California:

100% New zero-emission vehicle sales by 2035 will deliver extensive health, environmental and economic benefits.

May 2021

EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

Protective, next generation Advanced Clean Car II Standards will address the dual public health crises of air and climate pollution, saving lives, saving Californians money, and delivering jobs.

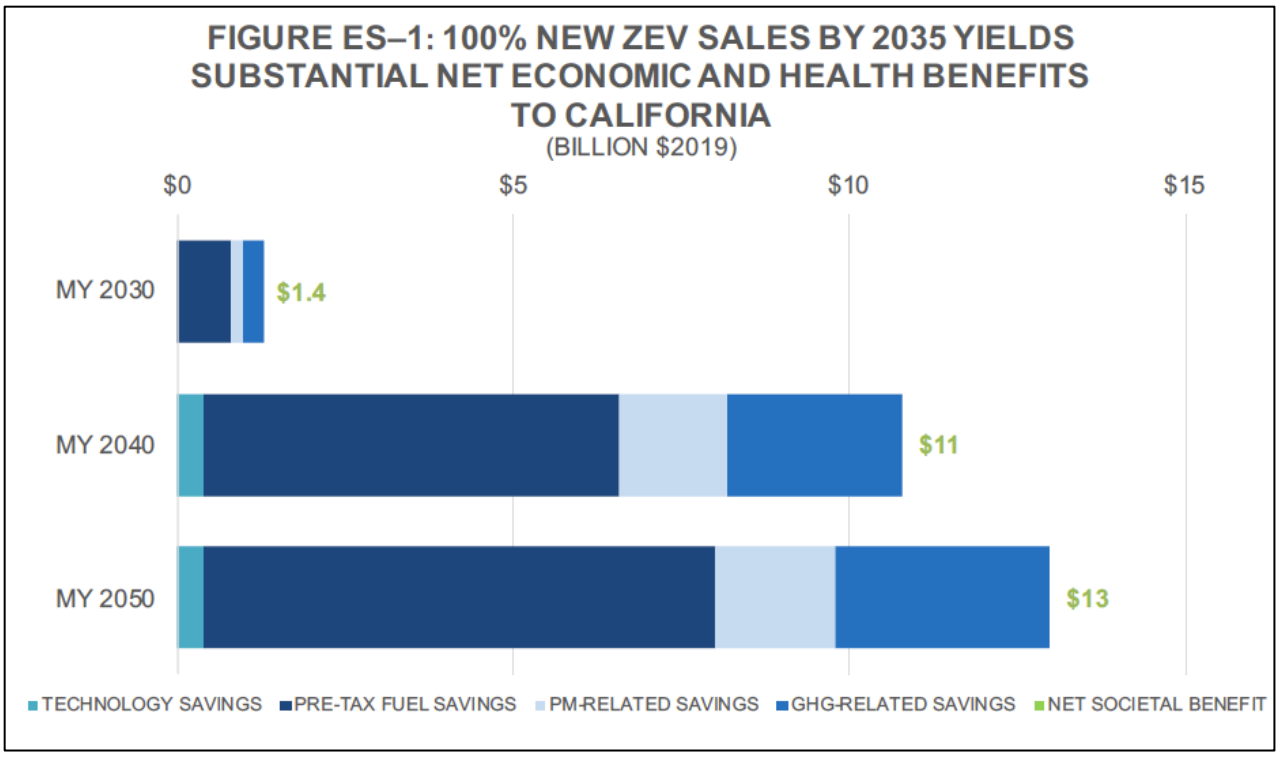
Introduction

In September 2020, California Governor Gavin Newsom issued an executive order directing the Air Resources Board (ARB) to adopt standards consistent with the goal of ensuring all new passenger vehicles are zero emission vehicles (ZEVs) by 2035.[1] The ARB will consider adopting these standards as part of its upcoming Advanced Clean Cars II rulemaking – a coordinated program that will control smog-causing pollutants and greenhouse gas emissions from passenger vehicles in California.

A shift to all new ZEV sales by 2035 will deliver substantial benefits to all Californians by reducing harmful air and climate pollution, saving lives, saving Californians money, and delivering jobs.

