Burning Rubber and Cash: How Inefficient Replacement Tires Are Costing Californians

A report from the Coalition for Clean Air and the Consumer Federation of America

Prepared by the Appliance Standards Awareness Project

July 2025

COALITION FOR CLEAN AIR

Consumer Federation of America

About the Coalition for Clean Air

The Coalition for Clean Air, founded in 1971, is a California nonprofit working to improve air quality, prevent climate change and protect public health.

About the Consumer Federation of America

The Consumer Federation of America is an association of nonprofit consumer organizations that was established in 1968 to advance the consumer interest through research, advocacy, and education. Today, nearly 250 of these groups participate in the federation and govern it through their representatives on the organization's board of directors.

About the Authors

Jeremy Dunklin is a senior technical advocacy associate at the Appliance Standards Awareness Project.

Joanna Mauer is the deputy director of the Appliance Standards Awareness Project.

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Summary

Inefficient replacement tires are costing California drivers $184 on average in extra gasoline costs over the lifetime of a set of tires while causing needless climate emissions and air pollution. Ensuring replacement tires are as efficient as those shipped on new cars would save California drivers over $25 billion through 2050. However, while the California legislature passed a bill more than 20 years ago directing the California Energy Commission to establish replacement tire efficiency standards, the Commission has yet to act.

Introduction

Car manufacturers typically ship new vehicles with fuel-efficient tires because they are a very low-cost way to help meet vehicle fuel economy standards. However, because there are no efficiency standards for replacement tires, replacement tires generally reduce a vehicle's fuel efficiency, meaning drivers pay more for gas or electricity and cannot travel as far on a full tank or charge. A set of tires only lasts a few years on average, so a typical vehicle will have several sets of replacement tires over its lifetime. Minimum standards ensuring that replacement tires are as good as the tires that come on a new vehicle would save Californians money and help drivers go further before needing to refill or recharge.

A tire's rolling resistance (i.e., the force resisting its rotational motion) is a key factor in a vehicle's fuel efficiency. Inefficient replacement tires with high rolling resistance require more energy to rotate, thereby reducing both fuel mileage and vehicle range. Fuel-efficient tires are readily available on the market today and leverage advances in rubber chemistry and structural/tread design to achieve low rolling resistance without compromising safety or longevity. Based on recent analysis from the National Highway Traffic Safety Administration (NHTSA), we estimate that more efficient replacement tires would yield fuel savings of about 3.1% for gasoline vehicles and 4.0% for electric vehicles (EVs), equating to a range increase of 10–15 miles for a typical EV.

A state law enacted in 2003, Assembly Bill 844 authored by then-Assemblymember Joe Nation, directed the California Energy Commission (CEC) to establish replacement tire efficiency standards.[1] The CEC restarted long-overdue work to set these standards in 2020,[2] collecting information, conducting analysis, and soliciting input, but more than four years later forward progress has stalled out again. This inaction is costing consumers and putting the state even further behind in reaching its emissions reduction targets. By moving promptly to complete these long overdue standards, the CEC can save Californians money and cut pollution that harms public health and the environment.

[1] www.leginfo.ca.gov/pub/03-04/bill/asm/ab_0801-0850/ab_844_bill_20030602_amended_asm.pdf

[2] efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=20-TIRE-01

Inaction on Replacement Tire Efficiency Is Costing Consumers and Harming Public Health and the Environment

Absent efficiency standards, inefficient replacement tires are currently burdening Californians with unnecessary gasoline and electricity costs. As shown in table 1, we estimate that California drivers of gasoline vehicles are spending $184 extra on gasoline on average over the lifetime of a set of four replacement tires,[3] while EV drivers are spending an extra $161 on electricity. Statewide, we estimate inefficient replacement tires are costing California drivers more than $1.1 billion this year alone. These added costs are particularly significant for low-income drivers, who are disproportionately burdened by fuel costs and are more likely to own an older vehicle with replacement tires.

Table 1. Increased per-set and statewide fuel costs due to inefficient replacement tires

Vehicle type	Average annual additional fuel costs (2024$)	Average lifetime additional fuel costs (2024$)	2025 statewide additional fuel costs (million 2024$)
Gasoline	48	184	1,100
Electric	42	161	34

Efficient replacement tires are very cost-effective for purchasers. Based on recent analysis from NHTSA, we estimate that a set of four replacement tires matching the efficiency of typical new car tires has a total incremental cost of $26.[4] As shown in table 2, accounting for the additional upfront cost, the life-cycle cost (LCC) savings are significant for drivers of both gasoline vehicles and EVs.[5] The additional upfront cost is paid back in just over six months in lower gasoline or electricity costs; these payback periods are significantly shorter than the roughly four-year average lifetime of a replacement tire set.

