BEFORE THE COLORADO AIR QUALITY CONTROL COMMISSION
COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

PREHEARING STATEMENT OF ENVIRONMENTAL DEFENSE FUND, NATURAL RESOURCES DEFENSE COUNCIL, SIERRA CLUB, SOUTHWEST ENERGY EFFICIENCY PROJECT, AND WESTERN RESOURCE ADVOCATES (COLLECTIVLEY, "ENVIRONMENTAL COALITION")

IN THE MATTER OF CLEAN CAR RULEMAKING EFFORTS --
PROPOSED REVISIONS TO REGULATION NUMBER 20:
ZERO EMISSION VEHICLE PROGRAM

I. EXECUTIVE SUMMARY

General Position. Environmental Defense Fund (EDF), Natural Resources Defense Council (NRDC), Sierra Club, Southwest Energy Efficiency Project (SWEEP), and Western Resource Advocates (WRA) (collectively, "Environmental Coalition") support the proposal from the Air Pollution Control Division (APCD or the "Division") and encourage its adoption by the Air Quality Control Commission (AQCC or the "Commission").

Legal and Factual Issues to be Resolved by the Commission and Related Testimony and Exhibits. The Environmental Coalition, in this prehearing statement and accompanying reports, will offer evidence and argument that support the Division's proposed revisions to Regulation 20. The Environmental Coalition reserves the right to respond to information and arguments submitted by other parties.

Exhibits offered into the record include expert reports submitted by **John M. German** (regarding emissions benefits associated with the proposed regulation and conditions in Colorado relative to other states with zero emission vehicle programs) and **Peter Howard & Jason Schwartz** (regarding the monetized carbon benefits of the proposed regulation). Exhibits also include technical documents referenced in those reports and this prehearing statement. All exhibits are listed, and voluminous exhibits summarized, in a table starting on page 47.

Estimate of Time Necessary for Presentation. The Environmental Coalition requests 4 hours to present its direct testimony, conduct cross-examination, and provide rebuttal testimony. The Environmental Coalition respects that the Commission's time is valuable and has tried to request a reasonable amount of time, in light of the extensive information that it is presenting in this Prehearing Statement and supporting materials. However, the Environmental Coalition reserves the right to request additional time based on information presented by other parties.

In addition, the Environmental Coalition requests that the Commission strike a fair balance in allocating hearing time among the Division, parties that support the proposed revisions to Regulation 20 and those that oppose it.

Witnesses. The Environmental Coalition anticipates offering the following witnesses for the hearing. These witnesses may refer to their expert reports or attachments thereto, as applicable:

- Shannon Baker-Branstetter, Manager of Cars and Energy Policy at Consumer Reports, an expert in transportation and energy policy and consumer issues and trends regarding vehicles. Ms. Baker-Branstetter will discuss the exhibits that relate to electric vehicle sales and adoption and related issues. A CV for Ms. Baker-Branstetter is included as EC – PHS EX-LLLL.
- Max Baumhefner, a senior attorney at NRDC, an expert in electric vehicle policy and electricity sector impacts of electric vehicle adoption. Mr. Baumhefner will discuss the exhibits that relate to electric grid and rate benefits and impacts caused by ZEVs and related issues. A CV for Mr. Baumhefner is included as EC – PHS EX-MMMM.
- Gwen Farnsworth, a Senior Energy Policy Analyst at WRA, an expert in electric utility regulation and policy, including rate design, renewable energy and power supply in Colorado. Ms. Farnsworth will discuss the exhibits that relate to electricity supply and utilization in Colorado and related issues. A CV for Ms. Farnsworth is included as EC – PHS EX-NNNN.
- Chet France, an expert in development and promulgation of motor vehicle and fuel emission control programs. Mr. France will discuss the exhibits relating to environmental, cost, and vehicle sales impacts of a ZEV program and related issues. A CV for Mr. France is included as EC – PHS EX-OOOO.
- John M. German, an expert regarding clean car technologies and evaluating modelling of vehicle emissions and costs of clean car programs. Mr. German will discuss the matters contained in his expert report (EC – PHS EX-LL) and attachments thereto, and other exhibits that relate to vehicle technology and cost and related issues. A CV for Mr. German is included as EC – PHS EX-PPPP.
- Peter Howard, PhD, an expert on valuing the social cost of GHGs. Dr. Howard will discuss the contents of his expert report (EC – PHS EX-B) and documents cited therein and related issues. A CV for Dr. Howard is included as EC – PHS EX-QQQQ.
- Aaron Kressig, a Flexible Grid Analyst at WRA, is an expert in policy and regulation relating to distributed energy resources such as electric vehicles and distributed storage. Mr. Kressig will discuss the exhibits that relate to electric grid impacts associated with electric vehicle adoption and related issues. A CV for Mr. Kressig is included as EC – PHS EX-RRRR.
- Thomas A. Bloomfield, presenting facts and legal arguments in support of the proposed rule amendment. He may rely on any of the exhibits presented herein.
- Sarah M. Keane, presenting facts and legal arguments in support of the proposed rule amendment. She may rely on any of the exhibits presented herein.
- Any witness identified by any other party.
- Any other witnesses that may be needed for rebuttal or impeachment purposes.

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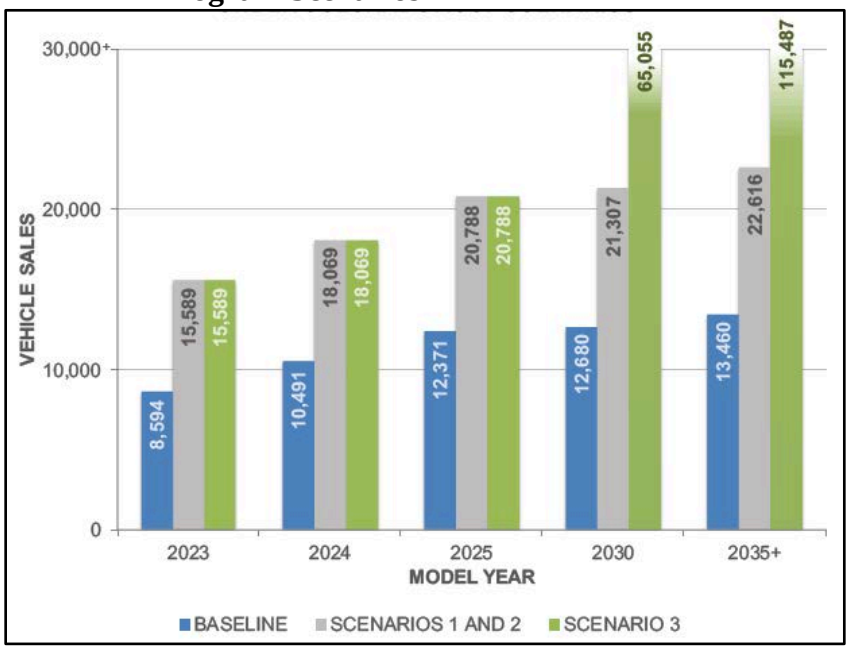
II. INTRODUCTION

Adoption of a zero-emission vehicle (ZEV) program in Colorado would increase electric vehicle sales in the state. According to a recent expert study, Colorado would realize an increase (over business as usual) of more than 8,000 ZEV sales by 2025 as a result of adopting a ZEV program.[1] The program will serve as a catalyst not only for deep reductions in highly-damaging climate pollution, but also significant reductions in criteria and hazardous air pollution. These reductions will also create large economic savings for hard working Coloradans across the state.[2] As ZEV sales continue to grow past 2025, Colorado could achieve more than 100,000 additional electric vehicle sales by 2035 compared to a baseline where the state does not adopt a ZEV program.[3]

Figure 1: Projected ZEV Sales in Colorado under Colorado Advanced Clean Car Program Scenarios



The Division has prepared an initial analysis that evaluates the anticipated reductions that would be achieved by the proposed amendment to Regulation 20. This initial estimate

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[1] EC – PHS EX-A, Richard Rykowski, *et al.* Colorado Zero Emission Vehicle Program Will Deliver Extensive Economic, Health, and Environmental Benefits, at 4 (hereinafter "Rykowski 2019 Report"). Mr. Rykowski is a leading national expert regarding evaluation of vehicle fuel and emission regulations in the United States. He worked for U.S. EPA for over 32 years, where he played a key role in the development of a number EPA's vehicle fuel and emissions regulations, including the first phase of the EPA light-duty GHG standards for MY 2012-2016 that was promulgated in 2010. He was a key architect of the EPA OMEGA model that was used in the two rulemakings that established the MY 2012-2025 GHG standards. Throughout his career, Mr. Rykowski received many prestigious awards including EPA's Engineer of the Year Award, as well as several Gold and Silver Medals for Meritorious Service. Additional details about Mr. Rykowski's expertise in contained in his report and attachments.

[2] *Id.*

[3] *Id.* For an additional analysis of projected ZEV sales in Colorado, see Section VII.A, *infra*.

conservatively projects that the ZEV program in Colorado will, through model year 2030, reduce damaging climate pollution by more than 2.2 million metric tons,[4] representing a social savings of $86 million to $260 million, net present value,[5] a meaningful contribution to the reduction in GHG pollution necessary to maintain the Colorado way of life we all cherish.

Over the longer term to 2050, the ZEV program will position Colorado for more significant, post-2025 growth in ZEVs. An amended Regulation 20, when considered as part of the overall advanced clean cars program (*i.e.* in combination with the Colorado Low Emissions Automobile Regulation adopted in 2018[6]), is anticipated to generate 152 million metric tons of carbon dioxide reductions, plus reductions in methane and nitrous oxide.[7] The program will serve as a key, foundational step in accelerating vehicle electrification throughout the state, consistent with the objectives outlined in Executive Order B 2019 0092, and moving the state towards the deep carbon reductions that will be required to meet the greenhouse gas reduction goals recently established by HB19-1261 (which includes an express reference to zero emitting technologies like ZEV vehicles), and as required by SB19-096 (which mandates that this Commission initiate rulemakings to achieve the state climate targets). In order to limit warming to two degrees Celsius and avoid the most catastrophic impacts of climate change, we must rapidly reduce greenhouse gas pollution from every sector of the Colorado economy. Rapid expansion of ZEVs is a key available technology pathway that will put Colorado on a trajectory to achieve the necessary deep reductions in carbon emissions from the transportation sector.

Adopting the ZEV program will also reduce criteria pollution emissions from Colorado's passenger vehicle fleet, improving air quality. By 2030, the amended Regulation 20 is anticipated to avoid in excess of 207 metric tons of nitrogen oxides (NOx), 256 metric tons of volatile organic compounds (VOC), 15 metric tons of fine particulate matter ($PM_{2.5}$) and 121 metric tons of sulfur oxides (SOx).[8] These substantial reductions in pollution will be especially important in the ozone nonattainment area, where significant reductions in criteria pollutant emissions will be required in coming years in order to protect public health and the environment and meet the minimum federal standards for air quality. These pollution reductions will also help to maintain clean air in portions of the state currently in compliance with federal standards. The criteria pollutant reductions attributable to a ZEV program will reduce the harmful public health effects exacerbated by ground-level ozone, or smog, including asthma, chronic heart disease, and other health conditions.[9]

A ZEV program will also save Colorado consumers money. As part of the full Advanced Clean Cars Program, which includes CLEAR, a ZEV program will result in $347 million of annual statewide savings in 2030 under a conservative analysis, and $730 million under an analysis

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[4] Initial Economic Impact Analysis, Revisions to AQCC Regulation Number 20: Zero Emission Vehicle Program (May 10, 2019) (hereinafter "Initial EIA").

[5] EC – PHS EX-B, Peter H. Howard and Jason A. Schwartz, Expert Report of Dr. Peter H. Howard, Ph.D. and Jason A. Schwartz, J.D., (July 9, 2019) (hereinafter "Howard & Schwartz Report") at Table 4.

[6] 5 C.C.R. 1001-24 (Colorado Low Emission Automobile Regulation).

[7] Howard & Schwartz Report, *supra*, note 5 at Table 3.

[8] Rykowski 2019, *supra* note 1, at 49, Table 16.

[9] *Id.* at 51, Table 18.

assuming a high cost of gasoline.[10] Consumers who purchase ZEVs already enjoy substantial savings in fuel and maintenance costs over the life of the vehicle. When combined with declining up-front costs, these operational savings will result in total cost-of-ownership parity between electric vehicles and conventional vehicles between 2022 and 2026,[11] without even accounting for substantial tax incentives that are anticipated to remain in effect.

If the Commission adopts the ZEV program, it will also improve consumer choice in the state, because adoption of the ZEV program strongly incentivizes manufactures to introduce a wide variety of ZEV vehicles alongside existing vehicle offerings at dealerships. The program also encourages manufacturers and dealers to ensure consumers have ready access to ZEV vehicles and invest in training programs designed to equip dealers with the best tools to educate consumers about the compelling benefits of ZEVs. States that have committed to ZEV programs generally see more variety in the models of ZEVs available for purchase in their states, together with increased availability at dealerships, while still maintaining a full range of choice of non-ZEV vehicles. This increased model availability will be especially important to help expand the ZEV offerings across all vehicle classes, including the light trucks and sport utility vehicles (SUVs) that many Coloradans enjoy.

The Commission not only has clear legal authority to adopt a ZEV program in Colorado, but a legislative mandate, and should exercise that authority to ensure that the broad suite of benefits such a program can offer are realized.

III. ADOPTING THE PROPOSED ZEV PROGRAM IS AN EFFECTIVE WAY TO REDUCE THE SIGNIFICANT GREENHOUSE GAS EMISSIONS FROM THE TRANSPORTATION SECTOR

Colorado state law now recognizes the grave threat to our state that climate change presents, and sets ambitious targets to address climate pollution.[12] Deep and significant reductions in GHG emissions from the transportation sector as a whole, and passenger vehicles in particular, are necessary to meet these statewide targets and to bring Colorado's GHG emissions in line with science-based recommendations. Adopting a ZEV program is a foundational step in achieving the necessary deep reductions, and would further Colorado's prominence as a leader on climate solutions.

A. Climate Change is a Major Threat That Must be Addressed

As the scientific consensus around the near-term threat that climate change poses to earth and humanity continues to grow, it has become increasingly clear that we must take immediate and significant steps to address the crisis. The 2018 Intergovernmental Panel on Climate Change (IPCC) special report on the impacts of global warming highlights these conclusions. Its Summary

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[10] *Id.* at 41, Table 12.

[11] *Id.* at Figure 1. This analysis in the Rykowski 2019 Report relies on data from Nic Lutsey and Michael Nicholas, Update on Electric Vehicle Costs in the United States through 2030 (The International Council of Clean Transportation, 2019), *infra* note 100.

[12] Colorado H.B. 19-1261.

for Policymakers[13] provides a number of sobering conclusions on the impact of already-released emissions and the need for extremely aggressive emission reductions to avoid the worst future impacts (emphasis in original):

- Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a *likely* range of 0.8°C to 1.2°C. Global warming is *likely* to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate (*high confidence*).[14]

- Climate models project robust differences in regional climate characteristics between present-day and global warming of 1.5°C, and between 1.5°C and 2°C. These differences include increases in: mean temperature in most land and ocean regions (*high confidence*), hot extremes in most inhabited regions (high confidence), heavy precipitation in several regions (*medium confidence*), and the probability of drought and precipitation deficits in some regions (*medium confidence*).[15]

- Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (*high confidence*).These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (*medium confidence*).[16]

The global trends caused by climate change are deeply concerning. According to the National Oceanic and Atmospheric Administration's State of the Climate: Global Climate Report for April 2019:[17]

- The first four months of the year were characterized by warmer-than-average conditions across much of the global land and ocean surfaces.[18] Above-average temperatures were present across much of the world's land and ocean surfaces.[19]

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[13] EC – PHS EX-C, Intergovernmental Panel on Climate Change (IPCC), Global Warming of 1.5 °C: Summary for Policy Makers (IPCC Switzerland, 2018), *available at* http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf.

[14] *Id.* at 6.

[15] *Id.* at 9.

[16] *Id.* at 14.

[17] EC – PHS EX-D, National Oceanic and Atmospheric Administration National Centers for Environmental Information, *State of the Climate: Global Climate Report for April 2019* (May 2019), *available at* https://www.ncdc.noaa.gov/sotc/global/201904.

[18] *Id.*

[19] *Id.*

- The global land and ocean surface temperature was the second highest for April since global records began in 1880.[20]

- The global land and ocean temperature for April tied with September 2015 as the 11th highest monthly temperature departure from average among all months (1,672 months) on record. The 10 highest monthly temperature departures from average have all occurred since 2015.[21]

These changes negatively impact human health and welfare around the world and here in Colorado. Rising temperatures due to global warming lead to more extreme heat events, worsening air pollution and the expanded range and timing of vector-borne illnesses.[22] Climate change can also exacerbate outdoor air pollution through increasing concentrations of ozone and fine particulate matter, which have harmful effects on respiratory and cardiovascular health.[23]

In 2018, the state of Colorado published an updated Colorado Climate Plan.[24] The plan was developed collectively by the Department of Natural Resources (DNR), the Colorado Department of Public Health and Environment (CDPHE), the Colorado Energy Office (CEO), the Colorado Department of Transportation (CDOT), the Colorado Department of Agriculture (CDA), the Office of Economic Development and International Trade (OEDIT), and the Department of Local Affairs (DOLA), with input from key stakeholders. It begins (internal citations omitted):

> Colorado has warmed substantially in the last 30 years and even more over the last 50 years. Future estimates project temperatures rising an additional 2.5ºF to 5ºF by 2050, meaning the warmest summers from our past may become the average summers in our future. With increasing temperatures come shifts in snowmelt runoff, water quality concerns, stressed ecosystems and transportation infrastructure, impacts to energy demand, and extreme weather events that can impact air quality and recreation.[25]

The most recent National Climate Assessment grimly reported that "as a harbinger, the unusually low western U.S. snowpack of 2015 may become the norm"[26]—an outcome with

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[20] *Id.*

[21] *Id.*

[22] *See* EC – PHS EX-E, ACEEE, Center for Biological Diversity, *et al.* Comment on Notice of Intent to Prepare an Environmental Impact Statement for Model Year 2022-2025 Corporate Average Fuel Economy Standards, 7-13, NHTSA-2017-0069-0152 (Sept. 25, 2017).

[23] EC – PHS EX-F, U.S. Global Change Research Program, *The Impacts of Climate Change on Human Health in the United States*: *A Scientific Assessment*, Ch. 3 Air Quality Impacts, Ch. 3.2, https://health2016.globalchange.gov/air-quality-impacts (hereinafter "Ch. 3 Air Quality Impacts").

[24] EC – PHS EX-G, Colorado Climate Plan: State Level Policies and Strategies to Mitigate and Adapt (2018), https://www.codot.gov/programs/environmental/Sustainability/colorado-climate-plan-2015.

[25] *Id.* at 1.

[26] EC – PHS EX-H, U.S. Global Change Research Program, *Climate Science Special Report*, Fourth National Climate Assessment, Volume 1, 236 (2017), https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf, (hereinafter U.S. CGRP).

devastating consequences to any economic sector dependent on snow or water.[27] This overall trend remains true and alarming, even in the occasional wet year such as 2019. Colorado will also experience damages from temperature increases and spikes, more frequent and more dangerous wildfires,[28] more extreme weather events like the 2013 Boulder floods,[29] and myriad other impacts. Considering the numerous and severe threats to Colorado, the state needs to continue adopting policies that will result in reduced GHG emissions.

B. Steep and Immediate Reductions in GHG Emissions from Light-Duty Vehicles Are Necessary to Avoid the Worst Effects of Climate Change and Comply with State Climate Law

The transportation sector accounts for a substantial portion of the GHG emissions that cause climate change. Indeed, more than one fifth of all GHG emissions in Colorado are attributable to passenger vehicles, which currently emit more than 19 million tons of CO_2 annually.[30] The transportation sector is the largest contributor to climate pollution in the United States, with passenger vehicles accounting for a majority of the sector's emissions.[31]

In 2019, Colorado's legislature recognized the magnitude of the climate crisis and took historic steps to help address it. Passed among a suite of other legislation to promote climate and clean objectives,[32] HB19-1261: Climate Action Plan to Reduce Pollution, sets ambitious GHG reduction targets for the state: 26% by 2025, 50% by 2030, and 90% by 2050, each as compared to 2005 levels.[33] SB19-096 mandates that this Commission, among other things, initiate a rulemaking to "implement measures that would cost-effectively allow the State to meet its Greenhouse Gas Emission Reduction Goals."[34] These economy-wide targets simply cannot be

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[27] *See* EC – PHS EX-I, Robert Steiger et al., *A Critical Review of Climate Change Risk for Ski Tourism*, Current Issues in Tourism, 1-37 (2017); *see also* EC – PHS EX-J, Cameron Wobus et al., *Projected Climate Change Impacts on Skiing and Snowmobiling: A Case Study of the United States*, 45 Global Environmental Change,1-14 (2017).

[28] EC – PHS EX-K, Zhihua Liu et al., *Climate Change and Wildfire Risk in an Expanding Wildland–Urban Interface: A Case Study from the Colorado Front Range Corridor*, 30 Landscape Ecology 10, 1943-1957 (2015).

[29] *See* U.S. CGRP, *supra* note 26, at 413.

[30] Rykowski 2019 Report, *supra* note 1, at 13; EC – PHS EX-L, U.S. Energy Information Administration, State Carbon Dioxide Emissions Data, Colorado, Data for 2016, released October 31, 2018, *available at* https://www.eia.gov/environment/emissions/state (accessed July 3, 2019).

[31] Rykowski 2019 Report, *supra* note 1at 13; EC – PHS EX-M, U.S. Energy Information Administration, *Annual Energy Outlook 2019* (January 24, 2019), at Tables A18 and A19, *available at* https://www.eia.gov/outlooks/aeo/tables_ref.php.

