

Full Benefit-Cost Analysis and Technical Support Document  
Proposed Amendments  
Title 250 - Department of Environmental Management  
Chapter 120 – Air Resources  
Subchapter 05 – Air Pollution Control  
Part 37 – Rhode Island’s Low-Emission and Zero-Emission Vehicle Programs

Rhode Island Department of Environmental Management  
Office of Air Resources

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## Contents

## Background

This document includes technical support and supplemental information for the Rhode Island Department of Environmental Management's (Department) proposed amendments to 250-RICR-120-05-37 (Part 37), "Rhode Island's Low-Emission Vehicle Program," for Advanced Clean Cars II, Advanced Clean Trucks, the Low NO<sub>x</sub> Heavy-Duty (HD) Omnibus, and Phase 2 Greenhouse Gas emission standards for trucks and trailers. Supplemental information and Full-Benefit Cost Analysis as referenced in the ORR Submission System Worksheet.

The Department proposes to amend Part 37 to reduce greenhouse gas and criteria pollutant emissions from passenger cars, light-duty trucks, and medium- and heavy-duty vehicles and engines that are delivered for sale or placed in service in Rhode Island.

In response to the threat of climate change, Rhode Island enacted the 2021 Act on Climate, which sets mandatory, enforceable climate emissions reduction goals leading the state to achieve net-zero emissions economy-wide by 2050. The transportation sector is responsible for approximately 39% of Rhode Island's greenhouse gas emissions.

The federal Clean Air Act (CAA) grants the U.S. Environmental Protection Agency (EPA) original jurisdiction for establishing emission standards for new motor vehicles, including heavy-duty trucks. Section 209(a) of the federal Clean Air Act (42 USC § 7543) prohibits states (except California) or other political sub-divisions, such as local or regional governments, from establishing emission standards for new motor vehicles. Under CAA Section 177 (42 USC § 7507), however, states that choose to adopt vehicle emission standards that are more stringent than the federal standards for new vehicles may adopt standards that are identical to any standards adopted by California. Rhode Island has previously adopted California's emissions standards for passenger cars and trucks and, with this rulemaking, would further opt-in to California's standards by amending Part 37 to include new standards for medium- and heavy-duty vehicles.

Reducing emissions from the vehicles on our roads is an important part of Rhode Island's programs to meet and maintain the health-based National Ambient Air Quality Standards (NAAQS), reduce the risk of exposure to toxic diesel particulate matter, and reduce the GHG emissions that contribute to climate change. The adoption of California's emissions standards is an imperative piece of the puzzle to Rhode Island's response and action on climate change.

## Summary of the Proposed Rule

Emissions from mobile sources are the greatest contributor to emissions of criteria pollutants<sup>1</sup> and greenhouse gases (GHG) in Rhode Island, accounting for about 60%<sup>2</sup> of non-biogenic ozone precursor emissions (including nitrogen oxides (NOx) and volatile organic compounds) and approximately 39% of statewide GHG emissions. In this rulemaking, the Department proposes to amend Part37 to reduce greenhouse gas and criteria pollutant emissions from passenger cars, light-duty trucks, and medium- and heavy-duty vehicles that are delivered for sale or placed in service in Rhode Island. This proposed amendment includes the adoption of California's Advanced Clean Trucks Rule, the Low NOx Heavy-Duty Omnibus Rule, and the Phase 2 Greenhouse Gas Rule, and amendments to California's Advanced Clean Cars program which was previously adopted in Rhode Island and incorporates previously adopted rules to control criteria and GHG emissions.<sup>3</sup>

- The Advanced Clean Trucks Rule (ACT) requires the sale of at least 30% zero-emission trucks by 2030 (depending on vehicle classification).
- The Low NOx Heavy-Duty Vehicle Omnibus Rule (HD Omnibus) requires a 90% reduction in NOx emissions for model year (MY) 2027 engines.
- The Phase 2 Greenhouse Gas Rule (Phase 2 GHG) sets greenhouse gas emission standards for heavy-duty trucks and truck trailers.
- Advanced Clean Cars II (ACCII) requires that all passenger car and light-duty truck vehicles delivered for sale by 2035 meet the definition of zero-emission vehicle and will further reduce smog-forming and GHG emissions from new internal combustion engine vehicles (ICEVs).

## Background of Analysis

The proposed rule will result in reduced NOx, PM2.5, and GHG emissions. Each of these pollutants presents a distinct set of challenges and risks to public health and the environment. NOx are a group of highly reactive compounds that pose direct human health impacts, such as irritation of the respiratory tract, and the worsening or triggering of asthma.<sup>4</sup> These gases are also precursor pollutants that undergo complex chemical reactions in the atmosphere to form other air pollutants of concern, such as PM2.5 and ground-level ozone (also known as smog). Breathing air with elevated concentrations of ozone is especially harmful to children, the elderly, and people of all ages who have asthma and other respiratory impairments. Breathing ozone can trigger a variety of health issues ranging from coughing to chest pain, to reduced lung function or damage.<sup>5</sup> PM2.5 is emitted directly from vehicle exhaust and formed through secondary reactions with NOx and other pollutants in the atmosphere. PM2.5 can be inhaled deeply into the lungs and transferred into the bloodstream resulting in significant health problems, such as reduced lung function, worsened asthma, non-fatal heart attacks, and premature death in individuals with heart or lung disease.<sup>6</sup> GHGs contribute to climate change causing increased risks to public health and safety, food and water resources, infrastructure, and ecosystems. Additional details on GHG emission impacts can be found below. To complete a thorough and sophisticated analysis of the

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<sup>1</sup> Criteria pollutants are those classified as such pursuant to the Clean Air Act: Oxides of nitrogen, Sulphur dioxide, Carbon monoxide, lead, ozone, and particulate matter.

<sup>2</sup> EPA - 2017 National Emissions Inventory: <https://gispub.epa.gov/neireport/2017/>

<sup>3</sup> Section 177 of the U.S. Clean Air Act (CAA) allows U.S. states to adopt California regulations that meet or exceed federal standards provided two conditions are met: (1) such standards are identical to California standards and (2) the state adopts such standards at least two years before commencement of any model year granted a waiver from the federal requirements by the U.S. Environmental Protection Agency Administrator.

<sup>4</sup> EPA – Basic Information about NO2 webpage: <https://www.epa.gov/no2-pollution/basic-information-about-no2>

<sup>5</sup> EPA – Health Effects of Ozone Pollution webpage: <https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution>

<sup>6</sup> EPA – Health and Environmental Effects of Particulate Matter (PM): <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>

emissions and economic benefits and impacts of the proposed amended Part 37, Rhode Island collaborated with several other “Section 177 states” and the Northeast States for Coordinated Air Use Management (NESCAUM). This analysis uses models such as the Motor Vehicle Emission Simulator (MOVES)<sup>7</sup>, the CO-benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)<sup>8</sup>, and other tools to aid in understanding how the implementation of these rules will benefit Rhode Islanders, and what economic impacts may result. This document also relies on the comprehensive analysis of costs and other impacts performed by the California Air Resources Board and is extrapolated here to apply to Rhode Island and the expected impacts from the adoption of the proposed Part 37 locally.

## Advanced Clean Cars II (ACCII)

Advanced Clean Cars II (ACCII) is an amendment to Rhode Island’s existing ACC program (Part 37) which covers passenger cars and light-duty trucks. The proposed amendments to Part 37 include the Low-Emission Vehicle (LEV) requirements that reduce both criteria air pollutant and greenhouse gas emissions from new internal combustion engine vehicles (ICEVs) for model year 2026 and beyond, and zero-emission vehicle (ZEV) program that increases the number of electric vehicles for sale in Rhode Island.

The proposed amendments to Part 37 require manufacturers to produce a percentage of vehicles certified to increasingly more stringent emission categories, according to schedules based on vehicle fleet emission averages for each manufacturer. The proposed amendments contains criteria air pollutant exhaust emission standards for 2026 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles<sup>9</sup>.

The proposed amended Part 37 requires that all passenger car and light-duty truck vehicles delivered by manufacturers for sale in Rhode Island by 2035 meet the definition of zero-emission vehicle (ZEV)<sup>10</sup>. A ZEV is a vehicle that produces zero vehicle exhaust emissions of any criteria air pollutant or greenhouse gas. The most common types of ZEVS are battery electric vehicles (BEV) and hydrogen fuel cell electric vehicles (FCEV). BEVs utilize batteries to store the electrical energy that powers the motor. FCEVs are fueled primarily by hydrogen stored on board to power a fuel cell in combination with a traction battery that produces electricity to power the electric motors, and may also have off-vehicle charge capability. Although not a ZEV by definition because of its internal combustion engine emissions, plug-in hybrid electric vehicles (PHEV) use a battery to power an electric motor, as well as another fuel, such as gasoline or diesel, to power an internal combustion engine.

