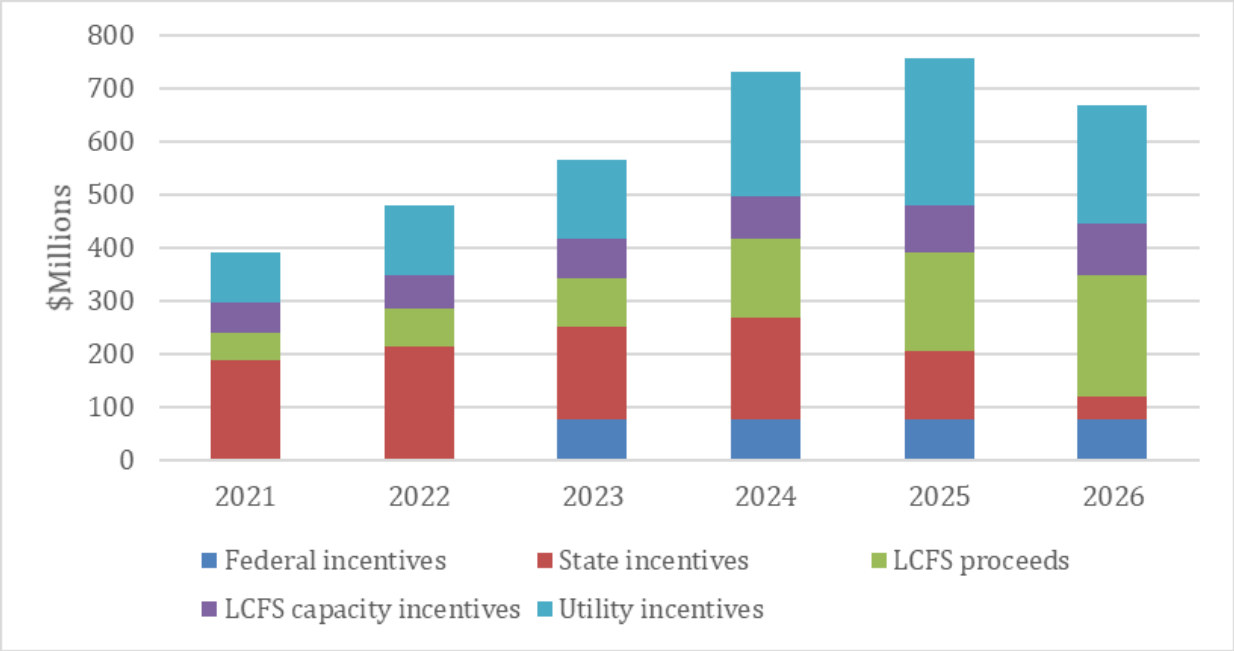
EVI-Pro outputs include public DC fast charging direct current fast chargers (DCFC- 150 kW), public Level 2 charging, and workplace charging. However, to capture the additional needs from multi-unit dwellings (MUDs), the Consultants also assumed shared EV chargers would be installed. The methodology is further described in Appendix A: Assumptions Around Charging Infrastructure Analysis.

The analysis revealed that investments from the state, the federal government, Low Carbon Fuel Standard, and electric utilities are currently projected to deliver $3.2 billion in support for charging infrastructure over the next five years in California. This amount could meet the state's public, workplace, and shared multi-unit dwelling charging needs over the next five years based on a conservative estimate, provided that the Legislature passes the Governor's ZEV investment proposal; the utilities implement their approved investments; federal funds are dispersed; and the Public Utilities Commission approves filings on Low Carbon Fuel Standard (LCFS), near-term priorities and Pacific Gas and Electric's new proposal.[77,78] Continued investments will likely be needed to meet the 2030 and 2035 public and shared private light duty charging infrastructure needs, including up to another $1.4 billion in public investments needed between now and 2030, and up to $6.3 billion between now and 2035, based on the most conservative case under the analysis. We note these amounts do not include consideration of potential funding needs for charging by fleets, single-family homes, or dedicated (assigned) parking in multi-unit dwellings. It is assumed under ACC II that much of these infrastructure categories will be borne by the EV driver and the private sector (including potential site-hosts).

[77] Assumes 100 percent of the cost would be paid for. However, private funds can likely pay for 20 to 50 percent of the cost. Source: California Energy Commission, *Draft Zero-Emission Vehicle Infrastructure Plan (ZIP)*, April 2022, CEC-600-2022-054, Thanh Lopez and Madison Jarvis, page 6, https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf. [Accessed April 14, 2022.]

[78] See the technical appendix for further details on the analysis by Atlas Public Policy and Dean Taylor Consulting.

Figure 13: State, Federal, and Utility Funding for Public and Shared Private Charging Infrastructure for Light-duty EVs Compared to the Needed Infrastructure



These findings are also consistent with recent analysis by California agencies showing sufficient infrastructure funding likely exists to meet the state's 2025 goal.[79] If California continues its investment trends, it could also be on a path to meet its ZEV and ZEV infrastructure goals for 2030 and beyond.[80] Furthermore, the evaluation reveals that:

- **Significant public and shared-private EV chargers already exist in California:** Currently 79,000 EV public and shared private chargers exist in the state, including direct current fast chargers (DCFC), level 2 chargers, and level 1 chargers. This does not include the estimated 800,000 private chargers at homes and for fleets.[81]
- **Significant increases in funding and incentives for public and shared-private chargers are expected**: A mix of new federal incentives for charging infrastructure, existing and proposed state incentives, utility investments, and LCFS credits are expected to provide about $3.1 billion in support for light-duty charging infrastructure,

[79] California Energy Commission, Commission Final Report: 2021–2023 Investment Plan Update for the Clean Transportation Program, December 2021, CEC-600-2021-038-CMF, Table ES-1, https://www.energy.ca.gov/publications/2021/2021-2023-investment-plan-update-clean-transportation-program [Accessed April 13, 2022.] Table ES-1 does not include the 2021 state budget, the proposed 2022 state budget, new private funds, or recent federal funds from the Infrastructure Investment and Jobs Act. Also see California Energy Commission, CEC Approves $1.4 Billion Plan for Zero-Emission Transportation Infrastructure and Manufacturing, November 21, 2021, https://www.energy.ca.gov/news/2021-11/cec-approves-14-billion-plan-zero-emission-transportation-infrastructure-and [Accessed April 13, 2022]

[80] California Energy Commission, Draft Report 600-2022-054, page 1.

