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## **California's Zero Emission Vehicle Action Plan**

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### **Summary**

California's zero-emission vehicle (ZEV) market represents about half of the United States' ZEV market. California's success may be attributed primarily to the state's strong climate and air quality policies, the ZEV regulation, bold leadership by California governors and the Legislature, and dedicated funding for expanding ZEV infrastructure, consumer incentives and supporting policies. This paper summarizes the State's effective leadership, interagency coordination and stakeholder engagement in the development of its ZEV Action Plans. It also describes some ZEV Action Plan implementation successes and challenges, lessons learned that can inform other jurisdictions and suggests future ZEV Action Plan direction.

*Keywords: infrastructure, charging, government, ZEV, electric vehicle*

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### **1 Introduction**

Over the past decade, California has emerged as the largest ZEV market in the nation, a center for investment in ZEV technology, and a leader in innovative ZEV policies. Undergirding California's success is its ZEV regulation in tandem with bold legislation, Governor's Executive Orders and a host of supporting policies to accelerate the market [1]. The number of ZEVs--battery-electric (BEVs), plug-in hybrid electric (PHEVs) and fuel-cell electric vehicles (FCEVs)--has grown to more than 700,110 cumulative sales, along with thousands of destination and highway charging stations and 41 open retail hydrogen fueling stations [2]. Governor Jerry Brown's goal of 1.5 million ZEVs by 2025 spurred coordinated state agency actions to lay the foundation for a new transportation paradigm. The California ZEV Action Plan, developed by the Governor's Office and implemented by many state agencies, has been a critical support to California's ZEV market expansion. The first ZEV Action Plan was published in 2013 and updated in 2016 and 2018 [3]. These plans contain hundreds of actions that have been, and are still being implemented.

### **2 California's ZEV Policies**

The ZEV Action Plans were built upon a foundation of strong California ZEV policies which have set the state on a trajectory of advancing transportation electrification. California's ZEV Regulation has been instrumental in spurring automobile manufacturers to produce PHEVs, BEVs and FCEVs since it was first

adopted by the California Air Resources Board (CARB) in 1990 as part of the Low Emission Vehicle regulation to achieve the state's long-term emission reduction goals. The ZEV regulation has been modified numerous times since 1990 to reflect technological advances. In 2012, CARB's Advanced Clean Cars was adopted as a package of coordinated standards that control smog-causing pollutants and greenhouse gas emissions of passenger vehicles in California [4]. The number of ZEVs and plug-in hybrid vehicle models being sold in California has increased from five in 2012 to 48 in 2020, with ZEV sales now representing about 8% of new car sales [5].

The California Legislature has enacted a number of bills that support clean transportation by requiring reductions in criteria pollutants, greenhouse gas emissions (GHGs), and the carbon intensity of transportation fuels. Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, requires the reduction of GHG emissions to 1990 levels by 2020 and Senate Bill (SB) 32 of 2016 requires GHG emission reductions of 40% below 1990 levels by 2030 [6]. In 2013, the State Legislature passed Assembly Bill 8 re-authorizing and extending two critical programs through 2024 that provides up to \$100 million per year toward innovative transportation and alternative fuel technologies including electric vehicle charging and hydrogen station infrastructure. The programs are the Air Quality Improvement Program (AQIP) administered by CARB and the Clean Transportation Program administered by the California Energy Commission (CEC) [7].

Over the past five years, the Legislature has enacted additional legislation guiding ZEV policies and programs. The Charge Ahead Initiative [8] (Senate Bill 1275, Chapter 350) of 2014 supported consumer incentives and rebates to enable one million ZEVs on California's roads by January 1, 2023. In 2015, the Clean Energy and Pollution Reduction Act of 2015 (Senate Bill 350, Chapter 547) established a state-wide policy of transportation electrification [9]. CARB was also required to adopt programs that benefit disadvantaged communities and provide grants to fleet managers to replace medium- and heavy-duty vehicles with cleaner vehicles. Under the CPUC's guidance, the California investor-owned utilities (IOU's) were encouraged to invest in transportation electrification. In 2015 the Governor's Executive Order B-32-15 directed state agencies to develop a California Sustainable Freight Action Plan to improve freight transportation system efficiency and transition freight vehicles and equipment to zero-emission technologies [10].

AB 32 required CARB to develop a multi-year program to reduced GHG emissions through its Scoping Plan which is currently being updated to reflect SB 32's targets[11]. CARB's 2016 Mobile Source Strategy demonstrates how the State can meet both air quality standards and achieve GHG emission reduction targets, decrease health risk from transportation emissions, and reduce petroleum consumption over a 15-year period [12]. In support of AB 32, the Low Carbon Fuel Standard (LCFS) was required by Executive Order S-01-07 in 2007 and required providers of transportation fuels in California to reduce the carbon intensity (CI) of their fuels using a market-based approach [13]. All of these actions have been instrumental in supporting the ZEV market in California.

