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California Energy Commission

DRAFT STAFF REPORT

Draft Framework of California's Replacement Tire Efficiency Program

Replacement Tire Efficiency Program Informational Proceeding

Docket Number 20-TIRE-01

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California Energy Commission

Bill Blackburn
Jontae Clapp
Andrew Hom
Ralph Lee
Tim Olson
Ken Rider
Sebastian Serrato
Primary Authors

Sebastian Serrato
Project Manager

Hannon Rasool
Director
FUELS AND TRANSPORTATION DIVISION

Drew Bohan
Executive Director

PREFACE

This report summarizes the progress of the California Energy Commission (CEC) to develop a Replacement Tire Efficiency Program, under Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003). The proposed program seeks to improve the energy efficiency of replacement tires through minimum standards and improving consumer access to information to ensure replacement tires for passenger cars and light-duty trucks sold in California are at least as energy-efficient as the tires sold as original equipment on new vehicles.

Assembly Bill 844, codified at Public Resources Code sections 25770-25773, amended the Warren-Alquist Act by directing the CEC to:

- Develop and maintain a database for tire efficiency information.
- Establish a rating system, based on an adopted test procedure, for the energy efficiency of replacement tires sold in the state.
- Set minimum performance efficiency standards for replacement tires.
- Require manufacturers to report the energy efficiency of replacement tires.
- Develop an efficient tire consumer information program using point-of-sale information or signs to enable consumers to make more informed decisions when purchasing replacement tires.
- Review and revise the program at least every three years following adoption and implementation.

The CEC began working to develop the program in 2003 but was delayed due to a variety of reasons, including when it appeared the federal government, through National Highway Traffic Safety Administration (NHTSA), would develop a similar program at the national level. With the federal program on efficient tires still pending, the CEC relaunched the state's program and on November 19, 2020, adopted an order instituting informational proceeding to obtain data and comments from stakeholders and to make recommendations on whether to adopt and implement a statewide Replacement Tire Efficiency Program.

Implementation of the program requires the adoption of a regulation, which CEC will develop through a rulemaking. CEC staff intends to request that the Commission consider an order initiating a rulemaking proceeding following the publication of this report.

This report provides background on California's policy drivers related to energy efficient tires, an overview of the efforts to develop the program, and includes details on recent tire testing. Discussion includes recent staff research on the tire market, the status of tire technology, considerations of alternative strategies and approaches, and draft regulatory language. The report also includes analyses of the cost-effectiveness, technical feasibility, safety, environmental impacts, and statewide benefits of the proposed standard in support of the requirements of sections 25700-25773 of the Public Resources Code.

ABSTRACT

Assembly Bill (AB) 844 (Nation, Chapter 645, Statutes of 2003) directs the California Energy Commission to adopt a Replacement Tire Efficiency Program to ensure replacement tires for passenger cars and light-duty trucks sold in California are at least as energy-efficient as the tires sold as original equipment on new vehicles. AB 844, codified at Public Resources Code sections 25770-25773, directs the California Energy Commission to:

- Develop and maintain a database for tire efficiency information.
- Establish a rating system, based on an adopted test procedure, for the energy efficiency of replacement tires sold in the state.
- Set minimum performance efficiency standards for replacement tires.
- Require manufacturers to report the energy efficiency of replacement tires.
- Develop an efficient tire consumer information program using point-of-sale information or signs to enable consumers to make more informed decisions when purchasing replacement tires.
- Review and revise the program at least every three years following adoption and implementation.

This staff report proposes adoption and implementation of a Replacement Tire Efficiency Program. This report proposes a regulatory framework that would add Chapter 14, Article 1 into Division 2 of Title 20 of the California Code of Regulations, commencing with Section 3300. California Energy Commission staff analyzed the cost-effectiveness and technical feasibility of the minimum performance standard for replacement tires for passenger vehicles. The statewide fuel and energy (electricity, in the case of electric vehicles) use, annual reduction in greenhouse gases, and consumer savings are included in this analysis.

The proposed minimum performance standard is cost-effective, is technically feasible, and based on initial staff estimates would save about 430.5 million gallons of gasoline, 1,996 gigawatt-hours of electricity, and 5.4 MMTCO_2e annually at full implementation of the replacement tire efficiency program. Consumers may save between $800 and $1,400 per set of four replacement tires over the life of the tires through increased efficiency savings.

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, cost savings to California consumers

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EXECUTIVE SUMMARY

Assembly Bill 844 (Nation, Chapter 645, Statutes of 2003) requires the California Energy Commission (CEC) to establish a program to address and improve replacement tire efficiency. Tires have a significant impact on the fuel economy of a vehicle because when tires roll, energy is converted to heat and that conversion affects the amount of fuel a vehicle will use. The rolling process that causes the conversion to heat can be measured and is referred to as "rolling resistance." Rolling resistance affects the effort required to keep a given tire rolling. Effectively, the tire consumes a portion of the power transmitted to the wheels, leaving less energy available for moving the vehicle forward.

The lower the rolling resistance, the less amount of energy a vehicle uses and therefore a low rolling resistant tire is energy efficient as it requires less energy to move the car forward. By reducing rolling resistance, vehicles become more fuel efficient which in turn means that California drivers will save money on fuel. Further, better fuel efficiency means that less gasoline for combustion vehicles and less electricity for electric vehicles will be needed to power the California fleet. This improves public health and air quality because less fuel will be combusted resulting in tailpipe emissions. It is also beneficial to combating the climate crisis because less greenhouse gases will be emitted.

Because of federal regulations, original equipment tires are manufactured to be energy efficient, however, the lack of regulations over replacement tires resulted in replacement tires not being as energy efficient. Replacement tires tend to vary greatly in efficiency, and on average, original equipment tires are roughly 20 percent more efficient than replacement tires. In general, tires last about three to six years, or between 36,000-75,000 miles. The lifespan of tires varies depending on factors like tire design, vehicle weight, driving habits, maintenance, weather, etc.

This report outlines the proposed program as required under Assembly Bill 844 for better replacement tire efficiency. With more than 28 million passenger cars and light trucks registered in California, improving the overall average efficiency of replacement tires will provide substantial reductions in fuel use — saving consumers potentially billions of dollars over time while helping the state reduce air pollution and greenhouse gas (GHG) emissions. The CEC proposes to achieve these goals using the authority granted in Assembly Bill 844 to set minimum performance standards and public information requirements for replacement tires. The proposed minimum standards would apply to the sale of new replacement tires starting with those sold on or after January 1, 2026, with a more stringent level coming into effect two years later in 2028.

Along with a minimum performance standard, CEC staff proposes a tire rating system for the fuel efficiency and peak wet traction of tire models, which will allow consumers to easily compare tire efficiency, safety, and other attributes. The proposed tire efficiency rating system is based on a one-to-five star scale (five stars being the most energy efficient and the most cost saving over time for the consumer). Under Assembly Bill 844, the proposal must not affect tire safety. Traction is a characteristic of tires that the proposed regulations use as a

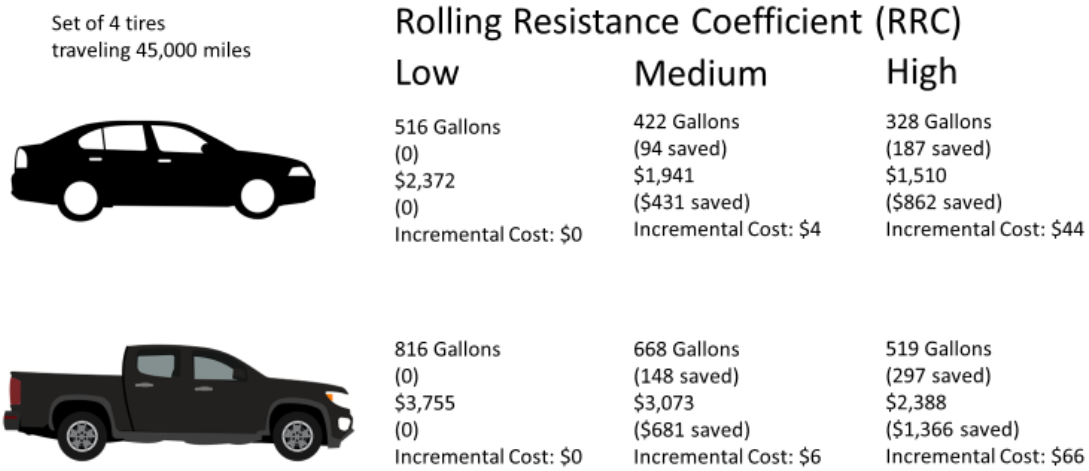
measure of tire safety. The federal government requires manufacturers to imprint a Uniform Tire Quality Grading system traction rating on the side of tires that indicates a tire's ability to stop on wet pavement. CEC staff's proposed regulation proposes an additional traction rating, a provisional peak wet traction rating, that would better indicate a tire's ability to stop on wet pavement for vehicles equipped with modern braking and handling systems.

CEC staff's proposed provisional peak wet traction rating includes AA, A, B, and C ratings, with AA meaning the tire has the best ability to stop on wet pavement, which is an aspect of safety. The replacement tire efficiency rating, in conjunction with the peak wet traction rating, will allow CEC staff to monitor compliance and effects of minimum efficiency standards. Moreover, the ratings will inform consumers so they can adjust their tire purchases to more efficient tires without sacrificing peak wet traction. Ratings will be made available at the point of sale. California's tire rating system will supplement existing available information from the Uniform Tire Quality Grading system. Consumer information is proposed to be provided through in-store posters, information on online retailers, and the star rating system.

CEC staff evaluated, as required by statute, the technical feasibility and cost-effectiveness of the proposal and investigated potential interactions with tire safety, tire life, and state efforts to manage scrap tires. The findings are that regulations that require replacement tires to perform at efficiency levels similar to original equipment tires are technically feasible, are cost-effective, and would not adversely affect tire safety, tire life, or the state's efforts to manage scrap tires.

CEC staff estimates the proposed regulations would increase the cost of replacement tires by $1 per tire in 2026 to meet the initial standard levels (this effective date results in the removal of tires with a rolling resistance coefficient above 9). Cost estimates are $11 per tire in 2028 to meet the more stringent standard levels (removal of tires with a rolling resistance coefficient of above 7). The improved efficiency of tires will reduce the amount of fuel a consumer will need to purchase. Figure 1 outlines savings for an example car and truck with tires of varying efficiencies and shows that the fuel savings is greater than the increased purchase cost.

Figure 1: Relative Cost-Effectiveness Comparison Among Various Rolling Resistance Efficiencies



Source: CEC staff

*Low Efficiency: 11 RRC, Medium Efficiency: 9 RRC, High Efficiency: 7 RRC

These costs are more than offset by reduced fuel consumption in Figure 1 above. Table 1 estimates energy savings from 2030 to 2035 of the proposed standards. In 2031 most tires on vehicles are assumed to meet the more stringent proposed standards. As consumers replace tires, the energy savings come from less efficient tires being replaced by more efficient tires. These numbers are preliminary and are considered a modeled potential but underscore the significant energy savings possible when the minimum efficiency performance standards are in place. These fuel reductions occur in the midst of major fuel switching within California's vehicle fleet, trending towards more electricity use and less gasoline usage.

Table 1: Estimated Benefits and Energy Savings between 2030 and 2035

	2030	2031	2032	2033	2034	2035
Savings ($Million)	$2,028	$2,516	$2,522	$2,530	$2,535	$2,536
GHG savings ($MMTCO_2e$)	4.66	5.71	5.65	5.58	5.50	5.40
Diesel (million gallons)	7.9	9.9	9.9	9.9	9.8	9.7
Gasoline (million gallons)	382.6	466.3	458.5	450.4	441.1	430.5
Electricity (GWh)	906.7	1273.4	1438.2	1614.3	1799.3	1996.1
Hydrogen (million kg)	0.5	0.7	0.8	0.9	1.1	1.2

Source: CEC staff analysis

*$MMTTCO_2e$ means Million Metric Tons Carbon Dioxide Equivalent

The fuel usage reductions provide important financial, environmental, and public health benefits shown in Table 1. Large areas of California suffer from some of the worst air quality in the nation. Air pollution from mobile sources contributes to a wide range of chronic health conditions and premature death. Fossil fuel combustion (primarily gasoline and diesel) from cars, trucks, and sports utility vehicles is a major source of criteria air pollutants and associated precursors, including oxides of nitrogen (NOx), oxides of sulfur (SOx), $PM_{2.5}$, and ozone.

Table 2: Additional Air Pollution Reduction Benefits of Proposed Regulations in 2035

Benefit	Estimated Potential Annual Reduction
NOx	1485 Tons
$PM_{2.5}$	239 Tons

Source: CEC staff analysis

Background and History

The Warren-Alquist Act established the CEC as California's primary energy policy and planning agency. The CEC is mandated to evaluate the economic and environmental costs and impacts of petroleum use, and 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 and improvements in 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.

The CEC launched the Replacement Tire Efficiency Program in 2003. The deadlines established in the legislation were not met when CEC paused the program development to defer to a federal effort by the U.S. Department of Transportation, National Highway Transportation Safety Administration program pursuing similar goals. While the National Highway Transportation Safety Administration promulgated federal regulations to prescribe the method that manufacturers must use to determine the rolling resistance rating, the peak wet traction rating, and the treadwear ratings, no minimum standards, rating system, or public information program was ultimately realized. Hence, the CEC restarted its efforts to develop the program on November 19, 2020, and adopted an order instituting informational proceeding to obtain data, information, and comments from stakeholders and make recommendations to implement a statewide Replacement Tire Efficiency Program. The CEC held a stakeholder workshop in February 2021 and gathered the information and data necessary to proceed with a proposal.

Energy Use in Tires

Key factors contribute to energy losses for on-road vehicles, including losses that occur within the tire itself. The key energy loss in tires is caused by a physical property called *rolling resistance*. Tire rolling resistance occurs primarily because of deformation of the tire during contact with the road. The test procedure commonly used to measure rolling resistance of tires is referred to as ISO 28580 (International Organization for Standardization). Two of the key outputs from the test procedure are the rolling resistance force, which is measured in newtons, and rolling resistance coefficient, which is the rolling resistance force divided by a proxy of vehicle weight. The rolling resistance force opposes the direction of motion of the vehicle, similar to aerodynamic drag. To maintain speed, a vehicle must produce an equal counterforce for the rolling resistance force of the tire. The greater the rolling resistance force, the more energy a vehicle will expend to travel a given distance, hence tires that are considered "efficient" have a lower rolling resistance force. The greater the rolling resistance coefficient the more energy must be expended to move a vehicle within a given weight class. The rolling resistance coefficient is used to be able to apply a single metric without needing to consider a tire's weight class.

Tire Technology

Rolling resistance is affected by factors that include the nature of the surface on which the tire rolls, operating conditions (temperature, inflation pressure, load, speed, and so forth), and the

composition and design of the tires, especially the tread. Advances in tire technology have lowered rolling resistance to meet market trends and needs, often without significant declines in tire longevity and traction. To determine the technical feasibility for a minimum efficiency performance standard, the CEC considered associated costs, safety, and tread wear for the tire industry and consumers, and the life-cycle cost to consumers of such a standard. CEC staff developed a plan to test a sample of 149 unique tire models to better understand key attributes of replacement and original equipment tires regarding safety, longevity, and efficiency attributes. Smithers, located in Akron, Ohio, completed the testing.

To provide a good representation of the California tire market for testing, the CEC selected tires used on the most common vehicle models (based on a registration list of high-volume vehicles in the state) to test for rolling resistance and wet grip. Based on the recent test results, the proposed efficiency standards were found technically feasible given what's available in the tire market. Considering the results from the tires tested, staff concluded that the current market has sufficient options for consumers and that the proposed standards are technically feasible regarding cost and efficiency, with no significant effect on safety or tire life.

Lack of Consumer Information

Unlike other tire attributes that are required to be printed on vehicle tires under federal rules, there are no requirements for rating the energy efficiency of tires. Assembly Bill 844 directs the CEC to inform consumers about attributes of energy-efficient replacement tires through the adoption of consumer information requirements. Under the mandate, the CEC must develop tire specifications to be provided at the point of sale such as information on energy efficiency through the use of a CEC-designed rating system in part derived from testing data. The CEC intends to address this information gap through the Replacement Tire Efficiency Program, providing a way for California consumers to make informed decisions about the differences in energy efficiency among models of replacement tires.

The consumer information program will also assist battery electric vehicle (BEV) owners with their unique tire needs. The rapid growth of electric vehicles (nearly 19 percent of new vehicle sales in California in 2022) is changing the tire market. BEV tires are designed to address unique attributes inherent in the electric drive platform, including low rolling resistance (to maximize driving range and energy efficiency), higher load ratings (due to the heavy batteries), and better traction (due to higher weight and instant torque). Thus, consumer information about tires designed specifically for BEVs provides value to owners.

Staff Proposed Regulatory Framework

To implement the mandate of Assembly Bill 844 to establish a Replacement Tire Efficiency Program, the CEC must adopt regulations through a rulemaking process. Staff proposes a regulatory framework that would add Chapter 14, Article 1 into Division 2 of Title 20 of the California Code of Regulations, commencing with Section 3300.

Key elements of the proposed regulation include a tire efficiency rating system and a minimum performance tire efficiency standard. The efficiency rating system for tire models is based on a one-to-five scale (five stars being the most efficient). Staff proposes the following design.

Table 3: Proposed California Tire Efficiency Rating System

CEC Tire Efficiency Rating	Passenger Cars and Light-Duty Trucks
Fuel efficiency class	RRC in N/kN
★★★★★	RRC ≤ 6.5
★★★★☆	6.6 ≤ RRC ≤ 7.7
★★★☆☆	7.8 ≤ RRC ≤ 9.0
★★☆☆☆	9.1 ≤ RRC ≤ 10.5
★☆☆☆☆	RRC ≥ 10.6

Source: CEC staff

In addition to the tire efficiency rating system, a minimum efficiency performance standard of 9.0 rolling resistance coefficient in newtons per kilonewtons (N/kN) — the industry standard for measuring tire fuel efficiency — would apply to the sale of new replacement tires starting January 1, 2026, with a more stringent standard of 7.0 rolling resistance coefficient taking effect on January 1, 2028.

Staff's proposed regulations would create a Tire Rolling Resistance Efficiency Database, called the "TRRED" for short. The TRRED would consist of the relative rolling resistance rating for each replacement tire for passenger cars and light-duty trucks sold or offered for sale in California. The TRRED database would include a publicly searchable online interface permitting users to search for and compare the relative rolling resistance rating and certain other attributes of replacement tires. It would also permit CEC staff to study the ongoing effects of these regulations on the energy efficiency, cost, safety, and tire life of replacement tires.

Staff's proposed regulations would require manufacturers to report various attributes about each replacement tire, including, among other information, the tire model, size, rolling resistance rating, and a provisional California peak wet traction rating (AA, A, B, or C) based on the federal government's existing Uniform Tire Quality Grading traction rating system. Manufacturer reporting for rolling resistance and peak wet traction would be based on test methods and rating systems adopted in these regulations. No other U.S. jurisdiction requires reporting rolling resistance and peak wet traction, although the National Highway

Transportation Safety Administration has adopted test methods within its federal Tire Fuel Efficiency Consumer Information program. Staff's proposed regulations would adopt the federal test methods.

Staff proposes allowing manufacturers to self-certify tire rolling resistance and peak wet traction ratings for their tires instead of submitting actual test measurements. Staff's proposed self-certification approach would not require manufacturers to base certifications and ratings on any particular tests, any number of specified tests, or any tests at all. The test procedures in the regulations would be standards that the CEC will use for compliance testing. A manufacturer would be required to exercise due care in certifying its tires. This framework would make reporting under the CEC's program like reporting under the pending federal Tire Fuel Efficiency Consumer Information Program.

Staff's proposed regulations would include a consumer information program that would provide replacement tire information at the point of sale but not labels or markings on tires. Tire retailers would be required to display information that is conspicuous and "readily accessible" about the energy efficiency tire rating system, including a web address and quick response code (QR code) linking to the CEC's website for specific tire and related information. Physical tire retailers would additionally be required to provide, upon request, a disclosure of the specific ratings for tires being considered. Staff anticipates that tire retail salespeople will take brief training supplied by the CEC to explain the rating system to consumers and answer potential questions on tire energy efficiency. Staff also proposes that the CEC's website would provide information to consumers about the benefits of tire maintenance on tire treadwear, traction, and fuel economy.

Each feature of staff's proposed regulatory framework and other supporting features are discussed in Chapter 4 of this report. The proposed regulatory language can be found in Appendix A.

Cost-Effectiveness Analysis

The relationship between cost and savings is important to the proposed minimum performance standards and the consumer information program. Quantifying the savings to consumers is key to explaining the value of improved efficiency to prospective tire purchasers, as well as what financial benefits a certain efficiency rating could provide when compared with other tire models. Per Assembly Bill 844, cost-effectiveness is 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."*

This report compares the cost differences of two tires by looking at the lifetime costs, which can be organized into fuel costs, tire purchase costs, installation costs, maintenance costs, and end-of-life costs. Staff examined the costs of several tires in the market and did not find a relationship between tire rolling resistance and purchase cost. For cost-effectiveness calculations in this report, staff selected incremental costs from a final rule published by federal agencies as one of the most recent sources and because it went through a thorough

stakeholder process by the U.S. Environmental Protection Agency and National Highway Transportation Safety Administration. These costs are offset by reduced fuel consumption. The analysis used the costs of fuel shown in Table 4.

Table 4: Fuel Cost Assumptions

Fuel Type	Cost per Unit
Gasoline	$4.60 per gallon
Electricity	$0.25 per kWh
Diesel	$4.60 per gallon
Hydrogen	$10.00 per kg

Source: CEC staff

These fuel costs are multiplied by the amount of energy savings from improved efficiency to generate an estimate of dollar savings.

The operating costs of replacement tires with a rolling resistance coefficient of 7 (among the most efficient available) are significantly lower than those of replacement tires with a rolling resistance coefficient of 11 (among the worst available). For a typical internal combustion passenger vehicle, the estimated operating cost savings is more than $800, and for a truck the estimated savings is nearly $1,400 over the life of a full set of tires. The savings are much larger than the $44 and $66 (respective of 7 and 11 rolling resistance coefficient) estimated incremental cost for the set of tires, with a payback at roughly 2,200 miles traveled, or based on 12,000 miles traveled in a year a payback of just more than two months.

Safety Analysis

Tires play a large role in vehicle safety as they are the only point of contact for a vehicle with the road. As required under Assembly Bill 844, CEC staff considered safety when drafting the proposal. Safety data collection was integrated into the testing conducted by Smithers through wet grip testing, a measure of how quickly a tire can stop on wet roads. Wet grip is widely used as an indicator of safety. The data results reveal that there are numerous replacement tires that have a high wet grip index and a low rolling resistance coefficient, indicating that more efficient tires with good safety characteristics are available and that efficiency and safety are not mutually exclusive.

In addition to wet grip, staff also examined another metric of traction. The National Highway Transportation Safety Administration Uniform Tire Quality Grading standard requires that tires be labeled with a measure of the wet braking traction performance (referred to as "Traction" on the sidewall of the tire), which includes ratings of AA (best), A, B, or C.

CEC staff researched possible tradeoffs of safety with low rolling resistance tires. This potential tradeoff of improving one or more attributes (that is, traction and efficiency) to the detriment of other attributes has been a consideration historically for the industry. Despite the potential

for tradeoffs, staff research did not uncover evidence that lower rolling resistance tires showed a significant decline in wet grip or other measures that would affect vehicle safety. As tire design and composition have advanced in recent years, these tradeoffs are being minimized or effectively eliminated.

As part of the CEC's efforts to test tires for this program, Smithers conducted wet grip tests on 149 tire models. The results of the wet grip tests were plotted against rolling resistance coefficient values. The results showed that these two key attributes of wet grip and efficiency are not strongly correlated. 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, per Assembly Bill 844 January 2023, and in Chapter 6.

In addition to conducting tests for wet grip, Smithers compared the tire rolling resistance coefficient results against the Uniform Tire Quality Grading standard for traction on the tires that were tested under this program. The results showed that the tires marketed as efficient had, on average, a lower traction rating. However, tires marketed as efficient in some cases were not as efficient as other replacement tires and made up a small segment of the tire market. When looking at replacement tires as a whole, instead of segregating by marketing claims, there is no clear relationship between efficiency and traction or wet grip. It is clear that efficiency and safety can simultaneously be achieved.

Based on the tire testing to date conducted for this program, along with research of the current literature, staff does not anticipate any material effect on safety as the result of key requirements of this program — in particular, the establishment of minimum efficiency performance standards.

Other Environmental Impacts

Tires also have an environmental impact when their useful life is finished. California generates roughly 51 million reusable or waste tires each year. The California Department of Resources Recycling and Recovery (CalRecycle) manages the program to divert most of these tires from landfill by reuse, retreading, combustion, and recycling. The proposed tire efficiency 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.

Staff examined the relationship between low rolling resistance and the treadwear of a tire. Specifically, staff examined warrantees and the Uniform Tire Quality Grading treadwear grade. The data from the test results, explained in more detail within the report, do not appear to have a strong correlation between efficiency and treadwear. In other words, efficient tires do not necessarily equate to a shorter tire life.

Tire particulates are another environmental/public health concern. A tire additive known in the industry as 6PPD, and used by tire manufacturers to reduce tire cracking and extend the useful life of tires, can be transformed to a toxicant, which has been found to harm Coho salmon and related fish species. The proposed efficient tire program is not expected to affect the use of these compounds.

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

Economic and Fiscal Analysis

The CEC considered the economic and fiscal impacts of the program as proposed in this report. The proposed program is expected to affect the tire industry, as it will effectively eliminate the least efficient replacement tires in California's market, while potentially encouraging research and development (R&D) for more efficient tires.

California's tire market affects jobs across many different sectors. Although there are no tire manufacturing plants operating in California, numerous manufacturing plants exist in the midwestern and southern United States, as well as internationally. These tires flow through California ports and several large tire distribution centers, which are located in Southern California and provide local jobs.

In addition to tire companies with distribution facilities in California, the state has hundreds of tire retail stores. Tire retailers will likely see effects from both increases and decreases in specific tire model lines. These effects are the result of the least efficient tire models being dropped and the likelihood that new more efficient models will come into the market. Compliance with the proposed regulation would require increased testing and certification activities.

Because R&D and manufacturing for the tire industry reside outside California, it is unlikely that significant investments in this area will occur in the state. The state may, however, provide incentives or rebates direct to the consumer, through retailers, or both to help stimulate the energy-efficient tire market and help address any cost (that is, purchase price) effects to low-income consumers that may result of the proposed program. Any such incentive program may have a moderate effect of stimulating the economy statewide and would be beneficial to tire retail companies, as well as tire manufacturers.

California maintains the highest vehicle registration count in the nation, and providing products that meet regulations and consumer needs has been demonstrated to be important to manufacturers from many different product sectors. Tire manufacturers maintain competitive advantage by investing in new tire model designs and new manufacturing processes, which includes advancing efficient tire technology.

Finally, the anticipated benefits of the proposed program include substantial savings in fuel use, reduced criteria pollutants and GHG emissions. These estimated benefits, quantified elsewhere in this report, will provide meaningful economic, public health, and environmental benefits to California and beyond.

Consumer Equity

The CEC looked at *consumer equity* — specifically, how the proposed program may impact low-income consumers and disadvantaged communities. Here, the term *disadvantaged communities* includes areas throughout California that suffer the most from a combination of economic, health, and environmental burdens. These burdens include poverty, air and water

pollution, as well as high incidence of diseases such asthma and heart disease. The state's Office of Environmental Health Hazards Assessment (oehha.ca.gov) created the analytical tool, CalEnviroScreen, which compares different types of census tract-specific information into a score to determine which communities are the most burdened or "disadvantaged."

Treadwear and tire durability are critical tire characteristics that directly affect the lifespan, life-cycle costs, and waste burden of a tire. Based on its recent tire testing data, along with available research, the CEC does not anticipate that the minimum efficiency standard or other parts of the proposed regulation will result in a significant degradation of tire longevity. This means the proposed regulation is not anticipated to raise costs by tires wearing out more frequently. In addition, the CEC has found no evidence that this regulation will have a meaningful effect on the state's scrap tire program; nor is tire longevity likely to effect low-income and disadvantaged communities.

The CEC found that replacement tire costs ranged from $45 to $520 per tire, although this range is not an exhaustive representation of products available on the market (detailed further in Chapter 8). In its research, staff found incremental costs range from negligible to approximately $11 per tire (not adjusted for inflation). Staff determined that except under the most extreme scenarios (i.e., extremely low fuel costs coupled with very high incremental tire costs) the anticipated fuel savings over the life of the tires exceeds the estimated incremental cost. Staff estimates the annual per-vehicle savings to be about $215 for a set of four compliant tires. Although the initial purchase price of a tire will likely increase, the savings generated through increased efficiency is quickly recuperated given the assumptions considered in this report. The lifetime savings anticipated from using low rolling resistance tires will provide an important economic benefit to consumers, especially those with low incomes.

However, even though staff anticipates that over the life of a set of tires the estimated savings will provide an important benefit to low-income consumers, any substantial incremental upfront cost of the tires will impact them the most. Higher purchase prices for efficient tires could burden low-income customers and could deter or delay them from purchasing replacement tires. However, high fuel costs could similarly deter or delay future purchases of replacement tires or other vehicle maintenance. Overall, the purchase power and ability for low-income customers to maintain their vehicles properly will be improved by a decrease in lifetime fiscal burden from more efficient tires.

The tire testing the CEC conducted along with available research did not show a meaningful deterioration in safety with low rolling resistance tires. However, should the incremental cost of efficient tires cause the purchase price to increase significantly, those consumers most sensitive to price may defer or delay the replacement of worn or damaged tires. This presents a potential situation where insufficient tread depth compromises the ability of a vehicle to perform as intended. Worn or damaged tires can affect handling, as well as braking on both dry and wet surfaces.

Importantly, properly targeted incentives and rebates for lower-income consumers should help address potential postponement due to the higher purchase price of efficient tires. Staff

maintains that the overall cost savings throughout the life of the replacement tires will contribute to the financial wellbeing for low-income customers, and safety may be improved by all consumers being able to use the cost savings from the regulations.

In general, when comparing the tire models used in the CEC tire efficiency testing program, no significant correlation was found between cost and wet traction, rolling resistance, and treadwear, although many factors must be accounted for, including driving behavior and vehicle maintenance.

Importantly, the CEC will continue to monitor potential impacts of the proposed program and will make adjustments accordingly.

CHAPTER 1:
Program Overview and Policy Background

Legislative Criteria

With the passage of Assembly Bill (AB) 844 (Nation, Chapter 645, Statutes of 2003), the California Energy Commission (CEC) is required to develop and maintain a replacement tire efficiency program under to Public Resources Code Sections 25770–25773.[1] The program shall be designed to ensure that replacement tires sold in California are at least as energy-efficient, on average, as original equipment (OE) tires on new passenger vehicles and light-duty trucks. AB 844 directs the CEC to:

- Develop and maintain a database for tire efficiency information.
- Establish a rating system, based on an adopted test procedure, for the energy efficiency of replacement tires sold in the state.
- Set minimum performance efficiency standards for replacement tires.
- Require manufacturers to report the energy efficiency of replacement tires.
- Develop an efficient tire consumer information program using point-of-sale information or signs to enable consumers to make more informed decisions when purchasing replacement tires.
- Review and revise the program at least every three years following adoption and implementation.

Per AB 844, minimum efficiency standard for replacement tires must be technically feasible and cost-effective. In addition, the standard shall not adversely affect tire safety, the average tire life of replacement tires, or the state's efforts to manage scrap tires. The energy efficiency standards shall be based on the results of laboratory testing. If the CEC finds that tires used to equip an authorized emergency vehicle are unable to meet the standards, the CEC shall authorize the operator to purchase tires that do not meet the standards for such vehicles.