[81] California Energy Commission, Data and Reports, "Electric Vehicle Chargers in California", https://www.energy.ca.gov/data-reports/energy-insights/zero-emission-vehicle-and-infrastructure-statistics/electric-vehicle. [Accessed March 31, 2022]. Note: this fact sheet does not consider fuel cell EVs and hydrogen stations. The private charging stations are estimated for both level 1 and level 2 charging that are currently in use.

as shown in the figure below. It should be noted that the figure below does not include additional funding sources such as settlement funds, private company funding or match (e.g., Tesla, Electrify America), future state funding or ballot measures, such as the Clean Cars and Clean Air ballot measure expected in November of 2022**.** According to the California Energy Commission (CEC), fewer than half the public and shared private chargers in California today have received public funding from the state, utilities, or settlement agreements.[82]

- **The investments include funding to increase access for frontline communities most burdened by tailpipe pollution.** To date, about 40 percent of utility investments have been designated for disadvantaged communities. However, more can be done by the legislature to ensure that state investments in infrastructure prioritize build-out in frontline communities, often low-income communities and communities of color facing the largest pollution burdens in the state.[83]
- **Continuing the trends to increase funding for infrastructure will enable California to meet its EV goals.** The expected public EV infrastructure investments will put the state on a very strong path to meet the infrastructure needs through 2027. Increasing public and private investments over time will be needed to facilitate even faster market growth in the future.
- **California's electricity grid can accommodate these ZEV goals with planning.** If there are 5 million ZEVs on the road by 2030, the CEC forecasts that EVs will account for approximately seven percent of annual electricity usage and one percent of the system peak demand.[84] The CEC's draft Zero Emission Vehicle Infrastructure Plan finds that "California's electric grid can accommodate near-term infrastructure goals and longer-term goals can be achieved with planning, which is already underway."[85] State agencies and policymakers are implementing policies to encourage grid-friendly, beneficial load growth, such as time-of-use rates and programs to encourage charging when renewables are in excess.[86]
- **Continued Smart Investments and Policy Action by California Are Needed On Infrastructure** California's agencies including the CEC, the Public Utilities Commission (CPUC), and CARB must continue working in partnership to establish

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[82] California Energy Commission, Draft Report 600-2022-054, page 6. https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf. [Accessed April 14, 2022.] Note that much of this comes from Tesla chargers and on page 38 the CEC notes that its grant program is only paying for about half the cost of level 2 chargers and two-thirds of the cost of DC fast chargers.

[83] Invest in Clean Air, '"Gas Prices. Drought. Smog. Fires. Invest in Equitable EV Programs Now" https://www.investincleanair.com/. [Accessed April 28, 2022.]

[84] California Air Resources Board, " Governor Newsom's Zero-Emission by 2035 Executive Order (N-79-20)" January 2021, https://ww2.arb.ca.gov/resources/fact-sheets/governor-newsoms-zero-emission-2035-executive-order-n-79-20 [Accessed March 31, 2022.]

[85] California Energy Commission, Draft Report 600-2022-054, page 1. https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf [Accessed April 14, 2022.]

[86] California Air Resources Board, "Governor Newsom's Zero-Emission by 2035 Executive Order (N-79-20)," January 19, 2021, https://ww2.arb.ca.gov/resources/fact-sheets/governor-newsoms-zero-emission-2035-executive-order-n-79-20. [Accessed March 31, 2022.]

infrastructure policies and goals, and to reduce all barriers to meeting the charging infrastructure needs. To stay on track, we recommend that:

- The CEC and the CPUC accelerate their investments in customer-side public and shared-private charging infrastructure at needed levels through 2035. We note, however, the CPUC in their Transportation Electrification Framework proceeding is considering scaling back their funding of customer side incentives for charging infrastructure which could harm progress after 2025 in particular. The recent Revised Staff Proposal in that proceeding has created significant regulatory and market uncertainty about future utility support.
- California state agencies fully implement:
  - Recommendations from the EV Infrastructure Strike Force, a public-private partnership between the state agencies, private industry, and the nonprofit organizations that have worked to identify the necessary investments to support charging infrastructure deployment over the next decade and beyond.
  - The principles of the broad-based, 36-member National EV Charging Initiative.
  - The 2022 Zero Emission Vehicle Infrastructure Plan developed by the CEC with eight other state agencies (currently draft) including recommendations on streamlining of construction permits and utility interconnections, additional standardization and reliability of charging stations, and expanded minimum requirements in building codes for charging infrastructure.
- The Governor's Office of Business and Economic Development (GO-BIZ) continue to support and cultivate opportunities to accelerate the ZEV market growth including through EV charging infrastructure deployment.
- CARB staff report back to its Board on its existing statutory authority regarding regulations to increase ZEV charging infrastructure as well as participating in research to further reduce the cost of charging.
- The California Legislature pass and the Governor sign AB 2700 which would expedite the build out of distribution infrastructure anticipated by California's goals and regulations for ZEVs.

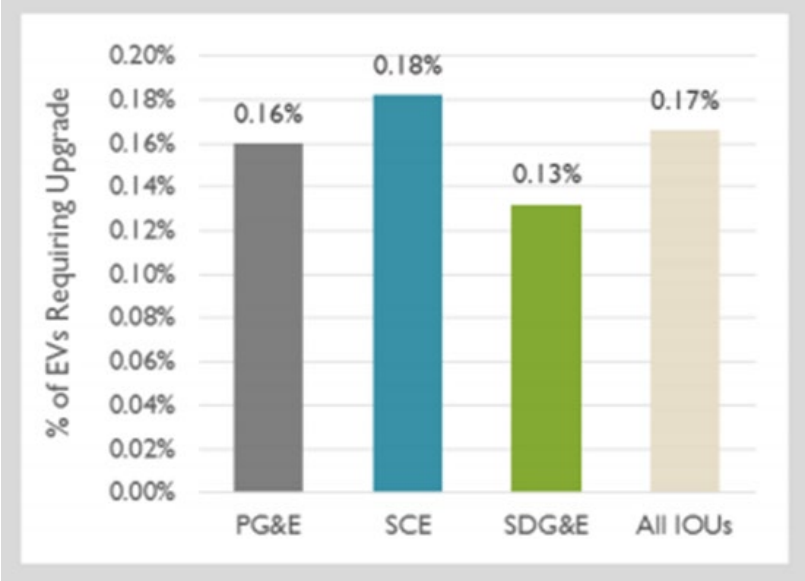
ii. <u>The Electric Grid Can Support the Proposed Increase in ZEVs</u>

ZEVs—specifically battery electric and plug-in hybrid vehicles (EVs)– need to utilize the electric grid to recharge the onboard batteries. However, the California electric grid can handle the influx of EVs that will result from ACC II and EVs can further be used as a grid resource and as battery storage to alleviate electricity outages, especially with proper utility investments and rate designs that shift charging to time when the grid is underutilized.

The costs of accommodating EV charging have been de minimis to date. A 2017 analysis of EV grid integration costs in California found that utilities collectively spent less than $610,000 on

upgrades out of a collective distribution capital budget greater than $5 billion—one hundredth of one percent of total distribution capital expenditures from 2012 to 2017.[87] In 2017, the number of EVs in three of California's utilities service territories (Pacific Gas & Electric (PG&E) and Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E)) increased by more than 22%, but the number of needed upgrades to support these vehicles dropped to only 0.17% for a cost of $500,000. Put simply, very few EVs required any distribution system or service line upgrades, as shown in Figure 14.

