| DOCKETED | |
|---|---|
| **Docket Number:** | 26-TIRE-01 |
| **Project Title:** | Tire Efficiency Rulemaking |
| **TN #:** | 269612 |
| **Document Title:** | Californias Proposed Replacement Tire Efficiency Program |
| **Description:** | N/A |
| **Filer:** | Spencer Kelley |
| **Organization:** | California Energy Commission |
| **Submitter Role:** | Commission Staff |
| **Submission Date:** | 4/24/2026 9:11:16 AM |
| **Docketed Date:** | 4/24/2026 |

California Energy Commission

**STAFF REPORT**

# California's Proposed Replacement Tire Efficiency Program

**April 2026 | CEC-600-2026-012**

# California Energy Commission

Bill Blackburn
Julie Burbridge
Andrew Hom
Ralph Lee
Ken Rider
David Sakai
Sebastian Serrato
Rachel Shuen
**Primary Authors**

Julie Burbridge
Sebastian Serrato
**Project Manager**

Jennifer Kalafut
**Deputy Director**
**FUELS AND TRANSPORTATION DIVISION**

Drew Bohan
**Executive Director**

# ABSTRACT

This report proposes new efficiency regulations for replacement tires sold for passenger vehicles and light-duty trucks in California.

Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003), codified in Public Resources Code Sections 25770 through 25773, directs the California Energy Commission (CEC) to adopt a replacement tire efficiency program "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." Replacement tires are those purchased by drivers to replace existing tires. The tires sold with new vehicles are referred to as original equipment tires. Testing commissioned by the CEC shows that original equipment tires are more efficient than replacement tires.

Tire efficiency has a significant impact on the energy consumption of vehicles. How easily a tire rolls, referred to as *rolling resistance*, affects how much drivers spend on fuel for their vehicle, whether gasoline, diesel, electricity, or hydrogen fuel. The regulations proposed in this staff report are, if adopted, expected to save each California driver of a gasoline passenger vehicle about $179 (2024 dollars) in fuel costs over the typical four-year life of a set of tires. In total, the regulations are anticipated to save California drivers about $979 million (2024 dollars) in fuel costs annually in 2035 and reduce greenhouse gas emissions by an estimated 2.0 million metric tons of carbon dioxide equivalent in 2035. This quantity is equivalent to about 1.9 percent of California's 2021 passenger vehicle emissions.

The CEC staff analysis shows that the regulations proposed in this staff report are technically feasible, are cost-effective, and will not compromise safety, reduce tire life, or increase tire waste.

**Keywords**: Efficiency regulations, fuel efficiency, energy efficiency, replacement tires, original equipment tires, low-rolling resistance tires, tire rating systems, minimum efficiency standards, fuels and transportation, petroleum reduction strategies, greenhouse gas emission reductions

Please use the following citation for this report:

Blackburn, Bill, Julie Burbridge, Andrew Hom, Ralph Lee, Ken Rider, David Sakai, Sebastian Serrato, and Rachel Shuen. 2026. *California's Proposed Replacement Tire Efficiency Program*. California Energy Commission. Publication Number: CEC- 600-2026-012.

# TABLE OF CONTENTS

# LIST OF FIGURES

Page

# LIST OF TABLES

# EXECUTIVE SUMMARY

This California Energy Commission (CEC) staff report proposes new regulations to increase the efficiency of passenger car and light-truck replacement tires pursuant to Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003). Public Resources Code Sections 25770 through 25773 direct the CEC to adopt a Replacement Tire Efficiency Program designed to ensure replacement tires for passenger cars and light-duty trucks sold in California are at least as energy-efficient as original equipment tires on new vehicles and develop a tire rating system.

This staff report proposes new regulations to:

1. Set reporting requirements for tire manufacturers.
2. Develop and maintain a database of tire information for replacement tires and limited production tires sold in California.
3. Set minimum performance standards for the energy efficiency (rolling resistance) of replacement tires.
4. Set a minimum performance standard for wet grip for replacement tires, to ensure safety.
5. Set a rating system for tire energy efficiency that will enable consumers to make more informed purchasing decisions.

## Increasing Replacement Tire Efficiency

The tire market is generally split into two product categories: original equipment and replacement tires. *Replacement tires* are those purchased by drivers to replace existing tires as opposed to the tires sold with new vehicles, which are referred to as *original equipment tires*. Original equipment tires may also be sold as replacement tires.

Tire efficiency is a key component of vehicle fuel efficiency. Energy-efficient tires have a low rolling resistance, meaning they can roll farther when given the same energy input as a tire with higher rolling resistance. Original equipment tires tend to have a lower rolling resistance than replacement tires. Testing commissioned by the CEC shows that original equipment tires are more efficient than replacement tires.

There are a couple reasons for this rolling resistance discrepancy. Historically, federal Corporate Average Fuel Economy (CAFE) standards required automakers to increase the efficiency of *new* vehicles but did not regulate the maintenance of that fuel efficiency after the vehicle is sold. Automakers can report increased fuel economy by installing highly efficient original equipment tires on new vehicles, but once a vehicle is sold, they have no obligation to maintain the fuel economy of the vehicle. Tire manufacturers design and develop replacement tires that do not have the same emphasis on efficiency, which result in replacement tires that are, on average, less fuel-efficient than similar original equipment tires.

Further, it is difficult to find information about the efficiency of a given tire. While automakers can demand a specific rolling resistance in their tire procurement, the competitive pressure on

rolling resistance in the replacement tire market is stunted without readily available and credible information. To date, neither the federal government nor state governments have set efficiency standards for original equipment or replacement tires of passenger cars and light-duty trucks. While the CAFE standards for automakers have resulted in improved fuel economy for new vehicles over the last several decades, there are no such requirements for tire manufacturers. The lack of tire efficiency standards increases driving costs for all vehicles, regardless of fuel. Regulating the efficiency of replacement tires is a clear opportunity to reduce the amount of money Californians spend on fuel while reducing important criteria pollutants and greenhouse gas emissions associated with fuel use.

## Proposed Regulations

These regulations apply to tire retailers, both in-store and online; tire manufacturers; and brand name owners doing business in California. The regulations require all replacement tires sold or offered for sale in California, except those with a specific criterion for exclusion, to meet minimum performance standards for rolling resistance and wet grip.

Under Public Resources Code Section 25773(a), these regulations must:

- Be technically feasible and cost-effective.
- Not adversely affect tire safety.
- Not adversely affect the average tire life of replacement tires.
- Not adversely affect state efforts to manage scrap tires.

The following tires are excluded from the proposed regulations:

- Specialty tires, including certain off-road tires, low-speed tires, deep-tread tires, winter snow tires, space-saver tires, and temporary-use tires
- Tires with a nominal rim diameter of 12 inches or less
- Motorcycle tires
- Tires manufactured specifically for use in off-road motorized recreational vehicles
- Tires used on emergency vehicles
- Tires with a load index of 122 or higher, or rated for a maximum load that exceeds 1,450 kilograms (kg)
- Limited production tires that are produced or imported into the United States in quantities fewer than 15,000 during any calendar year are only subject to reporting requirements to verify the limited production tire status.

In addition, the proposed standards offer an exception from the performance standards for a tire if there are no other compliant tires available for a given vehicle model that is operated in the state. Used and retreaded tires do not fall under the scope of the proposed regulation.

In accordance with Government Code Section 11343.3, CEC staff finds there is no evidence that these proposed regulations would impact vehicle weight or the ability of vehicle manufacturers or vehicle operators to comply with laws limiting the weight of vehicles.

## Effective Dates

The proposed regulation components in this staff report have different effective dates, as shown in Table ES-1.

**Table ES-1: Key Regulation Components and Effective Dates**

| Regulation Component | Effective Date |
|---|---|
| Reporting requirements for tire manufacturers for inclusion in tire database and rating system | January 1, 2028 |
| Energy Performance Standards | • Phase 1 — January 1, 2028<br>• Phase 2 — January 1, 2031 |
| Wet Grip Minimum Performance Standard | January 1, 2028 |

Source: CEC staff

## Reporting Requirements for Tire Manufacturers

The proposed regulations will require tire manufacturers that seek to sell regulated replacement tires in California report information about said tires to the CEC database. This required information including rolling resistance, via an online data submission system. Manufacturers will self-certify the ratings of their tires, based on specified test procedures, and will be required to provide test measurements and other documentation to the CEC upon request.

## Tire Program Database

The CEC will host reported data in a public online database. The database will show the tire energy efficiency rating for each replacement tire sold under the proposed regulations, as well as other relevant information. Staff will use this database to track product compliance and trends in the tire market, and consumers can use the online database to make more informed tire purchasing decisions.

Tire efficiency is quantified as a rolling resistance coefficient, expressed in newtons/kilonewtons, as defined by International Organization for Standardization Test Protocol 28580 and correlated to European Union values, an internationally recognized tire testing protocol. All other factors being equal, a tire with a lower rolling resistance coefficient is more efficient than a tire with a higher rolling resistance coefficient. The proposed tire energy efficiency ratings shown in the database are shown in Table ES-2.

**Table ES-2: Proposed Tire Energy Efficiency Rating**

| Fuel Efficiency Class | Rolling Resistance Coefficient in Newtons/Kilonewtons |
|---|---|
|  | ≤ 6.5 |
|  | 6.6-7.7 |
|  | 7.8-9.0 |
|  | 9.1-10.5 |
| (Not rated) | ≥ 10.6 |

Source: CEC staff

## Energy Performance Standard

The proposed regulations set minimum energy performance standards for all replacement tires sold or offered for sale in California covered by the regulations. The tire energy performance standards are expressed in rolling resistance coefficient in newtons/kilonewtons, as defined under the ISO 28580:2018 test protocol.

The proposed standards set the maximum rolling resistance coefficient according to tire product categories as shown in Table ES-3.

**Table ES-3: Definitions of Tire Categories**

| | |
|---|---|
| Base tires | Tires in the scope of the regulation that do not have any of the specific characteristics below. |
| Low-load-index tires | Tires with a load index of 91 or less. |
| Light-truck (LT) tires | Tires that carry the LT designation and are intended for use on light-duty trucks, sport utility vehicles, and vans. |
| Long-life tires | Tires with a UTQG wear test score of at least 1,000 but less than 1,400. |
| Ultra-long-life tires | Tires with a UTQG wear test score of 1,400 or higher |
| Ultra-high-performance tires | Tires with a W, (W), Y, or (Y) speed rating, capable of maintaining maximum speeds of 168 miles per hour or above, and a wet grip rating of at least 1.45. |

Source: CEC staff

All replacement tires sold or offered for sale in California covered by the regulations must comply with the energy performance standards, unless an exemption applies. Staff proposes

that the energy performance standards be implemented in two phases, with a more lenient standard in 2028 and the full standard coming into force in 2031. Implementation of the 2031 standard will achieve the statutory goal set forth in statute to make replacement tires on average as efficient as original equipment tires.

The energy performance standards vary by tire category to account for the different performance characteristics of those tires. In cases where a tire model qualifies in more than one category, the most lenient minimum performance standard will apply. The energy performance standards differentiated by the different tire categories and implementation phases are shown in Table ES-4. The rolling resistance coefficient values are expressed in newtons/kilonewtons, as defined under the ISO 28580:2018 test protocol.

**Table ES-4: Energy Performance Standards, Rolling Resistance Coefficient**

| Tire Category | Phase 1: January 1, 2028 | Phase 2: January 1, 2031 |
|---|---|---|
| Base tires | 9.0 | 7.1 |
| Low-load-index tires | 9.5 | 7.6 |
| Light-truck tires | 9.0 | 7.8 |
| Long-life tires | 9.4 | 7.8 |
| Ultra-long-life and Ultra-high-performance tires | 9.8 | 8.5 |

Source: CEC staff

### Wet Grip — Minimum Performance Standard

Under Public Resources Code Section 25773(a)(1)(B), the Replacement Tire Efficiency Program must not adversely affect tire safety. Third-party tire testing commissioned by the CEC found no relationship between tire efficiency and wet grip, or the ability of a tire to stop on a wet surface. This testing also found no relationship between tire efficiency and dry traction. Based on these findings, tire efficiency and safety can simultaneously be achieved.

To assure safety of all replacement tires, these regulations set a wet grip minimum requirement of 1.0 based on the ISO 23671:2021 test. Replacement tires that do not meet the 1.0 wet grip requirement will not be legal for sale in California unless there is an exemption.

Although the tire industry trade associations stated they would not make a tire with unacceptable traction, they recommended the wet grip minimum performance standard to ensure that tire and vehicle safety are not compromised for improved energy efficiency.

## Enforcement

CEC staff intends to ensure that the regulations proposed in this staff report are enforced and that noncompliant tires are not sold in California. The CEC has a dedicated Compliance and Enforcement Division that enforces efficiency standards on a wide range of products sold in

California, including light bulbs, televisions, and other appliances. The CEC Fuels and Transportation Division will also add dedicated staff to monitor the tire market and enforce compliance.

The specifics of how CEC staff will monitor the tire market and enforce these regulations will depend on manufacturer and retailer compliance. Strategies used by staff to enforce these regulations include conducting randomized tire testing and market monitoring. Staff may refer noncompliant manufacturers or brand name owners and retailers of tires illegally being sold or offered for sale in California to the Attorney General's Office for legal action.

## Feasibility and Cost-Effectiveness

As required by statute, the technical feasibility and cost-effectiveness of this proposal were investigated alongside potential effects on tire safety, tire life, and waste. The findings are that proposed replacement tire efficiency regulations are technically feasible, are cost-effective, and will not adversely affect tire safety, tire life, or the state's efforts to manage scrap tires.

Third-party testing at Smithers laboratories did not show any clear relationship between tire efficiency and cost. For assessing the costs of the proposed regulations, staff assumes that the regulations under Phase 2 of the program will increase the cost of a new set of four passenger vehicle tires by about $26 and a set of light-truck tires by $39.

Table ES-5 outlines the expected driver fuel costs savings and the incremental cost of tires moving from the current baseline to Phase 2 of the proposed regulation. The estimated savings are shown for passenger cars and light-duty trucks but will vary based on the specific vehicle, driving behavior, and fuel prices. The calculations in table ES-5 assume that a vehicle travels 10,413 miles per year, a gasoline price of $4.60 per gallon, and is driven with a full set of four compliant tires. Lighter vehicles are passenger cars and SUVs. Trucks and vans are considered heavier vehicles.

**Table ES-5: Cost-Effectiveness for a Gasoline Vehicle With Phase 2 Tires**

| Cost and Benefits | Lighter Vehicle Tires | Heavier Vehicle Tires |
|---|---|---|
| Incremental cost of compliant tires (set of four) | $26 | $39 |
| Fuel savings over tire life (gallons of gasoline) | 39 | 54 |
| Fuel savings over tire life (based on 2024 costs) | $179 | $246 |
| Net benefits | $153 | $207 |
| Basic payback period | 7 Months | 8 Months |

Source: CEC staff and Evergreen Economics

In total, CEC staff estimates that these regulations will save California drivers about $979 million (2024 dollars) annually in fuel costs in 2035. These fuel savings are significant for

drivers. As shown above, a driver of a gasoline passenger vehicle with a set of higher-efficiency Phase 2 tires would save $179 over the four-year lifespan of the tires.

Improved tire efficiency will reduce the amount of vehicle fuel used across all fuel types and significantly reduce vehicle tailpipe and upstream emissions, as shown in Table ES-6.

**Table ES-6: Expected Statewide Energy Savings in 2035**

| Fuel Type | Estimated Annual Fuel Use Reduction |
|---|---|
| Diesel (millions of gallons) | 3.4 |
| Gasoline (millions of gallons) | 141.1 |
| Electricity (terawatt-hours) | 0.9 |
| Hydrogen (millions of kilograms) | 0.5 |

Source: CEC staff

If adopted, the proposed regulations are estimated to reduce statewide emissions of greenhouse gases by more than 2.0 million metric tons of $CO_2$ equivalent in 2035. This estimate includes the expected shift of California's future vehicle fleet toward zero-emission vehicles.

Statewide passenger vehicle emissions were about 104.1 million metric tons of carbon dioxide equivalent in 2021. Two million metric tons of carbon dioxide equivalent would represent an emissions reduction of about 1.9 percent in passenger vehicles, equivalent to removing about 411,830 internal combustion vehicles off the road. The combustion of fossil fuels contributes to other forms of air pollution beyond greenhouse gases such as nitrogen oxides and particulate matter. While this report does not measure these benefits, the reduction in fossil fuel consumption will also lead to reduction in those other forms of air pollution.

Third-party tire testing commissioned by CEC staff did not reveal a clear relationship between tire efficiency and tire life. To ensure that manufacturers continue to maintain or increase tire life, the proposed regulations allow long- and ultra-long-life tires to meet a less stringent energy performance standard. Therefore, the regulations proposed in this staff report do not reduce tire life and do not increase tire waste.

The proposed regulations support consumer equity by reducing drivers' fuel costs and reducing overall air pollution. These regulations will provide disproportionate benefits for lower-income households. According to the U.S. Bureau of Transportation Statistics, households with income in the lowest 20 percentile spend about 30 percent of their income on transportation, versus only 12 percent for those in the highest twentieth percentile.

CEC staff has commissioned a forthcoming environmental impact report to identify any environmental effects of these regulations. This environmental impact report will be completed before any adoption of the regulations proposed in this report.

# CHAPTER 1: Introduction

The Warren-Alquist Act[1] established the California Energy Commission (CEC) as the state's primary energy policy and planning agency. The CEC is mandated to evaluate the economic and environmental costs and impacts of petroleum use, assess the costs of other transportation fuels, and establish a state transportation energy policy that results in the least environmental and economic cost to the state. Among several objectives, it is state policy to use all practicable and cost-effective conservation methods to improve the efficiency of energy use and distribution. Furthermore, the law states that petroleum use as an energy resource contributes substantially to such public health and environmental problems as air pollution, acid rain, and climate change.[2]

This report presents a proposed replacement tire efficiency program and is a revised version of the CEC staff report *Draft Framework of California's Replacement Tire Efficiency Program* or Draft Replacement Tire Framework, released in February 2023.[3] The proposed program is authorized by Assembly Bill (AB) 844 (Nation, Chapter 645, Statutes of 2003). This law was codified as Public Resources Code (PRC) Sections 25770 through 25773 to address replacement tire efficiency in passenger vehicles and light-duty trucks. The statute followed an earlier CEC study and other studies that showed an energy efficiency gap between the tires provided with new vehicles and those that subsequently replaced them.

Public Resources Code Section 25772 directs the CEC to set tire efficiency regulations to ensure that replacement tires sold in California are at least as energy-efficient, on average, as OE tires. CEC staff proposes new regulations to:

- Develop and maintain a tire efficiency database for California-compliant tires.
- Require manufacturers to report tire efficiency values and specifications based upon specified test procedures.
- Set minimum performance standards for efficiency and wet grip.
- Develop a rating system for tire energy efficiency that will enable consumers to make more informed purchasing decisions.
- Review and revise the program at least every three years following adoption and implementation.

---

1 Pub. Resources Code § 25000.

2 Pub. Resources Code § 25000.5(b), (c).

3 Blackburn, Bill, Jontae Clapp, Andrew Hom, Ralph Lee, Tim Olson, Ken Rider, and Sebastian Serrato. 2023. *Draft Framework of California's Replacement Tire Efficiency Program.* California Energy Commission. Publication Number: CEC-600-2023-026-SD, https://www.energy.ca.gov/publications/2023/framework-californias-replacement-tire-efficiency-program.

The statute requires that efficiency standards be technically feasible and cost-effective and shall not adversely affect tire safety, tire life, or efforts to manage scrap tires.

## Program History

Following the passage of AB 844 in 2003, CEC staff launched an effort to develop a Replacement Tire Efficiency Program. Staff tested hundreds of tires, held public workshops, met with industry stakeholders, and drafted proposed regulatory language. In 2007 the federal government passed the Energy Independence and Security Act, which called for the development of federal tire efficiency standards.[4] Following the Energy Independence and Security Act, the CEC paused the Replacement Tire Efficiency Program in expectation that the U.S. Department of Transportation would set tire efficiency regulations through the National Highway Traffic Safety Administration (NHTSA). However, to date NHTSA has not set tire efficiency standards, developed a tire efficiency rating system, or issued a public tire efficiency information program.

On November 19, 2020, the CEC restarted its efforts to develop the Replacement Tire Efficiency Program and adopted an order instituting an informational proceeding to obtain data, information, and comments from stakeholders and to make recommendations for a statewide Replacement Tire Efficiency Program.[5] The initial public workshop to solicit stakeholder comment on the Replacement Tire Efficiency Program was held February 18, 2021.[6]

CEC staff additionally commissioned a tire testing program with Smithers, an industry-recognized tire testing laboratory. This effort included testing three tires each of 149 unique tire models. Through test results and staff research, it was determined that the proposed efficiency standards are feasible, based on currently available tire models in the market.[7]

On February 2, 2023, the CEC released the Draft Replacement Tire Framework report to describe the program background and propose details on the expected regulation and program design. Following the release of the report, a public workshop was held February 14, 2023, to present a proposal of the program and solicit comment from industry, interested parties, and

---

4 Public Law No. 110-140 (Dec. 19, 2007), 121 Stat. 1492, https://uscode.house.gov/statutes/pl/110/140.pdf.

5 California Energy Commission staff. 2020. "Tire Efficiency Order Instituting Information Proceeding". 2020. California Energy Commission. https://efiling.energy.ca.gov/GetDocument.aspx?tn=234884&DocumentContentId=67746.

6 California Energy Commission staff. 2021. "Staff Workshop, Replacement Tire Efficiency Program." https://www.energy.ca.gov/event/workshop/2021-02/staff-workshop-replacement-tire-efficiency-program-order-instituting.

7 Smithers. 2021. *Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844*. Smithers File No. F49432BSR. https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-TIRE-01.

the public. Following the workshop, staff set up numerous meetings with industry trade associations, tire manufacturers, tire retailers and others, to discuss comments and concerns.[8]

After the public workshop, staff commissioned additional tire testing to provide a more complete picture of tire performance characteristics. Testing included an additional 30 sets of various OE, light-truck, and 14-inch (rim diameter) tire models for a total of 179 tire sets tested. Staff also continued dialogue with representatives of key government agencies from Canada, the European Commission and NHTSA. In July 2023, the CEC's Transportation Lead Commissioner and CEC staff toured the Sumitomo tire manufacturing plant in Buffalo, New York, to better understand the tire manufacturing process.