[32] *See*, *e.g.*, Colorado S.B. 19-077 (allowing investor-owned utilities to invest in EV charging infrastructure); Colorado H.B. 19-1198 (modifying the state's electric vehicle grant fund to facilitate the installation of EV infrastructure); Colorado H.B. 19-1159 (extending the state's tax credit for EV purchases); Colorado S.B. 19-236 (reauthorizing the state's Public Utilities Commission and codifying Xcel Energy's carbon reduction goals); and Colorado H.B. 19-1314 (creating a "Just Transition" office to help with the transition away from coal-fired power in the state).

[33] Colorado H.B. 19-1261.

[34] Colorado S.B. 19-096.

met without making steep GHG reductions from the transportation sector in Colorado, starting first and foremost with the passenger vehicle fleet.

Any attempt to meaningfully reduce GHG emissions to comply with HB19-1261 or otherwise align with GHG reduction targets recommended by the IPCC must necessarily address the light-duty vehicle sector.[35] Policies like ZEV programs that increase the penetration of electric vehicles into the light-duty vehicle fleet are essential strategies for achieving crucial GHG reductions needed both for compliance with state law and for broader climate stabilization.

C. The Climate Benefits from a ZEV program are Substantial, Putting Colorado on a Pathway to Deep Carbon Reductions from the Transportation Sector

The ZEV program, especially when combined with CLEAR, puts Colorado on a path towards a comprehensive transition to a low-emission, clean-energy economy. Increasing the share of ZEVs on the road creates climate benefits because full battery electric vehicles (BEVs) emit zero GHGs at the tailpipe, and plug-in hybrid electric vehicles (PHEVs) emit substantially lower GHGs at the tailpipe compared to conventional vehicles. Even accounting for upstream emissions by looking at how those cars are powered, the GHG benefits of a ZEV program are very substantial. The Division's Initial Economic Impact Analysis (EIA) conservatively estimates emissions reductions due to a ZEV program at nearly 2.2 million metric tons of avoided GHG emissions by 2030.[36] The Division's Initial EIA on its own provides a sufficient and compelling rationale for adoption of the ZEV program. Supplemental analysis, described in detail below, demonstrates that the benefits are likely to be even greater.

The ZEV program will position Colorado for more significant, post-2025 growth in ZEVs, and those benefits should be considered by the Commission in its deliberation on this rule. A combination of regulatory and economic drivers will likely lead to sustained growth in ZEV sales after 2025, though the degree to which Colorado can take advantage of this growth will likely depend on near-term investments in vehicle electrification and early action to introduce ZEVs into the fleet.[37] When that anticipated growth is considered as part of the overall clean cars program to the year 2050, Colorado stands to benefit from reductions of 152 million metric tons of carbon dioxide, 258,293 metric tons of methane, and about 5,581 metric tons of nitrous oxide.[38] Over the longer time period to 2050, these estimated reductions are considered to represent a more complete picture of the GHG benefits of the integrated clean cars program in Colorado, once the ZEV rule is adopted this year.

Given the recent history of electric resource planning and uptake of carbon-reduction commitments by utilities and government entities in Colorado, the Initial EIA's GHG estimates are based on highly conservative forecasts. Colorado utilities already source significant amounts of renewable electricity, complying with or exceeding minimum requirements set by the state's

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35 IPCC, *supra* note 13.

36 Colorado Department of Public Health and the Environment (CDPHE), Initial Economic Analysis for Revisions to AQCC Regulation Number 20; Zero Emission Vehicle Program, 16 (May 10, 2019) (hereinafter "Initial EIA").

37 Rykowski 2019 Report, *supra* note 1, at 20-21.

38 Howard & Schwartz Report, *supra* note 5, at Table 3.

Renewable Energy Standard (RES).[39] In 2018, Colorado's electricity was generated from coal (46%), natural gas (30%), and renewables (24%, including hydroelectric power and small solar).[40] However, that mix is rapidly moving towards even more reliance on zero-carbon sources, as demonstrated by three key trends:

- **Steep Declines in Prices for Renewable Energy:** Most Colorado utility acquisitions in recent years have been renewable generation such as solar or wind resources, with renewable generation more than doubling in the state since 2010.[41] Prices for wind, solar, and battery storage have decreased substantially over the past decade,[42] and are expected to continue to decline, making it highly probable that future incremental power demand will be met with zero-emission resources.[43]

- **Coal Plant Retirements:** Since 2010, Colorado utilities have retired or scheduled for retirement nine coal-burning units in the Front Range, eliminating all such generation in the Denver area as of 2018.[44] Xcel Energy's coal retirement plan approved by the Colorado Public Utilities Commission (PUC) in 2019 included replacement of approximately 50% of the energy previously generated by the retiring coal units with lower-emitting combined-cycle natural gas units, and the remainder with energy efficiency consumption reductions and renewable energy. Black Hills Energy has

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[39] The RES sets a minimum threshold for the percentage of electricity that a qualifying utility must source from eligible clean energy resources, which are mainly wind and solar energy sources. C.R.S. 40-2-124. As noted in the Initial EIA, all qualifying utilities in the state have historically been in compliance with the RES requirements and are well-positioned to comply with 2020 requirements (ranging from 20% for cooperative electric utilities to 30% for Xcel Energy and Black Hills Energy). *See* C.R.S. 40-2-124. Xcel has exceeded its annual minimum RES requirements for several years. EC – PHS EX-N, Colorado Public Utilities Commission Proceeding No. 16A-0139E, Robin Kittel Direct Testimony, Hearing Exhibit 101 at 11, and Attachment RLK-1 at 5; EC – PHS EX-O, Colorado Public Utilities Commission Proceeding No. 13A-0836E, Robin Kittel Direct Testimony, Hearing Exhibit 2 at 10, and Attachment RLK-1, at 4.

[40] EC – PHS EX-P, U.S. Energy Information Administration, *Electric Power Monthly, April 2019 release*, at Tables 1.4B-1.18B, https://www.eia.gov/electricity/monthly/.

[41] EC – PHS EX-Q, US Energy Information Administration, *Colorado State Energy Profile Overview*, (January 17, 2019), *available at* https://www.eia.gov/state/?sid=CO.

[42] *See* EC – PHS EX-R, Lazard, *Lazard's Levelized Cost of Energy and Levelized Cost of Storage 2018* (8 Nov. 2018), *available at* https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018/.

[43] Under the regulatory process at the Public Utilities Commission (PUC), utility generation resource acquisitions are determined based on the comparative cost of new resources at the time of acquisition. Low-cost renewable generation displaces higher cost generation relying on purchase and combustion of fossil fuels, meaning carbon-emitting power plants are utilized less, even before they are retired. 4 C.C.R. 723-3604 and 3613; EC – PHS EX-S, Colorado Public Utilities Commission Proceeding No. 16A-0369E, Decision No. C18-0761, at ¶ 4, *available at* https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Resource%20Plans/16A-0396E-Phase-II-Decision.pdf.

[44] These units include Xcel Energy's Arapahoe 3 and 4 units (153 MW combined), Valmont 5 (184 MW), Cherokee 2 and 3 (106 MW and 152 MW), and conversion of Cherokee 4 to operate minimally for scheduled maintenance on natural gas instead of coal (352 MW). *See* EC – PHS EX-T, Xcel Energy, Colorado Clean Air-Clean Jobs Plan, available at https://www.xcelenergy.com/environment/system_improvements/colorado_clean_air_clean_jobs. Xcel Energy has since scheduled its Comanche units 1 and 2 for retirement in 2022 and 2025, respectively, and Black Hills Energy shut down operations on two coal units beginning in 2013.

already retired all of its coal units, initially ceasing their operation under a cost-based "economic shutdown" by early 2013.[45] Tri-State also appears to be increasing reliance on renewable energy and decreasing its use of coal, with multiple acquisitions of renewable energy on a price-competitive basis and scheduled retirement of two coal-burning units by 2025.[46] These retirements are driven in large part by economics; recent utility and PUC analyses have concluded that coal-fired power plants are less economic to continue to operate when compared to renewable resources.[47]

- **Shifting Role of Gas-Fired Power:** The GHG emissions forecast in the Initial EIA assumes "natural gas-fueled power generation will remain significant and grow between present day and 2030."[48] However, recent gas generation acquisitions in Colorado are primarily to serve as a capacity resource, rather than an energy resource. In other words, instead of generating large amounts of electricity, gas plants often serve as a "back-up" or "firming" resource that operates intermittently and infrequently for system balancing.[49] Low-cost battery storage is also increasingly available to serve this system balancing function. Battery storage-plus-solar projects were lower cost than new gas generation in Xcel Energy's 2017 competitive solicitation.[50]

Looking ahead to 2030 and beyond, all trends indicate that there will be even a more extensive transition to zero-emission generation sources in Colorado to serve existing and new

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[45] EC – PHS EX-U, Colorado Public Utilities Commission, Proceeding No. 13A-0445E, Black Hills 2013 ERP Volume 1, Attachment FCS-1 (April 30, 2013), at 4. Black Hills also acquired a 60 MW wind power purchase agreement in 2016 that is "expected to provide energy at a lower price than would be generated using natural gas." EC – PHS EX-V, Colorado Public Utilities Commission Proceeding No. 16A-0436E, Decision No. C18-0462, at ¶ 29.

[46] EC – PHS EX-W, Tri-State Generation & Transmission, 2019 Electric Resource Plan, Stakeholder Meeting Presentation (presented March 27, 2019), *available at* https://www.tristategt.org/sites/tristate/files/PDF/resourceplan/ERPIRP-PublicMeetingPresentation-1-032819-v2.pdf. For a cost-based analysis of Tri-State coal-fired power plants compared to renewable alternatives, *see* EC – PHS EX-X, Mark Dyson & Alex Engel, A Low-Cost Energy Future for Western Cooperatives: Emerging Opportunities for Cooperative Electric Utilities to Pursue Clean Energy at a Cost Savings to Their Members, (Rocky Mountain Institute, 2018), *available at* http://rmi.org/wp-content/uploads/2018/08/RMI_Low_Cost_Energy_Future_for_Western_Cooperatives_2018.pdf; EC – PHS EX-Y, Tri-State, *Tri-State issues sixth renewable energy request for proposals*, (June 13, 2019), https://www.tristategt.org/tri-state-issues-sixth-renewable-energy-request-proposals (Tri-State has acquired 656 MW of utility-scale renewable generation under cost-competitive power purchase agreements since 2010 and in June 2019 announced its 6th renewable energy solicitation to acquire solar resources up to 200 MW).

[47] For example, in Xcel Energy's 2018 "Colorado Energy Plan," the utility obtained approval to retire two coal-fired generating units a decade ahead of schedule on a cost basis and will replace those units with a mix of wind (1,131 MW), solar (707 MW), battery storage (275 MW) and existing gas plants (383 MW). *See* EC – PHS EX-Z, Colorado Public Utilities Commission Proceeding No. 16A-0396E, Public Service 120 Day Report (filed June 6, 2018), at 8; *see also* Lazard, *supra* note 42 at ¶¶ 4, 68 and 103.

[48] Initial EIA at 16.

[49] For example, Xcel Energy acquired 383 MW of existing gas-fired resources as part of its 2016 Colorado Energy Plan. *Supra* note 47 at 14-15 (The two existing natural gas units are currently owned by independent power producers and have sold power and capacity to Xcel, and thus are not new plants on Xcel's Colorado system). These plants will be operated as peaking plants, so are unlikely to increase emissions. Xcel, *supra* note 47 at 8 and 21.

[50] *Id.* at 14, 50-52.

load. While cost drivers alone are likely to ensure new generation acquisitions are primarily zero-emissions renewable energy, there are other reasons to expect even lower GHG emissions than assumed in the Division's Initial EIA.

The Division's initial analysis of emissions reductions included Xcel's Colorado Energy Plan approved by the Public Utilities Commission in August 2018, which will drive down the utility's CO_2 emissions 60% by 2026 compared to 2005.[51] However, the Initial EIA did not consider recent legislation and public announcements of steeper clean energy commitments by Colorado utilities and communities:

- Xcel announced in December 2018 even further GHG reductions, committing to cut its emissions 80% below 2005 levels by 2030 and 100% by 2050.[52] A new state law in 2019 reinforces Xcel's commitment, by creating a legal requirement that Xcel submit a plan to reduce emissions by 80% for consideration and approval by the Public Utilities Commission.[53] To achieve this goal, Xcel will need to replace coal and gas-generated electricity with power from zero-carbon resources.

- Numerous local governments around the state have set objectives to secure all of their electricity from renewable or carbon-free sources by specified dates.[54]

- The Colorado Climate Action Plan was enacted in legislation in 2019 to achieve economy-wide GHG emissions by 50% by 2030 from a 2005 baseline.[55] If the 50% reduction of GHG emissions is allocated evenly across electricity generation in the state, the result would be a CO_2 emissions factor of 700 lbs/MWh compared with 1800 lbs/MWh in 2005.[56]

Electricity to serve incremental ZEV load growth through 2030 will likely be nearly entirely generated by renewable resources. As analyzed in a recent report by Richard Rykowski,

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[51] Initial EIA at 15.

[52] EC – PHS EX-AA, Xcel Energy, *Building a Carbon-Free Future,* https://www.xcelenergy.com/environment/carbon_reduction_plan.

[53] Colorado S.B.19-236.

[54] EC – PHS EX-BB, Sierra Club, *100% Commitments in Cities, Counties, & States,* https://www.sierraclub.org/ready-for-100/commitments,(City of Aspen has been powered by 100% renewable electricity since 2015. The Town of Nederland has set a goal of 100% renewable electricity by 2025. The Cities of Boulder, Fort Collins, Golden, Lafayette, Longmont, and the City and County of Denver have each committed to being powered by 100% renewables by 2030. Summit County, the City of Frisco, and the City of Pueblo have set goals of 100% renewable power by 2035); *See* EC – PHS EX-CC, *Polis Administration's: Roadmap to 100% Renewable Energy by 2040 and Bold Climate Action, available at* https://drive.google.com/file/d/0B7w3bkFgg92dMkpxY3VsNk5nVGZGOHJGRUV5VnJwQ1U4VWtF/view, (Governor Polis has put forward a road map for achieving 100% renewable energy in Colorado by 2040).

[55] Colorado H.B. 19-1261.

[56] These estimates are based on statewide net electric generation from the U.S. Energy Information Administration (https://www.eia.gov/opendata/register.php), statewide CO_2 emissions from U.S. Environmental Protection Agency, Air Markets Program Data (https://ampd.epa.gov/ampd/), and assuming a 1 percent annual growth in statewide electricity use from 2018.

et al. commissioned by EDF ("Rykowski 2019 Report"), even under a conservative assumption that new acquisitions across the state are just 75% renewable energy and 25% gas-burning resources, the implications for ZEV emissions are substantial, causing ZEV vehicles to generate very large net reductions in CO_2 emissions relative to conventional vehicles.[57] But given the trends outlined above, a 100% new renewable energy mix will likely more accurately reflect the growth of electricity supply in Colorado for electric vehicles. Adopting a ZEV program will allow Coloradans to leverage this increasingly green power system.

Finally, requiring passenger vehicle manufacturers to offer more ZEVs for sale in Colorado will jump-start statewide public and private investment in associated infrastructure and other services, as further described below. This, in turn, will spur further ZEV adoption. A ZEV program will also create new consumer options by ensuring a greater variety of ZEVs are offered for sale within the state. As dealers and manufacturers offer more ZEVs that meet the needs of Coloradans, ZEV adoption will continue to grow – further underscoring the conservative nature of the GHG benefits estimated by the Division.

D. Adoption of a Combined CLEAR and ZEV Program Will Generate Very Large Monetary Benefits in Avoided Climate Damage

State-of-the art analytical tools are available that allow economists to monetize climate damages by linking together global climate models with global economic models. The resulting monetary estimate represents money saved as a result of avoided climate damage and is called the social cost of greenhouse gases or social cost of carbon (SCC).[58] This monetary estimate shows how each additional unit of greenhouse gases will impact our health, economic activity, quality of life, and overall well-being.

The best available and most widely used estimates are those most recently developed by the Interagency Work Group (IWG), a collaboration of experts from twelve federal agencies. The IWG estimates are based on peer-reviewed models and inputs[59] and are the result of a rigorous, multi-agency analysis intended to quantify, to the extent possible, the impacts of climate change. This approach has been widely used, not only in Colorado (for example in the context of the recent Public Utilities Commission resource planning and in legislation signed by Governor Polis), but also by many other states and courts.[60]

The social cost of greenhouse gases provides important information for this Commission to consider in amending Regulation 20 to include ZEV programs, since it enables the Commission to evaluate the avoided climate damage that would accrue under Regulation 20, as amended. Monetizing the damage caused by climate pollution allows for greater consideration of health and

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[57] Rykowski 2019 Report, *supra* note 1, at 45.

[58] EC – PHS EX-DD, Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 Nature 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others), *available at* https://web.stanford.edu/~goulder/Papers/Published%20Papers/Revesz%20et%20al%20-%20Social%20Cost%20of%20Carbon%20(Nature%20508).pdf.

[59] Howard & Schwartz Report *supra* note 5, at 12.

[60] *Id.* at 12, 17.

climate benefits that are primarily discussed in a non-monetized context.[61] When emission reductions are monetized, the value of the reductions is more easily conceptualized. Consideration of these costs is essential when valuing the actual climate benefits associated with a combined CLEAR and ZEV program.

As explained in the expert testimony report of Peter Howard and Jason Schwartz, **the initial Division estimate of the carbon benefits of the rule amendment will have a present value today ranging from $86 million to $260 million.[62]** These figures do not even count all of the anticipated benefits of the amended rule, such as reduced upstream emission benefits, the related CLEAR rule and an accounting of the way that the amended Regulation 20 will serve as a catalyst for anticipated increased adoption of ZEVs in the state after 2025. Considering these factors, and calendar years 2025 to 2050, the amended Regulation 20 is anticipated reduce about 152 million metric tons of carbon dioxide, about 258,293 metric tons of methane, and about 5,581 metric tons of nitrous oxide. **Those reductions create the climate benefits ranging from $6 billion to $18.4 billion.**[63]

The IWG's methodology omits many important climate damage categories that cannot fully be monetized, so the estimates likely understate the benefits of the clean car program. It is important to inform policy decisions not only by using both the central estimate and the high-impact estimate, but also by qualitatively discussing additional significant but not-yet-monetized climate effects, such as:

- Catastrophic impacts and tipping points, including rapid sea level rise and damages at very high temperatures;
- Death, injuries, and illnesses from omitted natural disasters and interruptions in the supply of water, food, sanitation, and shelter;
- Agricultural impacts, including food price spikes and changes from heat and precipitation extremes;
- Ocean acidification and extreme weather effects on fisheries and coral reefs;
- Wildfires, including acreage burned, health impacts from smoke, property losses, and deaths;
- Biodiversity and habitat loss, and species extinction;
- Impacts on labor productivity from extreme heat and weather;
- Changes in land and ocean transportation;

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61 *Id.* at 3-4.

62 *Id.* at 24.

63 *Id.*, Table 5.

- National security impacts from regional conflict, including from refugee migration stemming from extreme weather and from food, water, and land scarcity;

- And many more categories.[64]

Consequently, while the IWG's estimates remain among the best available for government decisionmakers to use, they are widely acknowledged to be underestimates.[65] Though the IWG's high-impact estimate was developed as an imperfect proxy for some of these omissions, it is important to note that key impacts and resulting monetary damages are omitted such that the above referenced social cost benefits figure may be understated.[66]

IV. ADOPTING A ZEV PROGRAM WILL RESULT IN DEMONSTRABLE REDUCTIONS IN AIR POLLUTION

In addition to the extensive climate pollution reduction benefits described above, when combined with CLEAR, a state ZEV program will provide important near-and long-term reductions in health-harming ozone precursor emissions, particulates, and sulfur oxides. Importantly, the ZEV component of a combined Colorado clean car program will drive the technology necessary to achieve significant long-term criteria pollution reductions beyond 2025.[67] And because air pollution in Colorado is often especially concentrated near low-income residential neighborhoods, reducing local air pollution has important environmental justice benefits.

A. The ZEV program Will Help Protect Public Health by Reducing Ground Level Ozone

A Colorado ZEV program is an important policy tool in addressing ozone-precursor emissions from the state's transportation sector. The Rykowski 2019 Report shows that **under a combined Advanced Clean Car Program, Colorado would reduce annual ozone-forming oxides of nitrogen (NOx) by 207-248 metric tons and volatile organic compounds (VOCs) by 225-263 metric tons in 2030**.[68] By 2040, these reductions would increase to 373-458 metric tons per year of NOx and 406-486 metric tons per year of VOCs, with even greater reductions in 2050.[69] When accounting for the likely scenario that Colorado's ZEV market continues to grow

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64 *Id.* at 28; *see also* EC – PHS EX-EE, Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014), http://costofcarbon.org/reports/entry/omitted-damages-whats-missing-from-the-social-cost-of-carbon.

65 Howard & Schwartz Report, *supra* note 5, at 28; *see also* Revesz et al., *supra* note 58.

66 Howard & Schwartz Report, *supra* note 5, at 28.

67 Rykowski 2019 Report, *supra* note 1, at 20 ("the CLEAR standards provide the bulk of the near-term GHG and criteria emissions benefits through 2025, with the ZEV program laying the foundation for larger long-term benefits post 2025").

68 *Id.* at 49, Table 16. As described above, looking at only ZEV credits required for the rule, the actual emissions impact of Colorado's adoption of a combined clean cars program will likely fall somewhere between the emissions projections provided under scenarios 1 and 2 in the Rykowski 2019 Report analysis. See also note 70, which describes scenario 3, that presents a more complete picture of likely benefits of the rule, since it considers the anticipated continued growth of ZEVs that is likely to occur following Colorado becoming a ZEV state.

