

R2 Circularity, Energy, & Carbon Footprint



RIVIAN

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Introduction

At Rivian, we build products for the adventurous with the goal of accelerating our global transition to zero-emission energy and transportation. For us, mitigating our impact goes beyond electrification. We are rethinking the entire life cycle of our vehicles—minimizing our reliance on virgin materials and designing for a circular economy where resources are kept in use as long as possible.

In our 2022 Impact Report, we set an ambitious benchmark: to launch a vehicle by 2030 with half the life cycle carbon footprint of our R1 Launch Edition. The R2 Performance with Launch Package meets that goal four years early. By prioritizing recycled content and streamlining our manufacturing, we are proving that high-performance adventure and preserving the world for future generations need not be in conflict. We believe in transparency because it drives the entire industry forward. By sharing our story, we provide customers with the data they need to understand their impact and push the broader electric vehicle (EV) landscape toward higher standards of accountability.

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This report details the R2 carbon footprint, our progress in circularity, and our role in expanding the electrified choices available to today's drivers.



Meet R2



Meet R2

The R2 Performance with Launch Package is the debut vehicle on our all-new midsize platform, engineered to demonstrate that world-class capability and environmental responsibility can go hand-in-hand. This dual-motor, all-wheel drive vehicle delivers 656 horsepower and 609 lb-ft of torque, launching from 0-60 mph in as little as 3.6 seconds and offering an EPA-estimated range of up to 330 miles.



R2 represents a major leap in our decarbonization journey. By embedding sustainability into every stage of design and validation, and incorporating key learnings from our R1 and EDV programs, we have achieved our highest integration of recycled and bio-based materials to date.

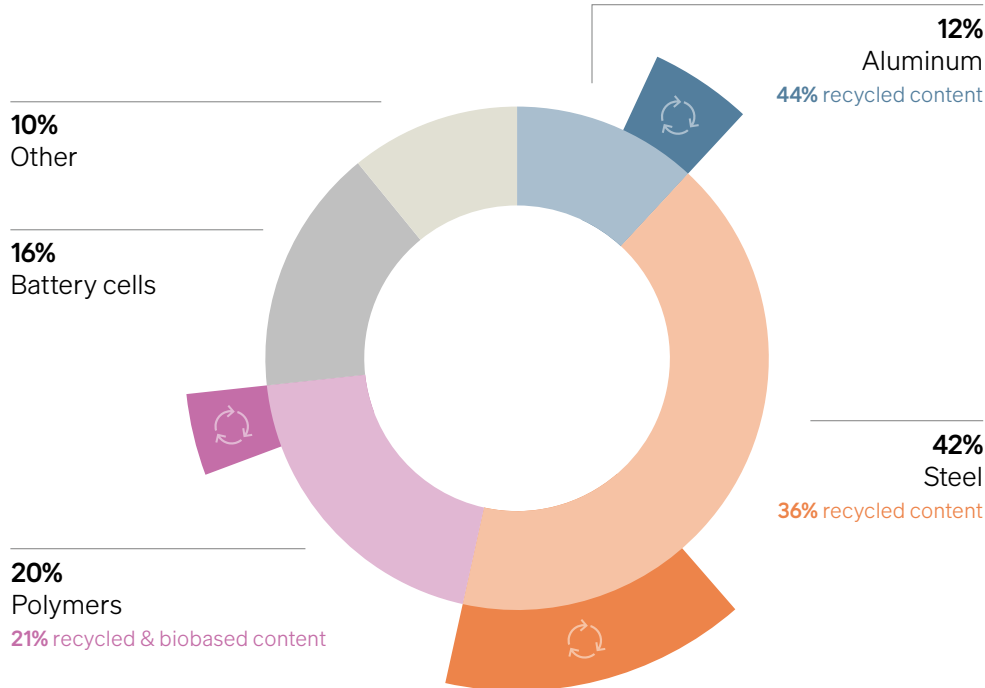
R2 boasts a life cycle carbon footprint of 211 g CO₂e/mi¹ and contains over 550 kg (1,200 lbs) of recycled and bio-based content, making it our most sustainable and technologically advanced vehicle yet.

¹Average carbon footprint when charged using the US average grid electricity with a 3% year-over-year improvement projection.

Circularity



What goes in | R2 materials and supply chain



At Rivian, we believe the most sustainable solutions are the ones that excel in the real world. We have worked closely with our supply chain partners and design teams to integrate recycled and bio-based materials that are both cost competitive and meet our most rigorous standards for performance, safety, and durability.

R2 is primarily composed of steel, aluminum, polymers, and the high-voltage traction battery. Over the last several years, Rivian has strategically focused on both reducing the carbon intensity and improving the circularity of these foundational materials.

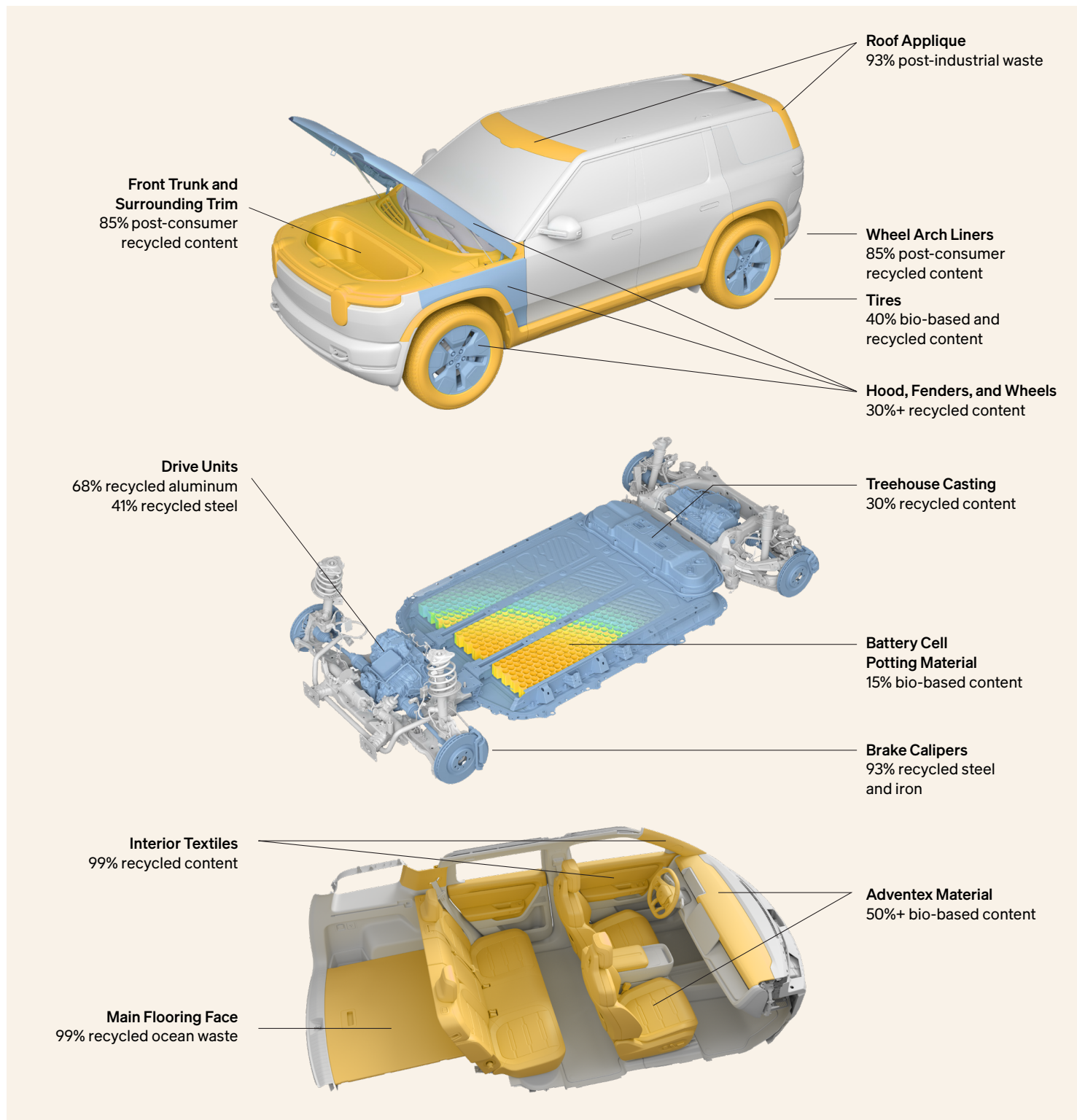
We have taken a rigorous approach to tracking and increasing the recycled content across our steel, aluminum, and polymer supply chains. Prioritizing recycled materials does more than just lower our cradle-to-gate carbon footprint—it builds the infrastructure for a truly circular economy.

25% of the R2 vehicle mass is made from recycled and bio-based materials. This means over 550 kg (1,200 lbs) of recycled and bio-based materials in every vehicle.

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As outlined in our first corporate impact report,² we are committed to reaching 70% recycled content in steel and aluminum and 40% recycled or bio-based content in polymers by 2030.

R2 represents a significant milestone toward those goals, with high-recycled content integrated across every major system.



A few touchpoints that are made of recycled and bio-based materials

²Rivian's previous impact reports can be found at: <https://rivian.com/scaling-responsibly>.



Another way of looking at our supply chain

A fundamental sustainability imperative is to do more with less. For Rivian, this means moving more people and enabling more adventure while taking less from the Earth. Rivian's mission to Keep the World Adventurous Forever can be measured, in part, by our ability to design, engineer, and manufacture vehicles that embrace nature while disrupting it less.