### **3 Development of the 2013 ZEV Action Plan**

In 2012, California's Governor issued Executive Order B-16-12 that sets a long term target of reducing transportation-related GHG emissions by 80% below 1990 levels by 2050 and established several milestones on the pathway to this target including [14]:

- The State's major metropolitan areas will be able to accommodate ZEVs through infrastructure plans and streamlined permitting by 2015
- Infrastructure to support 1 million ZEVs by 2020
- ZEVs will be cost competitive by 2020
- 1.5 Million ZEVs on California roads by 2025
- State fleets will purchase 10 % of ZEVs by 2015 and 25 % by 2020

- Widespread use of ZEVs for public transit and freight transport
- Growing economic investment and jobs associated with ZEVs

It also directed CARB, the CEC, and the California Public Utilities Commission (CPUC) and other relevant state agencies to work with the Plug-in Electric Vehicle Collaborative (PEVC) and the California Fuel Cell Partnership (CaFCP) to achieve these goals. The Executive Order resulted in the establishment of a Governor's Office-led multi-agency task force to develop the first 2013 ZEV Action Plan [15].

In April 2012, the Governor's Office established an interagency working group which included the agencies and organizations noted above, the Governor's Office of Planning and Research, the Governor's Office of Business and Economic Development (GO-Biz), the California Independent System Operator and eight other State agencies.

The appointed agency team leaders from the core agencies including CARB, CEC, CPUC and the Department of General Services, identified the barriers to achieving the Executive Order goals and developed specific milestones, metrics and actions to address them. The Governor's Office core task force met almost weekly for two months to quickly establish the framework for the first ZEV Action Plan and assigned team leaders to reach out to the other agencies to incorporate their feedback. The development of the Plan included a list of actions with the corresponding responsible state agency and expected completion date.

In order to present the Action Plan and solicit broader stakeholder input, the Governor's Office planned a large invitee-only stakeholder ZEV Action Plan Summit in late September 2012. As an intermediary step, the task force conducted a smaller, more informal July meeting with the PEVC and CaFCP with panel discussions focused on the four main goals of the ZEV Action Plan:

1. Complete needed infrastructure and planning
2. Expand consumer awareness and demand
3. Transform fleets
4. Grow jobs and investment in the private sector

In addition, the team conducted a ZEV Research Workshop to solicit input from the key academic institutions to inform agency research needs to fulfill the Action Plan. A draft ZEV Action Plan incorporating all feedback was distributed to Stakeholder Summit invitees in August 2012.

Over 200 invitees attended the day-long Summit entitled "California's Roadmap to 1.5 Million Zero Emission Vehicles" which included a high-level opening plenary session led by the Governor's Office and CARB Chair Mary Nichols and was followed by breakout sessions on topic areas relevant to the goals of the Action Plan. Summit participants including industry, academia, local and regional government representatives, and non-governmental organizations provided useful feedback for filling in gaps and expanding on needed actions. Input from the Summit was integrated into the final 2013 ZEV Action Plan published a few months later.

One action in the 2013 plan led to GO-Biz retaining a State ZEV Ombudsman to facilitate the State's ZEV infrastructure permitting and installation processes. This position proved to be pivotal in connecting ZEV related deployment actions between stakeholders and across agencies.

## **4 The 2016 ZEV Action Plan**

During the two years following the first Action Plan, the Governor's ZEV Action Plan task force met bi-monthly to hear from each agency on Action Plan progress, challenges encountered, areas for collaboration

and to provide a forum for accountability and coordination. The State made significant progress in the first two years on specific actions as described in the 2016 ZEV Action Plan report [16]. Inter-agency collaboration and communication increased and provided a good foundation for continued progress.

By 2015, the California market represented almost half of all ZEVs on the road in the United States and over 20 plug-in electric vehicle models and two fuel cell electric vehicles were available in California. By the time the 2016 ZEV Action Plan was in development, the California ZEV market had advanced significantly. Prior to developing the 2016 ZEV Action Plan, the Governor's Office held another stakeholder Summit in May 2015 to solicit input. The Summit's panel discussions featured participation by government representatives, academia, automakers, local government, local air districts, and non-governmental organizations. The Summit's feedback and conclusions were included in the draft 2016 ZEV Action Plan and then circulated for each state agency's comments and input.

The Governor's Office and GO-Biz staff led the development of the 2016 plan using a management tool called a "Smartsheet" of ZEV actions with "who does what, by when", helpful notes and resources relevant to the action and the implementation status [17]. The "Smartsheet" was a very useful tool for tracking agency progress and providing monthly online updates prior to the Interagency Task Force meetings.

The 2016 ZEV Action Plan goals were:

1. Achieve mainstream consumer awareness of ZEV options and benefits
2. Make ZEVs an affordable and attractive option for drivers
3. Ensure convenient charging and fueling infrastructure for greatly expanded use of ZEVs
4. Maximize economic and job opportunities from ZEV technologies
5. Bolster ZEV market growth outside of California
6. Lead by example integrating ZEVs into state government

GO-Biz effectively facilitated the monthly Interagency Task Force meetings by stimulating discussion and building rapport amongst agency representatives by opening meetings with a round table of "ZEV stories" followed by agency progress status reports. The meetings provided a forum for providing updates, exchanging ideas, sharing information and encouraging collaboration between agencies.