Corporate Average Fuel Economy (CAFE) Program

In response to supply disruptions and price increases for oil 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), a regulatory mechanism to mandate minimum fuel economy standards for new vehicles. Under CAFE, automakers are allowed to gather and average the fuel economy (in miles per gallon, or MPGs) for their vehicle product offerings to comply with increasingly stringent vehicle fuel economy standards. Automakers achieve compliance by incorporating several technologies, such as start-stop technology,

1 *Replacement tire* is a general term referring to tires purchased to replace tires, vs. tires that come on new vehicles (original equipment, or OE). The replacement tire market includes some OE tires.

lightweight components, improved aerodynamics, and other engine and transmission technology advances. Energy-efficient tires are also a technology option for CAFE compliance. Because low-rolling resistance tires are an attractive, low-cost option to boost vehicle fuel economy, automakers are motivated to incorporate efficient tires into their CAFE compliance strategy and work closely with tire manufacturers to ensure that they use the appropriate tires. Because CAFE standards are set specifically for vehicle manufacturers, there is little motivation to make replacement tires for passenger vehicles and light trucks energy efficient. This situation is detrimental to consumers because less efficient tires increase operating costs and there is a lack of information on tire efficiency.

Tires have a significant effect on passenger vehicle energy use. To meet strict federal fuel economy standards, original equipment manufacturers put fuel-efficient tires on new vehicles to sell vehicles based on miles-per-gallon. As such, tires found on new vehicles are on average about 20 percent more energy-efficient than replacement tires.[2] The same strict federal fuel economy standards do not apply to replacement tires; therefore, replacement tires are less efficient. Improving the energy efficiency of replacement tires for California's passenger and light truck fleet would yield significant economic, environmental, and health benefits without affecting vehicle performance, tire longevity, or safety.

With more than 29 million passenger cars and light trucks registered in California, improving the overall average efficiency of tires will provide substantial reductions in fuel use, therefore saving consumers potentially billions of dollars over time while reducing both greenhouse gas (GHG) emissions and criteria pollutants. Yet, with little information available on the fuel efficiency of replacement tire models, consumers often unknowingly buy tires that are significantly less efficient than the OE tires that came with the car or trucks.

Under AB 844, California's Replacement Tire Efficiency Program is intended to increase tire efficiency in replacement tires by using OE tires as an efficiency baseline. This increased tire efficiency will be accomplished by providing a rating system to compare the relative energy efficiency of various replacement tire models, establishing a minimum tire efficiency standard, and developing a consumer information program on efficient tires and related activities.

Relationship of California's Tire Efficiency Policy to California's Petroleum Reduction and Climate Change Policies

Background

The Warren-Alquist Act established the CEC as California's primary energy policy and planning agency. The act mandates the CEC to evaluate the economic and environmental costs and impacts of petroleum use, examine costs of other transportation fuels, and establish a state transportation energy policy that results in the least environmental and economic cost to the

2 The efficiency difference between OE and replacement tires varies. The CEC tire efficiency testing program results showed OE tires were roughly 20 percent more efficient, and ACEEE claiming a similar figure. See ACEEE. 2005. "Fact Sheet: Tire Standards Would Save Energy Without Adversely Affecting Safety." https://www.aceee.org/fact-sheet/tire-standards-would-save-energy-without-adversely-affectin.

state.[3] Among several objectives, it is the policy of the state to use all practicable and cost-effective conservation and improvements in the efficiency of energy use and distribution. Furthermore, the law states that petroleum use as an energy resource contributes substantially to public health and environmental problems, including air pollution, acid rain, climate change, and degradation of California's marine environment and fisheries.

Over the last several decades, the state has developed numerous programs and regulations to minimize transportation-related environmental and health-related impacts, as well as direct and indirect costs. In recent years California has developed policies to aggressively address the substantial contribution of GHG emissions from transportation, linked to the climate crisis. California's transportation sector, including petroleum refining, and oil and gas production, resulted in the release of 211 million metric tons of carbon dioxide (CO_2) equivalent, roughly 50 percent of the state's GHG emissions in 2019–2020.[4] The proposed regulation will also contribute toward the goals of Assembly Bill (AB) 32 (Núñez, Chapter 488, Statutes of 2006),[5] and to Senate Bill (SB) 32 (Pavley, Chapter 249, Statutes of 2016), which, among other things, requires GHG emissions reductions to 40 percent below 1990 levels by 2030.[6]

Improving replacement tire efficiency through lowering rolling resistance is one strategy of reducing GHG emissions. The full implementation of AB 844 is expected to reduce GHG emissions significantly. In addition, CEC staff anticipates that the program will provide substantial savings to California drivers through the reduction of transportation fuel use — primarily gasoline, diesel, and electricity consumption.

Greenhouse Gas Emission Impacts

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. The California Air Resources Board (CARB) maintains an economywide GHG inventory for the state that is consistent with the IPCC practices, which allows the state to compare with other countries and subnational governments.[7] The *IPCC Climate Change 2014: Synthesis Report*, otherwise known as the *Fifth Assessment Report*, highlights the severity of the adverse impacts of global warming.[8]

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3 The Warren-Alquist State Energy Resources Conservation and Development Act, Division 15 of the Public Resources Code, § 25000 et seq., available at https://www.energy.ca.gov/publications/2022/warren-alquist-act-2022-edition.

4 CARB. *2000-2019 GHG Inventory Trends.* https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2019/2000_2019_ghg_inventory_trends_figures.xlsx. See also CARB. 2021. *California Greenhouse Gas Emissions for 2000 to 2019: Trends of Emissions and Other Indicators.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/ca_ghg_inventory_trends_2000-2019.pdf.

5 https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32.

6 https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB32.

7 CARB. 2017. *California's 2017 Climate Change Scoping Plan,* https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf.

8 IPPC. 2015. *Climate Change 2014: Synthesis Report,* https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf.

The IPCC report detailed the consequences of continued emission of GHG and identified numerous strategies for GHG reduction, including fuel economy performance standards and vehicle efficiency. [9]

California Tire Policy

California's interest in energy-efficient tires dates back more than two decades. In response to Assembly Bill 2076 (Shelley, Chapter 936, Statutes of 2000), which required the CEC and CARB to develop a strategy to reduce petroleum dependence in California, the two agencies produced a joint report. Among several strategies included in the report, the agencies identified the use of fuel-efficient tires as a potential fuel efficiency option to reduce petroleum dependence.[10] The Legislature subsequently enacted Senate Bill 1170 (Sher, Chapter 912, Statutes of 2001) and AB 844 to further explore and potentially establish, among other goals, a statewide tire efficiency program.

AB 2076 and SB 1170

AB 2076 required the CEC and CARB to adopt recommended actions for consideration by the Governor and Legislature.[11] The reports directed by AB 2076, published in 2003, concluded that tire efficiency was one of several strategies that had a significant potential to reduce petroleum consumption in vehicles.[12] The findings of the reports and stakeholder comments continue to be valid.

SB 1170 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 the potential fuel economy improvements possible through state government purchase of fuel-efficient vehicles and tires.[13] 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*[14] and *Volume II:*

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9 Ibid. Under "Examples of sectoral mitigation measures," the table lists efficiency improvements as key energy saving options under the transport sector. Id. at 101.

10 CEC, CARB. 2002. *Reducing California's Petroleum Dependence, Task 3: Petroleum Reduction Options.* Publication Number: P600-02-011D. https://web.archive.org/web/20020601154020/http://www.energy.ca.gov/reports/2002-03-19_600-02-011D.PDF.

11 State Energy Resources Conservation and Development Commission: fuel supply. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=199920000AB2076.

12 CEC, CARB. 2003. *Joint Agency Report: Reducing California's Petroleum Dependence.* Publication Number: P600-03-005F.

13 SB 1170, Sher, Chapter 912, Statutes of 2000 (State vehicle Fleet) https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120020SB1170.

14 CEC. 2003. *California State Fuel Efficient Tire Report: Volume I, Summary of Findings and Recommendations*. Publication Number: 600-03-001F.

Consultant Report.[15] A summary of key findings and recommendations from Volume I includes the following:

> The consultants estimate, in theory, California could save approximately 300 million gallons of gasoline annually by using low-rolling resistant tires. Assuming a 25 to 35 percent penetration for the program could reduce gasoline consumption in the state by 77 to 107 million gallons annually, saving consumers in the state approximately $118 million to $165 million annually (not adjusted for inflation).

The report also found that tire data were insufficient to show conclusively what effect, if any, more fuel-efficient tires have on safety and other characteristics. Finally, the research showed that consumers lack information on tire efficiency and most "are completely unaware of how the tires they buy affect their vehicles' fuel economy." [16]

The report recommended that the state proceed with a replacement tire efficiency program that includes data collection (either from tire manufacturers or the state pursue its own testing) and the development of an efficient tire information program to help consumers make informed decisions about the efficiency differences in the replacement tire market.

AB 844

The findings and recommendations from the *California State Fuel Efficient Tire Report* helped guide AB 844, which aimed to address two concerns found in the replacement tire market. The first is that compared with OE tires, replacement tires are on average about 20 percent less energy-efficient. And second, consumers lack information on the energy efficiency attributes of replacement tires, preventing them from making informed decisions when purchasing tires.

AB 844 states that the CEC, on or before July 1, 2007, shall adopt, and on or before July 1, 2008, implement a tire energy efficiency program of statewide applicability for replacement tires for passenger cars and light-duty trucks. The program should be designed to ensure that replacement tires sold in the state are at least as energy-efficient, on average, as the tires sold in the state as original equipment on these vehicles. Under AB 844, the CEC shall:

- Develop a database of the energy efficiency of a representative sample of replacement tires sold in the state, based on test procedures adopted by the CEC.
- Develop a rating system for tires that provides consumers with information on the fuel efficiency of tire models.
- Establish requirements for tire manufacturers to report to the CEC the energy efficiency of replacement tires sold in the state.

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15 CEC. 2003. *California State Fuel Efficient Tire Report: Volume II, Consultant Report*. Publication Number: 600-03-001CR.

16 CEC. 2003. *California State Fuel Efficient Tire Report: Volume II, Consultant Report*. Publication Number: 600-03-001CR.

- Develop and adopt minimum energy efficiency standards for replacement tires.
- These standards shall:
    - Be technically feasible and cost effective.
    - Not adversely affect tire safety.
    - Not adversely affect the average life of replacement tires.
    - Not adversely affect state efforts to manage scrap tires.
- Develop and adopt a consumer information program for replacement tires.

Per AB 844,"'Consumer information requirement' does not include mandatory labeling, imprinting, or other marking, on an individual tire by the tire manufacturer or the tire retailer."

The bill also includes several exemptions from the program, including:

- Low-volume tires (under 15,000 units annually).
- Deep tread, winter snow tires.
- Space-saver tires or temporary use spare tires.
- Tires with a nominal rim diameter of 12 inches or less.
- Motorcycle tires.
- Tires manufactured specifically for use in an off-road motorized recreational vehicle.

The CEC initiated rulemaking proceedings in 2003 and again in 2007 to begin program development and meet the AB 844 mandates. The deadlines established in the legislation were not met for various reasons. The CEC relaunched the Replacement Tire Efficiency program in November 2020 with the issuance of the order instituting informational proceeding, Order 20-1110-3.

The legislation can be found in Appendix B.

Capability of Reducing Tailpipe Criteria Pollutants

The South Coast Air Quality Management District conducted a study in 2013 to evaluate the potential tailpipe emission benefits of low rolling resistance replacement tires for passenger vehicles. The study concluded that a potential 20 percent reduction in passenger vehicle tire rolling resistance would result in a 4 percent vehicle improvement in fuel economy. "In the modeling scenario, total lifetime vehicle emissions would drop by more than 1,500 tons of ozone precursors and 8,900 tons of total criteria pollutants primarily from vehicle tailpipes, along with reductions of over 1.2 million U.S. tons of CO_2."[17]

17 Energy Solutions. 2013. *Passenger Vehicle Replacement Tire Efficiency Study,* https://efiling.energy.ca.gov/GetDocument.aspx?tn=237146&DocumentContentId=70326.

State Tire Recycling Efforts

As discussed, AB 844 includes language to ensure that any minimum tire efficiency standard does not adversely affect tire longevity or the state's scrap tire program. To deal with millions of waste tires, the California Tire Recycling Act of 1990 (Recycling Act) was passed to address the problems associated with storage and disposal of used tires. The Recycling Act established a comprehensive, statewide response, including reducing landfill disposal of used whole tires, recycling of tires into secondary uses, source material development and promotion of secondary markets for used tire by-products, tire shredding, and energy recovery. The objective of the Recycling Act is to reduce the amount of used tires stored in landfills. The California Department of Resources Recycling and Recovery (CalRecycle) has informally adopted a 75 percent waste tire recycling goal, consistent with a statewide 75 percent recycling goal covering all waste materials mandated by Assembly Bill (AB) 341 (Chesbro, Chapter 476, Statutes of 2011).[18]

The effect of tire efficiency regulations will need to account for a potential increase or decrease in the volume of tire disposal and recycling. The CEC tire testing report published in 2007 noted there is not likely to be a major change in the recyclability of tires based on the trend to low rolling resistance designs (testing summary in Appendix C).[19]

Research and data show that implementing the program will not change the recyclability of tires, and the program will not decrease tire longevity (further discussed in Chapters 9 and 10). As such, the program should not affect state efforts to manage the scrap tire program. CEC staff has consulted with CalRecycle on this matter.

The Relationship of Federal and California Tire Statutes and Programs

After AB 844 took effect in 2003, the CEC initiated development of a Replacement Tire Efficiency Program for replacement tires for passenger cars and light-duty trucks. The program seeks to ensure that replacement tires sold in California are at least as energy-efficient as the tires sold as original equipment on the vehicles.

Under preexisting federal law, the National Highway Traffic Safety Administration (NHTSA), an entity within the U.S. Department of Transportation, adopted federal regulations establishing the Uniform Tire Quality Grading (UTQG) System for rating tire safety, tire wear (longevity), slide wet traction, and other related tire attributes.[20] Under the UTQG system, manufacturers are required to rate and label tires with ratings to help consumers make purchase decisions.

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18 CalRecycle. *Five-Year Plan for the Waste Tire Recycling Management Program (Ninth Edition, FYs 2017-2018 to 2021–2022),* https://www2.calrecycle.ca.gov/Publications/Download///1304.

19 CalRecycle. *Five-Year Plan for the Waste Tire Recycling Management Program (Ninth Edition, FYs 2017–2018 to 2021-2022)*.

20 National Motor Vehicle Safety Act of 1966 (Pub.L. No. 89-563 [Sept. 9, 1966] 80 Stat. 718, 729 [Title II, Section 203]), https://www.govinfo.gov/content/pkg/STATUTE-80/pdf/STATUTE-80-Pg718.pdf#page=4.

And in 2007, Congress enacted the Energy Independence and Security Act of 2007 (EISA).[21] The EISA required the U.S. Secretary of Transportation to promulgate rules establishing a national tire fuel efficiency consumer information program regarding the fuel efficiency, safety, and durability of replacement passenger car tires. 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 for educational purposes.
- Point-of-sale and internet information dissemination, but not permanent labeling on tires.
- 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. Shortly thereafter, the CEC paused its rulemaking to defer to NHTSA's rulemaking, which was pursuing similar goals.

On June 1, 2010, and amended January 20, 2012, NHTSA promulgated regulations to partially implement a national tire fuel efficiency consumer information program under the EISA. NHTSA's 2012 regulations prescribe the test methods that manufacturers must use to determine the rolling resistance rating, peak wet traction rating, and treadwear rating of each replacement tire. NHTSA's tire efficiency test procedure requires adherence to ISO 28580 using defined conditions.[22] But NHTSA has not adopted the rating systems itself nor the date manufacturers would need to begin reporting the ratings. Moreover, NHTSA did not adopt point-of-sale and internet information dissemination or a national tire maintenance consumer education program.

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 and some technical requirements for the program. The FAST Act did not amend the preemption clause on fuel efficiency consumer information, enacted by the EISA. Although 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. On November 19, 2020, the CEC adopted an order instituting informational proceeding to obtain data and comments from

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21 Pub.L. No. 110-140 (Dec. 19, 2007), 121 Stat. 1492.

22 Code Fed. Reg., tit. 49, § 575.106; ISO. 2009; "Passenger Car, Truck and Bus Tyre Rolling Resistance Measurement Method — Single Point Test and Correlation of Measurement Results." *ISO 28580:2009(E),* https://www.iso.org/standard/67531.html.

stakeholders and make recommendations to adopt and implement the program. 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, NHTSA has not adopted:

- A national tire fuel efficiency 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 or other point-of-sale and Internet information dissemination.
- Minimum performance standards for fuel efficiency or traction.
- A national tire maintenance consumer education program.

The EISA contains a clause expressly defining the interaction between the federal program and state laws and regulations on tire fuel efficiency consumer information, test methods, and standards.[23] CEC staff's proposed regulations are consistent with federal law.

First, 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 promulgated after January 1, 2006, if the requirements of that law or regulation are identical to the requirements promulgated under the EISA. The tire fuel efficiency consumer information requirements of the proposed regulations are identical to those requirements adopted by the NHTSA.

Second, the EISA's preemption clause 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 to adopt the same test methods and conditions for measuring tire efficiency and peak wet traction 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's replacement tire efficiency program does not apply to light-duty truck tires; therefore, CEC staff's proposed regulations applicable to light-duty truck tires do not conflict with federal law.

23 49 U.S.C., § 32304A(h).

SmartWay Program

The U.S. Environmental Protection Agency (EPA) developed the voluntary private-public federal SmartWay program to help companies advance supply chain sustainability by measuring, benchmarking, and improving freight transportation efficiency.[24] Fuel economy savings for tractor-trailers can be realized by different ways using various technology, including efficient tires with lower rolling resistance. SmartWay contains standardized test methods and provides equivalent target values of rolling resistance coefficients to be included on the list of SmartWay Verified Low Rolling Resistance Tires.[25] At the state level, CARB approved the Tractor-Trailer Greenhouse Gas (TTGHG) Regulation of 2008, which requires the use of SmartWay-verified low rolling resistance tires on 53-foot or longer box trailers and the tractors that pull them.[26] Initial discussions with tire retailers revealed that the SmartWay program is an understandable tire efficiency program used for tractor-trailer trucks that may be a model for a passenger vehicle tire program.

International Regulations

Numerous countries have mandatory or voluntary efficient tire programs that demonstrate the importance of alignment between market participants and stakeholders. Consistency across programs may occur at various levels, including test methods and standards, tire composition and materials selection, competitive business practices and supply chain effects, emissions and environmental impacts, and the regulatory environment in which the tires are sold.

Prioritization of tire characteristics can vary drastically among regions for passenger vehicles. For example, some regions may establish requirements for tires based on snow and ice conditions, while other regions may offer incentives for long tire life. Several countries considering tire efficiency standards have adopted ISO 28580 as the preferred test procedure to determine relative tire efficiency.

European Union Regulation

In 2009, the European Union established a framework for the provision of harmonized information on tire parameters through labeling, which allowed end users to make an informed choice when purchasing tires. Information is provided to consumers through a label that includes the fuel efficiency of the tire, the external rolling noise, and the wet grip. Normalization of the testing standards was aligned through agreement among the member states of the regulatory body and, in terms if tire efficiency, reflects the test methods outlined

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24 EPA. "Learn About SmartWay," https://www.epa.gov/smartway/learn-about-smartway.

25 EPA. *SmartWay Verified Low Rolling Resistance Tires: Performance Requirements.* Publication Number: EPA-420-F-12-024, https://www.epa.gov/sites/default/files/2016-02/documents/420f12024.pdf.

26 CARB. "U.S. EPA SmartWay Verified or Designated* Equipment," https://ww2.arb.ca.gov/sites/default/files/classic//cc/hdghg/technologies.htm.

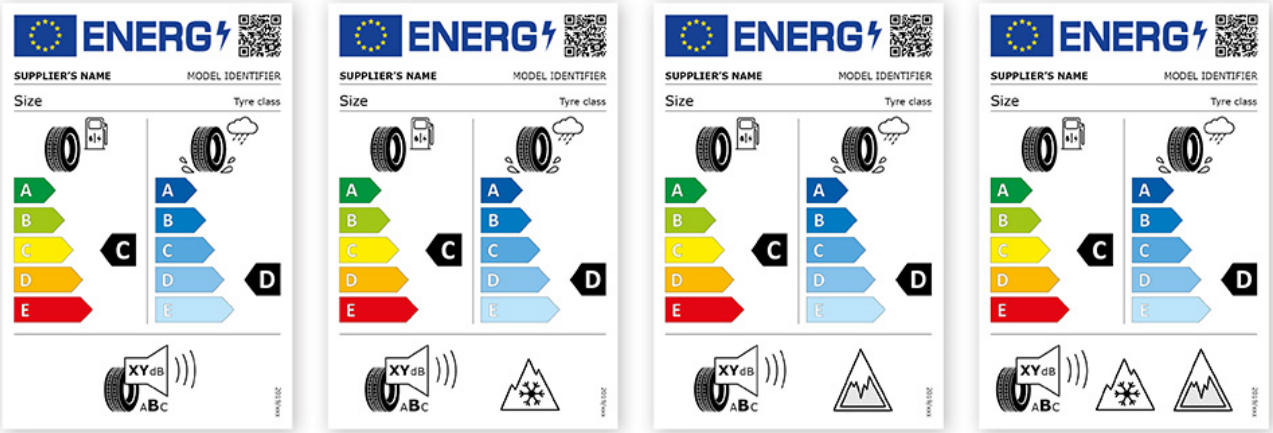
CARB. *Attachment A: Final Regulation Order for Phase 2 Greenhouse Gas Regulations and Tractor-Trailer GHG Regulations,* https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/phase2/finalatta.pdf.

in *ISO 28580 Passenger Car, Truck and Bus Tyre Rolling Resistance Measurement Method — Single Point Test and Correlation of Measurement Results*.

The fuel efficiency is based on the rolling resistance coefficient (RRC) and originally used an "A" to "G" scale that was updated in 2021 to increase the minimum standard that tires must comply. The scale was rescaled to "A" to "E," in accordance with United Nations Economic Commission for Europe (UNECE) Regulation No. 117 and its subsequent amendments."[27] Table 5 shows the vehicle classes that are designated on the EU tire label for cars (C1), vans (C2), and heavy-duty (C3) vehicles. Figure 2 shows examples of the EU label describing the efficiency, wet traction, noise, and snow designation characteristics of a tire.

27 European Commission. "Tyre Label," https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products/tyres_en.

Figure 2: Example of European Union Tire Labels



Source: European Union[28]

Table 5: European Union Tire Fuel Efficiency Classes and Rolling Resistance Coefficient

	Passenger Cars (C1)	Vans (C2)	Heavy-duty Trucks (C3)
Fuel Efficiency Class	**RRC in N/kN[29]**	**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 Union[30]

The European Commission facilitates overall implementation and engages member states to establish penalties and enforcement mechanisms applicable to infringements of the regulation.

28 European Commission. "Tyre Label," https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products/tyres_en.

29 Newtons per kilo-Newton.

30 European Commission. "Tyre Label," https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products/tyres_en.

Canadian Regulation

At a CEC Replacement Tire Efficiency Program public workshop held February 18, 2021, representatives from Natural Resources Canada participated and provided an overview of progress made to advance tire efficiency in their region.[31] Canada has established three overarching policies and drivers that guide several energy and climate change initiatives regarding the tire Minimum Energy Performance Standard (MEPS), Tire Consumer Information Program (TCIP), and international and domestic efficiency testing. Canada has tested tires annually from 2016 through 2022 and has initiated a rulemaking proceeding to analyze Canada's passenger car replacement tires.[32]

Japanese Regulation

In Japan, the Fuel-Efficient Tire Promotion Council was established. In 2010, Japan adopted a voluntary standard to classify wet grip and rolling resistance performance, as well as develop a tire labeling system. The program is generally aligned with the European Union standards for tire labeling (below).[33]

Figure 3: Japan Automobile Tyre Manufacturers Association Tire Labeling System

Source: The Japan Automobile Tyre Manufacturers Association, Inc.[34]

31 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, https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-TIRE-01.

32 Natural Resources Canada. *Market Analysis Report for Passenger Car Replacement Tires in Canada,* https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/resource-library/market-analysis-report-for-passenger-car-replacement-tires-canada/21805.

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

34 The Japan Automobile Tyre Manufacturers Association, Inc. "Introducing the Labeling System,"

https://www.jatma.or.jp/english/environment_recycle/aboutlabelingsystem.html.

Table 6: Japanese Tire Fuel Efficiency Classes and Rolling Resistance Coefficient

	Passenger Cars
Fuel efficiency class	**RRC in N/kN**
AAA	RRC ≤ 6.5
AA	6.6 ≤ RRC ≤ 7.7
A	7.8 ≤ RRC ≤ 9.0
B	9.1 ≤ RRC ≤ 10.5
C	10.6 ≤ RRC ≤ 12.0

Source: The Japan Automobile Tyre Manufacturers Association, Inc.[35]

Other Countries

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

Brazil issued rules in 2015 for a tire labeling system that provides ratings for rolling resistance, vehicle exterior noise, and wet grip performance similar to the system in Europe, as well as minimum performance requirements.[36]

The China Rubber Industry Association has concluded that the technical indicators of tire labels should be consistent with the existing content of the EU for rolling resistance, noise, and wet grip performances of the tires.[37] No significant government requirement has been adopted in China for low rolling resistance tires. However, companies and industry tire associations have probed bringing more efficient tires into the market.

In South Korea, the tire rating system provides indicators for consumers to understand tire efficiency and wet grip, as shown in Figure 4. According to a study of relevant literature for the South Korean labeling and rating program, the economic and environmental effects in South Korea are expected to reduce fuel consumption by 231 million liters each year, which is equivalent to KRW 438 billion (South Korean Won currency), and reduce CO_2 emissions by 490,774 metric tons annually.[38]

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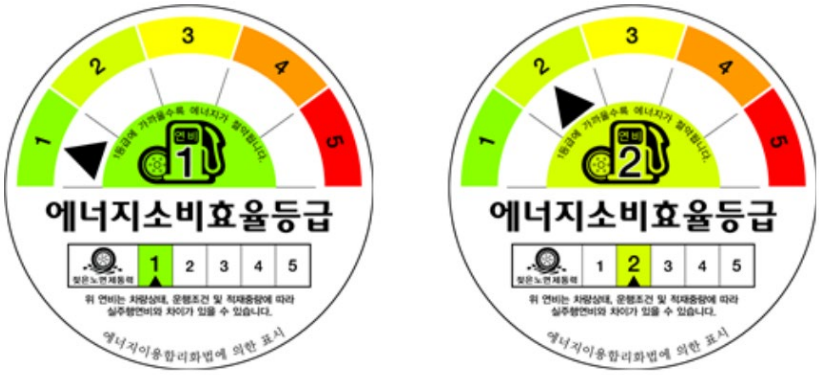
35 The Japan Automobile Tyre Manufacturers Association, Inc. 2021. *Tyre Industry of Japan,* https://www.jatma.or.jp/docs/publications/tyre_industry_2021.pdf.

36 Ibid.

37 China Rubber Industry Association. 2016. "CRIA: Tire Label Grading Standard Released in June 2016." *China Rubber Journal,* http://en.cria.org.cn/newsdetail/32133.html.

38 KAIST Business School, Lanxess Energizing Chemistry. 2011. *Socio-Economic Effects as a Result of the Enactment of Tire Efficiency Rating (Labeling) System in South Korea Final Report,* https://albeniztyrelabelling.com/albeniz/wp-content/uploads/2014/01/Korea.pdf.

Figure 4: Example of South Korean Tire Labeling



Source: KAIST Business School[39]

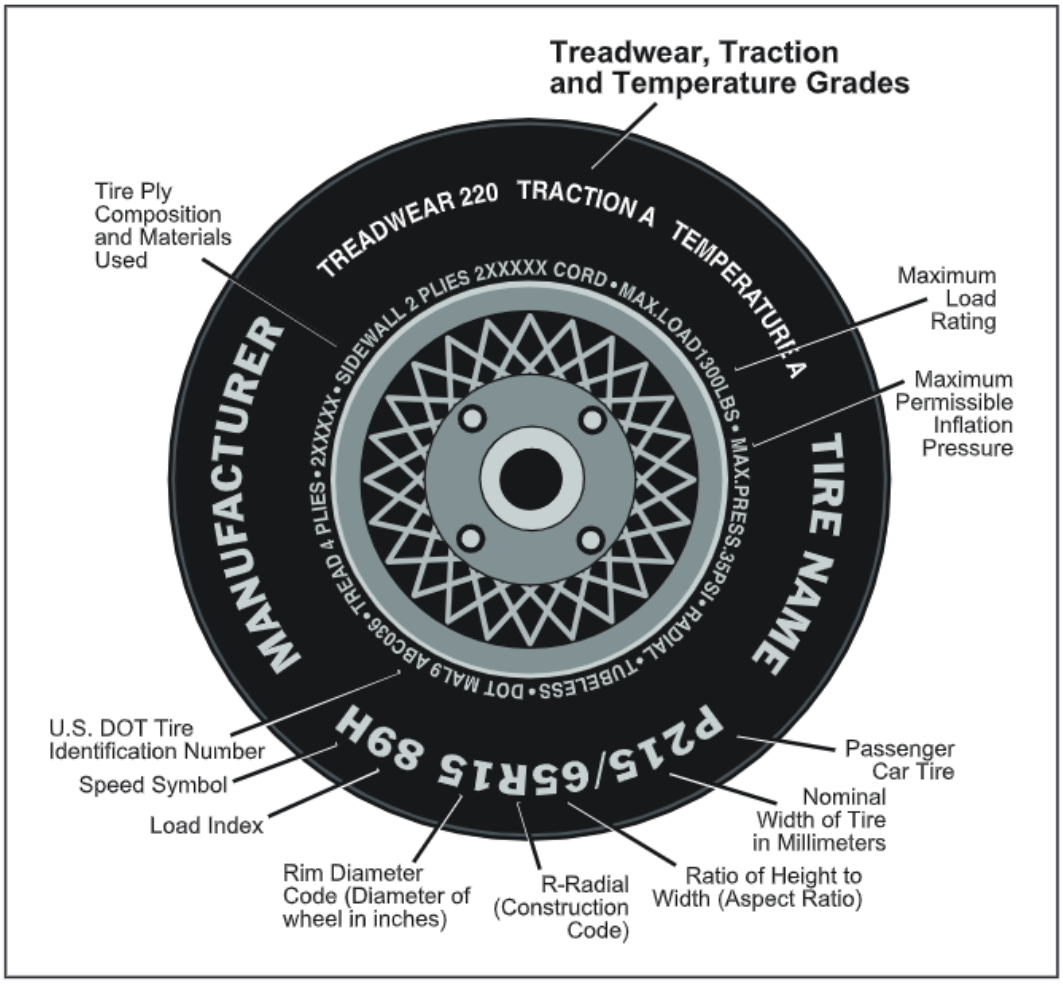
39 Ibid.

CHAPTER 2:
Tire Technology Background

Passenger Vehicle Tire Basics

Passenger vehicle tires are characterized and measured by several factors to reflect the makeup, size, type, and safety information, as shown in Figure 5 below. Characterization of various tire factors establishes standard guidelines for manufacturing, sale of tires, and information for consumer purchases. Rolling resistance, a measure of tire energy efficiency, is not included as a requirement in reporting and other mandated labeling in the United States.

Figure 5: Uniform Tire Quality Grading



Source: U.S Department of Transportation, National Highway Traffic Safety Administration[40]

40 NHTSA. 2017. *Consumer Guide to Uniform Tire Quality Grading.* Publication Number: DOT HS 812 459, https://www.nhtsa.gov/document/2017-consumer-guide-uniform-tire-quality-grading.