This revised staff report proposes changes to the regulations that address many of the comments and concerns expressed by various stakeholders. Significant changes to the proposed regulations include:

- Revising the proposed tire minimum energy performance standard (MPS) and setting different MPS values for tires with low-load-index values, long-life and ultra-long-life tires, light-truck tires, and ultra-high-performance tires.
- Presenting the rolling resistance coefficient (RRC) levels in measurements that follow the (International Organization for Standardization) ISO 28580:2018 test protocol that have been correlated with the European Union's (EU) program (referred to as "EU correlated" throughout). The Draft Replacement Tire Framework used non-EU correlated RRC numbers, therefore the RRC MPS presented in the Draft Replacement Tire Framework are not directly comparable to the MPS values presented in this report. This change was requested by a major tire manufacturer and will simplify compliance by manufacturers operating in both the EU and California.
- Adding a wet grip MPS.
- Providing longer timelines for the implementation of the regulations.
- Changing the proposed consumer information regulations.

These proposed changes are intended to allow for a smoother transition to lower-rolling-resistance tires for the tire manufacturing industry. These changes should also permit tire manufacturers to better plan for the design and development of energy-efficient tires that retain tire life and safety.

Furthermore, this final staff report updates the estimated costs and benefits expected from these regulations, including consumer fuel savings and greenhouse gas (GHG) and criteria pollutant emissions savings.

The remainder of this staff report is organized as follows:

---

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

- Chapter 2 reviews tire technology and the tire industry.
- Chapter 3 describes the legislative criteria for the proposed regulations.
- Chapter 4 reviews tire efficiency regulations in other jurisdictions.
- Chapter 5 summarizes the proposed regulatory text.
- Chapter 6 describes alternative regulations that were considered.
- Chapter 7 shows that the proposed regulations are technically feasible.
- Chapter 8 describes the costs of the regulations and potential savings.
- Chapter 9 describes the expected environmental impacts.
- Chapter 10 describes the economic and fiscal impacts.
- Chapter 11 provides a conclusion.

This report includes a glossary and an appendix. Staff cost and benefit calculations are documented in Appendix A.

The regulations described in this report may be adopted by the CEC at a future business meeting. The precise regulatory language for the proposed regulations is in accompanying rulemaking documentation in the CEC docket.

# CHAPTER 2
# Background

Tires are an important product that affect the lives of millions of California drivers. Inefficient tires increase drivers' spending on fuel, which disproportionately burdens lower-income households. According to the U.S. Bureau of Transportation Statistics, households with income in the lowest 20 percentile spend about 30 percent of their income on transportation, versus only 12 percent for those in the highest twentieth percentile.[9] Furthermore, at the end of life, tires are a major source of solid waste that require safe disposal.

Original equipment tires installed on new vehicles are, on average, more efficient than replacement tires. OE tires are traditionally designed to be efficient — in other words, have low rolling resistance — to help new vehicles meet federal regulations on fuel economy. The efficient OE tires sold with new vehicles are soon replaced, and tire manufacturers have no directive to increase the efficiency of replacement tires.

Improving the energy efficiency of replacement tires for California's passenger and light-duty trucks would yield significant economic, environmental, and health benefits without affecting vehicle performance, tire longevity, or safety. There is no tire efficiency performance standard requirement and little information available to consumers regarding tire efficiency. Consumers are left to buy tires based on other attributes, not knowing that replacement tires may be less efficient than the tires that came with their new vehicle.

## Tire Efficiency

For a tire to roll on the road, it must overcome forces that resist the rolling movement of the tire. One of these forces is "rolling resistance." Energy in the form of vehicle fuel is required to keep the tires on a vehicle rolling. Since higher rolling resistance increases the fuel required to move a vehicle a certain distance, tire efficiency plays an important part in vehicle fuel consumption.[10] The magnitude of rolling resistance depends on many factors: the tire used, the road surface, and operating conditions such as tire inflation, load, and speed.

Rolling resistance occurs when tires deform during rotation. The portion of the tire that is deformed is subjected to compression, bending, and shearing forces. Energy is used during these repeated deformations to overcome the viscosity of the rubber and is then dissipated as heat as the tire returns to the original shape.[11] Rolling resistance includes mechanical energy

9 U.S. Department of Transportation. 2023. "The Household Cost of Transportation: Is It Affordable?" https://www.bts.gov/data-spotlight/household-cost-transportation-it-affordable.

10 NHTSA. 2006. "The Pneumatic Tire." Publication Number: DOT HS 810 561. https://www.safetyresearch.net/wp-content/uploads/2009/11/NHTSA_Pneu_Tire.pdf.

11 Tonachel, L. 2008. "Fuel Efficient Replacement Tires for Cars and Light Trucks." Natural Resources Defense Council.

losses from aerodynamic drag associated with rolling, friction between the tire and road, friction between the tire and rim, and other energy losses within the structure of the tire.[12]

Tire efficiency testing typically involves testing several tires using dynamometers — a measurement device that simulates the use of tires — to measure the energy inputs and outputs. The output of the rolling resistance test machines is used to calculate the rolling resistance force (RRF) in pounds of force (lbf) or newtons (N) at the interface of the tire and drum, or to calculate the force at the axle required to make a loaded tire roll. Rolling resistance is often expressed and reported in terms of the rolling resistance coefficient (RRC), expressed in N/kN, kg/tonne, or lbf/kip, which is the rolling resistance force divided by the test load on the tire.[13]

## Original Equipment Tires Are More Efficient Than Replacement Tires

OE tires have traditionally been designed to be efficient in response to the incentives created by federal fuel economy standards. After the oil supply disruptions and price increases in the 1970s, Congress passed the Energy Policy and Conservation Act of 1975 (EPCA). Implementation of the EPCA included the creation of the Corporate Average Fuel Economy (CAFE) standards. Under CAFE standards, automakers' overall product offerings must meet minimum fuel economy standards.

Automakers achieve compliance by incorporating several technologies, including start-stop technology, lightweight components, improved aerodynamics, and other engine and transmission technology advances. Energy-efficient tires also assist in CAFE compliance because tires with low rolling resistance are an attractive, low-cost option to boost new vehicle fuel economy. Automakers have been motivated to incorporate efficient tires into their CAFE compliance strategy and work closely with tire manufacturers to ensure that they use the appropriate tires. The relative efficiency of OE tires compared to replacement tires shows that highly efficient tires are technically possible. Because CAFE standards apply only to new vehicles, tire manufacturers have not had strong incentives to increase the efficiency of replacement tires.

## Tire Consumer Information

Passenger car tires are characterized and measured by several factors that reflect makeup, size, type, and safety. Under the federal government's Uniform Tire Quality Grading Standards (UTQG), vehicle tires are rated on treadwear, traction performance, and temperature

---

https://www.responsiblepurchasing.org/UserFiles/File/Tires/Webcast/Tonachel%20FE%20Tires%202008-03-18.pdf.

12 NHTSA. 2006. "The Pneumatic Tire." Publication Number: DOT HS 810 561. https://www.safetyresearch.net/wp-content/uploads/2009/11/NHTSA_Pneu_Tire.pdf.

13 NHTSA. 2010. *Tire Fuel Efficiency Consumer Information Program*. Final Rule 75 FR 15894-01, 2010 WL 1186165. https://www.federalregister.gov/d/2010-6907/page-15894.

resistance. The UTQG tire ratings are required on the sidewall of every passenger car tire sold in the United States.

Federal UTQG rankings classify the following tire attributes:

- Load index is a measure of the weight a tire can safely carry. Tires with a low load index tend to be smaller than tires with a higher load index.
- Temperature grades are an indication of how well the tire resists heat. Sustained high temperature (for example, driving long distances in hot weather) can cause a tire to deteriorate, leading to blowouts and tread separation. From highest to lowest, the resistance to heat for a tire is graded as "A," "B," or "C."
- Traction is a measurement of the ability of a tire to maintain grip in wet conditions. A high-traction grade indicates that a car can stop on wet roads in a shorter distance. Traction is graded from highest to lowest as "AA," "A," "B," and "C."
- Treadwear grades provide information on how long the tread should last. The higher the treadwear number is, the longer it should take for the tread to wear down. For example, tires with a grade of 200 should wear twice as a long as a tire with a grade of 100.

UTQG tire ratings are shown in Table 1.

**Table 1: 2017 UTQG Standards Summary**

| UTQG Item | Summary of Percentage Within Each Grade |
|---|---|
| Traction | 15 percent are rated "AA"<br>77 percent are rated "A"<br>7 percent are rated "B"<br><1 percent are rated "C" (only 4 lines of tires) |
| Temperature | 62 percent are rated "A"<br>34 percent are rated "B"<br>4 percent are rated "C" |
| Treadwear | 2 percent are rated above 600<br>6 percent are rated 501–600<br>20 percent are rated 401–500<br>32 percent are rated 301–400<br>25 percent are rated 201–300<br>15 percent are rated below 200 |

Source: U.S. Department of Transportation, National Highway Traffic Safety Administration

Unlike UTQG requirements, there are no federal requirements for rating the energy efficiency of tires. As a result, consumers have little, if any, information about tire efficiency and the ways it affects their fuel costs.[14] Consumers often unknowingly purchase less efficient tires with higher rolling resistance because of this lack of information, resulting in higher lifetime operating costs and reduce vehicle range to the driver.

Several federal agencies have direct or indirect responsibility for passenger-car fuel economy. These agencies include the U.S. Department of Energy (and its national labs), the U.S. Environmental Protection Agency, and the U.S. Department of Transportation (through NHTSA). Websites developed and overseen by these agencies can assist consumers with improving vehicle fuel economy, choosing energy-efficient vehicles (for example, fueleconomy.gov), improving fuel economy (for example, the Alternative Fuels Data Center at afdc.energy.gov), as well as environmental impacts caused by passenger cars. While information about low-rolling-resistance tires can be found at these websites, staff was unable to find detailed data on the energy efficiency of individual tire models.

Many tire manufacturers provide limited information on their high-efficiency line of tires. CEC staff was able to identify seven tire models that have been distinguished as efficient tires by

14 Ibid.

the manufacturers. With names such as "Michelin Energy Saver," "Bridgestone Ecopia," and "Goodyear Assurance Fuel Max," these tire models suggest that they possess superior environmental attributes and fuel savings. Although some manufacturers provide estimates of the fuel savings over the life of the tires, these companies provide little, if any, quantitative data on how these tires compare with their own conventional tires or to comparable tires of other manufacturers. These naming descriptors are vague, subjective, and ultimately designed for marketing tires.

Tire retail and distribution companies provide a variety of information and resources to consumers, but to date, there are no requirements for displaying information for consumers on tire efficiency. Consumer information also varies considerably between retailers. Online tire sellers such as Tirerack.com do provide information for consumers researching tires before making a purchase. Major tire retailer Discount Tires — which also does business as America's Tire — offers an online "Treadwell" database that provides consumers efficiency information for a wide range of tires.[15] Despite databases like Treadwell, overall information about tire efficiency from tire retailers is sparse.

## Technological Developments

In recent years, advances in tire technology have increased tire efficiency. The viscoelastic properties of tires are a major factor relating to the dissipation of energy and overall efficiency for a tire.[16] Advances in materials science and design improvements are allowing innovative tire manufacturers to improve tire efficiency without sacrificing other important attributes like tire performance, safety, and wear.

CEC staff anticipates that trends in tire technology will continue to affect tire efficiency over the coming years. Key areas of technological development that increase tire efficiency include tread design, chemistry of tire rubber compounds, tire aerodynamics, and the use of plasticizers and silica. For example, increasing the silica content of tires has become a global trend for improving wet grip and rolling resistance without compromising safety, though it does add to costs. Improvements in tire aerodynamics include designs to reduce friction between the tire and the surrounding air, which also increases tire efficiency.

Manufacturers may need to conduct ongoing research and development (R&D) to address the complexities of advanced tire technology, consumer preferences, and traditional business practices to improve the market. Some manufacturers have already adopted technological changes for producing low-rolling-resistance tires. High-efficiency tires are already available now, and continued advancements in tire efficiency do not require revolutionary technology.

---

15 America's Tire. "https://www.americastire.com/treadwell?storeCode=1372." https://www.americastire.com/treadwell.

16 *Viscoelastic* refers to the physical properties of a material where it can behave like both a solid and fluid.

# CHAPTER 3:
# Legislative Background

## California Legislation

California has a long history of promoting advanced transportation technologies to address various public health, environmental, energy security, and economic issues. The history of California's legislative interest in tire efficiency dates back more than two decades.

### Assembly Bill 2076

Assembly Bill 2076 (Shelley, Chapter 936, Statutes of 2000) required the CEC and California Air Resources Board (CARB) to develop a strategy to reduce petroleum dependence in California. This 2003 report concluded that tire efficiency was one of several strategies that had a significant potential to reduce petroleum consumption in vehicles.[17] The findings of the report and stakeholder comments continue to be valid.

### Senate Bill 1170

Senate Bill (SB) 1170 (Sher, Chapter 912, Statutes of 2001) directed the CEC to evaluate ways to increase automotive fuel efficiency in the state government's motor vehicle fleet by 10 percent. Specifically, this bill directed the CEC and the State Department of General Services to study potential fuel economy improvements through state government purchase of fuel-efficient vehicles and tires.

SB 1170 also required the CEC, on or before January 31, 2003, to develop and adopt recommendations for consideration by the Governor and Legislature for a California State Fuel-Efficient Tire Program. From this directive, the CEC published the *California State Fuel Efficient Tire Report* in two volumes: *Volume I: Summary of Findings and Recommendations*[18] and *Volume II: Consultant Report*.[19] The report recommended that the state proceed with a replacement tire efficiency program and the development of a tire information program to help consumers make informed decisions about the efficiency of replacement tires on the market.

---

17 Shulock, Chuck, Eileen Tutt, Paul Weubben, Gerry Bemis, Susan Brown, Dan Fong, Sherry Stoner. 2003. *Joint Agency Report: Reducing California's Petroleum Dependence.* California Air Resources Board and California Energy Commission. Publication Number: P600-03-005F. https://ww2.arb.ca.gov/sites/default/files/classic/fuels/carefinery/ab2076final.pdf.

18 Blackburn, William and Bernard Treanton. 2003. *California State Fuel Efficient Tire Report: Volume I, Summary of Findings and Recommendations.* California Energy Commission, Publication Number: 600-03-001F. http://web.archive.org/web/20190228180638/https://www.energy.ca.gov/reports/2003-01-31_600-03-001F-VOL1.PDF.

19 Calwell, Chris, My Ton, Deborah Gordon, Travis Reeder, Marissa Olson, Suzanne Foster. 2003. *California State Fuel Efficient Tire Report: Volume II, Consultant Report*. California Energy Commission. Publication Number: 600-03-001CR. https://www.kannahconsulting.com/wp-content/uploads/2016/08/2003-01-31_600-03-001CRVOL2.pdf.

### Assembly Bill 844

The findings and recommendations from the *California State Fuel Efficient Tire Report* developed under SB 1170 influenced Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003), which aimed to increase the efficiency of replacement tires and to increase consumer information about tire efficiency. AB 844 was codified in Public Resources Code (PRC) Sections 25770 through 25773.

Under the statutes, these regulations must:

- Ensure that replacement tires sold in California are at least as energy-efficient, on average, as tires sold in the state as OE tires.
- Be technically feasible and cost-effective.
- Not adversely affect tire safety.
- Not adversely affect the average tire life of replacement tires.
- Not adversely affect state efforts to manage scrap tires.

## Federal Legislation

The U.S. Congress has also passed laws affecting tire efficiency. However, California retains the ability to set tire efficiency standards.

### Energy Independence and Security Act

In 2007, Congress enacted the Energy Independence and Security Act of 2007 (EISA).[20] The EISA required the U.S. Secretary of Transportation to issue rules establishing a national tire fuel efficiency consumer information program regarding the fuel efficiency, safety, and durability of replacement tires of motor vehicles. The EISA does not apply to certain tire categories, including light-truck tires. The federal program was to include:

- A national tire fuel efficiency rating system for replacement passenger car tires.
- Point-of-sale and internet information dissemination.
- Specifications for test methods for assessing and rating tires.
- A national tire maintenance consumer education program.

In June 2009, NHTSA published a notice of proposed rulemaking to adopt regulations to implement the program established by the EISA. On June 1, 2010, and later amended January 20, 2012, NHTSA issued regulations to partially implement a national tire fuel efficiency consumer information program under the EISA. The NHTSA's 2012 regulations prescribe the test methods that manufacturers must use to determine the rolling resistance rating, peak wet

20 Pub.L. No. 110-140 (Dec. 19, 2007), 121 Stat. 1492, https://uscode.house.gov/statutes/pl/110/140.pdf.

grip rating, and treadwear rating of each replacement tire. The NHTSA's tire efficiency test procedure requires adherence to ISO 28580 using defined conditions.[21]

The NHTSA has not adopted the rating systems itself nor set the date for which manufacturers would need to begin reporting their ratings. Moreover, the NHTSA did not adopt point-of-sale and internet information dissemination or a national tire maintenance consumer education program.

## Fixing America's Surface Transportation Act

In December 2015, the U.S. Congress passed the Fixing America's Surface Transportation Act ("FAST Act"), which supplemented the federal program to require setting additional minimum performance standards for the efficiency and traction of passenger car tires, with some technical requirements for the program. Although the NHTSA initiated a rulemaking to implement the FAST Act, the proceeding was halted in 2017 without adopting regulations or setting minimum performance standards for efficiency or traction.

With the federal program on efficient tires still pending, the CEC relaunched its effort to develop a state Replacement Tire Efficiency Program in November 2020. In preparing the proposed regulations and this staff report, CEC staff considered the federal program, including the EISA, NHTSA's 2012 regulations, and the FAST Act.

To date, no formal rulemaking has been adopted by the federal government to address:

- A national rating system for replacement tire fuel efficiency, traction peak coefficient of friction, or treadwear.
- A date by which manufacturers will be required to report fuel efficiency, traction, or treadwear ratings for replacement tires.
- Requirements for tire retailers for other point-of-sale and internet information dissemination.
- Minimum performance standards for fuel efficiency and traction.
- A national tire maintenance consumer education program.

## The Relationship Between State and Federal Tire Regulations

While the EISA and FAST Act called for federal tire efficiency standards, the CEC retains the ability to set tire efficiency regulations. CEC staff's proposed regulations are consistent with federal law.

First, the EISA contains a clause expressly defining the interaction between the federal program and state regulations on tire fuel efficiency consumer information, test methods, and standards.[22] The EISA's preemption clause provides that a state may adopt or enforce a law or regulation on tire fuel efficiency consumer information enacted or published after January 1,

21 ISO. 2018. ISO 28580:2009(E). https://www.iso.org/standard/67531.html.

22 49 US Code. Consumer Tire Information and Standards. § 32304A(h).

2006, if the requirements of that law or regulation are identical to the requirements issued under the EISA. The Legislature passed AB 844 in 2003, before the EISA, and the tire fuel efficiency consumer information requirements of the proposed regulations are essentially identical to those requirements adopted by the NHTSA. The FAST Act did not amend the preemption clause on fuel efficiency for consumer information, enacted by the EISA.

Second, the preemption clause of the EISA provides that EISA shall not be construed to preempt a state from regulating the fuel efficiency of tires (including establishing test methods for determining compliance with such standards) not otherwise preempted under the EISA. CEC staff proposes adopting the same or more recent test methods and conditions for measuring tire efficiency and peak wet grip that NHTSA adopted. Further, because NHTSA has not adopted federal minimum efficiency standards for passenger car tires under the EISA or the FAST Act, CEC staff's proposed regulations are consistent with federal law.

Finally, the EISA replacement tire efficiency program does not apply to light-truck tires; therefore, CEC staff has proposed regulations applicable to light-truck tires that do not conflict with federal law.

# CHAPTER 4:
# Regulatory Approaches

While no tire efficiency standards exist in the United States, several other countries have adopted replacement tire efficiency labeling standards comparable to the standards proposed in this staff report.

## European Union Regulation

In 2009, the EU established a framework for standardizing tire characteristic information through consistent labeling, which allowed consumers to make an informed choice when purchasing tires. These regulations provide tire efficiency information to consumers through labels that include information on the efficiency of a tire and associated wet grip. Staff proposal for CEC consumer information regulations in this staff report is largely consistent with the current EU regulations.

The EU display requirements rank the RRC of tire models. This scheme originally used an "A" to "G" scale and was updated in 2021 to increase the minimum standard for compliance. The scale was changed to "A" to "E," in accordance with United Nations Economic Commission for Europe (UNECE) Regulation No. 117 and subsequent amendments.[23]

The EU label ranks tire efficiency in three vehicle classes: passenger cars (C1), vans (C2), and heavy-duty (C3) vehicles. Table 2 shows the RRC rankings in newtons per kilonewton for each fuel efficiency class in the EU system, which is comparable to passenger cars and light-duty trucks.

**Table 2: European Union Tire Fuel Efficiency Classes and RRC**

| Fuel Efficiency | Passenger Cars (C1) | Vans (C2) | Heavy-duty Trucks (C3) |
|---|---|---|---|
| **Fuel Class Rating** | **RRC in N/kN** | **RRC in N/kN** | **RRC in N/kN** |
| A | RRC ≤ 6.5 | RRC ≤ 5.5 | RRC ≤ 4.0 |
| B | 6.6 ≤ RRC ≤ 7.7 | 5.6 ≤ RRC ≤ 6.7 | 4.1 ≤ RRC ≤ 5.0 |
| C | 7.8 ≤ RRC ≤ 9.0 | 6.8 ≤ RRC ≤ 8.0 | 5.1 ≤ RRC ≤ 6.0 |
| D | 9.1 ≤ RRC ≤ 10.5 | 8.1 ≤ RRC ≤ 9.0 | 6.1 ≤ RRC ≤ 7.0 |
| E | RRC ≥ 10.6 | RRC ≥ 9.1 | RRC ≥ 7.1 |

Source: European Commission

23 European Commission. "Tyre Labelling Regulation." https://energy-efficient-products.ec.europa.eu/product-list/tyres_en.