The proposed amendments do not require that consumers purchase an electric vehicle, or that dealers sell a required volume of electric vehicles. The proposed amendments to Part 37 contain requirements imposed solely on auto manufacturers to deliver a certain annual percentage of ZEVs to Rhode Island, increasing to 100% ZEVs by 2035. The annual ZEV requirement aligns with where the market is expected to be in 2026 and continues to ramp up quickly. Small volume manufacturers must comply with the annual ZEV requirement beginning with the 2035 model year. **Figure 1. Proposed Annual ZEV Requirement** below summarizes the ZEV requirement:

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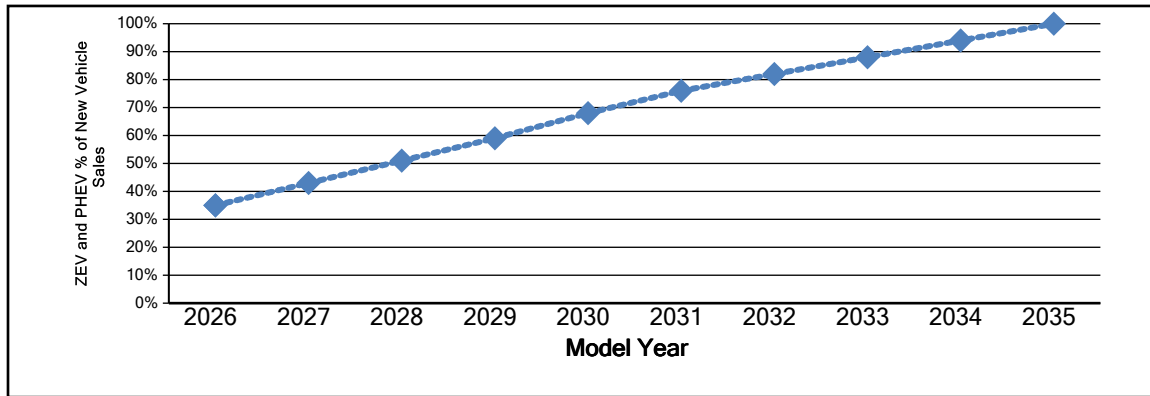
<sup>7</sup> EPA – MOVES and Other Mobile Source Emissions Models webpage: <https://www.epa.gov/moves>

<sup>8</sup> EPA – Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool webpage: <https://www.epa.gov/cobra>

<sup>9</sup> CARB Proposed Regulation Order, 13 CCR § 1961.4, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/appa1.pdf>. CARB Proposed Regulation Order, 13 CCR § 1962.4, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/appa5.pdf>

<sup>10</sup> CARB Proposed Regulation Order, 13 CCR § 1962.4, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/appa5.pdf>

Figure 1. Proposed Annual ZEV Requirement



Manufacturers earn credits for each certified ZEV produced for sale in Rhode Island and partial credits for PHEVs. These credits may be earned previously by the manufacturer starting with model year 2024 or acquired from another party. ZEV credits can also be earned by early compliance with ZEV requirements and through the environmental justice vehicle value option. The environmental justice vehicles value option will incentivize automakers to invest in community carshare programs, produce more affordable ZEVs, and ensure that more used ZEVs are available. To provide flexibility for manufacturers for model years 2026 through 2030, ACCII includes “pooling” which allows manufacturers to move a specified percentage of excess ZEV and PHEV credit values earned in one state for use in another state where there is a shortfall relative to the requirement.

The proposed amendment also includes enhanced consumer protection measures to improve vehicle warranties and ensure durability of battery technology. These ZEV assurance measures are necessary to ensure both that ZEVs function as expected over their lifetimes and that consumers are not deterred from purchasing them both new and used. For example, ZEVs must meet the following requirements:

- Minimum certification range value greater than or equal to 200 miles, determined by California according to the 2026 ZEV and PHEV Test Procedures.
- Minimum durability requirement for useful life, designed to maintain 80% or more of the certification range value for a useful life of 10 years or 150,000 miles, which occurs first, and comply with data reporting requirements.
- Battery labeling requirements for recyclability and repurposing.
- Data standardization including battery state of health to determine the current level of deterioration in the battery relative to when it was new.
- Service information requirements to disclose repair information to independent repair shops.
- Minimum warranty requirements to provide protection for consumers that experience failures or defects early in the life of the vehicle.
- Onboard diagnostics requirements to track and diagnose emission failures.
- Charging requirements, including an on-board charger with a minimum charging capability

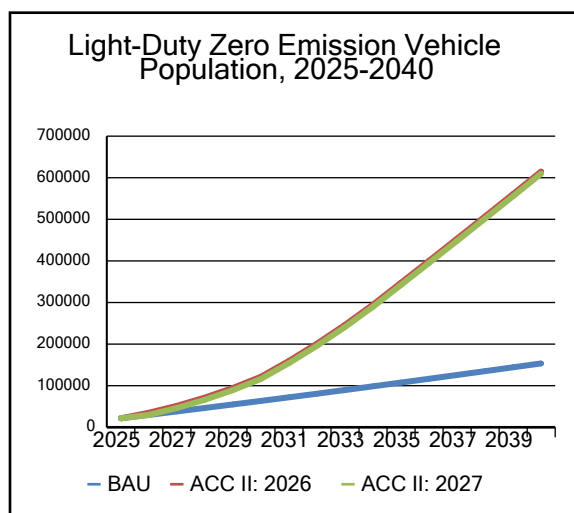
To date, 17 states<sup>11</sup> have adopted all or part of California’s low-emission and zero-emission vehicle regulations, as allowed under Section 177 of the CAA. The California Air Resources Board (CARB) adopted the new Advanced Clean Cars II standards in August 2022. To adopt ACCII, California adopted California Code of Regulations (CCR) Title 13 sections 1961.4, 1962.4, 1962.5, 1962.6, 1962.7, and 1962.8, and amended CCR title 13, sections 1900, 1961.2, 1961.3, 1962.2, 1962.3, 1965,

<sup>11</sup> States that have adopted California’s Vehicles Standards under Section 177 of the Federal Clean Air Act. [https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177\\_states\\_05132022\\_NADA\\_sales\\_r2\\_ac.pdf](https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf)

1968.2, 1969, 1976, 1978, 2037, 2038, 2112, 2139, 2140, 2147, 2317, 2903. These provisions will be incorporated by reference in 250-RICR-120-05-37.

Rhode Island has previously adopted California emissions standards for light-duty vehicles with advanced clean cars regulations to address model years 2015-2025. Figure 2 illustrates the potential growth in ZEV population over time.

Figure 2. Light-Duty Zero Emission Vehicle Population, 2025-2040



The proposed amendments address model years 2026-2035. Under the Clean Air Act, states must give manufacturers a two-year “lead-time” when adopting the new motor vehicle emissions standards before the regulation can go into effect. And because vehicle model years are often one year ahead of the calendar year, that means in order to participate in the first year of the requirements in the California ACCII (model year 2026) regulations, Rhode Island must adopt the proposed Part 37 by the end of calendar year 2022. Rhode Island will not be able to adopt this rule in time to mirror the 2026 model year implementation date in California due to the two-model year lead time requirement. If adopted, the proposed amendments to Part 37 will be incorporated by reference in Part 37 for model years 2027-2035, providing two years in advance of January 2, 2026, or January 2, 2024.

For more information on ACCII, see CARBS’s Initial Statement of Reasons and background materials<sup>12</sup>.

## ACC II: Economic and Societal Benefits and Costs For Vehicle Manufacturers

The proposed amendments to Part 37 implementing the ACCII requirements will require vehicle manufacturers to produce and sell new vehicles that initially will have a higher incremental cost than the baseline (i.e. without the regulation) for most vehicle classifications. This incremental cost will come from both complying with the ZEV requirements, which affect passenger cars and light-duty trucks, and from the LEV requirements, which affect passenger cars, light-duty trucks, and medium-duty vehicles.

CARB conducted a sophisticated economic analysis of the cost of compliance for each aspect of the regulation, for each model year, and for each vehicle type<sup>13</sup>. Based on this analysis and considering

<sup>12</sup> CARB, Advanced Clean Cars II, Initial Statement of Reasons (Hereinafter ACCII ISOR), <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf> ; CARB, Advanced Clean Cars II, Public Materials, <https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii>

<sup>13</sup> For more information on the methodology used by CARB, see pages 49 through 86 of the [ACCII Standardized Regulatory Impact Assessment](#) (Hereinafter ACCII SRIA), also see Section X and Appendices G and H of the ACCII ISOR, and Section VI of the ACCII Final Statement of Reason for Rulemaking (Hereinafter ACCII FSOR) Appendix F.

the total cost of complying with the LEV and ZEV requirements, CARB also estimated the average incremental cost per vehicle<sup>14</sup>. Ultimately, however, CARB assumes that vehicle manufacturers will pass these higher costs on to car buyers through increased vehicle prices<sup>15</sup>. For example, as a simplifying assumption, the cumulative incremental costs per manufacturer are divided equally over all new vehicles sold in California to provide an average incremental retail price per car. For model year 2027, an average incremental cost is equal to \$1,036. Rhode Island assumes the same compliance costs as prepared by CARB.

## ACC II: Economic and Societal Benefits and Costs For Individuals

The proposed amendments to Part 37 will benefit Rhode Islanders mainly from the reductions in NOx emissions resulting in reduced ozone exposure and reduced PM exposure from the secondary formation of Ozone and PM2.5, improving Rhode Island air quality and reducing adverse health impacts.

The proposed ACCII amendments in Part 37 will reduce NOx, PM2.5, and GHG emissions. Reductions in NOx and PM2.5 emissions result in health benefits for individual Rhode Islanders, including reduced instances of premature deaths, hospitalizations for cardiovascular and respiratory illnesses, and emergency room visits.

The analysis of program benefits was conducted by Sonoma Technology, Inc. (STI), with technical input on data and methods from the International Council on Clean Transportation (ICCT) and NESCAUM. The annual health benefits of Rhode Island’s adoption of ACCII in the proposed amendments to Part 37 were estimated using U.S. EPA’s CO-Benefits Risk Assessment (COBRA) screening model. Utilizing the COBRA model is generally consistent with EPA practice for estimating avoided health impacts and monetized benefits. The COBRA model estimates impacts to particulate matter (PM) air pollution concentrations, which are translated into health outcomes. Table 1 shows the estimated total cost savings from avoided premature deaths, avoided hospitalizations for cardiovascular and respiratory illnesses, and avoided emergency room visits due to a reduction in criteria pollutant emissions resulting from the proposed ACCII implementation for the year 2040 in Rhode Island, relative to the baseline. The analysis year 2040 was chosen to align with California’s approach. If an earlier analysis year was chosen the benefits would be small because the sales would not have resulted in significant vehicle turnover at that point. Note that this analysis does not include costs avoided due to reductions in GHG emissions. In general, adopting ACCII reduces on-road mobile source emissions but would increase electric generation emissions. Even though electric generation would increase, 100% of electricity in RI will be offset by renewable production by 2033. The net benefit of these emission changes in Rhode Island is \$60.7 million dollars.