When a tire rolls on the road, mechanical energy is converted to heat as a result of the phenomenon referred to as "rolling resistance." Effectively, the tire consumes a portion of the power transmitted to the wheels, leaving less energy available for moving the vehicle forward. Rolling resistance therefore plays an important part in vehicle fuel consumption.[41] Rolling resistance affects the effort required to keep a given tire rolling. The magnitude depends on the tire used, the nature of the surface on which it rolls, and the operating conditions — inflation pressure, load, and speed. Rolling resistance has historically been treated as a force opposing the direction of travel, like a frictional force.[42]

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.[43] Rolling resistance includes mechanical energy losses due to aerodynamic drag associated with rolling, friction between the tire and road and between the tire and rim, and energy losses taking place within the structure of the tire.[44]

Characteristics of Tires

Tires are categorized in many ways, including seasonal use, off-road characteristics, low noise, rim size, load index, weight rating, tire width, outside diameter, and others. Some of these characteristics are required by federal law, while others are promoted due to manufacturer business practices, all of which may or may not affect overall tire efficiency. Under the Uniform Tire Quality Grading System (UTQG), vehicle tires are rated by the federal government on treadwear, traction performance and temperature resistance. The tire ratings are on the sidewall of every passenger vehicle tire sold in the United States. Table 7 summarizes data published in 2017.

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.

Traction grades provide information on the ability of the tire to allow a car to stop on wet pavement. A higher traction grade tire should allow a car to stop on wet roads in a shorter

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41 NHTSA. 2006. *The Pneumatic Tire*. Publication Number: DOT HS 810 561.

42 Holt, W. L. and P. L. Wormeley. 1922. "Power Losses in Automobile Tires." *Technologic Papers of the Bureau of Standards*. V. 16, pp. 451-461; Gough, V.E.. 1958. "Tire-to-Ground Contact Stresses." Wear. V. 2, pp. 107-1267; Petrushov, V. 1969. "On Some Correctives to Coulomb's Law as Applied to Rolling of an Automobile Tire." Proc. NAMI and; Crum, W.B. 1975. "Road and Dynamometer Tire Power Dissipation." SAE Paper 750955, SAE International, Warrendale, PA.

43 Tonachel, L. 2004. "Fuel Efficient Replacement Tires," http://www.responsiblepurchasing.org/UserFiles/File/Tires/Webcast/Tonachel%20FE%20Tires%202008-03-18.pdf.

44 NHTSA. 2006. *The Pneumatic Tire*. Publication Number: DOT HS 810 561.

distance than a tire with a lower grade. Traction is graded from highest to lowest as "AA," "A," "B," and "C."

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, a tire resistance to heat is graded as "A", "B", or "C".

The (U.S.) Department of Transportation DOT Tire Identification Number (TIN) contains additional information, including the manufacturing and plant code, tire size code, manufacturer identity number, and the last four digits representing the week and year the tire was made. NHTSA recommends checking this date when purchasing tires, along with knowing the vehicle manufacturer's recommended tire replacement time frame.[45]

Table 7: 2017 UTQG System Summary

UTQG Item	Summary of percentage within each grade
Traction	15 percent are rated "AA" 77 percent are rated "A" 7 percent are rated "B" <1% are rated "C" (only 4 lines of tires)
Temperature	62 percent are rated "A" 34 percent are rated "B" 4 percent are rated "C"
Treadwear	2 percent are rated above 600 6 percent are rated 501 – 600 20 percent are rated 401 - 500 32 percent are rated 301 - 400 25 percent are rated 201 - 300 15 percent are rated below 200

Source: NHTSA

Characteristics of Rolling Resistance and Tire Efficiency

Rolling resistance has increasingly become an important factor in tire design, especially as auto manufacturers seek higher efficiencies as the result of tightening fuel economy

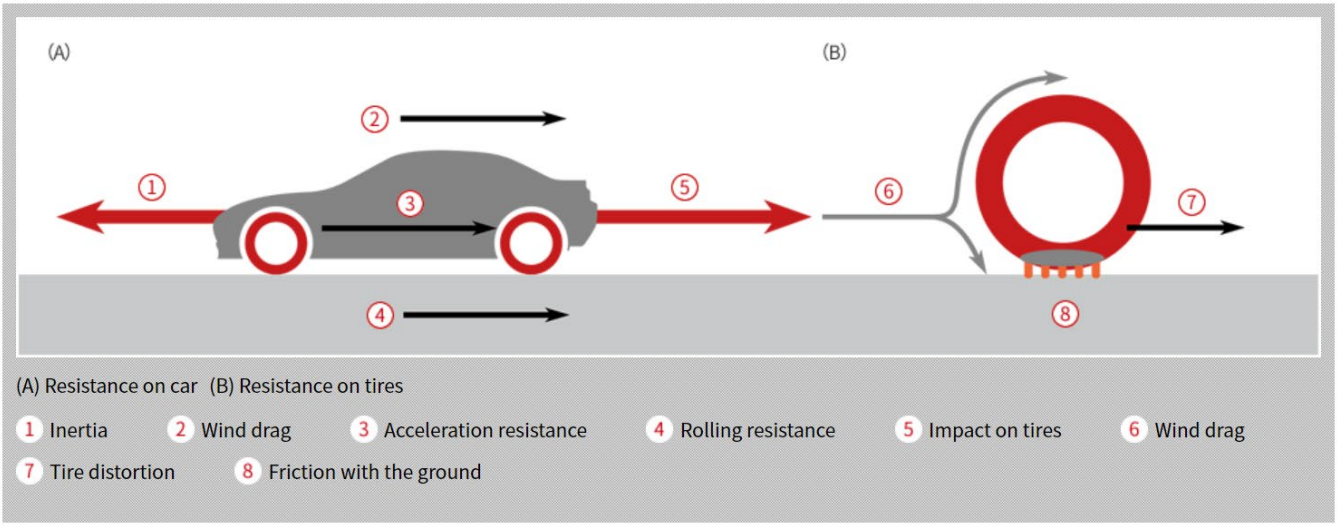
45 NHTSA. "Tire Buyers' FAQ—What You Should Know and Ask." *Tirewise*. https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/tire-buyers-faq.pdf.

standards and interest by consumers. The NHTSA *Pneumatic Tire Report* introduces the science of mechanical energy losses in a tire with the following excerpt.

> As a result of thermal dynamic energy transfer, the internal energy often changes within a system, resulting in changes in temperature. In a tire, much of the energy conversion occurs internally, resulting in heat dispersed throughout the tire, causing its temperature to increase. This heat dispersion is a result of the energy transfer within the tire materials, known as mechanical hysteresis. Additionally, friction between the tire and road, and between the tire and rim, causes heat to be generated, and the wind resistance between the tire and surrounding air leads to heat generation. Thus, all the mechanical energy losses associated with the rolling tire are converted into heat.[46]

As a tire flexes when it rotates, friction between molecules causes energy to be converted to heat. These hysteretic losses account for about 80–95 percent of the total rolling resistance. Most research efforts related to reducing rolling resistance have focused on this aspect. Behavior of tire materials results in dissipation of energy from the cyclically deformation during rolling, as depicted in Figure 6. If a tire material is more rigid (low elasticity, low viscosity), there will be improved energy efficiency with regards to rolling resistance.[47]

Figure 6: Yokohama Diagram on Tire Hysteresis



Source: Yokohama

Since most of the energy losses occur as the materials of the tire are deformed, it is important to understand the various deformations that take place during rolling. As a tire rolls, it is subjected to repeated deformation leading to energy dispersion. A loaded tire undergoes a

46 NHTSA. 2006. *The Pneumatic Tire*. Publication Number: DOT HS 810 561.

47 Yokohama. "Tire Care & Safety: Rolling Resistance and Fuel Consumption" https://www.y-yokohama.com/global/product/tire/learn/care_safety/rolling_resistance/.

deformation cycle as the tire completes a revolution. Such repeated deformation occurs throughout the tire as it rolls across and conforms to the road surface, especially in the area near the contact patch, which is the area of a tire tread that touches the ground. Tire flattening in the contact patch causes three main kinds of deformation: bending of the crown, the sidewalls, and the bead area; compression of the tread; and shearing of the tread and sidewalls. For radial tires, the energy dissipation is distributed as follows (typical values): crown: 70 percent, sidewalls: 15 percent, bead area: 15 percent.[48]

Other factors that impact rolling resistance include, deformations of a tire rolling on a flat or curved surface, road surface roughness, and temperature effects on inflation pressure. There are also other external effects on rolling resistance including load, pressure, and speed, in addition to the magnitude of engine torque applied in driving and braking. [49]

The complexity of tire design, width, tread depth, sidewall rigidity, rubber compounds and polymers can all have an impact on hysteresis and rolling resistance. These are some of the factors that affect tire efficiency in a vehicle whether an internal combustion engine (ICE) vehicle, battery electric vehicle (BEV) or fuel cell electric vehicle (FCEV).

Tire efficiency testing may include testing several tires using dynamometers 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 the force at the axle in the direction of travel required to make a loaded tire roll. Rolling resistance is often expressed and reported in terms of Rolling Resistance Coefficient (RRC) (N/kN, kg/tonne, lbf/kip), which is the rolling resistance force divided by the test load on the tire.[50]

California Tire Market

In 2021, California had 29 million registered passenger vehicles and new tire volume, both OE and replacement tires, was more than 37 million units.[51] Assuming all four tires are replaced simultaneously, tire turnover per vehicle occurs every three to six years. In 2021, California made up roughly one-tenth of the total U.S. market for tires and its new tire volume had a

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48 NHTSA. 2006. *The Pneumatic Tire*. Publication Number: DOT HS 810 561. https://www.fueleconomy.gov/feg/pdfs/PneumaticTire_HS-810-561.pdf

49 Schuring, D. J. 1977. "A New Look at the Definition of Tire Rolling Loss." *Tire Rolling Losses and Fuel Economy—an R&D Planning Workshop, SAE Conf. Proc. P-74, 31-37,* https://edccorp.com/library/TechRefPdfs/EDC-1038.pdf.

50 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165.

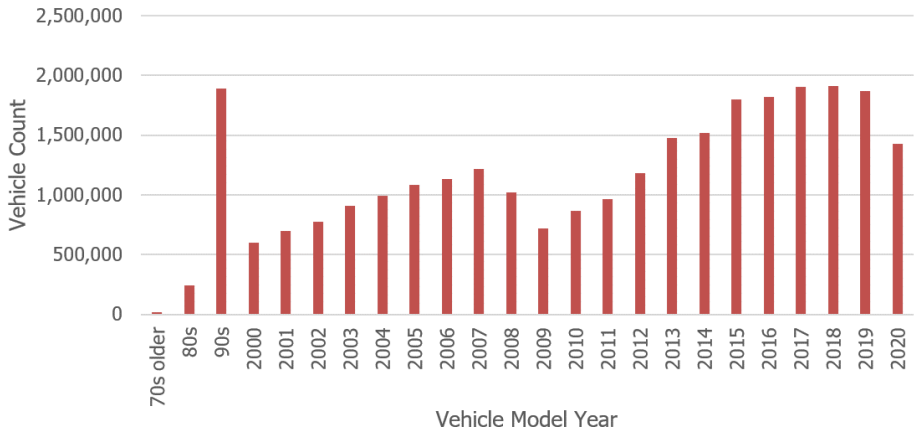
51 California Energy Commission. Zero Emission Vehicle Dashboard. https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/new-zev-sales

market value of more than $5 billion, with forecasts totaling more than 47 million units by 2028.

Market Trends

California has a large replacement tire market that is expected to grow in the future. The California passenger vehicle count by vehicle age is shown below in Figure 7.[52] This vehicle count illustrates the high potential candidates for replacement tire turnover by vehicle model year. Expected turnover for each vehicle is based on several assumptions, including more than 12,000 average vehicle miles traveled per year, average warranty periods, driver behavior, road surface, and other factors that will result in additional tire replacements.[53]

Figure 7: California Registrations for Passenger Vehicles based on Model Year in 2021



Source: CEC staff/California DMV Data

California's large vehicle population makes it a desired market for replacement tires. In 2019, 31.2 million replacement tires were sold in California, representing $3.7 billion in sales. Projected replacement tire sales from 2021 through 2028 are expected to have a compounded annual growth rate of 3.77 percent, resulting in up to 42.1 million replacement tires, representing $8.3 billion in sales in 2028.[54] In 2019, OE tires on new vehicle sales totaled 6.4 million tires, representing $946 million in sales.

Tire price analysis conducted by the CEC's contractor, Coherent Market Insights, indicated that lower-cost replacement tires represent roughly 50 percent of tires for hatchbacks, sedans, and SUVs. In 2022, the weighted average price per tire for hatchbacks, sedans, and SUVs was

52 CEC staff analysis of DMV Vehicle Registration Database.

53 U.S. Department of Transportation, Federal Highway Administration. 2022. "Average Annual Miles per Driver by Age Group," https://www.fhwa.dot.gov/ohim/onh00/bar8.htm.

54 Coherent Market Insights. 2022. *California Market Evaluation Study*.

calculated at $104, $140, $182, respectively. The study found that replacement tire costs ranged from $45 to $520 per tire.

In terms of tire types, all-season tires accounted for highest market share in the California replacement tire market, near 92 percent in 2020, and is expected to have a similar market share in 2028, with an estimated compounded annual growth rate of 10 percent between 2021 to 2028. All-season tires have tread designs and rubber compounds that allow them to be used in rainy situations as well as in a wide range of hot and cold climates.[55]

Advancing Technologies That Improve Tire Efficiency

In recent years, advances in tire technology have lowered rolling resistance to meet market trends and needs. There are five main forces to overcome to move a vehicle forward: rolling resistance forces, aerodynamic forces, internal frictional forces, gravitational forces, and inertial forces. As described previously, viscoelastic properties are a major component relating to the dissipation of energy and overall efficiency for a tire.[56] Controlling aspects of the viscoelastic properties is a mode that manufacturers are using to increase tire efficiency.

The CEC anticipates that current trends in tire technology will continue to affect tire efficiency over the coming years. Some key areas of technology development include changes to tread design, changes in the chemistry of rubber compounds used, ways that the rubber matrix combines with other tire components, tire aerodynamics, and the use of plasticizers and silica to increase efficiency. For example, abrasion resistance rubber is needed in different areas of the tire. Low rolling resistance sections need high abrasion resistance, while sidewalls need low abrasion resistance. Silica is derived from sand and is readily available throughout the world and widely used throughout the tire industry. The addition of silica into tires is a global trend. Higher silica content offers improved wet grip, rolling resistance, and maintaining compound integrity in tires. Highly dispersible silica is one of three new technology fillers that achieve the lowest possible rolling resistance and contribute to the growth of sustainable tire products. Although silica content in tires is increasing in most tire products, cost increases may be significant, making it difficult for some tire manufacturers to retool and scale up production to increase silica content in tire products. Tire aerodynamics that reduce friction between the tire and the surrounding air can also achieve increased fuel efficiency.

Some manufacturers have excelled at adopting technologic changes that are producing low rolling resistance tires. All manufacturers may need to conduct ongoing research and development to address the complexity of advanced tire technology and balance that with normal business practices. Although efficiency is a desirable tire characteristic, changes to the tire rubber matrix could lead to degradation in other tire characteristics. High-efficiency tires are available now; continued advancement can be addressed with known technologies and do not require revolutionary advances.

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55 Ibid.

56 Viscoelastic refers to a material's physical properties where it can behave like both a solid and fluid

CHAPTER 3:
Lack of Consumer Information on Tire Efficiency

AB 844 directs the CEC to inform consumers about attributes of energy-efficient replacement tires through the adoption of consumer information requirements. Per AB 844, the CEC must develop specifications for tire manufacturers to provide information to the CEC. Furthermore, the CEC must develop and adopt a rating system that will enable consumers to make more informed decisions when purchasing tires for their vehicles. The CEC must develop a consumer information requirement, which means point-of-sale information or signs that are conspicuously displayed and readily accessible. The CEC interprets point of sale to include physical retail stores, catalogs, and online retailers, as well as other locations. This includes information such as costs and energy efficiency through the use of a CEC-designed rating system based on tire efficiency.

As discussed, unlike other aspects of tires that are required to be printed on vehicle tires under NHTSA rules (UTQG), including size, treadwear, traction, composition, maximum load, and so forth, there are no federal requirements regarding the rating of the energy efficiency of tires. Furthermore, consumers have little, if any, convenient way of determining the effect of tire choices on fuel economy or the potential tradeoffs between tire fuel efficiency and tire safety and durability.[57] As a result, consumers often unknowingly purchase high rolling resistance tires because of the lack of readily available information, which results in higher lifetime operating costs to the driver. The CEC intends to address this information gap through its proposed program, providing for the first time a way for California consumers to make informed decisions about the differences in energy efficiency between models of replacement tires.

Consumer Decision Making on Which Tires to Purchase and Industry Influence

While the traditional method of buying replacement tires has been at retail stores, a significant and growing portion of tire purchases are completed through online sales, much like other retail sectors. The customer purchase decision is heavily weighted on initial purchase price for some consumers. However, purchase decisions are also influenced by other factors, including longevity and safety.[58] Rarely does energy efficiency play a major role when consumers make decisions about what tires to buy, in part because little information exists to understand the variability and effect of efficiency among tire models. This is a knowledge gap for a wide range

57 National Highway Traffic Safety Administration. 2010. "Tire Fuel Efficiency Consumer Information Program." Docket Number: NHTSA-2020-0036, https://www.nhtsa.gov/fmvss/tire-fuel-efficiency-consumer-information-program.

58 Bansal, Bhavika. 2022. "US/GB: What Factors Do Consumers Consider When Purchasing Tires?" *YouGov*. https://business.yougov.com/content/43667-usgb-what-factors-do-consumers-consider-when-purch.

of drivers, both those who primarily consider costs and those who are influenced by other factors.

An article published in 2021 by *Consumer Reports* highlights what consumers look for when shopping for tires and key influences. The organization surveyed nearly 16,000 of its members, who reported on their tire purchase and/or installation experiences at walk-in chains, online retailers, independent tire retailers and car dealerships. Among the many tire attributes consumers consider when shopping for tires, *Consumer Report's* members clearly valued all-weather grip, which perform well in a range of road conditions (dry, wet, icy, etc.). The survey also revealed that tire brand was important in their decision making. However, one of the most common reasons members cited for choosing a specific tire brand was price. Other top considerations include handling, treadwear warranty, quietness and wet grip. [59]

Fuel efficiency was not included on the list. However, if information was readily available on tire efficiency and the related financial impact over the life of the tire, it's reasonable to conclude that tire efficiency would be included as an important consideration for purchasing replacement tires.

Where Consumers Currently Get Information on Tires

When consumers purchase replacement tires, they often obtain information from a variety of sources, and researching tire information is relatively easy. However, information on tire efficiency is universally limited, as discussed below.

Tire Manufacturers

Many tire manufacturers provide limited information on their high-efficiency line of tires. Staff identified seven tire models that have been branded as efficient tires by manufacturers. With names like *Michelin Energy Saver, Bridgestone Ecopia*, and *Goodyear Assurance Fuel Max*, these tire models imply that they possess superior environmental attributes, including fuel savings. Some manufacturers provide estimates of the fuel savings that can be realized over the life of the tires. However, these companies provide little, if any, quantitative data on how these tires compare to conventional tires made by them or other tire manufacturers. These naming descriptors are vague and subjective — and ultimately designed to help sell tires. The CEC, through its contract with a testing lab (Smithers), tested several such models to verify the tire efficiency performance, as well as wet grip. (Test results are discussed later in this report.)

Retailers

Tire retail and distribution companies provide a variety of information and resources to consumers through nonstandardized methods, but to date, there are no requirements for displaying information for consumers on tire efficiency. Information on tire characteristics

59 Bartlett, Jeff. 2021. "The Driving Forces Behind Tire Purchases Revealed." *Consumer Reports,* https://www.consumerreports.org/tire-buying-maintenance/driving-forces-behind-tire-purchases-revealed-survey/.

varies considerably among retailers. However, most information found at tire stores and their online websites provide consumers basic information about the tires, including price, safety features (wet and dry grip, snow/ice traction, and so forth), speed rating, comfort, noise and treadwear, as shown below.[60] Additional information can also be found on the exterior side of the tire (UTQG information) and often online, such as heat rating, load, and so forth, but not efficiency.

Figure 8: Example of Tire Data Available

Source: Firestone

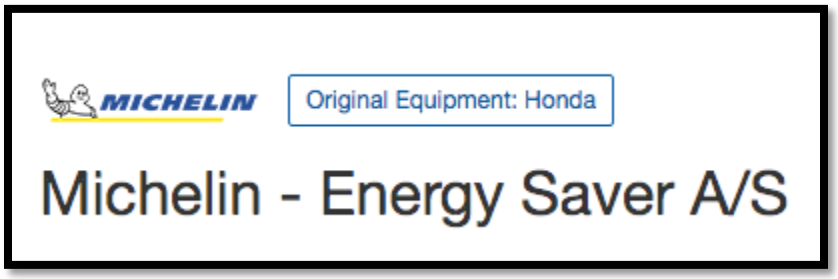
Some retailers, especially online tire sellers such as Tirerack.com, are geared toward those interested in researching tires before making purchase decisions. Such websites sometimes contain information on energy-efficient tires and may include a list(s) of low rolling resistance tire models. This information, while useful to some, is of limited value as well. Again, without quantitative data on rolling resistance, consumers lack sufficient data to make well-informed decisions. In addition, this information is not necessarily from objective or independently verified sources.

Finally, when retailers or manufacturers list tires as "original equipment" (OE), this can be helpful to consumers, indicating that a specific tire model is found on some new car models and is likely to be a low rolling resistance tire. Figure 9 is an example.[61]

60 Example of tire data available. Information found on Firestone Complete Auto Care website, https://www.firestonecompleteautocare.com/tires/vehicle/.

61 Costco Wholesale website, tires.costco.com.

Figure 9: Example of Consumer Marketing



Source: Costco

Auto Dealerships and Automotive Service Facilities

Consumers often purchase a tire or set of tires when their vehicle is being serviced for repair or maintenance at a dealership or service facility. Whether tires have been damaged or show sufficient signs of wear to warrant replacement, these facilities typically offer replacement tires. At a dealership, it is likely OE tires can be purchased, which tend to be more energy-efficient than most replacement tires. However, at a service facility (that is, fueling station, auto repair shop), it is more likely that the tires recommended as replacements will be from a limited selection of what models are present at the service facility or influenced by their supplier's inventory. As a result, information provided to consumers on the energy efficiency of tires is likely limited or nonexistent.

Government Sources

Several federal agencies have direct or indirect responsibility for passenger vehicle 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 and include information on topics such as choosing energy efficient vehicles (for example, fueleconomy.gov), improving fuel economy (for example, the Alternative Fuels Data Center, found at afdc.energy.gov), as well as environmental impacts caused by passenger vehicles. While information on 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.

In response to the passage of the national Energy Independence and Security Act of 2007 (EISA),[62] NHTSA began work on a program to lower rolling resistance of passenger vehicle tires. EISA includes a requirement that NHTSA develop a national tire fuel efficiency consumer

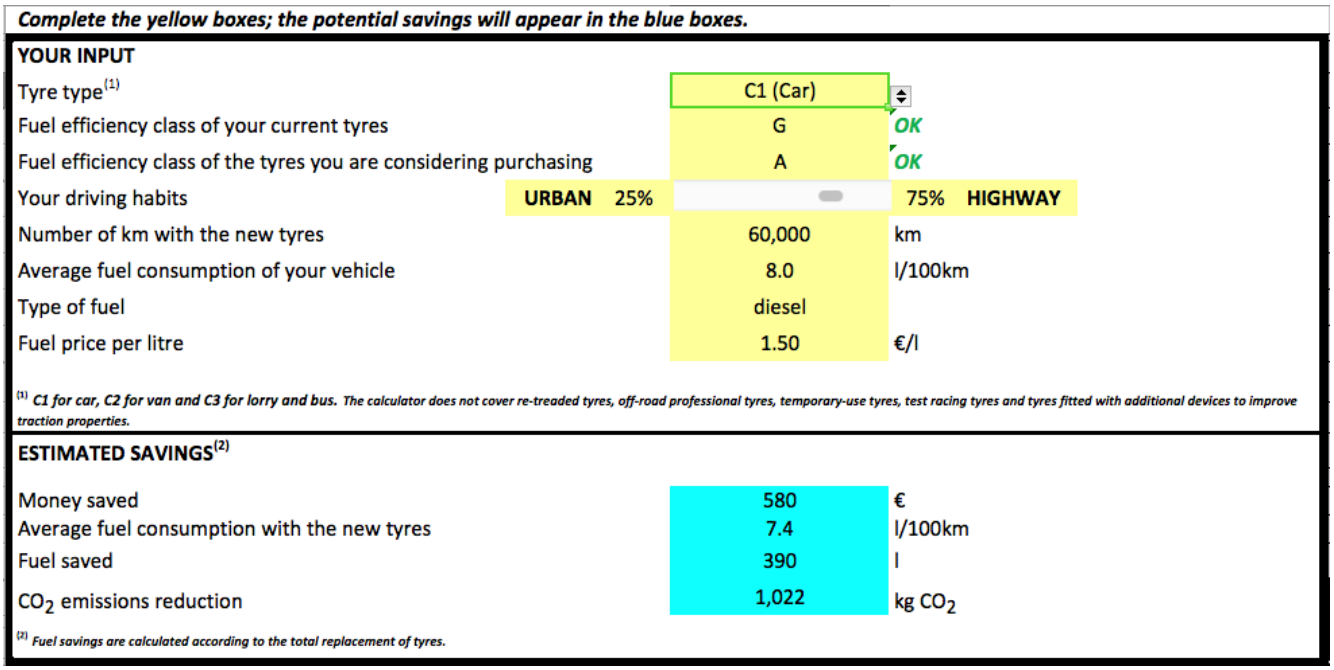
62 Pub.L. No. 110-140 (Dec. 19, 2007), 121 Stat. 1492.

information program to educate consumers about the effect of tires on automobile fuel efficiency, safety, and durability.[63]

Other Countries and Subnational Government Sources

Other countries have made efforts to provide tire efficiency and related data to consumers. However, it is unlikely that many consumers in California or the United States are aware of such information. Furthermore, because the conditions and priorities may vary (in other words, climate, road surfaces, regulations), program information on tire energy efficiency outside the United States is of limited value. Yet, it is instructive to note the design elements of other countries consumer education efforts. For example, the EU provides a simple, spreadsheet-based calculator to estimate the savings of fuel over the life of the tires, as shown in Figure 10.

Figure 10: EU Fuel Savings Calculator



Complete the yellow boxes; the potential savings will appear in the blue boxes.

YOUR INPUT			
Tyre type[1]		C1 (Car)	
Fuel efficiency class of your current tyres		G	OK
Fuel efficiency class of the tyres you are considering purchasing		A	OK
Your driving habits	URBAN 25%		75% HIGHWAY
Number of km with the new tyres		60,000	km
Average fuel consumption of your vehicle		8.0	l/100km
Type of fuel		diesel	
Fuel price per litre		1.50	€/l

[1] *C1 for car, C2 for van and C3 for lorry and bus. The calculator does not cover re-treaded tyres, off-road professional tyres, temporary-use tyres, test racing tyres and tyres fitted with additional devices to improve traction properties.*

ESTIMATED SAVINGS[2]		
Money saved	580	€
Average fuel consumption with the new tyres	7.4	l/100km
Fuel saved	390	l
CO_2 emissions reduction	1,022	kg CO_2

[2] *Fuel savings are calculated according to the total replacement of tyres.*

Source: European Commission[64]

As Figure 10 illustrates, consumers can use this online calculator and change the inputs on several key variables, including type of vehicle, expected life of tires, vehicle fuel type, fuel price, and so forth. In this example, a diesel passenger car switching from fuel efficiency "class

63 NHTSA. 2009. *Notice of Proposed Rulemaking, Replacement Tire Consumer Information Program Part 575.106, Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis,* https://www.nhtsa.gov/sites/nhtsa.gov/files/pria-rollingresistance.pdf.

64 European Commission. "Tyre Label," https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products/tyres_en#tyre-label.

G" tyres/tires (highest rolling resistance), to "Class A" tyres (lowest rolling resistance), the savings would total an estimated 580 Euros (roughly equivalent to U.S. dollars at the time of writing) over the expected life of the tires. Such tools offer consumers a quick means of estimating possible fuel savings and reductions in CO_2, which can be compared to any higher initial purchase cost associated with the tires.

States

California

As discussed in Chapter 1, California has a multidecade history of establishing programs aimed at addressing transportation related societal concerns. To date, the state has lacked a comprehensive, consumer-friendly information program on energy-efficient tires.

Other States

Information on fuel-efficient tires from other states, based on staff research, is extremely limited. For example, in 2007, the Washington State Legislature required that replacement tires for the state motor vehicle fleet must have the same or better rolling resistance than the original tires.[65] While laudable, this program has a narrow focus and is not aimed at consumers.

Other Sources

Some consumer-oriented and automotive publications periodically offer information on tire efficiency in their product comparison studies and publications. For example, *Consumer Reports* has published articles on the importance of low rolling resistance tires and the potential effect on fuel economy. These articles included testing and ranking several tires from various manufacturers on rolling resistance force in pounds for each tire tested.[66]

Information on tire efficiency based upon independent testing can be valuable to the public, yet it's far from comprehensive and is available only infrequently. Moreover, such information is often not readily accessible to the public at large, but rather as part of a paid subscription. Such independent, unbiased, and accurate information on tire rolling resistance is rare. Websites that focus on passenger cars, such as edmunds.com, cars.com, autobytel.com, and so forth, often have articles on low rolling resistant tires and may include a list of top tire picks for those interested in fuel economy. However, across all these sources, there is a lack of a consistent and uniform standard that provides information to the wide range of potential tire purchasers.

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65 State of Washington Department of Ecology. 2009. *Environmentally Preferable Purchasing Fact Sheet: Fuel Efficient Tires.* Publication Number: 09-07-03, https://apps.ecology.wa.gov/publications/documents/0907037.pdf.

66 Bartlett, Jeff. 2022. "Low-Rolling-Resistance Tires Can Save You Money at the Pump." Consumer Reports, https://www.consumerreports.org/tires/low-rolling-resistance-tires-can-save-you-money-at-pump-a1547901110/.

Changing Market

The rapid growth of electric vehicles (EVs) (nearly 19 percent of new vehicle sales in California in 2022) is not only changing the automotive landscape, but the tire market as well. Providing consumers access to unbiased, accurate information on EV replacement tires is critical for two reasons. Unlike tires for internal combustion engine (ICE) vehicles, EV tires are designed to address unique attributes inherent in the electric drive platform, including very low rolling resistance (to maximize driving range and energy efficiency), higher load ratings (due to the heavy batteries), better traction (due to higher weight and instant torque), and lower road noise (which is more noticeable than with ICE vehicles). Given California's policies aimed at ultimately replacing most ICE vehicles with fuel cell or battery-powered EVs, the efficient replacement tire consumer information program will be a vital source of information.

CHAPTER 4:
Staff's Proposed Regulatory Framework

This chapter presents staff's proposed regulatory framework for the proposed Replacement Tire Efficiency Program. Staff's proposed regulations would add Chapter 14, Article 1 into Division 2 of Title 20 of the California Code of Regulations, commencing with Section 3300.