We created an environmental metric called Raw Material Extracted, or RME, that estimates the mass of virgin raw material extracted from the Earth. RME leverages three established principles:

1. Primary fossil energy: fossil energy inputs measured by primary energy demand (PED)
2. Rock-to-metal ratio: the amount of rock mined to create a unit of metal
3. Part scrap rates: manufacturing losses from material utilization and part yields

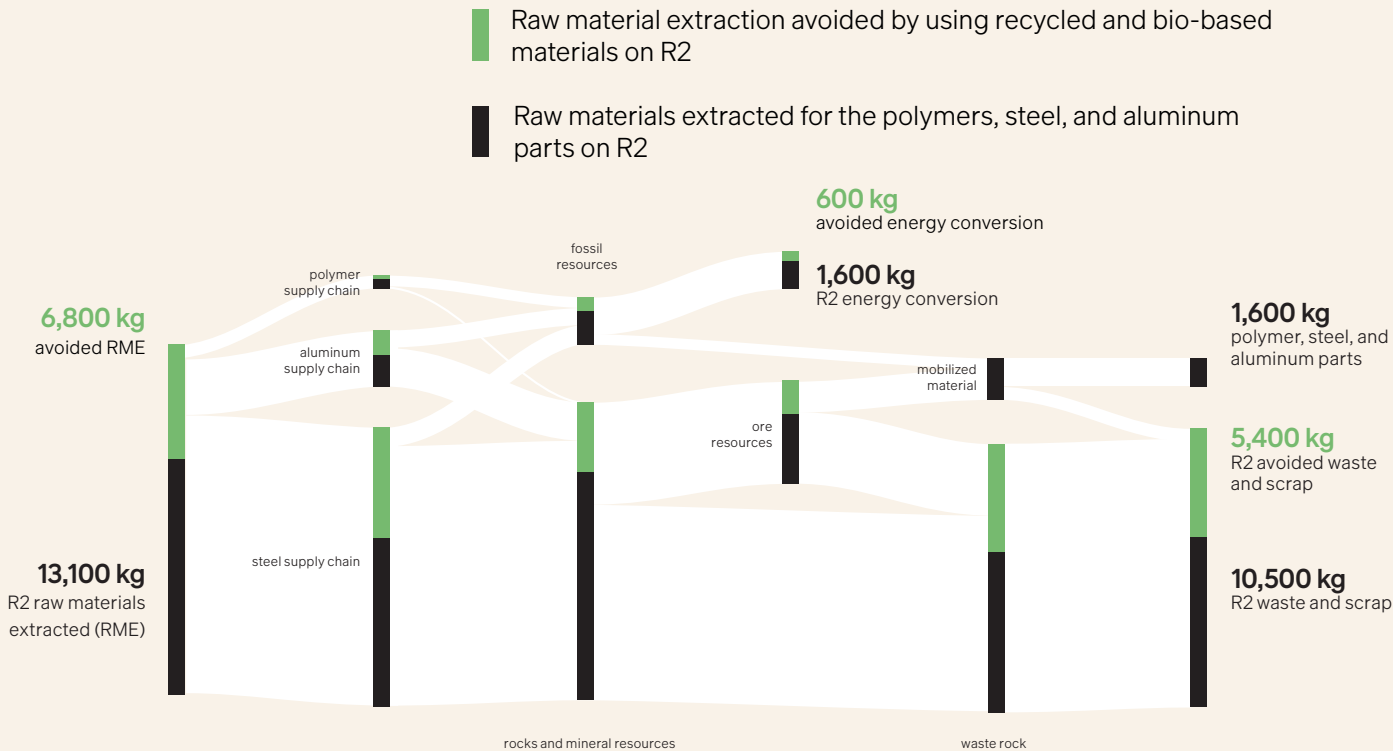
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For our first release of this metric, we focus on R2’s steel, aluminum, and polymer parts. A hypothetical R2 supply chain with fully virgin materials would require 20 metric tons of raw materials to be extracted per vehicle. However, the sustainable materials that our design, engineering, and supply chain teams have incorporated into R2 have reduced our RME by close to 7 metric tons relative to a fully virgin and fossil supply chain, which results in 34% less raw materials extracted.

This results in a RME Efficiency of 8:1, meaning that every kilogram of steel, aluminum, and polymers requires eight kilograms of raw materials to be extracted. For context, a virgin and fossil supply chain has an efficiency of 12:1—so we are headed in the right direction. Moreover, we see a pathway to achieving an efficiency of 4:1 through aggressive adoption of more sustainable materials and improved supply chains.

The sustainable materials that our design, engineering, and supply chain teams have incorporated into R2 have reduced our RME by close to 7 metric tons relative to a fully virgin and fossil supply chain

See the Behind the Scenes for the details on how we calculate RME.



R2 has avoided 7 metric tons of material extraction relative to a fully virgin supply chain. Avoided materials are shown in green; actual R2 materials are shown in black.

What comes out | R2 decommissioning

At Rivian, we view the end of a vehicle's road as the beginning of a new functional life for its core components. Our approach to decommissioning is multifaceted, prioritizing the remanufacturing of components, the identification of viable parts for second-life applications, and finally, the recovery of raw materials for recycling. While we look forward to a future where entire vehicle platforms can be uplifted and repurposed, our focus today is on ensuring that each component is directed toward its best possible use, keeping our resources in play long after their original driving days conclude.

Our strategic partnership with Redwood Materials is a great example of this effort, transforming how we manage end-of-life battery technology by repurposing retired packs to power our own manufacturing infrastructure. Upon completion, our Normal, Illinois, facility will be powered by over 100 Rivian EV batteries arranged in a space equivalent to a small parking lot. This project is projected to deliver an initial 10 megawatt-hours of dispatchable energy, a capacity comparable to connecting 1,000 home-energy storage units. These battery units are sourced from our internal testing fleet and vehicles that are no longer road-ready but still possess viable battery energy. By turning these batteries into flexible grid assets, we are creating a more resilient energy landscape and ensuring our vehicles remain sustainable throughout their entire life cycle.

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Energy

Our energy philosophy is simple: minimize demand first, then meet that demand with the cleanest energy possible. We do not view energy in a vacuum; we look at how our vehicles and facilities can actively transform the electricity grid to be more resilient, more affordable, and cleaner for everyone.

Designing for and building with efficiency

We believe the cleanest kWh is the one you do not use. This means designing for and building with efficiency. R2 is engineered for exceptional SUV efficiency at 268 Wh/mi,³ ensuring every kilowatt-hour takes the driver farther. By optimizing aerodynamics, lowering rolling resistance, streamlining the drivetrain, and reducing vehicle mass, we have achieved significant gains in propulsion efficiency compared to our R1 Launch Edition products. This engineering-first approach ensures that R2 remains one of the most efficient ways to explore the world.

We apply this same rigor to our manufacturing processes. As we continue to grow as an organization, we are optimizing production throughput at our Normal, Illinois facility. In 2025, we cut our onsite production overhead per vehicle by over half compared with that of our R1 Launch Edition products.

Notably, we anticipate that R2's entirely new platform and assembly process will result in higher initial energy overhead during the 2026 ramp-up compared with last year's results. We expect this heightened overhead to decrease significantly as we achieve volume production and optimize our manufacturing throughput.

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Improving the grid

Supporting the resilience and affordability of our energy system is not only essential to Rivian's mission, it is also an outcome of EV adoption. EVs are not just a convenient way to get around; they are powerful, software-enabled computers with batteries that can support hundreds of miles of driving and they are the perfect, nimble partner that serve as a resource for an evolving electric grid.

We are creating an increasingly intelligent charging experience that supports the grid. Following the launch of Schedule Recommendations⁴ in 2025, we are expanding features to include managed charging programs and virtual power plant (VPP) participation, allowing vehicles to both charge and discharge at optimal times. By transforming electric vehicles into flexible grid assets, we can help utilities flatten peak demand and create a more efficient grid, which lowers charging costs for our customers while contributing to a more resilient, reliable energy landscape for everyone.

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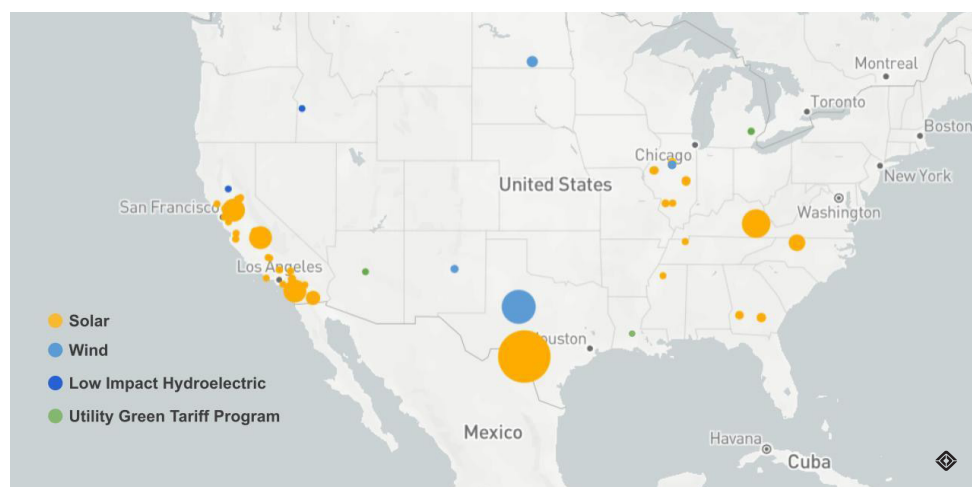
³According to EPA fuel economy rating.

⁴Rivian's smart charging feature that recommends off-peak charging times based on local utility and tariff data to help customers save money and better align charging with grid conditions.

Charging during off-peak hours does more than lower costs—it can also deliver meaningful carbon benefits by aligning charging with times clean energy is abundant. Rivian's analysis found that optimizing home charging can reduce associated carbon emissions by as much as 28%. Because these shifts help the grid operate more smoothly overall, the benefits extend beyond EV drivers alone.

With the help of Rivian drivers everywhere, we are also able to support impactful clean energy projects that enable a more reliable, more affordable, and cleaner grid for everyone. This starts when your vehicle is built, currently at our Normal, Illinois manufacturing plant, where its first charge comes from our on-site wind turbine and solar charge yard. We go even further by matching the first 10,000 miles of every Rivian delivered with 100% renewable energy,⁵ ensuring every adventure contributes to a cleaner grid, no matter where you charge. As always, the Rivian Adventure Network will continue to deliver 100% renewable energy across all locations.

709 MW Clean Energy portfolio



In partnership with The Nature Conservancy, we developed an impact-focused clean energy portfolio that does more than just add power; it strengthens local communities and protects vital habitats.⁶ We prioritize projects that improve grid reliability and utilize the existing built environment, such as upgrading legacy wind farms or integrating hydropower into existing irrigation canals. By sharing this impact-focused investment approach with the broader market, we aim to catalyze sustainable practices well beyond ourselves.

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⁵Rivian will continue retiring renewable energy certificates (RECs) generated from wind and solar projects in the US that correspond to the energy associated with 10k miles of driving an R2 (based on the average EPA Fuel Economy).

⁶For more information visit <https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change/clean-energy-transition/purpose-driven-toolkit/>.