*Table 1. Annual COBRA-estimated economic values of Rhode Island adopting ACCII, in millions of US dollars*

Analysis Year	Total Nox Reduction (Tons per year-TPY)*	Total PM2.5 Reduction (TPY)*	In-State Benefit**	Out-Of-State Benefit**	In-State Burden** *	Out-Of-State Burden** *	Net Benefit** **
2040	152	9	32.5	28.2	0	0	\$60.7

\*Emissions reduction in tons per year

\*\*The benefit of reduced on-road emissions

\*\*\*The burden of increased electric generation emissions

\*\*\*\*The sum of in-state and out-of-state benefits and burdens

<sup>14</sup> ACCII FSOR, Table VI-1.

<sup>15</sup> ACCII SRIA, Page 85. <https://dof.ca.gov/wp-content/uploads/Forecasting/Economics/Documents/ACCII-SRIA.pdf>



While the proposed amendments to Part 37 would not result in any direct costs to individuals, car buyers will be indirectly affected. As discussed above vehicle manufacturers are expected to see increased costs as a result of the requirements in ACCII, and they will likely pass the costs on to individuals through higher vehicle prices. Thus, it is important to understand any indirect costs to individual consumers.

Individual vehicle consumers, for most ZEVs in the program, will see cost savings when considering the total cost of ownership (TCO). As seen in Table 2, results show that for BEVs, operational savings will offset any incremental costs over the 10-year period evaluated. For example, a passenger car BEV with a 300-mile range will have initial annual savings occur in the first year for the 2026 model year technology. For the 2035 model year technology, the initial savings are nearly immediate and cumulative savings over ten years exceed \$7,500. These TCO savings are even more favorable for a BEV owner who has access to a home charger.

The proposed amendments to Part 37 will have an impact on individual vehicle owners in Rhode Island in the form of operation and ownership costs. CARB conducted a comprehensive analysis to determine the total cost of ownership (TCO) relative to internal combustion engine vehicles (ICEVs) for battery electric vehicles (BEVs), plug-in hybrid vehicles (PHEVs), and fuel cell electric vehicles (FCEVs). CARB found that most ZEV purchasers are estimated to realize significant operational savings, through reduced fuel/energy costs and repair and maintenance costs, such that the TCO results in a net savings within the first year of vehicle ownership. As CARB describes in the ISOR<sup>16</sup>:

These costs include the costs impacts of installing an electrical receptacle for electric vehicle supply equipment (EVSE) for purchasers of ZEVs, fuel costs, difference in maintenance costs, registration costs, and insurance costs over a ten-year period. These costs are combined with the incremental vehicle prices to estimate the total cost of ownership (TCO) during the period of proposed amended Part 37. An analysis<sup>17</sup> of the TCO for individual vehicle owners conducted by the CARB concludes that operational savings will offset and incremental costs of the initial electric vehicle purchase.

For fuel cell electric vehicles (FCEV) and plug-in hybrid EVs (PHEVs), neither type of vehicle will have a payback within a ten-year period. As of the date of writing, the average price of a gallon of gasoline and diesel have reached record-high levels in Rhode Island.<sup>18</sup> The TCO analysis conducted in California uses lower fuel prices that pre-date this price increase, therefore an updated analysis using today’s average prices would show that the difference in TCO between a BEV and an ICEV is more beneficial for the BEV owner, with a likely sooner date for initial savings to occur.

*Table 2. Total cost of ownership over 10 years for individual ZEV and PHEV buyer compared to baseline ICEV, 2026MY passenger car in a single-family home*

	BEV (300-mile range)		FCEV	PHEV
	With home charger	No home charger		
Incremental vehicle price	\$3,102	\$3,102	\$10,448	\$4,681
Home Level 2 circuit (not including the charger)	\$680			\$680
Finance costs & sales tax (for incr veh price and Level 2 circuit)	\$798	\$655	\$2,205	\$1,131

<sup>16</sup> ACCII ISOR, Page 15. <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf>

<sup>17</sup> ACCII ISOR, Page 144. <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf>

<sup>18</sup> See <http://gasprices.aaa.com/?state=RI>. As of December 28, 2022, the average price of gasoline in Rhode Island was \$3.701. The average price of a gallon of diesel was \$5.829.

Incremental Fuel costs	\$ (5,068)	\$ (3,306)	\$8,670	\$ (649)
Incremental Maintenance costs	\$ (4,540)	\$ (4,540)	\$ (1,249)	\$ (1,249)
Incremental Insurance	\$631	\$631	\$2,124	\$952
Incremental Registration	\$758	\$758	\$952	\$800
Total (10 years)	\$ (4,267)	\$ (3,216)	\$21,416	\$5,456
Initial annual savings	1 year	1 year	>10 years	>10 years

\*Finance costs include a 5-year loan at 5 percent interest; operation and ownership costs over 10 years (~150,000 miles) shown as net present value for 2026 at a discount rate of 10 percent.

Increasing access to ZEVs and clean mobility in low-income and frontline communities is of utmost importance. The proposed ACCII amendments to Part 37 will reduce exposure to vehicle pollution in communities that are often disproportionately impacted by motor vehicle pollution, such as near-roadway communities, by reducing emissions from ICEVs and accelerating the transition to ZEVs. Further, the proposed ZEV assurance measures will ensure these emissions benefits are long-lasting and support the development of a robust used ZEV market. In addition, the ZEV requirements incentivizes automakers to invest in community carshare programs, produce more affordable ZEVs, and ensure that more used ZEVs are available. While the proposed ACC II amendments to Part 37 will advance equity, a whole-of-government approach is needed to maximize access, ensure affordability, and direct benefits to low-income and frontline communities. Thus, other policies and programs beyond ACC II will be needed in California and the Section 177 states to ensure these communities benefit from and have direct access to ZEVs.

The proposed ACCII amendments to Part 37 also include assurance measures, which require manufacturers to provide battery and propulsion warranties. Battery warranties are currently not required for ZEVs; this proposed regulation provides consumers with assurance ZEVs purchased in 2026 or later will be durable and lasting. ZEV purchasers have the knowledge their batteries will maintain a sufficient battery state of health for the useful life of the vehicle. These warranties give car owners a consumer protection benefit that might not otherwise be guaranteed for a ZEV not certified to meet the ACCII requirement.

## ACC II: Economic and Societal Benefits and Costs For Businesses, Including Small Businesses

Businesses that will be directly affected by the proposed amendments to Part 37 include light- and medium-duty vehicle manufacturers because they are entities directly regulated and required to comply. ZEV-only manufacturers are likely to directly benefit from the regulation because they do not manufacture ICEV and will be able to over-comply and sell surplus credits to other manufacturers. Auto manufacturing is currently not occurring in Rhode Island.

Businesses that may be indirectly affected, and likely exist in Rhode Island, are suppliers of Tier 1 components supplied directly to auto manufacturers, electric vehicle service providers, electric utilities, electric charging, and hydrogen infrastructure providers. Suppliers of Tier 1 components would benefit from increased opportunities created by the need to develop, sell, and support technology to decrease emissions from ICEVs. Many of these companies are also changing their business models to include components for vehicle electrification, as demand for conventional vehicle components declines.

The proposed amendments to Part 37 will increase the total amount of electric vehicle miles traveled in the state, and the charging of those electric vehicles will increase Rhode Island's overall electric load. Electric infrastructure needed to charge BEVs and PHEVs represents a significant area of expected increased load for electric utility companies, as traditional areas of growth have slowed due to

energy conservation and energy efficiency efforts. Understanding the grid impacts of the additional load expected from electrification of the transportation system is an important consideration.

Over the next decade, ZEVs are expected to add only a small amount of electricity demand to Rhode Island's grid. California, the state with the most ZEVs in the country, has proven that ZEVs actually incur very little grid upgrade costs. Our utilities are planning for the transition to electric vehicle charging. Right now, the electrical grid can handle the current electric vehicle charging demand and can continue to support it for at least the next five years. As we look to future years, the utilities are incorporating planning and building to ensure enough energy is available for charging and what is being generated is clean. Rhode Island is committed to sourcing 100% of our energy from renewable sources by 2033. State agencies, like the Public Utilities Commission and the Rhode Island Office of Energy Resources, along with policymakers are working with utilities and implementing policies to encourage grid-friendly load growth. For example, management strategies, like time-of-use rates, will shift charging to non-peak system hours to ease grid impacts and prevent potential system overloads. Furthermore, ZEVs can be used as a grid resource and as battery storage to alleviate electricity outages, especially with proper utility investments and rate designs that shift charging to time when the grid is underutilized.

In addition to the electric utilities that will supply additional electricity to power BEVs and PHEVs under the proposed amendments to Part 37, ZEV infrastructure businesses will benefit as well. This includes companies that manufacture, install, operate, and maintain EV charging stations and hydrogen dispensing equipment. Electric Vehicle Supply Equipment (EVSE) providers, and hydrogen station operators will all benefit from increased demand for their equipment with home and public fueling stations. The proposed regulation will increase the total amount of electric vehicle miles traveled in the state, which in turn will likely increase utilization of charging and hydrogen stations across the state and lead to increased revenue for these businesses, making the business model for their investment more stable and predictable. This allows investor capital and venture capital funds to be accessed for increased deployment rates of ZEV infrastructure. Increased use of public charging stations may also have benefits to retail businesses operating or close to charging stations. Many charging stations are located in areas with available shopping, food, or other services such as dry cleaning. Additionally, Rhode Island businesses that are contracted to install stations will benefit from the rapidly growing network.