EDF ANALYSIS SHOWS THAT PROTECTIVE CALIFORNIA AIR POLLUTION STANDARDS WILL:

- Significantly reduce ozone forming pollution and harmful particulate pollution that disproportionately burdens people of color and lower income communities, avoiding as many as 380 premature deaths and 20,000 lost workdays each year by 2040 and preventing more than 7,400 premature deaths in total by 2050
- Avoid more than 60 million metric tons of greenhouse gas emissions every year by 2040 – equivalent to taking 15 coal-fired power plants offline for a year – and eliminate more than 1.2 billion tons cumulatively by 2050
- Save California nearly $11 billion annually by 2040 in economic and pollution benefits and $194 billion cumulatively by 2050 (Figure ES–1)
- Save buyers of a new 2027 battery electric vehicle (BEV) more than $9,000 over the life of the vehicle. In 2035, buyers of new BEVs will save more than $13,000 compared to a gasoline vehicle



California and State Leadership in Reducing Passenger Vehicle Air Pollution

California's clean car standards are among the most effective policies for reducing harmful motor vehicle air and climate pollution. California's ARB is currently developing next generation Advanced Clean Car (ACC II) standards for control of smog-forming (criteria) pollutants and greenhouse gas (GHG) emissions from the state's highway passenger vehicles. The ACC II should reflect Governor Newsom's executive order establishing a target that 100 percent of in-state sales of new passenger cars and trucks be zero emitting by 2035, and reduce emissions from the gasoline vehicles still being sold.[2]

This shift to ZEVs will help secure vital reductions in deadly particulates and ground-level ozone pollution afflicting communities across California. It will also put California on a path to achieving greater long-term GHG reductions, save money due to lower fuel costs, boost high-paying jobs, and provide more opportunities for Californians to choose clean, zero emitting vehicles.

There is broad support for California's vision. Automakers representing nearly half of the U.S. market have committed to working with California and the Biden-Harris administration to enact ambitious policies that will create high-quality domestic jobs, protect our health, and confront the climate crisis. Ford applauded California's bold commitment to make all new cars sold in

the state zero-emitting by 2035.[3] GM has committed to take action to eliminate tailpipe emissions from all new passenger vehicles by 2035.[4] Volvo anticipates battery electric vehicles (BEVs) will make up half of its sales in 2025 and will move to sell exclusively electric vehicles (EVs) by 2030.[5] Honda recently set a goal of total global EV sales by 2040.[6]

Price parity between electric vehicles and conventional vehicles will occur around 2025.

These and other automakers are investing billions of dollars in ZEV development. As a result, the cost of battery packs has fallen dramatically and is projected to continue to decline. Most analysts agree that price parity between electric vehicles and conventional vehicles will occur around 2025.[7] And depending on vehicle range, the total cost of ownership parity could occur one to two years earlier, due to high fuel cost savings.[8] A recent M.J. Bradley report on the status of the electric vehicle market found that automakers are investing $268 billion worldwide on electrification through 2030, with over $22 billion on domestic manufacturing.[9] EV model offerings will increase from 64 to 82 between 2021 and 2023 in the United States, and by 2021 there will be at least four EV models available for under $30,000 (MSRP) with a range of at least 250 miles.[10] GM announced that it is committing $27 billion to EVs and autonomous vehicles (AVs) by 2025 and 50 percent of its product development will go toward EV and AV development.[11] In February 2021, Ford announced its plan to invest $22 billion in electrification through 2025, nearly doubling its previous commitment.[12]

Automakers are investing **$268 billion** worldwide on electrification through 2030.

The growing demand for ZEVs and the related increase in manufacturing and infrastructure is creating jobs. The EV industry employed nearly 131,575 individuals across the U.S. in 2020, with employment growing more than six percent, the biggest increase of any clean energy category.[13] And U.S. jobs surpassed 273,000 when also including those associated with hybrid, natural gas, hydrogen, and fuel cell vehicles, with over 40,000 of these jobs in the state of California.[14]

Other states are also helping drive the shift to ZEVs. Massachusetts recently announced that it will follow California's lead and also ensure 100 percent new ZEV sales by 2035.[15] And California, together with eleven other bipartisan governors, recently sent a letter encouraging the Biden Administration to adopt strong federal standards consistent with a transition to 100 percent new ZEV sales by 2035.[16]

Protecting the health of communities across California

More than **20,000** **Americans die** prematurely every year as a result of the motor vehicle pollution on our roads and highways.