## Canadian Regulation

At the CEC Replacement Tire Efficiency Program public workshop held in February 2021, representatives from Natural Resources Canada provided an overview of Canadian tire efficiency policies. Canada has not set a minimum tire efficiency standard. However, the Canadian government has commissioned tire testing and has investigated establishing tire efficiency standards.[24]

## Japanese Regulation

As the result of recommendations from the International Energy Agency, as well as growing interest in the environmental movement, Japan established the Fuel-Efficient Tire Promotion Council. In 2010, Japan adopted a voluntary standard to classify wet grip and rolling resistance performance and developed a tire labeling system. The program is generally aligned with the European Union standards for tire labeling.[25]

## Other Countries

Brazil, China, and South Korea have also established tire efficiency labeling programs that appear to reflect the European Union rating system and efficiency tiers.

24 Natural Resources Canada. 2021. "Canadian Perspectives on Tire Minimum Energy Performance Standards (MEPS)." Publication Number: TN 236894. https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-TIRE-01.

25 Society of Automotive Engineers Japan, Inc. 2016. "Tires." https://www.jsae.or.jp/en/publications/yearbook_e/2016/docu/19_TIRES.pdf.

# CHAPTER 5:
# Proposed Regulatory Framework

The proposed Replacement Tire Efficiency Program would add Chapter 14, Article 1, into Division 2 of Title 20 of the California Code of Regulations, commencing with Section 3301.

The regulations proposed in this staff report include:

- New reporting requirements for tire manufacturers and brand name owners selling products in California.
- A CEC replacement tire and limited production tire database.
- A rating system for tire energy efficiency.
- A tire RRC minimum performance standard.
- A tire wet grip minimum performance standard.

This section of the report will discuss the scope of tires, tire manufacturers, tire retailers, and data that would be subject to staff's proposed regulations.

## Scope

Staff's proposed regulations would apply to all tire manufacturers, tire brand name owners, and tire retailers of any replacement tire or any limited production tire that is:

- Manufactured on or after January 1, 2028,
- Sold or offered for sale in California, except as wholesale for final retail sale outside the state, and
- Designed to replace a tire on a passenger car or light-duty truck.

### Tires Subject to Staff's Proposed Regulations

The proposed regulations center on "replacement tires." A "replacement tire" is defined as a tire sold in the state that is designed to replace a tire sold with a new passenger car or light-duty truck with certain exclusions.[26] Staff does not propose including used tires or retreaded tires under the scope of this regulation.

Tire testing data focus on areas of meaningful and repeatable data, which relies on new tires. It is not technically feasible or cost-effective to test used tires for rolling resistance or wet grip at any point during the remaining life of that tire. Wear and tear on each used tire are also unique, making it nearly impossible to determine compliance with minimum performance standards for resale. A used tire can also be retreaded. Retreading does not mean that a tire

26 PRC. § 25770(d).

matches all the sidewall specifications of the original tire because the treads are different. Including used tires under the regulation would also make it illegal for retailers to sell used or retreaded tires because it is the *manufacturer* who is responsible for reporting tires to the database. Used tires that cannot be resold would be discarded, which would increase tire waste.

Staff proposes excluding the following replacement tires from the regulations.

**Table 3: Exclusions**

| Tires Excluded | Notes |
|---|---|
| (1) Limited production tires: all units of a tire that are manufactured by one manufacturer that share the same dimensions, rubber compounds, tread patterns, and energy consumption characteristics, calendar year of manufacture, and manufacture plant, that would qualify as a replacement tire but for the fact that the total production in the United States or importation into the United States by the tire's manufacturer, or in the case of a tire marketed under a brand name, the total annual domestic purchase and purchase for importation into the United States by the tire's brand name owner, will be less than 15,000 tires during the current calendar year and has been less than 15,000 tires during every prior calendar year. | Limited production tires are excluded from minimum performance standards, but manufacturers are subject to reporting requirements that are reasonably necessary to distinguish between limited production tires and replacement tires that must comply with the minimum performance standards. |
| (2) A deep tread, winter-type snow tire, a space-saver tire, or a temporary use spare tire. | Deep tread tire means a tire with a tread depth of 18/32 inch or greater.<br>Winter-type snow tire is designed and constructed for winter use, attained a traction index of 112 or greater, and is equipped with studs or marked with an Alpine Symbol.<br>Temporary use spare tire means a tire with a "T" in the size designation and intended for temporary use. |
| (3) A tire with a nominal rim diameter of 12 inches or less. | The diameter of a wheel measured at the intersection of the bead seat and the flange. |
| (4) A motorcycle tire. | A tire intended for use on a motorcycle. |

| Tires Excluded | Notes |
|---|---|
| (5) A tire manufactured specifically for use in an off-road motorized recreational vehicle. | An "off-road motorized recreational vehicle" means a motor vehicle commonly referred to as a sand buggy, dune buggy, or all-terrain vehicle, or a recreational off-highway vehicle as defined in Vehicle Code Section 500. |
| (6) A tire with a load index of 122 or greater, or where the load index is not marked and the tire is rated for a maximum load that exceeds 1,450 kg; or a tire that is not capable of maintaining sustained speeds of greater than 50 miles per hour. | Tires exceeding the specified load index, maximum load, or sustained speed would not reasonably be designed to be equipped on passenger cars and light-duty trucks. |

Source: CEC staff.

### Executive Director Exemption

In addition to the exemptions automatically granted by the regulation, staff proposes that the regulation allows the CEC's executive director to review and grant, on a case-by-case basis, petitions for exemption from the regulation. Tire manufacturers can request an exemption for a specific tire that does not comply with energy performance and wet grip standards if there are no compliant tires available in sufficient quantities for a specific vehicle model operated in California of that unique tire dimension, based on characteristics such as size, aspect ratio, rim size, and load index.

To request an exemption, a tire manufacturer or brand name owner shall send the CEC's executive director a letter petitioning for an exemption from the minimum performance standard of the regulation. The letter shall state the tire line, size designation, and stock-keeping unit for each tire and demonstrate that there is no alternative available in California to meet the specifications required for a specific vehicle based on fit, vehicle weight, load index, and typical driving conditions.

The executive director shall evaluate the petition by reviewing the information provided in the petition letter with the existing tires available on the market in California and by assessing the tire manufacturer's ability to manufacture a compliant tire. The executive director shall evaluate the petition and shall have 60 days from the receipt of a complete petition letter to approve or deny the petition. The executive director maintains the right to revoke any granted exemption based on the manufacture date of a tire.

### Emergency Vehicles Exemption

Per Public Resources Code Section 25773(c), the CEC can allow an owner or operator of an authorized emergency vehicle to purchase tires that do not comply with energy performance standards if the CEC finds the tires are unable to meet the minimum performance standard. The unique and often demanding conditions that emergency vehicle tires are subject to

provide strong justification for CEC staff to propose that tires sold directly to the owner or operator of an authorized emergency vehicle be exempted from the standard.

### Medium/Heavy-Duty Exemption

Tires for medium- and heavy-duty vehicles are exempted from the regulations based on the definitions of passenger car and light-duty vehicles. Medium- and heavy-duty vehicles are excluded from those definitions and, therefore, exempt from the scope of the regulations.

## Tire Manufacturers Subject to Staff's Proposed Regulations

CEC staff proposes to apply the regulations to all manufacturers of any replacement tires for sale within California. Manufacturers of limited-production replacement tires, as defined below, would also be subject to proposed reporting regulations.

CEC staff recommends allowing a "tire brand name owner" to stand in for a manufacturer for tires marketed under a brand name different from the manufacturer's name. The federal Tire Fuel Efficiency Consumer Information Program similarly allows brand name owners to stand in as a manufacturer under its program.[27] Staff proposes to adopt the federal program definition of "brand name owner." This is a person or entity, other than a tire manufacturer, who owns or has the right to control the brand name of a tire or who licenses another to purchase tires from a tire manufacturer bearing the licensor's brand name.

## Tire Retailers Subject to Staff's Proposed Regulations

CEC staff proposes the definition of "tire retailer" to mean a dealer or distributor of replacement tires that are sold or offered for sale in California. This definition is intended to apply to all places where customers may purchase tires, including internet and mail order companies, tire dealers, manufacturer outlets, or retail department stores. This definition aligns with the scope of businesses covered under the federal Tire Fuel Efficiency Consumer Information Program.[28]

## Effective Dates

The effective dates of these regulations vary by component, as shown in Table 4. Staff proposes that the CEC implement the tire efficiency MPS in two phases.

27 Code Fed. Reg. Tit. 49. § 575.106(d)(2).

28 Ibid.

**Table 4: Key Regulation Components**

| Regulation Component | Effective Date |
|---|---|
| Reporting requirements for tire manufacturers to the CEC tire database including a tire rating. | January 1, 2028 |
| Energy performance standard | • Phase 1 — January 1, 2028<br>• Phase 2 — January 1, 2031 |
| Wet grip performance standard | January 1, 2028 |

Source: CEC staff

All replacement tires manufactured after a phase implementation date must meet that phase MPS requirement to be compliant for sale in California, unless an exemption applies. Tires that are manufactured before the regulatory implementation dates may continue to be sold after the phase-in dates.

## Definitions

CEC staff proposes the following definitions.

### Light-Duty Truck

Staff proposes to define "light-duty truck" to mean any motor vehicle other than a motorcycle, trailer, or passenger car that has a design capacity not exceeding a 10,000-pound gross vehicle weight rating. Thus, the definition of "light-duty trucks" complements the definition of "passenger cars" so that together they would encompass all motor vehicles designed primarily for driving on public streets, roads, and highways that have a gross vehicle weight rating limit of 10,000 pounds or less. This definition would provide maximum clarity on which tires are within the scope of these regulations.

### Long-Life Tires

CEC staff proposes to define tires that show superior wear characteristics and have above-average estimated lifetimes when compared with other similar replacement tires. The CEC staff proposes to provide an increased MPS value for long-life tires, which allows eligible tires to meet a slightly less stringent RRC level to ensure that these tires continue to thrive in California's replacement tire market.

CEC staff proposes to create two categories for tires with superior wear characteristics based upon the treadwear rating conditions and grading procedure in 49 Code of Federal Regulations part 575.104(e) (2023):

- **Long-Life** — Defined here as having a UTQG wear test score of at least 1,000 but less than 1,400
- **Ultra-Long-Life** — Defined here as having a UTQG wear test score of 1,400 or higher.

The definition relies on the direct test results of the UTQG test and not the rating ultimately placed on the tire sidewall. CEC staff found that the index directly calculated in the test procedure is highly correlated with median mileage estimates from Discount Tire's proprietary Treadwell database, which combines laboratory and real-world performance data to estimate the lifetime mileage of tire models. This finding indicates it is a reliable proxy for real world tire wear.

CEC staff's proposed thresholds are intended to balance several objectives, including rewarding tires with longer treadwear while ensuring significant fuel savings for drivers. A treadwear rating of 1,000–1,400 would be considered high and suggest a long-lasting tire.

The proposed thresholds for long-life and ultra-long-life are notably higher than even the highest UTQG sidewall treadwear rating from the Smithers test dataset. This finding is because manufacturers are able to underreport the results of the test procedure for public disclosure and tire labeling. Further, the UTQG sidewall rating is limited to 2–3 digits, precluding the ability for manufacturers to publish numbers as high as the thresholds used in these product definitions.[29] It is CEC staff's observation that the actual laboratory results of longer wearing tires exceed the sidewall values.

### Low-Load-Index Tires

*Tire load index* is an assigned number corresponding to the maximum weight that a tire can support when properly inflated. The higher the tire load index number, the greater the load-carrying capacity. Tire manufacturers have stated that, while maximum RRC levels are feasible over a broad range of load indices, there is a trend where particularly low load index tires suffer a bias toward higher RRC. Because tires with a low-load-index value tend to have higher rolling resistance, CEC staff proposes to provide an increased MPS value for low-load-index tires. *Low-load-index tires* are defined here as those with a load rating of 91 or less. This load index threshold of 91 or less captures tires that are common on older vehicles, especially compacts and subcompacts (for example, 14-inch tires on a 2002 Toyota Corolla).

### Passenger Car

CEC staff proposes to define "passenger car" to mean any motor vehicle designed primarily for transporting persons, having a design capacity of 10 persons or fewer, and not exceeding a 10,000-pound gross vehicle weight rating. This definition is based on the California Air Resources Board's definition of "passenger car"[30] and modified to add a gross vehicle weight rating limit of 10,000 pounds to align with the weight limit definition of "passenger car tire" in the federal Tire Fuel Efficiency Consumer Information Program.[31] The definition of "passenger car" would be subject to staff's proposed definition of "motor vehicle," which includes only

29 Code Fed. Reg. Tit. 49, § 575.104(d)(2)(i).

30 Cal. Code of Regs. Tit. 13, § 1900(b)(17).

31 Code Fed. Reg. Tit. 49, § 575.106(d)(2).

vehicles with a maximum speed capacity greater than 35 mph and is designed primarily for driving on public streets, roads, and highways, which aligns with the federal definition.[32]

### Basic Model

CEC staff proposes to define a "basic model" of a tire as all units of a given type of replacement tire (or class thereof) that are manufactured by one manufacturer and that share the same dimensions, rubber compounds, tread patterns, and energy consumption characteristics, or all units of a given limited production tire.

### Ultra-High-Performance Tires

CEC staff proposes to define *ultra-high-performance* as a tire that both bears a speed category symbol of "W," "(W)," "Y," or "(Y)" and is capable of maintaining maximum speeds of 168 miles per hour or above, and has a relative wet grip braking performance index of at least 1.45.[33]

## Regulation Components

The proposed regulations have the following major components:

- Reporting requirements for tire manufacturers who manufacture tires sold or offered for sale in California
- A tire database and tire efficiency rating system
- Minimum energy performance standards
- A tire wet grip minimum performance standard

### Tire Efficiency Rating Systems

Public Resources Code Section 25771(b) requires the CEC to develop a rating system for the energy efficiency of replacement tires sold in the state that will enable consumers to make more informed decisions when purchasing tires for their vehicles.[34]

CEC staff proposes to base the tire fuel efficiency rating on the tire RRC as measured by ISO 28580:2018 under the specified testing conditions and recommends a scale that rates replacement tires from zero to four leaf icons, with four being the most energy-efficient. Staff proposes the design shown in Table 5.

32 49 US Code, § 32101(7) (NHTSA definition of "motor vehicle"); see also Code Fed. Reg., Tit. 49, § 523.3 (NHTSA definition of "automobile").

33 For some high-performance tires a Z or ZR may appear in the middle of a tire's size information. For the proposed regulations, tires that include a Z or ZR will be considered ultra-high performance tires only if they have a speed rating of W or Y.

34 PRC, § 25771(b).

**Table 5: Proposed Tire Energy Efficiency Rating System**

| Fuel Efficiency Class | RRC Range |
|---|---|
|  | ≤ 6.5 |
|  | 6.6-7.7 |
|  | 7.8-9.0 |
|  | 9.1-10.5 |
| [No Rating] | ≥ 10.6 |

Source: CEC staff

CEC staff recommends the ranges shown above for each leaf rating to cover the span of replacement tires currently sold in California and would distribute most of those tires into the middle leaf categories. Moreover, these rating ranges would be consistent with the rating ranges adopted by other countries. Consistency between the California tire efficiency rating system and the European Union is advantageous because the U.S. Tire Fuel Efficiency Consumer Information Program has not adopted a rating system for tire efficiency.[35]

The CEC considered many symbolic representations of tire energy efficiency including a letter rating, star rating, a medal rating, or use of the RRC directly. These systems were either too complicated or inherently likely to be considered a general judgement of the performance of a tire rather than conveying information specifically about efficiency. CEC staff proposes the use of the leaf rating system because it will more clearly convey that the tires are of an environmentally beneficial quality: improved energy efficiency.

## Reporting Requirements for Tire Manufacturers

Public Resources Code Section 25771(c) authorizes the CEC to establish reporting requirements.[36] Accordingly, these regulations require tire manufacturers doing business in California to report to the CEC the data shown in Table 6 for replacement tires sold in California. This table indicates the required reporting information.

35 Code Fed. Reg., Tit. 49, § 575.106(e)(1) and (2).

36 PRC, 25771(c).

**Table 6: Replacement Tires, Required Data Reporting**

| Data Field | Description | Data Use |
|---|---|---|
| Manufacturer | Text field. | Identifying unique product. |
| Brand name owner (if applicable) | Text field. | Identifying unique product. |
| Brand name | Text field. | Identifying unique product. |
| Model name | Text field. | Identifying unique product. |
| DOT tire identification number (TIN) | First nine digits. | Identifying unique product. |
| Tread and sidewall ply & material identification | Text field. | Identifying unique product. |
| Load index | Text field. | Identifying eligibility for RRC. |
| Speed rating | Text field. | Identifying eligibility for RRC. |
| UTQG traction rating | AA, A, B, C, or N/A. | Identifying eligibility for RRC. |
| UTQG treadwear rating | 3 digit number, in multiples of 20. | Identifying eligibility for RRC. |
| UTQG temperature rating | A, B, or C. | Identifying unique product. |
| Tire size designation | Text field, width in mm.<br>Text field, aspect ratio.<br>Text field, rim diameter in inches. | Identifying unique product. |
| Tire energy efficiency rating | Number of leaves assigned to the tire under the rating system described in § 3307 | Self-attested efficiency rating. |
| EU correlated rolling resistance coefficient | As determined by ISO 28580:2018. | Verifying product compliance. |
| Any of the applicable conditions: | A. UTQG treadwear test score ≥ 1,400<br>B. UTQG treadwear test score ≥ 1000 but < 1,400<br>C. Load index 91 or lower<br>D. Designation as light-truck tire | Identification of tire category eligibility |

| Data Field | Description | Data Use |
|---|---|---|
| Relative wet grip braking performance index | <1.0<br>≥1.0 and < 1.45<br>≥1.45 | Verifying product compliance and tire category eligibility. |
| Tread depth | Text field. Listed in 1/32 of an inch. | Monitoring the effect of regulations on California tire market and any impact on average tire wear and safety. |
| Manufacture year | Beginning Date<br>End Date/"ongoing" | The beginning year when the basic model first complied with the regulations, up to the calendar year ten years prior to the date of the reporting submission, and an end year when the basic model will no longer comply with the regulations, which may be listed as "ongoing". |
| Plant code | Text field | Reportable if necessary to distinguish the basic model from other basic models. |
| Declaration (i.e., attestation) | Yes/No. | Manufacturer declaration that product is compliant. |

Source: CEC staff

Manufacturers of limited production tires must report the data shown in Table 7 for each limited production product sold in California, annually.

**Table 7: Limited Production Tires, Required Data Reporting**

| Data Field | Description | Data Use |
|---|---|---|
| Manufacturer | Text field. | Identifying unique product. |
| Brand name owner (if applicable) | Text field. | Identifying unique product. |
| Brand name | Text field. | Identifying unique product. |
| Model name | Text field. | Identifying unique product. |
| DOT tire identification number (TIN) | First nine digits. | Identifying unique product. |

| Data Field | Description | Data Use |
|---|---|---|
| Tire size | Text field, width in mm.<br>Text field, aspect ratio.<br>Text field, rim diameter in inches. | Identifying unique product. |
| Has the total production in the United States or importation into the United States by the tire's manufacturer, or in the case of a tire marketed under a brand name, the total annual domestic purchase and purchase for importation into the United States by the tire's brand name owner been less than 15,000 tires during every prior calendar year? | Yes/No. | Identifying eligibility exemption. |
| Will the total production in the United States or importation into the United States by the tire's manufacturer, or in the case of a tire marketed under a brand name, the total annual domestic purchase and purchase for importation into the United States by the tire's brand name owner be less than 15,000 tires during the current calendar year? | Yes/No. | Identifying eligibility exemption. |
| Manufacture year | Beginning Date<br>End Date/"ongoing" | The beginning year when the basic model first complied with the regulations, up to the calendar year ten years prior to the date of the reporting submission, and an end year when the basic model will no longer comply with the regulations, which may be listed as "ongoing." |
| Plant code | Text field | Reportable if necessary to distinguish the basic model from other basic models. |

| Data Field | Description | Data Use |
|---|---|---|
| Declaration (i.e., attestation) | Yes/No. | Manufacturer declaration that product is compliant. |

Source: CEC staff

The information collected under these regulations would allow CEC staff to identify reported tires and assist staff in monitoring the tire market for program feasibility, cost-effectiveness, safety, and tire life. The physical characteristics reported, including information that would typically appear on a tire sidewall, will be used to accurately identify tires during market surveillance related to compliance and enforcement.

Manufacturers would test tire rolling resistance using the ISO 28580:2018 standard and submit the results to the CEC along with a manufacturer affirmation of product compliance. This test measures the rolling resistance of a tire by running it on a test wheel under load at constant speed. The energy consumed by the rolling tire is directly proportional to the reaction forces in the form of torque on the test wheel, or force on the axle. The less force, the more fuel-efficient the tire. ISO 28580:2018 also states a procedure to correlate results between different test equipment.

CEC staff recommends allowing manufacturers to self-certify the rolling resistance, treadwear, and traction ratings for their tires rather than submitting actual test measurements, as specified in Table 6. Tire manufacturers would be required to provide test documentation to the CEC upon request. Manufacturers would report and certify tire data via an online data submission system.

Tire manufacturers attesting product compliance would be required to submit electronically an attestation, signed and dated by a company officer, to the CEC. This framework for reporting is in line with the pending federal Tire Fuel Efficiency Consumer Information Program.[37] Such an approach is not contrary to data collection under the Warren-Alquist Act, which, in the context of data collection for the CEC's *Integrated Energy Policy Report,* allows use of estimates and proxies under certain circumstances.[38]

## Tire Database

Statute requires the CEC to develop a database for the energy efficiency of replacement tires sold in the state.[39] Staff proposes the CEC develop and maintain an online database containing, at a minimum, the data submitted from tire manufacturers through the reporting requirements in these regulations.[40]

---

37 75 FR 15894-01, 3/30/2010. National Highway Traffic Safety Administration. 2010. "Final Rule on Tire Fuel Efficiency Consumer Information Program." 75 FR 15894-01. Pg. 15916. Tire Fuel Efficiency Consumer Information Program

38 Pub. Resources Code, § 25320(b)(3).

39 Pub. Resources Code, § 25771(a).

40 Ibid.

The tire database would allow manufacturers to report and certify data via an online data submission system and allow certain data to be accessible to the public. It would provide, among other things, a means for consumers to view the tire energy rating and other tire specifications for the replacement tire market. The database would be updated by the tire manufacturer or brand name owner as necessary.

