



Driving to Clean Air:

Health Benefits
of Zero-Emission Cars
and Electricity

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About this Report

“Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity” finds that a transition to 100 percent zero-emission new passenger vehicle sales by 2035, coupled with non-combustion electricity generation, would yield tremendous public health benefits across the United States. To provide significant reductions in harmful pollution, a growing list of states have adopted or are considering adoption of the “Advanced Clean Cars II” standard that cleans up new combustion engines and establishes a 100 percent sales standard for new passenger vehicles in 2035, with six states already having adopted this policy, and more in the process of doing so. The U.S. Environmental Protection Agency has proposed rules that require stronger limits on ozone-forming emissions, particle emissions and greenhouse gases projected to spur a significant increase in zero-emission vehicles across the nation by 2032. The passage of the Inflation Reduction Act in 2022 created a range of incentive programs to support consumer purchases of new and used zero-emission vehicles, and the passage of the Infrastructure Investment and Jobs Act in 2022 accelerated the nation’s zero-emission fueling networks. This report underscores the benefits of pursuing the Advanced Clean Cars II standard and stronger federal vehicle policies and investments to realize widespread health improvements.

This new data analysis of the health benefits of 100 percent zero-emission new passenger vehicle sales and non-combustion energy generation by 2035 stems from the March 2022 Lung Association “[Zeroing in on Healthy Air](#)” report. For a comprehensive analysis of the on-road transportation and electricity generation sectors, please see “Zeroing in on Healthy Air”. For a narrower analysis of the health benefits of zero-emission trucking along high-traffic freight routes in the United States, please see “Delivering Clean Air.” Both reports are available at Lung.org/ev.

Report History and Methodology

This report is the second offshoot of “Zeroing in on Healthy Air,” a report released by the American Lung Association in 2022. The data in this report come from that report’s analysis. The American Lung Association developed “Zeroing in on Healthy Air” with the assistance and technical support of ICF, LLC (ICF). Using a series of modeling tools, ICF provided estimated fleet characteristics and emissions profiles (US EPA MOVES2021 model, ICF’s custom fleet modeling), emissions associated with fuel and electricity generation (Argonne National Lab GREET Model, ICF’s custom IPM model) and health outcomes associated with changes in emissions (US EPA COBRA health model). ICF conducted a comprehensive analysis of the potential health and climate benefits of this transition as a consultant to the American Lung Association, which is solely responsible for the content this report.

“Driving to Clean Air” was created by isolating the health benefits of zero-emission passenger vehicles and energy generation from the broader “Zeroing in on Healthy Air” report initially published in March 2022. Additional details on the structure of “Zeroing In on Healthy Air,” a full methodology and assumptions about future vehicle fleets, changes in the electric power grid and citations are detailed in the technical report document prepared by ICF for the American Lung Association. Available online at Lung.org/ev



Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity

Key Findings: By 2050, as the United States moves to 100 percent zero-emission new passenger vehicles sales and clean, non-combustion electricity generation, the cumulative national public health benefits due to cleaner air could reach:

- \$978 billion in public health benefits
- 89,300 fewer premature deaths
- 2.2 million fewer asthma attacks
- 10.7 million fewer lost workdays

To achieve these benefits, it is imperative that states and the federal government implement stronger standards and take advantage of new funding programs to accelerate the transition away from combustion and to zero-emission technologies for transportation and energy generation. Implementing the Inflation Reduction Act (IRA), Infrastructure Investment and Jobs Act (IIJA) provisions and other public and private investments to accelerate EV adoption and infrastructure, and adopting state and federal policies to accelerate the deployment of zero-emission vehicles, will support cleaner air, reduced climate pollution and healthier communities across the nation.

Air Quality in the United States

The American Lung Association’s annual “State of the Air” report notes ongoing progress and challenges in local, state and federal efforts to achieve clean, healthy air for all communities. “State of the Air” 2023 found that over 35 percent of all Americans — approximately 120 million people — live in areas impacted by unhealthy levels of ozone and/or particle pollution. People of color make up the majority of those living in communities with unhealthy air. The report also notes that a person of color is 64 percent more likely than a white person to live in a community impacted by unhealthy air and 3.7 times more likely to live with the most polluted air in the United States.¹

Decades of peer-reviewed research demonstrates that the burdens of unhealthy air include increased asthma attacks, heart attacks and strokes, lung cancer and premature death. These poor health outcomes are not shared equally, with many communities of color and lower income communities at greater risk due to increased exposure to transportation pollution. The transportation sector is also the largest source of greenhouse gas emissions that drive climate change, which worsens air quality and amplifies and accelerates a wide range of health risks and disparities.

