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California Energy Commission

Economic Impact Analysis of the Replacement Tire Efficiency Program

Prepared by Evergreen Economics and California Energy Commission Staff

EVERGREEN ECONOMICS

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ABSTRACT

In 2022, the California Energy Commission (CEC) engaged Evergreen Economics (Evergreen) to perform an economic analysis as part of a Standardized Regulatory Impact Assessment (SRIA) for the proposed Replacement Tire Efficiency Program. Assembly Bill (AB) 844 (Nation, Chapter 645, Statutes of 2003) mandates the California Energy Commission to address the issue that replacement tires for passenger cars and light-duty trucks are, on average, less energy-efficient than original equipment tires that come equipped on new vehicles. Tire efficiency has a significant impact on the energy consumption of vehicles; it affects vehicle fuel costs and the associated greenhouse gas emissions. This regulation will establish minimum efficiency requirements for most replacement tires sold for use on light-duty vehicles in California starting in 2028.

This report evaluates the economic impact of these replacement tire efficiency standards on consumers, businesses, and government agencies within the state. The analysis focuses on the correlation between reduced rolling resistance of a tire and the resulting decrease in fuel consumption of a vehicle.

This report uses models built by Evergreen and refined by CEC staff. The regulations will produce about $4 billion in cumulative fuel cost savings to California drivers between 2028 and 2035 and $3 billion in net benefits over the same period, as defined as incremental fuel cost savings minus incremental costs. The proposed regulations will, in this estimation, reduce carbon dioxide equivalent emissions by 8.6 million metric tons between 2028 and 2035.

Keywords: Economic impacts, Standardized Regulatory Impact Assessment, tire efficiency regulations, rolling resistance, replacement tires, minimum performance standards, fuel economy, emissions abatement, light-duty vehicles, tire businesses, fuel cost savings, passenger car, SUV, light-duty truck, van, total social benefit

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The California Energy Commission (CEC), with assistance from Evergreen Economics (Evergreen), has developed a Standardized Regulatory Impact Assessment (SRIA) for the Replacement Tire Efficiency Program. California Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003) mandates that the CEC adopt a program to require replacement tires for passenger vehicles and light-duty trucks to be, on average, at least as efficient as the original equipment tires. Tire efficiency has a significant impact on the energy consumption of vehicles; it affects vehicle fuel costs and the associated greenhouse gas emissions. There are no comparable federal or local tire efficiency regulations.

The regulations will produce about $4 billion in cumulative fuel cost savings to California drivers between 2028 and 2035, and $3 billion in net benefits over the same period. That is, the incremental additional cost of more efficient replacement tires is vastly surpassed by the fuel cost savings to California drivers. For the average affected driver of a light-duty gasoline vehicle, the more efficient tires would pay for the incremental additional cost after fewer than 7 months of the tires' 4-year lifespan. The net benefits are estimated to increase household discretionary income. The proposed regulations will reduce carbon dioxide equivalent emissions by 8.6 million metric tons between 2028 and 2035. These estimates account for changes in California's vehicle fleet toward zero-emission vehicles.

Although the amount of savings vastly outweighs the costs and yields a net economic benefit for consumers, the CEC is required by statute to complete this SRIA and provide it to the California Department of Finance because the absolute economic impact of the proposed regulation exceeds $50 million in the first year the regulation takes effect. Specifically, in 2028, the first year the regulation takes effect, it is expected to produce approximately $41 million in fuel cost savings and $14 million in costs.

This SRIA includes a broad statewide economic impact model based in part on the estimated household fuel savings and incremental tire costs that would result from the proposed regulatory standards. Evergreen staff has analyzed the economic impacts of the proposed regulation. CEC staff has refined the model. This SRIA analysis uses Evergreen's analysis complemented by CEC staff's updates and refinements. All estimated values in this report are approximations.

CHAPTER 1:
Modeling Assumptions

Introduction

Evergreen and California Energy Commission (CEC) staff analyzed the potential economic impact of the proposed regulation on replacement tire efficiency in California. Directed by Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003), CEC staff proposed a regulation of replacement tire efficiency that would impact most passenger vehicles and light-duty trucks in the state.

The proposed regulation will be enacted in two phases. Starting January 1, 2028, Phase 1 of the regulation requires that replacement tires sold in California meet a minimum performance standard for tire efficiency. Starting January 1, 2031, Phase 2 of the regulation sets a more stringent requirement for tire efficiency. This report estimates the economic impact of the regulation, spanning 2028 through 2035.

Key Assumptions and Inputs for Estimating Economic Impacts Associated With the Proposed Regulation

The approach of the Standardized Regulatory Impact Assessment (SRIA) to estimating fuel cost savings under the proposed regulation is based on the relationship between the rolling resistance of a tire and the fuel economy of a vehicle. *Rolling resistance* refers to the loss of energy primarily due to tire distortion as the tire rolls.[1] The rolling resistance force opposes the motion of a vehicle and therefore requires additional energy from the vehicle engine or motor to maintain speed, directly affecting fuel consumption. Increased efficiency benefits combustion vehicle range and electric vehicle (EV) range.

The efficiency of a tire is rated by the respective *rolling resistance coefficient* (RRC). RRC is used in setting the standard instead of the *rolling resistance force* (RRF) because it normalizes the differences between differing vehicle weights, avoiding the need to set unique standards for specific vehicle weight classes.[2] The RRC is the RRF divided by the weight placed on the tire and measured in newton per kilonewtons. Therefore, a tire designed for a vehicle twice as heavy as another tire can have twice the RRF and still have the same RRC. A tire with a high RRC will be less efficient than one with a low RRC and, therefore, requires more fuel to generate the mechanical energy needed to overcome the higher rolling resistance. Conversely,

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1 Sandberg, Ulf, ed. 2011. Swedish National Road and Transport Research Institute. Rolling Resistance — Basic Information and State-of-the-Art on Measurement Methods, https://www.diva-portal.org/smash/get/diva2:674026/FULLTEXT02.pdf

2 Brewer, H. Keith, Ph.D. January 29, 2010. Rolling Resistance Force vs. Rolling Resistance Coefficient. Rubber Manufacturers Association, https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/oira_meetings/2127_01222010-2.pdf

tires with a lower RRC result in lower fuel consumption and, consequently, a lower fuel cost for the driver. The RRC of a tire is inversely proportional to the fuel economy of a vehicle.

The fuel economy improvement of the fleet is calculated as a function of the change in rolling resistance between baseline and compliant replacement tires. This report defines the baseline fuel costs as the costs associated with the fuel consumed by light-duty vehicles in California without the proposed regulation.

Evergreen based its calculation of fuel cost savings on the National Highway Traffic Safety Administration's finding that a 10 percent decrease in rolling resistance produces a 1.3 percent increase in fuel economy.[3] Previous research has shown that a 10 percent decrease in rolling resistance produces a larger 2 percent increase in fuel economy.[4] Therefore Evergreen's assumption of a 10 percent decrease in rolling resistance resulting in a 1.3 percent fuel economy improvement is a conservative estimate of this relationship.

This report assumes that tires are replaced in sets of four. Further, it is assumed that the average life expectancy of a set of four tires is four years.

The cost of tires and incremental cost for improvements vary by the tire size as a larger tire requires more material to construct. For simplification, the analysis aggregates, or combines, various vehicle types into two main tire categories: lighter vehicle tires and heavier vehicle tires. This report assumes that passenger vehicles and sport utility vehicles (SUVs) receive these lighter passenger vehicle replacement tires, and that light-duty trucks and vans receive heavier truck replacement tires.

The weighting of tire categories is based on the proportions of passenger vehicle tires (85 percent) and light truck tires (15 percent) in the U.S. replacement tire market in 2024.[5] These findings were compared with the size of the U.S. replacement tire market in 2023 among light-duty vehicles: passenger vehicle replacement tires (82 percent) and light truck replacement tires (18 percent).[6] This market share of replacement tires sold in the United States was then compared with the forecasted vehicle miles traveled (VMT) per year in California by vehicle type (passenger car, SUV, light-duty truck, van) between 2028 and 2035 (Table 1).[7]

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3 National Highway Traffic Safety Administration, Department of Transportation. 2010. *Tire Efficiency Consumer Information Program*. https://www.nhtsa.gov/sites/nhtsa.gov/files/fmvss/TFECIP%2520Final%2520Rule.pdf

4 US Energy Information Administration. 2022. *Assumptions to the Annual Energy Outlook 2022: Transportation Demand Module*, (p. 4) https://www.eia.gov/outlooks/aeo/assumptions/pdf/transportation.pdf

5 US Tire Manufacturers Association, "USTMA's February 2025 Forecast Predicts Higher 2025 Tire Shipments for U.S. Tire Market," March 6, 2025; numbers derived from article; approximate. https://www.ustires.org/newsroom/ustma-february-2025-forecast

6 Statista. *Size of the United States' (US) replacement tire market from 2016 to 2023, by segment.* March 20, 2024. https://www.statista.com/statistics/581639/size-of-the-pneumatic-tire-market-in-the-us/

7 California Energy Commission staff. 2023. *Final 2022 Integrated Energy Policy Report Update.* California Energy Commission. Publication Number: CEC-100-2022- 001-CMF.

Table 1: Estimated Distribution of California Fleet by Vehicle Type, 2028–2035

Vehicle Category	Share of Fleet
Passenger car	38%
SUV	43%
Light-duty truck	16%
Van	3%

Source: Analysis of data from CEC 2022 Integrated Energy Policy Report Update.

Given the market share of replacement tires compared with the breakdown of vehicle types shown in Table 1, it is estimated that passenger cars and SUVs will make up 81 percent of the fleet miles during this eight-year period, while light-duty trucks and vans will make up 19 percent of the fleet miles.

Table 2 summarizes the assumptions regarding vehicle and tire categories. This simplification does not consider the following:

- SUVs with light-duty truck behavior (for example, towing, cargo, off-roading) will be equipped with light truck replacement tires.
- Low-load index tires, long-life tires, and ultra-long-life and ultra-high-performance tires are aggregated in with otherwise standard tires in the economic impact of the proposed regulation.

Table 2: Assumptions of Vehicle and Tire Categories

Tire Category	Vehicles Included	Share of CA Fleet
Lighter vehicles tires	Passenger car, SUV	81%
Heavier vehicle tires	Light-duty truck, vans	19%

Source: Assumptions based on the California Air Resources Board (CARB) Vehicle Miles Traveled (VMT) forecast from the 2022 Integrated Energy Policy Report Update: Additional Achievable Transportation Electrification dataset provided by CEC staff.

Rolling Resistance Coefficients

Phase 1 of the proposed regulation requires that replacement tires sold in California meet the minimum performance standard (MPS) of an RRC of 9 newtons/kilonewtons for passenger vehicle tires and light truck tires. Phase 2 requires that replacement tires sold in 2031 meet the MPS of 7.1 newtons/kilonewtons for passenger vehicle tires and 7.8 newtons/kilonewtons for light truck tires. The term *light truck tires* refers to a specific class of tires within the tire market designed to be more durable than standard passenger tires. Most trucks in California do not actually use these more rugged tires, and conversely some SUVs or vans may use them

despite not being trucks. The regulation includes adjustments for certain tire types such as ultra-long-life tires and exemptions for certain categories such as tires for emergency vehicles.