CEC staff will develop a registration system and provide tutorials for designated employees of the tire manufacturers regarding how to register and submit tire information to the database. The registration will require detailed information about the company and the designated employee that will be responsible for submitting data.

Replacement tires that have no listings reported to the database and are not attested to be compliant with the regulations will not be legal for sale in California.

## Tire Energy Performance Standard

Staff proposes a tire energy performance standard, measured in RRC, for all qualifying replacement tires sold in California. An initial standard will be effective January 1, 2028, with a more stringent performance standard effective January 1, 2031, as shown in Table 8.

**Table 8: RRC Tire Energy Performance Standard**

| Tire Category | Phase 1: January 1, 2028 (in N/kN) | Phase 2: January 1, 2031 (in N/kN) |
|---|---|---|
| Base tires | 9.0 | 7.1 |
| Low-load-index tires | 9.5 | 7.6 |
| Light-truck tires | 9.0 | 7.8 |
| Long-life tires | 9.4 | 7.8 |
| Ultra-long-life and ultra-high-performance tires | 9.8 | 8.5 |

Source: CEC staff

Notably, the Draft Replacement Tire Framework (February 2023) of this report used *uncorrelated* ISO numbers that were not correlated to the EU's tire testing protocols. The CEC staff proposes that only *EU-correlated* RRC values be used for the regulations. The energy performance standard proposed in the CEC's Draft Replacement Tire Framework report should not be compared with the MPS shown in Table 8. Uncorrelated RRC numbers are not used in this report.

The EU correlated RRC values in this report were computed using the following adjustment equation:

$$EU\ correlated\ RRC = 0.9605 \times uncorrelated\ RRC - 0.3828$$

All replacement tires, including original equipment tires sold as replacement tires in California, will need to comply with the tire energy performance standards relative to the date of

manufacture. As a lower RRC value indicates a more efficient tire, the tire energy performance standard is the maximum RRC value a tire in any category can be to legally be sold in California.

Several categories of tires receive an increased energy performance standard:

- Staff proposes an increase of +0.5 RRC over the base energy performance standard in 2028 and 2031 for tires with a load index of 91 or less. CEC staff analysis suggests that this category of low-load-index tires includes about 20 percent of the tire market. This increase affects fuel savings as smaller-diameter tires, such as 14- and 15-inch tires, have a higher rolling resistance when compared to larger tires due to greater relative tire deformation. These smaller tires, however, are typically equipped on smaller, more fuel-efficient vehicles.
- Staff proposes that light-truck tires, those with the "LT" designation, receive an increase of +0.7 RRC over the base energy performance standard in 2031. This proposal reflects feedback from manufacturers regarding the unique performance and utility requirements of light-truck tires.
- Staff proposes that long-life tires would receive an increase of +0.4 RRC in 2028 and +0.7 RRC over the base energy performance standard in 2031. This value reflects feedback from manufacturers and state policy, which prioritize reducing tire waste.
- Staff proposes that ultra-high-performance tires and ultra-long-life tires qualify for an increase of +0.8 RRC in 2028 and +1.4 RRC beginning in 2031.

In cases where a tire model qualifies in more than one category, the highest — that is, most lenient — minimum performance standard will apply.

## Wet Grip Minimum Performance Standard

The CEC did not find a correlation between increased energy efficiency and wet grip that would indicate the proposed efficiency standards would cause a decline in safety. However, in USTMA/TRAC comments to CEC in March 2023, manufacturers stated:

*"While USTMA/TRAC member companies will not make a tire with an unacceptable wet traction level, we cannot predict how other tire manufacturers will respond to a very aggressive minimum performance standard for tire efficiency. Minimizing the impact of more stringent tire efficiency levels on wet traction performance requires advanced technology and materials that some manufacturers do not leverage. A companion wet grip minimum performance standard and easily understandable consumer ratings are critical to ensure that tire and vehicle safety are not compromised at the expense of achieving greater tire efficiency."*[41]

41 USTMA and TRAC. 2023. "Comments on Replacement Tire Efficiency Pre-Rulemaking Staff Workshop." https://efiling.energy.ca.gov/GetDocument.aspx?tn=249416&DocumentContentId=84020.

In slides presented to the CEC in February 2023, the USTMA and TRAC reiterated this concept stating that "(t)ire efficiency and wet traction standards should be set together to assure no inappropriate design tradeoffs" and further suggested a standard of 1.0 wet braking rating for North America.[42] CEC staff investigated its own data and found that only 7 of the 149 tire models it originally had tested would have a wet grip rating of less than 1. Therefore, more than 95 percent of the tires tested meet the proposed performance level. For those tires that tested as having a wet grip index below 1.0, the average performance was 0.96, meaning they are very close to complying, and most of those also would already need to be redesigned to meet proposed efficiency standards. The USTMA and TRAC proposal would therefore likely serve as a backstop to existing levels of wet grip performance rather than be transformative of the current marketplace's safety performance.

While the current market does not seem to include tires that would trade safety for efficiency, CEC staff agrees with industry that a performance standard for wet grip would ensure that inappropriate tradeoffs do not occur. Therefore, CEC staff proposes that the regulations include a wet grip MPS. Under these regulations, new replacement tires manufactured on or after January 1, 2028, that are sold or offered for sale in California would be required to meet a wet grip MPS of 1.0.

*Wet grip* is a measurement of the ability of a tire to maintain grip in wet conditions and is the primary measurement of the safety of a tire. Wet grip is a unitless metric and is tested through the ISO 23671:2021 test. Passenger car replacement tires sold in the United States display a wet grip rating on the sidewall of the tire, with some exceptions for specialty tires.

Staff proposes to adopt the ISO 23671:2021 wet grip testing procedure to verify wet grip. This procedure is identical to the test used in the federal Tire Fuel Efficiency Consumer Information Program and is the UTQG traction test with modifications to collect data on peak coefficient of friction (or peak braking coefficient).[43] Stakeholder feedback during the prerulemaking phase also suggested the use of global methods such as ISO 23671:2021 to test wet grip.

## Enforcement

CEC staff intends to ensure that the regulations proposed in this staff report are enforced and that noncompliant tires are not sold in California. The CEC has a dedicated Compliance and Enforcement Division that enforces efficiency standards on a wide range of products sold in California, including light bulbs, televisions, and other appliances. The CEC Fuels and Transportation Division may also add dedicated staff to monitor the tire market and enforce compliance.

---

42 USTMA and TRAC. 2023. "North American Tire Manufacturers Perspectives on Tire Consumer Information and Standards." https://efiling.energy.ca.gov/GetDocument.aspx?tn=248890&DocumentContentId=83431.

43 Code Fed. Reg., Tit. 49, § 575.106(g)(1)(iii); National Highway Traffic Safety Administration. 2010. "Final Rule on *Tire Fuel Efficiency Consumer Information Program*." 75 FR 15894-01. Page 15900. https://www.govinfo.gov/content/pkg/FR-2010-03-30/pdf/2010-6907.pdf.

The specifics of how CEC staff will monitor the tire market and enforce these regulations will depend on manufacturer and retailer compliance. Strategies used by staff to enforce these regulations may include conducting randomized tire testing and market monitoring. Staff may refer noncompliant manufacturers to the California Attorney General's Office for legal action.

# CHAPTER 6:
# Alternatives Considered

The CEC staff assessed two alternatives to the regulations proposed in this staff report. The CEC staff invites public feedback on consideration of Alternatives 1 and 2.

## Alternative 1: Original Proposed Minimum Performance Standard

In the Draft Replacement Tire Framework released in February 2023, staff proposed to establish an energy efficiency MPS for replacement tires, as seen in Table 9.

**Table 9: Original Proposed Efficiency MPS**

| Alternative 1 Proposal | January 1, 2026 | January 1, 2028 |
|---|---|---|
| Minimum RRC level for all replacement tires | 8.3 | 6.3 |

**Note: Proposed RRC MPS is shown in EU correlated ISO figures, while the February 2023 draft Replacement Tire Framework used uncorrelated ISO figures of 9.0 on January 1, 2026, and 7.0 on January 1, 2028.**

Source: CEC staff

This proposed efficiency MPS, as originally presented, was more aggressive than what is proposed and shown elsewhere in this report. The results would have produced substantial fuel savings for consumers and significantly lowered GHG emissions, shown in million metric tons of carbon dioxide equivalent ($MMTCO_2e$). Staff estimated that Alternative 1 would potentially provide the annual savings beginning in 2035, as shown in Table 10.

**Table 10: Benefits From Alternative Proposal 1: Original Staff Proposal in 2035**

| | |
|---|---|
| Consumer savings from reduced fuel use (billions of dollars) | $1.8 |
| GHG reduction ($MMTCO_2e$) | 3.6 |
| Gasoline use reduction (millions of gallons) | 257.1 |
| Diesel use reduction (millions of gallons) | 5.4 |
| Electricity use reduction (terawatt-hours) | 1.6 |
| Hydrogen use reduction (millions of kilograms) | 0.7 |

Source: CEC staff and Evergreen Economics

The estimated potential economic savings above are calculated as net savings, meaning that the expected incremental costs associated with more energy-efficient tires would be more than offset by the potential savings from reduced fuel use. Updates to modeling methods and

calculations have resulted in values that differ from the alternative proposal benefits that were expected for this proposal in the Draft Replacement Tire Framework.

Following the release of the 2023 Draft Replacement Tire Framework report, CEC staff held a workshop where staff heard extensive comments from industry representatives. These comments generally argued that it would be difficult or impossible for the tire industry to meet the regulations in the proposed timeline due to the long lead time necessary to develop and begin manufacturing new tire product lines. CEC staff finds some substance to the argument that an increase in stringency would require additional time to achieve and does not propose Alternative 1.

## Alternative 2: Relaxed Efficiency MPS

Following staff's release of the Draft Replacement Tire Framework, some industry stakeholders proposed an alternative efficiency MPS, shown in Table 11.

**Table 11: Relaxed Efficiency MPS**

| Alternative 2 proposal | First Phase — *Effective 36 months from date of final regulation* | Second Phase — *Effective at some unspecified future date* |
|---|---|---|
| Minimum RRC level | 9.7 | 8.7 |

**Note: RRC MPS is shown in EU correlated ISO figures. These proposed RRC levels were originally stated in uncorrelated RRC values and have been recalculated by CEC staff.**

Source: CEC staff

Alternative 2 is based on meetings with the United States Tire Manufacturing Association (USTMA) and the Tire and Rubber Association of Canada (TRAC), as well as comments submitted regarding a suggested MPS following the release of the CEC's Draft Replacement Tire Framework.[44]

Alternative 2 produces significantly less consumer, GHG, and energy savings benefits than either the staff proposal or Alternative 1, as shown in Table 12.[45]

44 USTMA and TRAC. 2023. "Comments on Replacement Tire Efficiency Pre-Rulemaking Staff Workshop." https://efiling.energy.ca.gov/GetDocument.aspx?tn=249416&DocumentContentId=84020.

45 The USTMA proposal did not specify an effective date for the second phase of the regulation. Table 11 assumes that the second phase under Alternative 2 would take effect in 2031.

**Table 12: Benefits From Alternative Proposal 2: Relaxed Efficiency MPS in 2035**

| | |
|---|---|
| Consumer savings from reduced fuel use (billions of dollars) | $0.3 |
| GHG reduction ($MMTCO_2e$) | 0.5 |
| Gasoline use reduction (millions of gallons) | 35.8 |
| Diesel use reduction (millions of gallons) | 0.9 |
| Electricity use reduction (terawatt-hours) | 0.2 |
| Hydrogen use reduction (millions of kilograms) | 0.1 |

Source: CEC staff and Evergreen Economics

Public Resources Code Section 25772 makes it clear that the CEC must develop a program intended to make replacement tires, on average, as energy-efficient as OE tires. Based on the CEC staff testing conducted at Smithers Laboratory, OE tires on average have a rolling resistance of about 7.1. Since this alternative does not set an MPS of at least 7.1 RRC, CEC staff rejects Alternative 2 as not compliant with the law. In addition, this alternative offers only significantly reduced consumer savings and environmental benefits.

# CHAPTER 7:
# Technical Feasibility

CEC staff finds that the proposed regulations are technically feasible. The results of tire testing commissioned by CEC staff and conducted by the respected tire consultancy Smithers shows that the proposed regulations will not compromise safety, as measured by wet grip, or reduce tire life through accelerated tire wear. These findings are documented in the Smithers report *Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844* and detailed in this chapter.

## The Proposed Tire Efficiency MPS Is Feasible

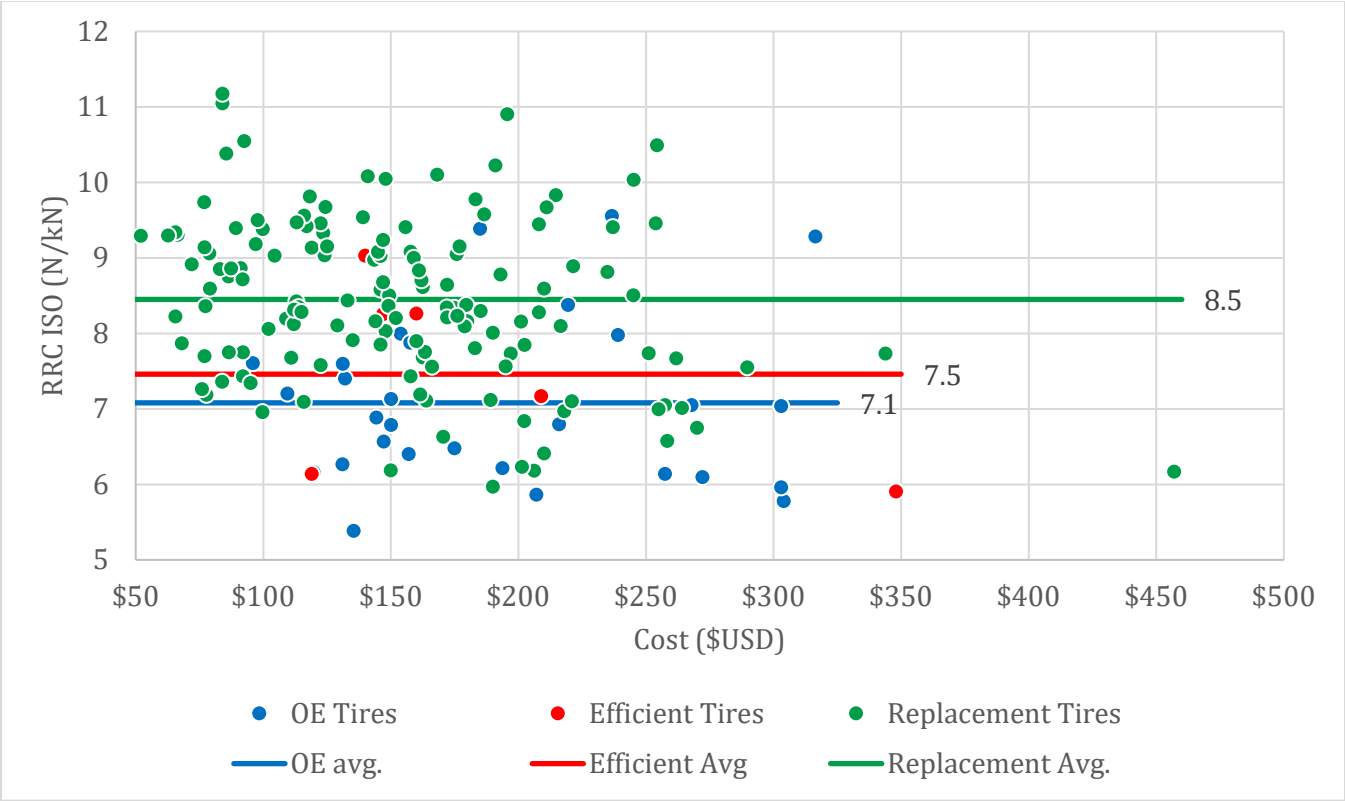
A primary goal of the tire program is to require replacement tires to be as efficient as OE tires. Smithers testing commissioned by CEC staff demonstrates that this goal is feasible.

The following graph displays the results of the tires tested with the associated rolling resistances and costs, separated into three categories: OE, replacement, and any tires marketed as efficient. OE tires are considered the tires that come with a new vehicle. Tires in the "efficient" category are designated as efficient by the tire manufacturer[46] and are not necessarily attributed as such by a performance characteristic or objective testing results.

The average RRC of each tire model tested is shown in Figure 1, with lines showing the average efficiency of OE, replacement, and efficient tires.

46 Tires in this category were chosen based on marketing-related designation by the manufacturer. These include tires with names like (Michelin) Energy Saver, (Hankook) Kinergy, (Bridgestone) Ecopia, and others.

**Figure 1: CEC Tire Test Program Results of RRC vs. Cost**




Source: CEC staff

The average RRC (EU-correlated) of tires with designations of OE, efficient, and replacement tires are 7.1 N/kN, 7.5 N/kN, and 8.5 N/kN respectively. (A lower RRC represents a more efficient tire.) Phase 2 of the regulation sets an RRC MPS of 7.1 N/kN and 7.8 N/kN for base and light-truck tires, respectively.

On average, OE tires are more efficient than replacement tires, yet there are replacement tire models that match or exceed the average efficiency of OE tires. CEC staff concluded that it is feasible to make replacement tires that are as efficient as OE tires because there are already several replacement tires in the market that match or beat the average OE RRC without a substantial increase in costs to the consumer. Additional information can be found in the final report developed by Smithers describing the tire testing program.[47]

The test data show that the technologies necessary to meet the proposed Phases 1 and 2 standards are not only available, but are already in deployment in popular tire models available in the market and across a wide range of price points and sizes.

47 Smithers, *Summary of Tire Testing*.

## The Proposed Regulations Will Not Compromise Safety

Tires are the only point of contact a vehicle has with the road. Consequently, tires play a significant role in overall vehicle safety. AB 844 states that any minimum efficiency standards implemented by the regulations shall not have an adverse effect on safety. In general, testing data carried out by Smithers indicate that more efficient tires should be at least as safe as existing tires.

Several key factors affect tire safety, including tread depth, tread design, durability, load rating, heat rating, and other factors beyond the scope of this report such as tire inflation and wear condition. These extraneous factors are not expected to be different for more efficient tires.

A key indicator of tire safety is wet grip, or the ability of a tire to stop on a wet surface. A secondary indicator of tire safety is dry traction, or the ability of a tire to maintain traction in dry conditions. This report examines the relationship between tire rolling resistance and both wet grip and dry traction.

### Wet Grip

Wet grip is a measure of how quickly a tire can stop on wet roads and is widely used as an indicator of safety. In the EU, it is the primary safety component presented to consumers in its tire consumer information program. Similarly, traction and wet grip are a focus of tire safety for the U.S. federal government and is embodied in the UTQG and in the FAST Act. A higher wet grip index indicates a tire that can stop in a shorter distance on a wet surface, increasing safety.

Staff research did not uncover published evidence that lower-rolling-resistance tires showed a decline in wet grip or other measures that would affect vehicle safety except at the extremes of traction performance. As tire design and composition have advanced in recent years, any such trade-offs are being minimized or effectively eliminated as evidenced by the lack of a relationship between rolling resistance and wet grip in the test data. For example, silica is a commonly used compound in tire tread to improve tire efficiency while maintaining traction and treadwear.[48]

A report on the federal government's CAFE standards by the U.S. EPA and NHTSA suggests that, overall, the tire industry is confident that it can meet the demands of increasing fuel efficiency standards with improved tire technology. The report states that "suppliers were generally optimistic about the ability to reduce tire rolling resistance in the future without the need to sacrifice traction (safety) or tread life (durability)."[49] While the statement refers to OE

---

48 Sattayanurak, S., W. M. Noordermeer, K. Sahakaro, W. Kaewsakul, W. K. Dierkes, and A. Blume. 2019. "Silica-Reinforced Natural Rubber: Synergistic Effects by Addition of Small Amounts of Secondary Fillers to Silica-Reinforced Natural Rubber Tire Tread Compounds." *Advances in Materials Science and Engineering* (2019). Article ID 5891051. https://www.sciencedirect.com/science/article/abs/pii/S0142941819313698?via%3Dihub.

49 U.S. Environmental Protection Agency, National Highway Traffic Safety Administration. 2012. *Joint Technical Support Document: Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and*

tires used on new vehicles, it underscores the technological improvements anticipated throughout the tire industry. Importantly, the fact that OE and EV-specific tires are being produced cost-effectively to provide high efficiency (low or ultra-low rolling resistance) without sacrificing safety provides useful context. An updated version of the CAFE analysis by NHTSA provides further details about the relationship between wet grip and rolling resistance:

*"...in recent years it has become possible to separately engineer rolling resistance and grip, and to mitigate issues related to stopping distance without raising rolling resistance. Tire manufacturers have done this by selecting different materials (e.g., various types of silica and/or Silanes as reinforcing fillers, and/or higher performance tread compound materials), and by using advanced tire design and tread design features (including with the help of computer simulations) … In fact, NHTSA's most up-to-date data on ROLL technology shows that there is no degradation in wet grip index values (i.e., no degradation in traction) for tires with improved rolling resistance technology installed on new vehicles."* [50]

NHTSA's analysis provides further technical detail on how manufacturers have achieved simultaneous improvements to wet grip and rolling resistance:

*"Through this research it has been discovered that silica and silanes reinforcements enable simultaneous boosts to wet grip and rolling resistance performance … [C]omputer simulation results have allowed tire engineers to select more beneficial versions of silicas, silanes and S-SBR compounds that amplify this effect, resulting in ever lower rolling resistance at higher traction levels."* [51]

To better understand tire efficiency and wet grip, CEC staff analyzed the 179 tire models tested by Smithers with respect to UTQG traction rating and RRC. A UTQG traction rating represents the ability of a tire to stop on wet pavement as measured under controlled conditions on specified test surfaces of asphalt and concrete. Results are shown in Figure 2.