Figure 14: Percentage of EVs Requiring Distribution or Service Line Upgrades[88]



The 2020 Joint Utilities EV Infrastructure Report included an analysis of historical upgrade costs through 2018 for the different Investor Owned Utilities (IOUs).[89] As shown in the table below, even as EV usage has increased significantly in California since 2012, the necessary upgrade costs for utilities has not been inflated relative to the increase in the number of EVs.

Table 6: Historical Upgrade Costs through 2018 from California's Investor Owned Utilities[90]

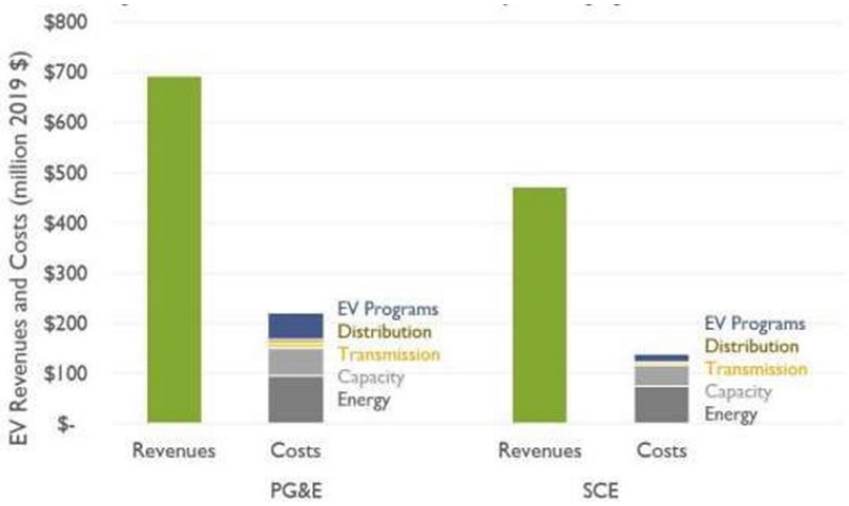
		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Historical Upgrade Costs[1]	Total Distribution System Costs Incurred by Utility for Upgrades	$ 282,719	$ 598,172	$ 1,476,647	$ 798,367	$ 404,236	$ 1,734,016	$ 927,375
	Total Service Line costs Incurred by Utility for Upgrades	$ 39,924	$ 69,380	$ 103,259	$ 41,377	$ 37,500	$ 27,706	$ 52,349
	Total Customer Portion of Utility Costs Covered by the exemption	$ 9,226	$ 34,125	$ 76,046	$ 19,669	$ 3,856	$ 3,983	$ 29,618

[87] Synapse Energy Economics, *Electric Vehicles Are Not Crashing the Grid: Lessons from California*, available at www.synapse-energy.com/sites/default/files/EVs-Not-Crashing-Grid-17-025_0.pdf
[88] *Id.*
[89] Joint IOU Electric Vehicle Charging Infrastructure cost Report, 8th Report Filed on April 1, 2020, Joint IOU Report
[90] *Id.*

Considering utilities spend upwards of $5 billion annually to maintain their systems, these upgrade cost figures for EVs are a drop in the bucket compared to other utility costs. However, while the grid costs have been nominal thus far, the revenues that have accrued from EV charging are significant.

EV investments, including those by utilities, can put downward pressure on rates for all utility customers—regardless of whether they own an EV. A recent analysis by Synapse Energy Economics entitled "Electric Vehicles are Driving Electric Rates Down" analyzed real-world data from the two utility service territories with the highest number of EVs in the country, PG&E and SCE and found that EVs are already putting downward pressure on rates. Accordingly, the benefits of EVs are not just environmental; as that study appropriately concluded: "EVs offer a key opportunity to reduce harmful emissions and save customers money at the same time."[91] Synapse evaluated the revenues and costs associated with EVs from 2012 through 2019 in PG&E and SCE service territories. They compared the new revenue the utilities collected from EV drivers to the cost of the energy required to charge those vehicles, plus the costs of any associated upgrades to the distribution and transmission grid and the costs of utility EV programs that are deploying charging stations for all types of EVs. In total, EV drivers contributed an estimated $806 million more than the associated costs. And this finding is not merely a result of the fact that most EV drivers in PG&E and SCE's territories remain on default rates and pay high upper-tier prices as a result. Even if three in four were on time-of-use rates designed for EVs, those drivers would still have provided approximately $621 million in net-revenues.

Figure 15: PG&E and SCE Revenues and Costs of EV Charging, 2012-2019[92]



[91] Frost et al., Synapse Energy Economics, "Electric Vehicles Are Driving Electric Rates Down", at 1 (June 2020), *available at*: https://www.synapse-energy.com/sites/default/files/EV_Impacts_June_2020_18-122.pdf.
[92] *Id.* at 4.

This indicates that EV charging can be integrated onto the electric grid without substantial costs and can in fact provide additional revenue and downward pressure on rates for all customers. This trend is expected to continue as more EVs are added onto California's roads. A peer-reviewed study in California observed what would happen if all households in a residential region in North California were driving an electric vehicle.[93] The analysis looked at 39 representative feeders and found that if just 30% of EVs shift charging to off-peak times, only 15% of the feeders would need to be upgraded– showing that the state can achieve high EV penetration without major grid upgrades, so long as smart grid integration strategies are implemented, such as time-of-use rates and dynamic price signals, which all three of California's large investor-owned-utilities already offer.[94]

Additionally, the IOUs in the state have begun to explore the role of Vehicle-Grid-Integration (VGI) technologies as another mechanism to support the electric grid as EVs continue to penetrate the market, while also preventing grid disturbances from turning into outages and supporting additional renewable energy integration onto the grid. In April, 2022, several California based entities, including the California Energy Commission, PG&E, SDG&E, SCE, and the City of Los Angeles signed onto a United States Department of Energy Memorandum of Understanding to establish a Vehicle-To-Everything Collaboration.[95] The intent of this Collaboration is to "explore opportunities for research, engineering, and infrastructure investments that will accelerate and enable bidirectional PEV integration into the electrical grid…" as well as to provide technical assistance to accelerate VGI deployment, within the next two years.[96] Additionally, under Senate Bill 676, the California Public Utilities Commission was directed to establish strategies to integrate electric vehicles into the grid.[97] As a result, in 2020, the Commission directed the state's IOU's to develop Vehicle-to-grid (V2G) pilot programs. In May 2022, the Commission approved three VGI pilot programs– totaling $11.7 million– for PG&E.[98] SDG&E and SCE have also filed annual reports based on their VGI pilot programs.[99]

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[93] J. Coignard, P. MacDougall, F. Stadtmueller and E. Vrettos, "Will Electric Vehicles Drive Distribution Grid Upgrades?: The Case of California," in IEEE Electrification Magazine, vol. 7, no. 2, pp. 46-56, June 2019, doi: 10.1109/MELE.2019.2908794.