More than 40 percent of all Americans live in counties with unhealthy levels of ozone or particle pollution.[17] California suffers from some of the worst air quality in the nation. Despite making substantial progress over the years, many communities in California still face unhealthy air quality levels.[18] The South Coast and San Joaquin Valley, for instance, are the only two areas in the nation designated as "extreme" nonattainment for the federal health-based ozone standard and the San Joaquin Valley has the highest fine particulate levels in the nation.[19] Across California and the nation, climate change has contributed to historic deadly wildfires, floods, droughts, crop losses and more health harming high ozone days.[20]

The transportation sector is responsible for 80 percent of smog-forming pollution, 95 percent of toxic diesel emissions, and more than half of all of California's carbon pollution.[21] California's light-duty vehicles are responsible for 13 percent of the state's ozone forming nitrogen oxide (NOx) pollution and 28 percent of the state's carbon dioxide (CO2) pollution.[22] A shift to ZEVs will reduce this harmful pollution and save lives across the state.

More than 20,000 Americans die prematurely every year as a result of the motor vehicle pollution on our roads and highways, including many Californians.[23] A recent study by researchers at George Washington University and the Environmental Defense Fund (EDF) found that, in the Bay Area alone, more than 2,500 lives are lost and 5,200 children develop asthma every year due to traffic-related air pollution exposure.[24]

Communities of color and low income communities suffer disproportionately from harmful vehicle pollution.

Communities of color and low-income communities suffer disproportionately from harmful vehicle pollution because these groups constitute a higher percentage of the population near our roads and highways.[25] And these communities already face health disparities, including higher rates of chronic disease and premature death.[26] A recent report by Moving Forward Network found that, on average, Asian and Black Americans bear a PM2.5 pollution burden from cars, trucks and buses that is 56 and 44 percent higher, respectively, than white Americans.[27] According to the American Lung Association's 2021 State of the Air report, people of color are more than three times more likely to breathe the most polluted air when compared to white people.[28] An EDF analysis of the Bay Area study data referenced above found that neighborhoods with higher percentages of residents of color experienced double the rate of asthma from NO2 – a pollutant often used as a marker for transportation-related pollution.[29] A forthcoming study found satellite-observed levels of NO2 in the least white census tracts of the United States were double the levels in the most white tracts prior to the COVID-19 lockdown in 2020. And even though COVID-19 lockdowns led to sharp

reductions in NO2 across all areas, the racial disparities were so large before the pandemic that the least white tracts continued to face even higher NO2 levels during the lockdown than the most white tracts experienced *before* the lockdowns.[30]

Another recent study found that Black Americans are exposed to 21 percent more fine particle pollution compared to average concentrations, while white Americans, by contrast, have 8 percent less pollution exposure than the average.[31] The study concludes that highway vehicles are often among the largest sources of this disparity and that the disparity is systemic, holding for nearly all major sectors, as well as across states and urban and rural areas, income levels, and exposure levels. The study also found that because of a legacy of racist housing policy and other factors, racial-ethnic exposure disparities have persisted even as overall pollution exposure has decreased.

Eliminating harmful pollution from the transportation sector is a critical measure that can help to protect public health, particularly for the communities that disproportionately bear the burdens of this pollution.

Methodology

This report examines the vehicle cost, fuel savings, pollution reductions, economic benefits and health-related benefits of California adopting next generation Advanced Clean Cars II standards that achieve 100 percent new passenger ZEV sales in 2035. The analysis estimates these impacts against a baseline that assumes ZEV sales in California will reach a level of 7.4 percent of new vehicles in 2026[32] and that California's gasoline vehicles comply with the original Obama Administration GHG and fuel economy standards in 2027.