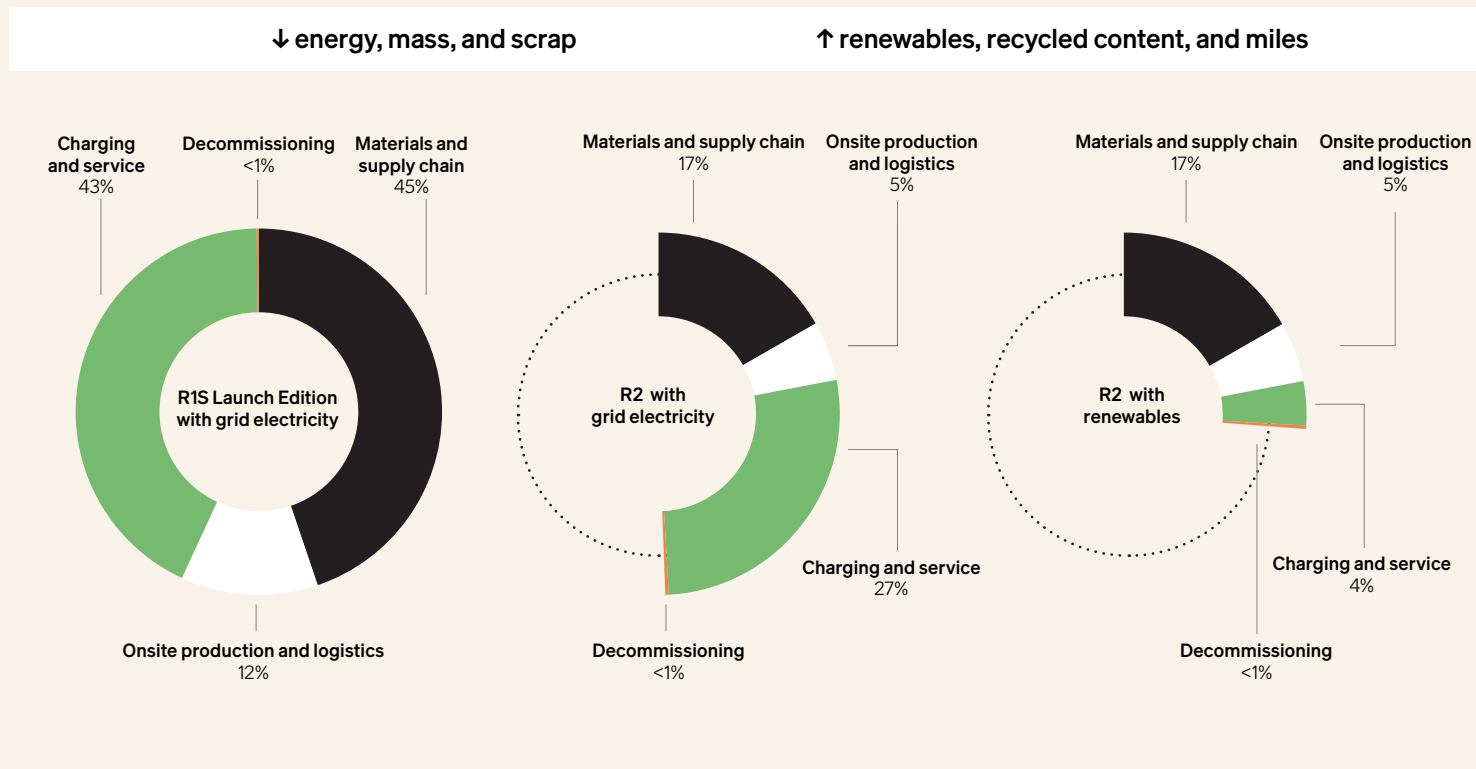
Carbon Footprint



Carbon Footprint

The R2 Performance with Launch Package has a carbon footprint of 211 g CO₂e/mi over 200,000 miles when charged with electricity from the weighted-average Rivian grid mix.⁷ This is a 50% reduction compared with our R1S Launch Edition vehicle.⁸ This reduction puts us four years ahead of our 2030 goal of launching a product with half the carbon footprint of our Launch Edition vehicles.

When R2 is powered exclusively by renewable electricity, its footprint drops to 111 g CO₂e/mi—a 47% reduction compared to our baseline R2 footprint.



While some of the carbon footprint reduction stems from the smaller size, R2 boasts a number of design and supply chain optimizations that account for the majority of this improvement.

Key decarbonization drivers:

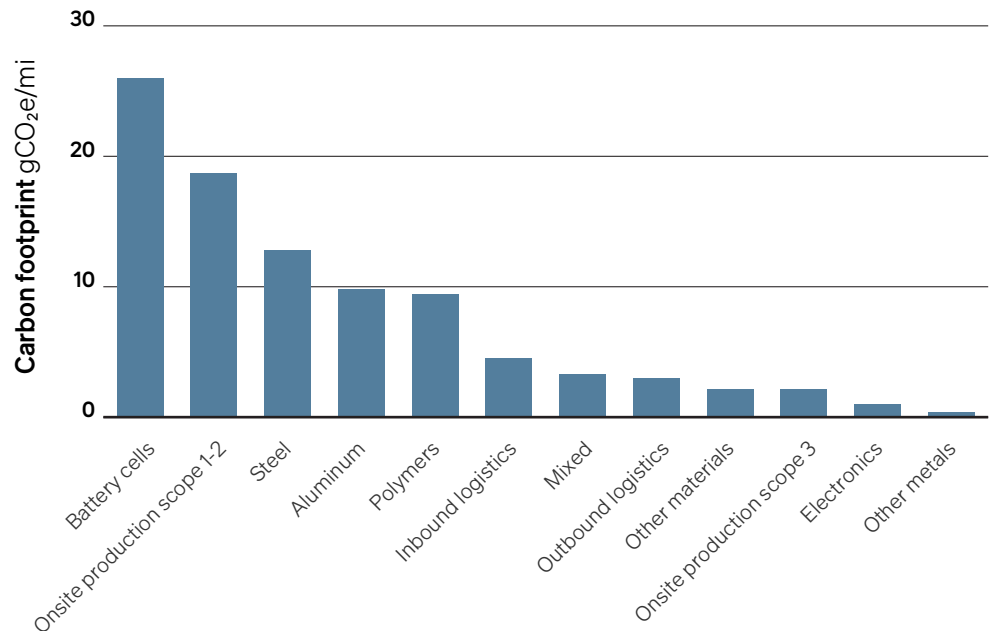
- Energy efficiency improvements
 - Aero and rolling resistance
 - In-house drive units
 - Continuous software improvements
- Extended durability target
- Increased recycled content and improved material utilization

⁷The Rivian grid mix is based on the average US grid with a 3% year-over-year grid improvement over a 10-year period, alongside Rivian's renewable matching programs (10k mile match, first charge, and Rivian Adventure Network (RAN)).

⁸Note: The durability target of the R1 Launch was 155k miles. When the R2 is evaluated over this assessment period the results are 242 g CO₂e/mi, which is a 43% reduction from the R1 Launch Edition. Rivian's previous carbon footprint reports can be found at <https://rivian.com/scaling-responsibly>.

Carbon Footprint

A deeper analysis of our cradle-to-gate results shows battery cells are the largest contributors to R2's carbon footprint. Rivian's product sustainability, procurement, and battery engineering teams collaborate closely to reduce upstream emissions while ensuring our high-voltage traction batteries lead in performance, safety, and durability.