69 *Id.*

post-2025,[70] the state would see even greater reductions in ozone-forming emissions. Under this scenario, **by 2040 Colorado would reduce its annual NOx emissions by 757 metric tons per year and VOCs by 1,163 tons per year.**[71] **By 2050, these annual reductions would increase to 1,139 metric tons per year of NOx and 1,735 metric tons per year of VOCs.**[72]

As this Commission is aware, Colorado has failed to meet both the 2008 and 2015 health-based National Ambient Air Quality Standards (NAAQS) for ground-level ozone and is facing a bump up from moderate to serious nonattainment designation for the Denver Metro North Front Range.[73] The American Lung Association (ALA) recently ranked two cities in Colorado's ozone nonattainment area among the most ozone-polluted in the United States. When comparing the number of high ozone days in 228 metropolitan regions, ALA ranked Denver the 12th dirtiest and Fort Collins the 24th most-polluted for ozone.[74] The significant reductions of ozone-forming NOx and VOCs provided under a Colorado clean car program that includes both CLEAR and a ZEV program would move the state closer to attainment of both the 2008 and 2015 NAAQS for ground-level ozone.

A well-established and extensive body of scientific research shows that ozone exposure can cause a range of adverse respiratory and cardiovascular impacts, including decreases in lung function and premature death.[75] Ozone pollution also disproportionately impacts vulnerable populations such as those with respiratory conditions and cardiovascular disease. The ALA's 2019 State of the Air Report identified children under the age of 18, adults over the age of 65, people living in poverty, children living with asthma, and adults living with asthma, chronic obstructive pulmonary disease (COPD), and cardiovascular disease among those groups most at-risk of experiencing the negative health impacts associated with ozone pollution.[76] This analysis shows that roughly 53 percent of people living in Denver and 46 percent of people living in Fort Collins are at-risk of experiencing the negative health impacts associated with the region's ozone pollution.[77] Among those most at risk are the 69,227 children and 278,690 adults in Denver and

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[70] *See id.* at 20 (Scenario 3, The ZEV growth scenario "evaluates the benefits a ZEV program can have in positioning Colorado for more significant, post-2025 growth of ZEVs in the state...[and] illustrates the potential long-term benefits by assuming that adoption of the ZEV program through 2025 will help position Colorado to experience overall ZEV market share growth by an absolute 3 percent per year for the ten years from MY 2026 through MY 2035, remaining constant after 2035").

[71] *Id.* at 49, Table 16.

[72] *Id.*

[73] EC – PHS EX-FF, Tamara Chuang & John Frank, *Front Range air quality is terrible, but Colorado's efforts are showing some improvement in ozone pollution*, The Colorado Sun (June 3, 2019, 5:00 AM), https://coloradosun.com/2019/06/03/colorado-air-pollution-terrible-but-improving/.

[74] EC – PHS EX-GG, American Lung Association, *State of the Air 2019, Most Polluted Cities*, https://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/most-polluted-cities.html.

[75] EC – PHS EX-HH, U.S. EPA, Integrated Science Assessment for Ozone and Related Photochemical Oxidants (National Center for Environmental Assessment-RTP Division, 2013), *available at* https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=247492.

[76] EC – PHS EX-II, American Lung Association, State of the Air 2019 20th Anniversary at 21, https://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2019-full.pdf.

[77] *Id.*

Fort Collins that suffer from asthma.[78] It is the health of these Coloradans that suffers most on high ozone days.

B. The ZEV program Will Reduce Particulate and Other Harmful Emissions

A combined Advanced Clean Car Program will also result in important reductions in health-harming PM2.5 and other hazardous air pollution. The Rykowski 2019 Report projects that under a combined clean car program, Colorado would reduce its annual fine particulate ($PM_{2.5}$) emissions by 15-18 metric tons per year in 2030, 27-33 metric tons per year in 2040, and 33-40 metric tons per year in 2050.[79] **This program would achieve even greater long-term reductions in particulate pollution under a scenario in which the ZEV market continues to grow, resulting in annual $PM_{2.5}$ emission reductions of 77 metric tons per year in 2040 and 105 metric tons per year in 2050.**[80]

This analysis also projects important reductions in sulfur oxides (SO_x), known to cause respiratory effects and to form health-harming particulate matter.[81] Under a combined clean car program, Colorado's annual SO_x emissions would decline by 121-146 metric tons per year in 2030, 204-258 metric tons per year in 2040, and 242-308 metric tons per year in 2050.[82] **Under a scenario that provides for continued ZEV market growth post-2025, Colorado would reduce its annual SOx emissions by 427 tons per year in 2040 and 563 tons per year in 2050.**[83]

Even short-term exposure to $PM_{2.5}$ pollution is associated with severe adverse health impacts, including cardiovascular effects and exacerbation of respiratory conditions such as asthma and COPD.[84] Long-term exposure to $PM_{2.5}$ is also known to cause decrements in lung function, development of asthma, and cardiovascular mortality.[85] Implementing a combined clean cars program would reduce the incidence of these negative health outcomes in Colorado.

The Rykowski 2019 Report used EPA's Co-Benefits Risk Assessment (COBRA) model to project Colorado-specific human health impacts associated with the reductions in criteria pollution under a combined clean cars program.[86] This model shows that under all scenarios, a Colorado combined clean car program would provide health benefits in the near-term, saving at least $2-6

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78 *Id.*

79 Rykowski 2019 Report, *supra* note 1, at 49, Table 17.

80 *Id.*

81 EC – PHS EX-JJ, U.S. EPA, *Sulfur Dioxide Basics*, https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects.

82 Rykowski 2019 Report, *supra* note 1, at 49, Table 17.

83 *Id.*

84 EC – PHS EX-KK, U.S. EPA, *Integrated Science Assessment (ISA) for Particulate Matter*, 2-9 - 2-10 (National Center for Environmental Assessment-RTP Division, 2009), *available at* https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=216546.

85 *Id.*

86 Rykowski 2019 Report, *supra* note 1, at 50.

million annually in 2025 and $7-18 million every year in 2030.[87] In the long-term, these annual benefits increase to $12-32 million in 2040 and $14-39 million in 2050.[88] **When accounting for continued growth in the Colorado ZEV market, a Colorado combined clean car program would save at least $45-102 million in public health benefits annually in 2050, prevent up to 10 premature deaths, and reduce annual incidence of asthma exacerbations by over 156 events, work loss days by over 670, and minor restricted activity days by 3,953.**[89]

These projections only account for positive health outcomes related to reductions in ambient PM2.5 and do not reflect health improvements related to reductions in greenhouse gas or ozone pollution.[90] Thus, these significant health and monetary benefits likely underestimate the overall health benefits of the program.

C. The ZEV Program Will Reduce Tailpipe Emissions in the Fleet

With the adoption of Regulation 20 last year, automakers will be required to meet declining levels of GHG emissions across their fleets in Colorado. In addition, existing Tier 3/LEV III emissions standards will require Colorado's new passenger vehicle fleet to have steadily decreasing criteria emissions over time as well. In theory, manufacturers could simultaneously increase the penetration of electric vehicles, which have no criteria or GHG emissions at the tailpipe, while introducing "dirtier" conventional cars and still meet their required fleetwide averages for both GHG and criteria pollution.

However, as explained in more detail by John German in his expert report,[91] there are five key reasons why automobile manufacturers will not take advantage of averaging to create a higher-emitting conventional fleet to sell in Colorado or other ZEV states.

1. Individual car models must be certified to a limited number of "emissions bins" for non-methane hydrocarbons and oxygenated hydrocarbons (NMOG) and NOx, which will limit automakers abilities to exploit criteria pollutant averaging across their fleets.[92]

2. The absolute increase in ZEV sales due to the adoption of a ZEV program in Colorado is not projected to be large enough to affect automakers plans for criteria emissions compliance.[93]

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87 *Id.*, at 51-52, Table 18 (bracketed scenarios 1 and 2 to provide this range).

88 *Id.*

89 *Id.*, at 51, Table 19.

90 *Id.*, at 50 ("The health impacts reflected in COBRA are solely due to changes in estimated ambient PM2.5 levels, as opposed to ozone").

91 EC – PHS EX-LL, John M. German, Expert Testimony of John M. German, JG Automotive Consulting LLC on Behalf of Environmental Coalition (July 9, 2019) (hereinafter "German Testimony").

92 *Id.* at 3.

93 *Id.* at 4.

3. There are a number of emission standards, such as the PM and evaporative emissions standards, that do not allow, and thus will prevent automakers from, backsliding on criteria emissions for conventional vehicles.[94]

4. Criteria emissions control technologies and strategies are not easily removed as they are integrated with overall vehicle design and control algorithms.[95]

5. Manufacturers are unlikely to take advantage of any potential savings in technology due to criteria emissions averaging with the Colorado fleet because these would be at least partially, if not fully, offset by increased engineering time and vehicle testing requirements for certifying the Colorado fleet to a second set of standards.[96]

Accordingly, the Division's assumption that a ZEV program will result in substantial criteria pollution reductions is correct.

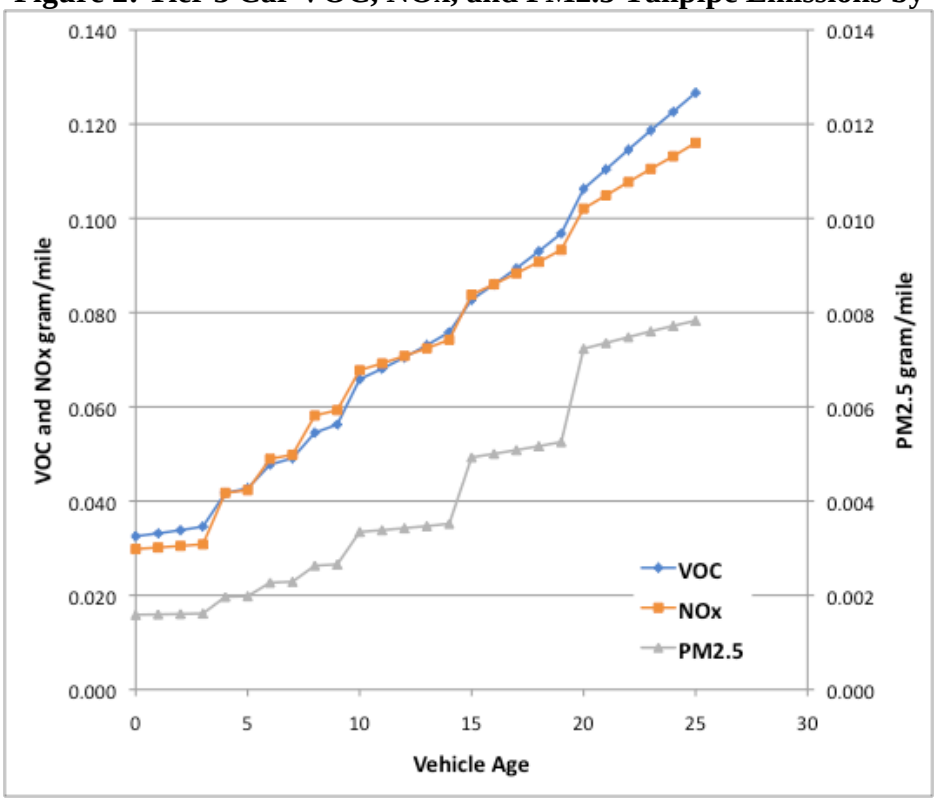
D. The ZEV Program Will Reduce Criteria Pollution By Reducing the Number of "Super Emitters" in the Fleet

Replacing some new conventional vehicles with electric vehicles also results in substantial pollution benefits because it eliminates the risks of emission control system deterioration, unrepaired malfunctions, or tampering by vehicle owners.

As analyzed by John German in his expert report, the effects of deterioration, malfunctions, and tampering are estimated to double in-use conventional vehicle emissions within 10 years, triple emissions within 15 years, and quadruple emissions within 25 years.[97] The effect of these "super-emitters" is illustrated in Figure 2 for Tier 3 vehicles built in 2025, after the Tier 3/LEVIII criteria pollution standards fully phase in (which is included as Figure 1 in the German Testimony).

[94] *Id.* at 5.
[95] *Id.*
[96] *Id.* at 6.
[97] *Id.* at 8

Figure 2: Tier 3 Car VOC, NOx, and PM2.5 Tailpipe Emissions by Vehicle Age



Yet, this analysis may substantially *underestimate* the true extent of the problem, based on additional information from EPA, as summarized in the German Testimony.[98] On the other hand, electric vehicles always have zero tailpipe emissions, regardless of any deterioration, tampering, or system malfunctions.

V. ELECTRIC VEHICLES PROVIDE SUBSTANTIAL SAVINGS, MAKING A ZEV PROGRAM HIGHLY COST EFFECTIVE

Adopting a Colorado ZEV program will be enormously cost effective, bringing considerable savings to drivers who purchase ZEVs. The Division's Initial EIA concludes that the net impact of the rule (incremental vehicle cost, minus discounted lifetime fuel and maintenance savings) will be a savings of $176 million for model years 2023-2025, and $735 million for model years 2026-2030.[99] Once again the Division's analysis provides a sufficient basis for adoption, with our supplemental analysis providing additional support.

[98] *Id.* at 8-10.

[99] Initial EIA at 13, Table 9.

A. Parity for Total Cost-of-Ownership of Electric Vehicles is Rapidly Approaching, Leading to Considerable Statewide Savings from Implementing a ZEV Program

The cost of electric vehicles is rapidly declining, driven in large part by declining costs in battery production, and is approaching up-front cost parity with their conventional counterparts, even without considering tax credits and other purchase incentives for EVs. For example, the International Council on Clean Transportation (ICCT) concludes that **the first owner of a 200-mile EV who operates it for 5 years (the typical length of a car loan) will reach cost-of-ownership parity in the 2022-2026 timeframe and realize fuel savings of $3,500 for cars, $3,900 for crossovers, and $4,200 for SUVs**.[100] ICCT also notes that nearly every previous study on EV costs has underpredicted battery cost reductions over time. So cost parity could come a year earlier based on ICCT's lower-cost sensitivity case.[101]

Another expert report, the Rykowski 2019 Report, projects the aggregate statewide impacts of a ZEV program in Colorado. This "calendar analysis" forecasts the statewide economic impacts that will occur in specific calendar years in the future, *i.e.*, it accounts for the expenditures and savings in the actual years in which they are realized. Table 1, below, (which is included as Table 12 in the Rykowski 2019 Report) summarizes the statewide economic impacts under conservative assumptions of the impact of the combined Advanced Clean Car Program.

Table 1: Projected Annual Statewide Economic Impacts under Colorado Advanced Clean Cars Program ($ millions)

Calendar Year	Vehicle	Fuel	Maintenance & Insurance	Total (Primary)	Total (High Fuel Price)
2025	$181	$(253)	$14	$(58)	$(211)
2030	$203	$(680)	$25	$(452)	$(835)
2040	$202	$(1,219)	$42	$(976)	$(1,632)
2050	$227	$(1,481)	$50	$(1,204)	$(2,025)

There are two major conclusions from Table 1. First, the net economic impact of the ZEV program and CLEAR, even under conservative assumptions, is positive and grows significantly over time. Second, the dominant statewide economic impact is fuel savings. Under the primary analysis, fuel savings approximately offsets higher upfront vehicle costs in 2025. By 2030, fuel savings are 3 times greater than incremental vehicle costs, and by 2050 fuel savings are 5 to 20

[100] EC – PHS EX-MM, Nic Lutsey and Michael Nicholas, Update on Electric Vehicle Costs in the United States through 2030 (The International Council of Clean Transportation, 2019) at 9, *available at* https://theicct.org/sites/default/files/publications/EV_cost_2020_2030_20190401.pdf.

[101] *Id*.

times the incremental vehicle costs. The ratio of fuel savings to vehicle costs are even greater with higher fuel prices.[102]

Most new vehicle purchases today are made with loans (in this respect, leases are also more similar to a loan purchase than a cash purchase). The Rykowski 2019 Report calculates the payback periods of 2-4 years for ZEVs. This period is well below the average length of automobile loans today. The typical consumer who buys with a loan would immediately benefit from day one with an improved overall cash flow.[103]

B. Fuel Cost Savings for Electric Vehicles are Substantial

Fuel costs are a critical factor in the relative cost of electric and conventional vehicle technologies. The fuel cost savings associated with electric vehicle technologies and their effect on the total cost of vehicle ownership make electric vehicles an attractive proposition for prospective owners even before initial cost parity. Indeed, fuel cost savings are the single biggest motivator of light-duty EV purchase decisions, as revealed by a survey of nearly 20,000 EV drivers.[104]

Electric vehicles' fuel cost savings result from the significantly greater efficiency of electric powertrains compared to gasoline powertrains and the fact that electricity fuel costs are lower and considerably more stable than those of gasoline motor fuels, which rise and fall with the global oil market. Given these fuel cost and fuel consumption factors, electric vehicles typically provide significant monetary fuel savings to their owners relative to conventional gasoline vehicles.

The fuel savings projected for the Colorado Energy Office by ICCT are consistent with the results of a recent analysis by other experts.[105] The expert analysis in the Rykowski 2019 Report found significant, positive fuel savings for MY 2025 plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs), ranging from $5,417 to $6,901, respectively.[106] Under the same lifetime costs and savings analysis, the report found fuel savings ranging from $6,132 to $7,557 for MY 2030 PHEVs and BEVs.[107] Under a "high fuel cost" case that models higher costs for conventional motor fuels, these savings increase significantly: the report finds that PHEVs and

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[102] The economic benefits of a ZEV program are even greater when the monetized benefits of emission reductions are taken into account. The Rykowski 2019 Report provides an analysis of the net economic and pollution benefits of a ZEV program. Rykowski 2019 Report, *supra* note 1, at 51–52 & Table 19.

[103] Rykowski 2019 Report, *supra* note 1, at 38.

[104] EC – PHS EX-NN, California Clean Vehicle Rebate Project, *EV Consumer Survey Dashboard*, Center for Sustainable Energy, https://cleanvehiclerebate.org/eng/survey-dashboard/ev.

[105] EC – PHS EX-OO, Nic Lutsey & Michael Nicholas, Electric Vehicle Costs and Consumer Benefits in Colorado in the 2020-2030 Time Frame (The International Council on Clean Transportation, 2018) (hereinafter "Colorado ICCT Report").

[106] Rykowski 2019 Report, *supra* note 1, at 32-33, Table 8.

[107] *Id.*

BEVs may enjoy the lifetime fuel savings that are $5,000-$7,000 higher relative to the primary analysis across the various technology types and model years.[108]

The fuel savings calculated in the Rykowski 2019 Report are also consistent with the Division's Initial EIA, which also found significant fuel cost savings associated with the ZEV program using the same or similar fuel cost assumptions.[109]

C. Electric Vehicles Also Enjoy Maintenance Cost Savings

As with fuel, the maintenance costs of EVs are lower than conventional vehicles. BEVs do not require routine gasoline-related maintenance (e.g., oil changes, air filters, engine coolant, spark plugs), but instead battery pack-related maintenance. PHEVs need both gasoline and battery pack maintenance. As shown in Table 2 below, the Rykowski 2019 Report estimates that the net maintenance savings relative to a gasoline vehicle are $672 for BEVs and $62 for PHEV50s, over the life of the vehicles.