Table 3: Minimum Performance Standards of the Proposed Regulation

Tire Category	Phase 1: 2028 – 2030	Phase 2: 2031-2035
Passenger vehicle tires, treated as lighter vehicles tires for modeling purposes	9	7.1
Light truck tires, treated as heavier vehicle tires for modeling purposes*	9	7.8

*Light truck tires are a specific class of tires within the tire market designed to be more durable than standard passenger tires.

Source: CEC staff

Table 4 summarizes the tire efficiency improvement between the baseline and Phase 1 and between Phase 1 and Phase 2. These efficiency improvements represent the average improvement across a vehicle class and incorporate the stringency deviations of the proposed regulation for light trucks and other factors such as ultra-long-life tires.

Table 4: Assumed Tire Efficiency Improvements by Phase of Regulation

Vehicle Type	Tire Category	Phase 1 MPS (2028-2030)	Baseline for Phase 1 Efficiency Improvement	Phase 2 MPS (2031-2035)	Baseline to Phase 2 Efficiency Improvement
Passenger Car	Lighter vehicle	9	2.4%	7.1	16.6%
SUV	Lighter vehicle	9	1.1%	7.1	10.6%
Light-Duty Truck	Heavier vehicle	9	2.1%	7.1 (7.8)*	14.0%
Van	Lighter vehicle	9	3.3%	7.1	16.2%

* Light truck tires are a specific class of tires within the tire market designed to be more durable than standard passenger tires.

Source: Analysis by CEC staff and Evergreen of data from CEC staff

These values are not directly comparable with the RRC MPS values presented in the *Draft Framework of California's Replacement Tire Efficiency Program* by CEC staff published in February 2023 because the RRC figures in this report have been transformed and correlated to the EU testing system.

Table 5 shows the estimated change in fuel efficiency of Phase 1 and Phase 2 by vehicle type, based on the relationship that a 10 percent decrease in the RRC of a tire results in a 1.3 percent increase in fuel economy.

Table 5: **Estimated Increase in Fuel Efficiency by Vehicle Type**

Vehicle Type	Tire Category	Phase 1 Fuel Efficiency Improvement	Phase 2 Fuel Efficiency Improvement
Passenger car	Lighter vehicle tires	0.3%	2.2%
SUV	Lighter vehicle tires	0.1%	1.4%
Light-duty truck	Heavier vehicle tires	0.3%	1.8%
Van	Lighter vehicle tires	0.4%	2.1%

Source: Analysis by CEC staff and Evergreen of data from CEC staff.

The improvement in efficiency results in lower fuel consumption and associated fuel costs. As an illustrative example, Table 6 shows the estimated savings for consumers who install a set of four higher efficiency tires on a gasoline vehicle.

Table 6: Gasoline Cost Savings for Four Tires Over the Life of the Tires

Tire Category	Phase 1	Phase 2
Lighter vehicle tires	$85	$179
Heavier vehicle tires	$129	$246

Source: CEC staff.

Incremental Costs

This report defines incremental costs as the additional premium on the price of a replacement tire that adheres to the MPS of the regulation. Assumed incremental costs are shown in Table 7.

Table 7: Incremental Costs of a Single Tire Relative to Baseline

Tire Category	Phase 1	Phase 2
Lighter vehicle tires	$1.50	$6.50
Heavier vehicle tires	$1.50	$9.75

Source: CEC staff

The CEC has estimated that the incremental cost for a lighter vehicle and heavy vehicle replacement tire compliant with the Phase 1 MPS will be $1.50. Starting in 2031, the CEC has estimated the consumer will pay an additional $6.50 for a light vehicle replacement tire and $9.75 for a heavy vehicle replacement tire, compliant with the Phase 2 MPS. For a set of four tires, the CEC estimates that the consumer will pay an additional $6.00 during Phase 1 and $26 for light vehicles and $39 for heavy vehicles during Phase 2. Given the shares of each vehicle type in Table 1, the calculated weighted average incremental cost is $28.47 per set of four replacement tires during Phase 2 of the regulation.[8]

The authors emphasize that some fleet vehicles will already have tires that comply with the MPS of the proposed regulation, meaning that those tires have no incremental cost. The incremental costs will apply to only those vehicles that are not yet compliant. Table 8 shows the share of each vehicle type that is not compliant with the two phases of the regulation.

Table 8: Share of Vehicle Types to Incur Incremental Costs of Replacement Tires

Vehicle Type	Phase 1 (2028)	Phase 2 (2031)
Passenger Car	31%	91%
SUV	17%	87%
Light-Duty Truck	30%	82%
Van	20%	100%

Source: CEC staff and Evergreen analysis of data from CEC staff

Compliance

Based on the CEC's estimate that the incremental cost of a Phase 1 tire is $1.50, it is assumed that there will be 100 percent compliance for Phase 1 of the regulation. The analysis does not foresee that an increase of $6.00 will deter consumers from purchasing a set of replacement tires. Given the assumed average incremental cost of $28.47 during Phase 2 of the regulation, it is assumed that there will be a 90 percent compliance rate in accordance with CEC staff assumptions.

Fuel Prices

These fuel prices are in 2024 dollars and are not adjusted for inflation between 2028 and 2035, as shown in Table 9. It is reasonable to not adjust fuel costs for inflation because the incremental cost of tires is not adjusted for inflation beyond 2024 either. Together, these can be taken as real costs over time. Moreover, it is reasonable to use constant real fuel costs

8 Weighted average of incremental cost per set of replacement tires for Phase 2:

$0.38 * \$26 + .43 * \$26 + 0.16 * \$39 + 0.03 * \$39 = \$28.470$

because the future price of fuels is not predictable and may be higher or lower than what is assumed here.

Table 9: Assumptions for Fuel Cost Per Unit

Fuel Type	Cost Per Unit	Source
Gasoline	$4.60 per gallon	California All Grades All Formulations Retail Gasoline Price, February 2023.[9]
Electricity	$0.34 per kWh	California average residential electricity price, July 2024.[10]
Diesel	$4.60 per gallon	Assumed the same as gasoline price for modeling simplicity.
Hydrogen	$10 per kg	CEC Assumption.

Source: CEC staff

Vehicle Miles Traveled

To calculate costs and benefits of the proposed regulation, the analysis used vehicle miles traveled (VMT) forecast data from the *2022 Integrated Energy Policy Report Update*: Additional Achievable Transportation Electrification. These data are segmented by vehicle type (passenger cars, SUVs, light-duty trucks, and vans) and fuel type (diesel, electric, gasoline, hydrogen, and plug-in hybrid). Vehicle and fuel type composition of the fleet changes over time in accordance with the California Air Resources Board's (CARB's) Advanced Clean Cars Program to meet California's greenhouse gas emissions goals.

This VMT forecast incorporates forward-looking changes in fleet size, composition, and miles traveled.

Economic and Demographic Projections

Population projections provided by the California Department of Finance are used in the projections for the *Integrated Energy Policy Report (IEPR)*, which were subject to vetting through the Energy Commission's IEPR process and adopted in December 2023.

9 Energy Information Administration. "All Grades Retail Gasoline Prices." Data for Dec 2023, release date August 19, 2024. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPM0_PTE_SCA_DPG&f=M

10 Energy Information Administration. "Electric Power Monthly." Data for May 2024, release date July 24, 2024. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

Carbon Dioxide Equivalent Emissions

To calculate the reduction in emissions, emissions factors from the 2019 California Air Resources Board Senate Bill 498 report were used.[11] These factors are shown in Table 10. Emissions of greenhouse gases are typically expressed in a common metric so the respective impacts can be directly compared since some gases are more potent (that is, have a higher global warming potential) than others. The standard practice is to express greenhouse gases in carbon dioxide equivalents (CO2e).[12] This report defines CO2e emissions as the seven greenhouse gases monitored by CARB, including carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, perfluorocarbons, and nitrogen trifluoride.[13] The combustion-engine vehicle emissions estimated in this report are tailpipe emissions; the report did not account for the upstream emissions of diesel and gasoline fuel production.

Table 10: 2035 Emissions Factors

Fuel	Emissions (Metric Tons CO2e)
1 gallon of diesel	0.013718
1 gallon of gasoline	0.011406
1 kilowatt-hour of electricity	0.000379
1 kilogram of hydrogen[14]	0.010598

Source: California Air Resources Board. 2019. SB 498 Report Appendix C: Quantification Methodologies, Table C-1.

Fuel Cost Savings

To estimate the annual fuel cost savings generated by the proposed tire efficiency regulation, the analysis compared the yearly fuel costs of the vehicle fleet in California with and without the proposed regulation. Given that the minimum performance standards of the regulation will be enacted in two phases and that the assumed average life of a set of tires is four years, the

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11 California Air Resources Board. 2019. *SB 498 Report Appendix C: Quantification Methodologies ,* Table C-1. https://ww2.arb.ca.gov/sites/default/files/2019-12/SB%20498%20Appendix%20C%20-%20quantification%20120919.pdf

12 U.S. Environmental Protection Agency. "Carbon Dioxide Equivalent." System of Registries, Terminology Services, https://sor.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do?search=&term=carbon%20dioxide%20equivalent&matchCriteria=Contains&checkedAcronym=true&checkedTerm=true&hasDefinitions=false.

13 California Air Resources Board. California Greenhouse Gas Emissions Inventory Program. "GHGs Descriptions & Sources in California," https://ww2.arb.ca.gov/ghg-descriptions-sources.

14 Assumes "gray" hydrogen produced from methane with unabated emissions.

report based the analysis on the premise that 25 percent of the fleet will receive replacement tires per year, with the RRC determined by the regulatory phase of that year.

Twenty-five percent of the fleet will purchase the first round of tires subject to Phase 1 regulations in 2028.[15] In the following year, as another 25 percent of the fleet gets replacement tires, half the fleet will be subject to the Phase 1 regulations. The year 2031 marks the first year that a quarter of the fleet will be subject to Phase 2 efficiency standards, and baseline tires (unregulated) will have been phased out of the fleet by the end of the year. By the end of 2034, all tires will be subject to Phase 2 efficiency standards (Table11).

Table 11: Stock Turnover of Replacement Tires, 2028–2035

Year	2028	2029	2030	2031	2032	2033	2034	2035
Baseline	75%	50%	25%	0%	0%	0%	0%	0%
Stock affected by Phase 1	25%	50%	75%	75%	50%	25%	0%	0%
Stock affected by Phase 2	0%	0%	0%	25%	50%	75%	100%	100%

Source: Evergreen analysis of proposed regulation timeline.

The analysis calculated the fuel consumption for each year, vehicle type, and fuel type under the proposed regulation and without the regulation. The difference between the fuel consumption of these two groups is the estimated fuel savings.

Every year, a proportion of the fleet drives on compliant replacement tires. As shown in Table11, this proportion grows by 25 percent as more compliant replacement tires are installed.