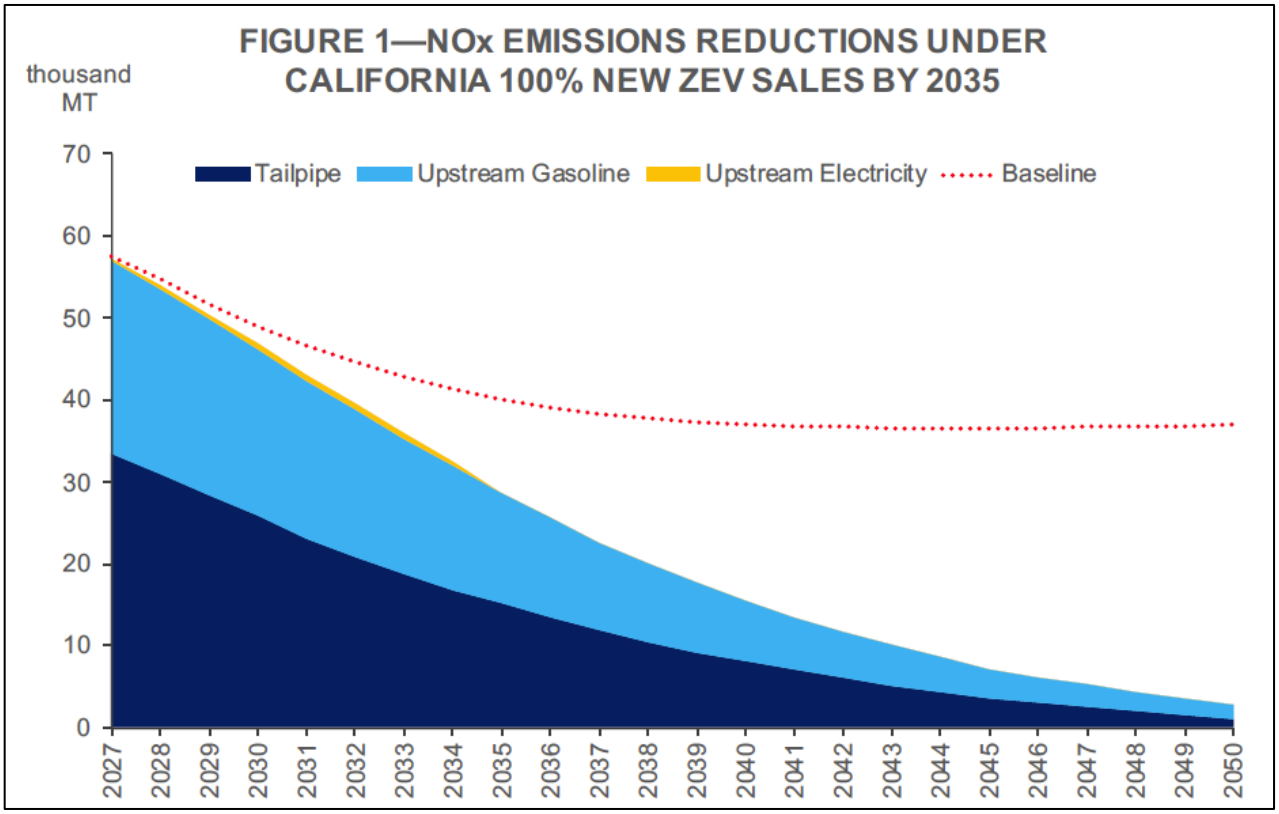
The methodologies underpinning this analysis are consistent with previous analyses conducted by the U.S. Environmental Protection Agency (EPA) in these areas, such as those used in its original Proposed and Final Determinations regarding the 2022-2025 GHG standards for cars and light trucks.[33] The report uses the most up-to-date projections of the cost of electric vehicles, as well as the most recent projections of future gasoline and electricity prices projected for California.[34]

Next generation ACC II standards could reduce ozone-forming **NOx pollution by over 420,000 tons** by 2050.

100% new ZEV sales in California by 2035 will reduce health-harming pollution and greenhouse gases

A transition to 100 percent new ZEV sales by 2035 will deliver significant health and climate benefits by reducing GHGs and criteria emissions, including CO_2, NOx, particulates and other health-harming pollutants.

Figure 1 shows that well-designed standards that rely on the availability of 100 percent new ZEV sales by 2035 could reduce ozone-forming NOx pollution by more than 11,000 tons per year in 2035 and 34,000 tons annually by 2050. **Cumulatively, the transition to ZEVs could reduce over 420,000 tons of NOx by 2050.** NOx contributes to the formation of fine particles ($PM_{2.5}$) and ground level ozone, both of which are associated with adverse health effects, and both of which disproportionately impact communities of color and low-income communities in California.