## **5 The 2018 ZEV Action Plan Priorities Update**

In January 2018, the Governor signed Executive Order B-48-18 that establishes a goal of 5 million ZEVs on California roads by 2030 and the construction and installation of 200 hydrogen fueling stations and 250,000 ZEV chargers, including 10,000 direct current fast chargers, by 2025 [18]. Executive Order B-48-18 also required that all State entities partner with regional and local governments to streamline ZEV infrastructure installation processes wherever possible. To that end, GO-Biz published the "Electric Vehicle Charging Stations Permitting Guidebook" and updated the "Hydrogen Station Permitting Guidebook"[19]. The Executive Order also

1. Required an update to the 2016 ZEV Action Plan to help expand ZEV infrastructure especially in low income and disadvantaged communities,
2. Recommended actions to boost ZEV infrastructure to strengthen the economy and create jobs in the State of California,
3. Recommended ways to expand ZEV infrastructure through the Low Carbon Fuel Standard (LCFS) Program,
4. Supported and recommended policies and actions that make it easier for people to install electric vehicle chargers in their homes and businesses, and
5. Ensured electric charging and hydrogen fueling are affordable and more accessible to drivers.

At the end of 2017, the Governor’s Office worked with all of the State agencies, reviewed the completed ZEV actions, and developed the “2018 ZEV Action Plan Priorities Update”, which highlights a list of 39 high-priority ZEV actions based on input from agencies and the Executive Order B-48-18 directives [20].

## **6 Implementation Successes and Challenges**

The ZEV Action Plan successes to date far outnumber its challenges. In addition to galvanizing State agencies, industry, academia and other stakeholders to work together, the actions themselves have produced tangible initiatives, investments and programs that are significantly advancing the ZEV market. A ZEV eco-system has emerged over the past seven years in much of California largely due to the impacts of these actions. Some of the ZEV Action Plan actions yield immediate results and others have medium- to long-term impacts. Some of the most impactful actions and their associated challenges are described under the 2016 ZEV Action Plan goal areas below.

### **6.1 Achieve Mainstream Consumer Awareness of ZEV Options and Benefits**

The State has supported a state-wide consumer education campaign through Veloz, a non-profit organization comprised of state agencies, utilities, automakers and other industry partners. It seeks to “inspire, educate and empower Californians to drive electric” [21]. Veloz gets the message out to Californians through its multi-stakeholder, multi-million dollar public awareness campaign, Electric For All, and produces online marketing content and buyer’s guide resources, and hosts forums throughout the state. One of its most impactful media campaigns recently was the *Kicking Gas* video short starring former California Governor Arnold Schwarzenegger [22].

The PEVC and Veloz also supported ride-and-drives between 2015 and 2017 with thousands of Californians getting behind the wheel of an electric vehicle, raising awareness and interest in ZEVs. Residents in disadvantaged communities are also getting exposure to ZEVs and benefiting from CARB-sponsored Car Share Pilots and Mobility Options Pilots in places such as Sacramento and Los Angeles [23]. In order to provide consumers with information on ZEV models and technology, CARB’s Drive Clean website has recently been updated [24]. In addition, under the CPUC’s guidance, the IOUs have developed marketing, education and outreach programs to improve broad ZEV awareness [25].

In spite of these efforts and increasing numbers of ZEV models available in California, a significant challenge is the ongoing lack of consumer awareness about ZEVs. A recent study by the U.C. Davis Plug-in Electric & Hybrid Vehicle (PH&EV) Center found that most Californians are still unaware that ZEVs exist or could meet their needs [26]. Clearly, the State, automakers and other stakeholders have more work to do to increase ZEV awareness.

### **6.2 Making ZEVs an Affordable and Attractive Option for Drivers**

CARB’s Low Carbon Transportation Light-Duty Projects include “Clean Cars 4 All”, the state-wide Clean Vehicle Rebate Project (CVRP), the state-wide Financing Assistance for Lower-Income Consumers Pilot Project, and Increased Public Fleet Incentives for CVRP-Eligible Vehicles [27]. All of these programs help to bridge the gap between the up-front cost of ZEVs and conventional vehicles. Since 2010, California has funded the Clean Vehicle Rebate Project (CVRP) which provides rebates to consumers who purchase or lease eligible light-duty ZEVs [28]. Rebates range from \$1,000 to \$7,000 depending on the ZEV model and consumer’s income level. According to a recent Center for Sustainable Energy (CSE) survey, in 2016-2017 58% of rebate recipients would not have purchased or leased their ZEV without a rebate [29].

Another very attractive incentive for drivers is access to the high-occupancy vehicle (HOV) lane via the Clean Air Vehicle (CAV) decal from the Department of Motor Vehicles. The CAV program was extended as a result of AB 544 in October 2017, and current 2020 orange decals are valid until 2024 [30]. A survey

by the U.C. Davis PH&EV Research Center of 3,500 plug-in electric vehicle owners in California found that between 34% and 57% of them deemed the CAV decal to be a prime motivation for their purchase [31].