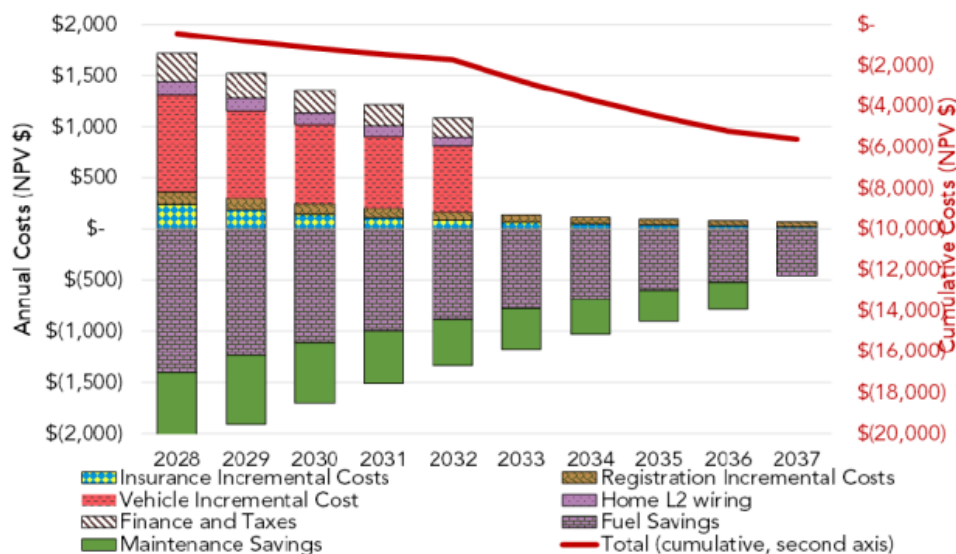
Typical passenger car rental businesses could see increasing incremental purchase costs for vehicles over the course of the regulation as stringency increases. At the same time, rental firms would benefit from operational savings due to the reduction in repair and maintenance costs. There may also be an increased cost for electricity depending on whether the rental business or the driver ends up bearing the costs of vehicle charging, though reduced gasoline usage leads to net fuel savings in nearly all cases.

ZEVs inherently have far fewer propulsion-related parts especially mechanical moving parts as electric motors and power electronics dominate the electric drive propulsion system instead of mechanical internal combustion engines and automatic transmissions comprised of mechanical components like valves, springs, and gears. As a result, it is expected that individual ZEVs will likely need fewer propulsion-related repairs than gasoline vehicles. While this will be a benefit to individual vehicle owners, the vehicle repair and maintenance service industry is estimated to see negative impacts, including dealerships that have service departments, as ZEVs become a greater portion of the fleet. This trend would suggest that the number of businesses providing the services may decrease along with the reduced demand.

The proposed amendments to Part 37 would provide operational savings to small businesses and small fleet owners, although the proposed regulation could increase initial vehicle prices and incremental costs on small fleet owners in the early years of the regulation. The proposed ZEV assurance measures would help owners of small fleets by eliminating or greatly limiting subsequent out-of-pocket costs for vehicle repairs during the time the vehicle is under warranty. In addition, the enhanced useful life and warranty reporting and battery warranty provisions would encourage manufacturers to produce more

durable components, resulting in fewer failures and less downtime for the small fleet owner. Small businesses would also benefit from operational and fuel savings. In an example analysis conducted by CARB<sup>19</sup>, a cost example for a small business that purchases a typical full-size light truck for business use is considered and the total cost of ownership analyzed over time. This result shows that the business owner breaks even at year six as annual savings accumulate sufficient to compensate for expenses. By the tenth year, the owner has saved nearly \$5,500 in total ownership costs.

Figure 3. Small business light-duty fleet purchase cost example



## Advanced Clean Trucks (ACT)

The Advanced Clean Trucks Rule (ACT) is a new regulatory program that has been adopted and implemented in California and a number of other states, including, but not limited to New York, Massachusetts, New Jersey, Oregon, and Vermont. Rhode Island has had limited to no regulations covering emissions from medium-and heavy-duty vehicles, this rule will be incorporated by amendment in Part 37.

The purpose of the ACT Rule is to accelerate the widespread adoption of ZEVs in the medium-and heavy-duty truck sector and reduce the amount of harmful emissions generated from on-road trucks. The ACT Rule applies to manufacturers of medium- and heavy-duty vehicles over 8,500 pounds gross vehicle weight rating (GVWR)<sup>20</sup> which includes passenger vans, buses, pickups, vocational trucks, box trucks, and tractor-trailer combinations used locally and for long-haul applications (Figure 4).

The ACT Rule has two main components, a manufacturers ZEV sales requirement and a one-time reporting requirement for large entities and fleets. In this rulemaking, the Department does not plan to adopt the one-time reporting requirement for large entities and fleets because Department currently lacks the staff capacity and resources to facilitate data collection and then process the volume of data and information this requirement will generate. The Department intends to adopt this reporting requirement at a later date as resources allow.

The ACT Rule requires manufacturers to sell ZEV trucks as an increasing percentage of their annual sales from model years 2025 to 2035, beginning with the model year 2027 in Rhode Island (Table

<sup>19</sup> ACCII SRIA, Page 102. <https://dof.ca.gov/wp-content/uploads/Forecasting/Economics/Documents/ACCII-SRIA.pdf>

<sup>20</sup> GVWR generally refers to the weight specified by the manufacturer as the loaded weight of a single vehicle

3).<sup>21</sup> Manufacturers with annual state sales less than 500 units are exempt from the ZEV sales requirement but can opt-in to earn credits for selling ZEVs. As with ACCII, this is not a requirement that fleet owners or truck operators purchase electric vehicles, but a requirement on the manufacturers of medium- and heavy-duty trucks to transition from diesel trucks and vans to electric zero-emission trucks beginning in model year 2027. The ACT requires the sale of at least 30% zero-emission trucks by 2030 (depending on vehicle classification). By model year 2035, zero-emission truck sales would need to be 55% of Class 2b – 3 truck sales, 75% of Class 4 – 8 truck sales, and 40% of truck tractor sales. Light-duty trucks (e.g., the F-150 Lightning) are covered under ACCII, discussed above.

Table 3. Manufacturer ZEV Sales Requirements Based on the Total Sales

Model Year	Class 2b-3	Class 4-8	Class 7-8 Tractors
2027	15%	20%	15%
2028	20%	30%	20%
2029	25%	40%	25%
2030	30%	50%	30%
2031	35%	55%	35%
2032	40%	60%	40%
2033	45%	65%	40%
2034	50%	70%	40%
2035+	55%	75%	40%

Figure 4. Examples of Vehicle Classes covered under ACT



Table 4 below presents the estimated MHD truck and bus population in Rhode Island by powertrain type, conventional or electric, between 2025 and 2050. These projections include all ZEVs, regardless of whether they are produced to meet the requirements of the ACT program or the GHG Phase II program, and assume 100% MHD ZEV sales beginning in model year 2040. The accompanying

<sup>21</sup> CARB, Final Regulation Order, Advanced Clean Trucks, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fro2.pdf>

spreadsheet includes additional projections reflecting the ACT program individually and also provides more detailed projections by vehicle weight class.

*Table 4. MHD Truck and Bus Population Projections in Rhode Island*

Year	MHD Vehicle Population		
	Internal combustion engine vehicle	Zero emission vehicles	Total
2025	49,148	262	49,410
2030	46,631	3,029	49,660
2035	43,511	9,419	52,930
2040	37,587	18,603	56,190
2045	27,293	32,377	59,670
2050	18,152	45,008	63,160

Note: The M/HD vehicle category includes all vehicles with a Gross Vehicle Weight Rating of 8500 pounds or higher. Estimates for 2040 and later include 100% ZEV sales beginning with the model year 2040. ZEV sales projections for baseline and ACT-only scenarios—without a 100% requirement in 2040—can be found in the accompanying Excel workbook.

California adopted the ACT regulation on January 26, 2021, at California Code of Regulations Title 13 sections 1963 through 1963.5 and sections 2012 through 2012.2. ACT addresses model years 2024 and subsequent years. Under the Clean Air Act, states must give manufacturers a two-year “lead-time” when adopting the ACT rule before the regulation can go into effect. And because vehicle model years are often one year ahead of the calendar year. These provisions will be incorporated by reference in 250-RICR-120-05-37. Rhode Island will not be able to adopt this rule in time to mirror the implementation date in California due to the two-model year lead time requirement explained in the background above. To maximize emission reductions projected to be achieved via the ACT rule starting with the model year 2027, the Department must adopt this rule by January 2, 2024.

For more information on ACT, see CARB’s Final Statement of Reasons.<sup>22</sup>

## Heavy-Duty Engine and Vehicle Omnibus Rule (HD Omnibus)

The Heavy-Duty Engine and Vehicle Omnibus (HD Omnibus) Rule and associated amendments require Nox emissions reductions from new on-road heavy-duty engines and vehicles, and ensure emission reductions are maintained as those engines and vehicles are operated.<sup>23</sup> The HD Omnibus Rule requires a 90% reduction in Nox emission from model year 2027 engines.

The HD Omnibus includes the following amendments summarized below:

- Exhaust Emissions Standards and Test Procedures for 2024 and Subsequent Model Year Heavy-Duty Engines and Vehicles,
- Heavy-Duty On-Board Diagnostic System Requirements,
- Heavy-Duty In-Use Testing Program,
- Emissions Warranty Period and Useful Life Requirements,

<sup>22</sup> CARB, Advanced Clean Trucks Regulation, Final Statement of Reasons, <http://ww2.arb.ca.gov/sites/default/files/barcu/regact/2019/act2019/fsor.pdf>

<sup>23</sup> 2 CARB, Title 13, Final Regulation Order, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hdomnibuslownox/froa-1.pdf> ; CARB, Title 17, Final Regulation Order, <https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/froa2.pdf>.



- Emissions Warranty Information and Reporting Requirements, and Corrective Action Procedures,
- In-Use Emissions Data Reporting Requirements,
- Phase 2 Heavy-Duty Greenhouse Gas Regulations, and
- Powertrain Test Procedures.

The HD Omnibus includes exhaust emission standards for low oxides of nitrogen (Nox) and particulate matter (PM) that would apply to heavy-duty Otto-cycle and diesel engines intended for use in vehicle service classes with gross vehicle weight ratings (GVWR) greater than 10,000 pounds.

The HD Omnibus Rule includes an emissions averaging, banking, and trading program that would allow manufacturers that elect to produce and certify heavy-duty zero-emission vehicles (ZEV) to generate Nox credits, in order to incentivize the sales of heavy-duty ZEVs earlier than would be required by the Advanced Clean Trucks (ACT) Regulation.

To legally sell new engines, manufacturers must certify that their engines will comply with applicable emission standards throughout a specified period called the regulatory useful life. This ensures that manufacturers consider deterioration in emissions performance in the initial design of the engine. Manufacturers demonstrate that the emissions from engines meet emission standards at the time of certification using a durability demonstration program (DDP) which simulates heavy-duty engine and emission-related control component aging throughout the applicable useful life period.