\$978 Billion

cumulative
public health
benefits by 2050

- ↓ Premature Deaths
- ↓ Asthma Attacks
- ↓ Lost Work Days





Traffic pollution and the benefits of zero-emissions

Decades of research demonstrates the overall health impacts of poor air quality on human health. As noted above, too many Americans continue to live with the negative health consequences of polluted air. Further, disparities in pollution exposures and negative health consequences are clear in terms of lower-income communities and people of color bearing greater burdens broadly, and due to transportation specifically.² Transportation pollution is a leading source of both harmful air and climate pollution in the United States, meaning that the road to clean air must include zero-emission vehicles.



Two recent publications have illustrated the health burdens and health potential of shifting away from combustion across the transportation sector. Notably, the research on early deployment of zero-emission vehicles highlights a gap in adoption of these vehicles (and associated health benefits) in communities with lower socio-economic status. The need for targeted policies and investments to ensure health benefits of zero-emission technologies accrue in underserved communities was also discussed in the original “Zeroing in on Healthy Air” report, and a growing body of research and — critically — public policy.

In June 2022, the Health Effects Institute published a review of 353 research papers regarding traffic pollution-related health effects and concluded with a moderate to high level of confidence that exposure to traffic pollution is linked with all-cause, circulatory, ischemic heart disease, and lung cancer mortality; asthma onset in both children and adults; and acute lower respiratory infections in children.³

Researchers with the Keck School of Medicine of the University of Southern California recently published an analysis of early air quality and health improvements following zero-emission vehicle deployments between 2013 and 2019. The research team analyzed Zip Code level data on vehicle registrations, monitored air pollution concentration and health outcomes to observe changes associated with zero-emission vehicles. Even at relatively low levels of zero-emission technology deployments seen during the study period, researchers found that increased zero-emission vehicle registrations corresponded with reductions in asthma-induced Emergency Department visits and a suggestive trend towards lower harmful air pollution. A key finding of this study was “adoption gap among populations with lower socioeconomic status,” indicating the ongoing need to build equity into zero-emission transportation policy.⁴



Growing Adoption of State Zero-Emission Vehicle Standards

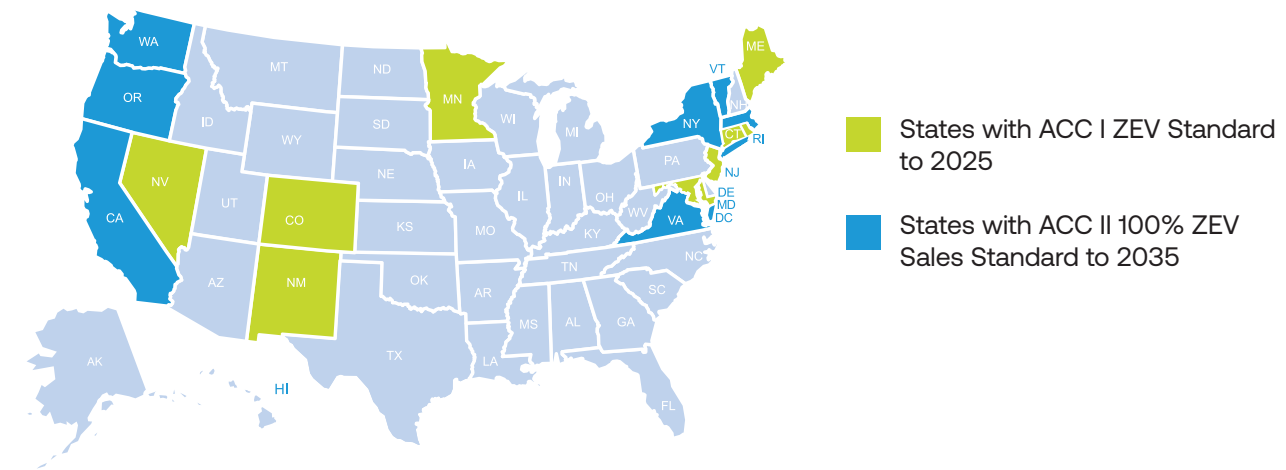
Under the federal Clean Air Act, states have the authority to implement state-level standards that are more health protective than federal standards. Under Section 177 of the federal Clean Air Act, states may voluntarily follow more stringent emissions and/or zero-emission standards adopted under California’s Section 209 Clean Air Act authority to establish and implement more health protective standards. Key policies adopted by California and followed by some other states include:

- “Advanced Clean Cars I” standard (ACC I): features stronger emission standards for combustion engines and requirements for automakers to produce increasing percentages of zero-emission vehicles (ZEVs) through 2025.
- “Advanced Clean Cars II” standard (ACC II): builds on ACC I standards and requires that 100 percent of new passenger vehicles sold be zero-emission vehicles by 2035, with interim year targets requiring increasing percentages of ZEVs. ACC II also requires stronger emissions standards for combustion vehicles to 2035.