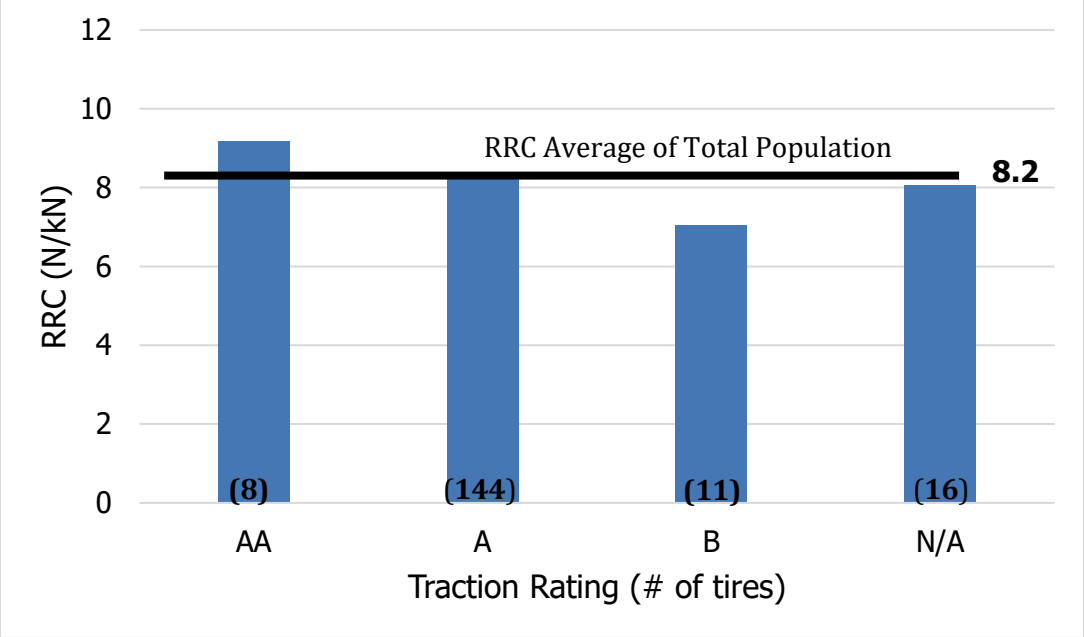
---

*Corporate Average Fuel Economy Standards.* Publication Number: EPA-420-R-12-901. https://www.nhtsa.gov/sites/nhtsa.gov/files/joint_final_tsd.pdf.

50 U.S. Department of Transportation, National Highway Traffic Safety Administration. 2024. *Technical Support Document Corporate Average Fuel Economy Standards for Passenger Cars and Light Trucks for Model Years 2027 and Beyond and Fuel Efficiency Standards for Heavy-Duty Pickup Trucks and Vans for Model years 2030 and Beyond*. Pages 3-168 to 3-170. https://www.nhtsa.gov/sites/nhtsa.gov/files/2024-07/NHTSA-final-technical-support-document-cafe.pdf.

51 Ibid.

**Figure 2: Total Tire Population RRC vs. UTQG Traction Rating**



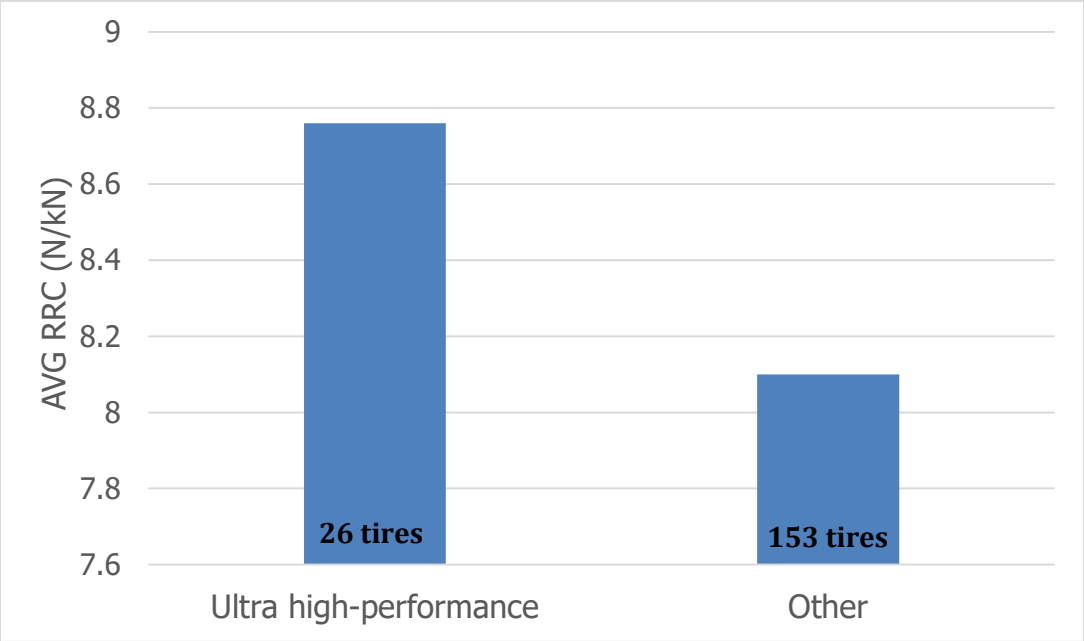

**Note: LT tires do not have UTQG ratings and are listed above as N/A. Of the tires tested, none had a "C" rating.**

Source: CEC staff/Smithers

This test showed that tires with the highest grip — those with an AA traction rating — did have lower efficiency than tires with lower traction. However, this apparent trade-off between traction and efficiency is most apparent in the limited number of tires that are designated as ultra-high-performance tires. These high-performance tires typically exhibit exceedingly high wet grip, as well as a higher average RRC.

To explore whether lower efficiency is an inherent trade-off of high traction or if this relationship is largely restricted to ultra-high-performance tires, staff compared the efficiency of ultra-high-performance tires with other tires. The average RRC of the 26 ultra-high-performance tires tested was nearly 8.8, as shown in Figure 3. This RRC is significantly higher (that is, less efficient) than the 8.1 RRC average of the 153 other tires that were not ultra-high-performance.

**Figure 3: RRC vs. Ultra-High-Performance and Other Tires**



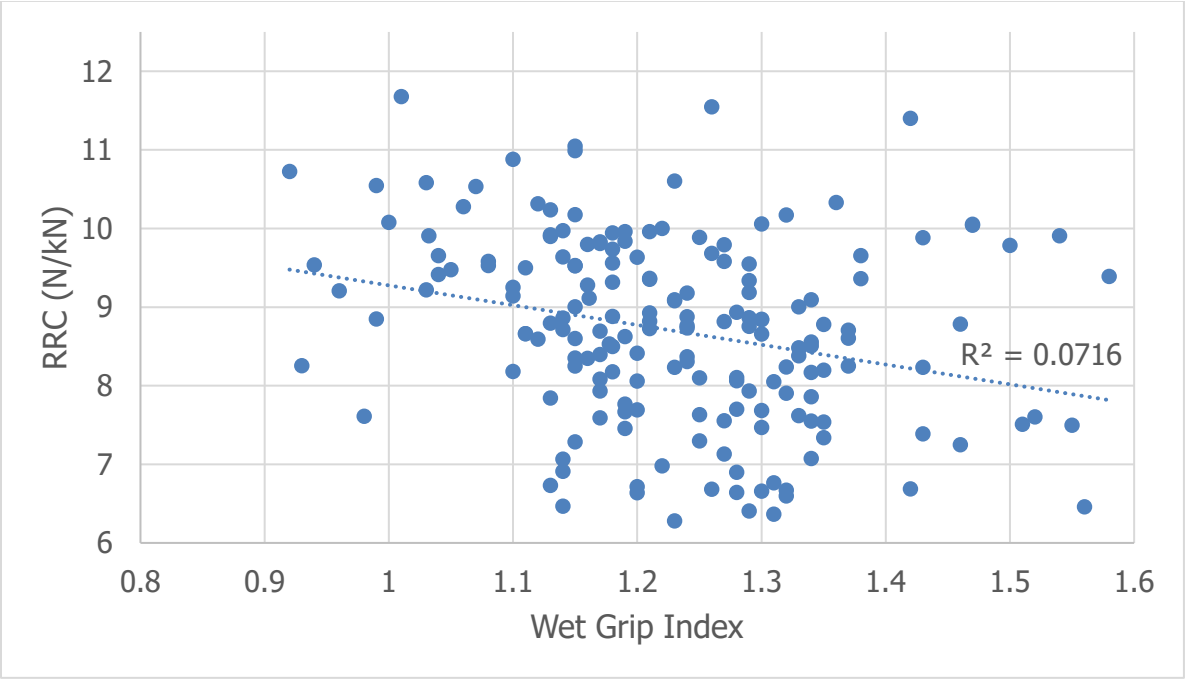

Source: CEC staff.

The average RRC of tires tested that were not ultra-high-performance was 8.1. This RRC is below (that is, more efficient than) the proposed MPS for base tires in 2028 (9.0). This finding suggests that base tires can achieve the efficiency MPS while not sacrificing wet grip and, therefore, safety.

The ultra-high-performance tires achieved on average nearly an 8.8 RRC, which is below the efficiency (that is, more efficient than) MPS for this tire category for 2028 (9.8). This RRC justifies the lower-efficiency MPS (that is, a higher RRC) for ultra-high-performance tires to reflect the high levels of traction these tires require. Staff proposes that this ultra-high-performance designation be reserved for tires that bear a speed category symbol of "W," "(W)," "Y," or "(Y)"; be capable of maintaining maximum speeds of 168 miles per hour or above; and has a relative wet grip braking performance index of at least 1.45.

To further investigate whether there is an inherent tradeoff between tire wet grip and efficiency, staff commissioned additional tire testing. A higher wet-grip-index value represents a shorter stopping distance on a wet surface, relative to a standard reference tire. The relationship between tire RRC and wet grip is indicated by the trendline in Figure 4 below, which seems to show that more efficient tires (with lower RRC) have marginally higher wet grip than less efficient tires.

**Figure 4: RRC vs. Wet Grip Index**




Source: CEC staff

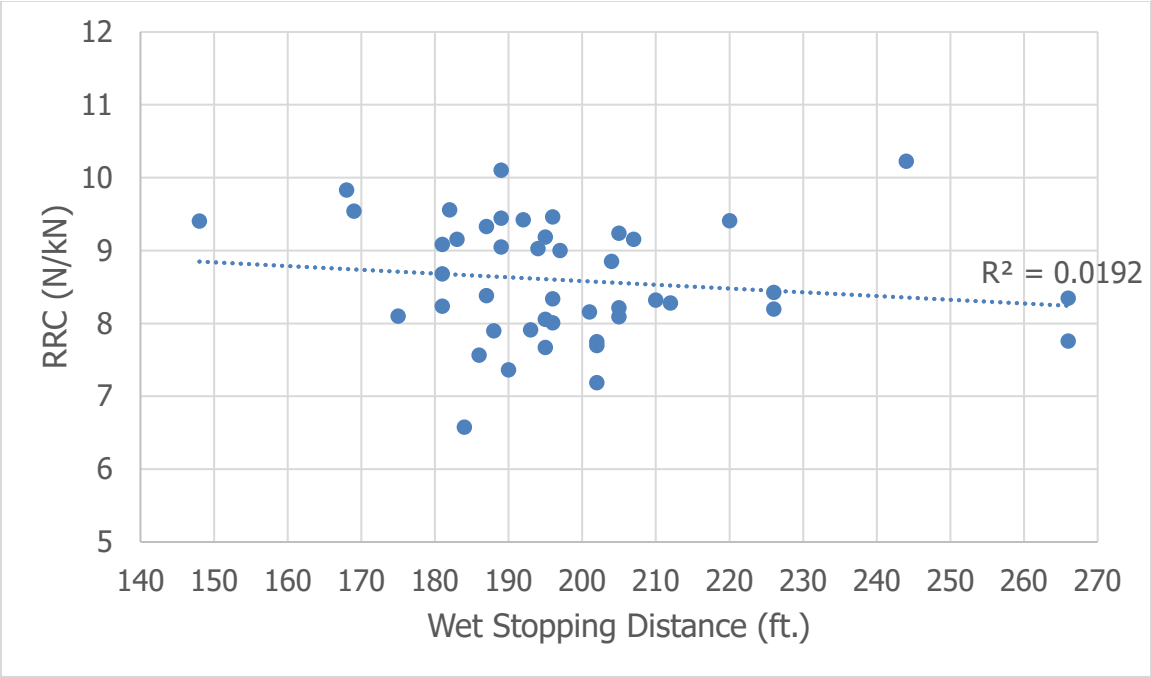
However, the explanatory power of this relationship as shown by the coefficient of determination or $R^2$ value is very low. This finding indicates that there is no clear relationship between the efficiency of a tire and safety. Indeed, many tire models are efficient and have high wet grip, showing that it is possible to manufacture and bring to market a tire with both attributes. Absent an exemption, replacement tires with a wet grip index of less than 1.0 would be illegal to sell in California under these regulations, eliminating replacement tires with the least traction from the market.

This lack of a clear relationship between tire efficiency and wet grip is confirmed by Smither's analysis. Further details on testing results, including graphical presentations, can be found in the Smithers final report to the CEC, *Summary of Tire Testing for California's Replacement Tire Efficiency Program.*

### Wet Grip of Worn Tires

To further investigate any impact of tire efficiency standards on safety, staff also analyzed the wet stopping distance of worn tires. Worn, wet tires are expected to have lower wet grip than an unworn tire, all else being equal. While Smithers did not test the stopping distance of worn wet tires, data provided to CEC staff by major retailer Discount Tires from its extensive Treadwell database allowed staff to compare the worn wet stopping distance of various tires. Results are shown in Figure 5.

**Figure 5: RRC vs. Wet Stopping Distance for Worn Tires**




Source: CEC staff analysis using Treadwell data

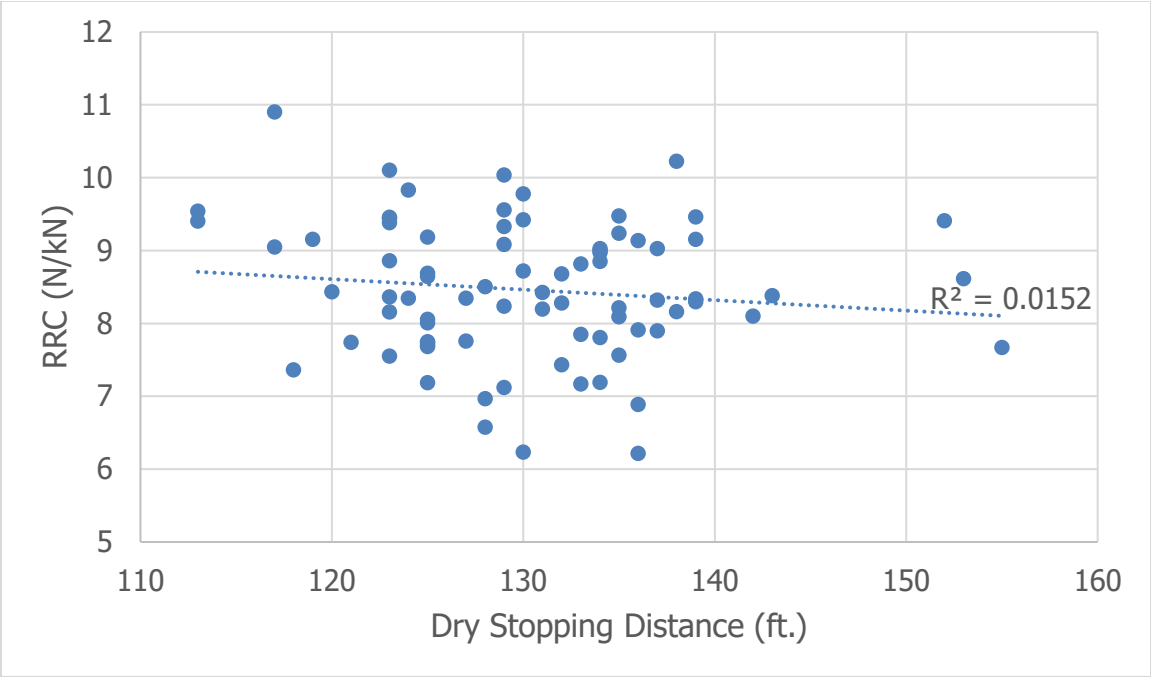
Staff again found no clear relationship between tire RRC and wet grip for worn tires, as shown by the low coefficient of determination or $R^2$. Many tires show both relatively low wet stopping distance and high efficiency (a lower RRC). This finding is further indication that increasing tire efficiency does not necessarily decrease tire wet grip, even in the most challenging conditions.

To conclude, a literature review and Smithers testing show that there is no clear relationship between tire efficiency and wet grip, meaning that the proposed regulations will not necessitate a decrease in tire wet grip.

### Dry Traction

Dry traction is the ability of a tire to maintain grip on a dry surface, while wet traction is the primary measure of tire safety. To further verify that these efficiency regulations will not affect safety, CEC staff investigated the relationship between tire efficiency and dry traction using tire data from Discount Tire's Treadwell database. Results are shown in Figure 6.

**Figure 6: RRC vs. Dry Stopping Distance**




Source: CEC staff analysis using Treadwell data

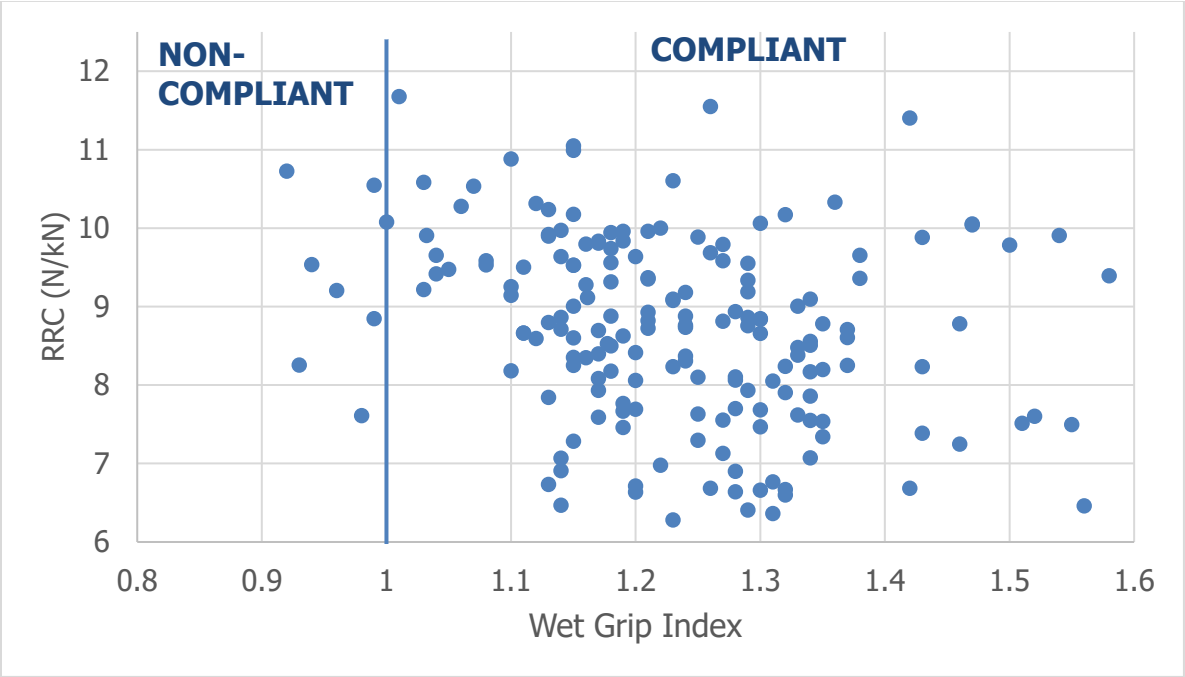
CEC staff found no clear relationship between tire efficiency and dry traction as shown by the low coefficient of determination or $R^2$.

To conclude, extensive testing and staff analysis using third-party data found no inherent relationship between tire efficiency and wet grip and no inherent trade-off between tire efficiency and dry traction.

### Wet Grip MPS

Furthermore, staff proposes a wet grip minimum performance standard of 1.0. CEC staff anticipates that this wet grip MPS will remove a limited number of tire models with very low wet grip from the California market, further assuring safety. Under the proposed regulations, tires with very low wet grip will not be legal for sale in California, as shown in Figure 7.

**Figure 7: Wet Grip Minimum Performance Standard**




Source: CEC staff. Wet grip MPS is illustrated by the vertical line at wet grip index equals 1.