Among this proportion of vehicles, there are also vehicle tires that are already compliant with the regulation. For example, when Phase 1 goes into effect in 2028, one-fourth of the fleet will receive replacement tires. As shown in Appendix A, the miles-per-gallon (MPG) of gasoline passenger vehicles with Phase 1 tires will increase from 24.40 MPG to 24.48 MPG. Therefore, 25 percent of gasoline passenger vehicles will have an improved MPG of 24.48, and 75 percent will have the baseline fuel economy of 24.40. The following year, it will be a fifty-fifty split.

Given the assumed 90 percent compliance with the regulation during Phase 2 in 2031, the analysis estimates that the share of the fleet that will receive compliant replacement tires would be 22.5 percent (0.25 x .90 = 0.225) each year instead of 25 percent.

15 A proportion of this group of buyers have purchased compliant tires in the past and, therefore, will not experience an incrementally higher cost of tires because of this proposed regulation.

For each year, the analysis calculates the fuel consumption of the miles driven by the baseline (with the baseline fuel economy and tires) and the fuel consumption of a fleet that includes tires altered by the regulations. The formula for one year of baseline fuel consumption of each vehicle type is:

$$Fuel\ Consumption_{baseline} = \frac{VMT}{Baseline\ Fuel\ Economy}$$

However, the calculation for the fuel consumption of the fleet altered by regulations is more complex and can consist of a mix of vehicles with baseline tires, Phase 1 efficiency tires, and Phase 2 efficiency tires. The more efficient tires are not expected to alter vehicle miles traveled; therefore, the only effect is to enhance fuel economy. The fuel consumption of a given year is therefore the weighted average of vehicle fuel economy with baseline, Phase 1, and Phase 2 tires as follows:

$$Fuel\ Consumption_{regulation} = \frac{VMT}{\begin{aligned} &Proportion_{baseline} \times Fuel\ Economy_{baseline} + Proportion_{phase\ 1} \times Fuel\ Economy_{phase\ 1} \\ &+ Proportion_{phase\ 2} \times Fuel\ Economy_{phase\ 2} \end{aligned}}$$

The proportions of each are shown in Table 11 for a given year, and the fuel economy of the baseline and each phase is shown in Appendix A. Once the fuel consumption is calculated for the baseline and regulated market cases, the fuel savings can be obtained by subtracting the lower consumption in the regulated case from the baseline case.

$$Fuel\ Savings = Fuel\ Consumption_{baseline} - Fuel\ Consumption_{regulation}$$

To enhance the clarity of this discussion, consider the fuel consumption of gasoline passenger vehicles in the year 2032. The baseline fuel consumption would be the VMT of 2032 for that vehicle type (approximately 75 billion miles) divided by 24.4 MPG from Appendix A, resulting in 3.07 billion gallons of gasoline use. The fuel consumption with regulation is calculated using the same 75 billion miles, but this time is divided by a fleet of 50 percent 24.48 MPG with Phase 1-compliant tires and 50 percent 24.92 MPG with Phase 2-compliant tires (a new average of 24.70 MPG). The 50 percent figures are found for 2032 in Table11, and the Phase

1 and Phase 2 fuel economies can be found in Appendix A. This results in a fuel consumption of 3.04 billion gallons for a savings of 37 million gallons of gasoline in 2032.

Table 12 summarizes model inputs used to calculate the benefits and costs of the proposed regulation.

Table 12: Model Input Summary

Input	Description	Source
Vehicle Miles Traveled (VMT)	The vehicle miles traveled per vehicle type and fuel type, between 2028 and 2035	2022 Integrated Energy Policy Report Update (IEPR Update)[16]
Baseline Fuel Efficiency	The average fuel efficiency per vehicle and fuel type, measured in miles per gallon (MPG), miles per kilowatt-hour (MPKWh), or miles per kilogram of hydrogen (MPKGs)	EPA National Vehicle and Fuel Emissions Laboratory[17]
Fuel Cost Per Unit	The assumed static cost of one unit of fuel	CEC staff
Proposed Regulation Minimum Performance Standards	The rolling resistance coefficient values, measured in newtons/kilonewtons	CEC staff
Proposed Regulation Efficiency Improvements	The assumed increases in tire efficiencies by vehicle type over current tires	CEC staff
Average Tire Life	4 years	CEC staff
Average Yearly Vehicle Mileage	10,413 miles	Evergreen Calculation based on 2021 IEPR CEC Light-Duty Vehicle Population in California[18]

Source: CEC staff and Evergreen

16 California Energy Commission. *2022 Integrated Energy Policy Report Update.*

17 U.S. Department of Energy and the Environmental Protection Agency. "Fuel Economy Data." Accessed August 5, 2024, https://www.fueleconomy.gov/feg/byfuel/byfueltypeNF.shtml.

18 California Energy Commission. "Zero Emission Vehicle and Infrastructure Statistics: Light-Duty Vehicle Population in California." https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection/light.

CHAPTER 2:
Estimated Costs

This report estimates that the proposed regulations will affect typical businesses, small businesses, jobs or occupations, individuals, and government agencies within the state. The proposed regulations contain reporting requirements.

Total Statewide Impact Summary

This report evaluates the economic impact in terms of incremental costs of the compliant replacement tires, and fuel cost and emissions savings.

Incremental Costs

Some tires that are already sold comply with the regulations in Phase 1 and Phase 2. As such, incremental costs apply only to a proportion of noncompliant tires that must be redesigned to meet the proposed standards or taken out of the California market. The analysis assumes that compliance rates will be 100 percent in Phase 1 and 90 percent in Phase 2. Furthermore, the analysis assumes that a quarter of vehicles will receive replacement tires each year.

The analysis calculated the proportion of tires that will increase in cost due to the regulation in Phase 1 and Phase 2 and multiplied it by the incremental cost to develop statewide costs. Total incremental cost was calculated using the following formula.

$$\begin{aligned} &Total\ Incremental\ Cost \\ &\quad = (Quantity\ of\ Vehicles * 0.25 * Compliance\ Rate \\ &\quad * Proportion\ of\ Noncompliant\ Tires) * Incremental\ Cost \end{aligned}$$

The quantity of vehicles is approximated using the statewide VMT and the average annual mileage shown in Table 12. The proportions of noncompliant tires that will increase in cost due to the regulation in Phase 1 and Phase 2 are listed in Table 8. The following is an example of how to calculate the incremental costs of enhanced efficiency tires to consumers for gasoline passenger vehicles in 2032. The VMT of those vehicles is about 75 billion miles. Using an average of 10,413 miles per vehicle, that means an estimated 7.2 million passenger gasoline vehicles are in California that year. Because the lifespan of a tire is assumed to be four years, one-quarter of those vehicles will need replacement tires, or 1.8 million sets of four tires.

The year 2032 is within Phase 2 of the proposed regulations, and the average incremental cost to a set of new tires is $28.47. Therefore, the incremental cost of tires in that year would seem to be:

$28.47 x 1,800,000 = $51.25 million

However, two more factors are considered: the percentage of the marketplace that was already at that efficiency level before the regulation and the compliance rate. Table 8 shows that about 9 percent of passenger tires already exceed the Phase 2 requirements in the absence of the regulation and therefore would not bear an incremental cost compared to baseline. Further, the compliance rate of 90% means that among those who would be affected, 10% will not pay an incremental cost nor experience the incremental benefit. Therefore, the total cost in 2032 for gasoline passenger vehicles is:

$51.25 x 90% compliance rate x 91% tires affected = $41.97 million

That process is repeated for all vehicle types and fuels and added together to calculate the total statewide costs for a given year.

Table 13 shows the annual and cumulative incremental costs to consumers from the proposed regulation. The analysis estimates that the cumulative incremental cost to consumers through 2035 is $949 million.

Table 13: Annual and Cumulative Incremental Cost of Replacement Tires

Year	Phase	Annual Cost ($ million)	Cumulative Cost ($ million)
2028	1	$11.43	$11.43
2029	1	$11.52	$22.96
2030	1	$11.61	$34.57
2031	2	$179.59	$214.16
2032	2	$181.18	$395.34
2033	2	$182.94	$578.28
2034	2	$184.63	$762.91
2035	2	$186.31	$949.21

Source: Analysis by CEC staff and Evergreen of data from the CEC staff

As shown in Chapter 3, the annual implementation cost of the regulation to all businesses is $2,713,128. This report considers the incremental cost of compliant tires and the implementation cost to businesses as the first-order cost of the regulation. Therefore, the total incremental first-order economic cost in the first year of the regulation (2028) compared to the baseline is $14.14 million.

Incremental Benefits

The benefits of the proposed regulation stem from the reduction of fuel needed to overcome the lower rolling resistance of the higher-efficiency replacement tires. This report interprets benefits as the difference in fuel costs for California drivers between the baseline and regulation fuel economy of the fleet, and the social benefit of lowered CO_2e emissions. CEC staff considers fuel cost savings as first-order benefits and CO_2e emissions as second-order benefits. Table 14 presents the estimated annual fuel savings per year with the proposed regulation. This report estimates the cumulative fuel cost savings with the proposed regulation is nearly $4 billion in 2035. The method for these calculations is discussed at the end of Chapter 1.

Table 14: Annual and Cumulative Fuel Cost Savings With the Proposed Regulation

Year	Annual Fuel Cost Savings ($ million)	Cumulative Fuel Cost Savings ($ million)
2028	$40.82	$40.82
2029	$80.90	$121.72
2030	$119.87	$241.59
2031	$380.01	$621.61
2032	$593.90	$1,215.51
2033	$800.90	$2,016.41
2034	$999.05	$3,015.46
2035	$979.32	$3,994.78

Source: Analysis by CEC staff and Evergreen of data from CEC staff

The first-order economic benefit in the first year of the regulation (2028) compared to the baseline is $41 million.

Fiscal Impact

According to CEC staff, there are no additional expenditures in the current fiscal year that are reimbursable by the state because the proposed regulations will not take effect until January 1, 2028. The CEC will incur internal staffing costs of $286,500 in Year 1 of the regulation. These costs are based on 1.5 personnel-year (PY) and a fully loaded salary for a mid-range air pollution specialist. This estimate does not include the existing CEC compliance and enforcement staff.

Information technology tasks to develop and test the database will require about 25 days of work followed by continuing minor time spent monitoring the database during full regulatory implementation. The bulk of the 1.5 PY year one costs will arise from enforcement activities such as market surveillance and verification of submitted data. Years two and three of the regulation will yield fully loaded salary costs of $191,000 (1 PY) in each year for ongoing monitoring and enforcement activities. Moreover, external contracting for a confirmatory tire testing contract will increase costs by roughly $100,000 in each of the first three years of the regulation. This contract would allow CEC staff to commission the testing of 25 random or suspicious tire models per year.

Total fiscal impacts for the first three years of the implemented regulation will be:

$$\$286,500 + \$191,000, + \$191,000 + \$100,000 + \$100,000 + \$100,000 = \$968,500$$

The CEC will absorb these additional costs within its existing budgets and resources.

This report also calculated the benefits, costs, and net effects to state and local government vehicle fleets. Applying the combined state and local governments' share (1.72 percent) of the total California vehicle fleet, Table 15 shows the benefits, costs, and net effects. These amounts do not incorporate the $968,500 in CEC staffing costs noted above because those costs will be absorbed within the existing CEC budget.