Key elements of the proposed regulation include a tire efficiency rating system and a minimum tire efficiency standard. CEC staff proposes a tire efficiency rating system for tire models that would be based on a one-to-five-star scale (five stars being the most efficient), as discussed later in this chapter. The star efficiency rating will be paired with other tire information, such as the federal UTQG system traction and treadwear ratings, and communicated to consumers through point-of-sale information, signs, and an online database. Providing a fuel efficiency rating, along with the wet traction and wear information, will help consumers quickly determine how various tire models are expected to affect the fuel economy of their vehicle and potential tradeoffs in other important tire qualities, such as safety and tire life.

In addition, CEC staff proposes a minimum efficiency performance standard of 9.0 rolling resistance coefficient (in N/kN) that would apply to the sale of new replacement tires starting on January 1, 2026, with a more stringent standard of 7.0 RRC taking effect two years later on January 1, 2028.

AB 844 requires the CEC to establish a Replacement Tire Efficiency Program of statewide applicability for replacement tires for passenger cars and light-duty trucks that is designed to ensure that replacement tires sold in the state are at least as energy efficient, on average, as the tires sold in the state as the original equipment on these vehicles.[67] To do this, AB 844 requires the CEC's program to include replacement tire minimum energy efficiency standards that are technically feasible and cost-effective and do not adversely affect tire safety, average tire life, or state efforts to manage scrap tires.[68] The program must also include consumer information requirements including point-of-sale information or signs.[69] Furthermore, AB 844 requires the CEC to develop and adopt the following tools regarding replacement tire energy efficiency: a test procedure, a database, a rating system, and a manufacturer reporting requirement.[70]

Staff proposes to add the following sections to Title 20:

- 3300: Purpose

67 Pub. Resources Code, § 25772.

68 Pub. Resources Code, § 25773(a)(1).

69 Pub. Resources Code, §§ 25770(b) and 25773(a)(2).

70 Pub. Resources Code, § 25771.

- 3301: Scope
- 3302: Definitions
- 3303: Rules of Construction
- 3304: Testing Requirements
- 3305: Tire Rolling Resistance Efficiency Database (TRRED)
- 3306: Filing of Statement by Manufacturers or Brand Name Owners
- 3307: Energy Performance Minimum Standard
- 3308: Replacement Tire Energy Efficiency Rating
- 3309: Retail Disclosure
- 3310: Compliance and Verification
- 3311: General Administration

The express terms of staff's proposed regulations are included as Appendix A to this report. The remainder of this chapter describes several features of staff's proposed regulatory framework.

Each of these features of staff's proposed regulatory framework is discussed below. A discussion of potential alternatives is provided in Chapter 5.

Scope

Staff's proposed regulations would apply to all tire retailers, manufacturers, and tire brand name owners of any new tire that is sold or offered for sale in California that is designed to replace a tire sold with a new passenger car or light-duty truck.[71] 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.

Tires Subject to Staff's Proposed Regulations

Staff's proposed regulations center on "replacement tires" as defined in AB 844. AB 844 defines "replacement tire" as a tire sold in the state that is designed to replace a tire sold with a new passenger car or light-duty truck.[72] AB 844's definition of "replacement tire" expressly excludes the following categories of tires:

> (1) [A] tire or group of tires with the same (Stock Keeping Unit [SKU]), plant, and year, for which the volume of tires produced or imported is less than 15,000 annually; (2) a deep tread, winter-type snow tire, a space-saver tire, or a temporary use spare tire; (3) a tire with a nominal rim diameter of 12 inches or

71 Appen. A, Proposed Cal. Code of Regs., Tit. 20, § 3301.

72 Pub. Resources Code, § 25770(d).

less; (4) a motorcycle tire; [and] (5) a tire manufactured specifically for use in an off-road motorized recreational vehicle.[73]

To define "replacement tire," staff must also define "passenger car" and "light-duty truck" because AB 844 defines a "replacement tire" as being designed for those classes of vehicles but does not define them. Staff proposes to define "passenger car" to mean any motor vehicle designed primarily for transporting persons, having a design capacity of 12 persons or fewer, and not exceeding a 10,000-pound gross vehicle weight rating.[74] This definition is based on the California Air Resources Board's definition of "passenger car"[75] 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.[76] The definition of "passenger car" would be subject to staff's proposed definition of "motor vehicle," which includes only vehicles designed primarily for driving on public streets, roads, and highways,[77] which aligns with the federal definition.[78]

Staff proposes to define "light-duty truck" to mean any motor vehicle other than a "passenger car" that has a design capacity not exceeding a 10,000-pound gross vehicle weight rating.[79] Thus, the definition of "light-duty trucks" complements the definition of "passenger cars" so that together they would comprehensively 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.

The scope of tires covered by staff's proposed regulations as "replacement tires" would necessarily be broader than the tires covered by the federal Tire Fuel Efficiency Consumer Information Program because California's AB 844 expressly includes tires designed for use on "light-duty trucks,"[80] whereas the federal program expressly excludes "light truck tires."[81] The scope of the federal consumer information program is defined to regulate "passenger car tires," even if they are intended for multipurpose passenger vehicles or trucks,[82] including "smaller sport utility vehicles (SUVs), pickup trucks, and vans," which NHTSA classifies as light

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73 Ibid.

74 Appen. A, Proposed Cal. Code of Regs., Tit. 20, § 3302.

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

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

77 Appen. A, Proposed Cal. Code of Regs., Tit. 20, § 3302.

78 See 49 U.S.C., § 32101(7) (NHTSA definition of "motor vehicle"); see also Code Fed. Reg., Tit. 49, § 523.3 (NHTSA definition of "automobile.")

79 Appen. A, Proposed Cal. Code of Regs., Tit. 20, § 3302.

80 Pub. Resources Code, § 25770(d)(2).

81 Code Fed. Reg., Tit. 49, § 575.106(c); 49 U.S.C., § 32304A(a)(3).

82 49 U.S.C., § 32304A(a)(3).

trucks.[83] The federal program excludes tires that are intended primarily for light- and medium-duty trucks, including full-size pickups and vans, which are commonly used in commercial service, have a GVWR of more than 6,000 pounds, and usually have the letters "LT" molded into the sidewall.[84] These LT tires would be included in the CEC's program if they are designed for a vehicle with of GVWR of up to 10,000 pounds.[85]

Moreover, staff proposes to include limited production tires, which AB 844 excludes from the definition of "replacement tires."[86] Including these tires within the scope would allow the CEC to require the associated manufacturers to report which tire models and sizes are limited production tires. Staff recommends that this information is necessary for compliance and enforcement to distinguish tires that must comply with minimum standards and those that do not because they are limited production tires and fall within an excluded category of tire. Staff proposes to publish information about limited production tires in staff's proposed publicly searchable online database, discussed below. Thus, the CEC enforcement staff and tire retailers would have a way to verify that a tire complies with the proposed regulations and is subject to a minimum efficiency standard, if applicable to that tire. Staff is interested in comments about whether a similar listing requirement should also apply to tires with less obvious physical characteristics to distinguish them from replacement tires, such as tires designed for off-road use, deep tread, and winter-type snow tires.

Furthermore, requiring manufacturers to list limited production tires would prevent tire customers' and retail operators' confusion about whether a tire meets efficiency standards. Including limited production tires in the database would assist consumers and retailers when they search for a tire that happens to be limited production because they would find a confirmation that the tire is limited production and not subject to a minimum efficiency standard.

Finally, staff proposes excluding retreaded tires from the scope of the regulations.[87]

"Tire manufacturers" Subject to Staff's Proposed Regulations

Staff proposes to apply the regulations to all manufacturers of any "replacement tire" and limited production tire. Staff proposes to include manufacturers of limited production tires so the regulations can require them to report which of their tires are limited production.[88]

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83 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15908.

84 Ibid.

85 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3302 (defining "replacement tire" and "light-duty truck").

86 See Appen. A, proposed Cal. Code of Regs., Tit. 20, §§ 3301(a), 3302; Pub. Resources Code, § 25770 (defining "excluded tire" and "replacement tire").

87 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3301(b).

88 Ibid.

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.[89] The federal Tire Fuel Efficiency Consumer Information Program similarly allows brand name owners to stand in as a manufacturer under its program.[90] Staff proposes to adopt the federal program definition of "brand name owner," which 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.[91]

"Tire Retailers" Subject to Staff's Proposed Regulations

Staff's proposed definition of "tire retailer" would mean a dealer or distributor of a replacement tires that is sold or offered for sale in California.[92] 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.[93]

Data Subject to Collection Under Staff's Proposed Regulations

Staff proposes to require tire manufacturers to report information for every "replacement tire" sold in the state to the CEC.[94] AB 844 authorizes the CEC to establish reporting requirements.[95] This information would include the identity and contact information of the manufacturer, brand name owner if any, and the following information from the markings on a tire sidewall:

- brand name
- tire model
- size
- overall diameter (in)
- DOT tire identification number (first seven digits)
- tread and sidewall ply and material identification
- load index
- sidewall max load (lbs)
- sidewall max pressure (psi)
- load range; speed rating

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89 See e.g., Appen. A, proposed Cal. Code of Regs., Tit. 20, §§ 3301(a), 3304(a), 3306(a).

90 See Code Fed. Reg., Tit. 49, § 575.106(d)(2) (definition) and (e) (requirements).

91 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3302 (definition of "brand name owner").

92 Ibid. (definition of "tire retailer").

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

94 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3306(e).

95 Pub. Resources Code, 25771(c).

- UTQG traction, treadwear, and temperature ratings
- whether lettering is blackwall, whitewall, outlined white letter, outlined black letter; and
- special features, such as run flat or color tread[96]

If additional information is required to be added to a tire sidewall in the future, such as through a federal regulation, then that information would also be required to be provided to the CEC. The information described in this paragraph would allow staff to identify reported tires. Moreover, it would assist staff in monitoring the market to ensure it is not skewed by the regulations, including to ensure efficiency standards do not adversely affect feasibility, cost-effectiveness, safety, or tread life, or management of scrap tires.[97] This information is essential for staff to review and revise the program as required by AB 844.[98]

For example, requiring manufacturers to report wet traction, treadwear, and temperature ratings[99] would help staff ensure that the CEC's efficiency standards do "not adversely affect tire safety" or "tire life." Staff would use the information to monitor whether regulations are affecting safety. And staff anticipates consumers would use the information to make more informed decisions when purchasing tires for their vehicles, consistent with AB 844.[100] Wet traction testing represents tire safety because it indicates the ability of a tire to stop on wet pavement. Treadwear testing represents tire life better than manufacturers' warranties because they are not always based on test results and not all tires carry a warranty.[101] The UTQG temperature rating indicates the resistance of a tire to the generation of heat and the ability of the tire to dissipate heat. Sustained high temperature can cause the tire material to degrade and reduce tire life, and excessive temperature can lead to sudden tire failure.[102]

Without traction, treadwear, and temperature reporting, efficiency standards could adversely affect tire safety or average tire life. For example, manufacturers can generate an improvement in rolling resistance by reducing initial tread depth, which could affect tire wear life.[103] Manufacturers could attempt to gain a price advantage by complying with minimum standards by optimizing tire rolling resistance at the expense of treadwear, traction, temperature, or all three, to minimize manufacturing costs. And consumers motivated by potential fuel savings could begin to purchase tires with better rolling resistance ratings without adequate information about reduced traction, tread life, and safety. Staff's investigations have shown that it is not necessary to sacrifice safety or tire life to improve

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96 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3306(e).

97 Pub. Resources Code, §§ 25773(a)(1)(A)-(E), (d).

98 Pub. Resources Code, §§ 25773(d).

99 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3306(e).

100 Pub. Resources Code, §§ 25771(b), 25773(a)(1)(B), (C), (2).

101 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15939, fn. 335.

102 Id. at 15931.

103 Id. at 15921.

rolling resistance.[104] Staff proposes to satisfy the mandates of AB 844to maintain safety and tire life by monitoring this information. Staff proposes to use the information collected from this reporting to review and revise the CEC's program as required by AB 844.[105] Furthermore, staff proposes to use the information to implement consumer information requirements by connecting tire rolling resistance ratings with traction and treadwear ratings that will allow consumers to shop for better rolling resistance without inadvertently sacrificing safety or tire life.

Staff proposes to require tire manufacturers to report tread depth. As mentioned, manufacturers can generate an improvement in rolling resistance by reducing initial tread depth, which could affect tire wear life.[106] This information would enable staff to monitor whether staff's proposed minimum rolling resistance standards affect tire life.[107]

Staff proposes to require tire manufacturers to report a peak traction rating. As discussed, staff needs safety information to ensure that its minimum standards are not adversely affecting tire safety. Traction is a characteristic of tires and is an aspect of tire safety. The federal government's Uniform Tire Quality Grading system includes a locked-wheel (slide) traction rating based on tire behavior on a wet surface, from AA, A, B, to C. Because it uses the sliding coefficient of friction, the UTQGS traction test procedure indicates the traction or wet pavement behavior for a vehicle that is not equipped with anti-lock brakes or electronic stability control. Modern anti-lock braking and stability control systems use wheel speed sensors and complex computer algorithms to modulate the brake pressure to operate near the peak coefficient of friction instead of slide, thus utilizing more available friction from the tire-road surface pair. The peak coefficient of friction is a metric that would better indicate traction performance for vehicles equipped with these advanced braking and handling systems. Staff's proposed peak traction rating would document the safety performance for modern vehicles with advanced braking technologies, which is not perfectly reflected in the UTQG traction rating marked on the tire.[108] Staff proposes to require manufacturers to report this information according to the testing and rating standards, which are discussed below in the sections on "Tire Testing" and "Rating Systems."

Staff proposes to require tire manufacturers to report the rolling resistance of replacement tires to comply with the mandate of AB 844 that the CEC require manufacturers to report energy efficiency.[109] Rolling resistance is a standard measurement for characterizing and comparing tire energy performance. This information is already required under the federal Tire Fuel Efficiency Consumer Information Program but is beyond what is required to comply with

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104 Id. at 15895.

105 Pub. Resources Code, § 25773(d).

106 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, pp. 15921, 15923.

107 Ibid.

108 Id. at 15923.

109 Pub. Resources Code, § 25771(c).

UTQG.[110] Staff proposes to require manufacturers to report this information according to the testing and rating standards, which are discussed below in the sections on "Tire Testing" and "Rating Systems."

Staff proposes to require manufacturers to report whether the tire is an OEM fitment (yes/no). This information would allow staff to identify OEM tires that are sold as replacement tires to ensuring that that replacement tires sold in the state are at least as energy efficient on average as OEM tires, consistent with AB 844.[111]

Staff intends to require tire manufacturers to report the suggested retail price of each replacement tire[112] to allow staff to ensure that minimum rolling resistance standards remain cost-effective, consistent with AB 844.[113]

Staff proposes to require tire manufacturers to report the manufacture date and manufacture facility to permit staff to monitor the consistency and accuracy of reported compliance with minimum tire efficiency standards. Comment on the federal program indicated that rolling resistance can vary significantly if manufactured at different facilities or at different times, even if it has the same SKU.[114] Identifying these tires allows staff to monitor these tires.

Staff proposes to require tire manufacturers to report the following information to permit Staff to monitor the consistency and accuracy of compliance with minimum efficiency standards, ensure tires remain feasible and cost-effective, and identify tires: tire weight, tread and sidewall ply and material identification; load index; sidewall max load (lbs); sidewall max pressure (psi); load range; speed rating; whether lettering is blackwall, whitewall, outlined white letter, outlined black letter; and special features such as run flat, or color tread.

Furthermore, the information listed in this section would allow consumers to compare tires when using the energy efficiency rating system. This ability would enable the CEC to provide consumers with the information necessary to make more informed decisions when purchasing tires, which is also consistent with the mandates of AB 844.[115]

Regarding limited production tires within the scope of the regulations but excluded from the definition of "replacement tire," staff proposes to require manufacturers to report the identity of limited production tires and the reason they are limited production.[116] As noted above, staff proposes to publish information about limited production tires in staff's publicly searchable online database. This information would assist consumers and retailers who search for a tire

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110 See Code Fed. Reg., Tit. 49, § 575.104 (UTQG requirements).

111 Pub. Resources Code, § 25772.

112 See Appen. A, proposed Cal. Code of Regs., Tit. 20, § 3306(e).

113 Pub. Resources Code, § 25773(a)(1)(A)

114 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15913.

115 Pub. Resources Code, § 25771(b).

116 See Appen. A, proposed Cal. Code of Regs., tit. 20, § 3306(f).

that happens to be limited production and who would find a confirmation that the tire is limited production and not subject to minimum efficiency requirements. Similarly, this information would increase compliance by allowing retailers to verify that limited production tires comply with the regulations.

Regarding limited production tires, staff proposes to require manufacturers to report:

- The identity and contact information of the manufacturer and brand name owner, and the brand name
- The tire line and model
- The Size
- The SKU
- The reason that is limited production including the plant information
- The number of tires imported
- The number of tires produced during the claimed year
- The claimed year of the tire[117]

Testing Procedures

Testing Procedures for Rolling Resistance

Staff proposes the tire rolling resistance test procedure, ISO 28580:2009(E), and proposes specified testing conditions.[118] This test measures rolling resistance of a tire by running it on a test wheel under load and 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. The test, ISO 28580:2009(E), also states a procedure to correlate results between different test equipment.

Although an updated version of the test procedure — ISO 28580:2018 — is available, the federal Tire Fuel Efficiency Consumer Information Program already adopted the ISO 28580:2009(E) test procedure, along with certain testing conditions and procedures.[119] Therefore, staff recommends aligning with the federal rule, conditions, and procedures, creating a single set of testing standards and conditions under both the state and federal program. Staff will consider adoption of the updated version of the test in future years when the regulation is revisited.

Testing Procedure for Peak Traction Coefficient

117 See Appen. A, proposed Cal. Code of Regs., tit. 20, § 3306(f)(C).
118 See Appen. A, proposed Cal. Code of Regs., tit. 20, § 3304 (incorporating ISO 28580:2009(E), the test method for "passenger car, truck and bus tyres-methods of measuring rolling resistance-single point test and correlation of measurement results").
119 Code Fed. Reg., tit. 49, § 575.106.

Staff proposes to adopt a wet traction testing procedure[120] identical to the one adopted by the federal Tire Fuel Efficiency Consumer Information Program, which is the UTQG traction test modified to additionally collect data on peak coefficient of friction (or peak braking coefficient).[121] Including peak and slide coefficients of friction measurements would document safety information that considers the safety performance for both old vehicles without advanced braking technologies (wet traction performance correlates to slide), and new vehicle types with advanced braking technologies (wet traction performance correlates to peak).[122] A safety rating based only on current UTQG slide or only on peak coefficient of friction would not necessarily represent either vehicles with advanced braking technologies or older vehicles with conventional brake technology, respectively.[123] Staff recommends aligning with the federal test conditions and procedures, thus creating a single testing standard under both the state and federal programs.

If manufacturers have not already adapted equipment to comply with peak coefficient of friction testing requirement of the federal program, the testing equipment may require a one-time modification in the software used for the test procedure.[124]

Rating Systems

AB 844 requires the CEC to develop a rating system for the energy efficiency of replacement tires sold in the state.[125] Staff's proposed tire rating system will support staff's minimum efficiency standards. Also, this rating system combined with the UTQG ratings would be communicated to consumers to help them quickly and easily determine how various tire models are expected to affect the fuel economy of their vehicle and potential tradeoffs in other tire qualities such as wet traction, treadwear, and tire life.

Staff proposes to base the tire fuel efficiency rating on the RRC in newtons per kilonewton (N/kN) — the rolling resistance force divided by the test load on the tire — as measured by ISO 28580:2009(E) under the specified testing conditions.[126]

Staff recommends a star scale that rates tires from one to five stars with five being the best. Staff proposes the following design:

120 See Appen. A, proposed Cal. Code of Regs., tit. 20, § 3304.
121 Code Fed. Reg., tit. 49, § 575.106(g)(1)(iii); NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15900.
122 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15923.
123 Ibid.
124 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15900.
125 Pub. Resources Code, § 25771(b).
126 See Appen. A, proposed Cal. Code of Regs., tit. 20, § 3308.

Table 8: Proposed California Tire Efficiency Rating System

CEC Tire Efficiency Rating	Passenger Cars and Light-Duty Trucks
Fuel efficiency class	RRC in N/kN
★★★★★	RRC ≤ 6.5
★★★★☆	6.6 ≤ RRC ≤ 7.7
★★★☆☆	7.8 ≤ RRC ≤ 9.0
★★☆☆☆	9.1 ≤ RRC ≤ 10.5
★☆☆☆☆	RRC ≥ 10.6

Source: CEC staff

Staff recommends the ranges shown above for each star rating because they span the efficiency of tires currently sold in California and distribute most of those tires into the middle star categories. Moreover, these star rating ranges approximate the rating ranges adopted in other international tire efficiency rating systems such as the one adopted by the European Union, which would help harmonize the CEC's program with those of other countries. The federal Tire Fuel Efficiency Consumer Information Program has not adopted a rating system.[127]

Staff recommends adopting the current UTQG rating system for traction,[128] as well as a rating for peak coefficient of friction. For peak coefficient of friction, staff recommends a rating system identical to the existing UTQG rating for slide coefficient of friction but modified to adjust the ranges up 67 percent to reflect values estimated to be roughly 67 percent greater than slide coefficient values.

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

128 Code Fed. Reg., Tit. 49, § 575.104(d)(2)(ii).

Figure 11: UTQG Traction Rating and California Provisional Peak Traction Rating

UTQG TRACTION RATING

Traction Rating	Asphalt	Concrete
AA	Above 0.54μ	Above 0.38μ
A	Above 0.47μ	Above 0.35μ
B	Above 0.38μ	Above 0.26μ
C	Less than 0.38μ	Less than 0.26μ

Source: 49 C.F.R. § 575.104.

CALIFORNIA PROVISIONAL PEAK TRACTION RATING

Traction Rating	Asphalt	Concrete
AA	Above 0.90μ	Above 0.63μ
A	Above 0.78μ	Above 0.58μ
B	Above 0.63μ	Above 0.43μ
C	Less than 0.63μ	Less than 0.43μ

Source: CEC staff

Staff recommends adopting no rating system for treadwear and temperature, but instead rely on the UTQG rating marked on the side of the tire.[129]

Manufacturer Reporting Requirements

Staff recommends requiring manufacturers to report the information described in the section of this chapter above regarding Data Subject to Collection Under staff's Proposed Regulations.

As to rolling resistance, traction, and treadwear data, staff recommends allowing manufacturers to self-certify the ratings for its tires instead of submitting actual test measurements. A self-certification approach would not require manufacturers to base certifications and ratings on any tests, any number of specified tests, or any tests at all. The test procedures in the regulations are standards that the CEC will use for compliance testing. Manufacturers would be required to exercise due care in certifying its tires. Manufacturers may be able to translate test data gathered using other test methods to obtain ratings under the test procedure specified in these regulations. It would be the responsibility of the tire manufacturer to determine initially what test results, computer simulations, engineering analyses, or other information it needs to enable it to certify that its tires comply with applicable standards. This framework would make reporting under the CEC's program like reporting under the pending federal Tire Fuel Efficiency Consumer Information Program.[130] 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.[131]

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

130 NHTSA Tire Fuel Efficiency Consumer Information Program, Final Rule (Mar. 30, 2010) 75 FR 15894-01, 2010 WL 1186165, p. 15916.

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

Staff recommends that manufacturers report and certify data via an online data submission system.

TRRED Database

AB 844 requires the CEC to develop a database of the energy efficiency of replacement tires sold in the state.[132] Staff proposes to have a CEC-created and -maintained online database containing, at a minimum, the data submitted from tire manufacturers through the reporting requirements in these regulations.[133] Staff proposes to designate this database as the Tire Rolling Resistance Efficiency Database, or "TRRED," for short. The TRRED would allow manufacturers to report and certify data via an online data submission system. And the TRRED would allow certain data to be accessible to the public, including tire consumers, via a public interface. It would provide, among other things, a means to compare the variety of rolling resistance characteristics found in the replacement tire market. The TRRED would be continually updated with new information from tire manufacturers.[134]

Rolling Resistance Minimum Performance Standards

AB 844 requires the CEC to adopt minimum energy efficiency standards for replacement tires. Rolling resistance is a standard measurement for characterizing and comparing tire energy performance. Staff proposes to implement rolling resistance minimum performance standards in two phases to give manufacturers time to prepare and adjust to the standards. First, beginning January 1, 2026, the CEC would prohibit selling or offering for sale in California, any replacement tire with a rolling resistance coefficient more than 9.0 N/kN. This standard would effectively prevent one-star tires being sold in California. Then, beginning January 1, 2028, the CEC would prohibit replacement tires more than 7.0 N/kN. This standard would effectively prevent some four-star tires and everything below from being sold in California.

Consumer Information About Replacement Tires

AB 844 also requires the CEC to implement a program to inform consumers about energy-efficient replacement tires, which would provide information at the point of sale but not labels or markings on tires.[135] The consumer information would be derived from the testing procedures, ratings, and reporting requirements discussed above and would be stored in the CEC's TRRED database. To disseminate the replacement tire information, staff proposes to require all tire retailers to provide consumer-friendly displays and information on tire efficiency and provide links to the CEC's own dissemination of information and resources regarding efficient tires.

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132 Pub. Resources Code, § 25771(a).

133 Pub. Resources Code, § 25771.

134 See Pub. Resources Code, § 25320(b)(3).

135 Pub. Resources Code, §§ 25770(b), 25773(a)(2).

Tire retailers, including traditional "walk-in" stores, online, and print catalog retailers, would be required to display information that is conspicuous and "readily accessible" about the energy efficiency tire rating system.

First, traditional "walk-in" store locations would be required to display a poster that would inform consumers about:

- CEC Energy Efficiency Ratings.
- The potential to reduce fuel consumption.
- The potential for driver cost savings, general environmental benefits.
- A web address and quick response code (QR code) to the CEC's website for specific tire and related information.

Physical tire retailers would additionally be required to provide, upon request, a disclosure of the specific ratings for tires being considered. It is anticipated that tire retail salespeople will be required to take brief training supplied by the CEC to explain the rating system to consumers and answer potential questions on tire energy efficiency.

Websites offering tires for sale would be required to display prominently, concurrent with the price, the efficiency star rating for each replacement tire and a clearly marked hyperlink to Energy Commission's TRRED webpage that displays additional information for the specific replacement tire. In addition, in a prominent location on the website, the online retailer shall inform consumers about CEC's Energy Efficiency Ratings, the potential to reduce fuel consumption, the potential for driver cost savings, and general environmental benefits.

Print catalog retailers would be required to include, on any spread of pages that includes the price of replacement tires sold in the state, a replacement tire energy efficiency disclosure. The disclosure would include:

- A description of the CEC's Energy Efficiency Ratings.
- The potential to reduce fuel consumption.
- The web address (URL) and QR code linking to the CEC's TRRED Replacement Tire Efficiency Program search page.

Staff recommends that the CEC make additional information on fuel-efficient tires available on the CEC's website, as well as by other means — reports, brochures, conferences, and so forth — to inform consumers on the importance of low rolling resistance tires. The details may include information about low rolling resistance tires, the impact they can have on the environment to reduce criteria pollutants and GHG emissions, as well as ways that they can save consumers money over the lifetime of the tires. Program information will be specifically designed for Californians and widely accessible. Importantly, by providing this information online, it will help address the paucity of consumer information on efficient tires. In addition, staff anticipates that the CEC would continue conducting research on efficient tires and sharing relevant data with consumers.

Staff recommends that the CEC's Consumer Information Program on efficient tires include:

- A searchable database on the CEC's website or a unique website developed specifically for the program that includes information on the rolling resistance of individual tire models subject to this regulation.
- An online, user-friendly calculator that will allow users to input their own information on tire size, type, and so forth and estimate the fuel savings for gasoline, diesel, and electric vehicles.
- Information on possible incentives and rebates for energy-efficient tires.
- Key program information on social media sites.
- Links to current articles and reports related to low rolling resistance tires, tire safety, maintenance, and so forth.
- Consumer tips on how to choose the best tires based on key tire attributes, including safety, longevity, and energy efficiency.
- The importance of replacing EV specific tires on vehicles with electric drivetrains.
- Resources and links to other related energy-efficient tire programs throughout the world, as well as links to other "green" transportation opportunities and programs supported by the state, such as zero-emission vehicles and other advanced transportation technologies.

The CEC may also expand its consumer information program to include relevant information available as brochures, flyers, videos, and downloadable apps for mobile devices on the subject. The CEC may additionally pursue opportunities for outreach at venues, such as conferences and exhibitions, as well as collaborate with consumers, consumer groups, market participants, and environmental organizations intent on pursuing similar results.

Consumer Information About Tire Maintenance

Staff proposes that the CEC's Consumer Information Program also disseminate information on the benefits of tire maintenance on tire treadwear, traction, and fuel economy.[136] Staff proposes the consumer information program provide information and suggestions on how to best maintain tires and will include these five important tips on tire maintenance:

Proper Tire Inflation

According to NHTSA, proper tire pressure is the most important part of maintaining your tires, as it affects safety, durability/wear, and fuel consumption.[137] Even with the requirement that all new passenger vehicles built after September 2007 be equipped with a tire pressure monitoring system (TPMS), tires need to be periodically checked. This is because the TPMS activates only when the tires are significantly underinflated.

136 See Pub. Resources Code, § 25773(a)(1)(A)-(D).

137 NHTSA. "Tires," https://www.nhtsa.gov/equipment/tires.

Rotation

Rotating tires at set intervals (that is, each 5,000 miles) will help the tires wear more evenly, extending the life of the tires.

Balancing and Wheel Alignment

Balancing tires and wheel alignment are also important for safety and maximizing tire life. Moreover, when wheels are unbalanced or misaligned, the added friction will negatively affect fuel economy.

Periodic Inspection

Tires should be inspected regularly for worn tread, uneven wear, cracks, and so forth. In addition, if the vehicle is not driving properly and a tire issue is a possible cause, the tires should be inspected immediately by an automotive service professional.

CHAPTER 5:
Proposed and Alternatives Considered

In developing staff's recommended regulatory framework, the CEC considered several alternatives to the proposed rulemaking and tire efficiency program. Under the proposed program, the CEC would:

- Develop and maintain a database for tire efficiency information.
- Establish a rating system, based on an adopted test procedure, for the energy efficiency of replacement tires sold in the state.
- Set minimum performance efficiency standards for replacement tires.
- Require manufacturers to report the energy efficiency of replacement tires.
- Develop an efficient tire consumer information program using point-of-sale information or signs to enable consumers to make more informed decisions when purchasing replacement tires.
- Review and revise the program at least every three years following adoption and implementation.

This chapter briefly discusses the alternative approaches that were considered.

Alternatives Considered

Consumer Information Only

In this scenario, the CEC would develop a consumer information program on fuel-efficient replacement tires. As discussed in Chapters 3 and 4, consumer information on fuel-efficient tires would be made available on the CEC's website as well as other possible means (reports, brochures, conferences, and so forth). In addition, the CEC could continue conducting research on efficient tires and sharing relevant data with consumers. In this scenario, the CEC would not pursue a rulemaking to fully implement the program, resulting in having no requirements for tire manufacturers to submit tire rolling resistance data, CEC developing an efficient tire rating system, or establishing minimum efficiency performance standards.

Establishing a consumer information program only would avoid the work and expense of developing a more robust and comprehensive efficient tire program. However, AB 844 requires the CEC to design and implement such a program. A consumer information-only program would potentially put the CEC in a position of not complying with California statute unless a sufficient rationale was determined that CEC could not reasonably pursue the program described in this report.

In addition, limiting the CEC's efforts to developing only a consumer information program would not provide the substantial environmental, public health, and economic benefits anticipated with the proposed efficient tire program. While consumers would receive general

information on efficient tires, without having access to data on the efficiency of individual tire models, it would be difficult or impossible for consumers to make informed decisions. Furthermore, the substantial estimated energy and cost savings would not be realized. Without access to the efficiency profile of tire models, a consumer information program alone would provide limited value to California consumers.