Table 2: Projected Differential Maintenance Costs for Gasoline Vehicles and ZEVs[110]

ITEM	FREQUENCY (MILES)	COST		
		GASOLINE	BEV	PHEV
OIL CHANGE/FILTER	7,500	$42	--	$21
AIR FILTER	30,000	$31	--	$16
ENGINE COOLANT	100,000	$64	--	$32
SPARK PLUGS	105,000	$94	--	$47
BATTERY CHECK	15,000	--	$42	$42
BATTERY COOLANT	105,000	--	$127	$127
LIFETIME COST (3% DISCOUNT RATE)	**--**	**$1,218**	**$546**	**$1,156**

D. Up-Front Electric Vehicle Costs Are Rapidly Declining, Driven Primarily by Battery Cost Reductions

The prices of electric vehicles have been steadily decreasing in recent years, a trend which will result in up-front cost parity with their conventional counterparts in coming years. According to manufacturers, by 2021 there will be at least five EV models available for under $30,000 (MSRP) with a range of up to 250 miles – and that does not include current federal, state, and local incentives, which would bring the price down even further for some models in some places.[111]

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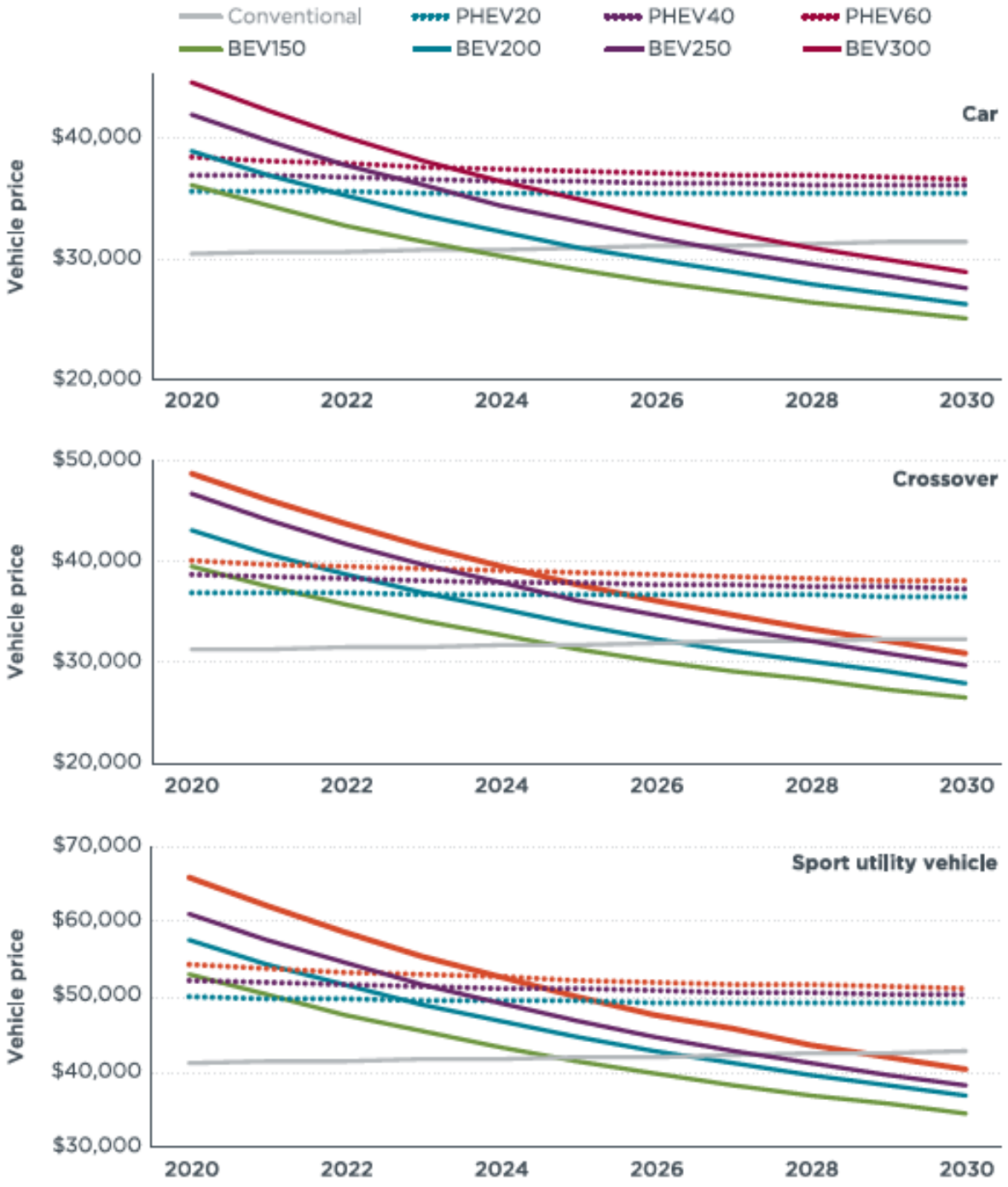
108 *Id.*

109 Initial EIA at 10.

110 This table is included as Table 7 in the Rykowski 2019 Report.

111 EC – PHS EX-PP, Dana Lowell & Alissa Huntington, *Electrical Vehicle Market Status: Manufacturer Commitments to Future Electric Mobility in the U.S. and Worldwide*, MJ Bradley and Associates, (May 2019) at 3, *available at* https://www.mjbradley.com/sites/default/files/ElectricVehicleMarketStatus05072019.pdf.

Figure 3: Initial Purchase Price of Conventional and Electric Cars, Crossovers, and SUVs for 2020-2030[112]

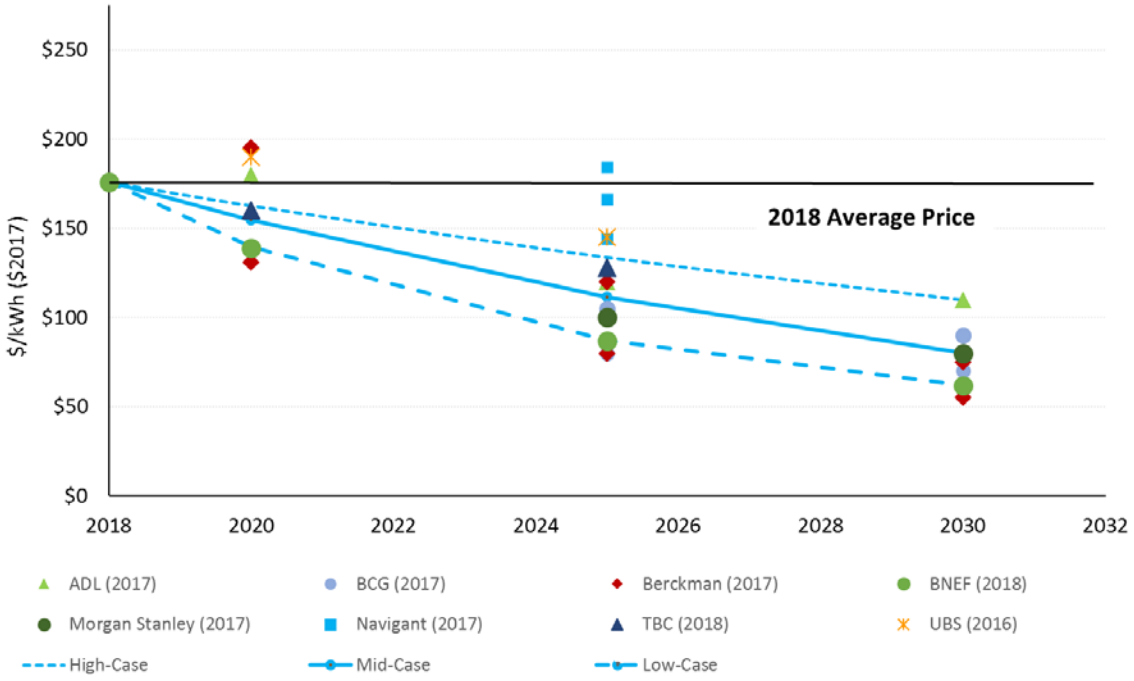


[112] Lutsey & Nicholas, *supra* note 100, at 7, Figure 4.

The steadily decreasing cost trends for purchasing electric vehicles is driven largely by cost declines in batteries, which have fallen by a factor of five in the last eight years.[113] Dramatic price declines will continue for many years.[114] A new analysis from ICCT projects that battery prices will fall enough to create purchase cost parity between plug-in electric vehicles and conventional vehicles between 2024-2028, depending on the range of the EV.[115] This applies to cars, crossovers and SUVs.

Likewise, a review of several recent studies by Kaffel and Mui (2019) shows that the battery cost forecasts utilized by the Division in its Initial EIA are reasonable, but conservative.[116] Battery cost reduction trends were assessed in this review using a linear interpolation approach based on estimates from eight recent studies identified, as shown in Figure 4.[117]

Figure 4: Lithium-Ion Battery Price Forecasts Through 2030 From Battery Price Literature Review



113 *Id.*

114 Bloomberg New Energy Finance, 2017 Lithium-Ion Battery Price Survey (2017) at 3 (hereinafter "BNEF 2017") (The declines are due to continued advances in battery technology (such as greater energy density), increased reliance on economies of scale, greater reliance on manufacturing automation and design optimization of the cells, battery pack and their ancillary systems, primarily simplifications to the battery management system). The BNEF price surveys are available on a subscription basis only and cannot be provided as part of an exhibit in the public record, as further explained in EC – PHS EX-QQ, Declaration of Simon Mui (July 9, 2019).

115 Lutsey & Nicholas, *supra* note 100, at 10; *see also* Colorado ICCT Report, *supra* note 105, at 15.

116 EC – PHS EX-RR, Max P. Kaffel & Dr. Simon Mui, *Cost-Competitiveness of Electric Vehicles: The Effects of Battery Cost Declines* (Natural Resources Defense Council, 2019).

117 *Id.* at 12.

With the global average price in 2018 as a starting point, a High, Mid, and Low Price scenario was developed based on annual improvement rates of 3.8%, 6.4%, and 6.6-11% respectively.[118] The Low Price case was matched to represent the Bloomberg New Energy Finance (BNEF) (2018) forecasts.[119] A summary of the values is displayed in Table 3.

Table 3: Price Forecasts for Lithium-Ion Battery Packs ($/kWh)[120]

Source	2020	2025	2030
ADL (2017)	180	120	110
BCG (2017)		80 105	70 90
Berckman (2017)	131 195	80 120	55 75
BNEF (2018)	139	87	62
Morgan Stanley (2017)		100	80
Navigant (2017)		144 166 184	
TBC (2018)	160	128	
UBS (2016)	190	145	
High-Case	163	134	110
Mid-Case	154	111	80
Low-Case (BNEF)	139	87	62

The Division's assumptions underlying its Initial EIA fall in the mid-range of the most recent lithium-ion battery pack price projections and should be considered conservative given real-world cost reductions have outpaced nearly all report estimates thus far.[121] Utilization of the low-price scenario (the estimate from BNEF) would lead to even more favorable upfront and total cost of ownership figures for BEVs than utilized by the Division.[122]

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118 *Id.*

119 Bloomberg New Energy Finance, 2018 Lithium-Ion Battery Price Survey (2018) (hereinafter "BNEF 2018"). The BNEF forecasts are available on a subscription basis only and cannot be provided as part of an exhibit in the public record, as further explained in EC – PHS EX-QQ, Declaration of Simon Mui (July 9, 2019).

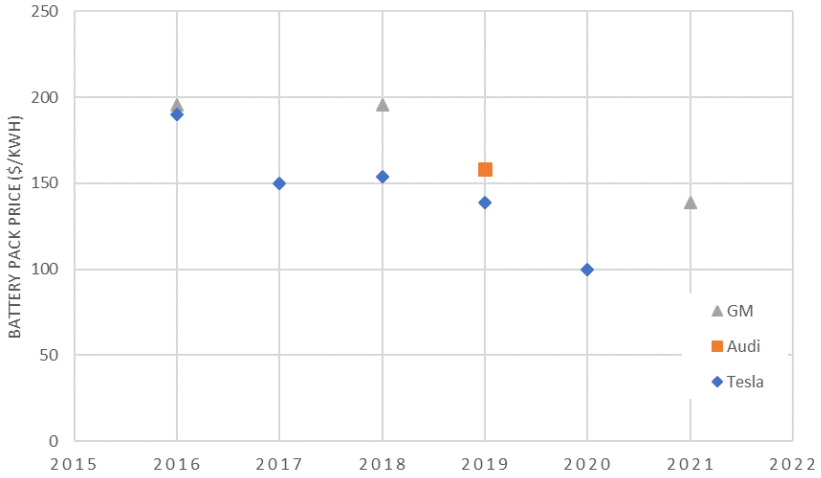
120 Mui and Kaffel , *supra* note116, at 14, Table 1.

121 The Division's analysis relies on the assumption that ZEV program compliance will be met primarily (approximately 75%) through the sale of BEVs. BEVs will have a cost advantage over PHEVs for the time period under consideration (Lutsey & Nicholas, *supra* note 101, at 8) and manufacturer announcements of future models also lean more heavily towards BEVs (EC – PHS EX-SS , *Projection of ZEV Sales in Colorado With and Without Adoption of a ZEV Regulation*, prepared for the Natural Resources Defense Council (Shulock Consulting, May 2019) *available at* https://docs.wixstatic.com/ugd/6fe7f1_eeca19bd30f74933814fbec8f6f8d8ab.pdf). Although the Division's assumption is appropriate, it is also conservative in that a heavier reliance on longer-range BEVs will results in a lower number of vehicles needed to comply, because BEVs earn more ZEV credit per vehicle than PHEVs.

122 BNEF 2017, *supra* note 114. The BNEF methodology may be the most robust out of currently available forecasts. That is largely because BNEF conducts annual price surveys of battery suppliers and purchasers (including auto manufacturers) to develop a volume-weighted average together with high and low ranges. BNEF has also utilized top-down estimates for their forecasts reinforced by bottom-up modeling of battery facilities to confirm their estimates are reasonable. As noted above, the Bloomberg forecasts publishing BNEF's methodology are available on a

A number of automakers and battery producers have reported their cell or pack costs based on reports in shareholder meetings or in the press.[123] Overall, the automaker costs and future expectations align with trends in lithium-ion battery cost reductions, as illustrated in Figure 5.

Figure 5: Battery Pack Prices Based On Automaker Statements



These multiple lines of evidence reinforce that the Division's estimate of cost savings in its Initial EIA is well supported, but understated.

VI. THE PROPOSED ZEV PROGRAM WILL BRING ADDITIONAL BENEFITS TO CONSUMERS AROUND COLORADO

A ZEV program will bring a wide array of additional benefits to individuals across the state, including those who never purchase or drive an electric vehicle.

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subscription basis only and cannot be provided as part of an exhibit in the public record. *See* EC – PHS EX-QQ, Declaration of Simon Mui (July 9, 2019).

[123] Automaker battery cell and pack costs have been reported in news stories by Cleantechnica.com; electric.co; and insideevs.com. *See, e.g.*, EC – PHS EX-TT, Jay Cole, *LG Chem "Ticked Off" With GM For Disclosing $145/kWh Battery Cell Pricing*, InsideEvs (Oct. 23, 2015, 10:00 AM), http://insideevs.com/lg-chem-ticked-gm-disclosing-145kwh-battery-cell-pricing-video/; EC – PHS EX-UU, Steve Hanley, *Tesla Has 20% Battery Cost Advantage on Competition, Says UBS Analyst*, Clean Technica (Nov. 21, 2018), https://cleantechnica.com/2018/11/21/tesla-has-20-battery-cost-advantage-on-competition-says-ubs-analyst/; EC – PHS EX-VV, Fred Lambert, *Tesla to achieve leading $100/kWh battery cell cost this year, says investor after Gigafactory 1 tour*, Electrek (Sep. 11th, 2018, 4:27 PM), https://electrek.co/2018/09/11/tesla-100-kwh-battery-cost-investor-gigafactory-1-tour/; EC – PHS EX-WW, Michael J. Safoutin, Predicting the Future Manufacturing Cost of Batteries for Plug-In Vehicles, (U.S. EPA, 2017), *available at* https://www.epa.gov/sites/production/files/2018-10/documents/evs30-intl-symp-exhib-safoutin-2017-10.pdf. In some instances, the same battery costs were reported across more than one year for a manufacturer without reference to the specific year. Where battery cell costs were reported, we have relied on the average 2018 battery cell to pack cost ratio from BNEF (2018) to convert the values.

A. Coloradans Will Have the Choice of a Greater Variety of EV Models if Colorado Becomes a ZEV State

Adopting a ZEV program will increase the variety of ZEV models available for purchase in Colorado alongside existing vehicle offerings, providing a benefit to consumers. Other states that have adopted ZEV programs have seen an increase in ZEV models available for purchase, and Colorado is likely to have the same experience. This is driven in large part by efforts undertaken by car manufacturers in ZEV states. In the "Statement of Interest" sent from the automakers to Colorado state officials in May 2019,[124] the automakers indicate that they could more aggressively market ZEVs in Colorado.

There are two aspects of the availability of ZEVs to potential customers: model offerings to the state as a whole and actual consumer availability at dealerships, each of which should improve if Colorado adopts a ZEV program.

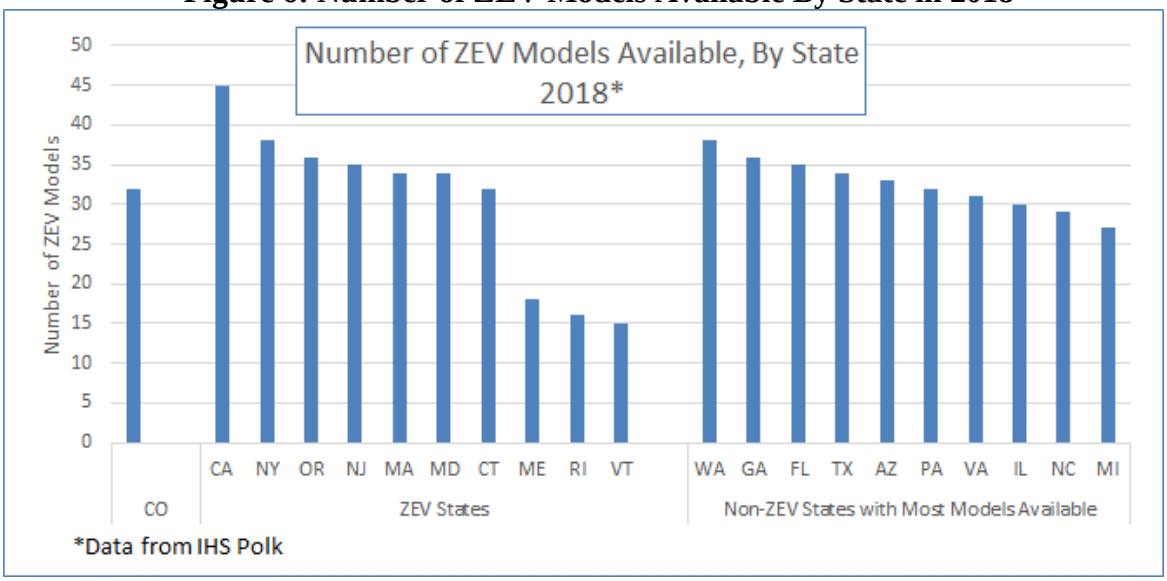
First, a ZEV program should increase the range of ZEVs offered by a manufacturer to dealerships in the United States that are actually sold in Colorado. A review of national industry data on ZEV sales shows this pattern already exists. IHS Polk data for 2018[125] show ZEV sales for each state by model type, and this data shows that populous ZEV states have greater availability of ZEV models than other states.[126] A review of Figure 6 shows the results for Colorado, the states with a ZEV regulation, and the 10 non-ZEV states with the most models available. Colorado, with 32 models available, ranks below all of the populous ZEV states and falls roughly in the middle of the 10 non-ZEV states. If manufacturers offered in Colorado all of the models available in California, the Colorado total would increase by 40 percent.

[124] EC – PHS EX-XX, Statement of Interest: Colorado Automaker (Memorandum of Agreement) sent to Colorado Department of Public Health and Environment (May 2019).

[125] IHS Polk data is proprietary and not publicly available, as further explained in EC – PHS EX-QQ, Declaration of Simon Mui (July 9, 2019).

[126] We use a lower bound of 5 sales statewide to rule out special purchases where the vehicle is not actually offered in the state. We did sensitivity analysis with higher and lower cutoff points and the results are very similar.

Figure 6: Number of ZEV Models Available By State in 2018

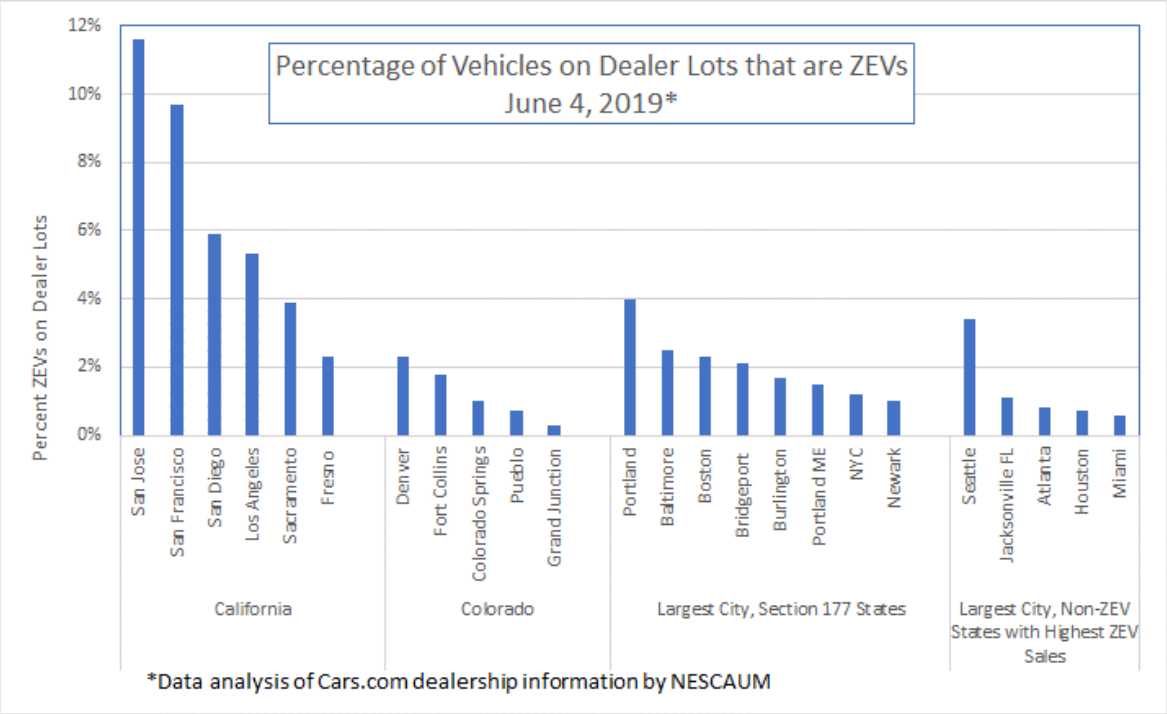


Second, a ZEV program should help Colorado consumers find vehicles technically "offered" to Colorado state dealers in dealer inventories or on showroom floors. Northeast States for Coordinated Air Use Management (NESCAUM) has developed a tool that counts, for specified areas,[127] the number of ZEVs and conventional vehicles reported on dealership lots on the Cars.com website. Using that tool, we calculated the percentage of vehicles on dealer lots that are ZEVs for cities in California, Colorado, the Section 177 states that have adopted the ZEV program,[128] and the non-ZEV states with the highest ZEV sales. The results are shown in Figure 7.

[127] For this analysis the NESCAUM tool searched within a 25-mile radius of the city center zip code.

[128] Data for Providence was not available.