To help ensure that emission controls are sufficiently durable to control emissions over applicable useful life periods, and well-maintained and repaired when needed, the HD Omnibus Rule lengthens the criteria pollutant emissions warranty and useful life period requirements for heavy-duty vehicles and engines. For components that fail under warranty, manufacturers may be required to report certain data to CARB and Rhode Island. If failure rates are high enough, manufacturers are required to conduct corrective actions such as recalling faulty components.

The HD Omnibus Rule requires manufacturers to test engines while they are operated on the road using portable emissions measurement systems. All heavy-duty engine manufacturers must conduct heavy-duty in-use testing (HDIUT) on their engine families, as specified by CARB which evaluates the in-use test data via the not-to-exceed (NTE) method. CARB also has the ability to independently test any engine family through CARB's in-house Heavy-Duty In-Use Compliance Program (HDIUC). Engine families that fail test requirements are subject to potential recall.

The HD Omnibus provides manufacturers an option to certify hybrid powertrains to criteria pollutant emission standards using specified hybrid-powertrain testing procedures. The hybrid-powertrain testing procedures would align with federal powertrain testing procedures and would be based on the U.S. EPA Phase 2 GHG technical amendments for powertrain testing. Powertrain testing provides an alternative to testing just the engine of a vehicle and enables manufacturers to quantify the impact of vehicle technologies such as hybridization that cannot be easily tested on an engine dynamometer.

California adopted HD Omnibus regulations on September 9, 2021, by amending California Code of Regulations Title 13 sections 1900, 1956.8, 1961.2, 1965, 1968.2, 1971.1, 1971.5, 2035, 2036, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2121, 2123, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2133, 2137, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2423, and 2485 and 17 CCR 95662 and 95663 and adopting new 13 CCR 2139.5, 2166, 2166.1, 2167, 2168, 2169, 2169.1, 2169.2, 2169.3, 2169.4, 2169.5, 2169.6, 2169.7, 2169.8, and 2170. These provisions will be incorporated by reference in Part 37. For more information on the HD Omnibus Rule, see CARB's Final Statement of Reasons.<sup>24</sup>

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<sup>24</sup> CARB, Heavy-Duty Engine and Vehicle Omnibus Regulation, Final Statement of Reasons for Rulemaking, <https://ww2.arb.ca.gov/sites/default/files/barcu/board/rulemaking/hdomnibuslownox/fsor.pdf>

## Phase 2 Greenhouse Gas Rule (Phase 2 GHG)

The Phase 2 GHG Rule sets standards to reduce GHG emissions associated with medium- and heavy-duty engines, vocational vehicles<sup>25</sup>, heavy-duty pick-up trucks and vans (PUVs)<sup>26</sup>, and applicable tractors and trailers. The Phase 2 GHG Rule requires manufacturers to improve existing technologies or develop new technologies to meet GHG emission standards. It also amends requirements for glider vehicles, glider engines, and glider kits.<sup>27</sup>

The Phase 2 GHG Rule sets new more stringent GHG emission standards for medium- and heavy-duty engines, tractors, vocational vehicles, PUVs, and trailers that are sold in Rhode Island.<sup>28</sup> These emission standards largely harmonize with the structure, timing, and stringency of federal Phase 2 standards jointly adopted by the U.S. EPA and the Department of Transportation's National Highway Traffic Safety Administration in 2016, providing nationwide consistency for engine and vehicle manufacturers.<sup>29</sup> The Phase 2 GHG requirements would apply to model year 2026 and newer Class 2b to 8 medium- and heavy-duty vehicles with greater than 8,500 pounds GVWR and the engines that power them, except for medium-duty passenger vehicles already covered in the light-duty regulations. To meet the proposed standards, regulated manufacturers are expected to apply GHG-reducing technologies, and may additionally elect to take advantage of credit opportunities.

**For medium- and heavy-duty vehicles**, the Phase 2 GHG requirements would apply to model year 2026 and newer class 2b to 8 medium- and heavy-duty vehicles with greater than 8,500 pounds GVWR and the engines that power them, except for medium-duty passenger vehicles already covered in the light-duty regulations.

**For vocational vehicles**, the Phase 2 GHG Rule establishes CO<sub>2</sub> standards (in grams emitted from carrying a ton of cargo over a distance of one mile (g/ton-mile)) for vocational vehicles that fall within 15 subcategories, distinguished by GVWR, duty cycle, and engine type (diesel vs. gasoline). Manufacturers of motor homes, coach buses, other buses (excluding transit buses), school buses, refuse trucks, cement mixers, and emergency vehicles have an option to certify those vehicles with less stringent standards than the primary vocational standards.

**For PUVs**, the Phase 2 emission standards are based on a “work factor” attribute that combines truck payload and towing capabilities, with an added adjustment for 4-wheel drive vehicles. There are separate target curves for diesel-powered and gasoline-powered vehicles. The PUV standards are expressed in gCO<sub>2</sub>/mile. PUVs, many of which are ¾ and 1-ton pick-up trucks, 12- and 15- passenger vans, and large work vans, are comprised of two classes of vehicles: Class 2b and 3. Heavy-duty vehicles with GVWR between 8,501 and 10,000 lbs. are classified in the industry as Class 2b motor vehicles. Heavy-duty vehicles with GVWR between 10,001 and 14,000 lbs. are classified as Class 3 motor vehicles.

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<sup>25</sup> Vocational vehicles include, but are not limited to, delivery vehicles, refuse vehicles, and transit buses and have three regulatory categories according to GVWR: light heavy-duty (LHD) vehicles that range from 8,501 to 19,500 pounds, medium heavy-duty (MHD) vehicles that range from 19,501 to 33,000 pounds, and heavy heavy-duty (HHD) I-4 vehicles that have greater than 33,000 pounds

<sup>26</sup> In the U.S. EPA's Phase 2 GHG Rule, EPA uses the term “heavy-duty pickups and vans” while the California regulation uses the term PUVs for these same vehicle types (i.e., class 2b vehicles with GVWR of 8,501 to 10,000 pounds and class 3 vehicles with GVWR of 10,001 to 14,000 pounds).

<sup>27</sup> A “glider vehicle” is a vehicle where the chassis and cab assembly is produced by a vehicle manufacturer without a new engine, transmission, or rear axle and a third party installs an engine, transmission, and/or rear axle to complete the vehicle.

<sup>28</sup> Greenhouse Gas Exhaust Emission Standards and Test Procedures for New 2014 and Subsequent Model Heavy-duty Vehicles, 17 CCR § 95663.

<sup>29</sup> Final Rule for Phase 2 Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rulephase-2-greenhouse-gas-emissions-standards>. Note, CARB and U.S. EPA use different terminology for vehicles in various weight classes. The main difference is the use of the terms medium-duty vehicles and medium-duty engines.



**For tractors**, Phase 2 emissions standards apply to ten subcategories of tractors, Class 7 and 8, and above 26,000 pounds GVWR. The engine and vehicle technologies employed to meet these standards will vary by tractor subcategory.

**For trailers**, the Phase 2 GHG Rule establishes separate standards for full aero box vans, partial aero box vans, non-aero box vans, and non-box trailers. A full aero box van is a box van that does not have any side or rear work performing equipment that would inhibit the application of aerodynamic technologies. A partial-aero box van has either side or rear work-performing equipment, but not both. A non-aero box van has both side and rear work performing equipment. Examples of work performing equipment include lift gates, access doors, and belly boxes. Examples of non-box trailers include flatbed, tanker, and container chassis trailers. The federal Phase 2 regulation also establishes separate standards for long box vans and short box vans. A short box van is less than or equal to 50 feet in length. A long box van is greater than 50 feet in length.

The exhaust emission standards specified in this rule apply to trailers based on the effect of trailer designs on the performance of the trailer in conjunction with a tractor; this accounts for the effect of the trailer on the tractor's exhaust emissions, even though trailers themselves have no exhaust emissions. Trailer fleet owners have the option of either purchasing Phase 2 certified trailers, or installing Phase 2 approved aerodynamic technologies and low-rolling resistance (LRR) tires to meet the requirements.

Additional elements of the Phase 2 GHG Rule include:

- Phase 2 certification requires manufacturers to submit certification information directly to CARB for an independent review and approval. Engine and vehicle families for which the U.S. EPA has issued a federal Certificate of Conformity would not be automatically “deemed to comply” with the California Phase 2 requirements.
- Additional vehicle labels are required for vocational vehicles and tractors to identify emission control systems that can be visually inspected by enforcement staff.
- Additional reporting of engine and A/C system-related information is required by manufacturers in initial certification information and each certified vehicle's end-of-year report.
- Manufacturers of motor homes, coach buses, school buses, refuse trucks, cement mixers, and emergency vehicles have an option to certify those vehicles with a less stringent process called “custom chassis”. Custom chassis standards are significantly less stringent than the primary vocational vehicle standards and include a simplified certification process. This optional less stringent standard is not available for transit buses.
- Additional credit provisions would encourage the use of low global warming potential (GWP) refrigerants, the sale of PHEVs with a minimum all-electric range and low Nox emissions, and the manufacture of lower-emitting transit buses.
- Additional “light-duty style” consumer labels required for PUVs to provide consumers with easy-to-read information on the relative GHG emission performance of a particular PUV model as compared to other similar PUVs.

California adopted the federal Phase 2 GHG regulations plus California distinctions on December 11, 2018, by amending California Code of Regulations Title 13 sections 1956.8, 1961.2, 1965, 2036, 2037, 2065, 2112, and 2141 and 17 CCR 95662 and 95663. The Department is proposing to adopt these amendments, as well as to adopt 17 CCR 95660 (Purpose) and 95661 (Applicability), which is part of California's Phase 2 GHG Standards, but which were pre-existing sections California did not need to amend. These provisions will be incorporated by reference in Part 37. For more information on the Phase 2 GHG Rule, see CARB's Final Statement of Reasons.<sup>30</sup>

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<sup>30</sup> CARB, Final Statement of Reasons for Rulemaking, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/phase2/fsor.pdf> ; see also CARB, Initial Statement of Reasons, <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/phase2/isor.pdf> .