Tire Efficiency Rating System and Consumer Information Program Only

In this scenario, the CEC would pursue a tire efficiency rating system but not establish a minimum efficiency standard for tire manufacturers. This effort would still require a rulemaking to develop a regulation to compel tire manufacturers to report data periodically on the rolling resistance of their replacement tires to be sold in the state. The reported data would provide valuable information to allow consumers to be better informed on the impacts to fuel economy based on individual tire models, especially when combined with a robust consumer information program.

Voluntary tire rating programs, like the one implemented in Japan, are considered voluntary in that efficiency information is made available to the public through a rating system (that is, the most efficient tires are rated AAA, the next best are rated AA, then A, B and C). But tire manufacturers are allowed to continue producing and selling high rolling resistance tires. Consequently, any energy, economic, or environmental benefits depend on the effectiveness the program has on consumers choosing more efficient tires.

Under this scenario, they still must meet the reporting requirements. But without a minimum standard or threshold for energy efficiency, tire manufacturers are allowed to continue selling all current tire models, including inefficient, high rolling resistance tires. Further, they could even introduce new tires with poor energy efficiency.

CEC staff research on this topic showed mixed results with rating systems that were strictly voluntary programs. Staff believes that most of the estimated benefits anticipated from the proposed program would be lost due to the reliance on consumer behavior. Furthermore, by not implementing a minimum efficiency standard, any incentive to push the industry to advance tire technology in areas of efficiency would be lost. Finally, without a clear explanation and rationale for why a minimum efficiency performance standard cannot be established, the CEC would potentially not be in compliance with AB 844.

Establishing Different Levels for a Minimum Efficiency Performance Standard

Staff proposes to establish a minimum efficiency performance standard for replacement tires of no greater than 9.0 RRC by 2026, followed by a drop in the standard to no greater than 7.0 RRC in 2028 and thereafter. However, staff considered several scenarios, including higher and lower RRC levels and having the standard constant over time versus a phased-in approach.

If the standards are set much lower than 7.0 RRC, they would be expected to result in additional fuel saved, along with commensurate benefits. However, staff believes that setting the standards too low may result in negative consequences, including possible higher manufacturing, research, and development costs for the tire industry and possible loss of business because of a more limited product suite available to California consumers. These

results may also limit the supply and variability of tires offered to consumers in California because of a large percentage of current tire models not being able to meet a more stringent efficiency standard.

Staff also considered setting a less stringent minimum efficiency performance standard. In this scenario, it may be easier and potentially less costly for the tire industry to meet the standard. Consumers in the state would likely have a wider selection of tire models to choose from. However, in this scenario, consumers would miss out on the fuel savings and environmental and health benefits associated with more fuel-efficient tires. The state's goals to address climate change (GHG emission reductions) and air quality (criteria pollutants and toxic air contaminants) would also suffer, commensurate with where the efficiency standards were set.

Delay Program Implementation

Another option that was considered is to postpone implementation of the program for an extended period, that is, several years. The primary benefits to delaying the program would be there would be less of an effect on tire manufacturers and retailers and potentially no change or limitation to a wide variety of tire types.

While not intended, the implementation of this program has been delayed several years. There are several reasons for this delay as discussed in other sections of this report. The consequence of this delay has meant that the bold and worthwhile goals codified in AB 844 have not been realized. Any further delay of program implementation would mean that the substantial benefits to California consumers and the environment would not be realized over the life of this program.

Do Nothing

In this scenario, the CEC would not pursue an efficient tire program. This option would require little or no further work by the CEC and its contractors. This approach would also ignore the requirements of AB 844. Consumers would continue to lack accurate information on the relative efficiency impacts of various replacement tire models, and the energy and cost savings, as described with other alternatives, would not be realized.

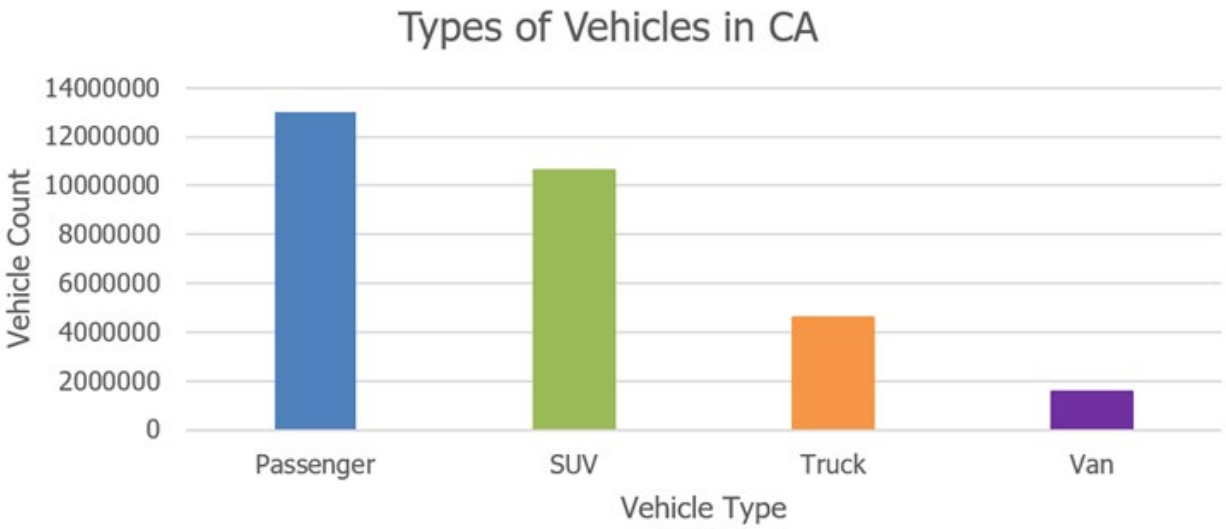
Public Input

The CEC encourages industry, interested stakeholders, and the public to provide comments and suggestions on the alternatives described above, as well as other alternatives and approaches. At the workshop(s) planned during the development and rulemaking phases of this program, the public can provide verbal comments, written comments, or both. Comments may be submitted to the docket and available to the public. Comments provided during the rulemaking will be considered and responded to, as appropriate.

CHAPTER 6:
Technical Feasibility

To determine the technical feasibility of a minimum tire efficiency standard, the CEC considered the values of costs, safety, and treadwear for the tire industry and consumers, and the life-cycle cost to consumers of a standard. Building on past tire testing under the Replacement Tire Efficiency Program, the CEC developed a plan to test a sample consisting of 149 tire models to better understand key attributes of replacement and OE tires regarding safety, longevity, and efficiency attributes. To provide a good representation of the California tire market for testing, the CEC selected tires based on the multiyear, high-volume, vehicle registration list to test for rolling resistance and wet grip. The test results of these tires provide insights about the range of tire efficiency and safety. Typical rim sizes and tire specifications for each car model were also selected. CEC staff evaluated the results of the 149 tire models tested by Smithers and determined that, based on the test results, the proposed efficiency standards are technically feasible based on currently available tire models in the market. Figure 12 displays a breakdown of the light-duty vehicle registrations in California separated into four vehicle types: Passenger car, SUV, Truck, and Van.

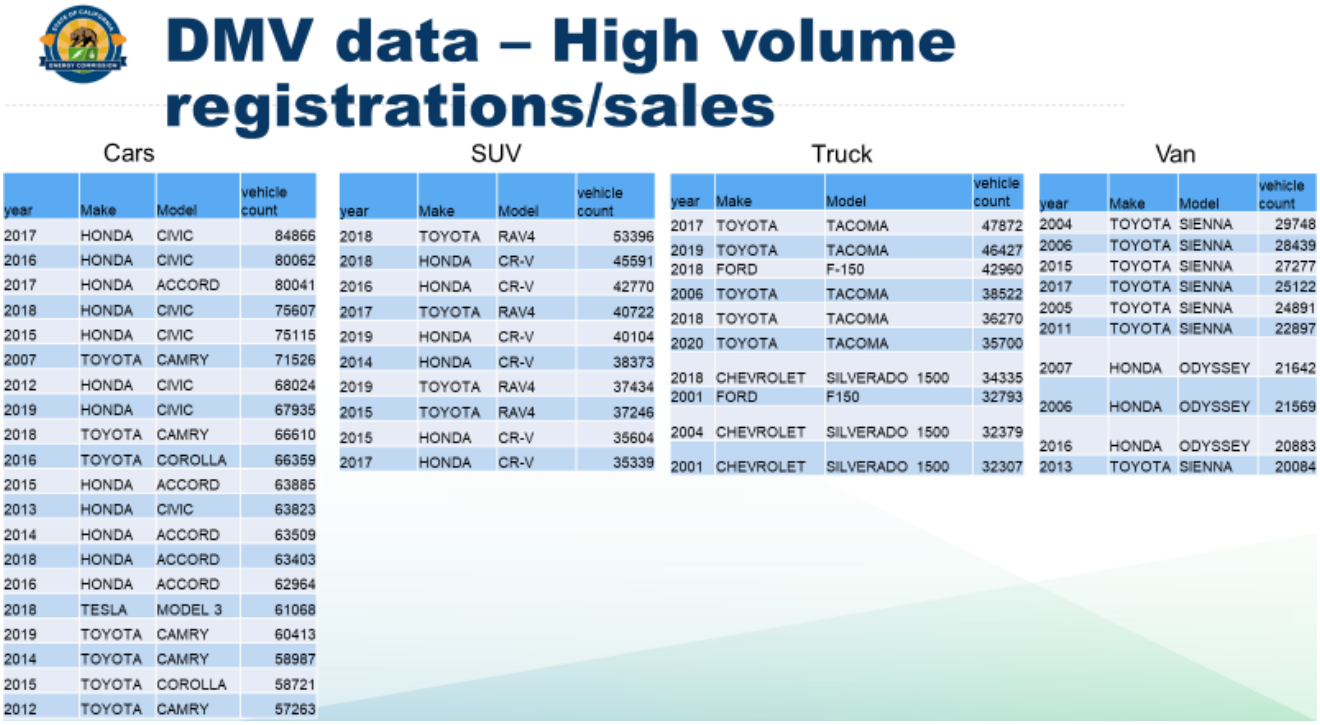
Figure 12: California Passenger Vehicle Type Cumulative Registrations Through 2020



Source: CEC staff/DMV Data

Using the highest population of vehicle registrations for the four vehicle types, 149 tire models were selected for testing. Figure 13 below shows which vehicles were selected to choose tires for testing. Staff reviewed several different vehicles to investigate other vehicle manufacturers and ZEVs, outlined in Appendix D.

Figure 13: Staff Analyses of High-Volume Vehicle Registrations



DMV data – High volume registrations/sales

Cars

year	Make	Model	vehicle count
2017	HONDA	CIVIC	84866
2016	HONDA	CIVIC	80062
2017	HONDA	ACCORD	80041
2018	HONDA	CIVIC	75607
2015	HONDA	CIVIC	75115
2007	TOYOTA	CAMRY	71526
2012	HONDA	CIVIC	68024
2019	HONDA	CIVIC	67935
2018	TOYOTA	CAMRY	66610
2016	TOYOTA	COROLLA	66359
2015	HONDA	ACCORD	63885
2013	HONDA	CIVIC	63823
2014	HONDA	ACCORD	63509
2018	HONDA	ACCORD	63403
2016	HONDA	ACCORD	62964
2018	TESLA	MODEL 3	61068
2019	TOYOTA	CAMRY	60413
2014	TOYOTA	CAMRY	58987
2015	TOYOTA	COROLLA	58721
2012	TOYOTA	CAMRY	57263

SUV

year	Make	Model	vehicle count
2018	TOYOTA	RAV4	53396
2018	HONDA	CR-V	45591
2016	HONDA	CR-V	42770
2017	TOYOTA	RAV4	40722
2019	HONDA	CR-V	40104
2014	HONDA	CR-V	38373
2019	TOYOTA	RAV4	37434
2015	TOYOTA	RAV4	37246
2015	HONDA	CR-V	35604
2017	HONDA	CR-V	35339

Truck

year	Make	Model	vehicle count
2017	TOYOTA	TACOMA	47872
2019	TOYOTA	TACOMA	46427
2018	FORD	F-150	42960
2006	TOYOTA	TACOMA	38522
2018	TOYOTA	TACOMA	36270
2020	TOYOTA	TACOMA	35700
2018	CHEVROLET	SILVERADO 1500	34335
2001	FORD	F150	32793
2004	CHEVROLET	SILVERADO 1500	32379
2001	CHEVROLET	SILVERADO 1500	32307

Van

year	Make	Model	vehicle count
2004	TOYOTA	SIENNA	29748
2006	TOYOTA	SIENNA	28439
2015	TOYOTA	SIENNA	27277
2017	TOYOTA	SIENNA	25122
2005	TOYOTA	SIENNA	24891
2011	TOYOTA	SIENNA	22897
2007	HONDA	ODYSSEY	21642
2006	HONDA	ODYSSEY	21569
2016	HONDA	ODYSSEY	20883
2013	TOYOTA	SIENNA	20084

Source: CEC staff/California DMV data

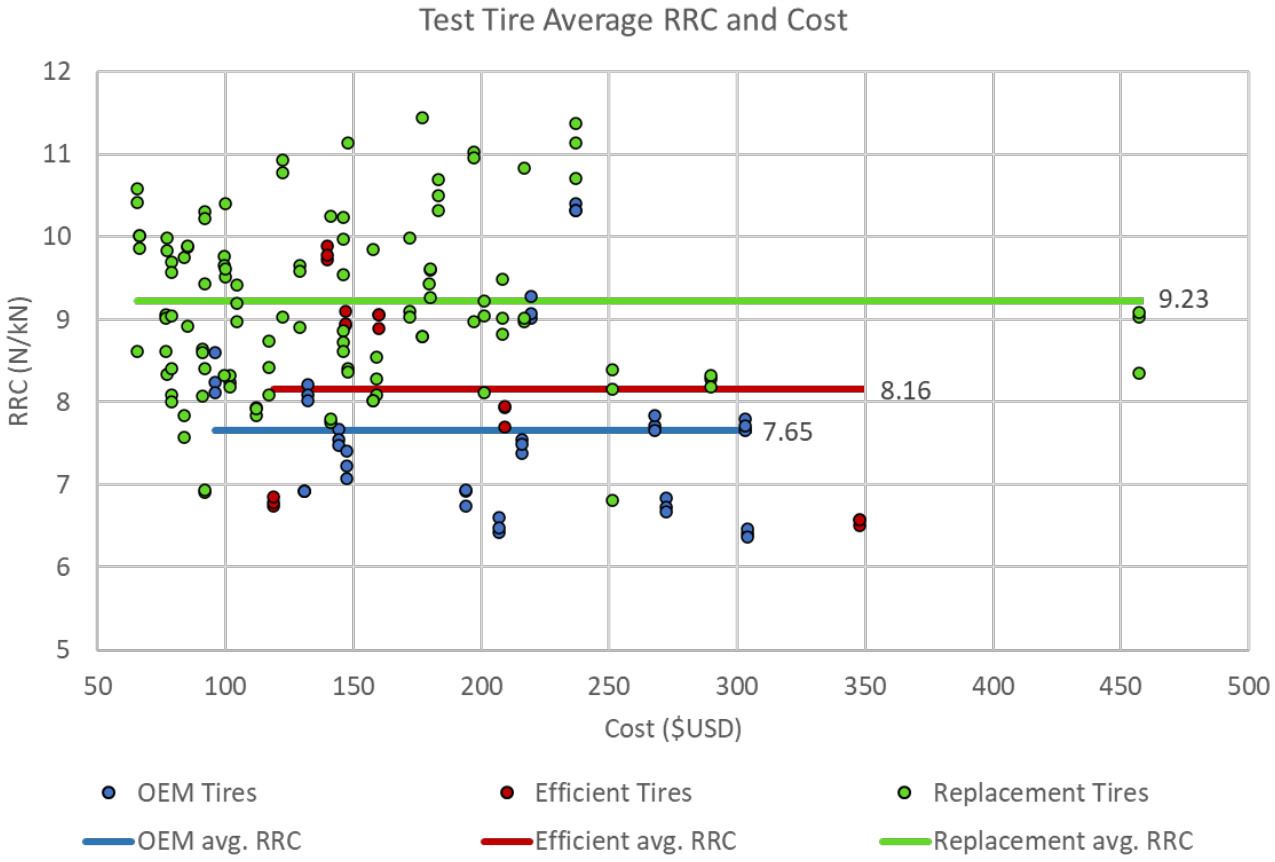
Smither's Scientific Test Labs Tire Testing Results

The following sections analyze the tire test results of rolling resistance with respect to cost, safety, and tire life.

High Efficiency and Cost

A primary goal of AB 844 is to have replacement tires be as efficient as OE tires. The following graph displays the results of the tires tested with the associated rolling resistances and costs, separated into three categories: OE, replacement, and efficient tires. 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 and are not necessarily attributed by a performance characteristic or objective testing results. Tires designated as efficient could also be included in the replacement tire market.

Figure 14: CEC Tire Test Program Results of RRC vs. Cost



Source: CEC staff

In Figure 14, the average RRC is resulting from each tire model being tested in triplicate. The average RRC with designations of OE, efficient, and replacement tires are 7.65, 8.16, and 9.23 respectively. (A lower RRC represents a more efficient tire.) On average, OE tires are more efficient than replacement tires. The goal of these standards is to help shift the averages of replacement and efficient tires toward the OE average. It is technically feasible to make replacement tires that are as efficient as OE tires because there are several replacement tires in today's market that already do without a substantial increase in costs to the consumer.

It should be noted that the tire data produced by Smithers and used here was not calibrated with the virtual testing equipment for rolling resistance now widely used in the European Union. As a result, the data obtained from Smithers will show slightly different results. These two approaches can be easily harmonized with the application of RRC corrections, which may

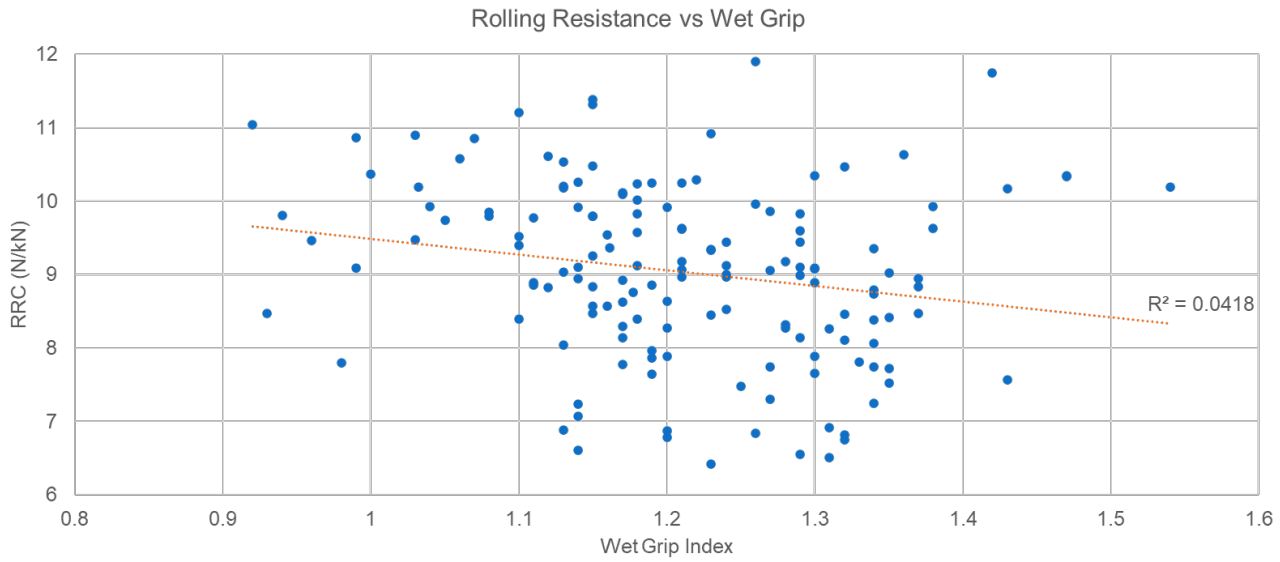
be done for future testing efforts by the CEC for this program. Additional information can be found in Smithers Final Report developed for this effort.[138]

Safety

In general, testing data indicate that more efficient tires should be at least as safe as existing tires and do not necessarily equate to a shorter tire life.

Wet grip is a measure of how quickly a tire can stop on wet roads and is widely used as an indicator of safety, which is discussed more in Chapter 9. In Figure 15, a higher wet grip index value represents a shorter stopping distance on a wet surface. AB 844 states that any minimum standards implemented shall not have an adverse effect on safety. From the results of the data, there are data sets that have a high wet grip index and a low RRC, which indicate that more efficient tires should be at least as safe as existing tires.

Figure 15: RRC vs. Wet Grip Index



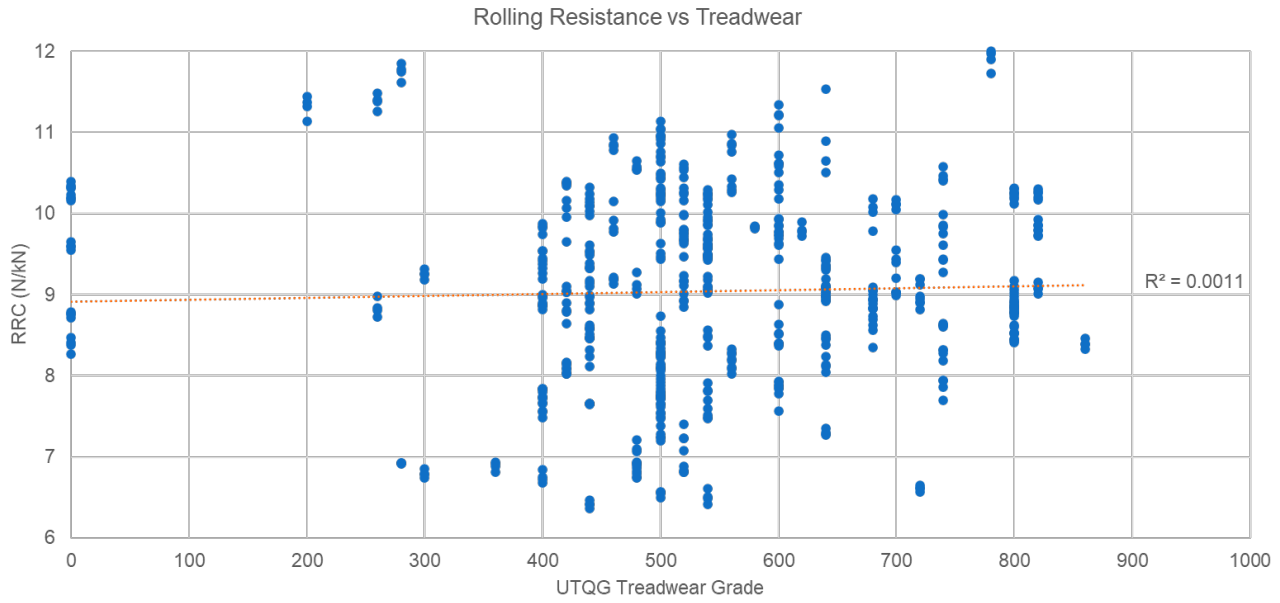
Source: CEC staff

Tire Life

A higher UTQG Treadwear grade represents a longer tire life. In Figure 16, the data from the test results do not appear to have a strong correlation between efficiency and treadwear, according to the low R^2 value, meaning efficient tires do not necessarily equate to a shorter tire life.

[138] Smithers, Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844. January 2023. Smithers File No. F49432BS

Figure 16: RRC vs. Treadwear



Source: CEC

Considering the results from the tires tested, staff concluded that the current market has sufficient options for consumers and that the proposed standards are technically feasible in regard to cost and efficiency, with no significant impact on safety or tire life.

CHAPTER 7:
Energy Use of Tires

Several key factors contribute to energy losses for on-road vehicles. This report focuses on the losses that occur from tire rolling resistance. As discussed, tire rolling resistance occurs primarily due to deformation of the tire during contact with the road. The test procedure commonly used to measure rolling resistance of tires is referred to as ISO 28580. Two of the key outputs from the test procedure are the rolling resistance force (RRF), which is measured in newtons, and rolling resistance coefficient (RRC), which is the RRF normalized by the force applied to the tire as a proxy of vehicle weight.

The RRF is a force that opposes the direction of motion of the vehicle, similar to aerodynamic drag. To maintain speed, a vehicle must produce an equal counterforce for the RRF of the tire.

A vehicle generates this counterforce by consuming fuel in a motor to generate torque on the tire through the drivetrain. This fuel-to-tire pathway adds significant energy losses to overcome rolling resistance. The efficiency of these pathways varies significantly by fuel, as seen in Table 9 below. These inefficiencies magnify the energy losses in the tire. For example, a gasoline ICE vehicle would see roughly three times the energy losses in the tire through the engine and drivetrain.

Table 9: Estimated Fuel-to-Wheel Efficiency for Various Fuel Types

Fuel Type	Fuel-to-Wheel Efficiency
Gasoline	27%
Diesel	33%
Electricity	74%
Hydrogen	45%

Source: CEC staff

Rolling Resistance Force and Coefficient

The rolling resistance is tested using ISO 28580, as directed by NHTSA.[139] The testing is conducted at 80 percent of the rated load of the tire and at a speed of about 50 miles per hour. The RRC is calculated from testing by dividing the resulting RRF by the associated load as described in the equation below.

139 Code Fed. Reg., Tit. 49, § 575.106.

Figure 17: Equation for Rolling Resistance Coefficient

$$RRC = \frac{1000 \times RRF}{Load}$$

Source: CEC staff

The rolling resistance forces of a car and truck at different load indices are shown below in Table 10.

Table 10: RRC and RRF of a Car and Truck at Different Load Indices

Car RRC	Car RRF	Car Load Index	Truck RRC	Truck RRF	Truck Load Index
12	63.1	94	12	99.8	110
11	57.8	94	11	91.5	110
10	52.6	94	10	83.2	110
9	47.3	94	9	74.9	110
8	42.1	94	8	66.6	110
7	36.8	94	7	58.2	110
6	31.5	94	6	49.9	110

Source: CEC staff

The RRC therefore forms a metric that measures losses relative to the useful purpose of carrying load. Using RRC allows performance parameters to be set without fine tuning for vehicle classes or load indices. Table 10 shows this relationship, where the same RRC for a car tire can be accomplished by a truck tire despite the truck tire having a larger RRF.

Calculating Tire Energy Use

The lifetime energy usage of a tire can be calculated using three primary components: tire life, RRF, and the fuel conversion efficiency of the vehicle. First, the amount of energy directly dissipated from rolling resistance is simply the RRF multiplied by the distance the tire will travel. Tire life is a representation of how far a tire will travel before being replaced. Therefore, multiplying the tire life by the associated RRF will result in an estimate of the energy dissipated in the tire over the lifetime — this can be thought of as wasted energy. The calculations used for this report assume a standard lifetime of a tire of 45,000 miles.

The tire losses can be converted to fuel loss by considering the energy content of the fuel and the vehicles fuel conversion efficiencies.

Figure 18: Equation for Lifetime Energy Loss

$$Lifetime\ Energy\ Loss = \frac{RRF \times Distance\ (in\ meters)}{Vehicle\ fuel\ conversion\ and\ drive\ train\ losses}$$

Source: CEC staff

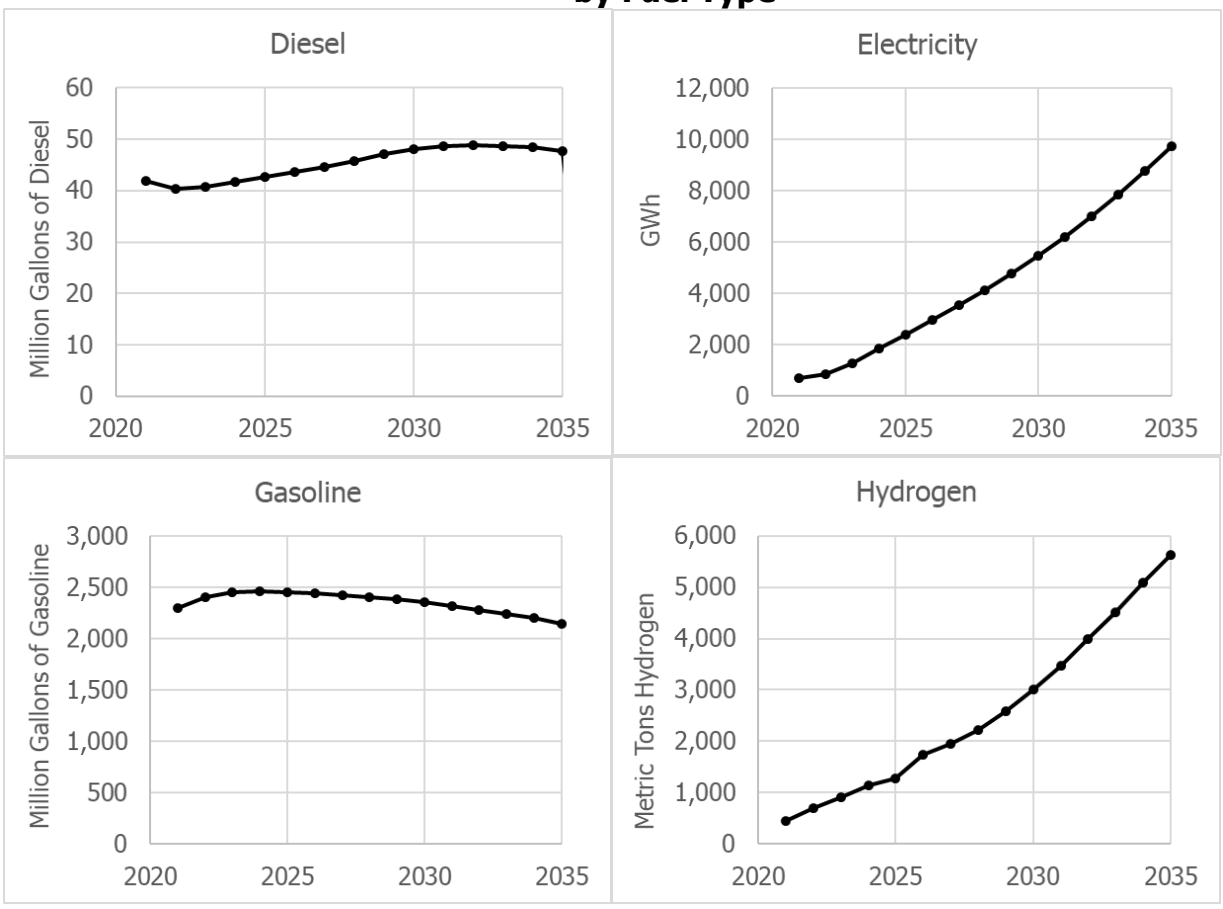
For an example, consider a gasoline car tire with a 10 RRC from Table 10 and a 45,000-mile life. Those energy losses due to the tire are equivalent to 117.3 gallons of gasoline (14.1 gigajoules) over the useful life of the tire.

Calculating statewide annual energy use by tires is done with a slightly different method than the lifetime calculation above. Instead of using the lifetime of the tire as the distance, the Energy Commission's forecast of statewide vehicle miles traveled (VMT), by fuel and vehicle class, is used. The RRF value used is the average RRF of a vehicle class, as supported by testing data. Staff adjusted the average RRF to evaluate the energy savings of potential minimum efficiency standards by adjusting the performance of less efficient tires to meet the standard and then recalculating the average RRF.

Statewide Energy Use

Using the methods described in the chapter, in combination with tire performance test data and the CEC's VMT forecast, the following charts show the statewide energy consumption that can be associated with tire losses, assuming performance stays constant.