Table 2. Consumer economics for a set of efficient replacement tires

Vehicle type	Average LCC savings (2024$)	Simple payback period (years)
Gasoline	145	0.5
Electric	124	0.6

Inefficient replacement tires are also causing needless additional emissions of nitrogen oxides (NO_x) particulate matter ($PM_{2.5}$), and carbon dioxide (CO_2) that harm public health and the environment. NO_x

[3] We estimate that the average lifetime of replacement tires is 3.8 years, based on an estimated tire lifetime of 34,716 miles and annual miles driven per vehicle of 9,126 miles/year.

[4] Our incremental cost estimates are generally consistent with analysis performed as part of CEC's rulemaking, which showed there are efficient replacement tires available on the market today at low price points (about $100 per tire) and that there is no apparent correlation between rolling resistance and price (see Appendix B, Figure B1). Smithers Test Report, pp. 21–27. efiling.energy.ca.gov/GetDocument.aspx?tn=249031&DocumentContentId=83588

[5] We calculated LCC savings by subtracting the incremental cost from the discounted lifetime fuel savings (5% discount rate).

and $PM_{2.5}$ are harmful to the human respiratory system and contribute to respiratory conditions, particularly in children, the elderly, and people with asthma. We estimate that this year alone, inefficient replacement tires in California are causing additional emissions of 1,490 tons of NO_x, 106 tons of $PM_{2.5}$, and 2.4 million metric tons of CO_2; these are roughly equivalent to the annual emissions from nearly three-quarters of a million gasoline vehicles.[6]

Replacement Tire Efficiency Standards Would Yield Significant Savings for California Consumers

Replacement tire efficiency standards would reduce gasoline and electricity consumption, yielding substantial savings for Californians. Table 3 summarizes the potential statewide cumulative fuel and cost savings through 2050 if replacement tires were as efficient as typical new car tires.[7] Potential cumulative statewide gasoline savings are equivalent to about 340,000 tanker trucks of gasoline,[8] while the potential cumulative electricity savings are equivalent to the annual electricity use of more than 5 million California households.[9]

Efficiency standards for replacement tires could save Californians over $25 billion through 2050.

Table 3. Potential cumulative statewide fuel and cost savings through 2050

	Fuel (billion gallons or TWh)	Fuel costs (billion 2024$)
Gasoline	2.9	13.6
Electric	33.6	11.8
Total	--	**25.4**

The estimated cost savings take into account the transition from a mostly gasoline vehicle fleet to a mostly EV fleet by 2050.[10] Nearly half of the cumulative cost savings are attributed to EV replacement tires, highlighting the importance of replacement tire efficiency even as the California light-duty vehicle market transitions to EVs.

Cutting needless electricity waste and reducing EV charging demand would also have positive impacts on the electric grid. Reducing electricity usage, particularly during peak demand periods, lessens strain on key grid components, making the grid less prone to blackouts or other outages. Reducing electricity demand can also lessen the need for costly grid infrastructure upgrades like new power plants or transmission upgrades, which can help moderate future electricity prices.

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[6] Based on our estimated gasoline savings (3.1%) and number of gasoline vehicles with replacement tires (23.4 million).

[7] We assumed that standards would take effect in 2027.

[8] www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results

[9] www.eia.gov/consumption/residential/data/2020/state/pdf/ce4.1.el.st.pdf

[10] We estimate the share of replacement tires miles driven by EVs will be more than 35% in 2035 and more than 90% in 2050.

Replacement Tire Efficiency Standards Would Cut Emissions

In addition to reducing gasoline and electricity consumption and associated fuel costs for Californians, more efficient replacement tires would deliver significant reductions in air pollution and greenhouse gas emissions that complement existing state policies aimed at reducing emissions. Cutting needless gasoline waste reduces both tailpipe emissions and upstream emissions associated with oil refining and distribution, while reducing electricity waste averts power plant emissions.