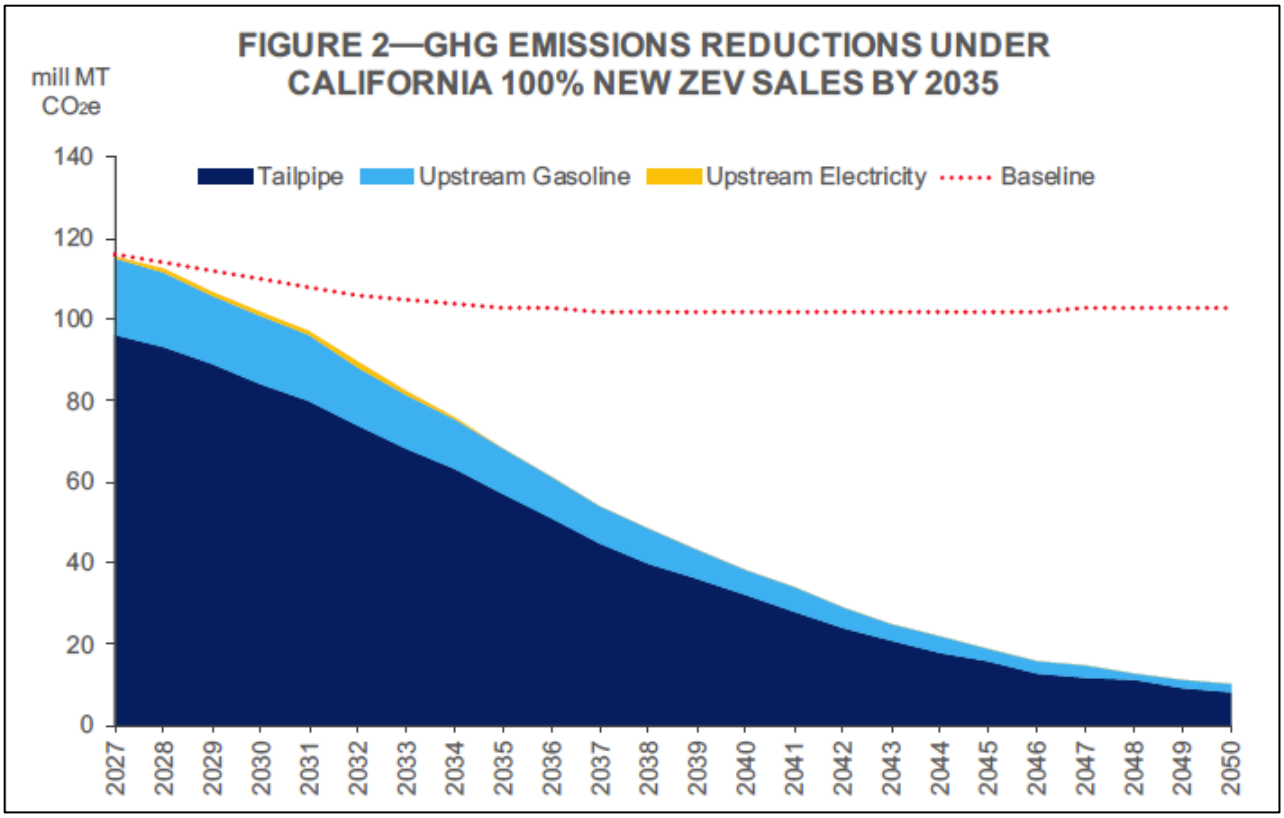


A shift to ZEVs could also reduce volatile organic compounds (VOCs), another precursor to ozone, by a total of more than 555,000 tons between now and 2050 and $PM_{2.5}$ emissions by more than 30,000 tons in total by 2050. Sulfur dioxides (SO_2) and toxic benzene would also be significantly reduced.

100% new ZEV sales by 2035 will eliminate more than **1.2 billion metric tons** of GHG pollution by 2050.

In addition to health-harming pollutants, California will also see a significant reduction in climate pollution. As shown in Figure 2, **California has the potential to reduce 35 million metric tons of GHG emissions annually in 2035 and more than 90 million metric tons every year by 2050**, relative to no action. Between now and 2050, next generation standards could eliminate more than 1.2 billion metric tons of GHG pollution in total. Not only are the reductions enormous, but the standards would nearly eliminate all tailpipe CO2 emissions from the state's light-duty fleet by

2050 – one of the biggest contributors to California's statewide GHG inventory.



By 2050, next generation ACC II standards could **prevent more than 7,400 premature deaths** across California.

100% new ZEV sales in California by 2035 will benefit public health

We used EPA's Benefit per Ton screening and mapping tool[35] together with the estimated emission reductions to estimate the health impacts of ACC II standards that ensure 100 percent new ZEV sales by 2035. The standards have the potential to result in 166-380 fewer premature deaths and more than 20,000 fewer lost workdays every year by 2040 (Table 1). **By 2050, a total of up to 7,406 fewer Californians will have died prematurely.**

All of these health impacts are due to changes in ambient fine particulate matter levels and do not include the substantial additional benefits that would result from reduced ozone or GHGs, which would further enhance the program's health benefits.