Table 15: Benefits, Costs, and Net Effects for State and Local Governments

Year	Annual Benefits (Thousands)	Annual Costs (Thousands)	Annual Net Effect (Thousands)	Cumulative Net Effect (Thousands)
2028	$702	$197	$505	$505
2029	$1,391	$198	$1,193	$1,699
2030	$2,062	$200	$1,862	$3,561
2031	$6,536	$3,089	$3,447	$7,008
2032	$10,215	$3,116	$7,099	$14,107
2033	$13,775	$3,147	$10,629	$24,736
2034	$17,184	$3,176	$14,008	$38,744
2035	$16,844	$3,204	$13,640	$52,384

Source: CEC staff analysis of data from the California Employment Development Department (CEDD)

Total Number of Businesses Affected

This report estimates the number of tire businesses in California that would be affected by the proposed regulation. The following sections detail these impacts. Table 16 shows the breakdown of California tire businesses by type. The total number of businesses affected by the regulation is 4,874. Car dealerships may be affected by the regulation as many sell replacement tires in addition to vehicles. The authors emphasize that Table 16, and this entire report, concern only implementation costs incurred within California.

Table 16: Quantity of Businesses Affected by the Proposed Regulation

Type of Business	Quantity	Share of Total	Percent Small Business
Tire Retailers	2,232	45.8%	45%
Car Dealerships	2,169	44.5%	34%
Warehouses (Big Box Stores)	462	9.5%	0%
Tire Manufacturer Offices	11	0.2%	0%
Total	**4,874**	**100%**	

Source: Analysis by Evergreen of data from CEDD

Small Businesses Affected by the Proposed Regulation

For this analysis, a *small business* is defined as a tire business (retail shop, car dealership and big box store) with fewer than 50 employees. It is estimated that 1,004 (45 percent) of the 2,232 tire retailers are small businesses.

Auto dealerships often sell tires and may be affected by the regulations. It is estimated that 737 (34 percent) of the car dealerships in California are small businesses.

In total, the authors estimate that there are 1,741 small businesses that would be affected by the proposed regulation, and that small businesses make up 36 percent of the affected businesses. It is assumed that no warehouse/big-box establishments that sell tires are small businesses. All manufacturer administrative offices in California are operated by large manufacturing corporations. No tire manufacturing factories operate in California.

Specific Economic Impact to Businesses and Individuals

The first-order economic costs of the proposed regulations are the incremental cost of compliant tires compared to the baseline. These are incremental costs accrued by drivers and implementation costs accrued by businesses. Table 17 shows the initial annual cost and ongoing annual cost of the regulations for small businesses and typical businesses.

Table 17: Cost Per Individual Business

Sector	Initial Cost	Ongoing Cost
Small Business	$445	$445
Typical Business	$620	$620

Source: Analysis by Evergreen and CEC staff

The compliance costs for regulated businesses were calculated. Each year, it assumes 10 hours of training for two employees per retail tire business, plus $100 for miscellaneous costs, and $50,000 in administrative expenses to tire manufacturing offices in California. Hourly wages are derived for various types of businesses in the tire industry using data from the California Employment Development Department, Quarterly Census of Employment and Wages.[19] Results are shown in Table 18.

19 California Employment Development Department. "Quarterly Census of Employment and Wages." Accessed August 9, 2024, https://labormarketinfo.edd.ca.gov/data/Quarterly_Census_of_Employment_and_Wages.html.

Table 18: Aggregate Business Compliance Costs per Sector

Type of Business	Annual Implementation Costs for Businesses
Tire Retailers	$804,078
Car Dealerships	$1,214,098
Warehouses (Big Box Stores)	$144,953
Tire Manufacturer Offices	$550,000
Total	**$2,713,129**

Source: Analysis by Evergreen and CEC staff

Small Businesses

The small businesses forecast to be affected by the regulation are tire retailers and auto dealerships. The annual implementation cost for small businesses is calculated by dividing the total implementation costs by the percentage of regulated businesses assumed to be small businesses. Table 19 shows the results.

Table 19: Total Annual Implementation Cost for Small Business

Tire retailers (45% of $804,078)	$ 361,835
Car dealerships (34% of $1,214,098)	$ 412,793
Total annual cost to all small businesses	$ 774,628

Source: Analysis by Evergreen and CEC staff

The share of small businesses within each type of business allows for the calculation of the expected initial and implementation cost per small business. Because the regulations do not include significant start-up costs for in-state regulated entities, the initial cost and ongoing costs are the same. Table 20 shows the results.

Table 20: Annual Implementation Cost per Small Business

Total annual implementation cost for all affected small businesses	$ 774,628
Number of tire businesses in California	1,741
Cost per business (cost / number of businesses)	$445

Source: Analysis by Evergreen and CEC staff

Typical Businesses

The analysis also estimates the cost to implement the regulation for typical businesses. Because the regulations do not include significant start-up costs for in-state regulated entities, the initial cost and ongoing costs are the same. Results are shown in Table 21.

Table 21: Average Annual Impact per Typical Business

Annual implementation cost to all typical affected businesses	$1,943,501
Number of typical affected businesses in CA	3,133
Cost per business (cost / number of businesses)	$ 620

Source: Analysis by Evergreen and CEC staff

All Businesses

The analysis estimates the cost to implement the regulation for all businesses. Because the regulations do not include significant start-up costs for in-state regulated entities, the initial cost and ongoing costs are the same. Table 22 shows the results.

Table 22: Average Annual Impact per Business

Annual implementation cost to all affected businesses	$2,713,128
Number of affected businesses in CA	4,874
Cost per business (cost / number of businesses)	$557

Source: Analysis by CEC staff

Individuals

This analysis estimates the cost of the regulation to an individual. For this calculation, the initial costs are taken to be the costs during Phase 1 of the regulation (2028–2030), and the ongoing costs are taken to be the costs in Phase 2 (2031–2035).

In Phase 1, the initial cost to an individual in the first year is $6, or $1.50 per year during the average four-year lifespan of the set of replacement tires. In Phase 2, the initial cost to an individual in 2031 and thereafter is $28.47 (weighted average based on shares of vehicle types on road), or about $7 per year during the average four-year lifespan of the set of replacement tires.

Other Economic Costs That May Occur

No tires are manufactured in California. Costs incurred by tire manufacturers to design and manufacture compliant tires that are passed on to consumers are included as the primary cost of the regulation. Since the SRIA concerns only economic costs within California and no tires are manufactured in California, costs that would be incurred by manufacturers but not passed on to California consumers through the cost of tires are excluded from this analysis.

Number of Businesses Created or Eliminated

It is not expected that any new businesses will be created or eliminated because of the proposed regulation. It is not anticipated that any expansion of businesses currently doing

business in California will occur. Tire demand is relatively inelastic, meaning that a moderate increase in the cost of tires under the regulation compared to the baseline is unlikely to affect overall demand for tires. Tire manufacturing does not take place in California, so any marginal increase in manufacturing costs over the baseline will not occur in California.

Geographic Extent of the Impacts

The proposed regulations would have a statewide effect as the proposal would regulate tire sales throughout California.

Number of Jobs Created or Eliminated

It is not expected that jobs will be directly created or eliminated by the proposed regulation. The volume of tires demanded by the market is relatively inelastic compared to the estimated incremental costs created by the program. Therefore, it is not anticipated that a change to the volume of tires sold through the current tire distribution system will occur.

Fuel cost savings, however, are expected to increase household discretionary spending and result in the second-order creation of jobs across all sectors. The number of jobs created by discretionary household spending is estimated in the next chapter.

Ability of California Businesses to Compete With Other States

The proposed regulations will not affect the competitiveness of California businesses because the regulated entities are tire manufacturers. No tires are manufactured in California. The regulations would additionally not deter a tire manufacturer from placing a hypothetical future tire manufacturing plant in California because all tires sold in California must meet the standards whether they were manufactured in-state or not. In other words, a manufacturing facility in California would have access to the exact same markets as it would otherwise have without the regulations in place.

There are possible dynamics that could occur in California's border regions where California consumers could seek noncompliant tires in an unregulated jurisdiction and import them to California without great inconvenience. However, this importation is not expected to create a major disadvantage because the incremental cost of the regulations is cost-effective due to fuel savings, and the areas where this may occur are generally sparsely populated. The importation of noncompliant tires from other states would likely be limited.

Increase or Decrease of Investment in California

Manufacturing and most research and development for the tire industry reside outside California. It is unlikely that significant investments will increase or decrease in California because of the regulations.

Incentive for Innovation in Products, Materials, or Processes

California has the highest vehicle registration count in the nation. Therefore, providing products that meet regulations and consumer needs has been demonstrated to be important

to manufacturers from many different product sectors, including the tire industry. Tire manufacturers maintain competitive advantage by investing in new tire model designs and new manufacturing processes, which enables efficient tire technology to be advanced and allows ongoing access to markets moving toward energy-efficient tires, like California. For example, EV sales in California have contributed to the development of tires with low noise levels, and these innovations are likely to continue because of the proposed regulations.

Cost of Reporting Requirements

An expense of $50,000 per year is assumed for each of the 11 tire manufacturing businesses doing business in California. As the actual tire manufacturing does not occur in California, this expense accounts for the administrative labor to comply with the proposed regulation. This labor includes tasks such as processing documentation, auditing, and internal and external communications with stakeholders. One hundred percent of these costs to tire manufacturers would be associated with the reporting requirement of the proposed regulation.

Impact on Housing Costs

The regulation will not directly impact housing costs, as the proposed regulations set standards for replacement tire efficiency, which is not a direct input to housing development.

Comparable Federal Regulations

There are no comparable federal tire efficiency regulations.

CHAPTER 3:
Estimated Benefits

Economic Benefits of the Proposed Regulation

The following benefits are calculated from the proposed regulation. The proposed regulations are expected to produce net benefits by reducing fuel consumption and carbon dioxide equivalent emissions and increasing household discretionary spending by reducing household fuel expenditures.

The savings from the expected regulations are primarily the expected fuel savings from adopting more efficient tires. This report considers fuel cost savings a first-order benefit and economic benefits from reduced pollution and changes in discretionary income to be second-order benefits.

The costs of the regulations consist of the first-order costs of more efficient replacement tires compared to tires sold without the regulation, as well as implementation costs to business.

Total Net First-Order Benefit of Fuel Cost Savings

Table 23 shows the statewide net first-order benefit which factors in the fuel cost savings and the associated incremental costs of tire replacement during the first eight years of the regulation. It is estimated that the cumulative net first-order benefit in fuel savings after the incremental costs of the higher efficiency tires after eight years will be $3 billion.

Table 23: Statewide Net First-Order Benefit

Year	Annual Net Benefits ($ Million)	Cumulative Net Benefits ($ Million)
2028	$29.38	$29.38
2029	$69.38	$98.76
2030	$108.26	$207.02
2031	$200.42	$407.44
2032	$412.72	$820.17
2033	$617.96	$1,438.13
2034	$814.42	$2,252.55
2035	$793.02	$3,045.57

Source: Analysis by CEC staff and Evergreen of data from CEC staff

Carbon Dioxide Equivalent Reduction Benefits

The expected reduction in CO_2e emissions resulting from the proposed regulation was estimated as part of the analysis. Using 2021 California emissions data, the annual percentage reductions for passenger vehicles and for the total economy was calculated.[20] Table 24 illustrates these impacts, showing a 2 percent reduction in passenger vehicle emissions and a 0.53 percent reduction in statewide emissions in 2035 relative to 2021.