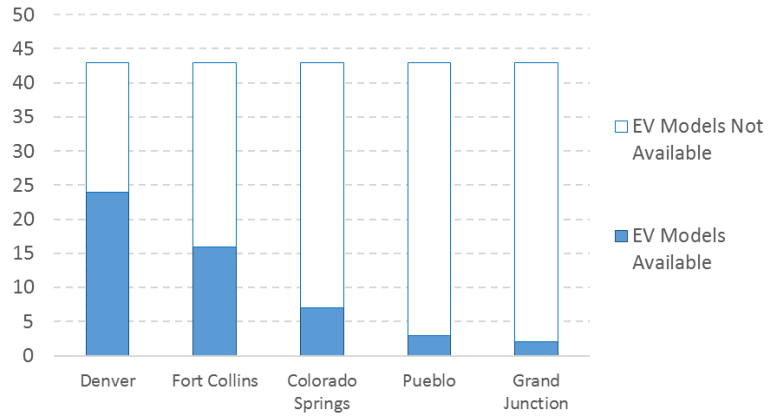
Figure 7: Percentage of Vehicles on Dealer Lots that are ZEVs, June 4, 2019



It is noteworthy that on this measure, which most accurately reflects the actual experience of vehicle purchasers, cities in non-ZEV states (with the exception of Seattle) rank well below cities in ZEV states. Once again it is apparent that bringing Colorado to the Section 177 ZEV state average, let alone the California average, would greatly increase the number of vehicles actually available for potential purchasers to see and test drive. For example, out of the 41 plug-in EV models (including BEVs and PHEVs) available in the U.S., only 24 were available within a 25-mile radius of Denver, Colorado in a survey of dealership inventories conducted in June 2019.[129] Only 59% of the plug-in EV models were thus available to be test driven or seen by consumers in the Denver metro area. Even more notably, only 39% of plug-in EV models were available at dealerships in Fort Collins, 17% in Colorado Springs, 7% in Pueblo, and 5% (just 2 models) in Grand Junction.

[129] Data collected on 6/21/2019 from Cars.com. A similar scan conducted on April 26, 2019 and June 7, 2019 showed similar results. We have not included hydrogen fuel cell vehicles largely because they are primarily available only in California.

Figure 8: Availability of Plug-In EV Models Within a 25-mile Radius at Dealerships



The specific EV models that are currently available in the United States, but not available in dealership inventories in and around Denver, are listed below in Table 4. Of particular interest is the Subaru Crosstrek Hybrid, a PHEV version of one of the best-selling Subaru SUVs in Colorado.

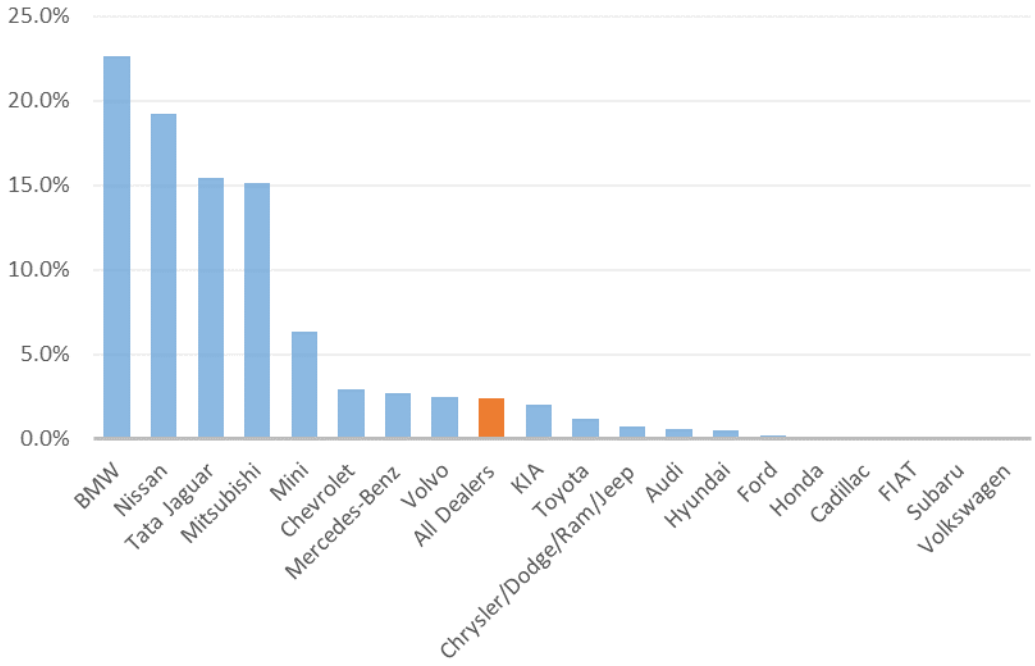
Table 4: Electric Vehicles Not Available on June 21, 2019 in Dealership Inventories Within a 25-Mile Radius of Denver, Colorado

1	BMW 745E (PHEV)
2	Cadillac CT6 Plugin (PHEV)
3	FIAT 500e (BEV)
4	Ford Focus Electric (BEV)
5	Ford CMAX Hybrid (PHEV)
6	Honda Clarity Electric (BEV)
7	Hyundai Sonata (PHEV)
8	Hyundai Kona EV (BEV)
9	KIA Optima (PHEV)
10	KIA Soul EV (BEV)
11	Mercedes-Benz GLE 550e (PHEV)
12	Mitsubishi i-MiEV (BEV)
13	Subaru Crosstrek Hybrid (PHEV)
13	Volkswagen e-Golf (BEV)
15	Volvo S60 Hybrid (PHEV)
16	Volvo S90 Hybrid (PHEV)
17	Volvo XC90 Hybrid (PHEV)

Closer inspection of the data shows a wide variation among automaker brands with respect to making vehicles available at dealerships around Denver. For example, as shown below in Figure 9, companies like BMW, Nissan, and Tata (Jaguar-Landcruiser and Mitsubishi) have made a relatively large percent of the plug-in EVs available at dealerships in the Denver region, while

other automaker brands offer few or no EV models at dealerships as a fraction of their inventory. This pattern is reflected in other regions of the state.

Figure 9: Percent of Dealership Inventories that are EVs, By Automaker Brand Denver Area (July 21, 2019)



Because a ZEV program requires that auto manufacturers deliver a minimum percentage of ZEVs to dealers, Colorado consumers will see increased availability at dealerships as the requirements come into effect.

B. The Economic Benefits of a ZEV Program Will Extend to Low- and Middle-Income Consumers by Expanding the Market for Used Electric Vehicles

Although a ZEV program would only directly apply to the sale of new cars in Colorado, it would have important benefits for purchasers of used cars as well. First, by requiring more new ZEVs to be sold in Colorado year over year to 2025, the nascent market for used electric vehicles will mature and expand more quickly under a ZEV program than under the status quo. And because lower-income consumers are considerably more likely to purchase used vehicles than new vehicles, a greater percentage of individuals across the income spectrum will have the opportunity to purchase an electric vehicle as more and a greater variety of used ZEVs become available for purchase.

Purchasers of used ZEVs will reap substantial, and immediate, cost savings. Even before electric vehicles reach cost parity with their conventional counterparts, the incremental difference in cost of a new electric vehicle will have depreciated substantially by the time a vehicle is being sold to its second owner. However, the fuel and maintenance savings of ZEVs can be enjoyed right away. Indeed, the ICCT estimates commissioned by the Colorado Energy Office show that

secondary owners of a model year 2025 battery electric vehicle will save more than $6,000 over the lifetime of the vehicle as compared to a used conventional vehicle.[130]

C. The ZEV Program Will Benefit Both Urban and Rural Drivers By Promoting Investment in Infrastructure and Other Public Goods

According to the recent Clean Jobs Colorado 2018 report,[131] Colorado is home to more than 2,700 jobs in the advanced vehicle industry, including technological innovation in lightweight materials, engine design, aerodynamics, EVs and EV charging infrastructure. Long-term standards and policy are essential to ongoing innovation and job growth, and to a further strengthen the manufacturing sector in Colorado and beyond. As a result, private investment in next-generation EV technology – both R&D and development and production – is flowing at higher rates to ZEV states, and at much lower levels to non-ZEV states. By adopting ZEV, Coloradans can expect the jobs in this industry to continue to grow.

A recent study by Synapse Energy Economics for the years 2020 through 2035 shows pursuing the ZEV program would result in a positive, long term economic benefit for the state—to the tune of an increase of about $72 million in consumer spending and 1,700 jobs, annually.[132] The economic benefits would grow over time, from the cumulative effects of less fuel consumption, lower maintenance costs, and as the cost to purchase EVs continue to come down. The ever-increasing economic benefits would extend to nearly every facet of the Colorado economy. The good news is environmental and health benefits of reduced emissions through ZEV can be achieved alongside employment and gross domestic product (GDP) growth in Colorado.

D. Increased Adoption of Electric Vehicles Will Provide Benefits For All Electricity Customers in Colorado

The acceleration of electric vehicle adoption spurred by a ZEV program in Colorado will improve the utilization of the electric grid, which puts downward pressure on electricity rates to the benefit of all ratepayers. A study completed by MJ Bradley and Associates in 2017 ("2017 MJ Bradley Report") projected that savings from increased EV adoption in Colorado could result in up to $103 million in bill reduction benefits to all electric ratepayers through 2030, regardless of whether or not they own an EV.[133] This is because EVs are generally charged during hours of the day when there is spare capacity on the electric grid, which means the additional revenue from EV charging exceeds associated costs. That net incremental revenue is returned to all customers in the form of lower electric rates and bills. This net benefit will be maximized if EV charging occurs predominantly when demand on the electric grid is the lowest, like late at night and early in the morning. Thankfully, at the direction of the Colorado Public Utilities Commission and the

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130 Lutsey & Nicholas, *supra* note 112 at 16, Table 3.

131 EC – PHS EX-YY, Susan Nedell, *Advanced Clean Cars Standards Results in Economic Growth for Colorado*, E2 Environmental Entrepreneurs, a Medium Corporation (Jun 21, 2018), https://medium.com/e2org/advanced-clean-cars-standards-results-in-economic-growth-for-colorado-2e4027e0c5.

132 *Id.*

133 EC – PHS EX-ZZ, MJ Bradley & Associates *Plug-in Electric Vehicle Cost-Benefit Analysis: Colorado*, (April 2017), *available at* https://mjbradley.com/sites/default/files/CO_PEV_CB_Analysis_FINAL_13apr17.pdf.

legislature through the passage of S.B. 19-077, Colorado utilities are already taking steps to encourage EV drivers to charge when there is plenty of spare capacity on the grid and when electricity is cheap.[134]

1. The ZEV Program Will Place Downward Pressure on Electric Rates

As more EVs are used in Colorado, there will be a greater need for electricity for vehicle charging. Thankfully, EV charging naturally occurs during hours of the day when there is plenty of spare capacity on the electric grid, which can reduce electricity bills for all ratepayers. This is because the incremental revenue that EV customers contribute to the body of utility customers generally exceeds associated costs. Under the system of rate regulation before the Colorado Public Utilities Commission, that net revenue is automatically returned to all electric utility customers in the form of reduced rates, resulting in reduced electric bills.[135] This potential benefit to Colorado utility customers has been quantified in forward-looking studies and this real-world benefit has been observed in utility service territories that already have hundreds of thousands of EV customers.

Colorado-specific studies analyzing the cost and benefits of increased EV adoption have concluded that increasing sales of electricity to accommodate EV charging will reduce electricity bills for all customers. The 2017 MJ Bradley Report found that Colorado can expect to see utility customer savings between $19 million and $57 million by 2030 in a moderate to high EV adoption scenario, regardless of when charging occurred.[136] A later MJ Bradley assessment ("2019 MJ Bradley Report"), looking specifically at Xcel Energy's Colorado service territory, saw utility customer savings by 2025 in multiple scenarios of EV adoption.[137] Xcel Energy's service territory in Colorado has a majority of the EVs in the state; roughly 17,000[138] of 20,000[139] of Colorado's EVs were located in Xcel's service territory as of December 2018.

Importantly, the positive benefits of EV adoption studied in the Colorado-specific reports are forward looking, but their conclusions have been validated by actual historical data on EV charging from other states. A 2019 Synapse Energy Economics report analyzed the costs versus savings for utility customers from EV adoption from 2012-2018 for the two utilities with the highest deployment of EVs in the U.S.: Southern California Edison and Pacific Gas and Electric. The report concluded that during those six years, the revenue associated with sales of electricity

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134 *See, e.g.*, EC – PHS EX-AAA, Public Service Company of Colorado, Advice No. 1798-Electric, Public Utilities Commission of Colorado (Xcel Energy, May, 24, 2019).

135 EC – PHS EX-BBB, Colorado Public Utilities Commission, *Colorado PUC Electric Vehicle Working Group Report*, Colorado Public Utilities Commission Proceeding 17I-0692E (Jan. 2019) at 29.

136 MJ Bradley & Associates, *supra* note 133, at 10.

137 EC – PHS EX-CCC, MJ Bradley & Associates, Plug-in Electric Vehicle Cost-Benefit Analysis: Xcel Energy's Service Area in Colorado (April 2019) at 27.

138 EC – PHS EX-DDD, Direct Testimony of Jack W. Ihle, Colorado Public Utilities Commission Proceeding 19AL-0290E. (May 2019) at 8.

139 EC – PHS EX-EEE, Auto Alliance Driving Innovation, *Advanced Technology Vehicle Sales Dashboard*, Colorado PHEV and BEV Registration from January 2011 to December 2018, https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/.

for EV charging exceeded the utilities' costs of supporting EV charging and the costs of utility programs that deploy charging infrastructure by over $584 million dollars.[140] As is the case in Xcel Energy's Colorado service territory, that net-revenue is automatically returned to Southern California Edison and Pacific Gas and Electric customers in the form of reduced electric rates and bills. In summary, increasing adoption of EVs reduces bills for all electric ratepayers, by increasing the pool of net utility revenue available to pay down system costs.

2. Shifting EV Charging to Off-Peak Periods will Increase Ratepayer Benefits and Colorado's Utilities are Already Taking Necessary Steps

The 2017 MJ Bradley Report showed that ratepayer benefits due to increased EV electricity sales will occur even without managed charging, but these benefits are significantly increased when EV charging is focused in off-peak periods.[141] Electricity is most expensive for utilities to provide during peak periods, when consumption on the grid is highest and transmission and distribution facilities become strained.[142] Electricity is less expensive to produce during off-peak periods, like late at night or early in the morning when fewer customers are using the grid.[143] If EV charging can be concentrated in off-peak periods, the customer savings from the resulting electric sales will be significantly higher than during peak periods. The 2017 MJ Bradley report projects that, under a moderate EV growth scenario, net revenue from EV charging will increase from $19 million for baseline charging to $35 million in an off-peak charging scenario.[144] In a high EV growth scenario, the report projects net revenue from EV charging to increase from $57 million in a baseline charging scenario to $103 million in an off-peak charging scenario.[145] This net revenue from EV charging puts more downward pressure on utility rates. The more EV customers can charge off-peak, the greater the relative benefits to all customers.

The bulk of EV charging naturally occurs overnight when people are sleeping and there is plenty of spare capacity on the grid, but with a little nudge, EV charging can occur almost exclusively during off-peak hours. EV owners can be encouraged to move away from on-peak charging through well designed rates and incentives, such as time of use (TOU) rates and implementation of smart charging technology, each of which was recommended by the Electric Vehicle Working Group Report prepared by Colorado PUC staff in 2018.[146] Colorado utilities

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140 EC – PHS EX-FFF, Jason Frost, Melissa Whited, & Avi Allisom, *Electric Vehicles Are Driving Electric Rates Down*, (Synapse Energy, 2019) at 3.

141 MJ Bradley & Associates, *supra* note 133 (The report assumes all Colorado drivers begin charging immediately when getting home (presumably on-peak) in the "Baseline Charging Scenario". In the "Off-Peak Charging Scenario", charging is assumed to be 35% on peak and 65% off peak).

142 EC – PHS EX-GGG, Home Improvement Leads & Energy Exchange, *What is Time-of-Use Pricing and Why is it Important?* Energy Exchange, http://www.energy-exchange.net/time-of-use-pricing/.

143 Colorado Public Utilities Commission, *supra* note 135, at 27.

144 MJ Bradley & Associates, *supra* note 133, at 7.

145 *Id.*

146 EV owners can be encouraged to move away from on-peak charging through well designed rates and incentives, such as time of use (TOU) rates and implementation of smart charging technology, each of which was recommended by the Electric Vehicle Working Group Report prepared by Colorado PUC staff in 2018. *See* Colorado Public Utilities Commission, *supra* note 135.

are already taking steps to develop TOU pilot tariffs for residential customers that provide EV users with the right incentives to adjust their charging behavior to maximized system benefits. For example, Xcel, the largest utility in Colorado with over 85% of Colorado's EV fleet in its service territory, is already taking several steps towards promoting off-peak charging as a part of its Colorado Electric Vehicle Plan.[147] Municipal and Co-operative utilities are also taking strides to encourage EV charging at off-peak periods and maximize grid benefits. Holy Cross Energy[148] and Colorado Spring Utilities[149] are offering optional TOU rates for customers, while Fort Collins Utilities transitioned to a TOU structure for all residential customers in October 2018.[150] These rate designs can maximize EV benefits for all customers.

Colorado's utilities are also exploring smart charging to maximize system benefits. Smart charging uses advanced software and charging technology to automatically control charging, which can further encourage off-peak charging and increase the benefits to the grid. Xcel plans to file a "smart charging" pilot that will aim to test new technology that will allow the utility to manage EV customer charging and shift it towards periods when energy is cheapest.[151] The Platte River Power Authority is also soon to launch a smart charging pilot to explore the viability and effectiveness of utility-controlled charging.[152] As utilities recognize the benefits of encouraging EVs to charge during off-peak periods, their new programs and rates will help to ensure that net benefits of EV charging for all ratepayers are maximized.

VII. ZEV PROGRAM REQUIREMENTS ARE READILY ACHIEVABLE IN COLORADO

Colorado ZEV sales are on a steady upward trajectory, and adoption of the ZEV regulation will require additional sales above and beyond current trends. ZEV sales in other states, along with performance and cost trends that are making ZEVs increasingly attractive to customers, prove that the increased sales needed to comply with a ZEV program are eminently feasible.

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147 Colorado Public Utilities Commission Proceeding, *supra* note 138. (For example, Xcel has already proposed a commercial and industrial rate applicable to EV fleets and public charging stations which will use a TOU design focused on shifting charging to off-peak). EC – PHS EX-HHH, Herman K. Trabish, *Rocky Mountain compromise: Inside Xcel's landmark Colorado solar settlement*, Utility Dive, (August 22, 2016), https://www.utilitydive.com/news/rocky-mountain-compromise-inside-xcels-landmark-colorado-solar-settlement/424843/, (Xcel will also consider a filing in 2019 to switch all residential customers to a TOU rate).

148 EC – PHS EX-III, Holy Cross Energy, *Proposed New Electric Rates Effective July 1st, 2019*, https://www.holycross.com/electric-service-tariffs-rules-and-regulations/.

149 EC – PHS EX-JJJ, Colorado Springs Utilities, *Electric Time of Use Rate*, https://www.csu.org/pages/electric-tou-r.aspx.

150 EC – PHS EX-KKK, Fort Collins Utilities, *Residential Electric Rates, available at https://www.fcgov.com/utilities/residential/rates/electric*.

151 EC – PHS EX-LLL, Colorado Public Utilities Commission Proceeding 18A-0606EG, on Public Service Company of Colorado 2019-2020 Demand Side Management Plan, Shawn White, Direct Testimony, at pages 37-38.

152 EC – PHS EX-MMM, Platte River Power Authority, *Platte River launches EV charging study* (Feb. 26, 2019), https://www.prpa.org/news/platte-river-launches-ev-charging-study/.

A. Colorado ZEV Sales Are Increasing, But Additional Sales Will Be Needed to Comply with the ZEV Regulation

Electric Vehicle adoption has been steadily increasing in Colorado, but a ZEV program will have an important incremental impact. The exact impact on ZEV sales is unclear, but can be estimated using reasonable assumptions.

A ZEV program requires automakers to generate "ZEV credits," calculated as a percentage of their total annual Colorado sales. The ZEV credit obligation in 2023 would be 17%, increasing year by year to 22% in 2025 when the regulation would be fully phased in. The program allows for wide variation in the number of vehicles that manufacturers must sell in order to comply and meet their credit requirements, and the types of vehicles that manufacturers choose to produce will have a large impact on the number of vehicles needed under a Colorado ZEV program

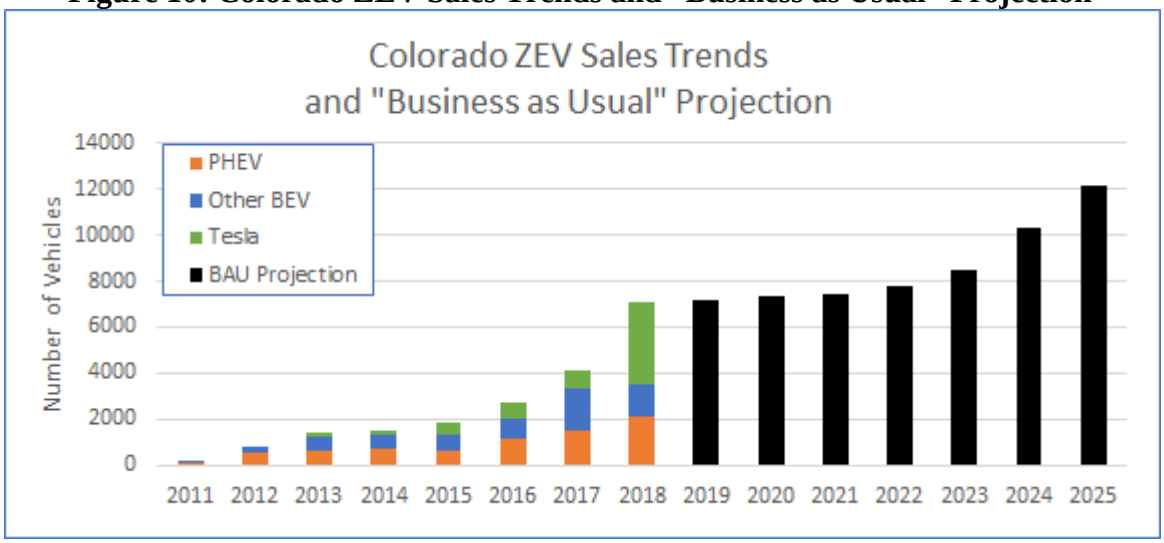
In order to estimate the additional ZEV sales that would result from a ZEV program in Colorado, the Environmental Coalition first established a "business as usual" sales projection (i.e. anticipated ZEV sales in Colorado absent the proposed regulation). Although sales have increased sharply in recent years, a large portion of the increase is due to Tesla, and in particular the 2018 introduction of the Model 3. The growth rate for the rest of the industry has been less sharp.[153] We use the 2018 industrywide sales level of about 7,100 vehicles per year as a conservative starting point for the "business as usual" baseline level of sales going forward, and then estimate the number of additional vehicles that will need to be sold in order to comply with the regulation.[154] Figure 10 below shows Colorado ZEV sales for calendar years 2011 through 2018, as well as the Environmental Coalition's "business as usual" projection through 2025.[155]

[153] ZEV credits earned by Tesla can be purchased by other manufacturers and used to satisfy their compliance obligation.