In the medium- and heavy-duty sector, the State has, or is developing, many important programs and regulations [32] [33]. A few of these include 1) CARB's Rural School Bus Pilot Project that funds zero-emission and conventionally fueled buses that use renewable fuels, replacing older more polluting buses; 2) Zero and Near-Zero-emission Freight Facilities Project established in 2017 to showcase advanced technologies and strategies that holistically reduce GHG and criteria pollutant emissions in freight facilities; 3) the Innovative Transit Regulation approved in 2018 requires transit agencies operating in California to start purchasing 100 percent zero-emission transit buses in 2029 and fully transition to zero-emission vehicles by 2040; 4) the Zero-Emission Airport Shuttle regulation that requires private and public airport shuttle fleet owners to fully transition their fleet to zero-emission shuttles by 2035; and 5) the Advanced Clean Trucks Regulation in development that will require heavy-duty vehicle manufacturers to produce and sell zero-emission vehicles in California with a gradual increase in zero-emission trucks on California roads over the next decade. The California Sustainable Freight Action Plan developed in 2016 provides a roadmap for the transition of California's freight transport system and is another important outcome of the ZEV Action Plan [34].

In order for the State to achieve its ZEV goals over the next 5-10 years, consumers will need to be aware of ZEV technology, be willing and able to purchase ZEVs, and confident about refueling. Until the state sees strong sales growth of competitively priced ZEVs with large numbers and types of ZEV models and convenient, reliable refueling, the State will need to continue its suite of complementary policies to support the market. A tipping point of mainstream consumer ZEV purchases is expected to occur in the next 5-7 years as battery pack and component costs continue to decline and many more ZEV models are introduced [35].

### **6.3 Ensure Convenient Charging and Fueling Infrastructure for Increasing Use of ZEVs**

The State has been investing in charging infrastructure and hydrogen stations over the past decade. The CEC has invested \$94.9 million in charging infrastructure and \$110.9 million in a network of hydrogen stations in key metropolitan areas around the State [36]. In 2012, the CPUC agreed to a settlement with NRG regarding the California energy crisis for \$102.5 million to install electric vehicle charging infrastructure across the state. In 2015-2016, the CPUC approved \$197 million in infrastructure pilot programs for Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), and Southern California Edison (SCE) to install 7,500, 3,500 and 1,500 charging stations respectively [37]. California's privately-owned utilities have submitted more than \$1 billion in applications for charging infrastructure, including medium- and heavy-duty support. Electrify America is investing \$800 million in California ZEV-related projects as part of the Volkswagen Diesel Emissions Settlement through 2025 [38]. Additional investments by Air Districts, Community Choice Aggregators, cities and private investment have resulted in 6,212 publicly available charging station locations (with over 24,825 chargers) and 41 open retail hydrogen fueling stations in California [39][40].

A high priority for the State is to streamline the permitting and inspection processes for efficient and timely ZEV station installation. To address that issue the Governor's Office of Planning and Research issued the ZEV Community Readiness Guidebook in 2013 and the GO-Biz Hydrogen Station Permitting Guidebook in 2015 [41]. Last year, GO-Biz published the "Electric Vehicle Charging Station Permitting Guidebook" to provide guidance on how local jurisdictions and developers can work together to streamline the planning, permitting, installation and ongoing operation of charging station and supporting equipment. GO-Biz is also tracking progress on permit streamlining across the State [42].

Projecting the number, type and location of charging stations is important for the State, regions, and local jurisdictions. In order to facilitate that process, the CEC developed the Electric Vehicle Infrastructure Projection (EVI-Pro) Analysis and Visualization Tool to plan for state-wide and county-level charging

station deployment [43]. The tool is used by the State to provide infrastructure goals and by local communities to develop charging infrastructure plans. For hydrogen stations, the State develops the “Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Station Network Development” [44].

In order for regions and communities to be prepared for many more ZEVs, local plans are important. The CEC has invested over \$11 million in regional ZEV readiness planning to equip communities for increasing numbers of ZEVs by establishing regional and local plans for ZEV infrastructure deployment, permit and inspection streamlining, “ZEV-ready” building codes updates, and ZEV consumer education and outreach strategies [45]. In 2017, the CEC released funding for a competition that challenged local and regional project teams to accelerate electrified transportation with a holistic and futuristic view of transportation planning [46]. The next step is for many more California cities to develop their own holistic ZEV action plans for as part of their sustainable transportation plans or climate action plans.

A primary challenge of infrastructure deployment is its high cost relative to early market revenue generation. One very effective way to lower the cost of future charging station installation is through the requirements for electric vehicle charging for new construction in the California Green (CalGreen) Building Standards Code [47]. CalGreen 2016 Code updates have resulted in increases in the non-residential percentage of parking spaces requiring electric vehicle (EV)-capable spaces. CARB’s “Technical and Cost Analysis for the 2019 CALGreen Code Cycle for EV Charging Infrastructure” recommended an increase from 3% to 10% of parking spaces in multi-family buildings to be EV-capable and elimination of the 17 unit size threshold [48]. The 2019 CALGreen Code changes went into effect January 1, 2020. They include a mandate for 10% of new multi-family dwelling parking spaces to be EV capable to support future charging equipment and voluntary Tier 1 and Tier 2 requirements of 15% and 20% of parking spaces, respectively [49]. Some cities such as San Francisco are even exceeding the voluntary requirements by requiring 100% of parking spots to be EV-capable in all new construction [50].