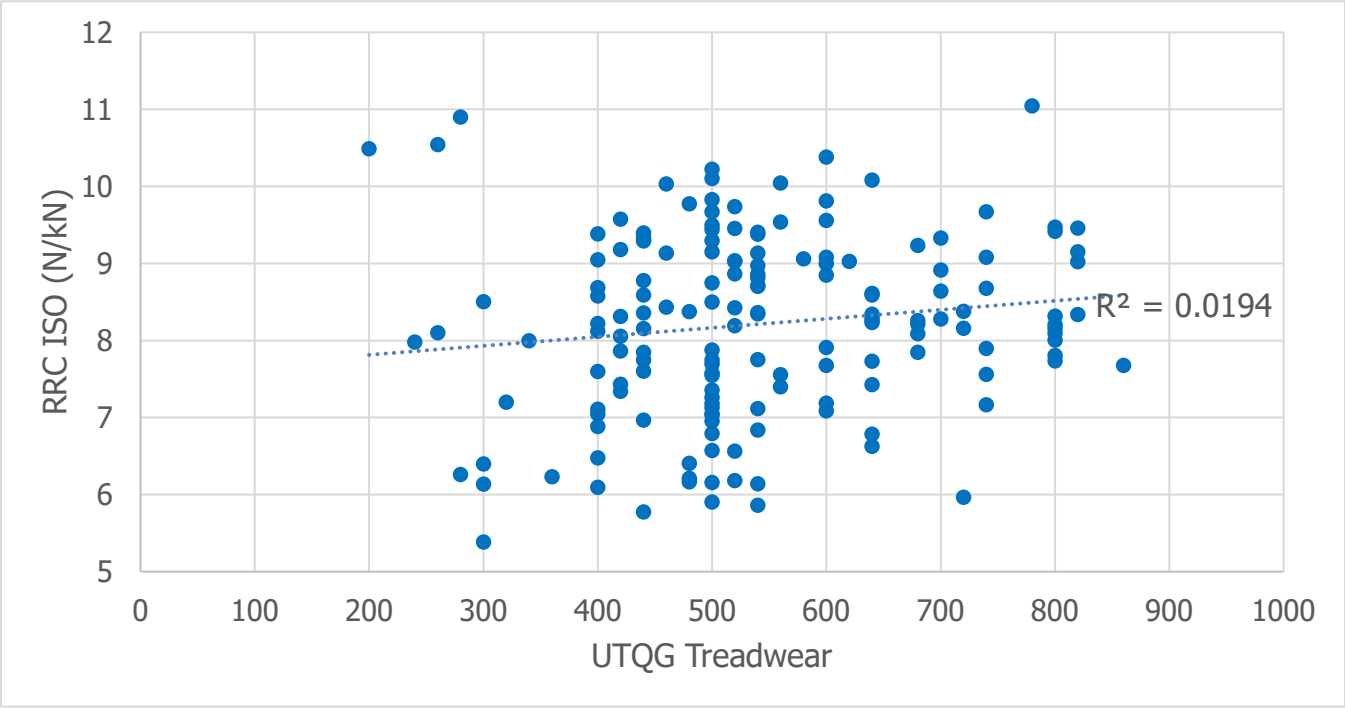
## The Proposed Regulations Will Not Reduce Tire Life

Public Resources Code 25773(a)(1)(c) requires that the proposed regulations not adversely affect the treadwear (also known as lifespan or mileage) of replacement tires. To verify that there is not an inherent trade-off between tire efficiency and treadwear, staff examined the relationship between tire efficiency and various measures of treadwear.

First, staff examined the relationship between tire efficiency and UTQG treadwear ratings. The UTQG treadwear ratings are required on the sidewall of every passenger car tire sold in the United States. A higher treadwear rating under the federal UTQG system represents a longer tire life.

Figure 8 compares UTQG tire treadwear and efficiency. A higher treadwear rating under the federal UTQG system represents a longer tire life, and a lower RRC represents a more efficient tire.

**Figure 8: RRC vs. UTQG Treadwear**




Source: CEC staff

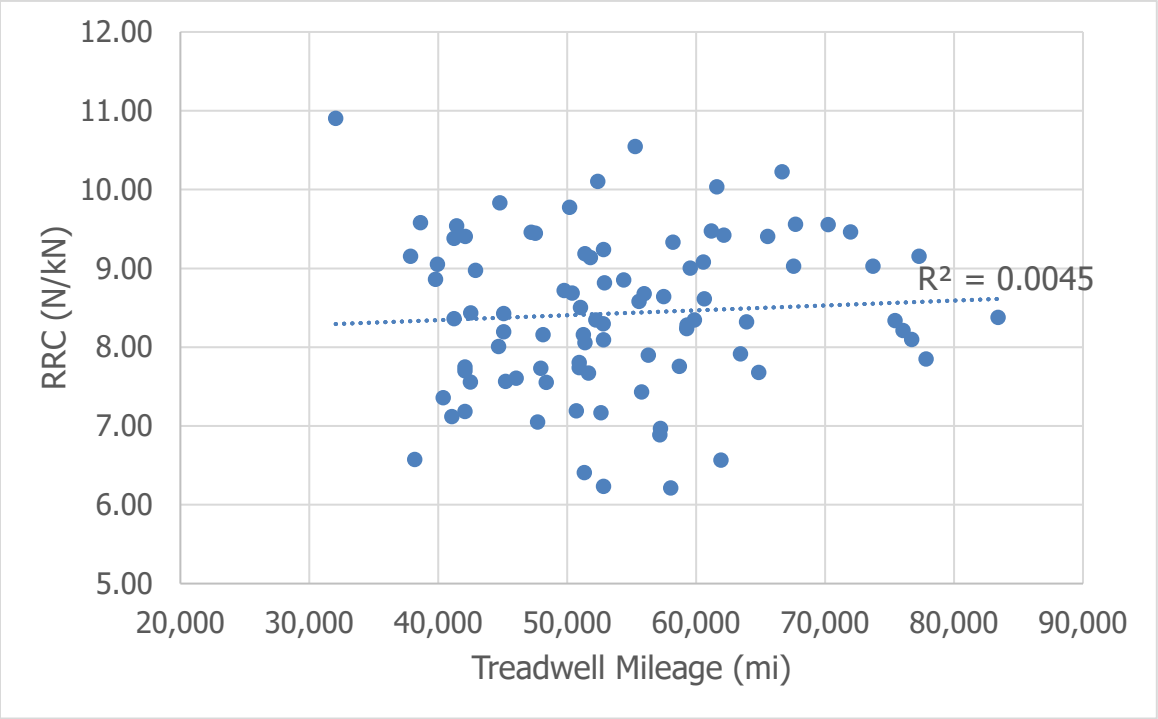
Figure 8 does not show a statistically significant relationship between UTQG treadwear and RRC. Staff notes that a significant number of tire models possess low RRC and high UTQG treadwear grades, which indicates that existing tires can and do achieve strong performance on both attributes simultaneously.

During the rulemaking process, industry stakeholders recommended that staff supplement a UTQG analysis with data from the proprietary Treadwell program developed by Discount Tire. Treadwell combines laboratory and real-world performance data to estimate the lifetime mileage of tire models.

The CEC worked with Discount Tire to identify Treadwell mileage estimates for the CEC's sample set of tires. Most of the tires CEC tested for efficiency were able to be matched to Treadwell estimates of tire mileage.

Figure 9 compares Treadwell mileage and efficiency. A higher Treadwell mileage rating represents a longer tire life, and a lower RRC represents a more efficient tire.

**Figure 9: RRC vs. Treadwell Mileage**




Source: CEC staff and Treadwell Data

Figure 9 does not show a statistically significant relationship between Treadwell mileage and RRC. Again, staff notes that a significant number of tire models possess both low RRC and high Treadwell mileage estimates, which indicates that existing tires can achieve strong performance on both attributes simultaneously.

These findings comport with the existing literature on treadwear and efficiency in tire design. As early as 2003, CEC's SB 1170 report similarly found "there is no significant relationships between tire wear rating and its rolling resistance characteristics."[52] This finding has been subsequently reconfirmed by data collected by both the National Research Council[53] and California Integrated Waste Management Board (now known as Cal-Recycle).[54] This finding

52 Calwell, Chris, My Ton, Deborah Gordon, Travis Reeder, Marissa Olson and Suzanne Foster. 2003. *California State Fuel Efficient Tire Report: Volume II, Consultant Report*. California Energy Commission. Publication number 600-03-001CR. Page 22. https://www.kannahconsulting.com/wp-content/uploads/2016/08/2003-01-31_600-03-001CRVOL2.pdf

53 National Research Council of the National Academies. 2006. *Tires and Passenger Car Fuel Economy: Informing Consumers, Improving Performance*. Special Report 286. https://www.nationalacademies.org/read/11620/chapter/1.

54 Pike, Ed. July 2011. *Opportunities to Improve Tire Energy Efficiency*, International Council on Clean Transportation. Page 9. https://theicct.org/wp-content/uploads/2021/06/ICCT_tireefficiency_jun2011.pdf. The data reflect testing conducted by the Waste Management Board (CalRecycle) in coordination with the California Energy Commission.

has also confirmed by the National Highway Traffic Safety Administration,[55] which noted that "there is no evidence from this data that a tire with reduced rolling resistance will necessarily have reduced tread life."

Based on the available data and literature, the CEC finds that there is no meaningful relationship between treadwear and efficiency and that the proposed efficiency standards will not adversely affect the treadwear of replacement tires.

However, as an additional precaution, staff has included mechanisms to reward higher treadwear tires. First, the proposed efficiency MPS would include more leniency for long-life (RRC MPS of 7.8 in Phase 2) and ultra-long-life tires (RRC MPS of 8.5 in Phase 2). These changes are expected to encourage tire manufacturers to continue to increase tire lifespans. Second, the proposed wet grip MPS will also prevent manufacturers from increasing tire efficiency by reducing tread depth. Tires with very low tread depth tend to have a wet grip lower than 1.0 and will not be legal for sale. These additional mechanisms will discourage manufacturers from reducing tire lifespan and ensure that the proposed regulations will not reduce tire life and increase tire waste.

Based on staff analysis of the relationship between low-rolling-resistance tires and wear, and meeting with staff at CalRecycle, the state agency overseeing the scrap tire program, CEC staff found no evidence that the proposed MPS would adversely impact the scrap tire program.

55 National Highway Traffic Safety Administration. 2009. *The Fuel Efficiency Consumer Information Program Development: Phase 2 — Effects of Tire Rolling Resistance Levels on Traction, Treadwear, and Vehicle Fuel Economy*. page 63. https://downloads.regulations.gov/NHTSA-2025-0491-0088/attachment_36.pdf.

# CHAPTER 8:
# Savings and Cost Analysis

This chapter examines the costs, savings, and ultimate cost-effectiveness of the proposed regulations. AB 844 requires that the regulations be cost-effective, defined as "the cost savings to the consumer resulting from a replacement tire subject to an energy efficiency standard that equals or exceeds the additional cost to the consumer resulting from the standard, taking into account the expected fuel cost savings over the expected life of the replacement tire."[56]

The savings from the expected regulations are primarily the expected fuel savings from adopting more efficient tires. The costs of the regulations consist of the direct and indirect incremental costs of more efficient replacement tires compared to tires sold today. The overall cost-effectiveness of the regulations is computed by comparing the lifetime costs of a replacement tire purchased today with the expected lifetime costs of the more efficient replacement tires required by the proposed regulations.

A full list of staff assumptions used to calculate cost and benefits of the program are shown in Appendix A.

## Costs

The lifetime costs of one tire compared with another can be organized into five categories: fuel cost, equipment/tire purchase costs, installation cost, maintenance costs, and end-of-life costs.

### Fuel Costs

*Fuel costs* are costs caused by energy losses during the use of a tire. The rolling resistance directly correlates with these losses where the greater the rolling resistance, the greater the energy loss and fuel costs. Conversely, a more efficient tire will reduce energy loss and lower fuel costs.

The goal of AB 844 is to increase the efficiency of replacement tires to be as energy-efficient as the average OE tire. CEC staff expects that the regulations will increase the efficiency of replacement tires by about 16 percent. This increased efficiency is expected to increase the efficiency of California passenger and light-duty vehicles by about 2 percent overall, equivalent to roughly $979 million in fuel savings in 2035 (in 2024 dollars).

Staff computed the expected per-driver savings by estimating the annual gasoline, diesel, electricity, and hydrogen fuel spending by California drivers based on the average vehicle miles traveled. These annual expenditures were then reduced by the approximate 2.0 percent efficiency gain expected from more efficient tires. This saving in required annual fuel inputs

56 Pub. Resources Code, § 25770(c).

was then multiplied by assumed fuel costs to produce the fuel costs savings expected from the regulations.

The full list of staff assumptions is documented in Appendix A: Staff Modeling Assumptions.

## Equipment/Tire Purchase Costs

The total purchase price of the tire itself to the final customer is the purchase cost. If an efficient tire required the use of more expensive materials or a more expensive manufacturing process, the increased manufacturing costs are typically reflected in the retail price. However, the manufacturing cost of a tire is only one factor in determining retail price. Factors such as brand, aesthetics, and advertising can also drive demand and affect retail price to the point of obscuring small changes in manufacturing costs.

To determine the incremental cost of more efficient tires CEC staff consulted the literature on the topic, which is limited. Several efforts have been made over the years to estimate what the incremental cost might be of more fuel-efficient tires, with a range from negligible to $15 per tire in 2024 dollars. Table 13 shows some of these estimates.

**Table 13: Summary of Estimates for Incremental Cost of Fuel-Efficient Tires**

| Publication | Date | Incremental Cost per Tire | Assumed improvement to RRC |
|---|---|---|---|
| *Tires and Passenger Car Fuel Economy*[57] | 2006 | $1.56 in 2024 dollars | 10% |
| *Draft Joint Technical Support Document: Proposed Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*[58] | 2011 | $2.10 in 2024 dollars<br><br>$15.41 in 2024 dollars | 10%<br><br>20% |

Source: CEC staff

For cost-effectiveness calculations in this report, staff considered incremental costs from *Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Fuel Economy Standards*, by NHTSA and U.S. EPA.[59] Staff selected this estimate because it is the most recent source and was determined through a stakeholder process by

57 National Research Council of the National Academies. 2006. *Tires and Passenger Car Fuel Economy: Informing Consumers, Improving Performance*. Special Report 286. Page 114. https://nap.nationalacademies.org/read/11620/chapter/1.

58 U.S. EPA and U.S. DOT. August 2012. *Draft Joint Technical Support Document: Proposed Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*. Pages 3-209 and 3-210/ https://www.nhtsa.gov/sites/nhtsa.gov/files/joint_final_tsd.pdf.

59 Ibid.

the U.S. EPA and NHTSA. This document estimates the incremental cost of a 20 percent increase in tire efficiency as $11 in 2010 dollars per tire, or $15 per tire in 2024 dollars.

Given that Phase 1 performance standards are modest, staff estimates the incremental cost of a compliant tire at $1.50. Under the performance standards of Phase 2, staff estimates the incremental cost of a compliant tire at $6.50. These are lower than the incremental costs estimated by NHTSA and U.S. EPA because the proposed regulations increase tire efficiency on average by less than 10–20 percent.

**Table 14: Incremental Tire Cost**

| Vehicle Type | Phase 1 | Phase 2 |
|---|---|---|
| Passenger car | $ 1.50 | $ 6.50 |
| Light-duty truck | $ 1.50 | $ 9.75 |

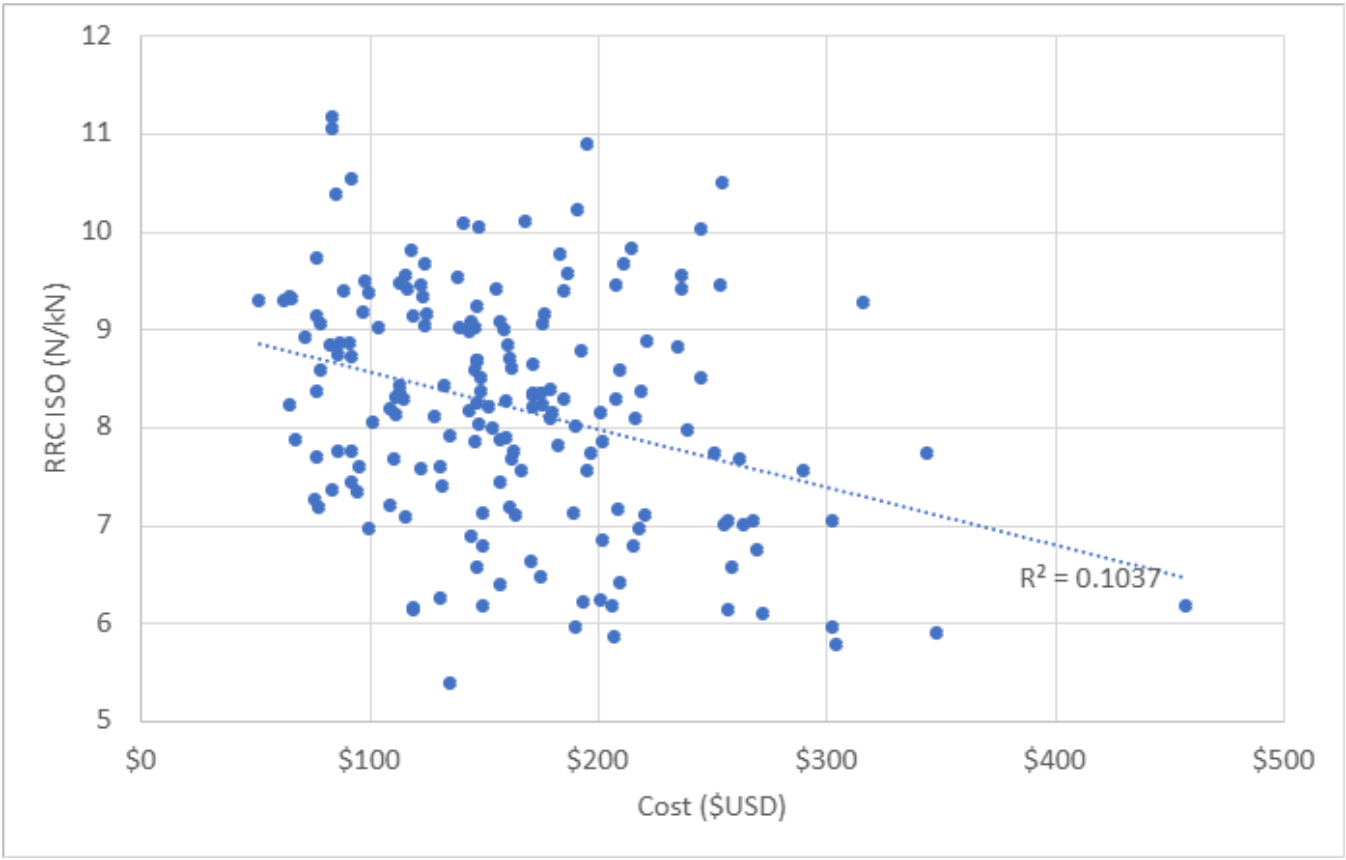
Source: CEC staff

This report assumes that the average driver will replace a set of four tires every four years. The increase in the cost of the replacement tires for passenger vehicles would be $6.50 per tire, or $26 for a set of four passenger car tires under Phase 2 of the program. CEC staff could not find information in the literature about the incremental cost of efficient light-truck tires and assumes a 50 percent increase from the incremental cost of the passenger car tire or $9.75 per tire. The higher cost includes the assumption that larger light-truck tires cost more due to rubber volume and rim size. A set of four light-truck tires is assumed to have an incremental cost of $39 under the standards for Phase 2.

If these first-time costs are recovered over the first four years of California tire sales (about 112 million tires), it would raise the "per-unit" tire cost by $0.05 and less than $0.01 per tire, when absorbed by national tire sales. This incremental cost of $0.05 per driver/year is negligible and therefore excluded from these calculations.

To validate the above cost assumptions, staff also compared the purchase price of tires selected for testing to the associated rolling resistance, as shown in Figure 10.

**Figure 10: Tire Rolling Resistance Compared to Cost**

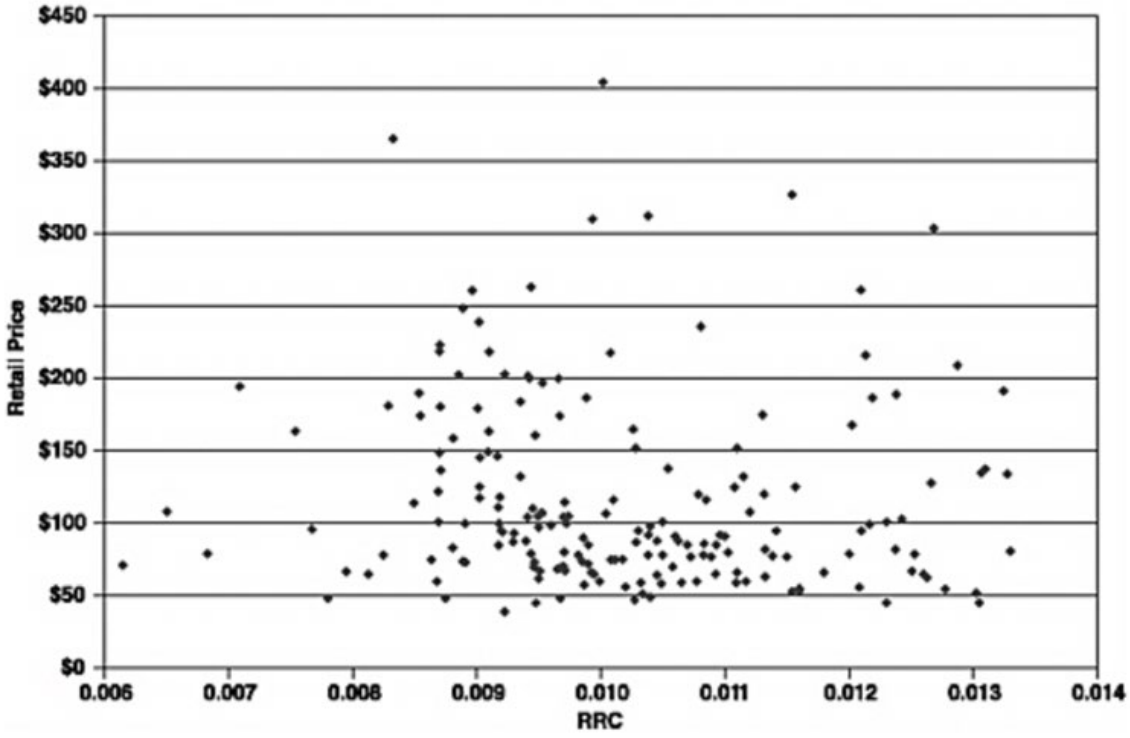



Source: CEC staff

This analysis of tire retail price and rolling resistance and efficiency shows a moderate relationship between tire price and efficiency. However, tire price is determined by many factors, making it difficult to determine what portion of the higher cost of more efficient tires is due to that efficiency itself. The resulting coefficient of correlation or $R^2$ was 0.1037, suggesting there is not a strong relationship between price and rolling resistance. The result does not mean that there is no incremental cost per se, but rather that other factors drive cost at a larger magnitude. It suggests, however, that the incremental cost is somewhat small considering the low correlation.

Similar findings have been observed in comparisons of tire price to rolling resistance, such as those taken from the *Tires and Passenger Car Fuel Economy* report, which are reproduced as Figure 11 below.