[154] For a more detailed explanation see Shulock, *supra* note 121.

[155] Total sales are taken from Auto Alliance, *Advanced Technology Vehicle Sales Dashboard*, supra note 139. Tesla sales are taken from EC – PHS EX-NNN, Colorado Automobile Dealers Association, *Archived Colorado Auto Outlook Stats*, https://www.colorado.auto/archived-colorado-auto-outlook-stats.

Figure 10: Colorado ZEV Sales Trends and "Business as Usual" Projection



Using the Division's assumed level of total future vehicle sales,[156] and applying reasonable assumptions about the types of ZEVs sold,[157] automakers would need to place about 6,100 additional ZEVs in 2023, the first year of compliance, increasing to about 7,500 additional ZEVs in 2025. Total ZEV sales (business as usual plus additional needed for compliance) would be about 14,600 in 2023 (about 5.25% of sales), ramping up to about 19,600 in 2025 (about 6.9% of sales). Figure 11 shows projected business as usual and additional ZEV sales under what the Environmental Coalition experts consider to be a "base case" assumption for the division of BEVs and PHEVs.[158]

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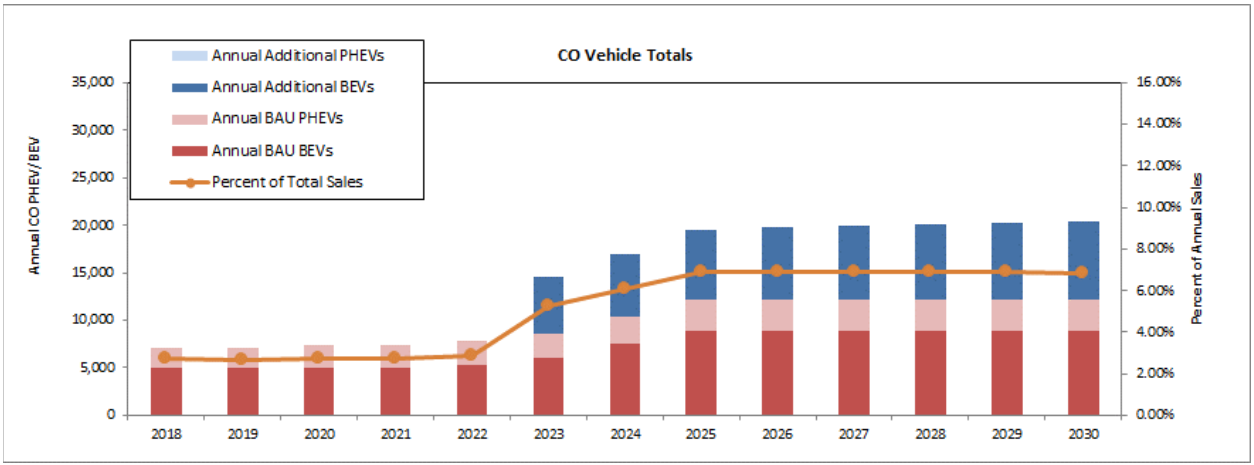
[156] The CDPHE assumes 2023 total sales of 277,992, increasing to 283,580 in 2025. Initial EIA at 5.

[157] The assumptions in this analysis regarding future model offerings are based on information from Baum and Associates (Baum and Associates, Hybrid Electric Vehicle Sales Forecast Values (March 2019)). Assumptions for future business as usual sales levels are based on data from Navigant Research (Navigant Research, Market Data: EV Geographic Forecasts; Battery and Plug-In Hybrid EV Sales and Populations in North America (3Q 2017)). Each of these data sources is available on a subscription basis only and cannot be provided as part of an exhibit in the public record, as further explained in EC – PHS EX-QQ, Declaration of Simon Mui (July 9, 2019). The projections use the ZEV compliance calculator developed by the California Air Resources Board, modified to match Colorado circumstances. Modifications to the California Air Resources Board calculator are described in Shulock, *supra* note 154 at 5.

[158] This "base case" scenario assumes about 80% BEVs (a mix of 150-mile and 250 mile vehicles) and 20% PHEVs (50-mile), and includes credits for fuel cells sold in other states (pursuant to the "travel" provision in the proposed ZEV program regulation).

Figure 11: Colorado Vehicle Totals: Business as Usual and Additional ZEV Sales



The Environmental Coalition's projected total ZEV sales are slightly higher than those in the Division's Initial EIA (13,484 in 2023 and 17,622 in 2025) due to differences in assumptions about the future ZEV vehicle fleet mix.[159] Either approach is reasonable[160] and each demonstrates that adopting a ZEV program will spur increased adoption of ZEVs in Colorado.

B. Meeting the Required Level of Sales under a ZEV Program is Feasible in Colorado Due to Numerous, Well-Documented Trends

The last decade has seen substantial advancements in EV technology resulting in a steadily growing EV market – both globally and in the United States. Global EV sales surpassed 2 million vehicles in 2018[161] and are expected to reach 11 million units by 2020.[162] In the U.S., electric vehicle sales increased by nearly 30 percent from 2016 to 2017[163] and another 81 percent in 2018.[164] ZEV programs across the U.S. are helping to drive electric vehicle sales. The ten states

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159 The Division assumes that all BEVs will have sufficient range to earn the maximum allowable ZEV credit. The Environmental Coalition's estimate uses a mix of 150-mile and 250-mile BEVs, which results in a lower average credit per vehicle and hence slightly more vehicles.

160 The Division's calculations accurately project the number of vehicles required given their assumptions.

161 EC – PHS EX-OOO, Mark Kane, *Global Sales December & 2018: 2 Million Plug-In Electric Cars Sold*, Inside EVs, (January 31, 2019, 9:59 AM), https://insideevs.com/global-sales-in-december-full-year-2018-2-million-plug-in-cars-sold/.

162 EC – PHS EX-PPP, Wintergreen Research, Inc., *Personal Electric Vehicle Cars: Market Shares, Strategies, and Forecasts, Worldwide, 2019 to 2025* (Research and Markets, 2019), *available at* https://www.researchandmarkets.com/reports/4760641/personal-electric-vehicle-cars-market-shares.

163 EC – PHS EX-QQQ, Peter Slowik & Nic Lutsey, *The Continued Transition to Electric Vehicles in U.S. Cities*, (ICCT, July 2018) at 15, *available at* https://www.theicct.org/sites/default/files/publications/Transition_EV_US_Cities_20180724.pdf.

164 EC – PHS EX-RRR, Julia Pyper, *US Electric Vehicle Sales Increased by 81% in 2018*, Green Tech Media, (January 7, 2019), *available at* https://www.greentechmedia.com/articles/read/us-electric-vehicle-sales-increase-by-81-in-2018#gs.v2SiFXA7.

that have ZEV programs account for approximately two-thirds of the of the U.S. EV market.[165] Recent studies show that ZEV programs result in greater model availability and other important factors related to increased EV uptake.[166]

Many factors are in play that suggest that manufacturers will be able to meet a 2023 ZEV requirement in Colorado, with increasing ease with time as technology continues to improve.

1. Manufacturer Lead Time

Federal regulations require that any state that adopts vehicle standards must do so at least two years before the commencement of the effective model year, which begins on January 2 of the previous calendar year.[167] Therefore, if Colorado adopts the ZEV regulation prior to January 2, 2020 (the 2021 model year) it will first be enforceable in the 2023 model year. Manufacturers will have several years to prepare to meet the requirements, and ZEV penetration worldwide will continue to advance during that time.

2. Current Sales Levels for Some Manufacturers

In calendar year 2018, more than 15% of BMW total sales in California were ZEVs, and nearly 10% of GM sales.[168] Just bringing Colorado to the 2018 fleetwide California electric vehicle sales percentage (7.8%[169]) would exceed the Colorado ZEV program obligation in 2025. Meanwhile Nissan, which actively markets the LEAF in Colorado, has about a 5% ZEV sales fraction in Colorado today, already almost reaching the 2023 requirement.

3. Additional Marketing Efforts

The recent "Statement of Interest" introduced by representatives of the automakers[170] represents an explicit acknowledgement, by the automakers themselves, that they could more aggressively market ZEVs in Colorado. This is not surprising. Manufacturers generally focus their marketing efforts on specific jurisdictions or regions, including in states that have adopted the ZEV requirement. In 2016 the Sierra Club sponsored a survey of the electric vehicle shopping experience, which found wide variations in dealership expertise and training.[171] If manufacturers

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165 EC – PHS EX-SSS, Nic Lutsey, *California's continued electric vehicle market development, ICCT*, (May 7, 2018), https://www.theicct.org/publications/california-electric-vehicle-2018.

166 Slowik & Lutsey, *supra* note 163.

167 42 U.S. Code Section 7507.

168 IHS Polk Market Data, Total New Car and Light Truck Registrations, Report Month: December 2018. IHS Polk data is proprietary and not publicly available, as further explained in EC – PHS EX-QQ, Declaration of Simon Mui (July 9, 2019).

169 EC – PHS EX-TTT, California New Car Dealers Association, *California Auto Outlook*, Volume 15, Number 1, (February 2019), https://www.cncda.org/wp-content/uploads/Cal-Covering-4Q-18.pdf.

170 Statement of Interest, *supra* note 124.

171 EC – PHS EX-UUU, Sierra Club, *Rev Up Electric Vehicles: Multi-State Study of the Electric Vehicle Shopping Experience*, *available at* https://contentdev.sierraclub.org/sites/www.sierraclub.org/files/program/documents/Rev%20Up%20EVs%20Report.pdf .

and dealers actively prepare to increase their electric vehicle sales in Colorado in anticipation of a ZEV program, there is every reason to believe their efforts will result in increased sales here.

4. Additional Model Offerings

Importantly, automakers are committing to vehicle electrification, which is evidenced by the sharp increase in model offers and production volume. The number of electric models increased from just one in 2010 to more than 40 in 2017.[172] And a new analysis by MJ Bradley that summarizes industry announcements and data found that the number of electrified models available in the U.S. is projected to reach 55 by the end of 2019 and 81 by the end of 2021, with new types of vehicles becoming available, including SUVs, cross-overs and pick-up trucks.[173] These newer models also boast substantially greater battery range. The average model year 2018 EV has an estimated 273-mile range, more than 3.5 times the range of an average model year 2011 vehicle.[174]

Most of the major automakers have also publicly committed to making EVs a larger share of their portfolio moving forward. For example, Volvo has said that every new model starting in 2019 will include an electric motor and that it plans to have over 1 million electrified vehicles on the road by 2025.[175] Daimler plans to electrify the entire Mercedes-Benz line by 2022.[176] Volkswagen Group announced plans to offer 70 new electric models and to build 22 million electric cars across its brands by 2028. It wants 40 percent of the vehicles it sells to be electric by 2030.[177] And some automakers have announced dedicated EV platforms, including Hyundai and General Motors (GM). In addition to producing more EV models, some are investing in electrification strategies while others are acquiring stakes in companies that develop EV charging and battery technology. All of these commitments and investments clearly indicate that the auto industry is fully embracing vehicle electrification.

All told, manufacturers plan to bring 26 additional plug-in models to market by 2022, including pickup trucks, crossovers and SUVs. These new vehicles will meet the needs of new categories of customers, further increasing the sales potential.

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172 Slowik & Lutsey, *supra* note 163.

173 Lowell & Huntington, *supra* note 111.

174 EC – PHS EX-VVV, EPA, *The 2018 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy and Technology Since 1975*, 54, (March 2019), *available at* https://www.epa.gov/automotive-trends/download-automotive-trends-report.

175 EC – PHS EX-WWW, Volvo Cars, *The road ahead*, https://www.volvocars.com/us/about/electrification.

176 EC – PHS EX-XXX, Daimler, *At a glance: Electric initiative at Mercedes-Benz Cars*, https://media.daimler.com/marsMediaSite/en/instance/ko/At-a-glance-Electric-initiative-at-Mercedes-Benz-Cars.xhtml?oid=32963028.

177 EC – PHS EX-YYY, Charles Riley, *Volkswagen is betting its future on electric cars*, CNN Business, (March 12, 2019, 7:26 AM), https://www.cnn.com/2019/03/12/business/volkswagen-electric-cars/index.html.

5. Decreased Cost and Increased Performance

As discussed in Section V above, ongoing reductions in battery cost, which exceed past projections, have a significant effect on electric vehicle cost competitiveness such that cost parity will be achieved in the 2025 timeframe or sooner. The dramatic declines in battery cost, and ongoing improvements in electric drive efficiency, will allow manufacturers to offer increased range. This in turn will drive more consumers to consider and purchase electric drive vehicles.

6. Transportation Network Companies and Autonomous Vehicles

Electric vehicles are a natural fit for transportation network companies such as Uber and Lyft because the high mileage of their vehicles takes full advantage of the fuel and operating cost savings achieved by electric vehicles. Automakers are pursuing this market, with GM offering a Bolt EV leasing program aimed at Uber and Lyft drivers in California.[178] Meanwhile both Uber and Lyft have announced their intention to increase the electrification of their services. Uber has announced an EV Champions Initiative[179] pilot program in seven cities, which aims to deliver at least 5 million EV rides in a year. Lyft recently announced that in 2019, it will work to introduce thousands of electric vehicles onto its platform and make it easier for riders to request them through Green Mode,[180] and has previously stated that by 2025 it will provide one billion autonomous electric rides, all powered by renewable electricity.[181] All of these trends contribute to increasing electrification of the light-duty vehicle fleet, with the result that the ZEV requirement will become increasingly easy for manufacturers to achieve.

7. ZEV States With Similar Vehicle Sales Mix to That of Colorado

States vary in the fraction of cars versus light trucks in their vehicle sales and vehicle population. There is similar variation across the states that have adopted the ZEV program.[182] Figure 12 shows the sales mix for Colorado, California, and the Section 177 states that have adopted the ZEV program, broken out for pickups plus SUVs, crossover utility vehicles (CUVs), and cars plus vans and minivans. As might be expected, the more urbanized states have a higher proportion of car sales than the more rural states. Colorado is consistent with this pattern, with a vehicle mix similar to that of Maine, Vermont and Oregon. In no way is Colorado an outlier among the ZEV states.[183]

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[178] EC – PHS EX-ZZZ, Cars.com, *GM Announces Bolt Lease for Uber, Lyft Drivers*, Cars.com, (May 4, 2017), https://www.cars.com/articles/gm-announces-bolt-lease-for-uber-lyft-drivers-1420695330355/.

[179] EC – PHS EX-AAAA, Adam Gromis, *Electrifying our network*, Uber, (Jun. 19, 2018), https://www.uber.com/newsroom/electrifying-our-network/.

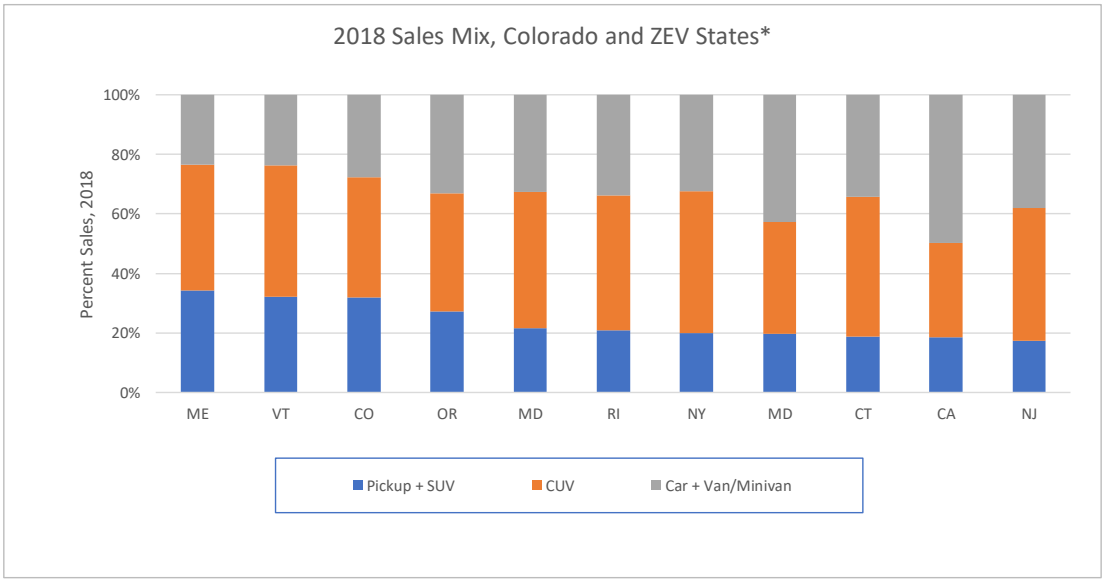
[180] EC – PHS EX-BBBB, Lyft Blog, *Making Cities More Livable With Electric Vehicles*, Lyft.com, (February 6, 2019), https://blog.lyft.com/posts/2019/2/6/making-cities-more-liveable-with-electric-vehicles.

[181] EC – PHS EX-CCCC, Lyft Blog, Lyft Climate Impact Goals, Lyft.com, (Jun. 14, 2017), https://blog.lyft.com/posts/2017/6/14/lyft-climate-impact-goals.

[182] The data was obtained from Auto Alliance, *supra* note 155.

[183] German Testimony at 10-11. Similarly, Colorado is not an outlier with respect to other ZEV states in terms of the mix of urban and rural driving or temperature, two other factors often cited by opponents of ZEV vehicles. *Id.* In fact, the higher elevations in Colorado make ZEV vehicles perform better in Colorado relative to other ZEV states that are at lower elevations. *Id.* at 12.

Figure 12: 2018 Sales Mix, Colorado and ZEV States



8. International Trends

Other nations and international cities are also embracing electrification. China leads the world in EV market share, in part driven by production and sales mandates. While EVs account for just over 3 percent of China's new car sales today, they are expected to surpass 30 percent in 2030.[184] And beginning this year, China will require foreign carmakers to start manufacturing and selling electric vehicles, gradually escalating quotas for pure-electric cars, plug-in hybrids and fuel-cell cars.[185] As a result, many automakers are making China their launch pad for EVs, unveiling their EV models in China first.

Norway is also considered a leader in this area – the country set a target that all new passenger cars and vans sold in 2025 should be zero emitting. By 2017, more than half of all cars sold in Norway were electric or hybrid vehicles.[186] And in March 2019, nearly 60 percent of new vehicle sales were fully electric.[187] Other nations have pledged commitments away from

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[184] EC – PHS EX-DDDD, Takashi S. Kawakami,) *Chinese electric-car makers charge ahead, powered by state*, Nikkei Asian Review, (November 17, 2018, 6:51 JST), https://asia.nikkei.com/Spotlight/Electric-cars-in-China/Chinese-electric-car-makers-charge-ahead-powered-by-state.

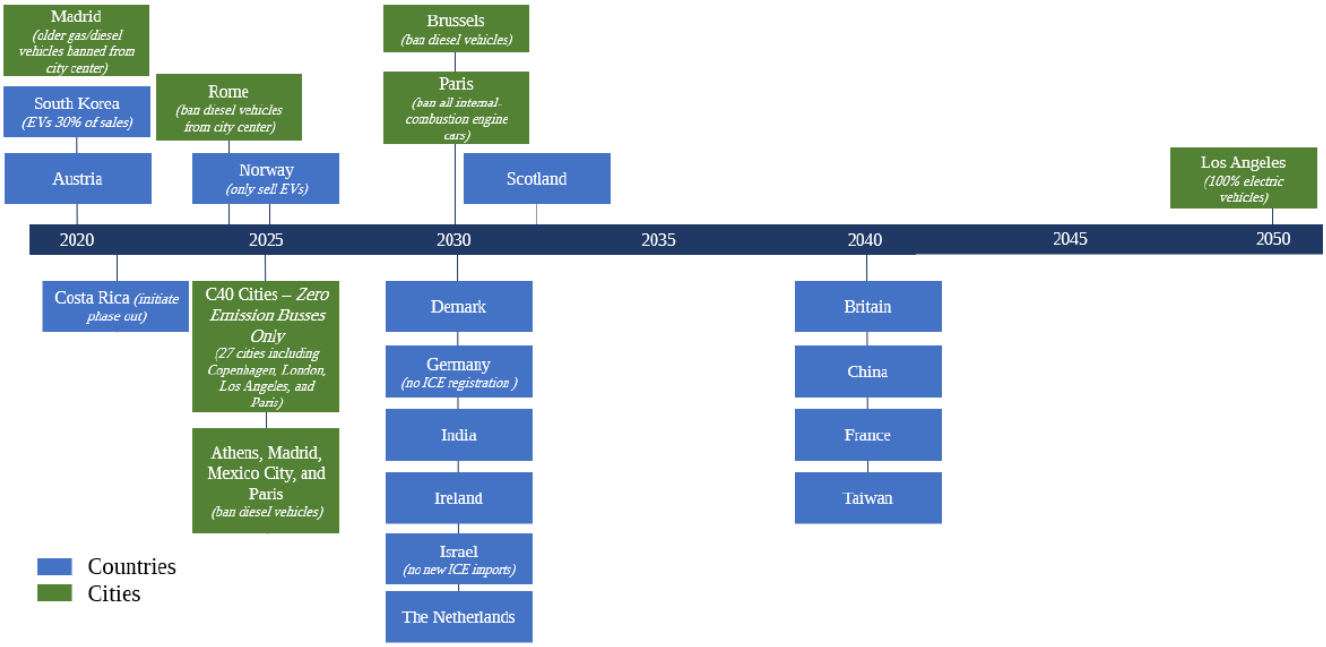
[185] EC – PHS EX-EEEE, Dow Jones Newswires *China sets new deadline for electric-car production*, Fox Business, (Sept. 28, 2017), http://www.foxbusiness.com/markets/2017/09/28/china-sets-new-deadline-for-electric-car-production.html.