Table 24: Annual Shares of Abated Carbon Dioxide Equivalent Emissions

Year	Annual Total Abated Emissions (Metric tons)	Percentage Reduction From Passenger Vehicles (Relative to 2021)	Percentage Reduction From Total Economy (Relative to 2021)
2028	96,509	0.09%	0.03%
2029	188,905	0.18%	0.05%
2030	275,745	0.26%	0.07%
2031	858,782	0.82%	0.23%
2032	1,315,255	1.26%	0.34%
2033	1,733,433	1.67%	0.45%
2034	2,106,511	2.02%	0.55%
2035	2,004,642	1.93%	0.53%

Source: CEC staff and Evergreen analysis of data from the California Air Resources Board

From the emissions factors in Table 10, the analysis calculated CO_2e emissions generated by the fuel consumed between 2028 and 2035. The calculation of the social cost of carbon emissions includes conservative and aggressive estimates of the social cost of CO_2e emissions, shown in Table 25. This is considered a second-order benefit and is not included in Table 23.

20 California Air Resources Board. 2021 "GHG Inventory Data Archive," https://ww2.arb.ca.gov/ghg-inventory-archive.

Table 25: Second-Order Benefit of Abated Carbon Dioxide Equivalent Emissions

Year	CO2e Savings (Metric Tons)	Social Benefit of CO2e Savings at $35 per Metric Ton ($ Million)	Social Benefit of CO2e Savings at $185 per Metric Ton ($ Million)
2028	96,509	$3.38	$17.85
2029	188,905	$6.61	$34.95
2030	275,745	$9.65	$51.01
2031	858,782	$30.06	$158.87
2032	1,315,255	$46.03	$243.32
2033	1,733,433	$60.67	$320.69
2034	2,106,511	$73.73	$389.70
2035	2,004,642	$70.16	$370.86
Total	**8,579,783**	**$300.29**	**$1,587.26**

Source: Analysis by CEC staff and Evergreen of data from CEC staff

Total Social Benefit of the Proposed Regulation

Assessment of the economic impact of the proposed regulation concludes with an estimate of the total social benefit. Total social benefit includes first-order and second-order costs and benefits and is defined as:

$$\begin{aligned} &total\ social\ benefit \\ &\quad = net\ benefits\ to\ consumers - costs\ to\ business \\ &\quad + social\ benefit\ of\ abated\ emissions \end{aligned}$$

The analysis estimated the total social benefit of the regulation under two social costs of carbon (SCC) scenarios, with a carbon price of $35 per metric ton[21] and $185 per metric ton.[22] Table 26 shows the annual and cumulative total social benefit under the two SCC scenarios by summing the net benefit to consumers, the net benefit to businesses, and the net social benefit of abated emissions. The regulation has a positive total social impact in both scenarios, with a cumulative total social benefit of $3.3 billion and $4.6 billion, respectively.

21 California Air Resources Board. May 2024 update. "California Cap-and-Trade Program Summary of California-Quebec Joint Auction Settlement Prices and Results." https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/auction-information

22 Rennert, K., Errickson, F., Prest, B. C., et al. 2022. "Comprehensive Evidence Implies a Higher Social Cost of CO2." *Nature, 610* (687–692), https://doi.org/10.1038/s41586-022-05224-9.

Table 26: Annual and Cumulative Total Social Benefit

Year	Total Social Benefit ($ Million with a $35 SCC)	Total Social Benefit ($ Million with a $185 SCC)
2028	$30.05	$44.53
2029	$73.28	$101.61
2030	$115.20	$156.56
2031	$227.77	$356.59
2032	$456.04	$653.33
2033	$675.92	$935.94
2034	$885.43	$1,201.41
2035	$860.47	$1,161.16
Cumulative	**$3,324.15**	**$4,611.12**

Source: Analysis by CEC staff and Evergreen

Economic Impact From Change in Residential Discretionary Income

Using motor-vehicle registration data from the Federal Highway Administration, the authors estimated that 82 percent of the California fleet of light-duty vehicles are residential vehicles.[23] The proposed regulation will result in individuals and households that own these vehicles spending more on replacement tires, but this increase in costs to consumers will be more than made up for in reduced spending on transportation fuel due to increased tire efficiency. The net impacts — savings to households — increase each year as more of the state's residential vehicle fleet is affected by the regulation. These savings grow rapidly beginning in 2032 in the second year of Phase 2.

The project team used Impact Analysis for Planning (IMPLAN) modeling software to estimate the economic impacts that the proposed regulation will have on California households as they transition to more efficient replacement tires. IMPLAN is an input-output model used to estimate the economic effects on businesses and households of proposed policies and projects. The IMPLAN model relies on user-specified inputs (for example, a change in household discretionary income) to generate estimates of economic impacts to a region (in this case, California), including changes in economic output, employment, and wages. For this analysis, the team used IMPLAN Version 24 modeling software.

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23 Federal Highway Administration. 2022. "Highway Statistics 2022: Table MV-1." U.S. Department of Transportation, https://www.fhwa.dot.gov/policyinformation/statistics/2022/mv1.cfm.

The net savings to households is characterized as "discretionary income" to the household.[24] Households are assumed to save some of this discretionary income but will spend most of it to purchase goods and services in California.[25]

Table 26 shows the economic impact on household spending resulting from the expected change in discretionary income during the first eight years of the proposed regulation. These impacts (jobs, wages, and economic output) represent second-order (or indirect) effects of the proposed regulation that are not immediately evident but become apparent over time. The economic impacts shown in Table 26 are not cumulative over the eight-year period. They represent the economic response estimate that will occur each year because of increased discretionary income by households.

Table 27: Economic Impacts from Increased Discretionary Income to California Households

Year	Discretionary Income	Jobs Created	Change in Wages	Economic Output
2028	$23,210,000	113	$8,609,313	$17,132,356
2029	$54,810,000	261	$19,795,578	$39,333,092
2030	$85,530,000	395	$29,986,414	$59,672,344
2031	$158,330,000	711	$53,966,669	$107,392,556
2032	$326,005,000	1,424	$108,044,570	$215,006,462
2033	$488,190,000	2,073	$157,276,545	$312,977,076
2034	$643,390,000	2,656	$201,514,234	$401,009,165
2035	$626,490,000	2,514	$190,766,410	$379,621,217

Source: Evergreen analysis of data from the U.S. Census Bureau, Federal Highway Administration, and CEC 2022 Integrated Energy Policy Report Update

24 *Discretionary income* is the income remaining to an individual or household after taxes, Social Security, other deductions, and mandatory expenses.

25 Based on spending data from California IMPLAN model and household income data from the American Community Survey, one-year estimates for 2022, the authors estimate that California households and individuals will spend 79 percent of discretionary income on goods and services in California. The remainder (21 percent) is either saved or spent on good and services from outside California.

Statutory Requirements of Benefits

According to CEC staff, the benefits are the result of specific statutory requirements. Public Resources Code Section 25772 requires that the CEC develop a "tire energy efficiency program of statewide applicability for replacement tires, designed to ensure that replacement tires sold in the state are at least as energy efficient, on average, as tires sold in the state as original equipment on new passenger cars and light-duty trucks." Further, Public Resources Code (PRC) Section 257739(a)(1)(A) requires the CEC include in the program energy efficiency standards that are "technically feasible and cost effective."

Qualitative Benefits to Health, Safety, and Welfare of California Residents, Worker Safety, and the State's Environment

CEC staff expects that the net fuel cost benefit from fuel-efficient tires will increase household discretionary spending and result in the second-order creation of jobs and improved quality of life. The social benefits of abated carbon dioxide emissions include the health benefits associated with reduced air pollution.

Increased energy efficiency in tires is not expected to adversely affect safety or the welfare of California residents, nor are these regulations expected to affect worker safety or the California environment.

CHAPTER 4:
Alternatives to the Regulation

The statewide economic effects of two alternatives to the proposed regulation are presented below.

Alternatives Considered

The project team considered two alternatives to the proposed regulations. Alternative 1 includes the original minimum performance standards for replacement tires from the Draft Framework published in February 2023. Alternative 2 is an adjusted version of the regulation based on comments from the United States Tire Manufacturers Association (USTMA) and the Tire and Rubber Association of Canada (TRAC) in response to the Draft Framework by CEC staff.

Alternative 1 requires that tires comply with more aggressive minimum performance standards starting in 2026, whereas Alternative 2 is a relaxed regulation with a substantial change in tire efficiency not occurring until 2031. In terms of the economics, that means both the costs and benefits will increase in Alternative 1 and decrease in Alternative 2. This report assesses the potential economic impact of these two alternatives based on the respective fuel cost and emissions savings. Table 28 summarizes the alternatives in comparison to the proposal.

Table 28: Proposed RRC Standards and Alternatives

Year	Phase 1 Start Year	Phase 1 Standard (RRC)	Phase 2 Start Year	Phase 2 Standard (RRC)
Proposed regulation	2028	9	2031	7.1 (7.8 for light truck tires)
Alternative 1	2026	8.3	2028	6.3
Alternative 2	2028	9.7	2031	8.7

Source: CEC staff

Total Statewide Costs and Benefits

This report estimates the total statewide benefits and costs of the proposed regulation, Alternative 1, and Alternative 2, as shown in Table 32. For simplicity, only first-order economic benefits and costs are shown. The first-order economic benefit is fuel cost savings. The first-order economic cost is the incremental cost of tires under each proposal compared to the baseline.

The costs and benefits for the proposed standards and alternatives look at economic effects from when each alternative regulation comes into force until 2035. Because proposals have different implementation timelines, costs and benefits begin in different years. For example, the earliest implementation dates occur in Alternative 1 in 2026, resulting in costs and benefits across a 10-year period (2026–2035). While Alternative 2 uses the same implementation dates as the proposed standard, the Phase 1 RRC levels for this alternative are at a level at which nearly all tires would currently comply, so the costs and benefits accrue over the five-year Phase 2 timeline (2031–2035).

The cost and benefit analysis for Alternatives 1 and 2 mirror the method and assumptions described in Chapters 1–3 and are evaluated against the same baseline. More stringent standards mean fewer existing tires already meet the requirements and less stringent standards mean more existing tires meet the requirements, and so the volume of tires affected changes between alternatives. Also, the alternative stringencies affect the specific fuel economies achieved in each alternative.

For example, under the proposed regulation the Phase 2 fuel economy of a gasoline passenger vehicle is listed as 24.92 MPG in Appendix A, but because Phase 2 requirements in Alternative 1 are more stringent the fuel economy is improved to 25.16. This change produces additional benefits under Alternative 1. Similarly, the lower stringency of Alternative 2 would lead to a worse Phase 2 fuel economy for gasoline passenger vehicles of 24.54 than under the proposed regulation. Table 29 describes the relative percentage of fuel economy improvement to California's vehicle fleet.