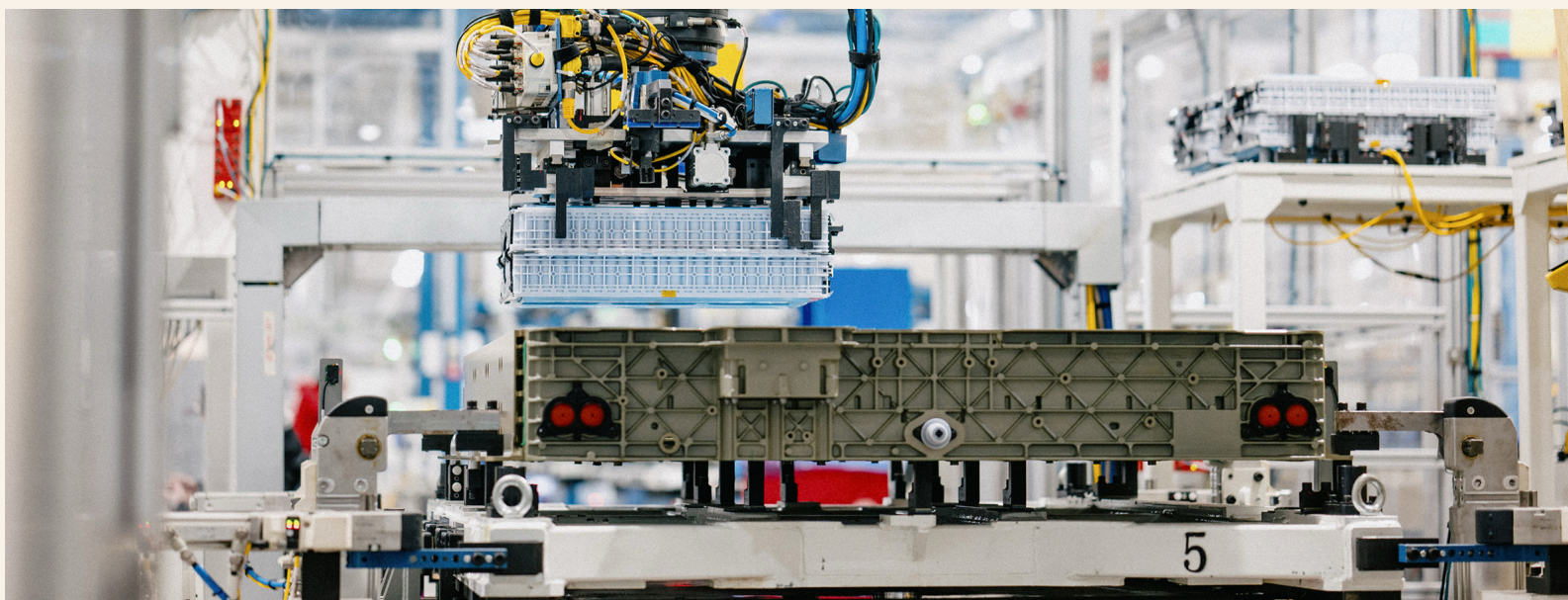


Expanded Pareto results materials — only to cradle-to-gate

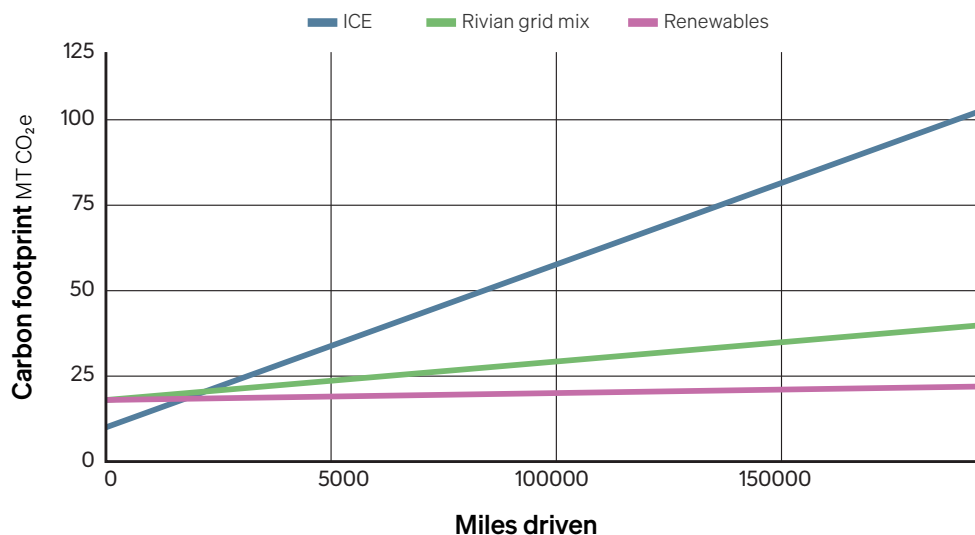
Building on the findings from our previous reports, we targeted and improved key GHG emission hot spots, specifically:

- Lithium production
- Synthetic graphite production
- Cell manufacturing

Improvements in these areas lead the R2 battery cells to boast a cradle-to-gate carbon intensity of 60 kg CO₂e/kWh, which is a significant reduction compared to that of the cells in our R1 Launch Edition vehicles.



Discussion



The transportation sector is responsible for nearly 30% of annual greenhouse gas (GHG) emissions in the United States, with the vast majority originating from light-duty vehicles powered by internal combustion engines (ICE).⁹

A recent study conducted by Rivian and University of California, Davis indicates that fully electrifying the U.S. light-duty fleet would reduce transportation emissions by 57%.¹⁰ When we plot R2 against the average 2023 ICE vehicle from that study, the climate advantage is undeniable. While R2 begins its life with a higher cradle-to-gate carbon footprint, it is significantly more efficient over its lifespan.

The “crossover point”—where R2 under baseline conditions becomes cleaner than the average gasoline vehicle—occurs between 20 and 25 thousand miles into the vehicle’s operation. From that point on, every mile driven further widens the gap, especially when R2 is powered by renewable energy.



⁹ <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions> (2024).

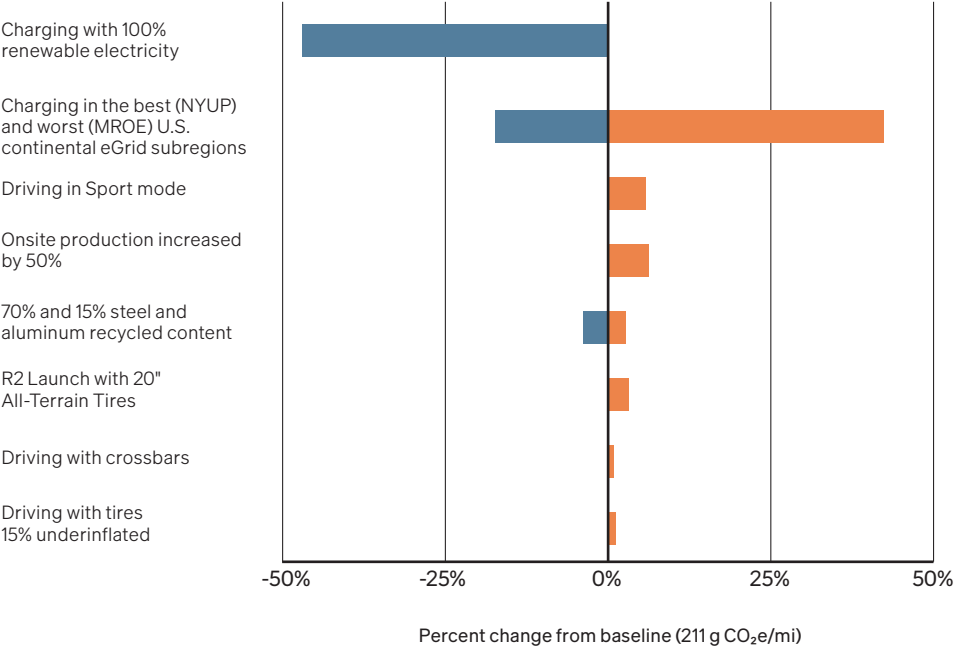
¹⁰ <https://www.nature.com/articles/s44458-025-00032-4>.

Carbon Footprint

The carbon footprints in this report represent fleet-wide averages. In practice, the life cycle emissions of an individual R2 will vary based on several factors, including geographic location, charging habits, driving style, tire maintenance, and total vehicle mileage.

To provide a more comprehensive view, we have supplemented our baseline results with findings from our scenario analyses, highlighting the variables that most significantly impact R2’s footprint.

As with all electric vehicles, R2’s carbon footprint is most sensitive to the carbon intensity of the electricity grid used for charging. Depending on the regional energy mix, the life cycle footprint can vary by nearly 50%.





How to minimize your R2 carbon footprint:

Prioritize Carbon-free Energy Sources

Align charging times with off-peak hours, generally when the grid mix is powered by lower carbon intensive and lower cost energy resources, support green tariffs with your utility supplier, or charge via home solar and renewable matched networks like the Rivian Adventure Network.

Maintain Tire Pressure

Ensure tires are properly inflated to reduce rolling resistance.

Streamline Your Drive

Remove external accessories, such as crossbars, when not in use to improve aerodynamics.

Drive Mindfully

Frequent maximum acceleration and use of “Sport” mode increases energy consumption; moderate use preserves range and reduces your footprint.

Finally, our analysis highlights the tangible climate benefits of our recycled content programs. By prioritizing reclaimed materials, we are not just supporting a circular economy—we are actively decoupling vehicle production from high-emission raw material extraction. Using recycled aluminum and steel, for instance, requires significantly less energy than refining virgin ore, directly lowering the “cradle-to-gate” impact of every R2 we build.

Standardization



One of the most significant challenges in communicating LCA results is the global lack of standardized methodology. LCA methods and data in the automotive industry have not yet been harmonized to the extent that would make vehicle comparisons meaningful or equitable. In our internal research, we found that choices in methods and data can independently change the carbon footprint of an EV by 50% or more.

To address this gap, Rivian championed the J3341 Task Force¹¹ within the Society of Automotive Engineers (SAE) International. This initiative aims to publish a Technical Information Report that establishes a rigorous, unified framework for the carbon footprints of light-duty vehicles.

The J3341 report provides a specific set of guidelines for LCA disclosures and scenarios via the J3341 Disclosure Addendum. As a commitment to this upcoming report, we have completed R2 carbon footprint analysis using the latest work-in-progress version of this addendum. You can find this document at the end of this report.

¹¹<https://www.sae.org/news/blog/j3341-carbon-footprint-lca>.

Behind the Scenes



Carbon footprint

Our carbon footprints consider the cradle-to-grave greenhouse gas (GHG) emissions of the vehicle, which capture the materials and supply chain, onsite production and logistics, charging and service, and, ultimately, decommissioning phases. This means evaluating thousands of individual parts and dozens of electricity grids and conducting numerous discussions with our engineering, design, procurement, and other teams to develop footprints that accurately reflect our vehicles. Our LCA methodology is evolving as we continue to learn and improve our processes. We believe our carbon footprint studies set the bar for depth and comprehensiveness for electric vehicles.

This report, coupled with the latest version of our Carbon Footprint Methodology Report,¹² conforms with International Organization for Standardization (ISO) 14040 and 14044¹³ standards. We use an attributional carbon footprinting approach and assess a single midpoint impact category: global warming potential (GWP) over a 100-year time frame. The characterization factors for greenhouse gases are established by the sixth assessment report (AR6) from the Intergovernmental Panel on Climate Change (IPCC), which includes climate-carbon feedback.

The functional unit is a Rivian R2 driven 200,000 miles over a 10-year period. The results are presented in grams of carbon dioxide equivalent per mile (g CO₂e/mi).



Materials and supply chain

Non-battery cell materials

The carbon footprint of the materials and supply chain phase includes resource mining/extraction and refining as well as upstream manufacturing.

A bill of materials (BoM)—a comprehensive, structured list of all raw materials, sub-assemblies, intermediate assemblies, subcomponent, and parts—along with the exact quantities, is extracted automatically from our product lifecycle management (PLM) system through a script that allocates thousands of material designations into roughly 60 material types, such as polyamides, hot-rolled steel, copper, and many others. Several material types are aggregations of mixed or unassigned materials, which are common among complex parts and/or complex supply chains. Parts with mixed and unassigned materials that are greater than 0.1% of the total vehicle mass are investigated individually through discussions with design teams, reviews of engineering drawings, and other efforts to gather more specific material information. Generally, our target is to reduce the mixed and unassigned materials to less than 15% of the overall vehicle mass, with an aim to reduce this threshold as our data improves. For mixed and unassigned materials, a weighted average of the known materials (excluding battery cells) is used to estimate the composition and apply the corresponding carbon intensity factors.

¹²Rivian Carbon Footprint Methodology Report v1.3.

¹³ISO 14044:2006 “Environmental management – Life cycle assessment – Requirements and guidelines” and ISO 14040:2006 “Environmental management – Life cycle assessment – Principles and framework”.

Based on feedback from our suppliers, the recycled content in our sheet aluminum and steel is 40% and 30%, respectively.¹⁴ This is an improvement from our starting estimate for the R1 Launch Edition model, which was 18% and 23%.