In 2018, the LCFS amendment added a ZEV infrastructure crediting provision to support the deployment of ZEV infrastructure [51]. The provision covers hydrogen refueling infrastructure and direct current fast charging infrastructure. Not only can LCFS credits be generated for dispensed eligible fuel, but it can generate infrastructure credits based on the capacity of the station less the quantity of fuel dispensed. Fuel providers are taking advantage of this provision to increase station size in preparation for higher future demand and improve their business case for infrastructure investments.

One challenge of funding infrastructure is that the ZEV market and technology is continually advancing so investments made at a point in time can quickly become outdated. Future proofing can help, but it doesn’t always resolve this dilemma. The CEC helped to solve its challenge of timely charging infrastructure installations by providing a block grant program called CALeVIP administered by the CSE to more nimbly deploy charging infrastructure in a focused, market-responsive way [52].

## **6.4 Maximize Economic and Job Opportunities From ZEV Technologies**

A growing ZEV market requires a robust manufacturing sector and a well-trained workforce. The State has invested in manufacturing of ZEVs and ZEV components over the past decade and also supported ZEV regional industry partnerships, and workforce development. The CEC’s Clean Transportation Program has funded over \$52 million for 24 manufacturing projects including ZEV powertrains and fully integrated zero-emission buses, trucks and motorcycles, and electric vehicle chargers [53]. Many of the 700 manufacturing jobs that have been created or retained as a result of these investments are vital to many disadvantaged and low-income communities as well as small businesses.

The CEC has also invested \$31 million in workforce projects for more than 17,400 trainees to support advanced vehicle technology maintenance and service sectors as well as support for clean transportation

technology innovation, demonstration, deployment and manufacturing. Through the Advanced Transportation and Logistics Initiative, the CEC has partnered with community colleges to fund ZEV curriculum, electric school bus training, and a Clean Fuels Transportation Pilot Career Opportunity Project for high school students [54]. California's largest manufacturer is now Tesla, a ZEV only company that has leveraged these and other state programs (including sales and use tax exclusions), to grow.

## **6.5 Bolster ZEV Market Growth Outside of California**

While California focused on its own ZEV progress, it also developed a multi-state ZEV collaboration with the governors of seven other states in 2013. Governor Brown signed a memorandum of understanding (MOU) with the seven states to commit to program coordination to deploy at least 3.3 million ZEVs by 2025. The MOU was followed by a May 2014 Multi-State ZEV Action Plan with 11 actions to accomplish the goals set forth in the plan [55]. Since that time, two more states have been added along with an updated 2018 Multi-State ZEV Action Plan [56].

California also co-founded the International ZEV Alliance, a collaboration of leading jurisdictions to accelerate the global deployment of ZEVs. It now includes California and 17 other national and sub-national jurisdictions who have committed to working together to transition to all ZEV passenger vehicle sales as quickly as possible, and no later than 2050 [57]. The jurisdictions work together and share best practices under the facilitation of the International Council on Clean Transportation [58]. The Alliance is actively seeking new members to adopt its ZEV goals and contribute to its collaboration.

## **6.6 Lead by Example Integrating ZEVs Into State Government**

The State Fleet's goal for the acquisition of ZEVs is on track to meet its light-duty vehicle goal of 50% by 2025. This success is a result of an innovative "ZEV-first" purchasing policy implemented by the Department of General Services (DGS). In addition, DGS Office of Sustainability has a goal of 5% of State workplace parking spots having access to charging to enable employee ZEV adoption [59].

## **7 Lessons Learned and Key Takeaways for Other Jurisdictions**

Other states and jurisdictions can learn from California's experience in developing and implementing the ZEV Action Plan as they embark on developing similar plans.

First, strong and bold leadership from the top is essential. California Governor's bold vision set forth goals and actions that gave state agencies a clear target and provided industry with investment confidence. Agency staff continue to implement these plans.

The Governor's Office leadership was crucial for communicating the ZEV vision for the State, engaging agencies at a high level, getting buy-in, and encouraging coordination and progress. The 2013 ZEV Action Plan's 100-plus actions successfully galvanized all agencies involved and provided focus on ZEV goal implementation. Occasionally, the Governor's Office intervened to motivate certain agencies to move forward on an action or to communicate with another agency. Without their leadership, progress would have been stymied.

The ZEV Action Plans were a helpful reference for agency management to justify state resource allocations and timeline justifications. The Plans also gave industry market confidence to invest in ZEV technology and a roadmap for investments. It encouraged ongoing partnerships and collaboration with the State, academia, non-governmental organizations, other states, countries and jurisdictions.



The Governor's Office used a "SmartSheet" to record progress for each agency on each of the ZEV actions [60]. It was a very effective management tool and provided transparency between the Governor's Office and all of the agencies. It is useful for tracking progress, recording actions taken, asking questions and a place to share resources and information. Agencies, however, could have used the tool even more pro-actively to engage with one another by sharing information and collaborating more effectively.