Figure 19: Baseline Statewide Energy Consumption from Rolling Resistance Losses by Fuel Type



Source: CEC staff

The shape of these curves reflects changing dynamics in the vehicle fleet in California. The consumption of electricity, and to a lesser extent hydrogen, is expected to grow rapidly because the population of vehicles that use that fuel is predicted to increase. Fluctuations in diesel and gasoline are driven by substitution with alternative fuels, as well as trends in vehicle classes such as the trend toward SUVs.

CHAPTER 8:
Savings and Cost Analysis

This chapter examines the costs, savings, and ultimately cost-effectiveness of using lower rolling resistance tires. The relationship between cost and savings is important to the proposal for minimum performance standards and the consumer information program. One of the conditions for setting an efficiency standard under AB 844 is that it is "technically feasible and cost effective." Quantifying the savings to consumers is also key to be able to explain the value of improved efficiency to prospective tire purchasers, and what benefits a certain efficiency rating could bring compared to another. AB 844 goes on to define cost-effectiveness 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."

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. Vehicles in California use several fuels and technologies to convert those fuels to torque and kinetic energy. The primary fuels evaluated are gasoline, electricity, diesel, and hydrogen. Each fuel has a different price. For this evaluation, the costs were assumed to be flat over time and are shown in Table 11 below.

Table 11: Fuel Cost Per Unit

Fuel Type	Cost per unit
Gasoline	$4.60 per gallon
Electricity	$0.25 per kWh
Diesel	$4.60 per gallon
Hydrogen	$10 per kg

Source: CEC staff

These costs can then be multiplied by the amount of energy loss a tire causes over the tire life to generate an estimate of fuel costs.

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 drive demand and, therefore, retail price to the point of obscuring small changes in manufacturing costs. For example, the *Tires and Passenger Vehicle Fuel Economy*[140] report shows improvement can be made for less than $0.50 (2006 dollars); so without any markup, a theoretical $100.00 tire would become a $100.50 tire. However, such a small increase would easily be overshadowed by other market factors. The analysis of retail price and rolling resistance shows no correlation for the most recent CEC test data; nor has it shown correlation in any of the other reviewed studies from the past. CEC staff assumes that the incremental manufacturing cost to produce more efficient tires is small, but it does not mean that it is zero.

Several efforts have been made over the years to estimate what the incremental cost might be of more fuel-efficient tires. They range from negligible to $10 per tire. Table 12 shows some of these estimates.

140 National Research Council of the National Academies. 2006. *Tires and Passenger Vehicle Fuel Economy: Informing Consumers, Improving Performance.* Transportation Research Board Special Report 286, https://onlinepubs.trb.org/onlinepubs/sr/sr286.pdf.

Table 12: Summary of Estimates for Incremental Cost of Fuel-Efficient Tires

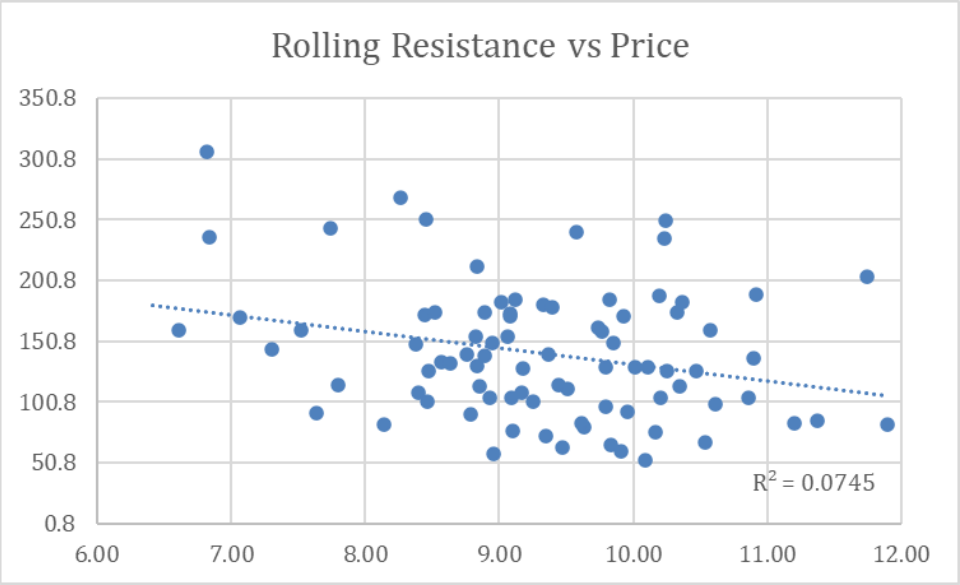
Publication	Date	Incremental Cost	Improvement to RRC
Tires and Passenger Vehicle Fuel Economy	2006	$1.00	10%
Draft Joint Technical Support Document: Proposed Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards[141]	2011	$1.50 $11.00 page 3-187	10% 20%
NHTSA Final Rule, 75 FR 15894-01	2010		Compliance costs

Source: CEC staff

For cost-effectiveness calculations in this report, staff selected incremental costs from Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Fuel Economy Standards as the most recent sources and because they went through thorough stakeholder processes by the U.S. EPA and NHTSA. Staff also compared the purchase price of tires selected for testing to the associated rolling resistance, as shown in Figure 20.

[141] California Air Resources Board. *Draft Joint Technical Support Document: Proposed Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards.* https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F1E5.PDF?Dockey=P100F1E5.PDF

Figure 20: Tire Rolling Resistance Compared to Price



Source: CEC staff

The resulting correlation was 0.0745, suggesting no 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 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 Figure 21 taken from the *Tires and Passenger Vehicle Fuel Economy* report.

Figure 21: A Comparison of Price and Rolling Resistance

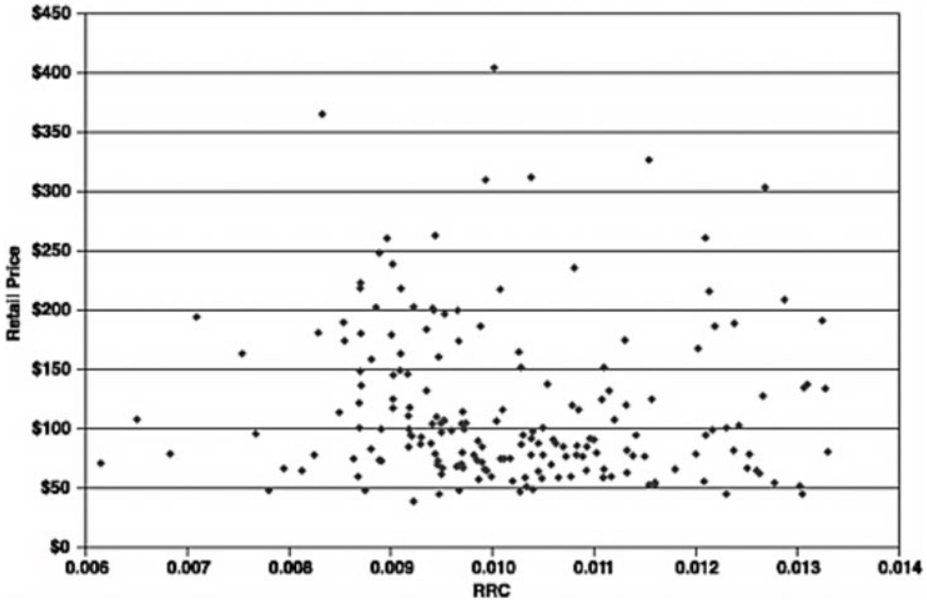


FIGURE 5-1 Retail price versus RRC for tires in combined Ecos Consulting and RMA data.

Source: National Research Council of the National Academies

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 the installation. The data gathered on tire efficiency do not point to a relationship to tire life, meaning it 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.

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 lifetime of the tire.

End-of-Life Costs

Tires are a significant source of waste. In California, there are state programs created to reduce negative impacts of this waste. As mentioned in the installation cost section, there is no expected change in the useful life of the tire because of the proposed program. Therefore, there is no expected increase, nor decrease, in the volume of tires in need of disposal from this proposal. In addition, the material and design changes in the technology chapter of this report would not require significant changes to the current tire waste approach. Therefore,

staff estimates the proposals would not lead to higher incremental costs for recycling and waste disposal of energy-efficient tires.

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.

Figure 22: Life-Cycle Cost Equation

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

Source: CEC staff

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

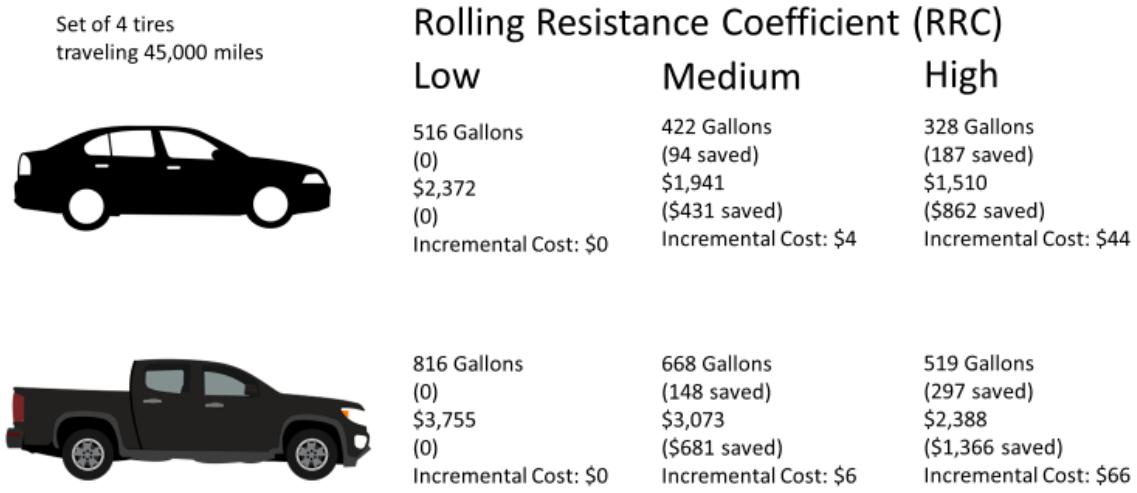
Figure 23: Relative Cost-Effectiveness Equation

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

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. Figure 24 shows the relative costs for a car and truck and a set of four tires at different rolling resistances.

Figure 24: Relative Cost-Effectiveness Comparison Among Various RRCs



Source: CEC staff

The incremental cost of truck tires in Figure 24 was simply increased by about 50 percent because of the larger size of the tires and the trend for costs to scale to rubber volume and rim size. No discount rate is used.

The operating costs of 7 RRC tires (among the best available) are significantly lower than that of 11 RRC tires (among the worst available). For a typical passenger vehicle, the operating cost savings is $862 and for a truck $1,366 over the life of a full set of tires. The savings are larger than the $44 and $66 incremental cost for the set of tires, with a payback at roughly 2,200 miles traveled, or based on 12,000 miles traveled in a year a payback of just over two months. The savings are much larger than the costs, demonstrating the proposed standards are cost effective.

Compliance Costs

CEC staff investigated further costs that might be passed to consumers because of the proposed regulation. These include costs for testing and certification of replacement tire products. NHTSA estimated these costs to be $3,727,000, with ongoing costs of $22,500 per year. These cost estimates were based on 2010 testing costs, when adjusted for inflation that would be equivalent to $5,106,000 one-time costs and ongoing costs of $30,825 per year. However, a significant number of tires are tested to the required parameters as a baseline because of international regulations such as those in effect in the European Union. 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 if it were absorbed by national tire sales.

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 the state over the long term. How much energy (petroleum, electricity, and hydrogen) savings are realized will ultimately depend on the stringency of the minimum efficiency performance standard, the timing for starting and phasing in the program, and the compliance rate by tire manufacturers and retailers. Based on the proposed minimum efficiency standards, Table 13 shows the theoretical potential fuel savings. Staff assumes a compliance rate of 85 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.

Table 13: Estimated Reduction in Fuel Use in 2035

Fuel Type (Units)	Estimated Potential Annual Reduction
Diesel (Gallons)	9,678,528
Gasoline (Gallons)	430,481,525
Electricity (Gigawatt-hours)	1,996
Hydrogen (kilograms)	1,181,657

Source: CEC staff

CHAPTER 9:
Safety and Environmental Impacts Analysis

Safety Analysis

For a vehicle, tires are the only point of contact with the road. Consequently, tires play a significant role in vehicle safety. Since there can be an inverse relationship between rolling resistance and tire grip (traction), minimum efficiency performance standards or thresholds must ensure no significant degradation to tire safety as a consequence of improved rolling resistance. AB 844 makes this a requirement. Section 25773 includes language that states: "Energy efficiency standards adopted ... (shall) not adversely affect tire safety." Several key factors affect tire safety, including tread depth, durability, load, heat rating, dry grip, and wet grip. Factors beyond the tire composition and design affect safety as well, such as tire inflation, tire condition, driving surface, weather conditions, speed, and so forth, but are beyond the scope of this report. These factors are not expected to be any different for more efficient tires.

For the Replacement Tire Efficiency Program, wet grip is being used as a proxy for safety. Wet grip is a measure of how quickly a tire can stop on wet roads; the test is widely used as an indicator of safety.[142] Several regions and countries include wet grip ratings in their mandatory tire labeling program, including Korea, Japan, and the European Union, as discussed previously. In addition, NHTSA's UTQG standard requires that tires be labeled with a measure of the wet braking traction performance (referred to as "Traction" on the sidewall of the tire), which includes ratings of AA (best), A, B, or C.

CEC staff also researched possible tradeoffs of safety with low rolling resistance tires. As discussed, of the numerous performance characteristics associated with vehicle tires (noise, load, comfort, handling, traction, and so forth), changes in tire design and composition to increase a certain characteristic can result in a trade-off or degradation in other characteristics. A 2009 NHTSA report[143] on developing a consumer information program on efficient tires states:

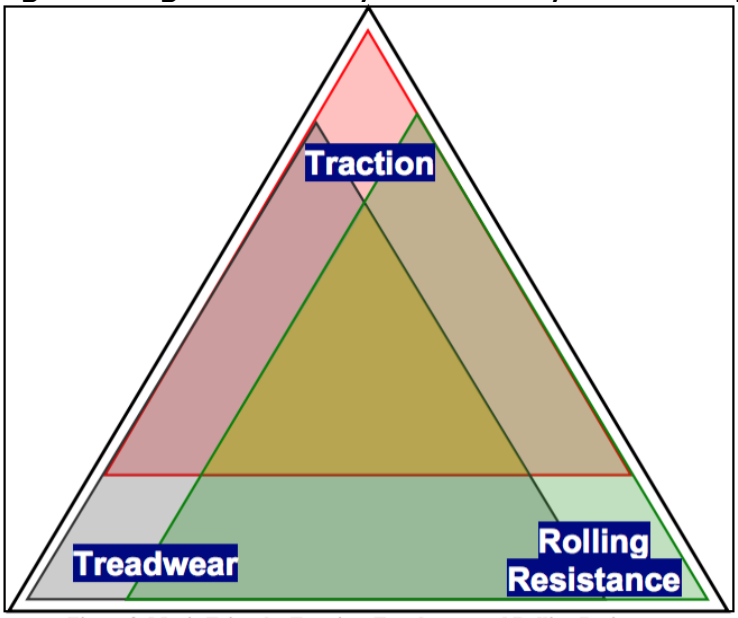
> "While the hysteretic losses of the tire (primarily the tread) consume a large amount of the available tractive energy, the tires also provide the traction necessary to start, stop, and steer the vehicles. Substances soft enough to provide traction on wet, dry, snow, dirt, gravel, etc., surfaces will also wear. Therefore, the topics of rolling resistance,

142 Pike, Ed. The International Council on Clean Transportation. 2011. "Opportunities to Improve Tire Energy Efficiency." *White Paper No. 13, http://large.stanford.edu/courses/2015/ph240/dominguez2/docs/pike.pdf*.

143 NHTSA. 2009. *NHTSA Tire Fuel Efficiency Consumer Information Program Development: Phase 2 – Effects of Tire Rolling Resistance Levels on Traction, Treadwear, and Vehicle Fuel Economy*. Publication Number: DOT HS 811 154, https://www.nhtsa.gov/sites/nhtsa.gov/files/fmvss/Laboratory_Test_Protocols.pdf.

traction, and treadwear are linked in what the tire industry refers to as the 'magic triangle' (Figure 3 [of the NHTSA report]). The triangle is a useful graphic since it conveys the point that a shift to improve properties in one corner of the triangle can diminish properties in both of the other corners if more advanced and often more expensive tire compounding and construction technologies are not employed."

Figure 25: Magic Triangle: Traction, Treadwear, and Rolling Resistance



Source: NHTSA[144]

Despite the potential tradeoff, staff research did not uncover evidence that lower rolling resistance tires showed a significant decline in wet grip or other measures that would affect vehicle safety. As tire design and composition has advanced in recent years, these trade-offs are being minimized or effectively eliminated. For example, silica is a commonly used compound in tire tread to improve tire efficiency (lower rolling resistance) while maintaining traction and treadwear.[145]

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 they 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

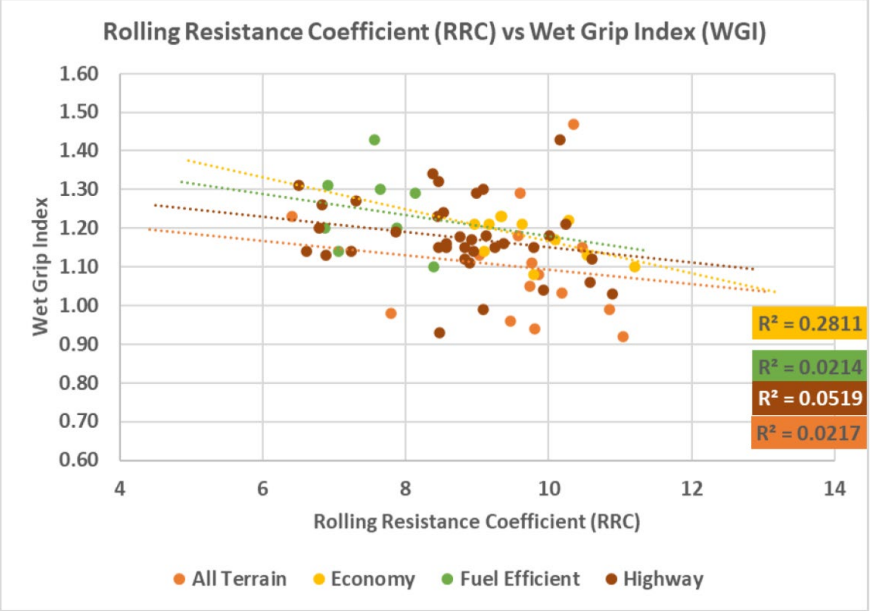
[144] Ibid

145 Sattayanurak, S., W. M. Noordermeer, K. Sahakaro, W. Kaewsakul, W. K. Dierkes, 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*. Hindawi. Article ID 5891051.

need to sacrifice traction (safety) or tread life (durability)."[146] While the statement refers to original equipment (OE) tires used on new vehicles, it underscores the technological improvements anticipated throughout the tire industry. Importantly, the fact that both OE and EV-specific tires are being produced cost-effectively to possess high efficiency (low or ultra-low rolling resistance) without sacrificing safety provides useful context.

As part of the CEC's efforts to test tires for the Replacement Tire Efficiency Program, wet grip tests were conducted on 149 tire models. The results of the wet grip tests were plotted against RRC values. The results showed a 0.037 R^2 value (or coefficient of determination), suggesting that these two key attributes of wet grip and efficiency are not strongly correlated. One example is illustrated in Figure 26, where rolling resistance is compared against wet grip for various tire types included in the CEC testing program. The trends for these specific tire types shows a minor inverse correlation between rolling resistance and wet grip, where wet grip increased with declining rolling resistance coefficient, although the R^2 values tended to be low. 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, per Assembly Bill 844 January 2023[147]

Figure 26: Smithers Test Results Comparing Rolling Resistance Coefficient Versus Wet Grip Index



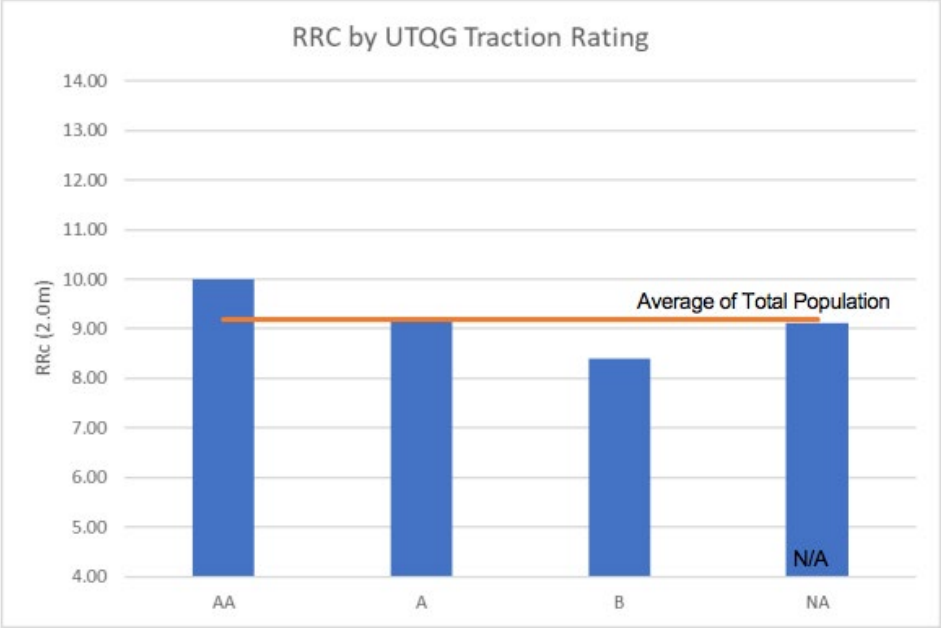
146 U.S. EPA, NHTSA. 2012. *Joint Technical Support Document: Final Rulemaking for 2017–2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards.* Publication Number: EPA-420-R-12-901, https://www.nhtsa.gov/sites/nhtsa.gov/files/joint_final_tsd.pdf.

147 Smithers, Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844. January 2023. Smithers File No. F49432BS

Source: Smithers[148]

In addition to conducting tests for wet grip, Smithers compared the tire rolling resistance (RRC) results against the UTQG standard for traction on the tires that were tested under this program. The results, displayed below, showed that the tires with the lowest rolling resistance (most energy efficient) had, on average, a lower traction rating.

Figure 27: Total Tire Population Rolling Resistance Coefficient vs. UTQG Traction Rating



Source: CEC staff/Smithers

Note: LT tires do not have UTQG ratings

The results show some correlation between rolling resistance and wet grip (traction). This correlation is an area worth monitoring and may warrant additional testing to ensure no compromises on safety. However, based on tire testing to date conducted for this program, along with research of the current literature, staff does not anticipate any material effect on safety as the result of key requirements of this program, in particular, the establishment of minimum efficiency performance standards. CEC staff invites any parties that may have additional data regarding the correlation of rolling resistance and wet grip to provide data, along with any relevant insights regarding this important area.

[148] Smithers, Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844. January 2023. Smithers File No. F49432BS

Environmental Impact Analysis

As discussed in this report, staff anticipates substantial environmental benefits as the result of the Replacement Tire Efficiency Program. Potential environmental impacts to be realized with program implementation are provided in the following overview. The anticipated fuel savings as the result of this program can be illustrated through the displacement of vehicles from California roads. For example, if the program results in a 1 percent fuel savings from, on average, lower rolling resistance tires, the effect is similar to removing 1 percent of vehicles from California roads. With 29 million passenger vehicles and light trucks in California, a 1 percent fuel savings would equate to removing 280,000 vehicles from the road. (Reference the Estimated Energy Savings included in Chapter 8.)

Estimated Reduction in Greenhouse Gas Emissions

As discussed, passenger cars and trucks are major contributors of greenhouse gas (GHG) emissions in the state and are being targeted to reduce the risks associated with climate change. Carbon dioxide (CO_2) is a major component of gasoline vehicle emissions and an important GHG. According to the U.S. EPA, each gallon burned emits 8,887 grams of CO_2, and each gallon of diesel burned emits 10,180 grams CO_2.[149] In addition to CO_2 emissions, there are other sources of GHGs that are produced from vehicles that run on fossil fuels (gasoline and diesel). These 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 (GWP) than CO_2, meaning that on a per unit basis these compounds have a higher impact on warming the atmosphere than CO_2 and some other GHGs.[150]

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

150 Ibid.

In addition to tailpipe emissions, the production and distribution of fossil fuels produce GHGs, so-called "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 emissions of GHGs. Electric vehicles (EVs) have no tailpipe emissions. However, emissions are created during the production and distribution of the electricity used to fuel the vehicle.[151] Further, reduced EV range will result in the need for more publicly accessible EV charging stations, the deployment of which have a cost. CEC modeling for diesel and gasoline vehicles includes tailpipe emissions, while EV and FCEV use upstream emissions.

The proposed Replacement Tire Efficiency Program will result in more energy-efficient tires, which will directly reduce GHG emissions because of the reduced consumption of transportation fuels, as described above. Staff estimates are in the table below, which is a theoretical potential reduction based on the proposed minimum efficiency performance standard, shown as carbon dioxide equivalent (CO_2e).[152] The economywide emissions for California were 404.5 $MMTCO_2e$, and the 5.4 $MMTCO_2e$ reduction would be an important contribution.[153]

Table 14: Estimated Potential Annual Reduction in CO2 in 2035

Units	Estimated Potential Annual Reduction
Million Metric tons (MMT) CO_2 equivalent	5.4

Source: CEC staff

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

151 Ibid.

152 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 (i.e., methane) to the equivalent amount of carbon dioxide with the same global warming potential.

153 CARB. 2022. "California Greenhouse Gas Inventory for 2000-2020 — by Category as Defined in the 2008 Scoping Plan," https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/ghg_inventory_scopingplan_sum_2000-20.pdf.

premature death.[154] Fossil fuel combustion (primarily gasoline and diesel) from cars, trucks, and SUVs is a major source of criteria air pollutants and their precursors, including oxides of nitrogen (NOx), oxides of sulfur (SOx), $PM_{2.5}$, and ozone.[155]

As a result of the energy savings expected from more efficient tires, a significant reduction in statewide criteria pollutants is anticipated. The reduction in criteria pollutants is estimated as a theoretical potential in the table below.

Table 15: Estimated Potential Annual Reduction in Criteria Pollutants in 2035

Pollutant	Estimated Potential Reduction in 2035 (Tons)
NOx	1485
$PM_{2.5}$	239

Source: CEC staff

Analysis of Tire Waste and Recycling

California generates about 51 million reusable or waste tires each year.[156] 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. 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 used by tire manufacturers to reduce tire cracking and extend the useful life of tires. When tiny particles from worn tires end up on roads, 6PPD can be transformed to the associated toxicant, 6PPD-quinone, which has been found to harm coho salmon and related fish species. To address this concern, the California Department of Toxic Substances Control (DTSC) issued a proposed regulation in May 2022. If approved, the regulation would require tiremakers to look for ways to reduce the use of 6PPD without affecting the functionality or performance requirements of

154 CARB. 2022. *2022 State Strategy for the State Implementation Plan,* https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf.

155 Ibid.

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

their products sold in the state.[157] The DTSC is also studying zinc as a potentially harmful compound found in tires. The proposed efficient tire program is not expected to affect the use of these compounds.

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

Net Environmental Impacts of Proposed Regulation

It is anticipated that the proposed program will lead to overall improved environmental quality in California. The energy saved from a population of more efficient tires will, over the long term, result in substantially less fossil fuel burned (gasoline and diesel), fewer power plants needing to be built (due to reduced electricity consumption by EVs), and less pressure on the limited energy resources, land, and water use associated with 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 carbon emissions (GHGs) over the long term.

157 DTSC. 2022. "News Release: California Proposes Requiring Tiremakers to Consider Safer Alternative to Chemical that Kills Coho Salmon," https://dtsc.ca.gov/2022/05/23/news-release_t-07-22/.

CHAPTER 10:
Economic and Fiscal Impacts

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

Jobs

The effect to jobs of the proposed program can be organized by direct jobs and indirect jobs. Direct job impacts would be in the tire manufacturing, distribution, installation, and maintenance of tires. While the program is estimated to lead to some incremental costs to tires, rooted in manufacturer costs, the manufacture of replacement tires does not occur in California to the best of the CEC's knowledge. The incremental cost may support some incremental jobs in the testing and certification of tires and possibly in the research and engineering work necessary to design tires to comply with minimum standards.
Tires flow through California ports and several large tire distribution centers, which are currently located in Southern California and provide a substantial number of jobs locally.[158] In addition to tire companies with distribution facilities in California, the state has hundreds of traditional (physical location) tire retail stores. These include small and medium size businesses, and better-known large operations, such as tire retailers (i.e., Les Schwab Tire Centers, Discount Tire), tire company retail facilities (i.e., Goodyear Auto Service, Firestone Complete Auto Care), "big box" warehouse-types (i.e., Walmart, Costco), general auto retail/repair facilities (i.e., Pep Boys) and automobile dealerships. In addition, several internet-only companies sell large volumes of tires, including names such as Tirerack.com and online retail giant Amazon.com.

The CEC assumes the volume of tires demanded by the market is relatively inelastic to the small incremental costs created by the program and, therefore, does not estimate a change to the volume of tires sold through distribution and installed by labor in the state. For these reasons the CEC does not estimate job creation or loss in the distribution, installation, and maintenance of tires.

It is important to consider the unique position of small businesses. Unlike larger tire companies, smaller companies often lack the same level of staffing and financial resources and rely to a greater extent on their distributors for compliance with rules and regulations.

However, it is likely that jobs will occur from the indirect effect of the program as it increases individual expenditures on tire goods and decreases expenditures on fuel, with a net savings

158 Examples of tire distribution facilities include Big O Tire Warehouse Distribution Center in Mira Loma, CA, Nexen Tire Distribution Center in Ontario, CA, and Tirerack.com Distribution Center in Santa Fe Springs, CA.

to drivers. This is because the program would redirect expenditures from low labor-intensity sectors of the economy such as electricity generation and fuel refining into higher labor-intensity retail and services sectors. The CEC intends to conduct a more detailed macroeconomic evaluation and quantification of these jobs as the program is further developed.

Business Creation and Elimination

The CEC does not believe the proposed program is likely to lead to the direct creation or elimination of businesses in California. The manufacture 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 rather than create new ones.

Tire retailers will likely see impacts from both increases and decreases in specific tire model lines. These impacts are the result of the least efficient tire models being dropped and the likelihood that new, more efficient models will come into the market. However, overall, the demand for new tires will remain the same as it is driven by road wear and VMT. Therefore, the existing retail environment would remain appropriately sized for the volume of tires needed post regulation.

Business Advantages and Disadvantages

The design of the regulation is to create an even playing field in access to the California replacement tire market. In other words, whether a business was located in California or offering tires to Californians from out of state, the rules would apply equally. Simultaneously, distributors located within the state but offering and shipping tires to other states or countries would be able to continue shipping tires through the state even if they were not allowed to sell them to consumers within the state.

There are possible inequities that could occur in the border regions of the state, where Californian consumers could reasonably seek a tire in an unregulated jurisdiction without great inconvenience. However, the CEC does not expect this to create a major disadvantage both because the California retailers will be able to offer a strong selection of similarly priced tires and because the areas that this occur are generally sparsely populated.

Investment

Because both R&D and manufacturing for the tire industry reside outside California, it is unlikely that significant investments in this area will occur in the state. The state may, however, provide incentives or rebates or both direct to the consumer (or through retailers) to help stimulate the energy-efficient tire market and help address cost (that is, purchase price) impacts to low-income consumers that may result from the proposed program. Any such incentive program may have a modest effect of stimulating the economy statewide and would potentially benefit tire retail companies and tire manufacturers.