[94] Pamela Macdougall, Natural Resources Defense Council, Steering EV Integration Forward, June 12, 2019, https://www.nrdc.org/experts/pamela-macdougall/steering-ev-integration-forward

[95] Memorandum of Understanding to Establish the Vehicle-to-Everything Collaboration, https://www.energy.gov/sites/default/files/2022-04/OTT%20V2X%20MOU%20Final.pdf

[96] *Id.*

[97] California Public Utilities Commission, Vehicle-Grid Integration Activities, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/vehicle-grid-integration-activities

[98] UtilityDive, Dive Brief, "California approves 11.7M vehicle-to-grid pilots in PG&E footprint", April 1, 2022, updated May 6, 2022 https://www.utilitydive.com/news/california-approves-117m-vehicle-to-grid-pilots-in-pge-footprint/621393/

[99] San Diego Gas & Electric Company, Before the Public Utilities Commission of the State of California, Rulemaking 18-12-006, "San Diego Gas & Electric Company (U 902 M) Vehicle Grid Integration Activities Mid-

iii. ZEV Demand Continues to Increase in the United States

The current Advanced Clean Car ZEV requirements level out after Model Year 2025 at about 7-8% sales. However, real world sales data shows that the demand for these vehicles is much higher than the current standard. In Q1 of 2022, California is already at about 16.32% ZEV sales[100] (up from about 12% 2021[101]). In 2018, ZEV sales in California already met the 2025 ZEV goals by reaching 7.84% sales. Across the United States, in 2021, EVs nearly doubled from 308,000 vehicles in 2020 to 608,000 in 2021.[102] The US Department of Energy notes that "The rapid growth in plug-in electric vehicle sales from 2020 to 2021 is remarkable in the context of overall light-duty vehicle sales, which increased by only 3% during the same period."[103] And this trend has been consistent for the past few years: While overall auto sales fell by 14.6 percent in 2020 relative to 2019, EV sales only fell by 4.6 percent relative to EV sales in 2019.[104] EV sales in January and February of 2021 resulted in all-time records for those months, exceeding the respective monthly totals from 2020 by 43 percent and 100 percent.[105]

Term Report for 2021", https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M407/K951/407951056.PDF and https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M407/K998/407998634.PDF

[100] California Energy Commission, New ZEV Sales in California, https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/new-zev-sales (accessed on May 13, 2022)

[101] Office of Governor Gavin Newsom, "California Leads the Nation's ZEV Market, Surpassing 1 Million electric Vehicles Sold, February 25, 2022, https://www.gov.ca.gov/2022/02/25/california-leads-the-nations-zev-market-surpassing-1-million-electric-vehicles-sold/

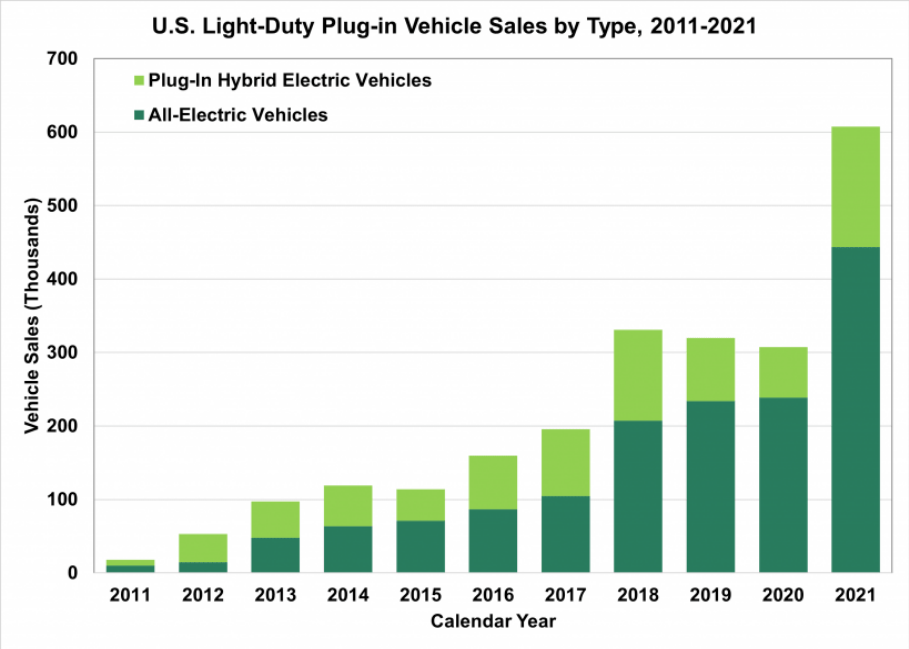
[102] US Department of Energy, Office of Energy Efficiency & Renewable Energy, Vehicle Technologies Office, "Light-Duty Plug-In Electric Vehicle Sales in the United States Nearly Doubled from 2020 to 2021", February 28, 2022, https://www.energy.gov/eere/vehicles/articles/fotw-1227-february-28-2022-light-duty-plug-electric-vehicle-sales-united

[103] *Id.*

[104] *See* Byron Hurd, *2020 sales wrap-up: The good and the bad of an ugly year*, Autoblog (Jan. 5, 2021), https://www.autoblog.com/2021/01/05/2020-year-end-auto-sales/; EV Hub, Sales data from the Atlas EV Hub Automakers Dashboard, at 1, https://www.atlasevhub.com/materials/automakers-dashboard/

[105] *Id.*

Figure 16: United States Plug-in Light-Duty Vehicle Sales[106]



This growth is also due in part to the increase in ZEV models available to drivers, and that almost every major vehicle manufacturer in the United States has committed to increasing the number of EVs in their model lineup, with some manufacturers committing towards 100% electrification within the next two decades. These commitments are important but indicate why ACC II is imperative– to ensure that manufacturers actually achieve these goals.

For example, in January 2021, General Motors announced it would strive to phase out its sales of gasoline-powered cars and trucks entirely by 2035.[107] Ford Motor Company, already the most forward-thinking of U.S. traditional automakers with regards to supporting stricter emissions standards,[108] followed with its own announcement in February doubling investment in electric vehicles to $22 billion through 2025.[109] Finally, in early March Volvo pushed the envelope a bit further by declaring its intention to phase out sales of any vehicle with an internal combustion engine by 2030 and "only sell fully electric cars."[110]

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[106] US Department of Energy, op. cit.