In retrospect, it was often a challenge for agencies to implement ZEV actions in a timely manner given competing schedules and priorities. It was not always possible to anticipate the amount of time necessary for various levels of coordination and the iterations required on ZEV implementation strategies and actions. Given the complexity of many of the actions, the state did a good job overall of establishing effective communication channels and staff-to-staff working relationships.

## **8 Ideas for Future ZEV Action Plan Updates**

Even with aggressive growth in the ZEV market, and a goal of ZEVs reaching 100 percent of new cars sales by 2035, California will fall short of its GHG reduction goals. In 2018, CARB issued a Progress Report on California's Sustainable Communities and Climate Protection Act of 2008, Senate Bill (SB) 375 which found that since 2000, California's emissions from state-wide passenger vehicle travel per capita increased instead of declined [61]. In order to overcome many of the challenges to implementing Sustainable Communities Strategies by Metropolitan Planning Organizations, the State is taking a holistic approach to aligning transportation, land use, and housing policies with State goals. Future ZEV Action Plans should pivot to a sustainable transportation focus including a goal of assisting local communities with developing a ZEV eco-system that includes equitable zero-emission mobility options in tandem with zero-emission affordable housing, active transportation options (e.g. biking and walking) and reducing passenger vehicle miles travelled. A ZEV eco-system includes a broad range of components tailored to a particular location such as ZEV deployment, infrastructure planning, permit streamlining, "ZEV-ready" building code updates, workforce training, consumer incentives, and innovative strategies such as discounted parking, curb side charging, zero-emission zones and support for car dealerships selling ZEVs.

In 2020, CARB published the Senate Bill 498 Report to the Legislature on its ZEV programs which included eight policy recommendations for the Legislature to act on [62]. If any of these recommendations are enacted into law the Governor's Office and State agencies could identify actions to support new ZEV initiatives for local communities. Ideally, the State can reduce the burden on local governments to plan for and implement sustainable transportation policies by centralizing resources and providing information, tools and guidance. The State can also provide funds through bonds or green banks to communities that prioritize implementing ZEV policies and reducing greenhouse gas emissions and passenger vehicle miles traveled. For example, investments in local transit and other mobility options should occur prior to enacting zero-emission zones.

Future ZEV Action Plan actions may include strategic implementation of emerging technologies such as vehicle-grid integration and smart charging for electric vehicles, refuelling for zero-emission transportation network company vehicles and fleets of automated vehicles, and maybe even zero-emission aviation. Local governments will have to plan for dedicated parking and charging for vehicle-grid integration in parking lots and curb side strategies and consider a roadmap for the eventual rollout of automated zero-emission vehicles.

California's ZEV Action Plans were organized around a simple question: can a ZEV market be created? The answer is a resounding yes, the market is growing. Today's question is slightly different: can the market scale in time to meet our climate commitments and health based air quality needs? Scale requires substantial private investment, and policies that help ensure the economics to attract that investment. It requires commitment from, and accountability to, multiple stakeholders. By Executive Order N-19-19, Governor Newsom doubled down on California's 5 million ZEVs by 2030 goal, while also spurring key agencies to leverage California's robust investment portfolio to create a Climate Investment Framework [63]. His administration is now developing a ZEV Market Development Framework to better organize collective action to scale the market. This framework

will include clear delineations of agency responsibility, feedback loops, as well as what the market needs from each stakeholder sector. The framework will serve as a backbone and roadmap to connect and align various agency initiatives around the core challenge: scaling up to end reliance on oil.

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## References

- [1] *California Air Resource Board ZEV Program*, <https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program>, accessed on 2019-10-10.
- [2] *Veloz*, <https://www.veloz.org/sales-dashboard/>, accessed on 2020-3-25.
- [3] *California's Governor's Office of Business and Economic Development*, <http://www.businessportal.ca.gov/zero-emission-vehicle-program/path-to-2030/>, accessed on 2019/10/10.
- [4] *CARB Advanced Clean Cars Program*, <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program>, accessed on 2020-2-24.
- [5] *Veloz Sales Dashboard*, <https://www.veloz.org/sales-dashboard/>, accessed on 2020-2-24.
- [6] Assembly Bill 32 Overview <https://ww3.arb.ca.gov/cc/ab32/ab32.htm> and Senate Bill 32 [http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32), accessed on 2020-2-24.
- [7] *Assembly Bill 8, Chapter 401, Alternative fuel and vehicle technologies: funding programs*, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201320140AB8](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB8), accessed on 2020-2-24.