Table 29: Comparison of Fuel Economy Improvements for Alternative Regulations

Phase	Proposed Regulation	Alternative 1	Alternative 2
Phase 1	0.2%	1.3%	0%
Phase 2	1.8%	3.1%	0.4%

Source: CEC staff and Evergreen analysis of data from CEC staff

The other major economic difference between the proposed regulation and alternatives is the incremental tire price. The analysis uses a cost curve to assign higher tire prices to higher levels of efficiency and lower tire prices to lower levels of efficiency compared to the proposal. To calculate the incremental costs of the two alternatives, the analysis imputed these costs as a function of change in tire efficiency based on the data from CEC staff and as described in Appendix B.[26] Table 30 shows the values used to calculate the incremental costs of Alternative 1 and Alternative 2.

26 See Figure 1 in Appendix C for the model and formula used to generate these values.

Table 30: Comparison of Incremental Costs for Alternative Regulations

Phase	Proposed Regulation	Alternative 1	Alternative 2
Phase 1	$6.00	$15.00	$0.00
Phase 2	$28.47	$95.00	$7.00

Source: CEC staff and Evergreen analysis of data from CEC staff

The final difference of assumptions is that the analysis applied a compliance rate of 90 percent to Phase 1 of Alternative 1 due to the similar stringency to Phase 2 of the proposed regulation. A compliance rate of 100 percent is assumed for Phase 2 of Alternative 2 given the similarities to Phase 1 of the proposed regulation.

Table 31 shows the annual and cumulative first-order costs, benefits, and net costs of the proposed regulations and each alternative.

Table 31: Comparison of Incremental Costs for Alternative Regulations

Year	Fuel Savings ($Million) Proposed	Fuel Savings ($Million) Alt 1	Fuel Savings ($Million) Alt 2	Incremental Costs ($Million) Proposed	Incremental Costs ($Million) Alt 1	Incremental Costs ($Million) Alt 2
2026	$0	$199.15	$0	$0	$58.22	$0
2027	$0	$398.54	$0	$0	$58.61	$0
2028	$40.82	$878.99	$0	$11.43	$645.00	$0
2029	$80.90	$1,353.46	$0	$11.52	$651.10	$0
2030	$119.87	$1,620.41	$0	$11.61	$656.86	$0
2031	$380.01	$1,877.32	$67.29	$179.59	$662.60	$23.83
2032	$593.90	$1,852.13	$132.65	$181.18	$668.59	$24.03
2033	$800.90	$1,824.44	$195.96	$182.94	$675.20	$24.27
2034	$999.05	$1,791.70	$256.79	$184.63	$681.54	$24.51
2035	$979.32	$1,755.14	$251.88	$186.31	$687.81	$24.74
Total	$3,994.78	$13,551.27	$904.56	$949.21	$5,445.52	$121.39

Source: CEC staff and Evergreen analysis of data from CEC staff

The first-order cost-effectiveness ratios are included in Table 32, as the total first-order benefits are divided by the total first-order costs for each proposal. Although Alternative 2

appears to be highly cost-effective, the performance standards in Alternative 2 do not meet the statutory requirement that replacement tires be at least as energy-efficient as original equipment tires, on average.

Table 32: Statewide First-Order Benefits and Costs, 2026–2035

Proposal	Fuel Savings Benefit ($ Million)	Incremental Tire Costs ($Million)	Incremental Implementation Cost ($Million)	Cost-Effectiveness Ratio
Regulation	$3,994.78	$949.21	$21.71	4.2
Alternative 1	$13,551.27	$5,445.52	$27.13	2.5
Alternative 2	$904.56	$121.39	$13.57	6.7

Source: Analysis by CEC staff and Evergreen

Total Social Benefit of the Proposed and Two Alternatives

Table 33 summarizes the total social benefit of the proposed regulation compared with the two alternative regulations. The social order benefit is distinct from the first-order economic cost shown above in Table 31 and is considered a second-order benefit. The estimated total social benefit of Alternative 1 is more than double the total social benefit of the proposed regulation.

Table 33: Comparison of Total Social Benefit

Social Benefit	Proposed Regulation: 2028–2035 ($Million)	Alternative 1: 2026–2035 ($Million)	Alternative 2: 2028–2035 ($Million)
Total social benefit ($35/metric ton CO2e)	$3,826.36	$9,135.12	$836.72
Total social benefit ($185/metric ton CO2e)	$5,262.63	$13,663.01	$1,124.30

Source: Analysis by CEC staff and Evergreen

Alternative 1

Alternative 1 is the set of proposed standards considered by the CEC at the beginning of 2023 and discussed in detail in its Draft Framework report.[27] Given the substantial change in mandated tire efficiency for replacement tires between the baseline and Phase 1 and between Phase 1 and Phase 2, the analysis assumed 90 percent compliance for all years. The analysis calculated the Phase 1 tire efficiency improvement for Alternative 1 based on the proposed regulation tire efficiency improvement of 2.4 percent for passenger cars from an assumed baseline RRC of 9.2 newtons/kilonewtons.

Table 34: Original Proposed Efficiency MPS

	Phase 1: 2026–2027	**Phase 2: 2028–2035**
Minimum RRC level for all replacement tires	8.3	6.3
Tire efficiency improvement	9.8%	24%
Fuel efficiency improvement	1.3%	3.1%

Source: CEC staff and Evergreen analysis of data from CEC staff

Alternative 1 Costs

Statewide Incremental Costs of Alternative 1

Given the more stringent minimum performance standards and the shortened timeline allowing tire manufacturers and retailers to adapt to the original proposed regulation, the analysis assumes an average $15 incremental cost for a set of replacement tires for Phase 1 and $95 for Phase 2 of the alternative regulation. These costs are derived from the cost curve described in Appendix B.

To calculate the incremental costs incurred by consumers purchasing replacement tires, the analysis estimates the quantity of vehicles that would not already be compliant with the Alternative 1 regulation. Table 35 shows the shares of vehicles not compliant in the two phases of this alternative to regulation.

27 These RRC values are correlated with the European Union's (EU) tire efficiency testing protocol and should not be compared with the values in the CEC Draft Framework report from February 2023.

Table 35: Share of Vehicles Affected by Alternative 1 Regulation

Vehicle Type	Phase 1	Phase 2
Passenger Car	67%	99%
SUV	46%	97%
Light-Duty Truck	57%	92%
Van	60%	100%

Source: CEC staff and Evergreen analysis of data from CEC staff

When the analysis takes a weighted average of these noncompliance rates based on the proportion of each vehicle type in the fleet (Table 1), it estimates that 30 percent of the fleet would not already be in compliance with Phase 1 of Alternative 1, and that 89 percent of the fleet would not already be in compliance with Phase 2. These proportions were used in calculating the annual incremental costs for Alternative 1 (Table 36).

Table 36: Statewide Incremental Costs of Alternative 1 Regulation

Year	Annual Incremental Costs ($Million)	Cumulative Incremental Costs ($Million)
2026	$58.22	$58.22
2027	$58.61	$116.82
2028	$645.00	$761.83
2029	$651.10	$1,412.93
2030	$656.86	$2,069.79
2031	$662.60	$2,732.39
2032	$668.59	$3,400.98
2033	$675.20	$4,076.18
2034	$681.54	$4,757.72
2035	$687.81	$5,445.52

Source: CEC staff and Evergreen analysis

Implementation Costs to Tire Businesses With Alternative 1

The analysis estimated that the annual implementation costs for businesses under Alternative 1 would be the same as those under the proposed regulation. Table 37 shows the cumulative implementation costs to the various tire businesses in California over the 10-year period.

Table 37: Cumulative Implementation Costs of Alternative 1, 2026–2035

Business Type	Implementation Costs
Tire Retailers	$8,040,780
Car Dealerships	$12,140,978
Warehouses (Big Box Stores)	$1,449,525
Tire Manufacturer Offices	$5,500,000
Total	$27,131,283

Source: Analysis by Evergreen of data from CEDD

Alternative 1 Benefits

Fuel Cost Savings of Alternative 1

Table 38 shows the savings in fuel costs from the Alternative 1 regulation, assuming a 90 percent compliance rate for Phase 1 and a 90 percent compliance rate for Phase 2.

Table 38: Fuel Cost Savings of Alternative 1 Regulation

Year	Annual Fuel Cost Savings ($Million)	Cumulative Fuel Cost Savings ($Million)
2026	$199.15	$199.15
2027	$398.54	$597.69
2028	$878.99	$1,476.68
2029	$1,353.46	$2,830.14
2030	$1,620.41	$4,450.55
2031	$1,877.32	$6,327.87
2032	$1,852.13	$8,180.00
2033	$1,824.44	$10,004.44
2034	$1,791.70	$11,796.14
2035	$1,755.14	$13,551.27

Source: CEC staff and Evergreen analysis of data from CEC staff

Social Benefit From Abated Carbon Dioxide Equivalent Emissions

Table 39 shows the estimated annual social benefit from the reduction of CO_2e emissions from Alternative 1. This is considered a second-order benefit.

Table 39: Social Benefit From Abated Carbon Dioxide Equivalent Emissions of Alternative 1

Year	CO2e Savings (Metric Tons)	Social Benefit of CO2e Savings at $35 per Metric Ton ($Million)	Social Benefit of CO2e Savings at $185 per Metric Ton ($Million)
2026	480,178	$16.81	$88.83
2027	953,250	$33.36	$176.35
2028	2,081,728	$72.86	$385.12
2029	3,167,569	$110.86	$586.00
2030	3,738,455	$130.85	$691.61
2031	4,258,237	$149.04	$787.77
2032	4,120,009	$144.20	$762.20
2033	3,969,365	$138.93	$734.33
2034	3,800,480	$133.02	$703.09
2035	3,616,636	$126.58	$669.08
Total	**30,185,905**	**$1,056.51**	**$5,584.39**

Source: Analysis by CEC staff and Evergreen of data from CARB and UC Berkeley

Economic Impacts from Additional Discretionary Income to California Households: Alternative 1

Table 40 shows the estimated impact on discretionary income, jobs, and wages for residential consumers with the Alternative 1 regulation. This is considered a second-order benefit.

Table 40: Alternative 1 Economic Impact of California Households

Year	Discretionary Income	Jobs Created	Change in Wages	Economic Output
2026	$111,342,600	576	$44,861,315	$89,365,230
2027	$268,544,700	1,350	$105,192,207	$209,546,371
2028	$184,844,200	904	$70,392,948	$140,225,090
2029	$554,864,400	2,637	$205,431,259	$409,225,890
2030	$761,204,500	3,518	$273,991,667	$545,800,500
2031	$959,636,700	4,311	$335,814,309	$668,953,256
2032	$934,996,600	4,084	$318,096,376	$633,658,546
2033	$907,899,600	3,855	$300,291,373	$598,190,389
2034	$877,026,400	3,621	$282,016,189	$561,785,615
2035	$843,190,700	3,384	$263,598,857	$525,097,677

Source: Evergreen analysis of data from the US Census Bureau, Federal Highway Administration, and CEC 2022 Integrated Energy Policy Report Update

Total Social Benefit of Alternative 1

With the benefits and associated costs outlined above, Table 41 shows the total social benefit of the Alternative 1 regulation with two social costs of CO_2e, $35/metric ton, and $185/metric ton, respectively. These are considered second-order benefits.