## ACT/HD Omnibus/Phase 2 GHG Rules: Economic and Societal Benefits and Costs For Individuals

The implementation of the ACT and HD Omnibus requirements in the proposed Part 37 impose requirements on vehicle manufacturers to produce and sell vehicles that may have higher upfront costs. These costs are expected to be passed on to Rhode Island vehicle fleets and individuals who purchase these vehicles, resulting in indirect impacts to those entities and individuals. The Phase 2 GHG regulation imposes requirements on medium- and heavy-duty engines, vehicles, and trailer manufacturers, which results in increased compliance costs that are also expected to be passed on to Rhode Island vehicle fleets and individuals who purchase these vehicles and trailers. While there are no direct costs to individuals as a result of these regulations, the positive and negative indirect impacts to small businesses, which may impact individuals who own fleets or a single medium or heavy-duty vehicle, are discussed below.

For the ACT requirements in the proposed Part 37, individuals may see health benefits due to ZEVs displacing ICE vehicles and providing statewide, regional, and local emission benefits. Individuals are also likely to benefit from cost savings as a result of reduced fuel consumption and fuel costs. Cost savings are also likely due to the enhanced warranty requirements of ACT and the HD Omnibus Rules. These warranty provisions should result in longer useful life of the subject vehicles, and broader coverage of warranty repairs within the subject vehicle’s warranty period.

The implementation of the ACT requirements in the proposed Part 37 will reduce NOx, PM2.5, and GHG emissions, while the proposed HD Omnibus requirements in Part 37 will reduce NOx and secondary PM.25 formation since NOx is a precursor to secondary PM2.5 formation. The proposed Phase 2 GHG requirements in the proposed Part 37 will require heavy-duty trucks and trailers to reduce GHG emissions. Reductions in NOx and PM2.5 emissions result in health benefits for Rhode Islanders, including reduced instances of premature deaths, hospitalizations for cardiovascular and respiratory illnesses, and emergency room visits.

To understand the impact these amendments to Part 37 could have on medium- and heavy-duty vehicle emissions in Rhode Island, Rhode Island partnered with NESCAUM and the International Council on Clean Transportation (ICCT) who commissioned Sonoma Technology, Inc (SIT) to estimate cumulative avoided NOx, PM2.5, and carbon dioxide equivalent (CO2e) emission reductions beginning in 2025 from Advanced Clean Trucks, the HD Omnibus Rule, and the Phase 2 GHG Rule. As part of the analysis, a business as usual (BAU) case was developed along with three regulatory scenarios: Omnibus only, ACT only, and Omnibus and ACT combined. An additional scenario reflecting 100% MHD ZEV sales in 2040 is also included.

Table 5<sup>31</sup>, below shows the estimated cumulative emissions avoided between 2020 and 2050 in Rhode Island compared to the Business as Usual (BAU) emissions scenario. These results reflect the benefits of all M/HD ZEVs following California’s approach to estimating in-use fleet penetration under the ACT program without adjustments to account for vehicles purchased out-of-state, ZEVs that may migrate out-of-state over time, or ZEVs that would have been produced to meet other requirements like the federal GHG Phase II standards. For estimates with these adjustments, which enable direct comparisons to California Air Resources Board ACT benefits estimates, please refer to the ‘ACT-only’ scenario results included in the accompanying spreadsheet files.

*Table 5. Cumulative MHD emissions benefits in Rhode Island compared to BAU, 2020-2050.*

Program	Cumulative emissions reductions		
	NOx (U.S. tons)	PM2.5 (U.S. tons)	CO2e (million metric)

<sup>31</sup> The ICCT and STI – Benefits of adopting California medium- and heavy-duty vehicle regulations under Clean Air Act Section 177

			tones)
ACT	9,250	76	8.88
HD Omni	6,680	N/A	N/A
ACT + HD Omni	13,080	76	8.88
ACT + HD Omni + 100% HD ZEV sales in 2040	15,900	119	11.49

Figure 5, Figure 6, and Figure 7 illustrate the emissions trends in Rhode Island over the timeframe of the analysis.

Figure 5. Tank-to-wheel HDV NO<sub>x</sub> emissions by scenario 2020-2050

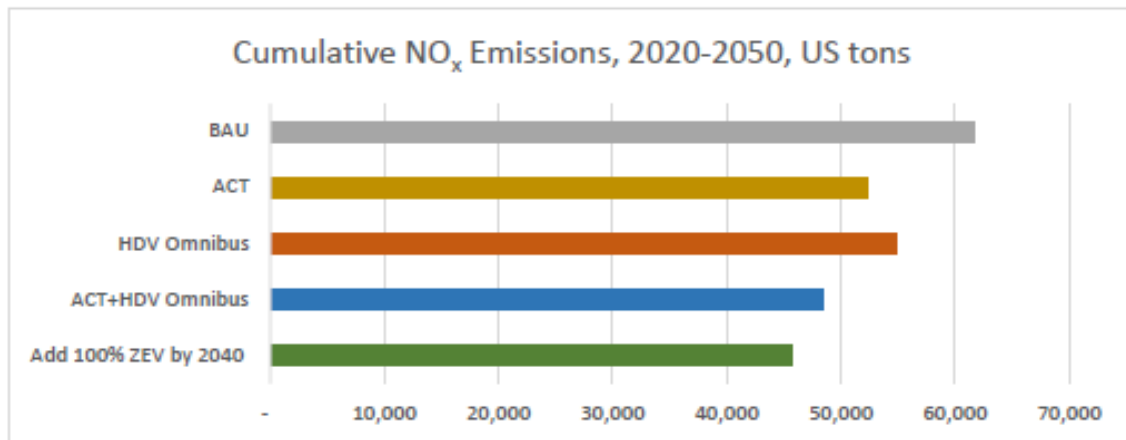


Figure 6. Tank-to-wheel HDV PM emissions by scenario 2020-2050

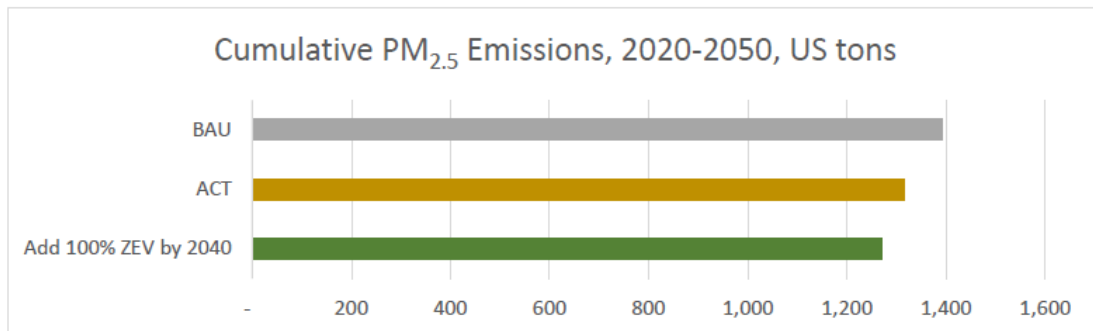
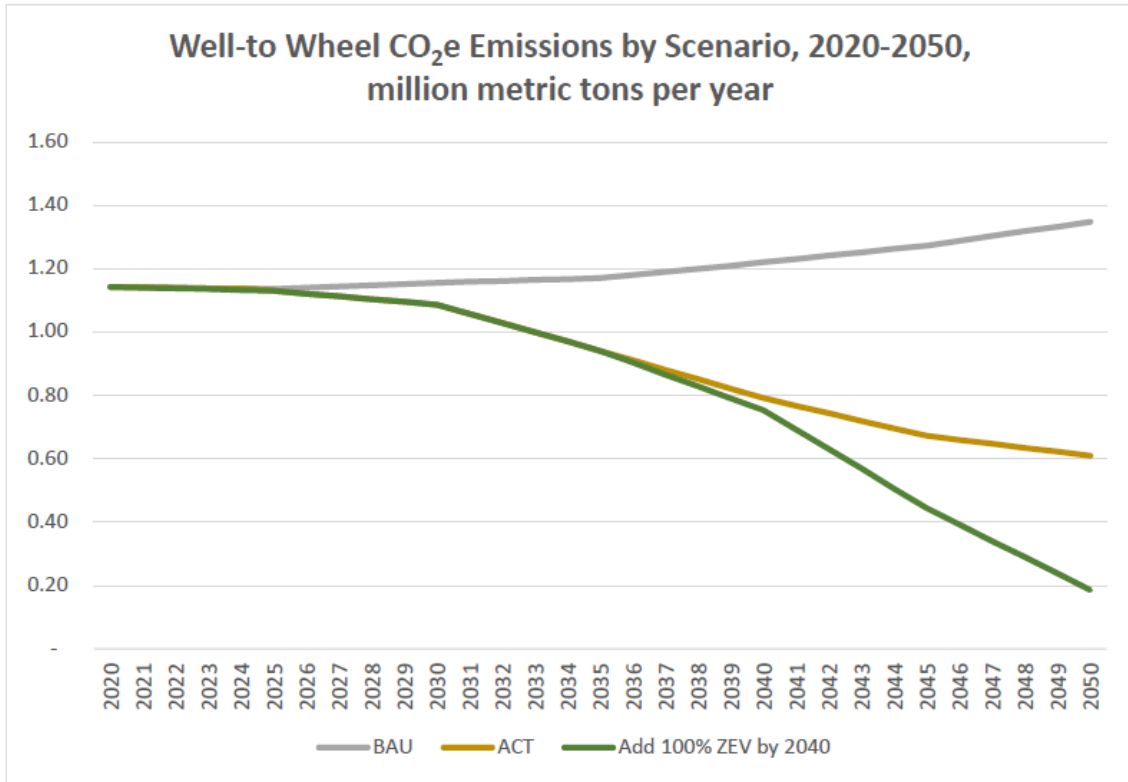


Figure 7. Well-to-wheel HDV CO<sub>2</sub>e emissions by scenario 2020-2050



### ACT: Economic and Societal Benefits and Costs For Businesses, Including Small Businesses

Manufacturers sell trucks to trucking fleets who operate the vehicles and incur costs following the point of sale including taxes, fueling, maintenance, midlife costs, and registration fees. Adding electric trucks to their fleet will also cause fleets to incur costs relating to EVSE, infrastructure, maintenance bay upgrades, workforce training, and other transitional costs.