- [8] *Charge Ahead California Initiative*, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201320140SB1275](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB1275), accessed on 2020-1-7.
- [9] *Senate Bill 350, Chapter 547*, [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB350](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350), accessed on 2020-1-7.
- [10] *Executive Order B-32-15*, <https://www.ca.gov/archive/gov39/2015/07/17/news19046/index.html>, accessed on 2020-2-13.
- [11] *CARB AB 32 Scoping Plan*, <https://ww3.arb.ca.gov/cc/scopingplan/scopingplan.htm>, accessed on 2020-3-4.
- [12] *CARB 2016 Mobile Source Strategy*, <https://ww3.arb.ca.gov/planning/sip/2016sip/2016mobsrsrc.htm>, accessed on 2020-2-24.
- [13] *CARB Low Carbon Fuel Standard*, <https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about>, accessed on 2020-2-24.
- [14] *California Department of Business and Economic Development ZEV Resources and Readiness*, <http://businessportal.ca.gov/zero-emission-vehicle-program/zev-resources/>, accessed on 2020-2-24.
- [15] Ibid
- [16] Ibid
- [17] *Smartsheet* <https://www.smartsheet.com/>, accessed on 2020-2-10.
- [18] *Executive Order B-48-18*, <https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>, accessed on 2020-1-6.
- [19] *Hydrogen Station Permitting Guidebook*, <http://www.businessportal.ca.gov/zero-emission-vehicle-program/zev-resources/>, accessed on 2020-1-6.
- [20] *2018 ZEV Action Plan Priorities Update*, September 2018, accessed on <http://business.ca.gov/ZEV-Action-Plan>, 1-16-20.
- [21] *About Veloz*, <https://www.veloz.org/about/#about>, accessed on 2020-2-19.
- [22] *“Kicking Gas”*, <https://www.veloz.org/news/>, accessed on 2020-2-19.
- [23] *Summary of Car Sharing and Mobility Options Pilot Project*, <https://ww3.arb.ca.gov/msprog/lct/carsharing.htm>, accessed on 2020-3-6.
- [24] *CARB’s Drive Clean*, <https://driveclean.arb.ca.gov/>, accessed on 2020-2-19.
- [25] *CPUC Transportation Electrification Activities Pursuant to Senate Bill 350*, <https://www.cpuc.ca.gov/sb350te/>, accessed on 2020-2-21.
- [26] *U.C. Davis International EV Policy Council Policy Guide, March 2018, “Driving the Market for Plug-in Vehicles: Increasing Consumer Awareness and Knowledge”*, <https://phev.ucdavis.edu/wp-content/uploads/increasing-consumer-awareness-and-knowledge.pdf>, accessed on 2020-2-10.
- [27] *CARB Low Carbon Transportation Light-Duty Vehicle Projects*, <https://ww3.arb.ca.gov/msprog/lct/projectlightduty-1.htm>, accessed on 2020-2-21.
- [28] *The Clean Vehicle Rebate Project*, <https://cleanvehiclerebate.org/eng>, accessed on 2020-1-28.
- [29] *“Growing the Electric Vehicle Market: EV Adopters, “Rebate Essentials,” and “EV Converts”*, Brett Williams Ph.D, [https://cleanvehiclerebate.org/sites/default/files/attachments/MktSeg\\_Roadmap12\\_v2019-12-05.pdf](https://cleanvehiclerebate.org/sites/default/files/attachments/MktSeg_Roadmap12_v2019-12-05.pdf), page 8, accessed on 2020-1-28.
- [30] *Clean Air Vehicle Decal Program*, <https://ww2.arb.ca.gov/resources/fact-sheets/current-clean-air-vehicle-decal>, accessed on 2020-2-21.
- [31] *U.C. Davis Plug-in & Electric Vehicle Research Center, Policy Brief 2014-01, “Evaluating the Impact of High Occupancy Vehicle (HOV) Lane Access on Plug-in Vehicles in California”*, [https://policyinstitute.ucdavis.edu/wp-content/uploads/Tal\\_June2014\\_Final.pdf](https://policyinstitute.ucdavis.edu/wp-content/uploads/Tal_June2014_Final.pdf), accessed on 2020-2-21.
- [32] *CARB’s Moving California Heavy-Duty Projects in Action*, <https://ww3.arb.ca.gov/msprog/lct/projectheavyduty.htm>, accessed on 2020-2-21.
- [33] *California Energy Commission School Bus Replacement Program*, <https://www.energy.ca.gov/programs-and-topics/programs/school-bus-replacement-program> and *Medium- and Heavy-Duty Vehicles*, <https://ww2.energy.ca.gov/transportation/altfueltech/medium-heavy-duty.html>, accessed on 2020-2-21.
- [34] *California’s Sustainable Freight Action Plan*, <https://ww2.arb.ca.gov/our-work/programs/california-sustainable-freight-action-plan>, accessed on 2020-2-21.
- [35] Michael Nicholas, *“Update on Electric Vehicle Costs in the United States Through 2030*, International Council on Clean Transportation, April 2, 2019, <https://theicct.org/publications/update-US-2030-electric-vehicle-cost>, accessed on 2020-2-13.
- [36] *California Energy Commission, Tracking Progress on ZEVs and Infrastructure*, <https://www.energy.ca.gov/data-reports/tracking-progress/zero-emission-vehicles-zevs-and-infrastructure>, accessed on 2020-2-13.