[186] EC – PHS EX-FFFF, Camilla Knudsen & Alister Doyle, *Norway powers ahead (electrically): over half new car sales now electric or hybrid*, Reuters, (January 3, 2018, 5:12 AM), https://www.reuters.com/article/us-environment-norway-autos/norway-powers-ahead-over-half-new-car-sales-now-electric-or-hybrid-idUSKBN1ES0WC.

[187] EC – PHS EX-GGGG, Lefteris Karagiannopoulos & Terje Solsvik, *Tesla boom lifts Norway's electric car sales to record market share*, Reuters, (April 1, 2019, 6:49 AM), https://www.reuters.com/article/us-norway-autos/tesla-boom-lifts-norways-electric-car-sales-to-58-percent-market-share-idUSKCN1RD2BB.

conventional engines and toward electrification. Britain and France announced that they intend to end the sale of gas and diesel-powered vehicles by 2040.[188] Scotland pledged to phase out new petrol and diesel cars and vans by 2032, eight years ahead of the UK target.[189] India has vowed to start selling only electric cars by 2030. The government's National Electric Mobility Mission Plan wants annual sales of electric and hybrid cars to hit 6 million to 7 million by 2020.[190] The cities of Paris, Madrid, Athens and Mexico City said they hope to remove diesel cars and vans by 2025.[191] A summary of major global commitments is captured in Figure 13 below, from an M.J. Bradley and Associates 2019 report.[192]

Figure 13: Timeline of Global Targets to Phase Out Internal Combustion Engines



Countries have set goals targeting no new ICE vehicle sales unless otherwise indicated. Madrid aims to ban older gas (made prior to 2000) and diesel (made prior to 2006) vehicles by 2020 and join Athens, Mexico City, and Paris by banning all diesel vehicles by 2025. Paris aims to ban diesel vehicles by 2025 and all internal-combustion engines five years later. Los Angeles's Green New Deal hopes 100 percent of vehicles in the city will be electric by 2050.

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188 EC – PHS EX-HHHH, Stephen Castle, *Britain to Ban New Diesel and Gas Cars by 2040*, The New York Times, (July 26, 2017), https://www.nytimes.com/2017/07/26/world/europe/uk-diesel-petrol-emissions.html.

189 EC – PHS EX-IIII, Shehab Khan, *Scotland to 'phase out' new petrol and diesel cars by 2032*, The Independent, (September 5, 2017, 16:08), http://www.independent.co.uk/news/uk/politics/scotland-petrol-diesel-cars-phase-out-ban-2032-nicola-sturgeon-snp-environment-air-pollution-a7930781.html.

190 EC – PHS EX-JJJJ, Jackie Wattles, *India to sell only electric cars by 2030*, CNN Business, (June 3, 2017, 5:22 PM), http://money.cnn.com/2017/06/03/technology/future/india-electric-cars/index.html?iid=EL.

191 EC – PHS EX-KKKK, Michael J. Coren, *Nine countries say they'll ban internal combustion engines. So far, it's just words*., Quartz, (August 7, 2018), https://qz.com/1341155/nine-countries-say-they-will-ban-internal-combustion-engines-none-have-a-law-to-do-so/.

192 Lowell & Huntington, *supra* note 111, at Figure 1.

These actions and targets send a clear signal that much of the international market is headed toward an electric future, making it increasingly easier for manufacturers to meet ZEV program requirements in individual markets in the United States. Colorado has the opportunity to help drive this innovation and benefit from the emissions reductions.

VIII. THE COMMISSION HAS CLEAR LEGAL AUTHORITY TO ADOPT THE PROPOSED ZEV RULE

A. The Commission May Adopt the Proposed ZEV Program as Part of a Program to Reduce GHG Pollution from Vehicles

The Commission has a legal duty and clear authority to reduce the harmful climate-altering GHG emissions from vehicles throughout the state, including through adoption of a ZEV program.

The legislature delegated to the Commission "maximum flexibility" to develop "an effective air quality control program" to protect and enhance the state's air quality.[193] Requiring the increased sale of ZEVs in Colorado would be integral to such a program. Moreover, it is the express policy of the state to "to foster the health, welfare, convenience, and comfort of the inhabitants of the state of Colorado and to facilitate the enjoyment and use of the scenic and natural resources of the state" and to achieve "the maximum practical degree of air purity in every portion of the state."[194] To this end, the Act requires "the use of all available practical methods which are technologically feasible and economically reasonable so as to reduce, prevent, and control air pollution throughout the state of Colorado".[195]

The Colorado legislature entrusted the Commission with the duty to promulgate emission control regulations to further the state's goal of ensuring clean air.[196] The Commission must promulgate emission control regulations for "each significant source or category of significant sources of air pollutants" and "each type of facility, process, or activity which produces or might produce significant emissions of air pollutants."[197] There is no question that the emissions for passenger vehicles and light-duty trucks are a significant source of air pollutants.

The Act provides clear and explicit authority for the Commission to regulate GHGs, which is the focus of the proposed amendment to Regulation 20. The capacious definition of "air pollutant" encompasses GHGs emitted my motor vehicles: "any fume, smoke, particulate matter, vapor, or gas or any combination thereof which is emitted into or otherwise enters the atmosphere, including, but not limited to, any physical, chemical, biological, radioactive (including source material, special nuclear material, and by-product material) substance or matter."[198] Carbon

193 C.R.S. 25-7-106.

194 *Id.* at 102.

195 *Id.*

196 *Id.* at § 25-7-105(1).

197 *Id.* at § 25-7-109(1)(a).

198 *Id.* at§ 25-7-103(1.5) (emphasis applied).

dioxide is a "gas" that is emitted into or otherwise enters the atmosphere, and is clearly a physical or chemical substance or matter.

The very narrow exclusions from the definition of air pollutant, and the repeated use of the word "any" buttresses this conclusion even further. The Act narrowly excludes from the definition of "air pollutant" "water vapor or steam condensate or any other emission exempted by the commission consistent with the federal act."[199] Thus, the definition of air pollutant is drafted very broadly to include any vapor or gas emitted to the atmosphere, excluding only: (a) water vapor or steam, and (b) other emissions that the commission chooses to exempt.[200] The Supreme Court held in *Massachusetts v. EPA*, 549 U.S. 497, 528-29 (2007), that the similarly-worded definition of air pollutant in the Clean Air Act "embraces all airborne compounds of whatever stripe [including carbon dioxide], and underscores that intent through the repeated use of the word 'any.'"[201] In so doing, the Court rejected EPA's position that the definition of "air pollutant" in the Clean Air Act excluded carbon dioxides and other GHGs. Indeed, the state Act provides even more express authority than the federal Clean Air Act. The state Act expressly states that the Commission has authority to regulate carbon oxides, as a specific constituent,[202] and carbon dioxide that is the focus of the proposed amendment to Regulation 20 is a type of carbon oxides.[203]

GHG emissions from light-duty vehicles are clearly significant as they represent a meaningful portion of the total GHG emissions in the state. The ZEV program will reduce such emissions by millions of tons. The proposed revisions to Regulation 20 will also reduce ozone precursors and criteria pollutants, as discussed in Section IV above, providing yet an additional basis for the adoption of the regulation.

These authorities make clear that this Commission has unambiguous authority to regulate GHGs from motor vehicles. The Commission rightly relied on this authority pursuant to the Colorado Act in adopting CLEAR in 2018.[204] As has been demonstrated in numerous other states, low-emission vehicle and ZEV programs such as being contemplated here are designed to work together as part of an integrated Advanced Clean Cars Program. The Commission should rely on its ample authority to fully adopt such a program in Colorado.

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199 *Id.*

200 *Id.*

201 *Massachusetts v. EPA*, 549 U.S. 497, 528-29 (2007).

202 C.R.S. 25-7-103(1.5); C.R.S. 25-7-109(2)(c) (specifically including "carbon oxides" as a emissions that the Commission can regulate as a pollutant).

203 Recently passed legislation further underscores the Commission's authority – and mandate – to pass regulations that reduce GHG emissions in Colorado. *See* Colorado H.B. 19-1261; Colorado S.B. 19-096. Indeed, H.B. 19-1261 expressly empowers the Commission to adopt rules that "facilitate adoption of technologies that have very low or zero emissions."

204 *See* 5 C.C.R. 1001-24 § XII.A.

B. The Proposed Federal Rollback and Associated Federal Action Do Not Undermine the Commission's Ability to Act Now

The Environmental Coalition anticipates that opponents will argue against adoption of the revisions to Regulation 20 because the federal government may seek to revoke the California waiver and may assert that state clean car programs are preempted by federal law. For the reasons outlined in the Environmental Coalition Opposition to Freedom to Drive Motion to Continue Rulemaking Hearing, this argument is without merit.[205]

The Commission should not wait for the federal rule and its forthcoming litigation to be resolved prior to adopting a ZEV program for Colorado. Indeed, adopting the proposed changes to Regulation 20 at this juncture will put Colorado on equal footing with California and the other Section 177 states that have adopted ZEV as they wait to determine the outcome of litigation over aspects of a federal rollback. More importantly, if attempts to limit state authority are not contained in a forthcoming final federal rule, or if such attempts fail in court, Colorado will be able to move forward with implementing its ZEV program in MY 2023 as currently proposed. However, if the Commission were to choose not to move forward with a ZEV program now while it waited for the federal matters to resolve, it may not be able to implement the program until potentially several years later, thereby sacrificing years of environmental and economic benefits for Colorado.

IX. CONCLUSION

A Colorado ZEV program, which would complete the Advanced Clean Cars Program in the state, is essential to getting Colorado on a path to the deep reductions in greenhouse gas pollution that will be necessary to limit global warming to two degrees, thereby avoiding the most damaging impacts of climate change. At the same time, it will provide financial benefits to drivers and increase economic opportunities in the state, while also creating other important environmental, public health and economic benefits.

The Commission should vote to adopt the proposed revisions to Regulation 20.

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[205] Joint Opposition of Environmental Coalition and Colorado Communities for Climate Action to Freedom to Drive Motion to Continue Rulemaking Hearing, in re: Clean Car Rulemaking Efforts-Proposed Revisions to Regulation Number 20 Zero Emission Vehicle Program (filed July 9, 2019).

Respectfully submitted this 10th day of July, 2019

ENVIRONMENTAL DEFENSE FUND
NATURAL RESOURCES DEFENSE COUNCIL
SIERRA CLUB
SOUTHWEST ENERGY EFFICIENCY PROJECT
WESTERN RESOURCES ADVOCATES

By:_____

Thomas A. Bloomfield
Sarah M. Keane
Kaplan Kirsch & Rockwell LLP

EXHIBITS

The Environmental Coalition attaches to this Prehearing Statement the following exhibits, each of which it hereby endorses and adopts by reference in the Prehearing Statement. Each exhibit is attached to this Prehearing Statement with the appropriate corresponding label. A summary of all exhibits, including voluminous exhibits, is included in the table below.

The Environmental Coalition not only reserves the right to list further exhibits or revise the collective or individual exhibit lists in response to other parties' prehearing statements, including the Division's prehearing statement and will identify any further exhibits as part of its rebuttal prehearing statement.

Exhibit	Exhibit Title	Exhibit Summary
EC – PHS EX-A	Richard Rykowski, et al., Colorado Zero Emission Vehicle Program Will Deliver Extensive Economic, Health, and Environmental Benefits	This report examines the vehicle cost, fuel savings, greenhouse gas and criteria emissions reductions, and health-related benefits for three different scenarios under a combined Advanced Clean Cars Program in Colorado, including LEV standards and a ZEV program.
EC – PHS EX-B	Peter H. Howard and Jason A. Schwartz, Expert Report of Dr. Peter H. Howard, Ph.D. and Jason A. Schwartz, J.D. (July 9, 2019)	This expert report provides values for the monetization of the environmental benefits of the ZEV program and the Advanced Clean Cars Program, using a social cost of carbon framework.
EC – PHS EX-C	Intergovernmental Panel on Climate Change (IPCC), Global Warming of 1.5 °C: Summary for Policy Makers (IPCC Switzerland, 2018)	This report analyzes GHG emission pathways and finds that significant reduction in GHG emissions is required to limit negative impacts associated with global warming of 1.5 °C.
EC – PHS EX-D	National Oceanic and Atmospheric Administration National Centers for Environmental Information, State of the Climate: Global Climate Report for April 2019 (May 2019)	This report includes statistics and trends regarding climate change, temperatures, and weather patterns around the world.
EC – PHS EX-E	ACEEE, Center for Biological Diversity, et al. Comment on Notice of Intent to Prepare an Environmental Impact Statement for Model Year 2022-2025 Corporate Average Fuel Economy Standards, 7-13, NHTSA-2017-0069-0152 (Sept. 25, 2017)	These comments were submitted on behalf of Acadia Center, American Council for an Energy-Efficient Economy (ACEEE), Center for Biological Diversity, Center for Energy Efficiency and Renewable Technologies, Clean Power Campaign, Coalition for Clean Air, Connecticut Fund for the Environment, Conservation Law Foundation, Environment America, EDF, Environmental Law & Policy Center, NRDC, Plug In America, Public Citizen, Safe Climate Campaign, Sierra Club, Union of Concerned Scientists, and Center for Auto Safety, and provided recommendations regarding the alternatives analysis and other comments in response to NHTSA's Notice of Intent to Prepare an Environmental Impact Statement for Model Year 2022-2025 CAFE Standards.
EC – PHS EX-F	U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, Ch. 3 Air Quality Impacts	This report analyzes health risks to American people caused by climate change, including risks associated with elevated temperatures; more frequent, severe, or longer-lasting extreme events; degraded air quality; diseases transmitted through food, water, and disease vectors; and stresses to mental health and well-being.

Exhibit	Exhibit Title	Exhibit Summary
EC – PHS EX-G	Colorado Climate Plan: State Level Policies and Strategies to Mitigate and Adapt (2018)	This document, a collaborative effort by seven state agencies with input from stakeholders through a public comment process, examines the likely impacts climate change will have on natural resources, public health, infrastructure, and various economic sectors in Colorado. The document identifies goals and strategies for reducing GHG emissions and mitigating the harmful effects of climate change.
EC – PHS EX-H	U.S. Global Change Research Program, Climate Science Special Report, Fourth National Climate Assessment, Volume 1, 236 (2017)	This report provides a United States focused assessment of climate change science to provide a foundation for assessing climate risks and responses.
EC – PHS EX-I	Robert Steiger et al., A Critical Review of Climate Change Risk for Ski Tourism, Current Issues in Tourism, 1-37 (2017)	This report reviews 119 publications that have examined the climate change risk of ski tourism in 27 countries, finding projected decreased reliability of slopes dependent on natural snow, increased snowmaking requirements, shortened and more variable ski seasons, and other effects.
EC – PHS EX-J	Cameron Wobus et al., Projected Climate Change Impacts on Skiing and Snowmobiling: A Case Study of the United States, 45 Global Environmental Change,1-14 (2017)	This analysis uses a physically-based water and energy balance model to simulate natural snow accumulation at 247 winter recreation locations across the continental United States, identifying reductions in winter recreation season lengths in virtually all locations.
EC – PHS EX-K	Zhihua Liu et al., Climate Change and Wildfire Risk in an Expanding Wildland–Urban Interface: A Case Study from the Colorado Front Range Corridor, 30 Landscape Ecology 10, 1943-1957 (2015)	This report assesses the relative influences of wildland-urban interface expansion versus climate-driven fire regime change on patterns of burned areas and concludes that the human footprint must be considered along with climate effects when assessing the impacts of changing fire regimes in future landscapes.
EC – PHS EX-L	U.S. Energy Information Administration, State Carbon Dioxide Emissions Data, Colorado, Data for 2016, released October 31, 2018	The State Carbon Dioxide Emissions Data tables provide emissions information for each state in the United States and by each major category of energy production.
EC – PHS EX-M	U.S. Energy Information Administration, Annual Energy Outlook 2019 (January 24, 2019)	The Annual Energy Outlook provides long-term energy projections for the United States and related statistics.
EC – PHS EX-N	Colorado Public Utilities Commission Proceeding No. 16A-0139E, Robin Kittel Direct Testimony, Hearing Exhibit 101 at 11, and Attachment RLK-1	This is Volume 1 of Xcel's 2017 Renewable Energy Plan, which presents a roadmap for how the utility plans to meet its customers' energy demands with affordable and clean energy options. The documents describes the details of Xcel's proposal for complying with Colorado's Renewable Energy Standard.
EC – PHS EX-O	Colorado Public Utilities Commission Proceeding No. 13A-0836E, Robin Kittel Direct Testimony, Hearing Exhibit 2 at 10, and Attachment RLK-1	This document contains the testimony of Robin Kittel, Xcel's Director of Regulatory and Strategic Analysis, before the Colorado PUC providing an overview of Xcel's 2017 Renewable Energy Plan.
EC – PHS EX-P	U.S. Energy Information Administration, Electric Power Monthly, April 2019 release	The Electric Power Monthly presents monthly electricity statistics for a wide audience including Congress, Federal and State agencies, the electric power industry, and the general public.
EC – PHS EX-Q	US Energy Information Administration, Colorado State Energy Profile Overview, (January 17, 2019)	This portal provides data and statistics regarding energy production and use in Colorado.

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EC – PHS EX-R	Lazard, Lazard's Levelized Cost of Energy and Levelized Cost of Storage 2018 (8 Nov. 2018)	This report analyzes the levelized cost of energy in the United States and shows a continued decline in the cost of generating electricity from alternative energy technologies, especially utility-scale solar and wind.
EC – PHS EX-S	Colorado Public Utilities Commission Proceeding No. 16A-0436E, Decision No. C18-0761	Approval, by the Public Utilities Commission, of Xcel's closure of coal-fired Units 1 & 2 at the Commanche Generating Station, Colorado Energy Plan Portfolio resource plan with greater focus on renewable generation resources, and associated procedural matters.
EC – PHS EX-T	Xcel Energy, Colorado Clean Air-Clean Jobs Plan	This plan, approved by the Public Utilities Commission in 2010, calls for Xcel Energy to retire coal-fired resources and replace them with a new natural gas plant, and take other efforts to reduce emissions from coal-fired power.
EC – PHS EX-U	Colorado Public Utilities Commission, Proceeding No. 13A-0445E, Black Hills 2013 ERP Volume 1, Attachment FCS-1 (April 30, 2013)	2013 Electric Resource Plan, describing Black Hills Colorado Electric's forecasted need for generation resources, plans to close Clarks Station coal-fired units to comply with an emissions reduction plan, proposal to also close coal-fired Pueblo 5 & 6, and discussing gas-powered as well as renewable replacements.
EC – PHS EX-V	Colorado Public Utilities Commission Proceeding No. 16A-0436E, Decision No. C18-0462, at ¶ 29.	Approval, by the Public Utilities Commission, of Black Hills Colorado Electric's proposed acquisition of a "wind resource" via a competitive process, expected by Black Hills to "provide both the lowest total expected future revenue requirements and to provide the most cost savings from the avoidance of natural gas fuel for electricity generation"
EC – PHS EX-W	Tri-State Generation & Transmission, 2019 Electric Resource Plan, Stakeholder Meeting Presentation (presented March 27, 2019)	Tri-State Generation and Transmission Association public PowerPoint Presentation, addressing Integrated Resource Plan requirements, Electric Resource Plan Requirements, forecasted need for generation resources, evaluation of existing resources, and resource as well as economic scenario modeling, among other subjects.
EC – PHS EX-X	Mark Dyson & Alex Engel, A Low-Cost Energy Future for Western Cooperatives: Emerging Opportunities for Cooperative Electric Utilities to Pursue Clean Energy at a Cost Savings to Their Members, (Rocky Mountain Institute, 2018)	Interest group report, arguing that emergence of very low-cost renewable energy pricing in the United States creates "creates unprecedented opportunities for utilities currently reliant on high-cost, legacy generating assets, particularly in the Mountain West," and using Tri-State Generation & Transmission Association's current situation to potential of "engag[ing] in large-scale procurement of cost-effective renewable energy projects, while maintaining system reliability requirements."
EC – PHS EX-Y	Tri-State, Tri-State issues sixth renewable energy request for proposals (June 13, 2019)	Tri-State Generation and Transmission Association press release, summarizing past efforts to increase use of renewable energy resources and announcing RFP for Tri-State's sixth renewable power purchase agreement, possibility including build-transfer solar projects.