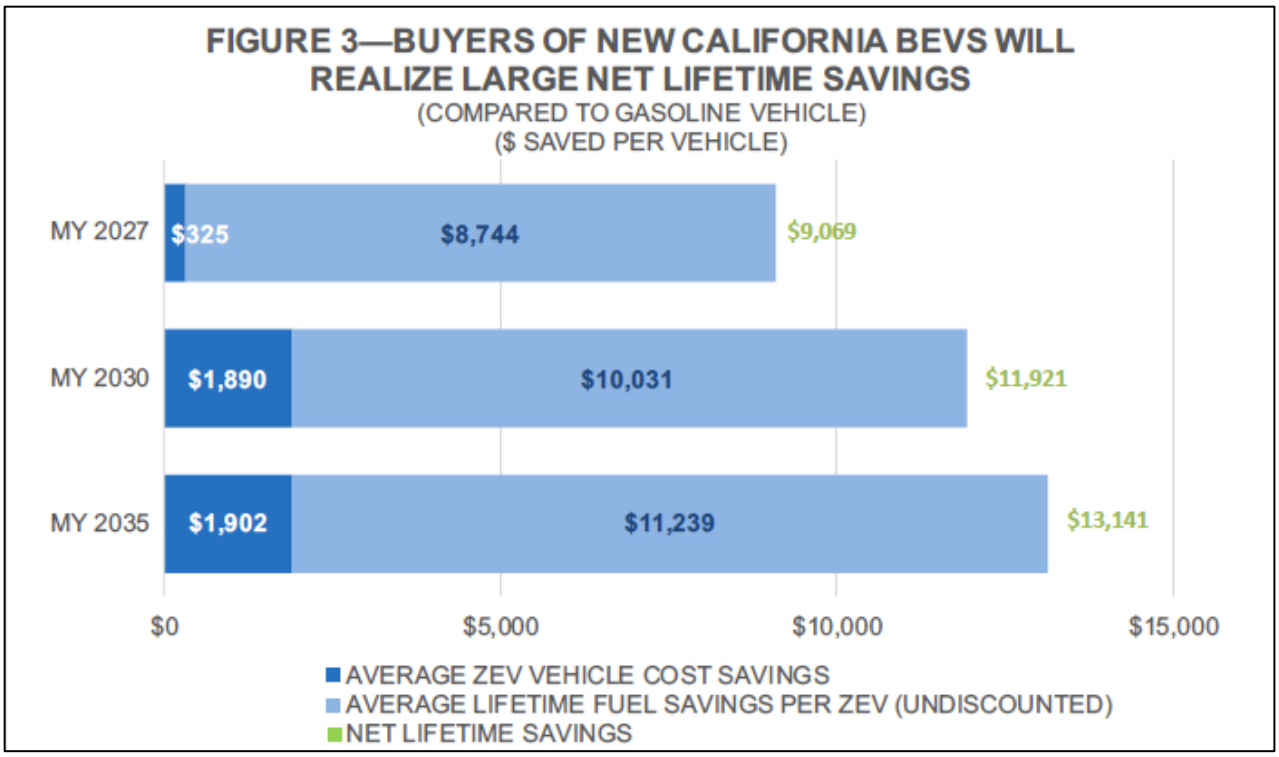
TABLE 1: CALIFORNIA 100% NEW ZEV SALES BY 2035 YIELDS SIGNIFICANT REDUCTIONS IN HEALTH IMPACTS				
INCIDENCES	2030	2040	2050	TOTAL THRU 2050
PREMATURE MORTALITY	18 – 41	166 – 380	254 – 583	3,230 – 7,406
WORK LOSS DAYS	2,291	20,749	31,754	404,241
RESPIRATORY SYMPTOMS	826	7,474	11,434	145,594
ASTHMA EXACERBATION	561	5,082	7,775	98,995
ACUTE BRONCHITIS	50	420	632	8,154
HEART ATTACKS	21	191	292	3,715
EMERGENCY ROOM VISITS OR HOSPITAL ADMISSIONS	20	175	267	3,400

100% new ZEV sales in California by 2035 will deliver substantial consumer savings

Purchasers of new ZEVs in California will quickly see significant vehicle and fuel cost savings.

Our analysis of the consumer economic savings associated with ensuring all new cars sold in Caliornia by 2035 are ZEVs assesses all major variables that affect the aggregate costs of owning and operating a vehicle: vehicle purchase, insurance, fuel, charging and maintenance costs.[36] We find that purchasers of new BEVs in California will quickly see significant vehicle and fuel cost savings, well before 2035, and the savings will continue to increase over time.