[107] Boudette and Davenport, *G.M. Will Sell Only Zero-Emission Vehicles by 2035,* New York Times (January 28, 2021)

[108] David Shepardson, *Ford says automakers should consider backing California emissions deal,* Automotive News (November 30, 2020)

[109] Ford Motor Company, *Ford Raises Planned Investment in EV, AV Leadership to $29 Billion; Further Advances Turnaround of Global Automotive Business in Q4,* press release at 4 (February 4, 2021).

[110] Volvo Cars, *Volvo Cars to be fully electric by 2030,* press release (March 2, 2021)

iv. Consumer Acceptance of ZEVs is Increasing

The demand for ZEVs is also driven in part by consumer acceptance and interest in this new technology. For example, the Ford F-150 Lighting, the electric version of the company's popular pick-up truck (the gasoline version of which is the best-selling car in the United States),[111] has received so many reservations (200,000) that the Company had to halt the reservation process in order to fulfill orders.[112] A 2020 survey by Consumer Reports found that 71% of drivers in the United States were interested in purchasing an electric vehicle in the future, with nearly a third of respondents stating that they would purchase an EV as their next vehicle.[113]

G. Recommended Modifications to Staff Analysis

i. Methodology and Assumptions

In general, the methodology and assumptions employed by staff in the ISOR follow standard CARB practice and provide a sound basis for regulatory adoption. Staff uses the latest version of the various analytical tools, updated as needed for this application.

Turning to more specific observations, NRDC has significant concerns with ZEV the cost analysis and minor comments on two other aspects of the analysis—the treatment of MY 2026 tailpipe GHG reductions and the assumed business as usual ZEV sales through MY 2026. Neither of the latter two have a significant impact but are noted for staff's consideration.

a. The ISOR's ZEV Costs are Too High

The ZEV technology package costs used in the ISOR have been reduced relative to those used for the Standardized Regulatory Impact Assessment (SRIA). NRDC appreciates staff's engagement on cost issues and use of more recent data. Even with those changes, however, the projected ZEV costs used in the ISOR are significantly greater than those derived by other recent authoritative analyses. Table 7 shows year-by-year cost estimates from ISOR Appendix G (ACC II ZEV Technology Assessment) as compared to parallel estimates derived from a 2019 study by the International Council on Clean Transportation (ICCT) which projected ZEV costs through 2030.[114] Results are shown for the ICCT cost categories of car, crossover and SUV.[115] Highlighted cells show years in which ZEVs reach or exceed cost parity with

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[111] CNBC, "Ford pickup remains Americas top selling truck for 45th year", https://www.cnbc.com/2021/12/02/ford-pickup-remains-americas-top-selling-truck-for-45th-year.html

[112] Business Insider, "If you didn't reserve an electric F-150 Lightning already, get ready to wait years to buy one", December 9, 2021, https://www.businessinsider.com/ford-f150-lightning-electric-truck-reservations-closed-production-release-date-2021-12

[113] Consumer Reports, "Consumer Reports Survey Shows Strong Intereest in Electric Cars, Updated December 18, 2020, https://www.consumerreports.org/hybrids-evs/cr-survey-shows-strong-interest-in-evs-a1481807376/

[114] Nic Lutsey and Michael Nicholas, *Update on electric vehicle costs in the United States through 2030*, International Council on Clean Transportation, April 2, 2019, https://theicct.org/wp-content/uploads/2021/06/EV_cost_2020_2030_20190401.pdf .

[115] The ISOR vehicle categories (small and medium car, small and medium SUV) are mapped onto the ICCT as shown in the table. ICCT provided cost projections for 200 and 250-mile BEVs. NRDC extrapolated the cost of a

conventional vehicles. As the table shows, ICCT projects more rapid cost declines and earlier cost parity.

Table 7: CARB vs. ICCT Projected Incremental Cost, 300-Mile BEV

		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Car	CARB Small + Medium	2344	1816.5	1325	867.5	521.5	214.5	-78	-355	-620	-872
	ICCT	886	-398	-1,571	-2,645	-3,730					
Crossover	CARB Small SUV	2779	2222	1703	1221	856	533	226	-66	-345	-610
	ICCT	2,786	1,304	-51	-1,291	-2,644					
SUV	CARB Medium SUV	2314	1647	1027	449	15	-369	-734	-1,081	-1,412	-1,726
	ICCT	1,627	-349	-2,148	-3,788	-5,418					

The November 2021 Zero-Emission Vehicles Factbook prepared by Bloomberg New Energy Finance (BNEF) also projects more rapid cost parity.[116] Slide 34 from the BNEF study, reproduced below, shows the year of expected cost parity for four vehicle types in several countries. BNEF projects US cost parity in 2023 and 2024, even sooner than ICCT and at least 6 years in advance of the ISOR.

Figure 17: BNEF Projections on Year of Expected Upfront Price Parity for BEVs compared to Internal Combustion Engines.[117]

The higher projected costs used in the ISOR have several negative consequences:

- Using the ISOR estimates, ZEVs reach price parity with conventional vehicles much later than in the other analyses referenced below. Although staff's recommended

300-mile BEV by adding to the ICCT 250-mile cost the projected incremental cost needed to go from a 200 to a 250 mile range.

[116] Zero-Emission Vehicles Factbook: A BloombergNEF special report prepared for COP 26, November 10 2021. BNEF Zero Emission Factbook

[117] *Id.* at 35.

stringency is not directly tied to price parity, more rapid cost reduction would provide additional support for the accelerated MY 2029-2034 trajectory recommended by NRDC.

- The overstated technology costs used in the ISOR directly result in overstated negative economic impacts. The SRIA, using staff's initial cost estimates, showed that ACC II adoption would have negative impacts on California employment, output, and gross domestic investment. Using the updated costs, the ISOR shows smaller impacts, but the results are still negative. NRDC does not have the capability to conduct a macroeconomic analysis using more appropriate cost projections but such an analysis would reduce or eliminate the purported negative impacts.
- The ISOR's conclusion that ACC II has negative macroeconomic impacts could adversely affect ACC II adoption in Section 177 states as well as the development of the next round of federal standards. Opponents of the regulations will cite California's projected negative economic impacts to support their case. California's ability to influence other jurisdictions to adopt aggressive standards is undermined.