Other types of steel are assumed to have a recycled content of 12%. This corresponds to the external scrap input into cold-rolled coil per global worldsteel¹⁵ data in the Sphera Managed LCA Content (Sphera MLC)¹⁶ database. Since worldsteel doesn't publish the total recycled content across all sources of scrap, this is a conservative estimate. This is also expected to be close to the minimum scrap content in practice as even so-called primary steel from the blast furnace/blast oxygen furnace route will contain around that much recycled content. For cast and extruded aluminum, we assume 40% and 35% recycled content, respectively, which is half of the average recycled content for these semi-fabricated products in North America, as reported by the Aluminum Association.¹⁷ For all other aluminum, we assume 18% recycled content, which is consistent with previous reports. In practice, steel and aluminum will likely have higher recycled content than the amounts included in this R2 study, as demonstrated by both the Aluminum Association and the American Iron and Steel Institute¹⁸. Rivian uses conservative assumptions to ensure that we are not accounting for lower-carbon materials until we are confident about their presence in our supply chains. The weighted average recycled content of the aluminum and steel in R2 is 44% and 36%, respectively.

We also collected supplier data for recycled and bio-based content for our polymers. For parts without primary data, we assume the polymers are made of 0% recycled or bio-based material. The resulting weighted average recycled and bio-based content of the polymers in R2 is 21%.

Battery cells

Battery cells are explored independently of other parts in the BoM due to their complexity and importance with respect to the R2 vehicle footprint. Rivian has created a custom battery model that allows us to integrate relevant details for the cells used in R2. The battery model is described in more detail in the Rivian Carbon Footprint Methodology Report.



¹⁴We gather recycled content information from our suppliers using direct communications facilitated through our supply chain teams.

¹⁵Life Cycle Inventory (LCI) Study: 2020 Data Release. World Steel Association. 2021.

¹⁶Sphera MLC is accessed through the LCA for Experts software version 10.7.

¹⁷The Environmental Footprint of Semi-Fabricated Aluminum Products in North America: A Life Cycle Assessment Report. The Aluminum Association. 2022.

¹⁸Life Cycle Inventories of North American Steel Products. American Iron and Steel Institute. 2020.

Onsite production and logistics

Onsite production

Production of the latest R2 vehicles currently occurs at the Rivian production plant in Normal, Illinois. The primary drivers of GHG emissions at the facility are from electricity and natural gas, with minor contributions from propane- and diesel-powered equipment and refrigerants.

Because our current energy metering system is not equipped with submetering, the carbon footprint of this stage conservatively includes business activities outside of production and is divided equally across Rivian vehicles using the total number of vehicles produced in 2025. While these figures reflect the established R1 and EDV lines, we anticipate that R2's entirely new platform and assembly process will result in higher initial energy overhead during the 2026 ramp-up.

This report is aligned with our corporate GHG accounting program, which utilizes hourly consumed emission rates from the Midcontinent Independent System Operator (MISO) Ameren Illinois local balancing authority for the Normal facility. For remaining production-related facilities, we use eGRID data (specifically subregion SRMW for the Normal plant). This is combined with life cycle inventory data for upstream fuel production from the International Energy Agency (IEA) and ecoinvent, following the GHG Protocol Standard and Scope 2 guidance. By including these upstream emissions, the variance between using eGRID versus Sphera factors is small.

The Normal plant is equipped with onsite solar and a wind turbine, which provided nearly 10 million kWh of onsite renewable energy in 2025.¹⁹ This reduced the total electricity procured from the grid and thereby reduced the carbon footprint from onsite production. The additional renewable energy, coupled with an increase in the throughput of our production, has resulted in significant GHG reductions in 2025 compared to the production of our R1 Launch Edition vehicles.

Logistics

Inbound logistics includes the transportation of the parts and materials from suppliers into the Rivian onsite production facilities. GHG emissions from inbound logistics include all incoming freight for materials and parts related to production at the Rivian plant. The GHG emissions from inbound logistics are divided evenly across all vehicles produced at the plant in 2025. The GHG emissions per vehicle are expected to continue to decrease as Rivian production volume increases and we move toward steady-state operations, thus decreasing logistics associated with the production ramp. Additionally, carbon factors from the Global Logistics Emissions Council (GLEC) are used when mass and distance data are reported in the Transportation Management System (TMS). In the absence of mass inputs, cost data are used alongside CEDA factors from CEDA 2025²⁰ to determine the GHG emissions from these parts. When comparing the mass and cost data for parts with both metrics available, we find the cost-based estimation consistently more conservative.

Outbound logistics consists of delivering finished Rivian vehicles to customers. Like inbound logistics, data are reported by our logistics team and divided across the number of Rivian vehicles produced in 2025 to yield the carbon footprint of outbound logistics per vehicle.

¹⁹No energy attributes are sold to the grid (or any other third party). The energy produced onsite is used exclusively by Rivian.

²⁰Comprehensive Environmental Data Archive (CEDA). Available at <https://watershed.com/solutions/ceda>.

Charging and service

Charging and service includes GHG emissions from vehicle usage during the 200,000 mile/10-year period used for this report.

Charging

The energy used by R2 is driven principally by propulsion efficiency but also includes charging losses and passive battery drain. We determine the propulsion efficiency using the EPA-reported range and the usable battery energy (UBE) for each vehicle. The EPA-reported range of R2 is between 307 to 330 miles (depending on wheel and tire configuration) and the UBE is approximately 87 kWh. This study evaluates R2 with the 21" all-season tires and wheels, which has a range of 330 miles. Over 200,000 miles, R2 is estimated to use roughly 70 megawatt-hours of electricity.

The first charge of each Rivian vehicle off the production line is done with 100% renewable energy.²¹ In November of 2024, Rivian launched a program in which the first 10,000 miles of driving are matched with 100% renewable energy. Additionally, all charging done at Rivian charging networks, such as Rivian Adventure Network (RAN) charging stations, which account for nearly 3% of user charging, is matched with 100% renewable energy by Rivian. As such, we assume that both the energy from the first full charge, next 10,000 miles, and 3% of the remaining charging energy are powered with 100% renewably sourced electricity. All other energy for charging is assumed to be sourced from grid electricity. Because our current model relies on annual average grid factors, it does not factor in the exact time of day a vehicle is charged. As such, the real-world benefits of smart charging and clean energy optimization features are not yet reflected in this footprint. These features allow drivers to charge during cleaner, off-peak hours, and we intend to continuously improve our analyses to incorporate this more granular data in future studies.

Grid emission factors have significant geographic variation and are expected to change over the life cycle of our vehicles. We estimate the carbon footprint from charging with the average U.S. grid electricity using a grid projection model. Rivian uses a 3% year-over-year improvement to model the annual carbon intensity of the electricity grid. This improvement is slightly more pessimistic than the most conservative projection from the International Energy Agency (IEA) World Energy Outlook 2021 report,²² which relies on "stated policies" rather than pledges or other aspirational improvements. From that, the years 2025, 2030, 2040, and 2050 were used to establish the 3% year-over-year improvement rate. All GHG data, including the IEA projections and eGRID subregions, are based on datasets from Sphera's MLC database.²³

Based on our grid projection and renewable matching, the resulting weighted average carbon intensity of the electricity used for charging a Rivian R2 is 317 g CO₂e/kWh.

Service

Service includes GHG emissions from scheduled maintenance activities and other common service items. Scheduled maintenance activities are included based on estimates from our engineering and service teams. For other common service items (e.g., windshield wipers), reasonable assumptions are used. In total, service includes periodic replacement of tires, washer fluid, coolant, brake fluid, 12-volt battery, cabin filter, and windshield wipers.

²¹<https://stories.rivian.com/renewable-energy-matching-program>.

²²World Energy Outlook. IEA. 2021.

²³MLC database v2026.1; emission factors include fuel supply, non-combustion emissions, and power trade.



Decommissioning

Rivian vehicles have not yet been decommissioned at scale under normal operating conditions, so we must make assumptions about the fate of the vehicles and their materials. Rivian has contracted with battery recycling companies and, as such, our batteries are expected to be recycled when the vehicle is decommissioned. We also assume that wheels and tires would be removed from the vehicle prior to vehicle shredding and sent to recycling facilities. We assume all materials are transported 932 miles (1500 km) by truck to a recycling facility.²⁴ Under the cut-off allocation approach, the burden from recycling batteries and other materials is not included in the R2 carbon footprint. All other parts of the vehicle are assumed to go through a shredding operation where most of the steel and aluminum are captured for recycling, per industry averages. Most other materials, including mixed and unassigned, are assumed to be classified as automotive shredder residue (ASR) and landfilled. Overall, decommissioning contributes less than 1% to the total carbon footprint of R2.

Carbon footprint final thoughts

We feel confident that this report represents a deep and comprehensive life cycle carbon footprint study for Rivian's latest R2 as of mid 2026. At the same time, like all Rivian vehicles, R2 is designed to operate a decade into the future, so the results of this study are merely snapshots of the product carbon footprints based on our best data available as of report publication. As always, we will continue to improve our understanding of our vehicle footprints and share updates as that information improves and our products change. These LCA reports serve not only to promote transparency and provide a step towards greater understanding for the public, but also to inform and drive Rivian's sustainability initiatives and track progress toward our goals. Below are some of the product sustainability goals we have made notable progress towards since our last carbon footprint report.²⁵

- Launch a product by 2030 with half the life cycle carbon footprint as 2022 R1 products.
- Increase percentage of recycled materials in vehicles:
 - Minimum 70% recycled content in steel and aluminum by 2030
 - Minimum 40% recycled and bio-based content in polymers by 2030.
- We view our carbon footprints as we do everything else at Rivian: Adventurous Forever.

²⁴EPD International. Product Category Rules: UN CPC 49113. PCR: 2024.02. Version 1.0.2.

²⁵More detail is available in the Goals Update Report.

Raw Material Extracted

Raw Material Extracted (RME) measures how much material needs to be removed from the Earth for a given part or product. The intent is to support more established metrics, such as recycled content, carbon footprint, or energy consumption, by using a well-understood unit (kilograms) and a simple method (material extracted). In addition, RME allows us to visualize the unseen materials involved in the production of a vehicle.

Method

RME combines (1) primary fossil energy demand, (2) rock-to-metal ratio, and (3) scrap rates to estimate the mass of raw material extracted from the earth. RME for individual parts are then summed together to create an estimate for the R2 vehicle as a whole.

First, we determine how much material is mobilized for each part, which is the sum of the final part and any manufacturing scrap generated. The data for this is already characterized in our carbon footprinting process.

Second, rock-to-metal ratio (RMR) provides the average mass of total rock extracted to produce a typical metal.²⁶ This accounts for ore grade, overburden, recovery losses, and other activities during the mining and refining operations.