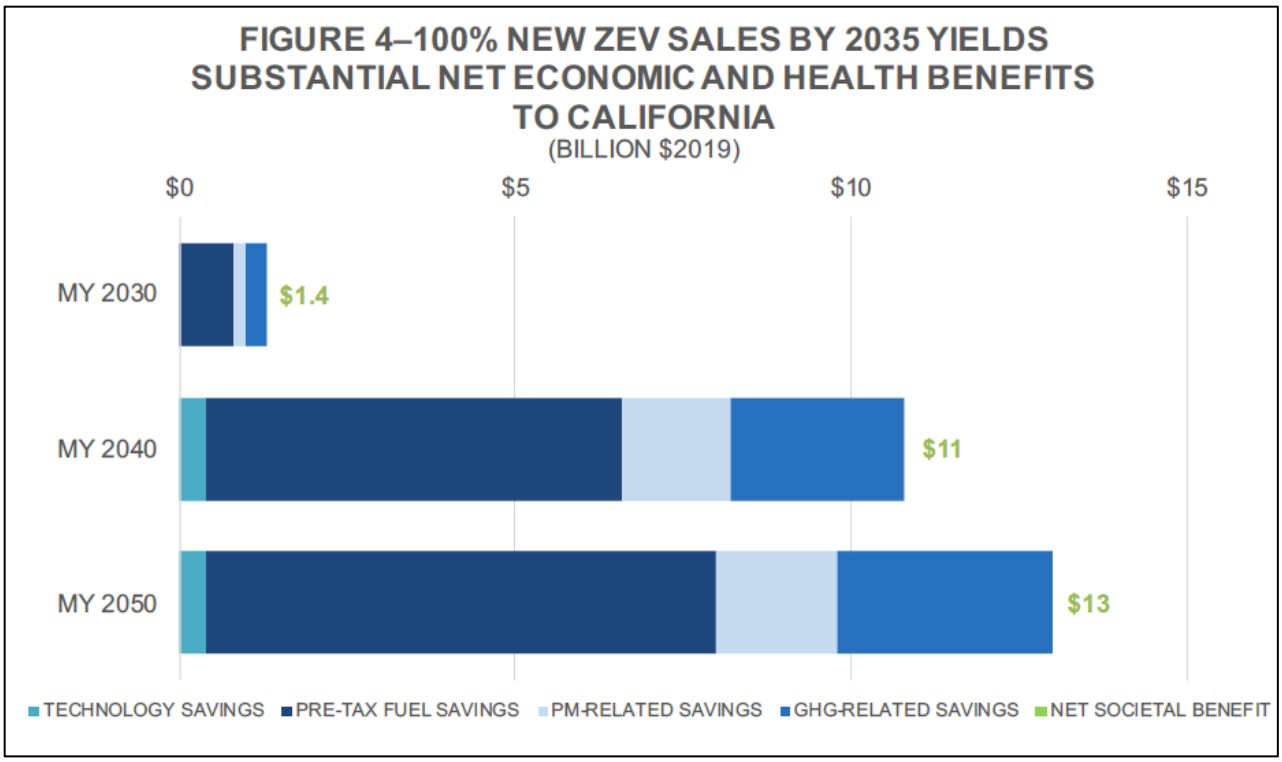
As shown in Figure 3, the buyer of a model year 2027 BEV could already save $325 on the upfront cost of the BEV compared to a comparable gasoline vehicle, due to decreasing battery prices and the lower cost of an electric motor compared to a gasoline engine and exhaust aftertreatment. The same buyer could save an additional nearly $9,000 in fuel costs over the life of the BEV.[37] **The purchaser of a model year 2030 BEV could see cumulative savings in vehicle and fuel costs of nearly $12,000 over the life of the BEV.** These savings to buyers of new California BEVs continue to increase in 2035 and beyond.



The cumulative net societal savings in California as a result of shifting to 100% new ZEV sales could reach **$194 billion** by 2050.

100% new ZEV sales by 2035 will deliver net economic and pollution benefits to the state

To evaluate the net economic and pollution impacts of selling 100 percent new ZEVs by 2035, we combine the vehicle-related economic benefits to consumers with the monetized benefits of the GHG emissions reductions and monetized ambient PM-related health benefits to society. Figure 4 summarizes the substantial aggregate economic and pollution benefits to California, relative to no action. **The annual statewide benefits are an estimated $1.4 billion in 2030, before the program is fully in effect, and jumps to $13 billion in 2050.** The cumulative net societal savings in California as a result of next generation standards that save lives could reach almost $194 billion by 2050.