**Figure 11: A Comparison of Price and Rolling Resistance**




**Note: RRC is in N/N and prices are in 2006 dollars**

Source: National Research Council of the National Academies, *Tires and Passenger Car Fuel Economy,* Figure 5-1

## Installation Costs

These costs are incurred to remove one tire and replace it with another. Incremental cost can occur in this category if one tire has a shorter life than another, or if there is added complexity in tire installation. The data gathered on tire efficiency do not point to a relationship to tire life, meaning more efficient tires would not drive any more or any less frequent replacements. In addition, staff has not uncovered any information that the installation of an efficient tire is different than a less efficient one. Therefore, the analysis assumes there are no incremental installation costs of efficient tires.

## Maintenance Costs

Staff did not encounter any information that would suggest a difference in the maintenance of a more efficient tire compared to a less efficient one. Therefore, the incremental maintenance cost is assumed to be zero over the life of the tire.

## End-of-Life Costs

At the end of the useful life, tires are a significant source of waste. In California, there are state programs created to reduce negative impacts of this waste. If more efficient tires add to tire waste, then higher end-of-life costs should be considered as incremental cost of the

program. However, as described in Chapter 7, the regulations are not expected to decrease the average lifespan of tires and will not add to tire waste. Thus, expected marginal end-of-life costs are assumed to be zero over the lifetime of the tire.

## Cost-Effectiveness

The cost-effectiveness of using a higher-efficiency tire compared to a low-efficiency tire is calculated by comparing the sum of the incremental costs of each. The life-cycle cost of a tire can be calculated as the sum of all costs discussed in this chapter.

$$Cost_{Lifecycle} = Cost_{Fuel} + Cost_{Purchase} + Cost_{Install} + Cost_{Maintenance} + Cost_{End\ of\ Life}$$

Source: CEC staff

The relative cost-effectiveness of one tire in comparison to the other can be found by subtraction.

$$Cost\ Effectiveness = Cost\ Tire\ A_{Lifecycle} - Cost\ Tire\ B_{Lifecycle}$$

Source: CEC staff

If the results are positive, then "Tire A" has a higher life-cycle cost, and it would be cost-effective to substitute it with "Tire B." If the number is negative, then "Tire A" is the more cost-effective tire.

As discussed, CEC staff estimates the incremental cost of the regulations to be about a $6.50 increase in the average cost of a single passenger car replacement tire. Since the average driver purchases four tires at once every three to four years, this increase is assumed to be an incremental cost of $26 every four years (or $6.50 per year). This incremental cost is then compared to the expected fuel savings from increased efficiency per year. If the incremental fuel savings — or benefits — are greater than the incremental cost of efficient tires, then the regulation is cost-effective.

Table 15 outlines the expected driver savings when comparing the status quo baseline to Phase 2 of the regulation. Estimated savings are shown for passenger cars and light-duty trucks. These savings are estimates and will vary based on actual incremental costs, tire efficiency gains, and the cost of fuel.

**Table 15: Estimated Cost-Effectiveness for a Gasoline Vehicle With Phase 2 Tires**

| Cost and Benefits | Lighter Vehicle Tires | Heavier Vehicle Tires |
|---|---|---|
| Incremental cost of compliant tires (set of four) | $26 | $39 |
| Fuel savings over tire life (gallons of gasoline) | 39 | 54 |
| Fuel savings over tire life (based on 2024 costs) | $179 | $246 |
| Net benefits | $153 | $207 |
| Basic payback period | 7 Months | 8 Months |

Source: CEC staff and Evergreen Economics

In total, staff estimates a net benefit of $153 to $207 per vehicle over the four-year lifespan of an average set of tires. Details on these cost assumptions are described in Appendix A. No discount rate is used in these calculations because of the overall short lifespan of a tire and even shorter payback period. Staff analysis indicates that the proposed regulation is cost-effective across all transportation fuels, including gasoline, electricity, diesel, and hydrogen.

## Estimated Statewide Energy Savings

The program goal of reducing the average rolling resistance of replacement tires will result in a significant reduction in energy use in California. How much energy (petroleum, electricity, and hydrogen) savings are realized will ultimately depend on the stringency of the energy performance standard, the timing for starting and phasing in the program, and the compliance rate by tire manufacturers and retailers. Table 16 shows the theoretical potential fuel savings.

**Table 16: Estimated Reduction in Fuel Use in 2035**

| Fuel Type | Estimated Potential Annual Reduction |
|---|---|
| Diesel (millions of gallons) | 3.4 |
| Gasoline (millions of gallons) | 141.1 |
| Electricity (terawatt-hours) | 0.9 |
| Hydrogen (millions of kilograms) | 0.5 |

Source: CEC staff and Evergreen Economics

This estimate accounts for the growing number of zero-emission vehicles expected to be on the roads in 2035. Staff assumes a compliance rate with the regulations of 90 percent. Staff will continue to monitor the market and conduct random sampling once the regulation is in place to confirm compliance rates, increase compliance rates, and take appropriate action to ensure market participants are complying with the law.

As shown in this chapter, the proposed regulations are cost-effective, which will benefit California drivers.

# CHAPTER 9:
# Environmental Impact Analysis

This chapter estimates the environmental benefits of increased tire efficiency. In addition to this staff report, the CEC has hired Aspen Environmental Group, a respected environmental consultant, to conduct a full environmental impact report (EIR) on the proposed regulations. The results of this EIR will be made public when completed.

## Estimated Reduction in Greenhouse Gas Emissions

As discussed, passenger vehicles and light-duty trucks are major contributors of GHG emissions in the state and are being prioritized to lower the impacts of the climate crisis and reduce the risks associated with public health impacts from the transportation sector. Carbon dioxide ($CO_2$) is a major component of combustion of petroleum-derived fuels and an important GHG. According to the U.S. EPA, each gallon of gasoline burned emits 8,887 grams of $CO_2$, and each gallon of diesel burned emits 10,180 grams $CO_2$. In addition to $CO_2$ emissions, there are other sources of GHGs that are produced from vehicles that run on gasoline and diesel. These sources include methane ($CH_4$) and nitrous oxide ($N_2O$) from the tailpipe.

The emissions of these gases are small in comparison to $CO_2$; however, the impact of these emissions can be significant because they have a higher global warming potential than $CO_2$, meaning that on a per-unit basis these compounds have a higher impact on warming the atmosphere than $CO_2$ and other GHGs.[60]

In addition to tailpipe emissions, the production and distribution of petroleum-based fuels produce GHGs, referred to as "upstream emissions." For example, gasoline and diesel production requires extracting oil from the ground, transporting it to a refinery, refining the oil into finished products, and transporting the fuel to gas stations. Each of these steps results in GHGs emissions. Although EVs have no tailpipe emissions, emissions are created during the production and distribution (via line losses) of the electricity used to fuel the vehicle. Staff estimates of the emissions impact of increased tire efficiency includes tailpipe emissions for gasoline and diesel vehicles, and upstream emission for EVs and FCEVs.

60 U.S. EPA. "Greenhouse Gas Emissions from a Typical Passenger Vehicle." https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#burning.

Staff estimated the potential emissions reductions from the proposed regulations as carbon dioxide equivalent ($CO_2e$).[61] If adopted, the regulations have the potential to reduce statewide emissions by 2.0 $MMTCO_2e$ annually in 2035.

Statewide passenger vehicle emissions were about 104.1 $MMTCO_2e$ in 2021, which means a 2.0 $MMTCO_2e$ savings would represent an emission reduction of about 1.9 percent in 2021 passenger vehicle emissions.[62] This reduction is equivalent to removing 411,830 internal combustion passenger vehicles off the road.[63]

This emission reduction estimate and others throughout this report are based on a dynamic model that incorporates future changes to California's vehicle population, in addition to increasing tire efficiency. The modeling accounts for a fleet that increasingly transitions to zero-emission vehicles through 2035, which reduces the future emissions reductions estimates because there will be fewer gasoline vehicles. Even so, the expected annual pollution reduction from the proposed regulations in 2035 is still very significant. A full list of modeling assumptions is described in Appendix B: Staff Modeling Assumptions.

## Estimated Reduction in Criteria Pollutants

Despite decades of progress in improving air quality, large areas of California still suffer some of the worst air quality in the nation. Air pollution from mobile sources contribute to a wide range of heart and lung illnesses, chronic health conditions, increased cancer rates, and premature death.[64] Fossil fuel combustion (primarily gasoline and diesel) from cars, trucks, and SUVs is a major source of criteria air pollutants and related precursors, including oxides of nitrogen (NOx), oxides of sulfur (SOx), fine particulate ($PM_{2.5}$), and ozone.[65]

As a result of the energy savings expected from more efficient tires, a modest but meaningful reduction in statewide criteria pollutants is anticipated. Table 17 estimates potential reductions in 2035 of 2.2 percent in NOx and $PM_{2.5}$.

---

61 Carbon dioxide equivalent (also CO2e or CO2eq) is a unit of measurement used to standardize the climate effects of various greenhouse gases on the basis of global warming potential by converting amounts of other gases (for example, methane) to the equivalent amount of carbon dioxide with the same global warming potential.

62 California Air Resources Board. 2023. "California Greenhouse Gas Inventory for 2000-2021." https://ww2.arb.ca.gov/sites/default/files/2023-12/ghg_inventory_scopingplan_sum_2000-21.pdf.

63 This calculation assumes 4.6 metric tons of carbon dioxide per passenger vehicle, annually.

64 California Air Resources Board. 2022. *2022 State Implementation Plan*. https://ww2.arb.ca.gov/resources/documents/2022-state-strategy-state-implementation-plan-2022-state-sip-strategy.

65 Ibid.

**Table 17: Estimated Potential Annual Reduction in Criteria Pollutants in 2035**

| Pollutant | 2020 Emissions from Passenger Vehicles (Tons) | 2035 Emissions from Passenger Vehicles (Tons) | Estimated Potential Annual Reduction in 2035 (Tons) |
|---|---|---|---|
| NOx | 70,927 | 19,958 | 426 |
| $PM_{2.5}$ | 1,189 | 482 | 10 |

Source: CEC staff/CARB EMFAC2025[66]

## Analysis of Tire Waste and Recycling

California generates about 51 million reusable or waste tires each year.[67] The California Department of Resources Recycling and Recovery (CalRecycle) manages the program to divert most of these tires from landfills. Tires are diverted through reuse, retreading, combustion, and recycling. As shown in Chapter 7, the proposed efficient tire program is not expected to increase tire wear (shorter tire life) and therefore is not expected to impact the used/waste tire market in any material way.

## Other Potential Environmental Issues

Researchers in Washington state have raised concerns about the compound 6PPD — a chemical compound that does not have a colloquial name — used by tire manufacturers to reduce tire cracking and extend the useful life of tires.[68] When tiny particles of worn tires, or tire wear particles, end up on roads, the 6PPD can be transformed to the associated toxicant 6PPD-quinone. The 6PPD-quinone leaches from the tire particles and can end up in streams and rivers and has been found to harm coho salmon and related fish species.[69]

To address this concern, the California Department of Toxic Substances Control (DTSC) issued a proposed regulation in May 2022. The regulation requires producers of vehicle tires for sale in the state to investigate safer alternatives to 6PPD. The DTSC approved the regulation in 2023, and it became effective October 1, 2023. The regulation designates 6PPD a *Priority Product*, meaning a consumer product that (1) contains one or more Candidate Chemicals that have been found to harm people or the environment, and (2) has been formally listed in the California Code of Regulations through a rulemaking. Both domestic and foreign manufacturers

66 California Air Resources Board. "Emission Factor (EMFAC) model." https://arb.ca.gov/emfac/.

67 CalRecycle. "Tire Management Overview." https://calrecycle.ca.gov/tires/overview/.

68 State of Washington, Department of Ecology. "https://ecology.wa.gov/waste-toxics/reducing-toxic-chemicals/addressing-priority-toxic-chemicals/6ppd," https://ecology.wa.gov/waste-toxics/reducing-toxic-chemicals/addressing-priority-toxic-chemicals/6ppd.

69 California Department of Toxic Substances Control. 2022. "https://dtsc.ca.gov/2022/05/23/news-release_t-07-22/. https://dtsc.ca.gov/2022/05/23/news-release_t-07-22/.

are required to inform the department if the tires that they produce for the California market contain 6PPD by November 30, 2023.[70]

The existing DTSC regulations reduce the chance that these proposed regulations will increase 6PPD pollution. CEC staff will remain in regular contact with the DTSC to monitor progress on the 6PPD alternatives.

The DTSC is also studying zinc as a potentially harmful compound found in tires. Zinc (typically as zinc oxide) is added to tire rubber to encourage vulcanization — a process that strengthens rubber and allows tire manufacturers to mold it into the precise shapes found in treads and other tire components. Tire-wear particles, when deposited on roads and surrounding areas, can be carried by stormwater into surrounding waterways. Tire wear particles are a significant source of zinc in the aquatic environment, and for aquatic organisms in streams, rivers, and lakes. The DTSC proposes to list motor vehicle tires that contain zinc as a Priority Product under the Safer Consumer Products Regulations.[71]

While 6PPD and zinc emissions are of concern, CEC staff research, and discussions with tire manufacturers, found no evidence that tire efficiency regulations would increase the use of these chemicals. The CEC staff will continue to monitor the use of these compounds and will make changes to the program in future rulemakings as necessary. In addition, CEC staff has commissioned a respected third-party consultant to research environmental impacts of the proposed regulations. The EIR investigates potential negative environmental impacts including 6PPD. The EIR will be completed by the time the CEC considers the final proposed regulations.

Staff has not identified other potential adverse environmental impacts from the proposed efficient tire program.

## Net Environmental Impacts of Proposed Regulation

CEC staff anticipates the EIR will show that the proposed program will lead to overall improved environmental quality in California. The energy saved from more efficient tires will result in substantially less gasoline, diesel, electricity, and hydrogen consumption. Reductions in transportation energy consumption will reduce pressure on the limited energy resources, land, and water use associated with the production of fossil fuels, electricity generation and hydrogen production. Finally, lower energy usage will result in reduced GHG and criteria pollutant emissions, aiding the state's efforts to simultaneously improve public health and reduce GHG emissions over the long term.

70 Department of Toxic Substances Control. "Adopted Priority Product: Motor Vehicle Tires Containing 6PPD." https://dtsc.ca.gov/scp/motor_vehicle_tires_containing_6ppd/.

71 Department of Toxic Substances Control. "Proposed Priority Product: Motor Vehicle Tires Containing Zinc," https://dtsc.ca.gov/scp/motor_vehicle_tires_containing_zinc/.

# CHAPTER 10:
# Economic and Fiscal Impact

This chapter provides an overview of possible economic and fiscal impacts of the proposed program. The impacts to the economy include changes to tire manufacturing, testing, and reporting, the resulting incremental cost of tires, and decreased fuel costs.

## Economic Impacts

### Jobs

The effect to jobs of the proposed program can be organized by direct jobs and indirect jobs. Direct job impacts involve employment changes in the manufacturing, distribution, installation, and maintenance of tires. While the regulations proposed in this report have an incremental impact in the cost of tires, direct job impacts of the regulations are expected to be minimal as no tire manufacturing occurs in California today. The regulations may support a minimal increase in jobs in tire testing and certification, as well as research and engineering.

Tire imports flow through California ports and several large tire distribution centers, located in Southern California, which provide jobs locally.[72] In addition to tire companies with distribution centers in California, the state has hundreds of physical tire retail stores. These include:

- Small and medium-sized businesses.
- Large operation tire retailers (for example, Les Schwab Tire Centers, Discount Tire or America's Tire, Big O Tires).
- Tire company retail centers (for example, Goodyear Auto Service, Firestone Complete Auto Care).
- "Big box" warehouse-types (for example, Walmart, Costco).
- General auto retail/repair facilities (for example, Pep Boys)
- Automobile dealerships.

In addition, there are several internet-only companies that sell large volumes of tires, including Tirerack.com and online retail giant Amazon.com.

CEC staff believes the volume of tires demanded by the market is relatively inelastic compared to the estimated incremental costs created by the program. Therefore, staff does not anticipate a change to the volume of tires sold through the current tire distribution system. For these reasons, the CEC staff does not anticipate significant job creation or loss in the distribution, installation, and maintenance of tires.

72 Examples of tire distribution facilities include Big O Tire Warehouse Distribution Center in Mira Loma (Riverside County), Nexen Tire Distribution Center in Ontario (San Bernardino County), and Tirerack.com Distribution Center in Santa Fe Springs (Los Angeles County).

It is still important to consider the unique position of small businesses because, unlike larger tire companies, small companies often lack the same level of staffing, technological capabilities, and financial resources, relying largely on their distributors for compliance with rules and regulations. Since small businesses do not manufacture tires, the only component of the proposed regulations expected to affect small businesses is ensuring that they are selling tires compliant with these regulations.

## Business Creation and Elimination

CEC staff does not believe the proposed program is likely to lead to the direct creation or elimination of businesses in California. As discussed, the manufacturing of tires does not occur in California, and there is no reason to believe that the proposed program would change that. In addition, there are ample testing centers available to manufacturers to meet program testing needs, and it is expected that the regulated community would rely on these testing centers rather than create new ones.

Tire retailers will likely see effects from increases and decreases in specific tire model lines. These effects are the result of the least efficient tire models being dropped and new, more efficient models coming into the California market. However, overall, the demand for new tires will likely remain the same as it is driven by road wear, vehicle miles traveled, and road hazards. Therefore, the existing retail environment would remain appropriately sized for the volume of tires needed once the regulation goes into effect.

## Business Advantages and Disadvantages

The proposed regulations apply equally to California-based businesses and those selling tires into the California market from out of state. Businesses will also be permitted to transport noncompliant tires through California to sell in other states or countries. This means that the regulations are unlikely to create any business advantages or disadvantages between California-based and out-of-state tire manufacturers or retailers.

There are possible inequities that could occur in California border regions, where California consumers could reasonably seek noncompliant tires in an unregulated jurisdiction and import them to California without great inconvenience. However, the CEC staff does not expect this to create a major disadvantage because the incremental cost of the regulations is cost-effective and the areas where this may occur are generally sparsely populated. Illegal importation of noncompliant tires from other states would likely be limited and unprofitable.

## Investment

Because manufacturing and the vast majority of R&D for the tire industry reside outside California, it is unlikely that significant investments will occur in California because of the regulations.

## Innovation

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.

## Fiscal Impact

The State of California operates thousands of passenger vehicles and light-duty trucks. The state may also face additional incremental upfront costs to procure tires for state vehicles as necessary. As discussed in Chapter 8, staff estimates that these regulations are expected to raise the upfront costs of replacement tires. However, the regulations are expected to reduce fuel costs to a greater extent, making the regulations a net cost reduction for the state.

The CEC will be required to devote resources for monitoring compliance and enforcing the regulations. These marginal fiscal costs are expected to be relatively small.

# CHAPTER 11: Conclusion

This staff report proposes a Replacement Tire Efficiency Program under AB 844. If adopted, these regulations would ensure that replacement tires on sale in California are as efficient, on average, as OE tires. These regulations include:

- New reporting requirements for tire manufacturers selling products in California.
- The creation of a CEC tire database.
- A tire energy performance standard.
- A tire wet grip minimum performance standard.
- A rating system for tire energy efficiency that will enable consumer to make more informed purchasing decisions.

CEC staff analysis and third-party testing show these regulations are technically feasible and are not expected to compromise safety. Analysis also indicates that the regulations will produce environmental benefits and will not add to tire waste. Further, the regulations are expected to be cost-effective and support equity through fuel savings.

Upon adoption of these regulations CEC will monitor the California tire market and manufacturer reporting to support implementation and operations of the Replacement Tire Efficiency Program.

# References


1. America's Tire. *Treadwell Tire Guide*. Available at https://www.americastire.com/treadwell
2. Bailey, Stephanie, Jane Berner, David Erne, Noemí Gallardo, Quentin Gee, Akruti Gupta, Heidi Javanbakht, Hilary Poore, John Reid, and Kristen Widdifield. 2023. *Final 2022 Integrated Energy Policy Report Update*. California Energy Commission. Publication Number: CEC-100-2022- 001-CMF. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=250084
3. Blackburn, Bill, Jontae Clapp, Andrew Hom, Ralph Lee, Tim Olson, Ken Rider, and Sebastian Serrato. 2023. *Draft Framework of California's Replacement Tire Efficiency Program.* California Energy Commission. Publication Number: CEC-600-2023-026-SD. Available at https://www.energy.ca.gov/publications/2023/framework-californias-replacement-tire-efficiency-program
4. California Air Resources Board. *California Greenhouse Gas Inventory for 2000–2021*. Available at https://ww2.arb.ca.gov/sites/default/files/2023-12/ghg_inventory_scopingplan_sum_2000-21.pdf
5. California Air Resources Board. *2022 State Implementation Plan.* Available at https://ww2.arb.ca.gov/resources/documents/2022-state-strategy-state-implementation-plan-2022-state-sip-strategy
6. California Air Resources Board. *Emission Factor (EMFAC) model*. Available at https://arb.ca.gov/emfac/
7. California Air Resources Board. 2019. *SB 498 report, Appendix C: Quantification Methodologies*. Table C-1. Available at https://ww2.arb.ca.gov/sites/default/files/2019-12/SB%20498%20Appendix%20C%20-%20quantification%20120919.pdf
8. California Department of Toxic Substances Control. 2022. *News Release: California Proposes Requiring Tiremakers to Consider Safer Alternative to Chemical That Kills Coho Salmon.* Available at https://dtsc.ca.gov/2022/05/23/news-release_t-07-22/
9. California Department of Toxic Substances Control. *Adopted Priority Product: Motor Vehicle Tires Containing 6PPD*. Available at https://dtsc.ca.gov/scp/motor_vehicle_tires_containing_6ppd/
10. California Department of Toxic Substances Control. 2024. *Proposed Priority Product: Motor Vehicle Tires Containing Zinc*. Available at https://dtsc.ca.gov/scp/motor_vehicle_tires_containing_zinc/
11. California Energy Commission and California Air Resources Board. 2003. *Joint Agency Report: Reducing California's Petroleum Dependence.* Publication Number: P600-03-005F. Available at https://ww2.arb.ca.gov/sites/default/files/classic/fuels/carefinery/ab2076final.pdf

12. California Energy Commission. 2003. *California State Fuel Efficient Tire Report: Volume I, Summary of Findings and Recommendations*. Publication Number: 600-03-001F. Available at http://web.archive.org/web/20190228180638/https:/www.energy.ca.gov/reports/2003-01-31_600-03-001F-VOL1.PDF

13. California Energy Commission. 2003. *California State Fuel Efficient Tire Report: Volume II, Consultant Report*. Publication Number: 600-03-001CR. Available at https://www.kannahconsulting.com/wp-content/uploads/2016/08/2003-01-31_600-03-001CRVOL2.pdf

14. CalRecycle, *Tire Management Overview.* Available at https://calrecycle.ca.gov/tires/overview/

15. 75 FR 15894-01, 3/30/2010. National Highway Traffic Safety Administration: Final Rule on *Tire Fuel Efficiency Consumer Information Program*. Available at https://www.govinfo.gov/content/pkg/FR-2010-03-30/pdf/2010-6907.pdf

16. European Commission. *Tyre Labelling Regulation*. Available at https://energy-efficient-products.ec.europa.eu/product-list/tyres_en

17. National Highway Traffic Safety Administration. February 2006. *The Pneumatic Tire*. Publication Number: DOT HS 810 561. Available at https://www.safetyresearch.net/wp-content/uploads/2009/11/NHTSA_Pneu_Tire.pdf

18. National Highway Traffic Safety Administration. August 2009. *The Fuel Efficiency Consumer Information Program Development: Phase 2 – Effects of Tire Rolling Resistance Levels on Traction, Treadwear, and Vehicle Fuel Economy*.