Table 4 summarizes the potential cumulative emissions reductions through 2050 for NO_x, $PM_{2.5}$, and CO_2; the $PM_{2.5}$ emissions reductions are equivalent to the yearly exhaust emissions from nearly 600,000 diesel school buses,[11] and the CO_2 emissions are equivalent to the yearly emissions from 84 gas-fired power plants.[12] Replacement tires on gasoline vehicles represent over 90% of the cumulative NO_x and CO_2 emissions reductions, even though we are assuming rapid EV adoption (100% of new sales by 2035). However, meaningful emissions reductions from improved EV replacement tire efficiency will also continue as long as electricity generation produces emissions.

Table 4. Potential cumulative statewide emissions reductions through 2050

	NO_x (thousand tons)	$PM_{2.5}$ (thousand tons)	CO_2 (million metric tons)
Gasoline	16.4	1.3	29.3
Electric	1.5	--*	2.7
Total	**17.9**	**1.3**	**32.0**

**$PM_{2.5}$ data were not available for upstream power plant emissions.*

Appendix A describes our methodology and sources for the analysis inputs and assumptions.

Reducing Tire Rolling Resistance Does Not Compromise Safety

Millions of new cars ship every year with tires that are both efficient and safe. Well-established advances in tire rubber chemistry and design enable lower-rolling-resistance tires without sacrificing performance.[13] As part of the CEC's rulemaking, the consulting firm Smithers tested wet grip traction for 149 tire models.[14] Wet grip index, a key safety metric measuring how quickly a tire can stop on wet pavement, was used to evaluate performance. As shown in figure 1, there is no apparent correlation between wet grip index (where higher is better) and rolling resistance. In fact, the worst-performing tire for wet grip (0.92 wet grip, see figure 1 red circle) also had poor efficiency, with a rolling resistance coefficient of 11.0 newtons per kilonewton (N/kN). Meanwhile, the most efficient tires (lowest rolling

[11] Assuming 14,000 miles per year and an exhaust $PM_{2.5}$ emissions factor of 0.155 g/mile. www.bts.gov/content/estimated-national-average-vehicle-emissions-rates-vehicle-vehicle-type-using-gasoline-and afdc.energy.gov/data/widgets/10309

[12] www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results

[13] pp. 3-168–3-170. www.nhtsa.gov/sites/nhtsa.gov/files/2024-06/CAFE-2027-2031-HDPUV-2030-2035_Final-Technical-Support-Document.pdf

[14] Smithers Test Report, pp. 17–20. efiling.energy.ca.gov/GetDocument.aspx?tn=249031&DocumentContentId=83588

resistance, see figure 1 green box) all achieved wet grip scores above 1.1. These results indicate that adopting replacement tire efficiency standards to reduce rolling resistance would not compromise safety.

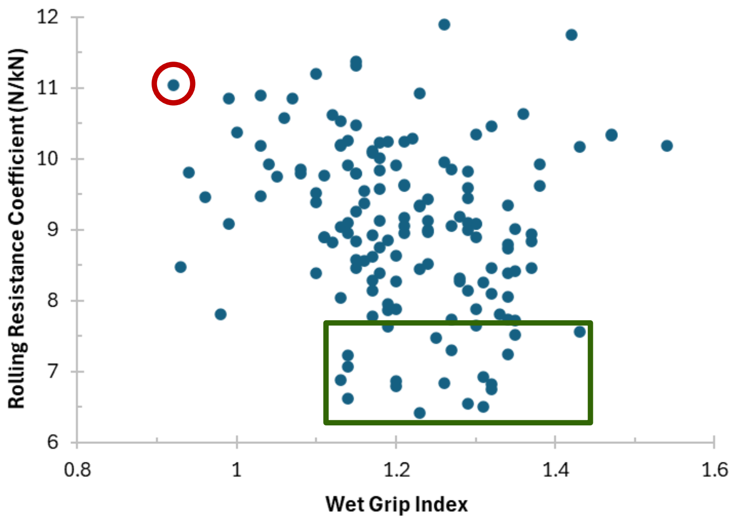

Figure 1. Tested tire rolling resistance versus tested wet grip index for 149 unique tires[15]

The CEC could also consider establishing a minimum wet grip index requirement in addition to a rolling resistance standard, helping ensure that manufacturers are producing quality tires that are both safe and efficient. There are currently no wet grip index requirements for tires sold in the United States.