As seen in the table on the following pages, many states have taken action to adopt the more stringent combustion emission standards and/or the zero-emission vehicle standards established by California. To date, states representing over 35% of the nation’s new vehicle market have adopted a zero-emission sales requirement for passenger vehicles.⁵ These states are driving the market and ensuring that the health benefits of zero-emission vehicles — and a wider range of consumer choices — are available to their residents.

In the short time since the initial 2022 adoption of Advanced Clean Cars II standard by the California Air Resources Board, six more states representing have adopted the zero-emission vehicle sales standard with a 100 percent requirement for sales in 2035 to be zero-emission. The growing list of states, President Biden’s Executive Order calling for at least 50 percent of vehicles sold across the nation to be zero-emission by 2030,⁶ and the United States Environmental Protection Agency’s April 2023 proposal⁷ to clean up the passenger vehicle fleet support the needed transition away from combustion in the transportation sector.

States with Zero-Emission Vehicle Sales Requirements





Results: Cumulative Health Benefits by State (2020-2050) 100% Passenger Vehicle Sales and Non-Combustion Power by 2035, and State ZEV Policies in Place

State	Monetized Health Benefits	Premature Deaths Avoided	Asthma Attacks Avoided	Lost Work Days Avoided	Emission Standard (ACC I)	ZEV Standard (ACC I)	2035 100% ZEV Sales (ACC II)
Alabama	\$11.9 B	1,090	23,500	111,000			
Arizona	\$10.2 B	928	25,900	123,000			
Arkansas	\$8.0 B	736	17,100	76,300			
California	\$119.0 B	10,900	312,000	1,540,000	●	●	●
Colorado	\$7.5 B	673	24,200	117,000	●	●	
Connecticut	\$11.5 B	1,060	22,900	120,000	●	●	
Delaware	\$4.3 B	396	9,470	46,800	●		
District of Columbia	\$1.4 B	121	4,590	29,400			
Florida	\$69.9 B	6,370	116,000	624,000			
Georgia	\$22.4 B	2,030	59,200	290,000			
Idaho	\$1.2 B	108	3,120	12,800			
Illinois	\$49.2 B	4,490	113,000	549,000			
Indiana	\$31.4 B	2,880	70,200	316,000			
Iowa	\$9.3 B	854	20,900	92,400			
Kansas	\$5.6 B	513	14,600	62,400			
Kentucky	\$17.5 B	1,600	36,500	170,000			
Louisiana	\$14.5 B	1,320	33,200	149,000			
Maine	\$3.6 B	330	4,770	25,200	●	●	
Maryland	\$23.0 B	2,100	52,400	260,000	●	●	
Massachusetts	\$14.7 B	1,350	28,800	158,000	●	●	●
Michigan	\$43.9 B	4,040	82,900	397,000			
Minnesota	\$12.3 B	1,130	30,100	141,000	●	●	
Mississippi	\$7.2 B	656	15,500	67,900			
Missouri	\$15.7 B	1,440	34,000	159,000			
Montana	\$1.0 B	92	1,910	8,800			
Nebraska	\$4.4 B	408	12,100	51,100			
Nevada	\$5.4 B	488	10,700	57,200	●	●	
New Hampshire	\$3.2 B	292	4,760	26,700			
New Jersey	\$36.0 B	3,290	76,100	382,000	●	●	
New Mexico	\$2.1 B	194	5,210	22,700	●	●	
New York	\$55.2 B	5,050	127,000	657,000	●	●	●
North Carolina	\$29.4 B	2,680	64,800	317,000			
North Dakota	\$1.3 B	114	2,790	12,500			
Ohio	\$60.9 B	5,600	121,000	563,000			