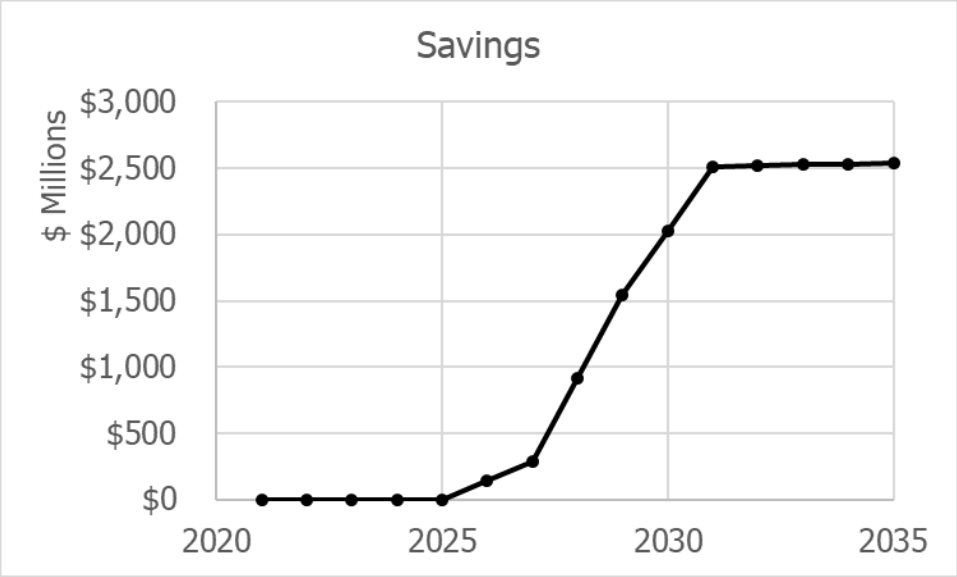
Innovation

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 pushing for energy-efficient tires, including California's. An example is the advancement of quiet tire technology designed to meet the needs of EVs.

Benefits

Finally, the anticipated benefits of the proposed program include substantial savings in fuel use, reduced criteria pollutants and GHG emissions, and public health benefits. Figure 28 below shows the annualized benefit of fuel use reductions caused by the use of more efficient tires required by the proposed program.

Figure 28: Potential Annual Savings from Reduction in Fuel Use



Source: CEC staff

These benefits are further fiscally augmented by air pollution reductions that would produce real health benefits to Californians.

CHAPTER 11:
Consumer Equity

This chapter provides a brief analysis of the Replacement Tire Efficiency Program effects on consumer equity — specifically, how it may impact low-income consumers and disadvantaged communities. Here, disadvantaged communities include areas of California that suffer the most from a combination of economic, health, and environmental burdens. These burdens include poverty, high unemployment, air and water pollution, presence of hazardous wastes, as well as high incidences of diseases such asthma and heart disease. The state identifies these areas primarily by collecting and analyzing information from communities around the state. The state created the analytical tool, CalEnviroScreen, which compares different types of census tract-specific information into a score to determine which communities are the most burdened or "disadvantaged."[159]

Tire Performance and Characteristics

Tires can be designed and manufactured for a wide range of performance attributes, including improved operation in various weather conditions, on different road surfaces, for different driving styles and different vehicle types, and to achieve certain characteristics, such as long life and low rolling resistance. Based on its recent tire testing data, along with available research, the CEC does not anticipate that the minimum efficiency standard or other parts of the proposed regulation will result in a significant degradation of key tire attributes, including longevity and safety. It is anticipated that consumers will see significant savings over the life of the tire. Therefore, the CEC does not anticipate that low-income and disadvantaged communities will be affected because of this regulation.

Lifecycle and Environmental Impacts

Treadwear and tire durability are critical tire characteristics that directly affect the lifespan, lifecycle costs, and waste burden of a tire. Based on its recent tire testing data, along with available research, the CEC does not anticipate that the minimum efficiency standard or other parts of the proposed regulation will result in a significant degradation of tire longevity. Therefore, the proposed regulation is not anticipated to raise costs by wearing out more frequently. In addition, the CEC has found no evidence that this regulation will have a meaningful effect on the state's scrap tire program. As a result, the CEC does not anticipate that low-income and disadvantaged communities will be affected because of this regulation.

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159 California Public Utilities Commission. "Disadvantaged Communities," https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities.

CalEnviroScreen was developed by CalEPA's Office of Environmental Health Hazard Assessment (OEHHA). OEHHA. "CalEnviroScreen," https://oehha.ca.gov/calenviroscreen.

Other Potential Environmental Impacts

In its research, the CEC found no evidence that the regulation requirements for lower rolling resistance tires will result in new negative impacts to the environment, such as the release of toxic compounds to the environment through tire particulates as the result of wear. Environmental impacts, both regional and local, are expected to be positive and provide benefits to all Californians, especially those living near freeways and high-traffic roadways.

Fiscal Impacts, Affordability, and Cost

Tires are designed for a variety of performance characteristics (such as high performance, all-weather, and so forth), which can affect purchase price and lifetime costs. The CEC replacement tire efficiency study found that replacement tire costs ranged from $45 to $520 per tire, although this range is not an exhaustive representation of products available on the market. Chapter 8 discusses savings and costs associated with implementation of a minimum performance standard and the potential increased costs (incremental costs) and savings borne by consumers. In its research, staff found incremental costs range from negligible to about $10 per tire (not adjusted for inflation). Staff recognizes that information on the incremental cost of low rolling resistance tires, which will be required under the proposed minimum efficiency standard, is uncertain and will likely result in marginally higher purchase prices for consumers.

Staff determined that except under the most extreme scenarios (that is, extremely low fuel costs coupled with very high incremental tire costs), the anticipated fuel savings over the life of the tires exceed the estimated incremental cost. Staff estimates the annual per vehicle savings to be about $215 for a set of four compliant tires. Although the initial purchase price of a tire will likely increase, the savings generated through increased efficiency is quickly recuperated given the assumptions considered in this report. The lifetime savings anticipated from using low rolling resistance tires will provide an important economic benefit to consumers, especially those with low incomes.

However, even though staff anticipates that over the life of a set of tires the estimated savings will provide an important benefit to low-income consumers, any substantial incremental upfront cost of the tires will impact them the most. Higher purchase prices for efficient tires may burden low-income consumers and could deter or delay them from purchasing replacement tires.

Tire Safety

As discussed in Chapter 9, the tire testing the CEC conducted along with available research did not show a meaningful deterioration in safety with low rolling resistance tires. However, as mentioned above, should the incremental cost of efficient tires cause the purchase price to increase significantly, those consumers most sensitive to price may defer or delay the replacement of worn or damaged tires. This conclusion presents a potential situation where insufficient tread depth compromises the ability of a vehicle to perform as intended. Worn or damaged tires can affect handling, as well as braking on both dry and wet surfaces. Tire tread depths of less than 2/32 of an inch (1.59 millimeters) are considered unsafe due to the loss of

traction. According to NHTSA, with tread depth at 2/32 an inch or less, vehicles experienced tire problems before the crash three times more than vehicles with tread depth between 3/32 to 4/32 of an inch. According to the tire industry, the average new tire for a car starts with a tread depth of 10/32 to 11/32 of an inch.[160] Trade-offs among traction, treadwear, and efficiency were discussed in the report. In general, when comparing the subset of tire models used in the CEC tire efficiency testing program, no significant correlation was found between cost and wet traction, rolling resistance, and treadwear, although many factors must be accounted for, including driving behavior and vehicle maintenance. Establishing a minimum efficiency performance standard and providing efficiency information to allow for comparison of the important characteristic of tire rolling resistance have the potential to save consumers money, including those with low incomes.

Importantly, the CEC will continue to monitor the potential impacts as the result of the proposed program presented in this report and will adjust accordingly.

160 NHTSA. 2013. "SAFETY 1N NUM3ERS." *Safety Sheet*. Volume 1, Issue 3, https://one.nhtsa.gov/nhtsa/safety1nnum3ers/index.html.

Glossary

Acronym	Term	Description
AB	Assembly Bill	A proposed law, introduced in the State Assembly during a session for consideration by the Legislature.
BEV	Battery-electric vehicle	A type of electric vehicle that derives power solely from the chemical energy stored in rechargeable batteries.
CAFE	Corporate Average Fuel Economy	Standards set by the National Highway Transportation 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.
CH4	Methane	A light hydrocarbon that is the main component of natural gas and a potent greenhouse gas.
CO2	Carbon dioxide	A common greenhouse gas produced by burning hydrocarbon fuels and by natural processes, such as respiration.
CO2e	Carbon dioxide equivalent	A measure used to compare emissions from various greenhouse gases based

Acronym	Term	Description
		upon the related global warming potential.
DOT	U.S. 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.
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 (CO2), methane (CH4) and nitrous oxide (N2O).
	Gigajoules	One gigajoule equals one billion joules. A joule is the unit of energy in the International System of Units and is equal to the amount of work done when a force of 1 newton displaces a mass through a distance of one meter in the direction of the force applied.

Acronym	Term	Description
GWh	Gigawatt-hours	A unit of energy representing one billion watt-hours.
GWP	Global warming potential	A measure of a greenhouse gases potential for (for example, carbon dioxide or methane) contributing to global warming.
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.
IPCC	Intergovernmental Panel on Climate Change	The United Nations body for assessing the science related to climate change
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.
LT	Light truck	A motor vehicle on a truck chassis with a gross motor vehicle weight rating of 8,500 pounds or less.
Mpg	Miles per gallon	A measure of vehicle fuel efficiency.
N	Newton	A unit of force that will accelerate one kilogram of mass one meter per second squared.
NHTSA	National Highway Traffic Safety Administration	A federal agency under the U.S. Department of Transportation and responsible for transportation safety, as well as fuel economy.

Acronym	Term	Description
NOx	Oxides of nitrogen	A mixture of gases that are composed of nitrogen and oxygen and considered an air pollutant.
NRDC	Natural Resources Defense Council	An international environmental advocacy group.
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 its 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.
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.
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, SO2, etc., many of which are air pollutants.

Acronym	Term	Description
SUV	Sports utility vehicle	A vehicle similar to a station wagon or estate car, often on a light truck chassis and suitable for off-road use.
TDF	Tire-derived fuel	A fuel derived from scrap tires.
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.
TRRED	Tire Rolling Resistance Efficiency Database	A database to be developed for California Energy Commission's Replacement Tire Efficiency Program.
UTQG	Uniform Tire Quality Grading System	A system used by the 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:
Draft Regulatory Language

Addition of California Code of Regulations Title 20, Public Utilities and Energy Division 2, Chapter 14, Article 1, Sections 3300 et seq:

§ 3300: Purpose

This Article implements Chapter 8.7 (commencing with section 25770) of Division 15 of the Public Resources Code.

§ 3301: Scope

(a) This Article applies to all tire retailers, tire manufacturers, and tire brand name owners, of any new tire that is sold in California, or offered for sale in California, except as wholesale for final retail sale outside the state, that is designed to replace a tire sold with a:

(1) Passenger car; or

(2) Light-duty truck.

(b) A retreaded tire is not a new tire within the meaning of subsection (a).

(c) The following tires are not designed to replace a tire sold with a passenger car or light-duty truck within the meaning of subsection (a):

(1) a deep tread tire;

(2) a winter-type snow tire;

(3) a space-saver tire;

(4) a temporary use spare tire;

(5) a tire with a nominal rim diameter of 12 inches or less;

(6) a motorcycle tire; or

(7) a tire manufactured specifically for use on an off-road motorized recreational vehicle.

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3302: Definitions

In this Article the following definitions apply:

"ASTM" means ASTM International.

"Basic model" means all units of a given type of tire (or class thereof) that are manufactured by one manufacturer that do not have any differing physical or functional characteristics that affect energy consumption or energy efficiency.

"Brand Name Owner" means 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.

"Database" means a structured collection of information.

"Declared Energy Efficiency Rating Value" and "The Energy Performance Rating" means the mean rolling resistance coefficient plus two standard deviations calculated from the test results of a sample of three tires with an identical SKU using the ISO 28580:2009(E) test method.

"Deep Tread Tire" means a tire with a tread depth of 18/32 inch or greater.

"DOT" is an acronym for United States Department of Transportation.

"Energy Commission" means the California Energy Commission.

"Executive Director" means the Executive Director of the Energy Commission and anyone the Executive Director designates as an agent.

"ISO" is an acronym for International Organization for Standardization.

"Light-Duty Truck" means any motor vehicle other than a passenger car that has a design capacity not exceeding 10,000 pounds gross vehicle weight rating.

"Limited Production Tire" means a tire or group of tires with the same SKU, plant information, and year, for which the volume of tires produced or imported, is less than 15,000 annually.

"Load Index" means a numerical code associated with the maximum load a tire can carry at the speed indicated by its speed symbol under specified service conditions.

"Manufacturer" means a person manufacturing or assembling replacement tires, or importing replacement tires for resale. This term includes any parent corporation, any subsidiary or affiliate, and any subsidiary or affiliate of a parent corporation of such a person.

"Material Change" means a change to a tire of such a type or magnitude as to raise the reasonable expectation of a change in the declared energy efficiency rating value listed in the database.

"Model Name" is synonymous with "Tire Line" and means the entire name used by a tire manufacturer to designate a tire product, including all prefixes and suffixes as they appear on the sidewall of a tire.

"Motorcycle" means a motorized vehicle designed to be driven astride a seat or saddle and designed to travel on not more than three wheels in contact with the ground.

"Motorcycle Tire" means a tire intended for use on a motorcycle.

"Motor Vehicle" means a vehicle driven or drawn by electrical or mechanical power and designed primarily for driving on public streets, roads, and highways.

"Nominal Rim Diameter" means the diameter of a wheel measured at the intersection of the bead seat and the flange.

"Off-Road Motorized Recreational Vehicle" means a motorized vehicle capable of travel without the benefit of a road or trail and designed primarily for cross-country travel on or over land, sand, snow, ice, or other natural terrain.

"National Highway Traffic Safety Administration" means an agency of the U.S. Department of Transportation.

"Passenger Car" means any motor vehicle designed primarily for transportation of persons, having a design capacity of twelve persons or less, and not exceeding 10,000 pounds gross vehicle weight rating.

"Plant Information" means the full name and address of the plant where a tire or group of tires were manufactured. The two- or three-character DOT alphanumeric code for production plants located in the United States assigned by the National Highway Traffic Safety Administration in accordance with 49 Code of Federal Regulations parts 574.5 (2021) and 574.6 (2021), is sufficient if available.

"Point of Sale" means the point in time at which an ultimate user purchases a replacement tire at a tire retailer, including but not limited to online.

"QR Code" is an abbreviation for quick response code, which is a square matrix barcode that directs a mobile device to a webpage when a QR code is scanned by holding a mobile device's camera near the QR code to view the QR code through a device's camera app.

"Replacement Tire" means a tire sold or offered for sale in California, except as wholesale for final retail sale outside the state, that is designed to replace a tire sold with a new passenger car or light-duty truck. "Replacement tire" does not include a retreaded tire or any of the following tires:

(1) a limited production tire;

(2) a deep tread tire;

(3) a winter-type snow tire;

(4) a space-saver tire;

(5) a temporary use spare tire;

(6) a tire with a nominal rim diameter of 12 inches or less;

(7) a motorcycle tire; or

(8) a tire manufactured specifically for use on an off-road motorized recreational vehicle.

"Rolling Resistance Coefficient" means the ratio of the rolling resistance force, in newtons (N), to the load on the tire in kilonewtons (kN). This quantity is dimensionless.

"Rolling Resistance Force" means the loss of energy (or energy consumed) per unit of distance traveled. The unit conventionally used for the rolling resistance is the Newton meter per meter (N m/m). This is equivalent to a drag force in newtons (N).

"SKU" is the acronym for "Stock Keeping Unit," which means a unique identifier for each distinct product that can be ordered from a supplier.

"Sold or offered for sale in California" means any sale of or offer to sell a replacement tire for end use in the state, regardless of the seller's physical location, and includes, without limitation, internet, telephone, and mail order transactions. For purposes of this Article, the

Uniform Commercial Code–Sales (Division 2 (commencing with Section 2101) of the Commercial Code) does not define "sold or offered for sale" or determine where sales or offers for sale occur.

"Space-saver Tire" means a temporary use spare tire of reduced size for fitting in a confined space.

"Temporary Use Spare Tire" means a tire with a "T" in the size designation and intended for temporary use.

"Tire Dealer" means a person selling and distributing replacement tires primarily to purchasers that in good faith purchase them other than for resale.

"Tire Distributor" means a person selling and distributing replacement tires primarily for resale.

"Tire Retailer" means a tire dealer or tire distributor of replacement tires.

"Tire Size Designation" means the nominal section width, nominal aspect ratio, and rim diameter.

"TRRED" is the acronym for the Energy Commission's Tire Rolling Resistance Efficiency Database.

"UTQG" is an acronym for the Uniform Tire Quality Grading System of the United States Department of Transportation, National Highway Traffic Safety Administration.

"Winter-Type Snow Tire" means a tire that attains a traction index equal to or greater than 112, compared to the ASTM F2493 standard reference test tire when using the snow traction test on the medium pack snow surface as described in ASTM F1805-20, and that is marked with an Alpine Symbol, specified in the Federal Motor Vehicle Safety Standards at 49 Code of Federal Regulations parts 571.139 S5.5(i) (2021), on at least one sidewall.

"Year" means calendar year.

The following documents are incorporated by reference into section 3302.

ASTM INTERNATIONAL

ASTM F1805-20	Standard Test Method for Single Wheel Driving Traction in a Straight Line on Snow- and Ice-Covered Surfaces

Copies available from:

ASTM International
100 Barr Harbor Drive
P.O. Box C700
West Conshohocken, PA 19428-2959
www.astm.org
Phone: (610) 832-9500
FAX: (610) 832-9555

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3303: Rules of Construction

(a) Where the context requires, the singular includes the plural, and the plural includes the singular.

(b) The use of "and" in a conjunctive provision means that all elements in the provision must be complied with or must exist to make the provision applicable. "Or" (rather than "and/or") is used where compliance with one or more elements suffices, or where the existence of one or more elements makes the provision applicable.

(c) "Shall" is mandatory and "may" is permissive.

(d) Unless otherwise stated, all time periods in this Article refer to calendar days.

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3304: Testing Requirements

(a) Rolling Resistance.

(1) The test method, procedures, and conditions to determine the rolling resistance of a replacement tire shall be the federal Fuel Efficiency Rating Conditions and Procedures set forth in 49 Code of Federal Regulations part 575.106(f) (2021) with the following specification:

A. The machine alignment procedure specified in section 10 of ISO 28580:2009(E) shall be conducted using pairs of the lab alignment tires specified [specification TBD].

(2) Testing pursuant to subsection (a) shall be performed at a test facility that the Executive Director determines, under section 3311(d) of this Article, that:

A. has been accredited to comply with ISO 17025:2017(E);

B. has been certified to comply with the Measurement Machine Alignment procedure specified in the ISO 28580:2009(E) test method;

C. agrees to and does interpret and apply the ISO 28580:2009(E) test method precisely as written;

D. has, and keeps properly calibrated and maintained, all equipment, material, and facilities necessary to apply the ISO 28580:2009(E) test method precisely as written;

E. agrees to and does maintain copies of all test reports, and provides any such report to the Executive Director on request; and

F. agrees to and does allow the Executive Director or designee to witness any test on request.

(b) Peak Coefficient of Friction.

(1) The test method, procedures, and conditions to determine the peak coefficient of friction of a replacement tire shall be the federal Traction Rating Conditions and Procedures set forth in 49 Code of Federal Regulations part 575.106(g) (2021).

The following documents are incorporated by reference into section 3304.

FEDERAL TEST METHODS

Code of Federal Regulations, title 49 section 575.106, subdivision (f) (October 1, 2021).	Federal Register. (75 FR 15944, pp. 15944-15945 (March 30, 2010)
Code of Federal Regulations, title 49 section 575.106, subdivision (g) (October 1, 2021).	Federal Register. (75 FR 15944, pp. 15944-15945 (March 30, 2010).)
Copies available from:	Superintendent of Documents U.S. Government Printing Office Washington, DC 20402 www.ecfr.gov

INTERNATIONAL ORGANIZATION FOR STANDARDS (ISO)

ISO 28580:2009(E)	Passenger car, truck, and bus tyres — Methods of measuring rolling resistance — Single point test and correlation of measurement results

ISO 17025:2017	General requirements for the competence of testing and calibration laboratories
Copies available from:	ISO Central Secretariat International organization for Standardization (ISO) 1, Rue de Varembé, Case Postale 56 CH-1211 Geneva 20, Switzerland www.iso.org Phone: +41 22 749 01 11 Fax: +41 22 733 34 30

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3305: Tire Rolling Resistance Efficiency Database (TRRED)

(a) Creation of the TRRED. The Executive Director shall maintain a database, known as the TRRED. The TRRED shall consist of the following parts:

(1) "Approved TRRED." The Approved TRRED shall contain, at least, information on all replacement tires that are currently in production offered for sale or distribution in the state, for which complete and accurate statements have been received pursuant to section 3306 of this Article and shall contain all of the data filed on all samples of tires as required by section 3306(f) of this Article.

(2) "Limited Production Tire TRRED." The Limited Production Tire TRRED shall contain, at least, a list of all tires the Executive Director determined to be limited production tires and the category into which each limited production tire falls within the definition in section 3302 of this Article.

(3) "Archived TRRED." The Archived TRRED shall contain, at least, information on all tires that:

(A) are no longer sold or offered for sale in California, for which complete and accurate statements have been received pursuant to section 3306(a) of this Article; or

(B) have been removed from the Approved TRRED pursuant to sections 3306(i) or 3305(c) of this Article.

(b) Confirmation of the TRRED Listings. The Executive Director may electronically request (either to the most recent email address filed pursuant to section 3306(d)(2) of this Article or directly through the TRRED) that a manufacturer or brand name owner confirm the validity of, or correct compliance with this Article for, any information the manufacturer or brand name owner submitted pursuant to section 3306 of this Article. If, within 30 days of the email there is no such reply, the tire shall be removed from the Approved TRRED and moved to the Archived TRRED.

(1) If the lack of compliance with any requirements of this Article is strictly limited to non-compliance with standards adopted since the most recent filing by the manufacturer or brand name owner, after initially notifying the manufacturer or brand name owner under the requirements found in subsection (c) of this section, all affected models will

be moved from the Approved TRRED to the Archived TRRED without providing any additional electronic notice to the manufacturer or brand name owner. Affected models shall be moved to the Archived TRRED no earlier than the effective date of the new standard.

Note: Authority cited: Sections 25213, 25216.5(d), 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3306: Filing of Statement by Manufacturers or Brand Name Owners

(a) **Filing of Statements**. Each manufacturer or brand name owner within the scope of section 3301 of this Article shall electronically file with the Executive Director through the TRRED a statement of information for each basic model sold or offered for sale in California, except as wholesale for final retail sale outside the state, that is designed to replace a tire sold with a passenger car or light-duty truck. The statement shall contain all of the information described in paragraphs (c) through (g) of this section and shall meet all of the requirements of paragraph (b) of this section and all other applicable requirements in this Article. The provisions of this Article are applicable to all submittals and filings made by a manufacturer or brand name owner.

(b) All statements filed pursuant to this Article shall comply with the following requirements.

(1) **Format and Categories.** Each statement shall be in a format (including but not limited to computer formats) and in categories specified by the Executive Director.

(2) **How Data Must Be Reported**.

(A) For the purposes of this section, each basic model and different SKU of a replacement tire is to be reported separately.

(B) The rolling resistance and peak coefficient of friction ratings shall be reported for each replacement tire according to ratings set forth in section 3308 of this Article.

(C) For any numerical value required that is produced by calculation from measured numerical results, the reported value shall be no higher than the exact result of the calculation where the consumer would prefer a high number, and no lower than the exact result of the calculation where the consumer would prefer a low number, unless different specific instructions are specified in the test method.

(3) **When Statements are Required.**

(A) For all basic models sold or offered for sale in California, each manufacturer or brand name owner must submit the information required in paragraphs (c) through (g) of this section by no later than December 31, 2024.

(B) For all basic model, beginning January 1, 2025, each manufacturer or brand name owner must submit the information required in paragraphs (c) through (g) of this section before the tire is sold or offered for sale in California.

(4) **Multiple Statements**. A manufacturer or brand name owner may electronically file statements through the TRRED for more than one basic model in a single submittal to the Executive Director. If a submittal contains statements for more than one basic model, there shall be only one statement for each basic model. The Executive Director shall allow multiple statements to be submitted in the same electronic file under conditions the Executive Director determines are necessary to ensure accuracy and compatibility with TRRED.

(c) Manufacturer and Brand Name Owner Information

(1) The name, address, telephone number, email address, and, if available, fax number, and URL (web site) address of the manufacturer and brand name owner; provided, however, that if a parent entity is filing on behalf of a subsidiary entity, if a subsidiary entity is filing on behalf of a parent entity, or if an affiliate entity is filing on behalf of an affiliate entity, then each entity shall be clearly identified, and the information shall be provided for both entities.

(2) The name, address, telephone number, email address, and, if available, fax number of an individual to contact concerning the statements pursuant to this section. Only one individual may be listed as the contact except that the individual may designate another contact during a temporary absence.

(3) The name, address, telephone number, email address, and, if available, fax number of the person signing the declaration pursuant to this section.

(d) Declaration

(1) Each statement shall include a declaration, executed under penalty of perjury of the laws of California, that:

(A) all the information provided in the statement is true, complete, accurate, and in compliance with all applicable provisions of this Article.

(2) If the declaration is executed by a corporation, partnership, or other business entity, the declaration shall be electronically signed by an individual authorized to make the

declaration and file the statement on behalf of the business entity, and the declaration shall contain an affirmation that the individual signing is so authorized.

(3) The declaration shall be submitted electronically through the TRRED and maintained by the Executive Director for a period of at least ten years, pursuant to the requirements in section 3311(c) of this Article.

(e) Statement of Information for Replacement Tires.

(1) Tire Manufacturer and Brand Name Owner Name

(2) From Marking on Replacement Tires

(A) Brand Name

(B) Model Name

(C) OEM Fitment (Yes/No)

(D) SKU Number

(E) Suggested Retail Price

(F) Warranty

(G) DOT Tire Identification Number (first seven digits)

(H) Tire Size Designation

(I) Special Feature: Runflat, Color Tread

(J) Tread and Sidewall Ply & Material Identification

(K) Sidewall Lettering: Blackwall, Whitewall, Outlined White Letter, Outlined Black Letter

(L) Weight (lbs)

(M) Overall Diameter (in)

(N) Tread Depth (in)

(O) Sidewall Max Load (lbs)

(P) Sidewall Max Pressure (psi)

(Q) Load Index

(R) Load Range

(S) Speed Rating

(T) Manufacture Date

(U) Manufacture Facility

(3) Rolling resistance rating

(4) Wet traction rating

(A) USQGS traction rating

(B) Peak traction rating

(5) Treadwear rating

(f) Statement of Information for Limited Production Tires.

(1) Claim and Tire Identification Information

(A) A statement that the tire is a limited production tire within the definition in section 3302 of this Article.

(B) The following information:

1. Tire Manufacturer or Brand Name Owner Name
2. Brand Name
3. Model Name
4. DOT Tire Identification Number (first seven digits)
5. SKU Number
6. Tire Size Designation
7. Plant Information
8. Number of Tires Imported and Produced During Claimed Year
9. Claimed year

(g) Statement of Modification of Tires or Tires Which Have Ceased Being Sold or Offered for Sale in California.

(1) If a material change is made to a basic model listed in the Approved TRRED, the manufacturer or brand name owner shall file a statement containing the identifiers and any modified information for the basic model. Upon receipt of such a statement, the Executive Director shall review the statement pursuant to subsection (i) of this section.

(2) If a change in production or importation occurs to a limited production tire that changes any of the information that was provided pursuant to subsection (f) of this section, the manufacturer or brand name owner shall file a new statement pursuant to this section. Upon receipt of such a statement, the Executive Director shall review the statement pursuant to subsection (i) of this section.

(A) **Tire Continues to Fit the Definition of Limited Production Tire**. If the Executive Director determines that the tire still meets the definition of a limited production tire, the Executive Director shall modify the listing of the tire in the Limited Production Tire Database to reflect the changed information.

(B) **Tire No Longer Fits the Definition of Limited Production Tire**. The manufacturer or brand name owner shall remove the tire from the Limited Production Tire TRRED and certify the tire as soon as it becomes reasonably apparent that the tire will not meet the limited production criteria. If the Executive Director determines that the changes reported for the tire no longer meet the criteria for exclusion, the Executive Director shall immediately remove the tire from the Limited Production Tire Database into the Archived TRRED and shall so inform the manufacturer or brand name owner that it must immediately comply with the requirements of this section for the tire.

(3) If any basic model listed in the Approved TRRED or Limited Production Tire TRRED has ceased being sold or offered for sale in California, the manufacturer or brand name owner shall file a statement so stating. Upon receipt of such a statement, the Executive Director shall review the statement pursuant to subsection (i) of this section. If the statement is complete, accurate, and in compliance with all applicable provisions of this Article, the Executive Director shall move the tire into the Archived TRRED.

(h) Review of Statements by the Executive Director.

(1) Determination. The Executive Director shall determine whether a statement is complete, accurate, and in compliance with all applicable provisions of this Article.

(2) Informing Manufacturer or Brand Name Owner of Determination.

(A) The Executive Director shall inform the TRRED-designated contact person of the determination within 30 days after receipt by the Executive Director.

(B) The Executive Director's determination shall be sent electronically through the TRRED to the TRRED-designated contact person.

(3) Nature of Determination.

(A) **Statement is Incomplete**. If the Executive Director determines that a statement is not complete, or that the statement does not contain enough information to determine whether it is accurate, the Executive Director shall return the statement by email or through the TRRED to the TRRED-designated contact person with an explanation of its defects and a request for any necessary additional information. The manufacturer or brand name owner shall refile the statement through the TRRED with all information requested by the Executive Director and with any other information it wants to file. The Executive Director shall review the refiled statement according to the time limits in subsection (i)(2) of this section.

(B) **Statement is Inaccurate or Tire Does Not Comply**. If the Executive Director determines that the statement is inaccurate or that the tire does not comply with the applicable standard, the Executive Director shall reject the statement and return it through the TRRED to the TRRED-designated contact person with an explanation of its defects. The manufacturer or brand name owner may submit a revised statement through the TRRED at any time.

(C) **Statement is Complete and Accurate**. If the Executive Director determines that the statement is complete and accurate, the Executive Director shall immediately include the tire(s) in the TRRED and shall so inform the TRRED-designated contact person.

(i) Assessment of Completeness, Accuracy, and Compliance of Statements. Notwithstanding any other provision of these regulations, the Executive Director may at any time challenge the completeness, accuracy, and compliance with the requirements of this Article, of any statement or confirmation filed pursuant to this section. If the

statement is incomplete or inaccurate, or if the Executive Director determines that the statement otherwise fails to comply with any of the requirements of this Article, then the Executive Director shall, within ten working days after providing electronic notice via email or directly through the TRRED to the person designated in subsection (d)(3) of this section, remove the basic model from the TRRED as described in section 3305(a) of this Article.

(1) If the lack of compliance with any requirements of this Article is strictly limited to non-compliance with standards currently in effect, but not in effect when the statement was filed, all affected models will be moved from the Approved TRRED to the Archived TRRED without providing any advance notice to the manufacturer or brand name owner. Affected models shall be moved to the Archived TRRED no earlier than the effective date of the new standard.