Efficient Tires Do Not Compromise Product Lifetimes

Tire lifetime is an important consideration with respect to both consumer impacts and tire pollution concerns. To investigate the impact of an efficiency standard on replacement tire lifetime, the analysis conducted for the CEC rulemaking also looked at Uniform Tire Quality Grading System (UTQG) treadwear ratings as a function of tested rolling resistance. The UTQG is a set of passenger tire standards created by NHTSA; since 1979, the standards have required tire manufacturers to stamp UTQG ratings on each tire's sidewall. The data on treadwear showed that replacement tire rolling resistance and treadwear rating are not correlated.[16] More broadly, the testing results show a wide range of treadwear ratings among both inefficient and efficient tires. Additionally, real-world testing data from Consumer Reports suggest that fuel-efficient replacement tires can last just as long as less efficient models. For example, of the 51 all-season tire models tested by Consumer Reports, tires with rolling resistance scores of 4 or 5 (out of 5) had average measured tire tread lifetimes that were about 5% higher than those of less efficient tires with rolling resistance scores of 3 or lower.[17]

[15] Plot is reproduced from data tables (pp. 76 to 96) in Smithers' test report. efiling.energy.ca.gov/GetDocument.aspx?tn=249031&DocumentContentId=83588

[16] See Appendix B, figure B2.

[17] Accessed on April 21, 2025. www.consumerreports.org/cars/tires/c200973/

As part of the CEC's rulemaking, the Commission has initiated the preparation of a draft environmental impact report.[18] While this environmental impact report has not been published as of the publication date of this policy analysis, we are not aware of any data suggesting that improved replacement tire efficiency would have a negative impact on tire dust pollution (e.g., microplastics and particulate matter). Manufacturers generally incorporate both design changes and improved tread formulations to reduce rolling resistance.[19] Most notably, silica is the main additive used to decrease rolling resistance without diminishing tire lifetime or performance. Silica is not considered a microplastic and does not possess any unique pollution concerns relative to other tire rubber-related compounds.

The CEC Should Act Promptly to Complete the Replacement Tires Rulemaking

California Assembly Bill 844 of 2003 directed the CEC to adopt a replacement tire efficiency program to ensure replacement tires for passenger cars and light-duty trucks are at least as efficient as tires sold on new vehicles.[20] The CEC began work on the program in 2003, but efforts were paused in deference to federal efforts by a NHTSA program created to pursue similar goals. However, while NHTSA eventually prescribed the test method that manufacturers must use to determine a tire's rolling resistance rating, peak wet traction rating, and treadwear ratings, the agency has never established any minimum rolling resistance standards, rating system, or labeling program. In 2020, the CEC restarted its efforts and in 2023 published a Draft Framework document,[21] which included proposed minimum efficiency standards. However, there has been no formal rulemaking activity since. The CEC should act promptly to complete the tires rulemaking to reduce costs for Californians and cut emissions.

Conclusion

California drivers of vehicles with inefficient replacement tires are spending $184 in added gasoline costs on average over the lifetime of a set of four tires. These fuel costs add up to about $1.1 billion annually statewide. Efficient replacement tires are very cost-effective, with estimated payback periods of just over six months. Efficiency standards for replacement tires that ensure they are as efficient as tires on new cars could cumulatively save California drivers over $25 billion in fuel costs through 2050. In addition to the substantial cost savings, more efficient replacement tires would also reduce harmful air pollution, cut greenhouse gas emissions, increase EV range, and lessen the strain on the electric grid. As California leaders look for ways to increase affordability and reduce emissions, prompt action by the CEC to set replacement tire efficiency standards is urgently needed to save Californians money and reduce environmental harms.

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[18] efiling.energy.ca.gov/GetDocument.aspx?tn=259127&DocumentContentId=95190

[19] pp. 3-168 to 3-170. www.nhtsa.gov/sites/nhtsa.gov/files/2024-06/CAFE-2027-2031-HDPUV-2030-2035_Final-Technical-Support-Document.pdf

[20] The program was to include a tire efficiency database, minimum efficiency standards, and point-of-sale consumer information. www.leginfo.ca.gov/pub/03-04/bill/asm/ab_0801-0850/ab_844_bill_20030602_amended_asm.pdf

[21] efiling.energy.ca.gov/GetDocument.aspx?tn=248639&DocumentContentId=83135

Appendix A. Methodology and Assumptions

To estimate the annual gasoline and electricity savings that could be achieved by requiring replacement tires to meet the same level of efficiency as typical tires on new cars, we used estimates of per-unit gasoline or electricity savings, annual replacement tire shipments, the percentage of replacement tire miles driven by gasoline vehicles versus EVs, and average tire lifetime. Tables A1 and A2 summarize our analysis inputs and sources.