State	Monetized Health Benefits	Premature Deaths Avoided	Asthma Attacks Avoided	Lost Work Days Avoided	Emission Standard (ACC I)	ZEV Standard (ACC I)	2035 100% ZEV Sales (ACC II)
Oklahoma	\$10.1 B	924	25,700	110,000			
Oregon	\$1.8 B	163	3,720	18,800	•	•	•
Pennsylvania	\$73.3 B	6,740	124,000	616,000	•		
Rhode Island	\$3.2 B	288	5,430	29,400	•	•	
South Carolina	\$13.6 B	1,250	25,600	123,000			
South Dakota	\$1.3 B	120	3,430	13,700			
Tennessee	\$20.4 B	1,800	43,600	206,000			
Texas	\$81.0 B	7,300	268,000	1,180,000			
Utah	\$3.2 B	285	14,700	52,600			
Vermont	\$1.7 B	156	2,430	13,300	•	•	•
Virginia	\$25.4 B	2,320	60,600	299,000	•	•	•
Washington	\$3.7 B	331	9,220	44,600	•	•	•
West Virginia	\$8.6 B	797	14,200	71,800			
Wisconsin	\$16.0 B	1,470	32,700	154,000			
Wyoming	\$0.7 B	63	1,800	7,750			

Note: Data for Alaska and Hawaii are not presented in this report because the US EPA COBRA Model provides health outputs only for the contiguous United States.

Ensuring Equitable Distribution of Zero-Emission Benefits

As noted above, significant disparities remain in terms of local air pollution burdens and access to the benefits of zero-emission transportation. More must be done to ensure all communities benefit from the transition to zero emission. Whether building out stronger incentive programs supporting lower-income residents’ pathways to new and used zero-emission vehicles, financing or car-sharing services or developing other innovative zero-emission mobility choices, equity must be built into local, state and federal policies. This is vital to ensuring all communities — and especially communities bearing the greatest health impact of transportation pollution today — benefit from the shift from combustion.

Inflation Reduction Act: New Tax Credit for Used Zero-Emission Vehicles

Section 25E of the federal Inflation Reduction Act of 2022 creates the first federal tax credit for used zero-emission vehicles. Income-qualified buyers are eligible for up to \$4,000 in tax credits for used zero-emission vehicles. For eligibility requirements: www.irs.gov/credits-deductions/used-clean-vehicle-credit



Policies to Protect Health:

- States should utilize their Clean Air Act authority to implement the Advanced Clean Cars II regulation to ensure increasing levels of cleaner combustion vehicles as the state transitions to 100 percent zero-emission sales by 2035.
 - U.S. EPA must approve the Advanced Clean Cars II Clean Air Act waiver in a timely manner to ensure implementation remains on schedule.
- U.S. EPA must finalize federal multi-pollutant vehicle emission standards that accelerate deployment of zero-emission vehicles, recognize state zero-emission sales standards and take full advantage of investments made possible through federal Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA) of 2022 funds to accelerate the transition to zero-emission transportation.
- Local, state and federal agencies and policy makers must continue to invest in infrastructure needed to support zero-emission power and transportation while also addressing barriers to infrastructure and zero-emission vehicle access.
 - These investments must go above and beyond new resources made possible through the federal IRA and IIJA legislation of 2022.

Conclusion:

Major improvements in public health would result from the transition to zero-emission technologies in the passenger transportation and electricity generation sectors. This transition represents a critical public health intervention to reduce harmful pollutants and prevent health emergencies. Strong state and federal actions to transition to 100 percent zero-emission passenger vehicle sales and non-combustion electricity sources by 2035 are needed to bring the health benefits of zero-emission technologies home to communities across the United States.

¹American Lung Association. State of the Air 2023. April 2023. www.lung.org/sota

²United States Environmental Protection Agency. Fact Sheet: Transportation Pollution and Environmental Justice. March 2022. <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144Y3.pdf>

³Health Effects Institute. Special Report 23. A Special Report of the HEI Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution June 2022. <https://www.healtheffects.org/publication/systematic-review-and-meta-analysis-selected-health-effects-long-term-exposure-traffic>

⁴Erika Garcia, Jill Johnston, Rob McConnell, Lawrence Palinkas, Sandrah P. Eckel, California's early transition to electric vehicles: Observed health and air quality co-benefits. *Science of The Total Environment*, Volume 867, 2023, 161761, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2023.161761>. (<https://www.sciencedirect.com/science/article/pii/S0048969723003765>)

⁵California Air Resources Board. States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act. May 2022. https://ww2.arb.ca.gov/sites/default/files/2022-05/C2%A7177_states_05132022_NADA_sales_r2_ac.pdf

⁶President Joseph R. Biden, Jr. August 2021. Executive Order on Strengthening American Leadership in Clean Cars and Trucks. <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/#:~:text=Policy,or%20fuel%20cell%20electric%20vehicles>

⁷United States Environmental Protection Agency. Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles. April 2023. <https://www.epa.gov/system/files/documents/2023-04/420f23009.pdf>