b. MY 2026 Tailpipe GHG Reductions

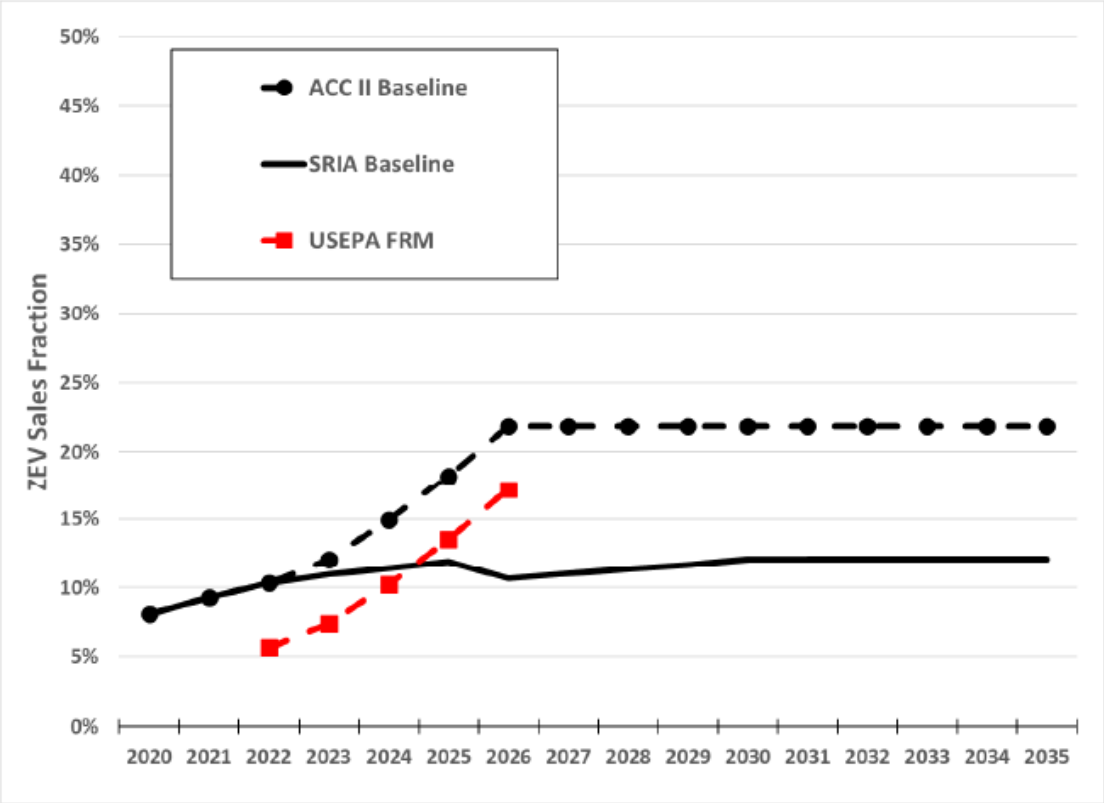
Although it is not stated explicitly, the emission reduction analysis shown in Appendix D of the ISOR appears to include a GHG tailpipe reduction in MY 2026 due to increased ZEV penetration.[118] However, in MY 2026 manufacturers will be governed by the existing GHG tailpipe fleet average standards imposed by the ACC I GHG regulation or the recently adopted federal standards. Those standards allow manufacturers to include ZEVs in the fleet average, which means that emission reductions from ZEVs can be offset by emission increases elsewhere in the fleet. NRDC does not have manufacturer-specific compliance plans for MY 2026 but as a general rule we have not assigned any GHG tailpipe reductions to increased ZEV penetration under ACC I. Manufacturers may choose to voluntarily over comply with the GHG tailpipe fleet average in MY 2026 in anticipation of a future rule that removes the ability to include ZEVs in the fleet average, but our understanding is that from a legal standpoint they are not required to do so. Assuming that new federal and/or state GHG tailpipe standards are adopted for MY 2027 and beyond, this issue only applies to MY 2026.

c. Baseline ZEV Sales Through MY 2026

Figure 30 in the ISOR, reproduced below, shows staff's updated estimate of ZEV baseline (business-as-usual) ZEV sales as compared to the baseline used in the SRIA. Staff updated the baseline by applying the ZEV sales increase assumed in the recently adopted USEPA standards to California baseline sales, beginning in MY 2022.

[118] Emissions Inventory Methods and Results for the Proposed Amendments, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/appd.pdf

Figure 18: ZEV Fractions in the Updated ACC II Baseline, SRIA baseline, and U.S. EPA FRM[119]



Although applying the United States EPA rate of increase is reasonable, the baseline ZEV sales trajectory shown above clearly understates actual MY 2021 California ZEV sales and very likely understates MY 2022 sales. NRDC suggests that a more appropriate trajectory would start with actual MY 2021 ZEV sales (a known quantity) and apply the United States EPA growth rate from there. That results in the trajectory shown in Figure 19 and Table 8 below.

[119] ISOR, Figure 30

Figure 19: ZEV Sales Trajectory Utilizing Actual MY 2021 Sales Numbers

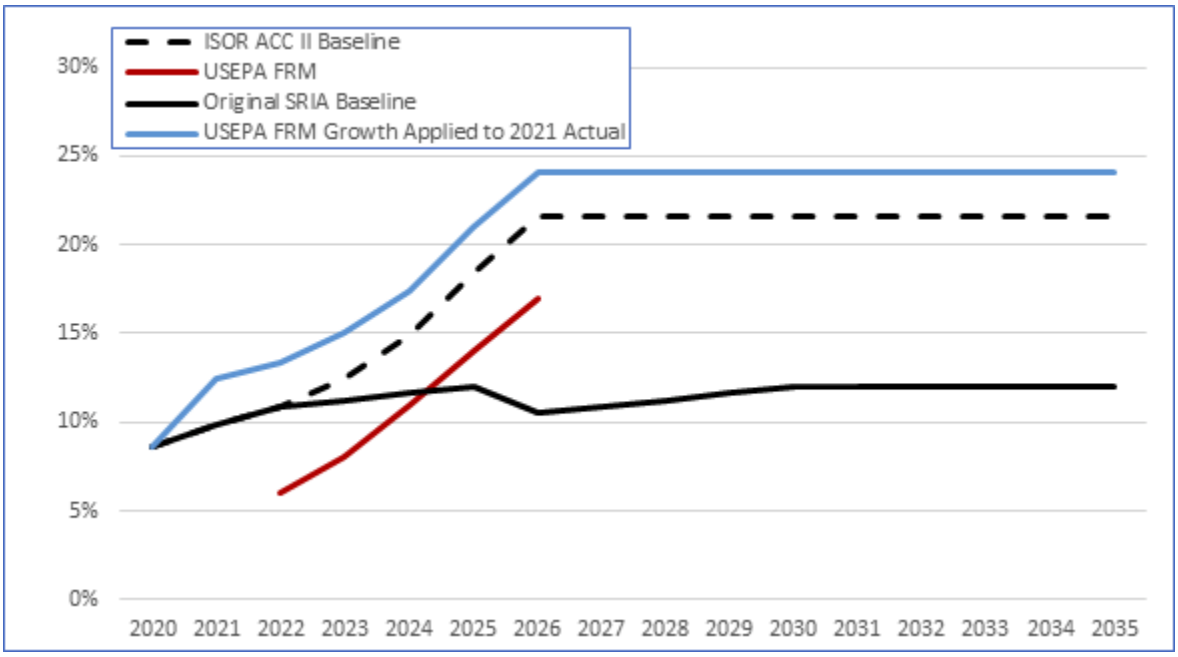


Table 8: ZEV Sales Trajectory Utilizing Actual MY 2021 Sales Numbers

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
ISOR ACC II Baseline	8.6%	9.9%	10.9%	12.5%	14.9%	18.5%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%
Original SRIA Baseline	8.6%	9.9%	10.9%	11.2%	11.6%	12.0%	10.5%	10.5%	10.5%	10.5%	10.5%	10.5%	10.5%	10.5%	10.5%	10.5%
USEPA FRM			6.0%	8.0%	11.0%	14.0%	17.0%									
USEPA FRM Growth Applied to 2021 Actual	8.6%	12.4%	13.4%	15.0%	17.4%	21.0%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%

Increasing the baseline would reduce both the incremental cost and the emission benefits of the ACC II rule, because fewer additional ZEVs would be needed to comply. But it would not change the fundamental rationale for adoption.