Table 41: Total Social Benefit of Alternative 1

Year	Social Benefit: CO2e Savings at $35 per Metric Ton ($Million)	Social Benefit: CO2e Savings at $185 per Metric Ton ($Million)
2026	$155.03	$227.06
2027	$370.82	$513.57
2028	$304.13	$616.39
2029	$810.51	$1,285.64
2030	$1,091.58	$1,652.45
2031	$1,361.05	$1,999.79
2032	$1,325.02	$1,943.03
2033	$1,285.45	$1,880.86
2034	$1,240.46	$1810.53
2035	$1,191.20	$1,733.69
Total	**$9,135.12**	**$13,663.01**

Source: Analysis by CEC staff and Evergreen of data from CEC staff, CARB, and UC Berkeley

Statewide Net First-Order Benefit to Consumers

Table 42 presents the statewide benefit of Alternative 1 as the annual and cumulative fuel costs savings with the associated costs of the tire replacement to the consumer. These are first-order benefits.

Table 42: Statewide Net Benefit of Alternative 1 Regulation

Year	Annual Net Benefit ($Million)	Cumulative Net Benefit ($Million)
2026	$140.94	$140.94
2027	$339.93	$480.87
2028	$233.98	$714.85
2029	$702.36	$1,417.21
2030	$963.55	$2,380.76
2031	$1,214.73	$3,595.48
2032	$1,183.54	$4,779.02
2033	$1,149.24	$5,928.26
2034	$1,110.16	$7,038.42
2035	$1,067.33	$8,105.75

Source: CEC staff and Evergreen analysis of data from CEC staff

Alternative 2

There are two important aspects of this alternative. First, the Alternative 2 Phase 1 RRC is not stringent enough to improve fuel efficiency of the fleet (Table 43). Second, the Alternative 2 Phase 2 MPS does not meet the criteria set by Assembly Bill 844, which requires that replacement tires be as energy-efficient as original equipment tires, which requires a rolling resistance coefficient of at most 7.1.[28]

28 Alternative 2 did not specify a start date for Phase 2. Evergreen has used the assumption by CEC staff that the phases of the regulation requirements for tire efficiency are the same as the proposed regulation.

Table 43: Alternative 2 Minimum Performance Standards

Efficiency	Phase 1: 2028 – 2030	Phase 2: 2031 – 2035
Minimum RRC level for all replacement tires	9.7	8.7
Tire efficiency improvement	0%	3.2%
Fuel efficiency improvement	0%	0.4%

Source: CEC staff and Evergreen analysis of data from CEC staff

As the Phase 1 requirement for replacement tires does not enforce a significant change in tire efficiency, the analysis assumes 100 percent compliance in Phases 1 and 2.

Alternative 2 Costs

Incremental Costs to Consumers With Alternative 2

To calculate the incremental costs incurred by consumers purchasing replacement tires, the analysis estimated the quantity of vehicles that would not already be compliant with the Alternative 2 regulation (Table 44). This estimate is based on the shares of replacement tires noncompliant with the proposed regulation in Table 43. This estimate assumes no incremental cost during Phase 1 and an incremental average cost of $7 per set of replacement tires during Phase 2.

Table 44: Share of Vehicles Affected by Alternative 2 Regulation

Vehicle Type	Phase 1	Phase 2
Passenger Car	0%	58%
SUV	0%	30%
Light-Duty Truck	0%	44%
Van	0%	20%

Source: CEC staff and Evergreen analysis of data from CEC staff

The weighted average of the noncompliance rates and proportion of each vehicle type in the fleet (Table 1) expects that 27 percent of the fleet are not already be in compliance with Phase 2 of Alternative 2. These vehicles would incur the incremental cost when purchasing replacement tires in compliance with the regulation. Table 45 shows the annual and cumulative incremental costs associated with Alternative 2. These costs are considered first-order costs.

Table 45: Incremental Costs of Alternative 2 Regulation

Year	Annual Incremental Costs ($Million)	Cumulative Incremental Costs ($Million)
2028	$0	$0
2029	$0	$0
2030	$0	$0
2031	$23.83	$23.83
2032	$24.03	$47.86
2033	$24.27	$72.13
2034	$24.51	$96.64
2035	$24.74	$121.39

Source: CEC staff and Evergreen analysis of data from CEC staff

Implementation Costs to Tire Businesses With Alternative 2

The implementation costs below reflect the absence of significant regulation on replacement tires during Phase 1 of Alternative 2. Table 46 shows the cumulative implementation costs to the various tire businesses in California over an eight-year period. These costs are considered first-order costs.

Table 46: Cumulative Implementation Costs of Alternative 2, 2028–2035

Business Type	Cumulative Implementation Costs
Tire Retailers	$6,432,624
Car Dealerships	$9,712,784
Warehouses (Big Box Stores)	$1,159,624
Tire Manufacturer Offices	$4,400,000
Total	$21,705,032

Source: Analysis by Evergreen of data from CEDD

Alternative 2 Benefits

Estimated Fuel Cost Savings With Alternative 2

Table 47 shows the estimated statewide fuel cost savings as a result of Alternative 2. Since Phase 1 of Alternative 2 does not require an increase in tire efficiency, there are no expected fuel cost savings in the first phase of the regulation. This is considered a first-order benefit.

Table 47: Fuel Cost Savings of Alternative 2 Regulation

Year	Annual Fuel Cost Savings ($Million)	Cumulative Fuel Cost Savings ($Million)
2028	$0	$0
2029	$0	$0
2030	$0	$0
2031	$67.29	$67.29
2032	$132.65	$199.94
2033	$195.96	$395.90
2034	$256.79	$652.69
2035	$251.88	$904.56

Source: Analysis by CEC staff and Evergreen of data from CEC staff

Social Benefit From Abated Carbon Dioxide Equivalent Emissions

Table 48 shows the estimated annual social benefit from the reduction of CO_2e from Alternative 2. This is considered a second-order benefit.

Table 48: Social Benefit From Abated Carbon Dioxide Equivalent Emissions From Alternative 2

Year	CO2e Savings (metric tons)	Social Benefit of CO2e Savings at $35 per Metric Ton ($Million)	Social Benefit of CO2e Savings at $185 per Metric Ton ($Million)
2028	0	$0	$0
2029	0	$0	$0
2030	0	$0	$0
2031	151,545	$5.30	$28.04
2032	292,574	$10.24	$54.13
2033	422,127	$14.77	$78.09
2034	538,511	$18.85	$99.62
2035	512,486	$17.94	$94.81
Total	**1,917,243**	**$67.10**	**$354.69**

Source: Analysis by CEC staff and Evergreen of data from CEC staff, CARB, and UC Berkeley

Economic Impacts From Additional Discretionary Spending by California Households: Alternative 2

Table 49 shows the estimated impact on discretionary income, jobs, and wages for residential consumers with the Alternative 2 regulation. This is considered a second-order benefit.

Table 49: Alternative 2 Economic Impact of California Households

Year	Discretionary Income	Jobs Created	Change in Wages	Economic Output
2028	$0	0	$0	$0
2029	$0	0	$0	$0
2030	$0	0	$0	$0
2031	$34,333,400	154	$11,702,495	$23,287,723
2032	$85,809,8000	375	$28,435,157	$56,585,375
2033	$135,635,100	576	$43,696,552	$86,955,237
2034	$183,501,200	758	$57,473,855	$114,371,785
2035	$179,440,600	720	$54,639,721	$108,731,917

Source: Evergreen analysis of data from the U.S. Census Bureau, Federal Highway Administration, and CEC 2022 Integrated Energy Policy Report Update

Total Social Benefit of Alternative 2

Table 50 shows the total social benefit of the Alternative 2 regulation. This is considered a second-order benefit.

Table 50: Total Social Benefit of Alternative 2

Year	Social Benefit: CO2e Savings at $35 per Metric Ton ($Million)	Social Benefit: CO2e Savings at $185 per Metric Ton ($Million)
2028	$0	$0
2029	$0	$0
2030	$0	$0
2031	$46.05	$68.79
2032	$116.14	$160.03
2033	$183.75	$247.07
2034	$248.42	$329.19
2035	$242.35	$319.23
Total	$836.72	$1,124.30

Source: Analysis by CEC staff and Evergreen of data from CEC staff, CARB, and UC Berkeley

Statewide Net Benefit to Consumers

Table 51 presents the statewide benefit of Alternative 2 as the annual and cumulative fuel costs savings with the associated costs of the tire replacement to the consumer.

Table 51: Statewide Net First-Order Benefit of Alternative 2 Regulation

Year	Annual Net Benefit ($Million)	Cumulative Net Benefit ($Million)
2028	$0	$0
2029	$0	$0
2030	$0	$0
2031	$43.46	$43.46
2032	$108.51	$152.08
2033	$171.69	$323.77
2034	$232.28	$556.05
2035	$227.13	$783.18

Source: CEC staff and Evergreen analysis of data from CEC staff

Rationale for Choosing the Proposed Major Regulation

Following the release of an initial regulatory concept in the February 2, 2023, draft staff report, the CEC held a workshop to solicit public input February 18, 2023. The workshop information can be found on the Energy Commission website[29] on Docket 20-TIRE-01. Staff heard extensive comments from industry representatives. Following the workshop, staff set up numerous meetings with industry trade associations, tire manufacturers, tire retailers, and others to address comments and concerns. Stakeholder comments generally argued that it would be difficult for the tire industry to comply with Alternative 1 due to the long lead time necessary to develop and begin manufacturing new tire product lines. CEC staff finds some substance to this argument and is not proposing Alternative 1.

Alternative 2 does not comply with the requirements of Public Resources Code Section 25772. The statute requires that the Replacement Tire Efficiency Program be designed to ensure that replacement tires sold in California are as energy-efficient, on average, as original equipment tires. Based on testing conducted at Smithers Laboratory and commissioned by the CEC, original equipment tires sold in California today have an average rolling resistance of about

29 California Energy Commission. "Replacement Tire Efficiency Pre-Rulemaking Staff Workshop," https://www.energy.ca.gov/event/workshop/2023-02/replacement-tire-efficiency-pre-rulemaking-staff-workshop.

7.1. Since Alternative 2 does not set an MPS of at most 7.1 RRC, Alternative 2 does not achieve the goal set out in the law.

As such, the CEC concludes that the proposed major regulation is less burdensome and equally effective in achieving the purpose of the regulation in a manner that also meets the purposes of the statute.

Consideration of Performance Standards

According to CEC staff, the proposed regulations set tire efficiency standards and do not mandate the use of specific technologies or equipment, nor prescribe specific actions or procedures. The proposed standards are performance standards. As shown in this chapter, several stringencies of performance standards were evaluated for cost-effectiveness and effectiveness of achieving the purposes of tire program legislation.

CHAPTER 5:
Summary of Impacts

CEC staff proposes new regulations to increase the efficiency of passenger car and light-duty truck replacement tires.