Third, primary energy demand (PED) in the Sphera MLC database provides fossil resources used for either energy conversion or polymer feedstocks. PED values for petroleum, natural gas, and coal are converted from energy (MJ) to mass (kg) using specific energy content factors. Waste from coal mining is also captured.²⁷ Sphera datasets match those used in the carbon footprint analysis.

Similar Approaches

The RME concept builds on existing frameworks, most notably the Material Input per Service Unit (MIPS) method established in the 1990's by the Wuppertal Institute.²⁸ MIPS prioritizes the assessment of initial resource inputs to calculate a comprehensive “Material Footprint.” This system categorizes natural resources across five distinct mass-based indicators: abiotic raw materials, biotic materials, water, air, and earth movements. A critical component of this methodology is the inclusion of unused extraction, such as mining overburden, based on the principle that total volume of earth displaced is a primary driver of environmental disruption. Methodologically, MIPS utilizes midpoint indicators including Raw Material Input (RMI) for economically utilized materials and Total Material Requirement (TMR) to capture the aggregate extraction mass.

In comparison, Rivian's Raw Material Extracted (RME) metric provides a streamlined alternative specifically optimized for the automotive sector. While the MIPS framework leverages macroeconomic LCI databases to track a broad spectrum of resources, our RME metric currently focuses on the foundational materials of steel, aluminum, and polymers. The calculation methodology also differs: RME determines the mobilized mass of a component—accounting for both final mass and manufacturing scrap—before applying specific rock-to-metal ratios. Furthermore, a key distinction is that RME is engineered to provide

²⁶Nassar, N.; Lederer G.; Brainard J.; Padilla A.; and Lessard J. Rock-to-Metal Ratio: A Foundational Metric for Understanding Mine Wastes. *Environmental Science & Technology*. 2022. 56(10). <https://pubs.acs.org/doi/10.1021/acs.est.1c07875>.

²⁷Fecko P.; Tora B.; Tod M. The Coal Handbook: Towards Cleaner Production. 3 - Coal Waste: handling, pollution impacts, and utilization. pp. 63-84. 2013. <https://doi.org/10.1533/9781782421177.1.63>.

²⁸Klaus Wiesen, Mathieu Saurat, Michael Lettenmeier. Calculating the Material Input per Service Unit using the Ecoinvent database *International Journal of Performability Engineering*. 2014. 10(4): 357-366. <https://www.ijpe-online.com/EN/Y2014/V10/I4/357>.

unique extraction factors for virgin versus recycled feedstocks, empowering us to directly measure and disclose the raw material extraction avoided through our commitment to sustainable supply chains.

Data and Calculations

RME factors for aluminum, steel, and polymers are provided for both virgin and recycled feedstocks. Polymer factors are the weighted averages by mobilized mass across all R2 polymer types (e.g., polypropylene, polycarbonate). The actual RME calculations are completed for each specific polymer and added together, which is the same approach as in the carbon footprint.

RME for recycled feedstocks is much lower since they bypass mining and drilling operations necessary for virgin feedstocks. Recycled feedstocks still require fossil resource inputs to capture, collect, remelt, or otherwise process the recycled materials.

RME breakdowns for R2 and a hypothetical R2 with only virgin and fossil feedstocks are provided to illustrate the material extraction demands for these scenarios. The virgin and fossil feedstock scenario is not intended to be a realistic baseline for the automotive industry; rather, it helps articulate the benefits of using recycled and bio-based materials relative to their virgin counterparts. This is similar to how recycled content percentages are presented as standalone metrics that are intrinsically relative to systems with zero recycled content.

Limitations and Future Work

We purposely simplified the RME metric for its inaugural release. Rather than create perfect calculations, our primary objective is to introduce this additional metric, socialize it with our customers, employees, and the public, and solicit feedback on how to improve for future releases.

The significant limitations for the R2 RME include the following:

- Scope only includes steel, aluminum, and polymer parts
- Energy mixes are averages as described by the LCA datasets used in the carbon footprint analysis
- Average rock-to-metal ratios are used rather than mine-specific information
Energy and material resources for part manufacturing are not included.

The scope is expected to be expanded to other materials (e.g., copper, glass, lithium) in future releases. Data availability for rock-to-metal ratios may limit the inclusion of some materials. Average data can be improved with better supply chain tracking and integration with Rivian systems.



RME factors

(units: kg per kg mobilized material)

	Aluminum		Steel		Polymers	
	Virgin	Recycled	Virgin	Recycled	Virgin	Recycled
Total fossil resources	2.5	0.4	0.6	0.1	2	0.1
petroleum	0.4	<0.1	0	<0.1	1	<0.1
natural gas	0.8	0.3	0	0	0.7	0
coal	1.4	<0.1	0.6	<0.1	0.2	<0.1
Total rock and minerals	7.7	<0.1	9.5	<0.1	<0.1	<0.1
waste rock (mining)	2.9		6.1			
waste rock (coal)	0.5	<0.1	0.3	<0.1	<0.1	<0.1
ore	4.2		3.1			
Raw Materials Extracted (RME)	10.2	0.4	10.1	0.2	2	0.1

RME breakdown for R2

(units: kg)

	Aluminum	Steel	Polymers	Total
Part mass	300	900	400	1600
Total fossil resources	500	700	800	2000
Total rock and minerals	1400	9600	100	11000
Raw Material Extracted (RME)	1900	10300	900	13100

RME breakdown for hypothetical R2

with only virgin and fossil feedstocks

(units: kg)

	Aluminum	Steel	Polymers	Total
Part mass (kg)	300	900	400	1600
Total fossil resources	800	1000	1000	2700
Total rock and minerals	2400	14600	100	17100
Raw Material Extracted (RME)	3200	15600	1100	19900

Critical Review



Rivian develops the LCA models and reports entirely in-house, led by our Sustainability Science team. Rivian works with an independent expert to review this report, the underlying Methodology Report, and Supporting Information for conformance with ISO 14044. The review was conducted by Dr. Christoph Koffler, former Technical Director Americas, Sustainability Consulting at Sphera and Dr. Michael Faltenbacher, Consulting Director Transport & Mobility at Sphera in September 2026.

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- Critical Review Statement -

R2 Product Sustainability Report

Commissioned by:	Rivian Automotive, Inc. ("Rivian")
Conducted by:	Rivian Automotive, Inc. ("Rivian")
Reviewer:	Christoph Koffler, PhD – former Technical Director Americas, Sustainability Consulting Michael Faltenbacher, PhD - Consulting Director Transport & Mobility, Sustainability Consulting
References:	ISO 14044:2006 – Environmental Management – Life Cycle Assessment – Requirements and Guidelines ISO 14067:2018 Greenhouse gases – Carbon Footprint of Products – Requirements and Guidelines for Quantification ISO/TS 14071:2014 – Environmental management – Life cycle assessment – Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006

Scope of the Critical Review

In accordance with ISO 14044:2006, section 6.1, the goal of the Critical Review was to assess whether:

- the methods used to carry out the LCA are consistent with the international standards ISO 14040 and ISO 14044,
- the methods used to carry out the LCA are scientifically and technically valid,
- the data used are appropriate and reasonable in relation to the goal of the study,
- the interpretations reflect the limitations identified and the goal of the study, and
- the study report is transparent and consistent.

As carbon footprints are unable to support comparative assertions intended to be disclosed to the public, the review was performed by single independent expert following ISO 14044:2006, clause 6.2.

This review statement is only valid for the specific reports and version numbers listed in the header of this review statement.

The review was performed exclusively on the above documents. No software models were shared during the review.

The reviewers performed the review in their capacity as an independent expert.

Critical Review process

The review was conducted by exchanging comments and responses using a spreadsheet template based on Annex A of ISO 14071:2024. It was carried out in parallel with the review of the Carbon Footprint Methodology Report (Version 1.3).

The critical review was carried out between April 2026 (online kick-off meeting) and September 2026 (delivery of the final review statement). There were multiple formal rounds of comments on different draft versions of the reports, online meetings to discuss and clarify those comments, as well as several email conversations in-between.

A copy of the final review report containing all written comments and responses has been provided to Rivian along with this review statement.

The overall review was conducted in an equitable and constructive manner. The reviewer would like to highlight the good and constructive collaboration with the authors of the study. All comments were addressed and all open issues resolved. There were no dissenting opinions held by any of the involved parties upon finalization of the review.

General evaluation

The study is well scoped and capable of supporting the goal of the study. It shows a high level of technical knowledge and methodological proficiency. It is based on a multitude of data sources and primary data points covering material composition, in-house manufacturing, and use phase parameters to achieve a high level of data quality.

Its main limitation lies in the complexity of the automotive supply chain and the limited availability of primary supplier data, which is a general issue in the automotive industry and not specific to this study. As such, the study should be understood to represent mostly market-average supply chain emissions based on conservative assumptions and best-available data. Nevertheless, the results are deemed to be sufficiently accurate for external communication as well as for internal use to identify opportunities for further improvement.

Conclusion

Based on the final report documents, it can be concluded that the methods used to carry out the LCA are consistent with the International Standard ISO 14044, that they are scientifically and technically valid, that the data used are appropriate and reasonable in relation to the goal of the study, and that the interpretations reflect the limitations identified and the goal of the study. The report documents are considered sufficiently transparent and consistent.

When communicating results to third parties outside of Rivian, ISO 14044, section 5.2 requires that a third-party report be made available to any such parties. For this specific study, the combination of Summary Report (including Appendix) and Methodology Report shall constitute the third-party report.



Michael Faltenbacher, PhD

Valid as of September 4, 2026

Appendix



Appendix

6.1 Carbon Intensity Sources

Tables 6.1a, 6.1b, and 6.1c outline the default assumptions and carbon intensity datasets. All data points from Sphera's Managed LCA Content (MLC) database are from the 2025.1 release accessed via the Sphera LCA for Experts software, version 10.7.

The effective carbon intensity calculation for materials is shown below. The following data represents the latest BoM from our product lifecycle management system at the time of assessment (March 2026). We assume a conservative average part yield of 95%.

$$CI_{\text{weighted average}} = [\% RC \times CI_{\text{recycled materials}} + (1 - \% RC) \times CI_{\text{virgin materials}}]$$
$$CI_{\text{effective}} = \frac{[CI_{\text{weighted average}} / \% MU] + CI_{\text{manufacturing process}}}{\% Y}$$

CI= Carbon Intensity
% RC= Percent Recycled Content
% MU= Percent Material Utilization
% Y= Percent Yield

Table 6.1a also outlines the default assumptions and carbon intensity datasets for the activities excluding raw material mining and refining. The following data are critical to assessing the carbon footprint of upstream production processes, on-site production, operation and service, and decommissioning.