- [37] *California Public Utilities Commission Zero-Emission Vehicles*, <https://www.cpuc.ca.gov/zev/>, accessed on 2020-3-25.
- [38] *CARB Volkswagen Zero Emission Investment Commitment*, <https://ww2.arb.ca.gov/our-work/programs/volkswagen-zero-emission-vehicle-zev-investment-commitment/about>, accessed on 2020-3-25.
- [39] *Alternative Fuel Data Center Alternative Fueling Station Locator*, [https://afdc.energy.gov/stations/#/analyze?region=US-CA&fuel=ELEC&show\\_map=true](https://afdc.energy.gov/stations/#/analyze?region=US-CA&fuel=ELEC&show_map=true), accessed on 2020-3-25.
- [40] *CPUC Zero-Emission Vehicles and transportation electrification*, <https://www.cpuc.ca.gov/zev/>, accessed on 2020-2-21.
- [41] *GO-Biz ZEV Resources and Readiness*, <http://www.businessportal.ca.gov/zero-emission-vehicle-program/zev-resources/>, accessed on 2020-1-28.
- [42] *Electric Vehicle Charging Station Permitting Guidebook, July 2019*, <http://businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf>, accessed on 2020-1-28.
- [43] *CEC and NREL EV Infrastructure Projection Tool (EVI-PRO)*, <https://maps.nrel.gov/cec/?aI=0&hI=cdark&cF=0&IR=0&mC=36.86204269508728%2C-116.34521484375001&zL=6>, accessed on 2020-2-20.
- [44] *Annual Hydrogen Evaluation*, <https://ww2.arb.ca.gov/resources/documents/annual-hydrogen-evaluation>, accessed on 2020-2-21.
- [45] *California Energy Commission, Tracking Progress on ZEVs and Infrastructure*, <https://www.energy.ca.gov/data-reports/tracking-progress/zero-emission-vehicles-zevs-and-infrastructure>, accessed on 2020-2-13.
- [46] Ibid
- [47] *2015 Electric Vehicle Charging Infrastructure, Green Building Standard (CALGreen) Code Suggested Code Changes for Nonresidential Buildings Technical and Cost Analysis*, CARB, <https://ww3.arb.ca.gov/cc/greenbuildings/pdf/tcac2015.pdf>, accessed on 2020-2-21.
- [48] *Electric Vehicle Charging Infrastructure: Multi-Family Building Standards*, <https://ww3.arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf>, accessed on 2020-2-21.
- [49] *CALGreen Title 24, Part 11*, <https://www.dgs.ca.gov/BSC/Resources/Page-Content/Building-Standards-Commission-Resources-List-Folder/CALGreen#@ViewBag.JumpTo>, accessed on 2020-2-21.
- [50] *SF Environment San Francisco Building Code*, <https://sfenvironment.org/green-building-ordinance-sf-building-code>, accessed on 2020-2-24.
- [51] *LCFS ZEV Infrastructure Crediting*, <https://ww2.arb.ca.gov/resources/documents/lcfs-zev-infrastructure-crediting>, accessed on 2020-2-21.
- [52] *CALeVIP*, <https://calevip.org/>, accessed on 2020-2-10.
- [53] *California Energy Commission, Draft Staff Report 2020-2023 Investment Plan Update for the Clean Transportation Program*, pages 58-59, <https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/2020-2021-investment-plan-update>, accessed on 2020-3-6.
- [54] Ibid, pages 59-61, accessed on 2020-3-6.
- [55] *Multi-State ZEV Task Force*, <https://www.zevstates.us/>, accessed on 2020-1-7.
- [56] *2018 Multi-State ZEV Action Plan: Accelerating the Adoption of Zero Emission Vehicles*, <https://www.zevstates.us/2018-zev-action-plan/>, accessed on 2020-1-16.
- [57] *The International ZEV Alliance*, <http://www.zevalliance.org/members/>, accessed on 2020- 2-13.
- [58] *The International Council on Clean Transportation*, <https://theicct.org/> accessed on 2020- 2-13.
- [59] *California Department of General Services Office of Sustainability*, <https://www.dgs.ca.gov/OS/About#@ViewBag.JumpTo>, accessed on 2020-2-21.
- [60] *Smartsheet*, <https://www.smartsheet.com/?a=73598644272329&c=21&dev=c&k=smartsheet&m=5500&msclkid=c8aafb560b3d1c6b40c9a5796914637f&mtp=be&qst=smartsheet&s=55>, accessed on 2020-1-27.
- [61] *2018 Progress Report on California's Sustainable Communities and Climate Protection Act*, [https://ww2.arb.ca.gov/sites/default/files/2018-11/Final2018Report\\_SB150\\_112618\\_02\\_Report.pdf](https://ww2.arb.ca.gov/sites/default/files/2018-11/Final2018Report_SB150_112618_02_Report.pdf), accessed on 2020-2-21.
- [62] *Draft Assessment of CARB's Zero-Emission Vehicle Programs per SB 498*, <https://ww2.arb.ca.gov/resources/documents/draft-assessment-carbs-zero-emission-vehicle-programs-sb-498>, accessed on 2020-2-12.
- [63] *State of California Executive Order N-19-19*, <https://www.gov.ca.gov/wp-content/uploads/2019/09/9.20.19-Climate-EO-N-19-19.pdf>, accessed on 2020-3-25.