This report estimates that the proposed regulation will produce $29 million in net cost savings for drivers in the first year the regulations are introduced, and about $3 billion in net benefits by 2035. Furthermore, this report estimates that the proposed regulations will produce substantial pollution reduction benefits. These savings and abated emissions are expected to contribute to discretionary household spending that will create second-order jobs and increase the social benefits associated with better air quality.

Based on this analysis, CEC staff judges that impacts from the proposed regulations on businesses and individuals are outweighed by the fuel cost benefits associated with more efficient tires. The costs-benefits analysis results in substantial statewide savings in energy and greenhouse gas emissions.

Glossary

Acronym	Term	Description
AB	Assembly Bill	A proposed law, introduced in the State Assembly during a session for consideration by the Legislature.
CARB	California Air Resources Board	State agency responsible for air quality and climate change mitigation.
CEC	California Energy Commission	State agency responsible for energy policy and planning.
CEDD	California Employment Development Department	State agency responsible for employment services and labor market information.
CO_2	Carbon dioxide	A common greenhouse gas produced by burning hydrocarbon fuels and by natural processes, such as respiration.
CO_2e	Carbon dioxide equivalent	A measure used to compare emissions from various greenhouse gases based upon the related global warming potential.
DOT	United States Department of Transportation	Federal agency responsible for transportation and safety.
EPA	United States Environmental Protection Agency	Federal agency responsible for environmental policy and enforcement.
EU	European Union	An international organization comprising 27 European countries.
EV	Electric vehicle	A vehicle that uses an electric propulsion system. Examples include battery-electric vehicles and fuel cell electric vehicles.
FCEV	Fuel cell electric vehicle	A type of electric vehicle that derives power from an onboard fuel cell.

Acronym	Term	Description
GHG	Greenhouse gas	Any gas that absorbs infrared radiation in the atmosphere. Examples of greenhouse gases include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).
IEPR	Integrated Energy Policy Report	A comprehensive biennial report by the CEC providing long term energy assessments and policy guidance.
ISO	International Organization of Standardization	A nongovernmental, worldwide federation of national standards bodies.
Kg	Kilogram	A basic unit of mass for the metric system, equivalent to 2.205 pounds.
LT	Light truck	A tire that carries a LT designation and is intended for light-duty trucks, SUVs, and vans.
t	Metric ton	A unit of weight equal to 1,000 kilograms.
MPG	Miles per gallon	A measure of vehicle fuel efficiency.
MPS	Minimum performance standard	The baseline requirements for fuel efficiency that a replacement tire must meet.
N	Newton	A unit of force that will accelerate 1 kilogram of mass 1 meter per second squared.
NHTSA	National Highway Traffic Safety Administration	A federal agency under the U.S. Department of Transportation responsible for transportation safety, as well as fuel economy.
NOx	Oxides of nitrogen	A mixture of gases that are composed of nitrogen and oxygen and considered an air pollutant.

Acronym	Term	Description
OE	Original equipment	An item of motor vehicle equipment, including tires, which were installed in or on a motor vehicle or available as an option for the particular vehicle from the original manufacturer at the time of the delivery to the first purchaser.
RTEP	Replacement Tire Efficiency Program	The name of the California Energy Commission's tire program under Assembly Bill 844.
RRC	Rolling resistance coefficient	A measure of rolling resistance that is the ratio of the force of rolling friction to the total weight of the object.
RRF	Rolling resistance force	A measure of resistance in pounds or kilograms that provides a direct way to compare tires of the same size, as well as offers an accurate means of comparing differently sized tires to one another.
SB	Senate Bill	A proposed law, introduced in the State Senate during a session for consideration by the Legislature.
Smithers	Contracted tire testing laboratory	A testing facility used for testing tires.
SOx	Oxides of sulfur	A group of compounds made up of oxygen and sulfur, such as SO, SO_2, etc., many of which are air pollutants.
SRIA	Standardized Regulatory Impact Analysis	A legally mandated economic and policy assessment required for major regulations with potential economic impacts exceeding $50 million. The SRIA evaluates the economic and fiscal impacts of a proposed regulation to understand the costs, benefits, and effectiveness of the regulatory actions.

Acronym	Term	Description
SUV	Sports utility vehicle	A vehicle similar to a station wagon or estate car, often on a light-duty truck chassis and suitable for off-road use.
TRAC	Tire and Rubber Association of Canada	National trade association for tire manufacturers and rubber product producers in Canada.
USTMA	United States Tire Manufacturers Association	National trade association for tire manufacturers in the U.S.
VMT	Vehicle miles traveled	A measure of distance traveled by a vehicle or group of vehicles over time, such as a year.

APPENDIX A:
Fuel Efficiency

Table A-1 shows the estimated change in fuel economy of each vehicle type during Phase 1 and Phase 2 of the proposed regulation. The Phase 1 and Phase 2 fuel economy rates were calculated from the estimated fuel efficiency improvements in Table 5.

Table A-1: Fuel Efficiency by Vehicle Type and Phase of Regulation

Vehicle Type	Fuel Type	Unit	Baseline Fuel Economy	Phase 1 Fuel Economy	Phase 2 Fuel Economy
Passenger car	diesel	MPG	34.00	34.11	34.73
	electric	MPKWh	2.90	2.91	2.96
	gasoline	MPG	24.40	24.48	24.92
	hydrogen	MPKG	64.00	64.20	65.38
	plug-in hybrid	MPG	45.00	45.14	45.97
SUV	diesel	MPG	23.50	23.53	23.82
	electric	MPKWh	2.80	2.80	2.82
	gasoline	MPG	17.80	17.83	18.05
	hydrogen	MPKG	64.00	64.09	64.88
	plug-in hybrid	MPG	40.00	40.06	40.55
Light-duty truck	diesel	MPG	23.50	23.56	23.92
	electric	MPKWh	2.00	2.01	2.04
	gasoline	MPG	17.80	17.85	18.12
	hydrogen	MPKG	64.00	64.17	65.16
	plug-in hybrid	MPG	22.00	22.06	22.40
Van	diesel	MPG	23.50	23.60	23.99
	electric	MPKWh	2.00	2.01	2.04
	gasoline	MPG	13.60	13.66	13.89
	plug-in hybrid	MPG	30.00	30.13	30.63

Source: Evergreen estimates based on data from the EPA National Vehicle and Fuel Emissions Laboratory and DOE Alternative Fuels Data Center

APPENDIX B:
Incremental Cost for Alternative Regulations

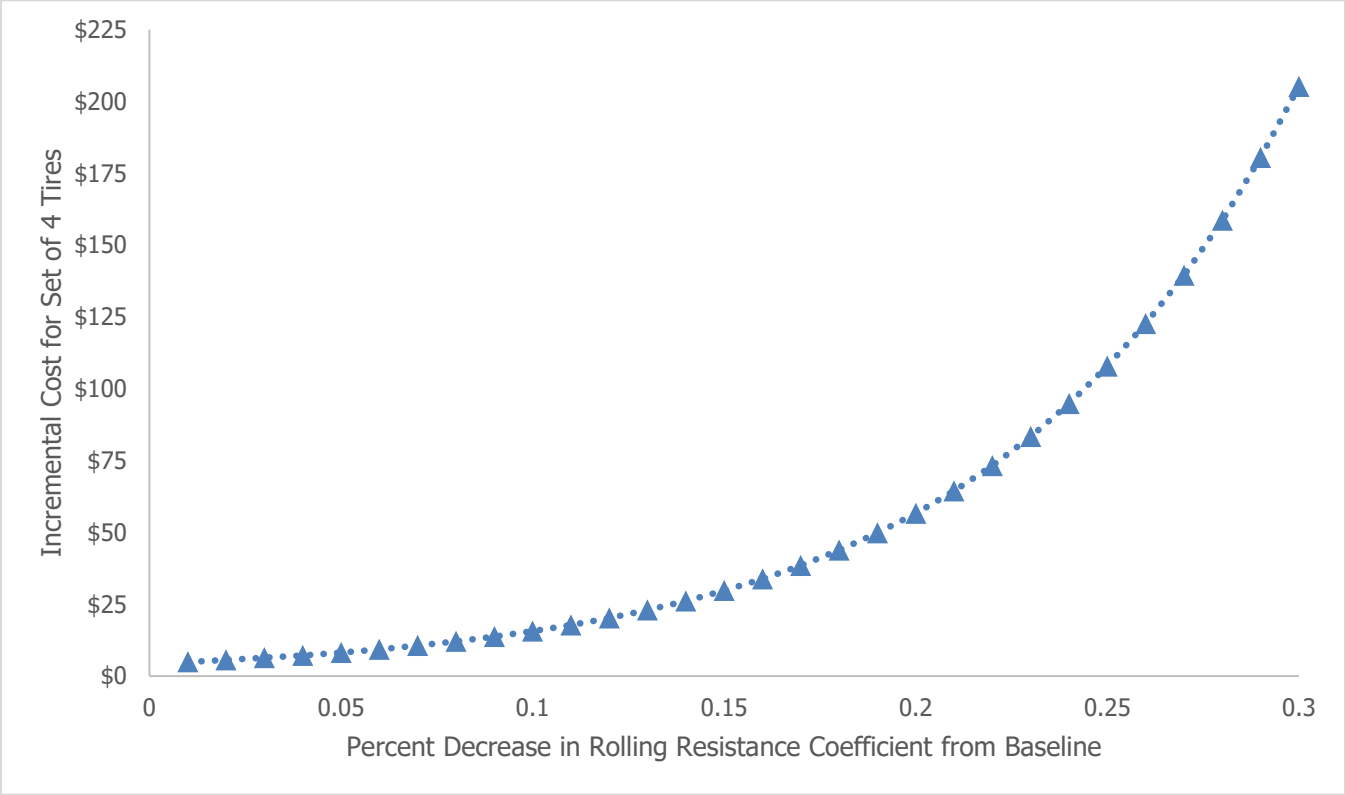
The following model was used to estimate the incremental costs for the alternative regulations relative to baseline costs. Instead of assuming a linear relationship between rolling resistance improvements and price, this model uses an exponential function. This more accurately reflects the marginal return of each dollar invested in more efficient tires, as well as the marginal costs associated with further efficiency improvements. The model is designed using the cost per improvement figures of the proposed regulation as well as information from the CEC 2023 draft staff report *Draft Framework of California's Replacement Tire Efficiency Program.*[30] The model that estimates the marginal costs of compliant tires is as follows:

$$Y = 4.3122 \times e^{12.876\,x}$$

Where Y is the incremental cost of a set of four tires and x is the percent decrease in rolling resistance from baseline. Figure 1 illustrates the increase in incremental cost as a function of the decline in the rolling resistance coefficient of a tire.

30 Blackburn, Bill, Jontae Clapp, Andrew Hom, Ralph Lee, et al. February 2023. *Draft Framework of California's Replacement Tire Efficiency Program.* California Energy Commission. Publication Number: CEC-600-2023-026-SD, https://efiling.energy.ca.gov/GetDocument.aspx?tn=248639.

Figure B-1: Incremental Cost Model



Source: CEC staff and Evergreen analysis of data from CEC staff.

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