V. Conclusion

Transitioning California's light-duty vehicle fleet to 100 percent zero-emissions vehicles is vital for the state to achieve its climate, air quality, and health goals. Given the increased ZEV vehicle sales in California, as well as the increased vehicle demand and planned infrastructure investments, ARB should strengthen the proposal in Model Years 2029- 2034 to increase the number of ZEV vehicles on California's roads and stimulate the secondary ZEV market.

ARB now has the opportunity to solidify California's global leadership in zero-emission transportation. We look forward to continued engagement throughout the regulatory process to put California on an accelerated path towards a zero-emission transportation future.

VI: Appendix A: Assumptions Around Charging Infrastructure Analysis

Background on funding and investment streams for electric vehicle charging infrastructure.

The sources of funding considered include the following:

Low Carbon Fuel Standard (LCFS) credits for owners of charging stations:

- Credits for owners of charging stations: The current California LCFS program is making it highly economical for stations to be installed. For the past three years, LCFS credits for non-residential charging resulted in a market value of about $0.16 per kWh, a very valuable source of income for the owners of the L2 or DC chargers. Assuming current LCFS credit prices of $200 per metric ton, this can be worth about $1500-$3000 per year for a typical level 2 chargers and 10 to 20 times that for DC fast chargers.[120] However, Figure 1 conservatively assumed $100 per metric ton for LCFS credits.
- Credits for owners of DC fast charging stations: Currently, 1,949 DC fast chargers at 318 sites have been approved for the LCFS program's ZEV infrastructure capacity credits, and high potential exists for more (e.g., supporting the 10,000 DC fast chargers by 2025 in the Executive Order B-48-18).[121] Assuming CARB extends this program from 2026-2035 the potential could be for another 10,000 or more DC fast chargers.[122]

Utility programs:

- Currently, the CPUC has approved almost $1.2 billion by investor-owned utilities that have been proposed or already spent to partially pay for about 75,000 chargers at multi-unit dwelling or public charging, with another $240 million proposed by CPUC staff (through 2029).[123] In addition, about $320M or 40 percent of funds are dedicated for disadvantaged communities. The costs on the "utility-side" of the meter can typically represent 30 percent of total costs shown above, but with the new AB 841 law (enacted 2020) these costs are treated like other investor-owned utility costs and no longer assigned to the site and do not need to be requested in special filings as in the past.[124] Publicly owned utilities are also investing tens of millions per year utilizing LCFS credit proceeds to support non-

[120] Applies to level 2 uses cases such as curbside or public lot charging or workplace charging for Level 2 chargers where several EVs charge each day on charger.

[121] The LCFS regulation limits these credits to 2.5 percent of total deficits. Source: California Air Resources Board, Transportation Fuels Branch, Zero-Emission Vehicle (ZEV) Infrastructure Crediting within the LCFS: How Does it Wo*rk?* August 2021, Slide 4, [Accessed March 29, 2022.] https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/zev_infra_crediting_overview.pdf.

[122] Ibid, Slide 3.

[123] California Public Utilities Commission, *Energy Division Staff Proposal to Establish Transportation Electrification Funding Cycles and Statewide Behind-the-Mete Program,* February 2022. See Figure 1 and endnote 4 for details. The analysis also assumes $200M out of $1B in the Energy Division Staff proposal goes to non-charger programs (e.g., evaluations, outreach) and thirty percent goes to fund customer side costs for multi-unit dwelling related chargers.https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M453/K952/453952700.PDF

[124] California Public Utilities Commission, *Decision Authorizing Southern California Edison Company's Charge Ready 2 Infrastructure and Market Education Programs,* D-20-08-045, September 2, 2020, Table 1, CPUC D-20-08-045. Also see California Legislative Information, Assembly Bill 841, September 30, 2020, LegInfo AB 841. Also see California Public Utilities Commission, Resolution E-5167, October 7, 2021, CPUC Resolution E-5167. [Accessed April 12, 2022.]

residential light duty EV charging programs, such as for medium and heavy-duty truck charging infrastructure.[125]

State Incentives:

- The California Energy Commission (CEC) has spent about $200 million to date on public and shared private chargers with almost 50% for disadvantaged communities.[126] Out of the $10 billion state budget for ZEVs (FY 2021-22 and proposed FY 2022-23), up to $0.9 billion could benefit public and shared private charging for passenger EVs.[127]
- State ballot initiative: A potential ballot measure (The Clean Cars and Clean Air Act) could be voted on in November 2022, and would provide approximately $35 billion for EV charging infrastructure, half of which is reserved for low-income and disadvantaged communities.[128]

Federal funding:

- The Infrastructure Investment and Jobs Act (enacted 2021) provided $5 billion in formula funding for corridors and an additional $2.5 billion for other charging and fueling infrastructure through a competitive program. California will receive at least $348 million and potentially as much as $940 million over the next 5 years for community and corridor charging.[129]

Private investments (automakers, retailers, 3rd party service providers, TNCs):

- Private companies are playing an increasing role over time (e.g., Tesla, Electrify America, EVgo, ChargePoint, Rivian) which suggests that incentives can come down over time. In addition, more and more companies are entering the public charging station business and some evidence exists that prices to drivers for away-from-home charging are coming down a little.[130]

Trends: Public investment from state and federal budgets and from utility programs will likely continue. The LCFS program does not expire, and the residential LCFS credits (which increase with the number of EVs) could become a new source of funds, if needed.