We calculated per-unit gasoline and electricity savings assuming a 15% reduction in rolling resistance (from a baseline of 9.00 N/kN to 7.65 N/kN). The average rolling resistance for tires on new cars (7.65 N/kN) is based on Smithers data provided in support of the CEC's rulemaking.[22] Although the average rolling resistance of replacement tires in the Smithers data is slightly higher (9.23 N/kN) than our assumed baseline, we used a baseline value of 9.00 N/kN for consistency with the 2024 NHTSA analysis for CAFE standards that we used to estimate per-unit savings and incremental cost. Thus, our per-unit savings estimates are likely conservative.

Our per-unit savings estimates are based on the average of NHTSA's fuel consumption improvement estimates for reductions in rolling resistance of 10% and 20%. NHTSA modeled fuel consumption (i.e., fuel economy) improvement across a range of vehicles, with larger percentage savings typically associated with very efficient hybrids or EVs. Since about 10% of new car models are EVs and EVs are typically the most efficient vehicles, we assumed an average fuel economy improvement for EVs based on the 95th percentile of fuel consumption improvement for all models in the analysis (i.e., approximating the median EV model); this equates to a fuel economy improvement of 4.15% (translating to 4.0% fuel savings). Similarly, for gas vehicles, we assumed the 45th percentile (i.e., the median non-EV), which equates to a per-unit fuel economy improvement of 3.19% (3.1% fuel savings).

We assumed average new vehicle fuel economy of 28 miles/gallon for gasoline vehicles and 3.13 miles/kWh for EVs based on 2024 model year vehicles. We then calculated the average fuel economy of comparable vehicles with inefficient replacement tires based on this average new vehicle fuel economy and the fuel economy improvements associated with a 15% reduction in rolling resistance; this yielded estimated average fuel economy for vehicles with inefficient replacement tires (i.e., baseline fuel economy) of 27.13 miles/gallon and 3.01 miles/kWh.

We calculated the baseline and standards case per-unit annual gasoline and electricity consumption (for a set of four tires) by dividing the estimated average annual miles driven per vehicle (9,126) in California by the respective fuel economy for both gasoline vehicles and EVs. We assumed that average vehicle fuel economy and per-unit fuel savings from more efficient tires will remain constant over time. We note that higher fuel economy is associated with larger percentage savings from improved tire efficiency. Thus, any reductions in baseline per-unit fuel consumption over time would be offset at least in part by an increase in percentage savings.

We estimated California sales of replacement tire sets (i.e., sets of four tires) by multiplying national shipments by the ratio of vehicle miles traveled by light-duty vehicles in California to national vehicle miles traveled (9.7%). We projected future annual replacement tire shipments based on the projected increase in statewide vehicle miles traveled in the California Air Resources Board's (CARB) EMFAC 2021

[22] efiling.energy.ca.gov/GetDocument.aspx?tn=248639&DocumentContentId=83135

model.[23] We estimated average tire lifetime in miles (35,149) based on national replacement tire shipments, national vehicle registrations, and average vehicle lifetime.

We used historical and projected EV sales and vehicle survival rates to estimate the percentage of replacement tire miles driven by EVs in each year of the analysis. To estimate annual EV sales, we used historical California EV sales data for 2010–2024 and Advanced Clean Cars II (ACCII) requirements for 2026–2050 sales; we estimated 2025 EV sales as the average of 2024 and projected 2026 sales. For each year of the analysis, we estimated the percentage of total miles driven by EVs by summing the product of EV sales as a portion of total vehicle sales for a given vehicle age cohort by the percentage of total vehicle miles driven by each vehicle age cohort.[24] This approach accounts for both the fact that newer vehicles are driven more than older vehicles and that a small portion of vehicles remain on the road for nearly 40 years. We delayed the estimated percentage of replacement tire miles driven by EVs by three years to account for the fact that new EVs are not on replacement tires. We project that more than 35% of replacement tire miles will be driven by EVs in 2035, increasing to more than 90% in 2050.