Material utilizations are planned scrap losses that occur during manufacturing. These are often very difficult to ascertain, particularly when these steps occur in the supply chain. We use a mix of internal data, industry averages, and estimates for material utilizations. In-house stamping utilizations are based on Rivian data for the R2. Casting, drawing, and injection molding processes are typically high-utilization processes and are assumed to have 95% utilization. Aluminum extrusion is based on the Aluminum Association data and is 74%. All other processes, including those for mixed and unassigned materials, are assumed to have a 75% utilization. In addition to utilizations, we also include a 95% yield to all parts. This is an assumed value and is used to acknowledge that a certain fraction of all parts will not meet specifications or otherwise are unavailable for the final vehicle.

Part level recycled content and material utilization is applied when available. In the absence of primary data, the following default values in table 6.1a are used for material utilization and recycled content.

Table 6.1a
Background datasets by material type

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
ABS	Polymers	Primary Material: Sphera - DE: Acrylonitrile-butadiene-styrene granulate (ABS) mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC ²⁹ Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Adhesive	Polymers	Primary Material: Sphera - DE: Thermoplastic polyurethane (TPU, TPE-U) adhesive Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: n/a	100%	95%	0%

Appendix

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
Aluminum (other)	Aluminum	Primary Material: RNA: Aluminum sheet (0% recycled content) <LC> Secondary Material: RNA: Aluminum sheet (100% recycled content) <LC> Process: n/a	75%	95%	18%
Aluminum casting	Aluminum	Primary Material: RNA: Aluminum ingot (0% recycled content + remelting) <LC> Secondary Material: RNA: Aluminum ingot (100% recycled content + remelting) <LC> Process: US: Aluminium die-cast part Sphera 5% scrap (plan) <LC>	95%	95%	40%
Aluminum extrusion	Aluminum	Primary Material: RNA: Aluminum ingot (0% recycled content + remelting) <LC> Secondary Material: RNA: Aluminum ingot (100% recycled content + remelting) <LC> Process: RER: Aluminium extrusion profile - open input aluminium ingot Sphera <p-agg>	74%	95%	35%
Aluminum forging	Aluminum	Primary Material: RNA: Aluminum ingot (0% recycled content + remelting) <LC> Secondary Material: RNA: Aluminum ingot (0% recycled content + remelting) <LC> Process: US: Drop-forging process (plan) <LC>	95%	95%	18%
Aluminum sheet	Aluminum	Primary Material: Sphera - RNA: Aluminum sheet (0% recycled content) <LC> Secondary Material: RNA: Aluminum sheet (100% recycled content) <LC> Process: US: Aluminum sheet deep drawing <LC>	confidential	95%	40%
ASA	Polymers	Primary Material: Calculated - Estimated using ABS Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Bamboo	Other materials	Primary Material: Sphera - RNA: Softwood plywood CORRIM <LC> Secondary Material: n/a Process: n/a	75%	95%	0%
Brass	Other metals	Primary Material: Sphera - RER: Brass (CuZn20) Sphera <p-agg> Secondary Material: n/a Process: US: Metal cast part (automotive) process (plan) <LC>	95%	95%	0%
Bronze	Other metals	Primary Material: Sphera - RER: Brass (CuZn20) Sphera <p-agg> Secondary Material: n/a Process: US: Metal cast part (automotive) process (plan) <LC>	95%	95%	0%
Carbon fiber	Other materials	Primary Material: Sphera - DE: Carbon Fibre (CF; from PAN; standard strength) Sphera Secondary Material: n/a Process: n/a	75%	95%	0%
Ceramic	Other materials	Primary Material: Sphera - RER: Glass ceramic production Sphera Secondary Material: n/a Process: n/a	75%	95%	0%
Cold rolled steel sheet	Steel	Primary Material: US: Cold rolled steel coil (HDG, 0% recycled content, AISI) <LC> Secondary Material: Linear Interpolation from: Steel Sheet Cold Rolled (37% Recycled Content) Process: US: Steel sheet deep drawing <LC>	confidential	95%	30%

Appendix

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
Composite	Polymers	Primary Material: Calculated - Carbon Fiber reinforced polyamide Secondary Material: n/a Process: US: Plastic compounding + injection moulding <LC>	95%	95%	0%
Copper	Other metals	Primary Material: Sphera - GLO: Copper cathode, 99.99% Cu ICA Secondary Material: n/a Process: US: Copper wire (0.6 mm) process (plan) <LC>	95%	95%	0%
Cork	Other materials	Primary Material: RNA: Softwood plywood CORRIM <LC> Secondary Material: n/a Process: n/a	75%	95%	0%
ECU	Electronics	Primary Material: Custom ECU analysis primary data from an internal analysis Secondary Material: n/a Process: n/a	100%	95%	0%
Electronics (other)	Electronics	Primary Material: Custom ECU analysis primary data from an internal analysis Secondary Material: n/a Process: n/a	75%	95%	0%
EPDM	Polymers	Primary Material: Sphera - DE: Ethylene Propylene Diene Elastomer (EPDM) Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
EPP foam	Polymers	Primary Material: Sphera - US: Expanded Polypropylene (EPP) <LC> Secondary Material: n/a Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
EVA	Polymers	Primary Material: Sphera - RER: EVA roof sheets (EN15804 A1-A3) Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: n/a	75%	95%	0%
Fiberglass	Polymers	Primary Material: Sphera - DE: Glass fibres Sphera Secondary Material: n/a Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Glass	Other materials	Primary Material: Sphera - RER: Float flat glass Sphera Secondary Material: n/a Process: n/a	75%	95%	0%
HDPE	Polymers	Primary Material: Sphera - DE: Polyethylene high density granulate (HDPE/PE-HD) mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Hot rolled steel sheet	Steel	Primary Material: GLO: Hot rolled steel coil (HDG, 0% recycled content, AISI) <LC> Secondary Material: Linear Interpolation from: Steel Sheet Hot Rolled (48% Recycled Content) Process: US: Steel sheet deep drawing <LC>	confidential	95%	30%

Appendix

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
Iron	Other metals	Primary Material: Sphera - DE: Cast iron component (EN15804 A1-A3) Sphera <p-agg> Secondary Material: DE: Cast iron component (EN15804 A1-A3) Sphera <p-agg> Process: n/a	95%	95%	0%
Liquid	Other materials	Primary Material: Sphera - DE: Rinsing-agent (100% solvents) Sphera Secondary Material: n/a Process: n/a	100%	95%	0%
Magnesium	Other metals	Primary Material: Sphera - CN: Magnesium Sphera Secondary Material: n/a Process: US: Magnesium die-cast process Sphera (plan) <LC>	95%	95%	0%
Magnet	Other materials	Primary Material: Sphera - GLO: market for permanent magnet, for electric motor ecoinvent 3.8 Secondary Material: n/a Process: n/a	100%	95%	0%
Mica	Other materials	Primary Material: Sphera - DE: Kaolin Sphera Secondary Material: n/a Process: n/a	95%	95%	0%
Nickel	Other materials	Primary Material: Sphera - GLO: Nickel (Class 1, >99.8% Nickel) Nickel Institute Secondary Material: n/a Process: US: Metal cast part (automotive) process (plan) <LC>	95%	95%	0%
Oil	Other materials	Primary Material: Sphera - US: Lubricants at refinery Sphera Secondary Material: n/a Process: n/a	100%	95%	0%
Other foam	Polymers	Primary Material: Sphera - DE: Polyurethane flexible foam Sphera <Mfg> Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PA	Polymers	Primary Material: Sphera - DE: Polyamide 6 granulate (PA 6) mix Sphera Secondary Material: Literature: Tinz et al. (2022) Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Paint	Other materials	Primary Material: Sphera - RER: Solvent paint white (EN15804 A1-A3) Sphera Secondary Material: n/a Process: n/a	75%	95%	0%
Paper	Other materials	Primary Material: Sphera - EU-25: Graphic Paper Euro-graph/ELCD <LC> Secondary Material: n/a Process: n/a	75%	95%	0%
PBT	Polymers	Primary Material: Sphera - DE: Polybutylene terephthalate granulate (PBT) mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%

Appendix

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
PC	Polymers	Primary Material: Sphera - DE: Polycarbonate granulate (PC) Sphera Secondary Material: Literature: Tinz et al. (MDPI Waste) Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PC/ABS	Polymers	Primary Material: Calculated - Average of PC and ABS Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PC/ASA	Polymers	Primary Material: Calculated - Average of PC and ABS Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PET	Polymers	Primary Material: Sphera - DE: Polyethylene terephthalate granulate (PET via DMT) Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Plastic	Polymers	Primary Material: Calculated - 50% PP, 25% PC, 25% PA Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PMMA	Polymers	Primary Material: Sphera - DE: Polymethyl methacrylate granulate (PMMA) mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
POM	Polymers	Primary Material: Sphera - DE: Polyoxymethylene granulate (POM) Mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PP	Polymers	Primary Material: Sphera - DE: Polypropylene granulate (PP) mix Sphera Secondary Material: Literature: Nordahl et al. (PNAS) Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PPA	Polymers	Primary Material: Sphera - DE: Polyphenylene Ether (PPE) Sphera Secondary Material: Literature: Nordahl et al. (PNAS) Process: n/a	75%	95%	0%
PPO	Polymers	Primary Material: Sphera - DE: Polyphenylene Ether (PPE) Sphera Secondary Material: Literature: Nordahl et al. (PNAS) Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PPS	Polymers	Primary Material: Sphera - DE: Polyphenylene sulfide granulate (PPS) Sphera Secondary Material: Literature: Nordahl et al. (PNAS) Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Press hardened steel sheet	Steel	Primary Material: US: Cold rolled steel coil (HDG, 0% recycled content, AISI) <LC> Secondary Material: Linear Interpolation from: Steel Sheet Cold Rolled (37% Recycled Content) Process: US: Steel sheet deep drawing <LC>	confidential	95%	30%