Note: Authority cited: Sections 25213, 25216.5(d), 25218(e), 25301, 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25301, 25770-25773, Public Resources Code.

§ 3307: Energy Performance Minimum Standard

(a) Except as provided in subsection (b), no replacement tire shall be sold or offered for sale in California that has a rolling resistance coefficient value greater than the following:

(1) Beginning January 1, 2026, 9.0 N/kN.

(2) Beginning January 1, 2028, 7.0 N/kN.

(b) Petition for Exemption of Tires Used to Equip Authorized Emergency Vehicles.

(1) Nothing in this section shall prohibit a tire retailer from selling or offering for sale replacement tires that do not meet the standards in subsection (a) to an operator of an authorized emergency vehicle fleet to equip authorized emergency vehicles exempted under this section.

(2) Petition for Exemption. An entity or multiple entities jointly may petition for exemption of authorized emergency vehicles defined in Section 165 of the Vehicle Code. The petition shall be written, and shall be submitted to the Executive Director. It shall be supported by a declaration executed under penalty of perjury of the laws of the State of California stating:

(A) the full legal name, address of the principal place of business, telephone number, and e-mail address of both the person executing the declaration and any entity seeking an exemption by the petition, and the title of the person;

(B) that the person executing the declaration is authorized to do so and to submit the petition on behalf of all entities included in the petition;

(C) a list of the make, model, and number vehicles at each entity that are authorized emergency vehicles defined in Section 165 of the Vehicle Code for which exemption is sought, and the facts supporting a conclusion that the tires used to equip those vehicles are unable to meet the standards established pursuant to subsection (a) of this section, such as, without limitation, that replacement tires meeting the standards in subsection (a) are not available in the volume required, are not cost effective over the life of the tire, or that their use would adversely affect safety or performance; and

(D) if a petition for exemption was previously denied, then the new information that has become available or changed circumstances that have occurred that materially affect the previous determination.

(3) Executive Director Determination. The Executive Director's shall determine whether the entity seeking exemption has demonstrated that the tires used to equip its authorized emergency vehicles are unable to meet the standards established pursuant to subsection (a) of this section, and that the vehicles should be exempt. The Executive Director shall issue a determination on the petition pursuant to section 3311(d).

(4) Appeal to Commission. Within 30 days of any decision or determination made by the Executive Director pursuant to subsection (b)(3), any entity subject to the decision or determination may appeal it to the Commission pursuant to section 3311(e).

(5) Renewal. An exemption granted under this section shall remain in effect for five years and then terminate without notice unless renewal is granted. An entity may renew the five-year period of an exemption at any time before an exemption terminates by petitioning for an exemption as set forth in subsection (2)(b) of this section. Nothing in this section prohibits an entity whose exemption has terminated from petitioning for exemption as set forth in subsection (2)(b).

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3308: Ratings for Replacement Tires

(a) **California Rating System Applicable to Rolling Resistance**. The purpose of this subsection is to aid potential purchasers in the selection of new replacement tires by providing them, at the point of sale, with a relative rating of the energy efficiency of a replacement tire. Tires are rated from one (⋆) to five stars (⋆⋆⋆⋆⋆), with one star assigned to the least energy efficient tires, and five stars to the most energy efficient tires. The Executive Director shall assign a replacement tire rating, as set forth in Table 1, to each replacement tire listed in the TRRED.

Table 1: Replacement Tire Energy Efficiency Rating Values

REPLACEMENT TIRE RATING	Passenger Cars and Light-Duty Trucks (LT)
Five Star (⋆⋆⋆⋆⋆)	Has a declared rolling resistance coefficient value no more than 6.5 N/kN or less.
Four Star (⋆⋆⋆⋆)	Has a declared rolling resistance coefficient value greater than 6.5 and no more than 7.7 N/kN.
Three Star (⋆⋆⋆)	Has a declared rolling resistance coefficient value greater than 7.7 and no more than 9.0 N/kN.
Two Star (⋆⋆)	Has a declared rolling resistance coefficient value greater than 9.0 and no more than 10.5 N/kN.

One Star (⋆)	Has a declared rolling resistance coefficient value greater than 10.5 N/kN.

(b) **California Provisional Rating System Applicable to Peak Traction Coefficient**. Each replacement tire shall be graded for traction performance with the word "CALIFORNIA PROVISIONAL PEAK TRACTION," followed by the symbols AA, A, B, or C, when the tire is tested in accordance with the conditions and procedures specified in subsection (b)(1) through (b)(4) of this section.

(1) The tire shall be graded C when the adjusted traction coefficient is either:

(A) 0.63 or less when tested in accordance with section 3304(b) of this Article on the asphalt surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021), or

(B) 0.43 or less when tested in accordance section 3304(b) of this Article on the concrete surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021).

(2) The tire may be graded B only when its adjusted traction coefficient is both:

(A) More than 0.63 when tested in accordance with section 3304(b) of this Article on the asphalt surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021), and

(B) More than 0.43 when tested in accordance with section 3304(b) of this Article on the concrete surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021).

(3) The tire may be graded A only when its adjusted traction coefficient is both:

(A) More than 0.78 when tested in accordance section 3304(b) of this Article on the asphalt surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021), and

(B) More than 0.58 when tested in accordance with section 3304(b) of this Article on the concrete surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021).

(4) The tire may be graded AA only when its adjusted traction coefficient is both:

(A) More than 0.90 when tested in accordance with section 3304(b) of this Article on the asphalt surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by Code of Federal Regulations part 575.106(g) (2021); and

(B) More than 0.63 when tested in accordance with section 3304(b) of this Article on the concrete surface specified in 49 Code of Federal Regulations part 575.104(f)(1)(i) (2021) as modified by 49 Code of Federal Regulations part 575.106(g) (2021).

The following documents are incorporated by reference into section 3304.

FEDERAL TEST METHODS

Code of Federal Regulations, title 49 section 575.104, subdivision (f) (October 1, 2021).	Federal Register. (43 FR 30549, pp. 30550-30551, 30555 (July 17, 1978).)
Code of Federal Regulations, title 49 section 575.106, subdivision (g) (October 1, 2021).	Federal Register. (75 FR 15944, pp. 15944-15945 (March 30, 2010).)
Copies available from:	Superintendent of Documents U.S. Government Printing Office Washington, DC 20402 www.ecfr.gov

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3309: Retail Disclosures

(a) Starting on April 1, 2025, each tire retailer as defined in section 3302 of this Article must provide the disclosures required by this section at the time any replacement tire is sold or offered for sale in California.

(1) Replacement Tires Sold at Physical Retail Locations. Each physical retail location must prominently display at least one California replacement tire sign so as to render the sign likely to be seen, read, and understood by an ordinary individual under customary conditions at the time the tire retailer, as defined in section 3302 of this Article, conveys or displays the price of any replacement tire at a physical retail location. The location of the California replacement tire sign shall be accessible within arm's length of the accessible location.

(A) **California Replacement Tire Sign.** The California replacement tire sign shall have the following characteristics.

1. Dimensions shall be at least 8 ½ by 11 inches.

2. Font on sign shall be at least 22-point type.

3. Sign shall include the words, "California Tire Efficiency Rating," and [state the potential to reduce fuel consumption, the potential for driver cost savings, and general environmental benefits (specific text TBD)].

4. Sign shall display the web address, and provide a QR code linking to, the Energy Commission's TRRED Replacement Tire Efficiency Program search page.

5. Sign height must be between 48 and 60 inches measured from the floor to the bottom of the sign.

6. Sign must be affixed on a wall, poster stand, or other surface, with a clear floor space of at least 18 inches by 18 inches, centered on the middle of the bottom of the sign.

7. [Example Photo that meets requirements.]

(B) **Tire Energy Efficiency Disclosure.** Upon request by a customer at a physical retail location, a tire retailer shall provide the customer with a Tire Energy Efficiency Disclosure for any replacement tire or tires that the tire retailer offers for sale for the customer's vehicle. The Tire Energy Efficiency Disclosure shall display at least the tire brand name, tire model name, tire size, Energy Commission rolling resistance star rating, UTQG treadwear and traction rating, the

peak traction rating, the operating cost calculated according to subsection (f) of this section, and a QR code linking to the Energy Commission's TRRED Replacement Tire Efficiency Program search page. The Tire Energy Efficiency Disclosure may additionally include a comparison of multiple replacement tires. The disclosure shall be no smaller than 5 by 5 inches and font shall be sans serif and no smaller than 14-point type. Tire retailer may satisfy this requirement with a print or electronic display. A printout of the Energy Commission's TRRED website that displays for the replacement tire, the brand name, model name, tire size, Energy Commission star rating, shall satisfy the requirement of this subsection.

(2) Replacement Tire Sold over the Internet

(A) Any webpage that displays the price of one or more replacement tires sold or offered for sale in California shall also prominently display, concurrent with the price, the efficiency star rating for the replacement tire and a clearly marked hyperlink to Energy Commission's TRRED webpage that displays the information for the specific replacement tire. For purposes of this section, this information is not prominently displayed if the purchaser must search for it in the general content of the website.

(3) Replacement Tire Sold Through Print Catalog

(A) For catalog purchases, a disclosure must be provided in the catalog in a manner that it is visible on every spread (set of pages viewed together) that displays the price of replacement tires sold or offered for sale in California, and in a manner and location that clearly associates it with replacement tires.

(B) The disclosure shall have the following characteristics.

1. Dimensions shall be at least 3 by 2 1/2 inches and enclosed in a black box.

2. Font on sign shall be at least 11-point type. Characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms.

3. Disclosure shall include the words, "California Tire Efficiency Rating."

4. Disclosure shall list the web address, and provide a QR code linking to, the Energy Commission's TRRED Replacement Tire Efficiency Program search page.

(b) The disclosures required by this section must use sans serif type and characters shall not be italic, oblique, script, highly decorative, or of other unusual forms. QR codes required by this section must be at least 3/4 x 3/4 inches.

(c) The disclosures required by this section must be provided in English and in any other language used for labeling or advertising the replacement tire on the premises, the internet website, including mobile device applications, or catalog.

(d) **Calculating Annual Operating Costs.** The annual operating costs for purposes of this Article shall be calculated using the following formula: rolling resistance x operating factor x price of fuel.

(1) The rolling resistance shall be based on the lowest rolling resistance coefficient in the star rating of a basic model.

(2) The operating factor shall be [TBD].

(3) The price of gasoline shall be $4.60 per gallon.

(4) The price for electricity used for electric vehicles shall be [TBD].

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

§ 3310: Compliance and Verification

(a) Submittal of Reports of Manufacturer or Brand Name Owner Ratings.

(1) For any replacement tire within the definition in section 3302 of this Article, the Executive Director or designee may at any time request from a manufacturer or brand name owner a copy of the test report or other information that provides the basis for the information submitted under section 3306 of this Article. The request shall be sent to the email address designated in section 3306(d)(2) of this Article. The manufacturer or brand name owner shall provide a copy of the applicable information, including any applicable test report, to the Executive Director within 14 days of receipt of the Executive Director's request, or at a mutually agreed upon date.

(2) If the Executive Director does not receive the information within the required or agreed upon time under subsection (a)(1), the Executive Director may move the tire into the Archived TRRED described in section 3305(a)(3) of this Article and shall so inform the TRRED-designated contact person.

(3) If the information submitted indicates that the tire performance is greater than or less than declared by the manufacturer or brand name owner pursuant to section 3306(e) of this Article, the Executive Director shall, after providing electronic notice by email or directly through the TRRED to the person designated in section 3304(d)(2) of this Article, modify the listing of the tire in the TRRED to accurately reflect the test report and shall so inform the TRRED-designated contact person.

(b) Inspection of Tires by the Executive Director.

(1) The Executive Director may periodically inspect tires sold or offered for sale in California, to determine whether or not they conform to sections 3304 through 3308 of this Article.

(2) Inspection of a basic model shall consist of inspection of at least one tire.

(A) If the inspection indicates that the tire conforms to sections 3304 through 3308 of this Article and the information listed in the database of section 3305 of this Article is correct, the matter shall be closed.

(B) Inspection may include testing under subsection (c) of this section.

(3) If the inspection indicates that the tire does not conform to sections 3304 through 3308 and/or the information listed in the database of section 3305 of this Article is not correct, the Energy Commission may undertake a proceeding against the manufacturer, the brand name owner, or both pursuant to Sections 11445.10-11445.60 of the California Government Code (or, at the manufacturer's or brand name owner's option, pursuant to Sections 11425.10-11425.60 of the California Government Code).

(c) Testing of Tires by the Executive Director.

(1) The Executive Director may periodically cause the testing of tires sold or offered for sale in California, at test facilities meeting the criteria of section 3304 of this Article, to determine whether or not the tires are as reported and declared by the manufacturer or brand name owner pursuant to section 3306 of this Article. Testing shall be performed as follows:

(A) The Executive Director shall cause tests on three units of tires with identical SKUs, using the applicable test procedure specified in section 3304 of this Article and determine the mean plus two standard deviations of the Rolling Resistance Coefficient for the three tires.

(B) Upon completion of the test, the Executive Director shall make a determination and proceed as follows:

1. **Tire Is No Different Than Reported and Declared by Manufacturer or Brand Name Owner.** If the test result indicates that the tire is no different than reported and declared by the manufacturer or brand name owner pursuant to section 3306 of this Article, the matter shall be closed.

2. **Tire Is Different Than Reported and Declared by Manufacturer or Brand Name Owner.** If the test result indicates that the tire is different than reported and declared by the manufacturer or brand name owner pursuant to section 3306 of this Article, the Executive Director shall modify the information of the tire in the TRRED to accurately reflect the Executive Director's determination and shall so inform the TRRED-designated contact person.

(d) Costs. Except as otherwise provided in this Article, all costs of inspection and tests showing results as described in subsections (b)(2)(A) or (c)(1)(B)(1) of this section shall be borne by the Energy Commission. All costs, including the acquisition cost of tires, for all

other inspections and testing pursuant to this Article shall be paid by the manufacturer, brand name owner, or both.

Note: Authority cited: Sections 25210, 25216.5(d), 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25210, 25216.5(d), 25770-25773, Public Resources Code.

§ 3311: General Administration

(a) Forms and Formats Specified by Executive Director. The Executive Director may specify and require the use of any form or format for the submittal of any data, reports, or other information required by this Article, including but not limited to computer programs or formats.

(b) Electronic Filing.

(1) Unless otherwise stated in this Article, the statements and other submittals required or allowed by this Article shall be filed electronically to the TRRED so that the electronic filing to the TRRED uses a format and characteristics, including without limitation appropriate formatting, that are specified by the Executive Director.

(2) Any electronic filing to the TRRED constitutes a representation by the person making the filing that:

(A) all applicable requirements of this Article have been met;

(B) the person will electronically acknowledge receipt through the TRRED of all electronic communications concerning the filing from the Executive Director through the TRRED to the person;

(C) all electronic communications concerning the filing from the Executive Director through the TRRED to the person shall be deemed received by the person upon notification to the Executive Director, by the computer or other electronic device from which the Executive Director communication has been sent, that the communication has been sent; and

(D) all electronic communications concerning the filing from the person to the Executive Director shall be deemed received by the Executive Director only upon actual receipt.

(3) At any time the Executive Director may forbid electronic filings by any person and may remove affected tire models from the TRRED upon finding that an applicable requirement of this Article is not being met.

(c) Retention of Records

(1) Manufacturers and brand name owners shall retain all data, forms, information, and all other records required by this Article concerning each tire:

(A) for at least two years after the manufacturer or brand name owner informs the Executive Director, by the statement required by section 3306(g)(4) of this Article, that the tire has ceased being sold or offered for sale in California; and

(B) in a manner allowing ready access by the Executive Director on request.

(2) The Executive Director shall retain all data, forms, information, and all other records required by this Article concerning each tire for at least 10 years after the record is initially filed or reconfirmed.

(d) Appeal to Commission. Within 30 days of any decision or determination made by the Executive Director pursuant to this Article, any entity subject to the part of the decision or determination at issue may appeal the decision or determination to the Commission. The following procedures apply to the appeal:

(A) The appeal shall be in writing and signed by the appellant and submitted to the Commission. The appeal shall consist of a written argument, stating the grounds for modifying or reversing the decision, identifying the statutes and regulations relevant to the appeal, and stating whether an oral hearing is requested, and a copy of all relevant notices, responses, correspondence, documents, and decisions.

(B) Within 30 days after the date the appeal was filed, the Executive Director shall provide the appellant and the Commission a written argument, stating the grounds for affirming, modifying, or reversing the decision, identifying the statutes and regulations relevant to the appeal, and stating whether an oral hearing is requested. The Executive Director's written argument shall also be accompanied by any relevant notices, responses, correspondences, documents, and decisions not previously provided by the appellant.

(C) Commission Consideration of Appeal:

1. The proceedings on appeal shall be conducted in a manner consistent with Chapter 4.5 of the Government Code (section 11400 et seq.) and Title 20 CCR sections 1200-1216.

2. The Commission shall review the decision or determination made pursuant to this section for substantial evidence.

Note: Authority cited: Sections 25213, 25218(e), 25770-25773, Public Resources Code; Reference: Sections 25216.5(d), 25770-25773, Public Resources Code.

APPENDIX B:
California Tire Policy Legislation

AB 844

LEGISLATIVE COUNSEL'S DIGEST

Assembly Bill (AB) 844 (Nation, Chapter 645, Statutes of 2003), Replacement Tire Efficiency Program.[161]

Existing law, with respect to energy conservation and development, states the policy of the state, among other things, to fully evaluate the economic and environmental costs of petroleum use and to establish a state transportation energy policy that results in the least environmental and economic cost to the state.

This bill would require the State Energy Resources Conservation and Development Commission, in consultation with the California Integrated Waste Management Board, to adopt, on or before July 1, 2007, and implement, no later than July 1, 2008, a replacement tire efficiency program of statewide applicability for replacement tires for passenger cars and light-duty trucks, that is designed to ensure that replacement tires sold in the state are at least as energy efficient, on average, as the tires sold in the state as original equipment on these vehicles. The bill would define "replacement tire." The bill would require the commission, in consultation with the board, to review and revise the program as necessary, but not less than once every 3 years.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. (a) The Legislature finds and declares all of the following:

(1) Substantial evidence indicates that replacement tires for passenger cars and light trucks are less energy efficient, on average, than tires installed as original equipment.

(2) Improving the energy efficiency of replacement tires for California's passenger and light truck fleet could yield significant economic and environmental benefits without affecting

161 Replacement Tire Efficiency Program (AB 844, Nation, Chapter 645, Statutes of 2003). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200320040AB844.

vehicle performance or safety, while also reducing California's vulnerability to oil price increases.

(3) There are strong indications that technologies are available to make replacement tires more energy efficient and longer lasting.

(4) According to a January 2003 report by the State Energy Resources Conservation and Development Commission, titled "California State Fuel Efficient Tire Report: Volume 1," energy efficient tires have the potential to significantly reduce fuel consumption by California drivers, resulting in significant cost and fuel savings. According to the report, adequate tire pressure will also promote fuel savings, and a specified tire testing procedure developed by the Society of Automotive Engineers should be used to measure the fuel efficiency of tires.

(b) It is the intent of the Legislature to provide the statutory framework to ensure that replacement tires sold in California are at least as energy efficient, on average, as original-equipment tires.

(c) It is further the intent of the Legislature that the Replacement Tire Efficiency Program not increase the amount of scrap tires generated within California, nor negatively impact state efforts to manage scrap tires pursuant to the California Tire Recycling Act.

SEC. 2. Chapter 8.7 (commencing with Section 25770) is added to Division 15 of the Public Resources Code, to read:

CHAPTER 8.7. Replacement Tire Efficiency Program

25770. For the purposes of this chapter, the following terms have the following meanings:

(a) "Board" means the California Integrated Waste Management Board established pursuant to Division 30 (commencing with Section 40000).

(b) "Consumer information requirement" means point-of-sale information or signs that are conspicuously displayed, readily accessible, and written in a manner that can be easily understood by the consumer. "Consumer information requirement" does not include mandatory labeling, imprinting, or other marking, on an individual tire by the tire manufacturer or the tire retailer.

(c) "Cost effective" means 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.

(d) "Replacement tire" means a tire sold in the state that is designed to replace a tire sold with a new passenger car or light-duty truck. "Replacement tire" does not include any of the following tires:

(1) A tire or group of tires with the same SKU, plant, and year, for which the volume of tires produced or imported is less than 15,000 annually.

(2) A deep tread, winter-type snow tire, a space-saver tire, or a temporary use spare tire.

(3) A tire with a nominal rim diameter of 12 inches or less.

(4) A motorcycle tire.

(5) A tire manufactured specifically for use in an off-road motorized recreational vehicle.

25771. On or before July 1, 2006, the commission shall develop and adopt all of the following:

(a) A database of the energy efficiency of a representative sample of replacement tires sold in the state, based on test procedures adopted by the commission.

(b) Based on the data collected pursuant to subdivision (a), 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.

(c) Based on the test procedures adopted pursuant to subdivision (a) and the rating system established pursuant to subdivision (b), requirements for tire manufacturers to report to the commission the energy efficiency of replacement tires sold in the state.

25772. On or before July 1, 2007, the commission, in consultation with the board, shall, after appropriate notice and workshops, adopt and, on or before July 1, 2008, implement, a tire energy efficiency program of statewide applicability for replacement tires, designed to ensure that replacement tires sold in the state are at least as energy efficient, on average, as tires sold in the state as original equipment on new passenger cars and light-duty trucks.

25773. (a) The program described in Section 25772 shall include all of the following:

(1) The development and adoption of minimum energy efficiency standards for replacement tires, except to the extent that the commission determines that it is unable to do so in a manner that complies with subparagraphs (A) to (E), inclusive. Energy efficiency standards adopted pursuant to this paragraph shall meet all of the following conditions:

(A) Be technically feasible and cost effective.

(B) Not adversely affect tire safety.

(C) Not adversely affect the average tire life of replacement tires.

(D) Not adversely affect state efforts to manage scrap tires pursuant to Chapter 17 (commencing with Section 42860) of Part 3 of Division 30.

(2) The development and adoption of consumer information requirements for replacement tires for which standards have been adopted pursuant to paragraph (1).

(b) The energy efficiency standards established pursuant to paragraph (1) of subdivision (a) shall be based on the results of laboratory testing and, to the extent it is available and deemed appropriate by the commission, an onroad fleet testing program developed by tire

manufacturers in consultation with the commission and the board, conducted by tire manufacturers, and submitted to the commission on or before January 1, 2006.

(c) If the commission finds that tires used to equip an authorized emergency vehicle, as defined in Section 165 of the Vehicle Code, are unable to meet the standards established pursuant to paragraph (1) of subdivision (a), the commission shall authorize an operator of an authorized emergency vehicle fleet to purchase for those vehicles tires that do not meet those standards.

(d) The commission, in consultation with the board, shall review and revise the program, including any standards adopted pursuant to the program, as necessary, but not less than once every three years. The commission may not revise the program or standards in a way that reduces the average efficiency of replacement tires.

APPENDIX C:
California 2007 Tire Test Result Summary

Below are the tasks and findings resulting from that testing program conducted by Smithers Scientific Services.[162]

- ☐ Rolling Resistance Testing 15-inch rims
  - o Rolling resistance responses were normally distributed and ranged from about 7.5 lbs. to 12.7 lbs. (rolling forces), which correlated to a range of rolling resistance coefficients of approximately 8.4×10^{-3} to 14.2×10^{-3}. Rolling resistance rolling forces and rolling resistance coefficients correlated because the same test loading was used for all tires of this size.
  - o Linear correlation studies of rolling resistances with the basic parameters of tire weight, overall diameter, tread depth, and UTQG treadwear rating did not generate correlations that could be considered to represent useful tools to the consumer for predicting rolling resistance qualities of tires.
- ☐ Rolling Resistance Testing 17-inch rims
  - o Rolling resistance responses were normally distributed and ranged from about 13.3 lbs. to 22.8 lbs. (rolling forces), which correlated to a range of rolling resistance coefficients of approximately 7.5×10^{-3} to 12.9×10^{-3}. Rolling resistance rolling forces and rolling resistance coefficients correlated because the same test loading was used for all tires of this size.
  - o Linear correlation studies of rolling resistances with the basic parameters of tire weight, overall diameter, tread depth, and UTQG tread wear rating again did not generate correlations that could be considered to represent useful tools to the consumer for predicting rolling resistance.
- ☐ Size Impact Study
  - o Rolling resistance responses ranged from about 8.1 lbs. to 15.1 lbs. (rolling forces); rolling resistance coefficients ranged from approximately 9.4×10^{-3} to 12.9×10^{-3}. Rolling resistance rolling forces and rolling resistance coefficients did not correlate.
  - o Linear correlation studies of rolling resistance values with the parameters: tire weight, overall diameter, load indices and branded sidewall maximum load

162 Smithers Scientific Services. 2007. *Tire Rolling Resistance Contract 600-04-017*.

capabilities yielded higher R^2 correlations, particularly with respect to rolling forces, than found during the individual size studies:

Correlation	R^2;%
tire weight and rolling resistance forces	76.0
tire outside diameter and rolling resistance forces	76.5
tire load indices and rolling resistance forces	82.8
tire max. sidewall load capabilities and rolling forces	85.9

Stronger correlations were thought to be attributable to the fact that the differences in weights and outside diameters between tire group sizes were significantly greater than studied during the individual size studies. Furthermore, the critical tire architecture and compound hysteretic quality parameters that impacted the correlations between tire groups in the individual size studies were significantly more standardized in the Size Impact Study, since the tires were from a single manufacturer/design combination.

- ☐ Original Equipment versus Replacement tires studies using both 15- and 17-inch rims
  - Histograms of rolling resistance responses (rolling resistance forces) for original equipment tires exhibited significant overlap with the response distributions representing replacement tires. This finding was true for both sizes studied
  - The interval plots indicated that at the 95% confidence interval, the means were significantly different between the OE vs. replacement tire distributions for both sizes. The mean OE rolling resistance (rolling force) of the P195/65R15 tires was approximately 14% less than the replacement tire distribution mean. The mean OE rolling resistance (rolling force) of the P265/70R17 tires was approximately 15% less than the replacement tire distribution mean.

Smithers Tire Testing Task 4 Findings[163]

1. Task 7 Tire Recycling Study
   a. There is not likely to be a major change in the recyclability of tires based on the trend to low rolling resistance designs. There will be a minor reduction in the fuel content of tires used for TDF (tire derived fuel) but not likely to the extent that they will need to be sorted and precluded from use based on this characteristic. Whether there is a benefit for some aftermarket products ensuing from the change to low hysteresis tire grind cannot be determined at this time

163 Ibid.

APPENDIX D:
Tire Specification for High-Volume California Vehicle Registrations

The table below shows the OEM tire specifications for the high-volume registration vehicles that were used for selection to represent the largest part of the market with the number of tires tested.

Tire Specification for High-Volume California Vehicle Registrations

Year	Make	Model	Rim Size	Width	OEM Tire spec
2017	HONDA	CIVIC	16	7	215/55R16 93H
2016	HONDA	CIVIC	16	7	215/55R16 93H
2017	HONDA	ACCORD	19	8	235/40R19 96V
2018	HONDA	CIVIC	16	7	215/55R16 93H
2015	HONDA	CIVIC	15	6.5	P195/65R15
2007	TOYOTA	CAMRY	16	6.5	P215/60R16
2012	HONDA	CIVIC	15	6	P195/65R15 89H
2019	HONDA	CIVIC	16	7	215/55R16 93H
2018	TOYOTA	CAMRY	17	7.5	P215/55R17 94V
2016	TOYOTA	COROLLA	15	6	P195/65R15
2015	HONDA	ACCORD	18	8	P235/45R18
2013	HONDA	CIVIC	15	6	P195/65R15 89H
2014	HONDA	ACCORD	16	6.5	205/65R16
2018	HONDA	ACCORD	19	8.5	235/40R19 96V
2016	HONDA	ACCORD	19	8	235/40R19 96V
2018	TESLA	MODEL 3	18	8.5	235/45R18
2019	TOYOTA	CAMRY	17	7.5	P215/55R17 94V

Year	Make	Model	Rim Size	Width	OEM Tire spec
2014	TOYOTA	CAMRY	16	6.5	P205/65R16
2015	TOYOTA	COROLLA	15	6	P195/65R15
2012	TOYOTA	CAMRY	16	6.5	P205/65R16
2018	TOYOTA	RAV4	17	6.5	P225/65R17 102H
2018	HONDA	CR-V	17	7.5	235/65R17 104H
2016	HONDA	CR-V	17	7	225/65R17 102T
2017	TOYOTA	RAV4	17	6.5	P225/65R17
2019	HONDA	CR-V	18	7.5	235/60R18 103H
2014	HONDA	CR-V	16	6.5	215/70R16 100S
2019	TOYOTA	RAV4	17	7	225/65R17 102H
2015	TOYOTA	RAV4	17	6.5	P225/65R17
2015	HONDA	CR-V	17	6.5	P225/65R17
2017	HONDA	CR-V	18	7.5	235/60R18 103H
2017	TOYOTA	TACOMA	16	7	P265/70R16 112T
2019	TOYOTA	TACOMA	16	7	P265/70R16 112T
2018	FORD	F-150	18	7.5	P265/60R18
2006	TOYOTA	TACOMA	16		P245/75R16
2018	TOYOTA	TACOMA	16	7	P265/70R16 112T
2020	TOYOTA	TACOMA	16	7	P265/70R16 112T
2018	CHEVROLET	SILVERADO 1500	17	8	P255/70R17
2001	FORD	F150	20		P275/45R20
2004	CHEVROLET	SILVERADO 1500	16		P235/75R16
2001	CHEVROLET	SILVERADO 1500	16		P235/75R16
2004	TOYOTA	SIENNA	16		P215/65R16
2006	TOYOTA	SIENNA	16		P215/65R16

Year	Make	Model	Rim Size	Width	OEM Tire spec
2015	TOYOTA	SIENNA	17	6.5	P235/60R17
2017	TOYOTA	SIENNA	17	6.5	P235/60R17 100T
2005	TOYOTA	SIENNA	16		P215/65R16
2011	TOYOTA	SIENNA	17	6.5	P235/60R17
2007	HONDA	ODYSSEY	16	7	P235/65R16 103T
2006	HONDA	ODYSSEY	16		P235/65R16 T
2016	HONDA	ODYSSEY	17	7	235/65R17 103T
2013	TOYOTA	SIENNA	18	7	P235/55R18
2015	TOYOTA	PRIUS	15	6	P195/65R15
2015	NISSAN	ALTIMA	16	7	P215/60R16
2017	FORD	EXPLORER	18	7.5	P245/60R18
2013	HYUNDAI	ELANTRA	16	6	P205/55R16
2015	KIA	OPTIMA	16	6.5	P205/65R16
2011	BMW	3 SERIES	16	7	P205/55R16 H
2017	SUBARU	OUTBACK	18	7	225/60R18 100H
2018	JEEP	WRANGLER UNLIMITED	17	7.5	P245/75R17
2019	VOLKSWAGEN	JETTA	16	6.5	205/60R16 H
2017	LEXUS	RX 350	18	8	235/65R18 106V
2013	MERCEDES-BENZ	C-CLASS	17	7.5	225/45R17
2019	CHEVROLET	BOLT EV	17	6.5	P215/50R17
2018	TESLA	MODEL X	20	9	265/45R20 108V
2019	NISSAN	LEAF	16	6.5	P205/55R16
2017	TOYOTA	MIRAI	17	7	P215/55R17 93V
2020	HYUNDAI	KONA EV	17	7	215/55R17

Year	Make	Model	Rim Size	Width	OEM Tire spec
2016	FIAT	500E	15	5.5	185/55R15
2019	BMW	I3	19	5	155/70R19

Source: CEC Staff