To calculate statewide annual gasoline and electricity savings, we multiplied the number of sets of affected replacement tires on gasoline vehicles and EVs in each year of the analysis by the respective per-unit savings. In any given year, we counted only one-half year of savings from tires purchased in that year to account for tires being purchased throughout the year.

We calculated per-unit annual fuel cost savings by multiplying per-unit fuel savings by 2024 California gasoline and electricity prices. For gasoline prices, we calculated the average of 2024 California monthly prices based on U.S. Energy Information Administration (EIA) data ($4.64). For electricity prices, we calculated a weighted-average electricity price ($0.35/kWh) assuming an EV charging ratio of 83% residential (Level 1/Level 2) charging and 17% DC fast charging (Level 3) based on the IEA EV Outlook 2024; we used the average 2024 California residential electricity price from EIA and a Q4 estimate of Level 3 charging rates in California. We assumed that fuel prices will remain constant over time.

We estimated the incremental cost ($26) for a set of four tires associated with a 15% reduction in rolling resistance based on a linear interpolation of the estimated incremental costs for a 10% reduction and a 20% reduction in the NHTSA CAFE standards analysis.

We calculated statewide NO_x, $PM_{2.5}$, and CO_2 emissions reductions by multiplying annual gasoline and electricity savings by tailpipe and upstream emission factors. For gasoline tailpipe emission factors, we used CARB EMFAC 2021 estimated fleet averages for NO_x and $PM_{2.5}$ and EPA's estimate for 2024 model year vehicles for CO_2. For upstream emission factors, we used California-specific gasoline upstream emission factors (i.e., associated with refining and distribution) from DOE's CA-GREET4.0 model for NO_x, $PM_{2.5}$, and CO_2 and EV upstream emissions (i.e., associated with power plant emissions) factors for NO_x and CO_2 based on AEO 2025 Electricity Market Module (EMM) regional data. ($PM_{2.5}$ data were not available for upstream EV emissions.) We calculated upstream emissions factors for each year of the analysis by dividing projected electric power sector emissions by projected electric power generation for each EMM region, assuming transmission and distribution losses of 4.2%.[25] Since California spans more than one EMM region, we calculated weighted-average emissions factors based on electricity sales.

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[23] arb.ca.gov/emfac/emissions-inventory/96a73fb78623f89bd5aa13f52390b3e5ab8ed297

[24] Based on a fleet-weighted average of car, van/SUV, and truck data.

[25] Based on Table 10 of the EIA State Electricity Profiles. https://www.eia.gov/tools/faqs/faq.php?id=105&t=3

Table A1. Analysis inputs and sources

Input	Value	Description/Source
Vehicle miles driven per year	9,126	Calculated from 2022 Department of Transportation Statistics: www.fhwa.dot.gov/policyinformation/statistics/2022/ps1.cfm www.fhwa.dot.gov/policyinformation/statistics/2022/mv1.cfm
Standards case gas vehicle fuel economy	28 miles/gallon	2024 model year new car mpg from 2024 EPA Auto Trends 2024 (p. 14): www.epa.gov/automotive-trends/download-automotive-trends-report#Full%20Report
Standards case EV fuel economy	3.13 miles/kWh	Weighted average for 2024 model year new car mi/kWh, based on 2024 Cox Automotive sales report and DOE data on EV efficiency: www.coxautoinc.com/wp-content/uploads/2025/01/Q4-2024-Kelley-Blue-Book-EV-Sales-Report.pdf www.energy.gov/eere/vehicles/articles/fotw-1373-december-16-2024-efficiency-evs-model-year-2024-ranges-53-140-mpge
Gas vehicle fuel economy improvement	3.19%	Based on the 45th percentile of % fuel economy improvement for a 15% reduction in rolling resistance (average of 10% and 20% results, p. 3–174, Fig. 3–43): www.nhtsa.gov/sites/nhtsa.gov/files/2024-07/NHTSA-final-technical-support-document-cafe.pdf
EV fuel economy improvement	4.15%	Based on the 95th percentile of % fuel economy improvement for a 15% reduction in rolling resistance (average of 10% and 20% results, p. 3–174, Fig. 3–42): www.nhtsa.gov/sites/nhtsa.gov/files/2024-07/NHTSA-final-technical-support-document-cafe.pdf
EV share of replacement tire miles driven	See table A2	Initial EV sales data through 2024 and total sales from 2021 to 2024: www.energy.ca.gov/files/zev-and-infrastructure-stats-data 2010 through 2020 total sales: www.cncda.org/wp-content/uploads/Cal-Covering-4Q-24-FINAL.pdf