Implementation of the ACT requirements in the Proposed Part 37 will likely increase the supply of ZEVs and will provide another vehicle option for fleets to consider in meeting their needs. Individual businesses that have operations that are well suited for using ZEVs will likely be able to lower their total cost of ownership by taking advantage of the operational cost savings of battery-electric vehicles. Reduced costs to the overall state’s trucking fleet are forecast as the operational cost savings of the ZEVs likely outweigh the potential infrastructure and vehicle prices. Amortizing the vehicle and infrastructure investments will help with these companies’ cash flow to realize positive cash flow shortly after purchase.

Table 6 below illustrates an example where a reference fleet purchases 20 Class 4-5 trucks in 2024 for usage in last-mile delivery applications over twelve years.<sup>32</sup> The costs for 20 diesel vehicles, 20 battery-electric vehicles and the difference between them is shown. The costs over the twelve-year period are lower for the battery-electric fleet as compared to the diesel fleet; however, the upfront capital expenses are significantly higher for the BEV fleet. Access to capital or financing will be critical for fleets to take advantage of the overall savings of BEVs.

<sup>32</sup> California Air Resources Board – Advanced Clean Trucks Initial Statement of Reasons, Page IX-33.

Table 6. Advanced Clean Trucks Fleet Cost Example

Cost line items	Diesel	Battery-Electric	Difference
Amortized Vehicle Price	\$1,270,361.00	\$1,747,840.00	\$477,479.00
Sales Tax	\$93,280.00	\$135,896.00	\$42,616.00
Amortized EVSE Cost	-	\$104,315.00	\$104,315.00
Amortized Infrastructure Upgrades	-	\$417,261.00	\$417,261.00
Charger Maintenance	-	\$120,000.00	\$120,000.00
Fuel Costs	\$2,220,329.00	\$947,961.00	\$(1,272,368.00)
Maintenance Costs	\$1,914,913.00	\$1,436,185.00	\$(478,728.00)
Midlife Costs	-	\$259,200.00	\$259,200.00
Maintenance Bay Upgrades	-	\$20,000.00	\$20,000.00
Transitional Costs and Workforce Development	-	\$12,564.00	\$12,564.00
Registration Fees	\$245,823.00	\$232,840.00	\$(12,983.00)
<b>Total</b>	<b>\$5,744,706.00</b>	<b>\$5,434,062.00</b>	<b>\$(310,644)</b>

The implementation of the ACT requirements in the Proposed Part 37 will increase the number of ZEVs deployed, which will in turn increase the amount of electricity supplied by utility providers. Increased electricity usage from ZEVs provides an opportunity for a number of benefits to the utilities, their customers, and the overall grid itself. Electric vehicles are capable of shifting load to off-peak periods, stabilizing voltage frequency, and potentially reducing the use of temporary frequency regulation through emergency generators, while also increasing overall demand, creating a more efficient, highly utilized grid with storage potential. Studies have found that light-duty ZEVs provide a benefit to all utility customers as their electricity utilization drives down rates for all other ratepayers.<sup>33</sup>

There is no expected direct cost on small businesses, defined as businesses having three or fewer medium-and heavy-duty vehicles, under the ACT implementation. No manufacturers or fleets who are regulated under this rule are considered to be small businesses. Small businesses that operate trucks will not be required to purchase zero-emission trucks but may independently decide to do so. This may enable cost savings for small businesses due to electric trucks' lower cost of operation.

Vehicle dealerships wishing to be certified for sales and service of zero-emission vehicles may face costs imposed by their manufacturers for training and equipment but there is no requirement that every dealer be qualified to sell such vehicles, and this will end up being a business decision between dealers and manufacturers.

### HD Omnibus/Phase 2: Economic and Societal Benefits and Costs For Businesses, Including Small Businesses

Medium- and heavy-duty engine/vehicle manufacturers are the regulated entities under the HD Omnibus implementation in the proposed Part 37. Because these manufacturers are located outside of Rhode Island, the Department assumes those manufacturers would pass the direct compliance costs onto the Rhode Island vehicle fleets that purchase the California-certified vehicles and engines that are subject to the HD Omnibus Rule. Typical businesses are defined here to be Rhode Island fleets with four or more medium- and heavy-duty vehicles (GVWR >10,000 pounds). The actual cost impact on fleets would depend on the number of new California-certified heavy-duty vehicles that fleets would purchase during the lifetime of

<sup>33</sup> M.J. Bradley and Associates, MJB&A Analyzes State-Wide Costs and Benefits of Plug-in Vehicles in Five Northeast and Mid-Atlantic States, 2017.

this cost analysis. A lifetime analysis including an initial purchase price increase, lifetime Diesel Exhaust Fluid (DEF) consumption for NOx control, lifetime savings from warranty, net lifetime cost impact, and percent increase in lifetime cost from the assumed purchase price is presented in Table 7<sup>34</sup>.

*Table 7. Lifetime Cost Analysis of 20 Medium and Heavy-Duty Diesel Trucks*

<b>Engine MY</b>	<b>Lifetime Net Cost Per Vehicle</b>	<b>Lifetime Net Cost of 20 Vehicles</b>
2024	\$2,839	\$56,780
2027	\$5,317	\$106,340
2031	\$5,814	\$116,280

Similar to typical fleets, the actual cost impact on smaller businesses and their fleets would depend on the number of new California-certified heavy-duty vehicles that fleets would purchase during the lifetime of this cost analysis. As shown in Table 7 above, for a small fleet that would buy one new medium heavy-duty diesel (MHDD) vehicle with a 2024, 2027, or 2031 MY engine, the net lifetime vehicle cost due to the HD Omnibus is estimated to be \$2,839, \$5,317, or \$5,814, respectively.

The HD Omnibus requirements in the proposed Part 37 impact new vehicle dealerships by requiring that new on-road heavy-duty engines and vehicles for sale in Rhode Island meet California emissions standards. By aligning Rhode Island’s requirements with other states in the region, dealerships will benefit from the ability to continue to trade vehicles with dealers in those states.

## Alternatives to Proposed Rule

Pursuant to R.I. Gen. Laws Chapter 23-23 (Rhode Island Air Pollution Control Act), the Department is provided the basic authority to adopt regulations as needed to effectuate the purposes of RI and Federal Law. Beyond this, Section 177 of the Clean Air Act permits states to adopt motor vehicle emissions standards that are identical to California’s standards, even if those standards are more strict than federal standards.

The Department considered whether or not to pursue to amend Part 37 to adopt the ACCII standards, Advanced Clean Trucks, the Low NOx HD Omnibus, and the Phase 2 Greenhouse Gas rules and determined that not doing so would be contrary to state policy to reduce emissions from all types of vehicles, and achieve the greenhouse gas emission reduction goals set forth by R.I. Gen Law Chapter 42-6.2 (2021 Act on Climate).

If Rhode Island does not amend Part 37 to implement these standards, it will result in a reversion to the current EPA federal motor vehicle emission standards, which are less stringent and would represent significant backsliding in the progress Rhode Island has made so far in reducing criteria pollutant emissions and greenhouse gas emissions since the implementation of previous California motor vehicle emissions standards in Part 37.

As alternatives to the proposed amendments to Part 37 the following alternatives were considered. Alternative 1 considers the proposed amended rule not being implemented resulting in the reversion to the current EPA federal motor vehicle emission standards as stated above, the business as usual (BAU) scenario. Alternative 2, considers the reversion to the proposed new federal EPA emissions standards beginning with MY 2027, (EPA 2027). Both alternatives considered contain less stringent emissions standards than proposed amended Part 37. Our analysis utilized the best available information for the proposed federal standards.

<sup>34</sup> California Air Resources Board – HD Omnibus Initial Statement of Reasons, Page IX-52.  
<https://ww2.arb.ca.gov/rulemaking/2020/hdomnibuslownox>

EPA conducted an extensive national level analysis of benefits and costs relative to their current regulatory structure (i.e., an analysis that evaluated the alternative in precisely the fashion required by the Rhode Island Administrative Procedures act. (§RI 42-35-2.9)<sup>35</sup>. The Departments approach is to scale the national analysis such that it most closely mirrors the consumer population. RI comprises ~0.33% of the national population. Taking EPAs final calculations and scaling them<sup>36</sup>, yields the following;

Table 8: Total net benefits of proposed EPA MY 2027 by population

	Total Population (as of 1/2023)	Percentage	Net benefits <b>through 2055</b>
United States	339,172,809	100%	\$850 billion to \$1.6 trillion
Rhode Island	1,110,822	0.3275%	\$2.805 to \$5.280 billion

The net benefit range projected by EPA extends to 2055, which significantly exceeds DEMs analysis of the proposed state regulation. In order to compensate for the disparate time frames and to address the nature of the model year structure in the automotive industry, DEM finds that using annualized costs and benefits provides the closest approximation to the regulation under consideration.

Table 9: Annualized net benefits of proposed EPA 2027 by population

	Annualized net benefits
United States	\$60 to \$85 billion
Rhode Island	\$198 to \$280.5 million

The EPA generated analysis provides a useful starting point to calculate RI specific values for benefits and costs. **However, a national-level analysis fails to address critical state specific variables that drive outcomes in Rhode Island.** Rhode Island occupies a specific geographic and demographic space in the national context. As a result, the national level EPA analysis likely overestimates certain benefits of the proposed EPA regulation relative to proposed amended 250-RICR-120-05-37. To determine the magnitude and direction of the estimation deviations, DEM conducted a sensitivity analysis of emission reductions by regulatory proposal and by type of pollution.