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EC – PHS EX-Z	Colorado Public Utilities Commission Proceeding No. 16A-0396E, Public Service 120 Day Report (filed June 6, 2018)	All-Source Solicitation 120-Day Report, describing the Preferred Colorado Energy Plan Portfolio's additional reliance on renewable energy resources, as compared to the Preferred Electric Resource Plan portfolio, and submitting the Preferred Colorado Energy Plan Portfolio for the Public Utility Commission's consideration.
EC – PHS EX-AA	Xcel Energy, Building a Carbon-Free Future	This report outlines Xcel Energy's plan to reduce GHG emissions in its electricity fleet, setting out objectives for 2030 and 2050 and the key strategies to achieve those objectives, including increasing reliance on renewable energy and retiring coal-generating units.
EC – PHS EX-BB	Sierra Club, 100% Commitments in Cities, Counties, & States	This website documents local government commitments to 100% renewable or clean energy around the United States.
EC – PHS EX-CC	Polis Administration's: Roadmap to 100% Renewable Energy by 2040 and Bold Climate Action	This roadmap identifies several key strategies to achieving Governor Polis' clean energy and climate objectives, including modernizing the Public Utilities Commission, growing green jobs and saving consumers money, promoting energy efficiency, increasing ZEVs and commuting options, ensuring a just and equitable transition away from fossil fuel-generated electricity, supporting local commitments to 100% renewable energy, and moving towards zero emission buildings.
EC – PHS EX-DD	Richard L. Revesz et al., Global Warming: Improve Economic Models of Climate Change, 508 Nature 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others)	This paper argues that climate-economic models need to be extended to include a wider range of social and economic impacts.
EC – PHS EX-EE	Peter Howard, Omitted Damages: What's Missing from the Social Cost of Carbon (Cost of Carbon Project Report, 2014)	This report describes how the social cost of carbon (SCC) is greater than previously thought because estimates fail to account for climate impacts such as forced migration, social and political conflict, violence, weather variability, and health, and recommends that the OMB and other executive agencies finalize proposed rules with the 2013 IWG's current SCC estimates.
EC – PHS EX-FF	Tamara Chuang & John Frank, Front Range air quality is terrible, but Colorado's efforts are showing some improvement in ozone pollution, The Colorado Sun (June 3, 2019, 5:00 AM)	This news article discusses air quality trends in the Colorado Front Range.
EC – PHS EX-GG	American Lung Association, State of the Air 2019, Most Polluted Cities	This website provides air pollution data and information for several cities around the United States.
EC – PHS EX-HH	U.S. EPA, Integrated Science Assessment for Ozone and Related Photochemical Oxidants (National Center for Environmental Assessment-RTP Division, 2013)	This report provides a concise synthesis and evaluation of the most policy-relevant science relating to ozone and other photochemical oxidants and provided the scientific bases for EPA's decision regarding the adequacy of national ambient air quality standards for ozone to protect human health, public welfare, and the environment.

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EC – PHS EX-II	American Lung Association, State of the Air 2019 20th Anniversary	This report analyzes air pollution in several U.S. cities, finding significant increases in the number of days with high particulate pollution and smog levels in numerous cities, and adding to the evidence that a changing climate is marking it harder to protect human health.
EC – PHS EX-JJ	U.S. EPA, Sulfur Dioxide Basics	This website report provides an overview of the effects of sulfur dioxide pollution.
EC – PHS EX-KK	U.S. EPA, Integrated Science Assessment (ISA) for Particulate Matter, 2-9 - 2-10 (National Center for Environmental Assessment-RTP Division,2009)	This report provides EPA's evaluation of the scientific literature on the potential human health and welfare effects associated with ambient exposures to particulate matter.
EC – PHS EX-LL	John M. German, Expert Testimony of John M. German, JG Automotive Consulting LLC on Behalf of Environmental Coalition (July 9, 2019)	In this expert declaration, John German provides his expert opinions that: (1) manufacturers will continue to create 50-state cars from criteria emission perspective; (2) ZEVs eliminate emissions from deterioration, malfunctions, and tampering, thereby substantially reducing criteria pollution; and (3) relative to other ZEV states, Colorado does not present unique urban/rural conditions, a materially different preference for light duty trucks or unusual temperature conditions.
EC – PHS EX-MM	Nic Lutsey and Michael Nicholas, Update on Electric Vehicle Costs in the United States through 2030 (The International Council of Clean Transportation, 2019)	This working paper assesses battery electric vehicle costs in the 2020-2030 time frame and analyzes the anticipated timing for price parity for representative electric cars, crossovers, and SUVs compared to their conventional gasoline counterparts.
EC – PHS EX-NN	California Clean Vehicle Rebate Project, EV Consumer Survey Dashboard, Center for Sustainable Energy	This website collects and allows users to sort and view data from consumers who purchased or leased an eligible clean vehicle, received a rebate, and responded to a voluntary survey.
EC – PHS EX-OO	Nic Lutsey & Michael Nicholas, Electric Vehicle Costs and Consumer Benefits in Colorado in the 2020-2030 Time Frame (The International Council on Clean transportation, 2018)	This white paper analyzes EV prices and consumer benefits for the Colorado light-duty vehicle market from 2023 through 2030, applying state-of-the-art battery projections to evaluate the implications of increased deployment of EVs to comply with a ZEV regulation.
EC – PHS EX-PP	Dana Lowell & Alissa Huntington, Electrical Vehicle Market Status: Manufacturer Commitments to Future Electric Mobility in the U.S. and Worldwide, MJ Bradley and Associates, (May 2019)	This paper summarizes the current status, and projected growth, of the U.S. EV industry over the next five to ten years, including drivers of U.S. and global EV growth, auto manufacturer investments in EV development, announced new EV model introductions, projected EV sales, projected battery pack costs, and projected date of EV "price parity" with internal combustion engine vehicles.
EC – PHS EX-QQ	Declaration of Simon Mui	In this declaration, Simon Mui of NRDC attests to the accuracy of proprietary data and reports used for analysis in the Prehearing Statement.
EC – PHS EX-RR	Max P. Kaffel & Dr. Simon Mui, *Cost-Competitiveness of Electric Vehicles: The Effects of Battery Cost Declines* (Natural Resources Defense Council, 2019)	This paper reviews numerous recent forecasts of lithium-ion battery costs in the passenger vehicle segment and assesses the implications for the cost-competitiveness of battery electric vehicles compared to internal combustion engine vehicles.

Exhibit	Exhibit Title	Exhibit Summary
EC – PHS EX-SS	Charles M. Shulock, Projection of ZEV Sales in Colorado With and Without Adoption of a ZEV Regulation, prepared for the Natural Resources Defense Council (Shulock Consulting, May 2019)	This paper analyzes the number of ZEVs that would be placed in Colorado under a "business as usual" scenario with no ZEV regulation, and a scenario with a ZEV regulation that requires additional ZEV sales in the state.
EC – PHS EX-TT	Jay Cole, LG Chem "Ticked Off" With GM For Disclosing $145/kWh Battery Cell Pricing, InsideEvs (Oct. 23, 2015, 10:00 AM)	This article states that General Motors announced battery cell costs for their electric vehicles as an industry-leading $145k/Wh.
EC – PHS EX-UU	Steve Hanley, Tesla Has 20% Battery Cost Advantage on Competition, Says UBS Analyst, Clean Technica (Nov. 21, 2018)	This article describes a Financial Times report that concluded Teslas has a 20% cost advantage over its closest competitor for battery cells produced for electric vehicles with $111 k/Wh.
EC – PHS EX-VV	Fred Lambert, Tesla to achieve leading $100/kWh battery cell cost this year, says investor after Gigafactory 1 tour, Electrek (Sep. 11th, 2018, 4:27 PM)	This article describes analyzes Tesla's assertion that it is on track to achieve a battery cell cost of $100 k/Wh by the end of 2018.
EC – PHS EX-WW	Michael J. Safoutin, Predicting the Future Manufacturing Cost of Batteries for Plug-In Vehicles, (U.S. EPA, 2017)	This presentation describes the approach to battery cost modeling, predicts the future manufacturing cost of batteries, and compares those predictions to other sources.
EC – PHS EX-XX	Statement of Interest: Colorado Automaker (Memorandum of Agreement) sent to Colorado Department of Public Health and Environment (May 2019)	Draft memorandum of agreement, involving Colorado Department of Health and Environment as well as an unidentified automaker, committing to efforts to support the Colorado market adoption and use of zero emissions vehicles over the course of the next half-decade.
EC – PHS EX-YY	Susan Nedell, Advanced Clean Cars Standards Results in Economic Growth for Colorado, E2 Environmental Entrepreneurs, a Medium Corporation (Jun 21, 2018)	This article describes the economic benefits from Colorado's adoption of LEV standards.
EC – PHS EX-ZZ	MJ Bradley & Associates Plug-in Electric Vehicle Cost-Benefit Analysis: Colorado, (April 2017)	This report analyzes the estimated costs and benefits of increased penetration levels of plug-in electric passenger vehicles and trucks in Colorado using a moderate and a high plug-in EV scenario.
EC – PHS EX-AAA	Public Service Company of Colorado, Advice No. 1798-Electric, Public Utilities Commission of Colorado (Xcel Energy, May, 24, 2019)	This letter describes a proposed service for Xcel customers called Secondary Voltage Time-of-Use Electrical Vehicle Service (Schedule S-EV) that would allow customers to use their purchased electric service to charge electric vehicles used by a third party and charge a fee for that vehicle charging.
EC – PHS EX-BBB	Colorado Public Utilities Commission, Colorado PUC Electric Vehicle Working Group Report, Colorado Public Utilities Commission Proceeding 17I-0692E (Jan. 2019)	This report analyzes the regulatory issues that come with the development of electric vehicles and the associated charging infrastructure in Colorado and provides strategy recommendations by the Colorado Public Utilities Commission on how to deal with those issues.
EC – PHS EX-CCC	MJ Bradley & Associates, Plug-in Electric Vehicle Cost-Benefit Analysis: Xcel Energy's Service Area in Colorado (April 2019)	This report estimates the costs and benefits of increased plug-in electric vehicles for Xcel Energy's Colorado service area through three different PEV scenarios and estimates the benefits that would accrue to Xcel's electric utility customers due to increased utility revenues from PEV charging.

Exhibit	Exhibit Title	Exhibit Summary
EC – PHS EX-DDD	Direct Testimony of Jack W. Ihle, Colorado Public Utilities Commission Proceeding 19AL-0290E. (May 2019)	This testimony contains a report by Jack W. Ihle, Xcel Energy Directory of Regulatory and Strategic Analysis, on behalf of Public Service, that outlines Public Service's plans for increased involvement in the Colorado EV market and supports new proposed rates for EV fleet charging and public fast charging.
EC – PHS EX-EEE	Auto Alliance Driving Innovation, Advanced Technology Vehicle Sales Dashboard, Colorado PHEV and BEV Registration from January 2011 to December 2018	This website displays light-duty advanced technology vehicle sales by state for 2011-2018.
EC – PHS EX-FFF	Jason Frost, Melissa Whited, & Avi Allisom, Electric Vehicles Are Driving Electric Rates Down, (Synapse Energy, 2019)	This report describes how electric vehicles decrease electricity rates for all households by comparing the electric utility revenues from EV charging with the costs of serving EV load.
EC – PHS EX-GGG	Home Improvement Leads & Energy Exchange, What is Time-of-Use Pricing and Why is it Important?	This website describes what time-of-use rate plans are and how they can save consumers money.
EC – PHS EX-HHH	Herman K. Trabish, *Rocky Mountain compromise: Inside Xcel's landmark Colorado solar settlemen*t, Utility Dive, (August 22, 2016)	Industry newsletter, discussing far-reaching compromise between Xcel Energy and 26 solar as well as community interest groups on a rate case, controversial large-scale utility solar program, and regular review of Colorado's renewable energy program.
EC – PHS EX-III	Holy Cross Energy, *Proposed New Electric Rates Effective July 1st, 2019*,	Notice of Holy Cross Energy's proposed revenue-neutral changes to its "Electric Service Tariffs, Rules and Regulations," effective July 1, 2019.
EC – PHS EX-JJJ	Colorado Springs Utilities, Electric Time of Use Rate	Webpage describing Colorado Springs Utilities' "time of use" electric pricing.
EC – PHS EX-KKK	Fort Collins Utilities, Residential Electric Rates	Web page, describing Fort Collins Utilities' "Time-of-Day" electric pricing for residential customers.
EC – PHS EX-LLL	Colorado Public Utilities Commission Proceeding 18A-0606EG, on Public Service Company of Colorado 2019-2020 Demand Side Management Plan, Shawn White, Direct Testimony	Testimony of Shawn White, Demand-Side Management and Renewable Regulatory Strategy & Planning at Xcel Energy, to the Public Utilities Commission, describing Xcel Energy's 2019/2020 Demand-Side Management Plan, providing context, and requesting the Commission's approval.
EC – PHS EX-MMM	Platte River Power Authority, Platte River launches EV charging study (Feb. 26, 2019)	This article describes Platte River Power Authority's launch of a distributed charging study to evaluate vehicle electric energy consumption patterns and test smart charging technology.
EC – PHS EX-NNN	Colorado Automobile Dealers Association, Archived Colorado Auto Outlook Stats	This website contains Colorado Auto Outlook statistics for every month from 2012 to 2019.
EC – PHS EX-OOO	Mark Kane, Global Sales December & 2018: 2 Million Plug-In Electric Cars Sold, Inside EVs, (January 31, 2019, 9:59 AM)	This article describes electric vehicles sales in 2018 and ranks the available models.
EC – PHS EX-PPP	Wintergreen Research, Inc., Personal Electric Vehicle Cars: Market Shares, Strategies, and Forecasts, Worldwide, 2019 to 2025 (Research and Markets, 2019)	Report, detailing 2019 to 2025 market shares, strategies, and other forecasts for the worldwide personal electric vehicle market.

Exhibit	Exhibit Title	Exhibit Summary
EC – PHS EX-QQQ	Peter Slowik & Nic Lutsey, *The Continued Transition to Electric Vehicles in U.S. Cities*, (ICCT, July 2018)	This report analyzes the driving forces behind the U.S. electric vehicle market, identifies exemplary market practices, and analyzes the links between various policies, infrastructures, and incentives.
EC – PHS EX-RRR	Julia Pyper, US Electric Vehicle Sales Increased by 81% in 2018, Green Tech Media, (January 7, 2019)	This article describes the large growth of U.S. EV sales in 2018 and what that growth means for the EV market in the U.S.
EC – PHS EX-SSS	Nic Lutsey, *California's continued electric vehicle market development, ICCT,* (May 7, 2018)	This report provides an update for California electrical vehicle sales through 2017 and compares their sales growth to the broader U.S. market and California's 2025-2030 goals.
EC – PHS EX-TTT	California New Car Dealers Association, *California Auto Outlook*, Volume 15, Number 1, (February 2019)	This publication provides comprehensive information on the California vehicle market in 2018.
EC – PHS EX-UUU	Sierra Club, Rev Up Electric Vehicles: Multi-State Study of the Electric Vehicle Shopping Experience	This report describes the Sierra Club's investigation into the electric vehicle consumer shopping experience and describes both exemplary practices and areas in need of improvement.
EC – PHS EX-VVV	EPA, The 2018 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy and Technology Since 1975, 54, (March 2019)	This report provides both current and historical compliance and estimated real-world data for the automotive industry in the U.S., including data on light-duty vehicle models.
EC – PHS EX-WWW	Volvo Cars, The road ahead	This website describes Volvo's plan for getting more electric vehicles on the road.
EC – PHS EX-XXX	Daimler, At a glance: Electric initiative at Mercedes-Benz Cars	This website describes Mercedes-Benz's electric vehicle goals.
EC – PHS EX-YYY	Charles Riley, Volkswagen is betting its future on electric cars, CNN Business, (March 12, 2019, 7:26 AM)	This article describes Volkswagen's development of electric vehicles.
EC – PHS EX-ZZZ	Cars.com, GM Announces Bolt Lease for Uber, Lyft Drivers, Cars.com, (May 4, 2017)	This article describes General Motor's announcement that it will lease EVs to ride-sharing service drivers.
EC – PHS EX-AAAA	Adam Gromis, Electrifying our network, Uber, (Jun. 19, 2018)	This press release describes Uber's announcement of an initiative to increase the number of EV rides provided by the company's drivers.
EC – PHS EX-BBBB	Lyft Blog, Making Cities More Livable With Electric Vehicles, Lyft.com, (February 6, 2019)	This website article outlines Lyft's plans to introduce thousands of EVs onto its platform and make supporting changes to its system.
EC – PHS EX-CCCC	Lyft Blog, Lyft Climate Impact Goals, Lyft.com, (Jun. 14, 2017)	This website article outlines Lyft's climate impact goals.
EC – PHS EX-DDDD	Takashi S. Kawakami, Chinese electric-car makers charge ahead, powered by state, Nikkei Asian Review, (November 17, 2018, 6:51 JST)	This article discusses the state of the EV market in China.

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EC – PHS EX-EEEE	Dow Jones Newswires China sets new deadline for electric-car production, Fox Business, (Sept. 28, 2017)	This article discusses China's EV mandate and the impact it may have on global auto markets.
EC – PHS EX-FFFF	Camilla Knudsen & Alister Doyle, Norway powers ahead (electrically): over half new car sales now electric or hybrid, Reuters, (January 3, 2018, 5:12 AM)	This article discusses the EV market and sales in Norway.
EC – PHS EX-GGGG	Lefteris Karagiannopoulos & Terje Solsvik, Tesla boom lifts Norway's electric car sales to record market share, Reuters, (April 1, 2019, 6:49 AM)	This article discusses the robust EV market in Norway.
EC – PHS EX-HHHH	Stephen Castle, Britain to Ban New Diesel and Gas Cars by 2040, The New York Times, (July 26, 2017)	This article discusses Britain's plan to ban the sale of new conventional vehicles by 2040.
EC – PHS EX-IIII	Shehab Khan, Scotland to 'phase out' new petrol and diesel cars by 2032, The Independent, (September 5, 2017, 16:08)	This article discusses Scotland's phase out the sale of new conventional vehicles by 2032.
EC – PHS EX-JJJJ	Jackie Wattles, India to sell only electric cars by 2030, CNN Business, (June 3, 2017, 5:22 PM)	This article discusses India's plan to phase out the sale of new conventional vehicles by 2030.
EC – PHS EX-KKKK	Michael J. Coren, Nine countries say they'll ban internal combustion engines. So far, it's just words., Quartz, (August 7, 2018)	This article summarizes country's plans and commitments to ban the sale of new conventional vehicles.
EC – PHS EX-LLLL	Curriculum vitae of Shannon Baker-Branstetter	
EC – PHS EX-MMMM	Curriculum vitae of Max Baumhefner	
EC – PHS EX-NNNN	Curriculum vitae of Gwen Farnsworth	
EC – PHS EX-OOOO	Curriculum vitae of Chester France	
EC – PHS EX-PPPP	Curriculum vitae of John M. German	
EC – PHS EX-QQQQ	Curriculum vitae of Peter Howard, PhD	
EC – PHS EX-RRRR	Curriculum vitae of Aaron Kressig	

CERTIFICATE OF SERVICE

The undersigned certifies that on this 10th day of July, 2019, an electronic copy of the foregoing PREHEARING STATEMENT OF ENVIRONMENTAL COALITION was emailed to the following:

butlerpeter2@gmail.com trisha.oeth@state.co.us jeremy.neustifter@state.co.us theresa.martin@state.co.us tom.roan@coag.gov barbara.dory@coag.gov garrison.kaufman@state.co.us doug.decker@state.co.us clay.clarke@coag.gov sdouglas@autoalliance.org cwilmarth@autoalliance.org epwaeckerlin@hollandhart.com rmoskowitz@afpm.org jsavage@sidley.com jbiever@lewisbess.com dratliff@lewisbess.com grangerl@api.org hackenbergerc@api.org jrege@globalautomakers.org sspendlove@intermountainca.com anne.smart@chargepoint.com justin.wilson@chargepoint.com sdunbar@keyesfox.com mark.zeigler@colorado.auto lingers@autonation.com tim.jackson@colorado.auto matthew.groves@colorado.auto jsmith@cc4ca.org easley@rockymountainclimate.org skeane@kaplankirsch.com scaravello@kaplankirsch.com shoshana.lew@state.co.us	curt.baker@state.co.us sophie.shulman@state.co.us michael.king@state.co.us herman.stockinger@state.co.us marie.nakagawa@state.co.us will.toor@state.co.us andrew.sand@state.co.us christian.williss@state.co.us david.banas@coag.gov vann.ellerbruch@coag.gov laura.kelly@coag.gov toddo@ciada.org angie@coloradopetroleumassociation.org pzalzal@edf.org ahenderson@edf.org lshields@edf.org nlong@nrdc.org joe.halso@sierraclub.org tmadsen@swenergy.org mfrommer@swenergy.org ellen.kutzer@westernresources.org erin.overturf@westernresources.org aaron.kressig@westernresources.org gwen.farnsworth@westernresources.org penny.anderson@westernresources.org tbloomfield@kaplankirsch.com skeane@kaplankirsch.com btrull@kaplankirsch.com nola@gescoalition.com ean@clfdenver.org mhiatt@earthjustice.org mdarby@earthjustice.org	kvsloan@gmail.com sebyp@gtlaw.com tieslaum@gtlaw.com chris.menges@cityofaspen.com jim.true@cityofaspen.com ccopeland@bouldercounty.org olucas@bouldercounty.org mike.salisbury@denvergov.org lindsay.Carder@denvergov.org lee.Zarzecki@denvergov.org dana.erpelding@eaglecounty.us bryan.treu@eaglecounty.us carchuleta@fcgov.com jhurst@fcgov.com jrada@jeffco.us abcruser@vfblaw.com jonwac@lakewood.org timcox@lakewood.org kurt.dahl@pitkincounty.com john.ely@pitkincounty.com kate.berg@summitcountyco.gov jeffrey.huntley@summitcountyco.gov kross@eatonco.org donald.mcleod@townofseverance.org msilverstein@raqc.org smccannon@raqc.org mmines@raqc.org kauerbacher@tesla.com vmandell@comcast.net tkurowski@tesla.com

By: /s/ William Trull
William Trull
Kaplan Kirsch & Rockwell LLP