		ACCII requirements: ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii Vehicle survival data (see "parameters_ref"): www.nhtsa.gov/file-downloads?p=nhtsa/downloads/CAFE/2024-FRM-LD-2b3-2027-2035/Central-Analysis/
2024 national replacement tire shipments (set of 4)	64.6 million	www.moderntiredealer.com/suppliers/article/33038241/ustma-calls-for-record-year-of-tire-shipments
2024 California replacement tire shipments (set of 4)	6.26 million	Based on national shipments and California % of national annual non-truck vehicle miles: www.fhwa.dot.gov/policyinformation/statistics/2022/ps1.cfm
Incremental cost (set of 4, 2024$)	$26.39	Linear interpolation between the costs associated with reductions in rolling resistance of 10% and 20% (pp. 3–175, 3–176, Table 3–126): www.nhtsa.gov/sites/nhtsa.gov/files/2024-07/NHTSA-final-technical-support-document-cafe.pdf
Tire lifetime	34,716 miles 3.80 years	Lifetime (years) is lifetime in miles divided by yearly miles driven. Tire lifetime (miles) is based on national replacement tire shipments, number of vehicles registered, and vehicle lifetime: www.fhwa.dot.gov/policyinformation/statistics/2022/pdf/mv1.pdf www.nhtsa.gov/file-downloads?p=nhtsa/downloads/CAFE/2024-FRM-LD-2b3-2027-2035/Central-Analysis/
Gasoline price (2024$)	$4.64/gal	www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPM0_PTE_SCA_DPG&f=M
Electricity price (2024$)	$0.35/kWh	Weighted average of California residential and Level 3 DC charging rates: www.eia.gov/electricity/data/browser/#/topic/7?agg=1,0&geo=vvvvvvvvvvvvo&endsec=8&linechart=ELEC.PRICE.US-RES.M~ELEC.PRICE.CA-RES.M&columnchart=ELEC.PRICE.US-RES.M&map=ELEC.PRICE.US-RES.M&freq=M&start=200101&end=202412&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin= stable.auto/insights/electric-vehicle-charger-price-by-state

		www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-vehicle-charging
Tailpipe (gasoline) emissions factors:		www.epa.gov/automotive-trends/download-automotive-trends-report#Full%20Report
CO_2	8.54 kg/gal	arb.ca.gov/emfac/emissions-inventory/96a73fb78623f89bd5aa13f52390b3e5ab8ed297
NO_x	See table A2	
$PM_{2.5}$	See table A2	
Upstream factors (gasoline)		CA-GREET4.0
CO_2	1.48 kg/gal	www.energy.gov/eere/greet
NO_x	4.61 g/gal	
$PM_{2.5}$	0.037 g/gal	
Upstream factors (electricity)		AEO 2025 (Table 54)
CO_2	See table A2	www.eia.gov/outlooks/aeo/tables_ref.php
NO_x	See table A2	

Table A2. Yearly analysis inputs for percentage of replacement tire miles driven by EVs and emissions factors that change over the analysis period (2027 to 2050)

Year	Percentage of replacement tire miles driven by EVs	Tailpipe gasoline NO_x emissions factors (g/gal)	Tailpipe gasoline $PM_{2.5}$ emissions factors (g/gal)	Upstream electricity CO_2 emissions factors (MMT/TWh)	Upstream electricity NO_x emissions factors (tons/TWh)
2027	8.8%	1.45	0.038	0.139	0.060
2028	10.8%	1.36	0.037	0.133	0.057
2029	13.1%	1.29	0.035	0.134	0.058
2030	15.9%	1.22	0.033	0.145	0.072
2031	19.2%	1.16	0.032	0.155	0.076
2032	22.9%	1.11	0.030	0.158	0.068
2033	27.2%	1.06	0.029	0.138	0.060
2034	31.9%	1.02	0.027	0.129	0.058
2035	36.8%	0.99	0.026	0.122	0.056
2036	41.9%	0.96	0.025	0.111	0.052
2037	47.2%	0.93	0.024	0.102	0.051
2038	52.6%	0.90	0.023	0.097	0.050
2039	57.7%	0.88	0.022	0.090	0.050
2040	62.4%	0.86	0.021	0.090	0.051
2041	66.8%	0.84	0.020	0.083	0.047
2042	70.8%	0.82	0.020	0.071	0.045
2043	74.5%	0.81	0.019	0.071	0.043
2044	77.8%	0.80	0.019	0.072	0.043
2045	80.8%	0.79	0.019	0.069	0.042
2046	83.5%	0.78	0.018	0.061	0.040
2047	85.8%	0.77	0.018	0.063	0.040
2048	87.9%	0.76	0.018	0.063	0.039
2049	89.7%	0.76	0.018	0.059	0.038
2050	91.2%	0.76	0.018	0.053	0.036