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[125] California Energy Commission, Draft Report 600-2022-054, page 11.Also see endnote 4.
[126] California Energy Commission, December 2021, CEC-600-2021-038-CMF, Table 1 and Figure 2,, https://www.energy.ca.gov/publications/2021/2021-2023-investment-plan-update-clean-transportation-program. [Accessed April 13, 2022.]
[127] Combines $314M for FY 2021/2022 state budget and $600M for proposed FY 2023/2023 state budget for light-duty public and shared private charging and excluding equitable home charging. California Energy Commission December 2021, https://www.energy.ca.gov/news/2021-11/cec-approves-14-billion-plan-zero-emission-transportation-infrastructure-and California Energy Commission, April 2022, CEC-600-2022-054, page 13, https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf
[128] Martin Wisckol, "California ballot proposal would raise billions for electric cars, charging stations" *The Mercury News*, January 17, 2022, https://www.mercurynews.com/2022/01/17/ballot-proposal-would-raise-billions-for-electric-cars-charging-stations/. Additional funds would go to single family home chargers , chargers for electric trucks and other ZEV incentives, but these are not included in the analysis The analysis assumes $3B per year would be raised. [Accessed April 18, 2022]
[129] See endnote 4.
[130] Jamie Dunckley and Chanakya Valluri, "Presentation on Cost to Charge from the Plugshare Data Set" *EPRI*, December 31, 2017 https://www.epri.com/#/pages/product/3002011098/ and David Trinko, Emily Porter ,Jamie Dunckley, Thomas Bradley, and Timothy Coburn, "Combining Ad Hoc Text Mining and Descriptive Analytics to Investigate Public EV Charging Prices in the United States," *Energies 2021 Special Issue on Data Mining Applications for Charging of Electric Vehicles*, August 24, 2021, https://www.mdpi.com/1996-1073/14/17/5240/htm. [Accessed April 11, 2022.]

The specific assumptions for the development of Figure 1 include the following:

- Federal incentives: Low case shown: $384M in funds from National EV Charging Infrastructure formula funding comes to CA. Source: California Energy Commission, CEC-600-2022-054, page 41, https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf. [Accessed April 14, 2022.] This analysis is conversative by assuming this scenario: $4.5 of the $5B in formula funds for corridor charging reaches the states and CA receives 12 percent proportional to its population, and CA receives 16 percent of the competitive charging and fueling infrastructure for public and shared private charging out of $2.5B nationally by providing higher matching funds in competitive bids.
- State incentives: See endnotes 23 and 24 below.
- LCFS proceeds: Assume $100 per credit (or metric ton) which is much lower than historic electricity credits and LCFS credit prices. Source: California Air Resources Board, Transportation Fuels Branch, *Data Dashboard,* Figure 4: Monthly LCFS Credit Price and Transaction Volumes, https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm. [Accessed March 31, 2022.] The analysis assumes 20 percent of total electricity credits go to public and shared private charging (not including multi-unit dwellings, single family homes or fleets). LCFS increases with number of EVs registered in state. For future years assume trajectory from Shulock Consulting to 8 million EVs in 2030, but due to EVs moving out of state or being removed due to crashes or retirement, the EV adoption trajectory only reaches 6.7 million EVs registered in 2030.
- LCFS capacity credit proceeds: Assume developers reach full potential which is 2.5 percent of LCFS deficits. Source: California Air Resources Board, Transportation Fuels Branch, *Zero-Emission Vehicle (ZEV) Infrastructure Crediting within the LCFS: How Does it Work?* August 2021, Slide 4. https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/zev_infra_crediting_overview.pdf. [Accessed March 29, 2022.]
- Utility incentives: Includes approved light duty programs by SCE, PG&E, SDG&E, Liberty, Bear Valley and NRG from SB 350, settlements, AB 1082 and AB 1083(e.g., Charge Ready 1 and 2 Light-Duty, Power Your Drive 1 and 2, EV Charge Network, PG&E DC Fast Charge, Priority review projects). Source: California Public Utilities Commission, *Transportation Electrification*, https://www.cpuc.ca.gov/zev/. [Accessed March 31, 2022.] Assumes all pending or staff proposed projects move forward for light duty EV public and shared charging including approval of LCFS holdback funds and extending PG&E's EV Charge Network. Source: California Public Utilities Commission*, Pacific Gas and Electric Company Electric Vehicle Charge 2 Prepared Testimony*, See https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2110010/4240/417398449.pdf. [Accessed April 4, 2022.] In addition, the analysis assumes $240M for customer-side charging rebates in multi-unit dwellings from 2025-2029 (or $48M per year) based on CPUC's staff proposal. See endnote 20 for details. For public electric distribution utilities assumes half of $50M per year for LADWP and smaller POUs goes to public and shared private light duty charging. See California Energy Commission, Draft Report CEC-600-2022-054, page 11, https://www.energy.ca.gov/sites/default/files/2022-04/CEC-600-2022-054.pdf. [Accessed April 14, 2022.]
- The above assumptions for Figure 1 are conversative and reasonable. For example, LCFS prices are assumed to be $100 per credit (MT) which is low compared to prices for the last three years. Federal funds are estimated at the lowest number in the literature. Regarding the proposed state budget for FY

21/22, the analysis assumed that $300M for home charging was not included. The investor-owned utility funds do not include funds for utility side costs. The publicly owned utility funds were reduced by 50 percent to account for spending on charging for medium and heavy duty EVs. Many sources of funds (e.g., private, future state and ballot measures) are excluded. Does not assume any funds from community choice aggregators.

The assessment of EV charging infrastructure and investment needs conducted by Atlas Public Policy and Dean Taylor Consulting utilized the following methodology:

- The consultancies utilized the U.S. Department of Energy's Electric Vehicle Infrastructure Project Tool (EVI-Pro) Lite model to assess the charging infrastructure needed.
- The consultancies utilized the California Air Resources Board's Advanced Clean Cars II proposed adoption curves for battery EVs and plug in hybrid EVs (PHEVs) sourced from Shulock Consulting to determine the need for shared private charging at multi-unit dwellings and workplaces, Level 2 public charging and DCFC public charging out to 2050.
- The need did not include DCFC for long trips or transportation network company charging, or private assigned parking at homes, condos, apartments, and fleets.
- For PHEVs, the need assumed that a dwindling number of PHEVs will use away from home level 2 charging for 50 percent of trips rather than 100 percent used in CEC reports.
- Cost per port were derived for level 2 charging from CPUC decisions and are a weighted average of PG&E's EV Charge Network's average costs ($17,956), SDG&E's Power Your Drive ($21,605), SCE's ($13,731), reduced by 30 percent in order to exclude utility make-ready costs (based on utility estimate) due to it being covered by AB 841's requirements. See footnote 21. Source for cost per port for DCFC: Michael Nichols, *Estimating Electric Vehicle Charging Infrastructure Costs Across Major U.S. Metropolitan Areas*, International Council on Clean Transportation, August 12, 2019, https://theicct.org/publication/estimating-electric-vehicle-charging-infrastructure-costs-across-major-u-s-metropolitan-areas/. [Accessed March 31, 2022.]
- Atlas Public Policy further assumed PHEVs with 50 mile all electric range and battery EVs with 250-mile range, that 71 percent of drivers had access to home charging, that two EVs shared multi-unit dwelling chargers, that chargers were in place two years prior to BEV adoption and did not include existing port counts from the CEC.