19. National Research Council of the National Academies. 2006. *Tires and Passenger Car Fuel Economy: Informing Consumers, Improving Performance.* Special Report 286. Available at https://nap.nationalacademies.org/read/11620/chapter/1

20. Natural Resources Canada. 2021. *Canadian Perspectives on Tire Minimum Energy Performance Standards (MEPS): California Energy Commission Workshop – Tire Efficiency Program Information*. Publication Number: TN 236894. Available at https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-TIRE-01

21. Pike, Ed. July 2011. *Opportunities to Improve Tire Energy Efficiency*, International Council on Clean Transportation. Available at https://theicct.org/wp-content/uploads/2021/06/ICCT_tireefficiency_jun2011.pdf

22. Sattayanurak, S., W. M. Noordermeer, K. Sahakaro, W. Kaewsakul, W. K. Dierkes, A. Blume. February 2019. *Silica-Reinforced Natural Rubber: Synergistic Effects by Addition of Small Amounts of Secondary Fillers to Silica-Reinforced Natural Rubber Tire Tread Compounds*. Advances in Materials Science and Engineering. Hindawi. Article ID 5891051. Available at https://onlinelibrary.wiley.com/doi/10.1155/2019/5891051

23. Smithers. March 2023. *Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844 January 2023.* Smithers File No. F49432BSR.

Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=249031&DocumentContentId=83588

24. Smithers. May 2024. *Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844, January 2023: Phase 2 – Correlated to the European Virtual Machine.* Smithers File No. F53018BS, May 2024.
25. Society of Automotive Engineers Japan, Inc. 2016. *Tires*. Available at https://www.jsae.or.jp/en/publications/yearbook_e/2016/docu/19_TIRES.pdf
26. State of Washington, Department of Ecology. *Tire anti-degradant (6PPD) and 6PPD-quinone (6PPDQ)*. Available at https://ecology.wa.gov/waste-toxics/reducing-toxic-chemicals/addressing-priority-toxic-chemicals/6ppd
27. US Department of Transportation, National Highway Traffic Safety Administration. June 2024. *Technical Support Document Corporate Average Fuel Economy Standards for Passenger Cars and Light Trucks for Model Years 2027 and Beyond and Fuel Efficiency Standards for Heavy-Duty Pickup Trucks and Vans for Model years 2030 and Beyond.* Available at: https://www.nhtsa.gov/sites/nhtsa.gov/files/2024-07/NHTSA-final-technical-support-document-cafe.pdf
28. U.S. Department of Transportation. 2023. *The Household Cost of Transportation: Is It Affordable?*, Available at https://www.bts.gov/data-spotlight/household-cost-transportation-it-affordable
29. U.S. Energy Information Administration. *Petroleum & Other Liquids*. Available at https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=emm_epm0_pte_sca_dpg&f=m
30. U.S. Energy Information Administration. *Electric Power Monthly, Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector*. Available at https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a
31. U.S. Energy Information Administration. 2022. *Assumptions to the Annual Energy Outlook 2022: Transportation Demand Module*.Available at https://www.eia.gov/outlooks/aeo/assumptions/pdf/transportation.pdf
32. U.S. Energy Information Administration. August 2024. Petroleum & Other Liquids. *All Grades Retail Gasoline Prices*, Data for Dec 2023. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPM0_PTE_SCA_DPG&f=M
33. U.S. Environmental Protection Agency and U.S. Department of Transportation. August 2012. *Joint Technical Support Document: Proposed Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards*. Available at https://www.nhtsa.gov/sites/nhtsa.gov/files/joint_final_tsd.pdf

34. U.S. Environmental Protection Agency. *Greenhouse Gas Emissions from a Typical Passenger Vehicle*. Available at https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#burning

# GLOSSARY

| Acronym | Term | Description |
|---|---|---|
| AB | Assembly Bill | A proposed law, introduced in the State Assembly during a session for consideration by the Legislature. |
| CAFE | Corporate Average Fuel Economy | Standards set by the National Highway Traffic Safety Administration, under the U.S. Department of Transportation, to regulate how far our vehicles must travel on a unit of fuel. |
| CalRecycle | Department of Resources Recycling and Recovery | State agency responsible for waste reduction and recycling efforts and programs. |
| 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. |
| CFR | Code of Federal Regulations | The codification of the general and permanent regulations promulgated by the executive departments and agencies of the U.S. government. |
| $CH_4$ | Methane | A light hydrocarbon that is the main component of natural gas and a potent greenhouse gas. |
| $CO_2$ | 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. |
| DTSC | Department of Toxic Substances Control | State agency responsible for protecting the public and environment from harmful effects of toxic substances. |

| Acronym | Term | Description |
|---|---|---|
| EISA | Energy Independence and Security Act of 2007 | A federal act aimed at increasing U.S. energy security, develop renewable energy production, and improve vehicle fuel economy. |
| 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. |
| 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 ($N_2O$). |
| GWh | Gigawatt-hours | A unit of energy representing 1 billion watt-hours. |
| ICE | Internal combustion engine | A heat engine in which the combustion that generates the heat takes place inside the engine and runs on a fuel, such as gasoline, diesel, or natural gas. |
| 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. |
| lbf | Pounds of force | A unit of force. The pound-force is about equal to the gravitational force applied on a mass of one pound on the surface of the Earth. |

| Acronym | Term | Description |
|---|---|---|
| LT | Light truck | A tire that carries an 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. |
| 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. |
| 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. |
| $PM_{2.5}$ | Particulate Matter 2.5 microns | Extremely small particles or droplets in the air that are 2.5 microns or less in width and can be damaging to public health. |
| PRC | Public Resources Code | A consolidation of laws that balance California's environmental conservation with responsible development pertaining to the state's natural resources. |
| Program | 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. |

| Acronym | Term | Description |
|---|---|---|
| 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. |
| 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. |
| TIN | Tire Identification Number (DOT) | An identification system used by the U.S. Department of Transportation indicating where the tire was manufactured, tire size and the manufacturer's code, along with the week and year the tire was manufactured. |
| TWh | Terawatt-hour | A unit of measuring electrical power that is equal to one trillion watts-hours. |
| UTQG | Uniform Tire Quality Grading Standards | A system used by the U.S. federal government to compare attributes, such as traction, heat rating and wear, among tire models. |
| VMT | Vehicle miles traveled | A measure of distance traveled by a vehicle or group of vehicles over time, such as a year. |

# APPENDIX A:
# Staff Modeling Assumptions

This appendix documents staff assumptions used to calculate the costs and benefits of the proposed regulation in Chapter 8. The following assumptions are for estimation only and should not be considered true forecasts. These estimates follow work performed by CEC Staff and Evergreen Economics in the Standardized Regulatory Impact Assessment.

## Emissions Forecast

Staff's emissions factor assumptions are shown in Table A-1, expressed in metric tons of carbon dioxide equivalent (CO2e).[73] Data are drawn from the 2019 California Air Resources Board SB 498 report.

**Table A-1: 2035 Emissions Factors**

| Fuel | Emissions |
|---|---|
| 1 gallon of diesel | 0.013718 metric tons CO2e |
| 1 gallon of gasoline | 0.011406 metric tons CO2e |
| 1 kilowatt-hour of electricity[74] | 0.000379 metric tons CO2e |
| 1 kilogram of hydrogen[75] | 0.010598 metric tons CO2e |

Source: CEC staff

## Energy Use Reduction From Efficient Tires

Staff assumptions about the increase in tire efficiency, by category, over current tires are shown in Table A-2.

73 CARB. 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.

74 Electric emissions in 2035 are drawn from the *2021 Integrated Energy Policy Report*. California Energy Commission. Publication Number: CEC-100-2021-001. 2022. Available at https://www.energy.ca.gov/publications/2021/2021-integrated-energy-policy-report.

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

**Table A-2: Efficiency Improvements**

| Vehicle Type | 2028 | 2031 |
|---|---|---|
| Passenger car | 2.4% | 16.6% |
| SUV | 1.1% | 10.6% |
| Truck | 2.1% | 14.0% |
| Van | 3.3% | 16.2% |

Source: CEC staff and Evergreen Economics

When calculating the projected fuel savings, staff assumed a 90 percent compliance rate with the regulations.

The assumed tire efficiency improvements, fleet size and composition, and compliance rate produce fuel savings in 2035. The estimated savings by fuel type is shown in Table A-3.

**Table A-3: Estimated Fuel Savings in 2035**

| Fuel Type | (Estimated) Potential Annual Reduction |
|---|---|
| Diesel (millions of gallons) | 3.4 |
| Gasoline (millions of gallons) | 141.1 |
| Electricity (terawatt-hours) | 0.9 |
| Hydrogen (millions of kilograms) | 0.5 |

Source: CEC staff and Evergreen Economics

## Fuel Costs

Passenger vehicles in California use several fuels and technologies. The primary fuels, which were evaluated for this report, are gasoline, electricity, diesel, and hydrogen. The costs were assumed to be static during the period of this analysis and are shown in Table A-4 below.

**Table A-4: 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, December 2023.[76] |
| Electricity | $0.34 per kWh | California average residential electricity price, April 2024.[77] |
| Diesel | $4.60 per gallon | Assumed same as gasoline price for modeling simplicity. |
| Hydrogen | $10 per kg | Staff assumption. |

Source: CEC staff

# Calculations

## Energy Consumption of a Tire

The calculation for energy consumption in a tire is rolling resistance force (RRf) of a tire multiplied by distance over a year (vehicle miles traveled, VMT). The equation is:

$$E = RRf \times VMT \quad \text{[or "Energy = RRf x VMT"]}$$

While this is the basic calculation, there are additional factors to consider. The first consideration is the energy losses in the vehicle to go from the energy source (fuel) to an effective force (mechanical) that can counter the RRf. In other words, to convert the energy stored in a gallon of gasoline into a force at the tire, the gasoline must be combusted in the engine to be converted to mechanical energy at considerable loss, and subsequently pass through a drivetrain, where additional losses occur. In addition, the CEC staff introduced an adjustment factor to account for typical vehicle weight compared to the tire test weight and discount for the distance traveled where RRf is not adding to tire loss, such as coming to a stop.

## Energy Savings

Estimated energy savings were calculated by taking the average vehicle efficiency gains multiplied by the estimated number of passenger vehicles, multiplied by the estimated miles driven per year.

*Fuel Savings per Vehicle x Number of Vehicles x Annual Miles Driven = Total Fuel Savings*

76 U.S. Energy Information Administration. "Petroleum & Other Liquids," https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=emm_epm0_pte_sca_dpg&f=m.

77 U.S. Energy Information Administration. "Electric Power Monthly, Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector," https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

### Greenhouse Gas Emission Reductions

Estimated reductions of greenhouse gases are based upon emissions factors applied to fuel types. The GHG emission reductions are derived from the estimated total reduction in fuel consumption based on the regulations multiplied by the emissions factor of each fuel.

### Criteria Pollutants Reductions

Estimated reductions of criteria pollutants were calculated using CARB's EMFAC202 (v2.0.0) Emissions Inventory modeling tool. The emission rates of various criteria pollutants were determined with base years in 2020 and 2035 for passenger cars (LDA), light-duty trucks (LDT1, LDT2), medium-duty vehicles (MDV), light-heavy-duty public trucks (LHD1 Public), and light-heavy-duty other trucks (LHD1 Other). The emission rates were then applied with inputs from Table 16.

## Vehicle Forecast

CEC staff assumes that changes in the size and composition of California's passenger car and light-duty truck fleet in 2035 follow the "Mid" forecast from the CEC's *2021 Integrated Energy Policy Report (IEPR)*.[78] In this scenario, light-duty truck EVs account for about 33 percent of the vehicle fleet in 2035. Vehicle miles traveled estimates are based on the 2022 IEPR Additional Achievable Transportation Electrification Scenario 3.[79] The resulting assumptions are located in Tables A-5 part 1 and 2.

78 CEC. *2021 Integrated Energy Policy Report*. Available at https://www.energy.ca.gov/publications/2021/2021-integrated-energy-policy-report

79 Bailey, Stephanie, Jane Berner, David Erne, Noemí Gallardo, Quentin Gee, Akruti Gupta, Heidi Javanbakht, Hilary Poore, John Reid, and Kristen Widdifield. 2023. *Final 2022 Integrated Energy Policy Report Update*. California Energy Commission. Publication Number: CEC-100-2022- 001-CMF. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=250084.

## Table A-5 CA Miles Traveled by Vehicle Type and Year (millions of miles)

| Vehicle Type | Fuel | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAR** | diesel | 212.5 | 194.1 | 172.6 | 154.4 | 133.3 | 106.6 | 82.0 | 59.1 | 40.2 | 27.7 | 17.5 |
| **CAR** | electric | 13,640.1 | 16,868.0 | 20,571.4 | 24,900.7 | 29,819.9 | 35,389.8 | 41,626.1 | 48,429.4 | 55,726.3 | 63,398.3 | 71,087.1 |
| **CAR** | gasoline | 115,350.1 | 110,315.8 | 105,117.2 | 99,857.1 | 94,359.9 | 88,410.3 | 82,004.5 | 75,451.8 | 68,886.9 | 62,299.1 | 55,755.0 |
| **CAR** | hydrogen | 257.4 | 262.9 | 280.1 | 317.4 | 372.6 | 444.1 | 530.2 | 629.1 | 736.8 | 856.5 | 984.4 |
| **SUV** | diesel | 237.6 | 216.9 | 195.6 | 174.4 | 157.3 | 140.1 | 111.9 | 84.9 | 66.3 | 55.2 | 49.2 |
| **SUV** | electric | 10,250.8 | 12,907.2 | 16,258.2 | 20,370.8 | 25,275.9 | 31,037.4 | 37,598.9 | 44,747.9 | 52,491.2 | 60,790.4 | 69,812.7 |
| **SUV** | gasoline | 116,634.2 | 117,818.5 | 117,729.0 | 116,632.0 | 114,575.3 | 111,336.5 | 107,027.3 | 101,864.0 | 96,044.3 | 89,387.5 | 82,013.6 |
| **SUV** | hydrogen | 25.5 | 23.5 | 24.2 | 28.7 | 39.8 | 54.3 | 71.7 | 92.0 | 117.9 | 144.1 | 174.9 |
| **TRUCK** | diesel | 4,828.8 | 4,997.6 | 5,152.5 | 5,297.8 | 5,433.4 | 5,518.0 | 5,523.6 | 5,456.9 | 5,327.8 | 5,125.5 | 4,843.9 |
| **TRUCK** | electric | 522.1 | 964.2 | 1,696.4 | 2,594.2 | 3,662.9 | 4,931.3 | 6,391.8 | 7,993.0 | 9,737.9 | 11,656.3 | 13,883.6 |
| **TRUCK** | gasoline | 40,556.1 | 41,309.3 | 42,001.1 | 42,286.8 | 42,310.9 | 42,259.4 | 42,024.0 | 41,584.4 | 40,840.7 | 39,692.4 | 38,190.1 |
| **TRUCK** | hydrogen | 33.7 | 67.8 | 95.9 | 128.2 | 167.9 | 214.8 | 265.7 | 320.2 | 380.0 | 444.0 | 511.8 |
| **VAN** | diesel | 313.3 | 276.5 | 242.2 | 210.7 | 181.9 | 155.5 | 132.2 | 111.8 | 94.3 | 79.4 | 64.2 |
| **VAN** | electric | 352.4 | 469.5 | 630.8 | 853.6 | 1,091.4 | 1,341.2 | 1,635.9 | 1,971.4 | 2,343.3 | 2,754.6 | 3,152.5 |
| **VAN** | gasoline | 11,152.1 | 10,702.3 | 10,254.8 | 9,805.2 | 9,181.5 | 8,410.5 | 7,686.0 | 6,991.9 | 6,311.8 | 5,637.3 | 4,963.8 |

Source: CEC staff.

# APPENDIX B:
# Treadwell Tire Data

This appendix documents Treadwell tire information that was shared by Discount Tires. The tire data is also associated with the same Group ID as tested by the Smithers Laboratory.

**Table B-1: Treadwell Tire Data**

| Group ID | DT Mileage | Dry Stopping (ft) | Wet Worn Stopping (ft) |
|---|---|---|---|
| 1 | 45097 | 131 | 226 |
| 2 | 42910 | 134 | N/A |
| 3 | 55582 | N/A | N/A |
| 5 | 47534 | 123 | 189 |
| 6 | 39956 | 117 | 189 |
| 7 | 51330 | N/A | N/A |
| 8 | 41429 | 113 | 169 |
| 10 | 45097 | 131 | 226 |
| 13 | 38631 | N/A | N/A |
| 14 | 60652 | 153 | N/A |
| 15 | 50209 | 130 | N/A |
| 16 | 47211 | 123 | N/A |
| 17 | 52896 | 133 | N/A |
| 18 | 52381 | 123 | 189 |
| 19 | 55280 | N/A | N/A |
| 20 | 50406 | 125 | N/A |
| 22 | 51381 | 125 | 195 |
| 23 | 63913 | 137 | 210 |
| 25 | 75425 | 139 | 196 |
| 26 | 51381 | 125 | 195 |
| 27 | 83426 | 143 | 187 |
| 30 | 58206 | 129 | 187 |
| 31 | 52640 | 133 | N/A |
| 32 | 76727 | 142 | 175 |
| 37 | 71980 | 139 | 196 |
| 38 | 52242 | 124 | N/A |
| 39 | 32046 | 117 | N/A |
| 40 | 41250 | 123 | N/A |
| 41 | 48381 | 123 | N/A |
| 42 | 62168 | 130 | 192 |

| Group ID | DT Mileage | Dry Stopping (ft) | Wet Worn Stopping (ft) |
|---|---|---|---|
| 52 | 59303 | 132 | 212 |
| 53 | 59553 | 134 | 197 |
| 55 | 73729 | 134 | N/A |
| 57 | 47971 | 125 | N/A |
| 60 | 48141 | 123 | 201 |
| 61 | 51272 | 138 | N/A |
| 63 | 50953 | 134 | N/A |
| 66 | 65563 | 152 | 220 |
| 67 | 67562 | 137 | 194 |
| 68 | 49766 | 130 | N/A |
| 70 | 50953 | 121 | N/A |
| 74 | 77306 | 139 | 207 |
| 75 | 51053 | 128 | N/A |
| 76 | 44791 | 124 | 168 |
| 77 | 42089 | 125 | 202 |
| 79 | 58028 | 136 | N/A |
| 82 | 42089 | 125 | 202 |
| 83 | 44679 | 125 | 196 |
| 85 | 66679 | 138 | 244 |
| 86 | 77833 | 133 | N/A |
| 87 | 52806 | 139 | N/A |
| 88 | 40401 | 118 | 190 |
| 92 | 42519 | 120 | N/A |
| 95 | 60565 | 129 | 181 |
| 96 | 41250 | 123 | N/A |
| 100 | 64855 | 125 | N/A |
| 101 | 59882 | 127 | 266 |
| 102 | 58717 | 127 | 266 |
| 103 | 57485 | 125 | N/A |
| 105 | 57236 | 128 | N/A |
| 106 | 63457 | 136 | 193 |
| 107 | 50717 | 134 | N/A |
| 108 | 67718 | 129 | 182 |
| 109 | 54396 | 134 | 204 |
| 110 | 41064 | 129 | N/A |
| 111 | 55986 | 132 | 181 |
| 112 | 52840 | 130 | N/A |
| 114 | 61202 | 135 | N/A |

| Group ID | DT Mileage | Dry Stopping (ft) | Wet Worn Stopping (ft) |
|---|---|---|---|
| 115 | 39800 | 123 | N/A |
| 116 | 57184 | 136 | N/A |
| 117 | 42089 | 125 | 202 |
| 118 | 52824 | 135 | 205 |
| 119 | 51653 | 155 | 195 |
| 120 | 76067 | 135 | 205 |
| 121 | 42099 | 113 | 148 |
| 122 | 38184 | 128 | 184 |
| 123 | 52824 | 135 | 205 |
| 124 | 55792 | 132 | N/A |
| 125 | 61945 | N/A | N/A |
| 127 | 59276 | 129 | 181 |
| 128 | 45227 | 135 | 186 |
| 132 | 56303 | 137 | 188 |
| 134 | 51818 | 136 | N/A |
| 135 | 42492 | N/A | N/A |
| 137 | 37870 | 119 | 183 |
| 139 | 46044 | N/A | N/A |
| 144 | 61614 | 129 | N/A |
| 145 | 70242 | N/A | N/A |
| 149 | 47727 | N/A | N/A |

Note: Data from the Treadwell database was not available for all the tire models that were tested by the CEC. Group ID numbers that do not have Treadwell data are excluded from this table.

Source: CEC staff and Treadwell data.