Conclusion

Adopting next generation Advanced Clean Cars II standards that ensure 100 percent of new vehicles sold in California are zero-emitting by 2035 will benefit Californians substantially. They will save California families thousands of dollars in avoided fuel costs and avoid more than 60 million metric tons of greenhouse gas emissions every year by 2040. The standards will likewise significantly reduce ozone forming pollution and harmful particulate pollution that disproportionately burdens communities of color and low-income communities, avoiding as many as 380 premature deaths and 20,000 lost workdays each year by 2040 and preventing more than 7,400 premature deaths in total by 2050.

[1] California Executive Order N-79-20. See https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-text.pdf

[2] ARB is hosting a workshop on ACC II on May 6, 2021, a critical step in the rulemaking process. One of the key purposes of this paper is to inform the deliberations on the wide-ranging benefits of ensuring a transition to ZEV vehicles.

[3] Rachel Becker, "Newsom orders ban of new gas-powered cars by 2035," Cal Matters (Sept. 25, 2020) https://calmatters.org/environment/2020/09/california-ban-gasoline-powered-cars-in-2035/; 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," Press Release (Sept. 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/#:~:text=SACRAMENTO%20%E2%80%93%20Governor%20Gavin%20Newsom%20today,passenger%20vehicles%20to%20be%20zero-

[4] http://blogs.edf.org/climate411/files/2020/12/Letter-from-Mary-Barra-to-Environmental-Leaders-11.23.20.pdf; https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2021/jan/0128-carbon.html

[5] Volvo Car USA Newsroom, "Volvo Cars to be fully electric by 2030," (March 2, 2021). https://www.media.volvocars.com/us/en-us/media/pressreleases/277409/volvo-cars-to-be-fully-electric-by-2030

[6] Celine Castronuovo, "Honda sets goal of all electric vehicle sales by 2040," *The Hill* (April 23, 2021). https://thehill.com/policy/transportation/automobiles/549924-honda-sets-goal-of-reaching-all-electric-vehicle-sales-by?rl=1

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[9] M.J. Bradley & Associates, an ERM Group Company. 2021. *Electric Vehicle Market Status – Update*. https://www.mjbradley.com/sites/default/files/EDF_EV_Market_Report_April_2021_Update.pdf

[10] *Id.*

[11] https://investor.gm.com/static-files/f059ac9f-9ad8-4016-938a-5cc664b64e83

[12] Sam Abuelsamind, "Ford Doubling Investment In Electric Cars And Trucks To $22 Billion," *Forbes* (February 4, 2021). https://www.forbes.com/sites/samabuelsamid/2021/02/04/ford-doubles-investment-in-electrification-to-22b-7b-for-avs/?sh=56e259662d25

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[14] *Id.*

[15] https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download

[16] https://www.gov.ca.gov/wp-content/uploads/2021/04/4.21.21-Multi-State-Governors-ZEV-Letter.pdf

[17] American Lung Association. 2021. State of the Air. https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf

[18] *Id.*

[19] U.S. EPA. Nonattainment Areas for Criteria Pollutants (Greenbook). https://www.epa.gov/green-book

[20] The recent National Climate Assessment concluded that, "*Earth's climate is now changing faster than at any point in the history of modern civilization"* and that "*the evidence of human-caused climate change is overwhelming and continues to strengthen, that the impacts of climate change are intensifying across the country, and that climate-related threats to Americans' physical, social, and economic well-being are rising*." USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018. https://nca2018.globalchange.gov/

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[31] Christopher W. Tessum et. al. 2021. $PM_{2.5}$ polluters disproportionately and systemically affect people of color in the United States. *Science Advances*, 7 (18). https://advances.sciencemag.org/content/7/18/eabf4491

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[33] U.S. EPA. 2019. Final Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation, EPA-420-R-17-001. U.S. EPA. 2016. Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation, EPA-420-R-16-020.

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associated with the production of gasoline and electricity. GREET projects emissions for California gasoline specifically. The breakdown of sources of electricity were taken from AEO2021 for the Pacific region.

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[36] Environmental Defense Fund and Energy Innovation recently released a separate report analyzing the environmental and economic benefits of California's Advanced Clean Trucks Rule, *available at* https://energyinnovation.org/wp-content/uploads/2020/06/Clean-Trucks-Big-Bucks_June_17_2020.pdf.

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