Appendix B. Additional Smithers Test Report Data[26]

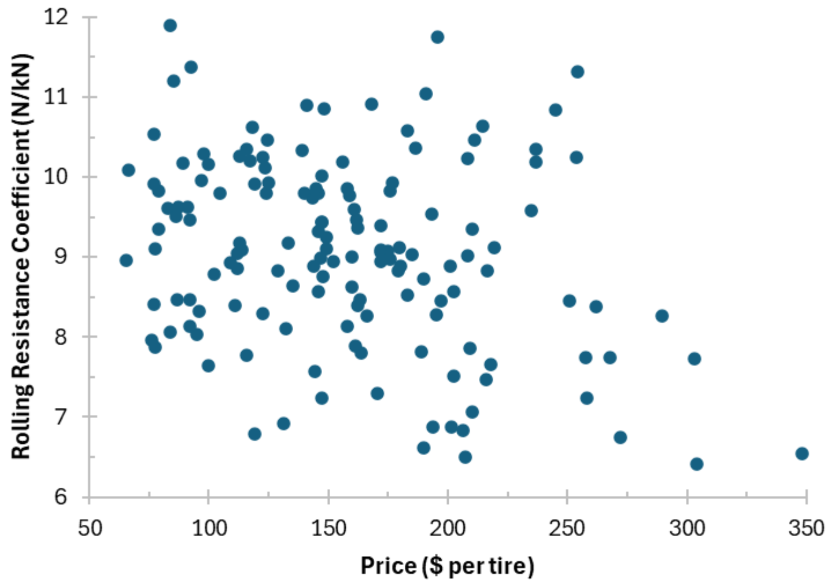

Figure B1. Tested tire rolling resistance versus purchase price for 149 unique tires

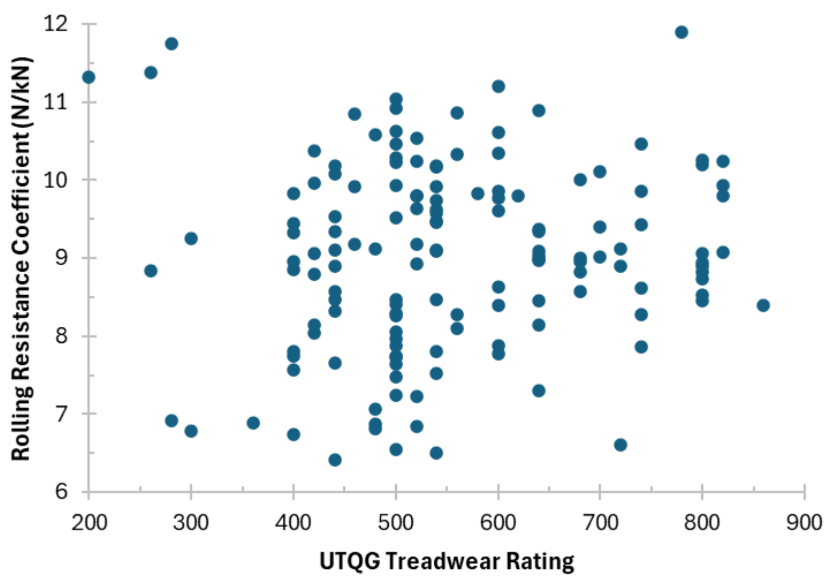

Figure B2. Tested tire rolling resistance versus UTQG treadwear rating for 149 unique tires

[26] Plots shown are reproduced from data tables (pp. 76–90, 96–100) in Smithers' test report. efiling.energy.ca.gov/GetDocument.aspx?tn=249031&DocumentContentId=83588