Figure 8: Well-to-wheel Light-Duty CO2e emissions by scenario 2025-2040

<sup>35</sup> Rhode Island Administrative Procedures <http://webserver.rilin.state.ri.us/Statutes/TITLE42/42-35/42-35-2.9.htm>

<sup>36</sup> Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles Draft Regulatory Impact Analysis <https://www.epa.gov/system/files/documents/2023-04/420d23003.pdf>



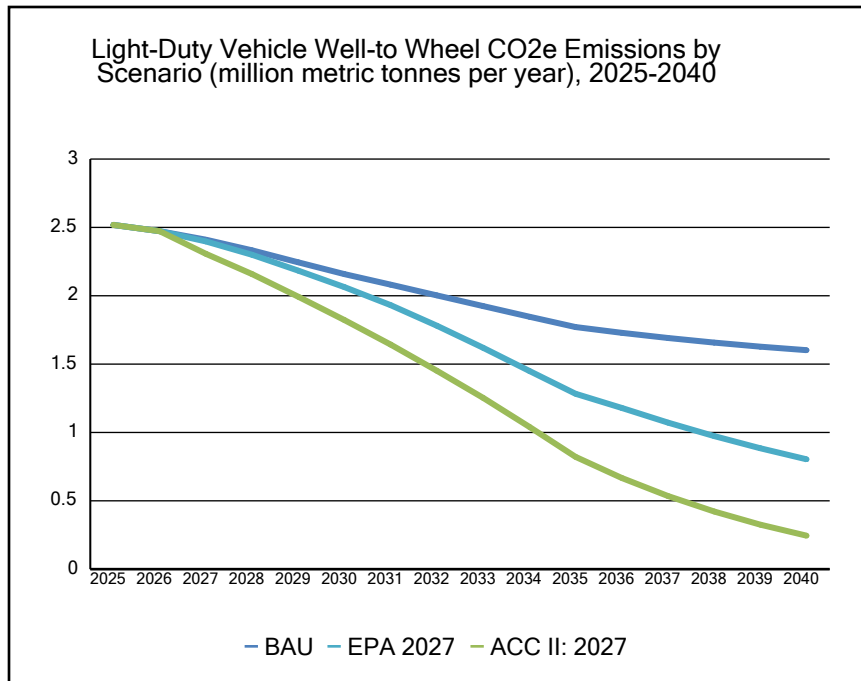


Table 10: CO2 emissions benefits in Rhode Island compared to Alternative 1 (BAU) and Alternative 2 (EPA 2027)

Comparison of Proposed Standards				
Model year	Proposed standards	BAU	EPA 2027	
	CO <sub>2</sub> (million metric tonnes per year)	CO <sub>2</sub> (million metric tonnes per year)	CO <sub>2</sub> (million metric tonnes per year)	
2026	2.47	2.47	2.47	2.47
2027	2.31	2.41	2.40	2.40
2028	2.16	2.33	2.30	2.30
2029	2.00	2.25	2.18	2.18
2030	1.83	2.16	2.06	2.06
2031	1.64	2.08	1.93	1.93
2032	1.45	2.01	1.78	1.78
2033	1.25	1.93	1.62	1.62
2034	1.04	1.85	1.45	1.45
2035	0.82	1.77	1.28	1.28
2036	0.67	1.73	1.18	1.18
2037	0.54	1.69	1.07	1.07
2038	0.42	1.66	0.97	0.97
2039	0.33	1.63	0.88	0.88
2040	0.24	1.60	0.80	0.80
Total	21.69	32.09	26.91	

Figure 8 and Table 10 above, displays the decrease in CO2 emissions over the timeframe of the analysis in Rhode Island. This data shows the proposed standards as the overall best option as to help achieve the greenhouse gas emission reduction goals set forth by R.I. Gen Law Chapter 42-6.2 (2021 Act on Climate).

Figure 9: Tank-to Wheel NOx (short tons per year) Emissions by scenario 2025-2040



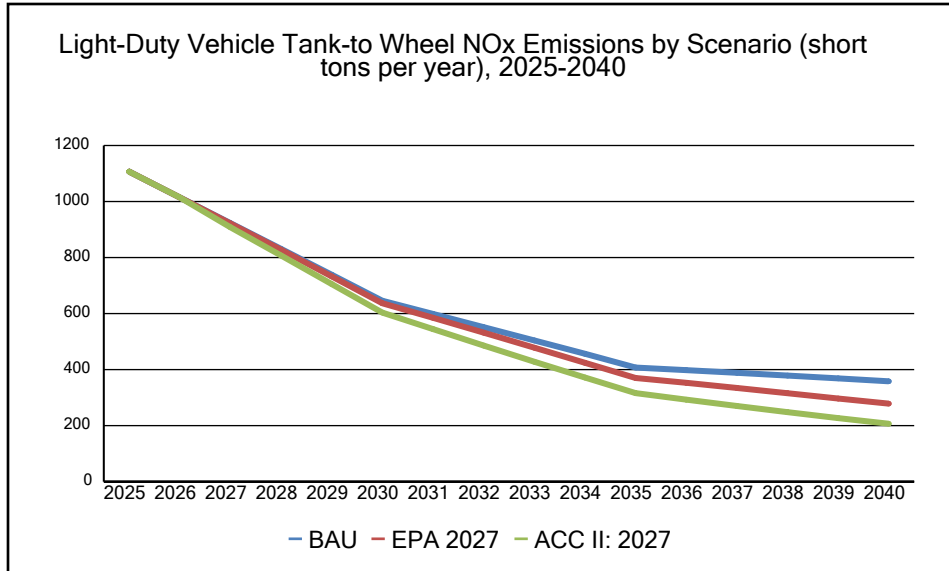


Table 11: NOx (short tons per year) Emissions benefits in Rhode Island compared to Alternative 1 (BAU) and Alternative 2 (EPA 2027)

	Proposed standards	BAU		EPA 2027
	Tank-to Wheel NOx Emissions	Tank-to Wheel NOx Emissions	Tank-to Wheel NOx Emissions	Tank-to Wheel NOx Emissions
2026	1,015	1,015	1,015	1,015
2027	908	923	923	922
2028	807	831	831	828
2029	705	739	739	733
2030	603	646	646	637
2031	545	599	599	585
2032	486	551	551	532
2033	428	504	504	478
2034	372	457	457	424
2035	316	407	407	370
2036	293	398	398	353
2037	270	389	389	334
2038	248	379	379	316
2039	227	369	369	297
2040	207	358	358	278
Total	8,536	9,670	9,670	9,208

Figure 9 and Table 11 show the decrease in NOx emissions over the timeframe of the analysis in Rhode Island. This data shows the proposed standards as the overall best option as to help achieve the greenhouse gas emission reduction goals set forth by R.I. Gen Law Chapter 42-6.2 (2021 Act on Climate).

Figure 10: Tank-to Wheel PM2.5 (short tons per year) Emissions by scenario 2025-2040

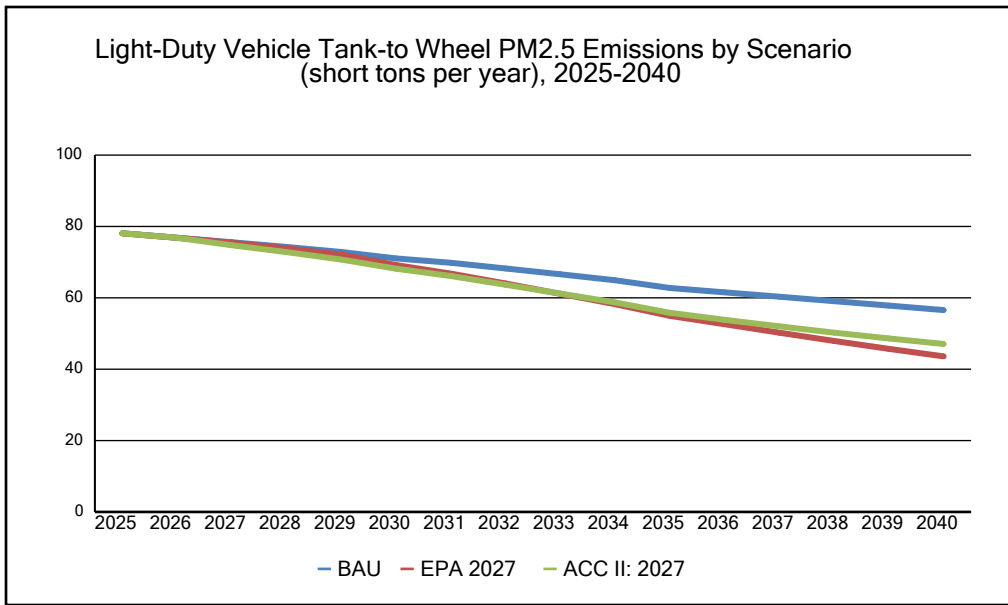


Table 12: PM2.5 (short tons per year) Emissions benefits in Rhode Island compared to Alternative 1 (BAU) and Alternative 2 (EPA 2027)

**Comparison of Proposed Standards**

Model Year	Proposed standards		BAU	EPA 2027
	Tank-to Wheel PM2.5 Emissions		Tank-to Wheel PM2.5 Emissions	Tank-to Wheel PM2.5 Emissions
2026	77		77	77
2027	75		76	75
2028	73		74	74
2029	71		73	72
2030	68		71	69
2031	66		70	67
2032	64		68	64
2033	61		67	61
2034	59		65	58
2035	56		63	55
2036	54		62	53
2037	52		60	50
2038	50		59	48
2039	49		58	46
2040	47		57	44
Total	999		1,076	991

Figure 10 and Table 12 show the decrease in PM2.5 emissions over the timeframe of the analysis in Rhode Island. While this data set shows Alternative 2 with a larger reduction in PM2.5 emissions, the amount is so small that it is negligible.

As a result of the analysis of the proposed amended Part 37 versus Alternatives, the proposed amended Part 37 is anticipated to result in a greater reduction of CO2 and NOx emissions compared the Alternatives. Given these reductions and the comparable PM2.5 impacts, and pursuant to R.I. Gen. Law Chapter 22-23 (Rhode Island Air Pollution Control Act), the proposed regulation will be an integral part in the climate policy needed to achieve the greenhouse gas emission reduction goals set forth by R.I. Gen. Law Chapter 42-6.2 (2021 Act on Climate). As a result of the analysis of 250-RICR-120-05-37 versus the Alternatives the DEM proposes that the proposed amendments to 250-RICR-120-05-37 provide the greatest benefits to the state of Rhode Island.