Appendix

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
PTFE	Polymers	Primary Material: Sphera - DE: Polytetrafluoroethylene granulate (PTFE) Mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PU	Polymers	Primary Material: DE: PUR synthetic leather seat cover (1 kg) <LC> Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PUR	Polymers	Primary Material: DE: PUR synthetic leather seat cover (1 kg) <LC> Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PUR foam	Polymers	Primary Material: Sphera - DE: Polyurethane flexible foam Sphera <Mfg> Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
PVC	Polymers	Primary Material: Sphera - DE: Polyvinyl chloride granulate (S-PVC) mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Rubber	Polymers	Primary Material: Sphera - DE: Silicone rubber (RTV-2, condensation) Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Sheet molding compound	Polymers	Primary Material: Sphera - DE: Sheet Moulding Compound resin mat (SMC) Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: n/a	75%	95%	0%
Silicone	Polymers	Primary Material: Sphera - DE: Silicone rubber (RTV-2, condensation) Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Silver	Other metals	Primary Material: Sphera - GLO: Silver mix Sphera Secondary Material: n/a Process: n/a	75%	95%	0%
Stainless steel	Steel	Primary Material: Sphera - RER: Stainless steel cold rolled coil (316) Eurofer <LC> Secondary Material: n/a Process: US: Metal cast part (automotive) process (plan) <LC>	95%	95%	0%
Steel (other)	Steel	Primary Material: US: Cold rolled steel coil (HDG, 0% recycled content, AISI) <LC> Secondary Material: Linear Interpolation from: Steel Sheet Cold Rolled (37% Recycled Content) Process: US: Steel sheet stamping and bending (5% loss) process (plan) <LC>	75%	95%	12%
Titanium	Other metals	Primary Material: Sphera - GLO: Titanium Sphera Secondary Material: n/a Process: n/a	75%	95%	0%

Appendix

Material Type	Material Category	Source/Datasets	Default Material Utilization	Yield	Default Recycled Content
TPE	Polymers	Primary Material: Sphera - DE: Polypropylene / ethylene propylene diene elastomer granulate (PP/EPDM, TPO, TPE-O) mix Sphera Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
TPO	Polymers	Primary Material: Calculated - Estimated using TPE Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
TPU	Polymers	Primary Material: Calculated – Estimated using TPE Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: n/a	75%	95%	0%
TPV	Polymers	Primary Material: Calculated - Estimated using TPE Secondary Material: Calculated assuming 50% recycled PP, 25% recycled PA , 25% recycled PC Process: US: Plastic compounding + injection moulding (plan) <LC>	95%	95%	0%
Washer Fluid	Other Materials	Primary Material: Sphera - US: Washer Fluid (21% ethyl alcohol / 79% deionized water) (plan) <LC> Secondary Material: n/a Process: n/a	100%	95%	0%
Wood	Other materials	Primary Material: Sphera - RNA: Softwood plywood CORRIM <LC> Secondary Material: n/a Process: n/a	50%	95%	0%
Zinc	Other metals	Primary Material: Sphera - GLO: Special high grade zinc only from Zn concentrate IZA <LC> Secondary Material: n/a Process: US: Metal cast part (automotive) process Sphera (plan) <LC>	95%	95%	0%
Standard tire	Polymers	Primary Material: Supplier - Standard Tire Secondary Material: n/a Process: n/a	100%	95%	0%
Sustainable tire	Polymers	Primary Material: Supplier - Sustainable Tire Secondary Material: n/a Process: (included in vendor data)	100%	95%	0%
Lead-acid battery	Other materials	Primary Material: Sphera - DE: Lead battery 12V (approximation) Sphera (for 21.5 kg) Secondary Material: n/a Process: n/a	100%	95%	0%

Appendix

Table 6.1b
Other relevant datasets

Material Category	Datasets
Steel	GLO: Value of scrap worldsteel RNA: Steel hot rolled coil AISI RNA: Steel cold rolled coil AISI
Aluminum	RNA: Primary aluminum ingot AA RNA: Recycled aluminum ingot (100% recycled content) AA RER: Aluminum sheet – open input
Polymers	GLO: Plastic extrusion profile (unspecific) Sphera US: Lubricants at refinery Sphera GLO: Compressed air 7 bar (medium power) Sphera GLO: Compounding (plastics) Sphera GLO: Plastic injection moulding RER: Tap water from groundwater Sphera

Table 6.1c
Other carbon factors

Transportation Process	Datasets
Air	GLO: Cargo plane Sphera (plan) <LC>
Rail	US: Rail transport cargo - average, average train, gross tonne weight 1,000t / 726t payload capacity <LC>
Autocarrier	US: Truck - auto carrier (EPA SmartWay) Sphera (plan) <LC>
Truck	US: Truck - dray (EPA SmartWay) Sphera (plan) <LC>
Electricity	
AKGD	US: Electricity grid mix – AKGD Sphera
AKMS	US: Electricity grid mix – AKMS Sphera
AZNM	US: Electricity grid mix – AZNM Sphera
CAMX	US: Electricity grid mix – CAMX Sphera
ERCT	US: Electricity grid mix – ERCT Sphera
FRCC	US: Electricity grid mix – FRCC Sphera
HIMS	US: Electricity grid mix – HIMS Sphera
HIOA	US: Electricity grid mix – HIOA Sphera
MROE	US: Electricity grid mix – MROE Sphera
MROW	US: Electricity grid mix – MROW Sphera
NEWE	US: Electricity grid mix – NEWE Sphera
NWPP	US: Electricity grid mix – NWPP Sphera
NYCW	US: Electricity grid mix – NYCW Sphera
NYLI	US: Electricity grid mix – NYLI Sphera
NYUP	US: Electricity grid mix – NYUP Sphera
PRMS	US: Electricity grid mix – PRMS Sphera
RFCE	US: Electricity grid mix – RFCE Sphera
RFCM	US: Electricity grid mix – RFCM Sphera
RFCW	US: Electricity grid mix – RFCW Sphera
RMPA	US: Electricity grid mix – RMPA Sphera
SPNO	US: Electricity grid mix – SPNO Sphera

Appendix

Electricity	Datasets
SPSO	US: Electricity grid mix – SPSO Sphera
SRMV	US: Electricity grid mix – SRMV Sphera
SRMW	US: Electricity grid mix – SRMW Sphera
SRSO	US: Electricity grid mix – SRSO Sphera
SRTV	US: Electricity grid mix – SRTV Sphera
SRVC	US: Electricity grid mix – SRVC Sphera
US Average	US: Electricity grid mix (eGRID) Sphera
US Generic Renewables	US: Green electricity grid mix (production mix) Sphera
US Solar	US: Electricity from photovoltaic Sphera
US Wind	US: Electricity from wind power Sphera
US Natural Gas	US: Electricity from natural gas Sphera
China	CN: Electricity grid mix Sphera
Korea	KR: Electricity grid mix Sphera
Europe	RER: Electricity grid mix Sphera
Other Energy Sources	
Chinese steam energy	CN: Process steam from natural gas 90% Sphera
Chinese thermal energy	CN: Thermal energy from natural gas Sphera
US steam energy	US: Process steam from natural gas 90% Sphera
US thermal energy	US: Thermal energy from natural gas Sphera
Diesel	US: Diesel mix at filling station Sphera
Regular gasoline	US: Gasoline mix (regular) at filling station Sphera
Liquefied petroleum gas	US: Liquefied Petroleum Gas (LPG) (70% propane; 30% butane) Sphera
Heavy fuel oil (2.5 wt.%)	US: Heavy fuel oil at refinery (2.5wt.% S) Sphera

6.1.1 Aluminum

Rivian developed carbon footprint models for aluminum ingot and sheet. The models are based on the Aluminum Association LCA report for semi-fabricated³⁰ products. Rather than use the information directly from the report or the analogous datasets in the Sphera MLC, Rivian reconstructed these models so that recycled content could be a variable. Any level of recycled content can be evaluated through interpolation between these models. Utilizations and processing steps mirror the information in the Aluminum Association report and use automotive-specific information whenever available.

6.1.2 Steel

Rivian developed carbon footprint models for hot and cold-rolled sheet with varying levels of recycled content. The American Iron and Steel Institute (AISI)³¹ for steel sheet assumes a scrap input based on industry averages. By adding worldsteel's Value-of-Scrap inventory³² as the upstream burden of steel scrap, we approximate a theoretical steel sheet with 0% recycled content. These models are combined with AISI datasets in Sphera so that any level of recycled content can be evaluated through interpolation and extrapolation. All steel is assumed to be hot-dip galvanized. The hot-dip galvanizing model was developed in Sphera LCA FE using data from AISI, which includes the energy and material inputs for process.

³⁰ The Environmental Footprint of Semi-Fabricated Aluminum Products in North America. The Aluminum Association. 2022. https://www.aluminum.org/sites/default/files/2022-01/2022_Semi-Fab_LCA_Report.pdf.

³¹ Life Cycle Inventories of North American Steel Products. American Iron and Steel Institute. 2020.

³² Life Cycle Inventory (LCI) Study: 2020 Data Release. World Steel Association. 2021.

6.1.3 Electronic Control Units

Much of the advanced electronics are housed in electronic control unit (ECU) modules. The GHG emissions of ECUs can vary significantly depending on the size and complexity of the printed circuit board (PCB), onboard electronics, and the housing materials. To better understand the carbon footprint of the low-voltage electronics in our vehicles, Rivian conducted an internal study to determine the carbon footprint of all the ECUs in Rivian vehicles. From this, we derived average carbon intensity factors for our ECUs that will be used across all Rivian vehicles until another study is conducted.

The subcomponents of an ECU can be broken down into two categories: populated PCBs and mechanical parts. The mechanical parts are made up of polymers and metals. As such, the corresponding carbon factors from the datasets shown in Table 6.1a scale by mass, which allows us to use the ECU BoM to find the carbon footprint of the mechanical parts.

The GHG emissions for an unpopulated PCB are determined by exploring engineering drawings to determine the rectangular dimensions and number of layers of the PCB. Using rectangular dimensions rather than actual area allows us to approximate losses associated with panelization efficiency during PCB fabrication. These data are then combined with carbon intensity factors for the appropriate type of PCB.

Determining the GHG emissions of the onboard electronics (integrated circuits, resistors, capacitors, etc.) is more difficult and has not been researched in detail. For our early models, we estimate that a populated PCB will have approximately quadruple the carbon footprint of an unpopulated PCB based on examination of generic populated PCB data from Sphera's MLC database. While this estimation is relatively rough, the populated ECUs contribute less than 1% to the life cycle carbon footprint of an R2. As such, the uncertainty introduced into the overall results is acceptable for the goal of this study.

6.1.4 Other Life Cycle Inventory Models

A variety of other plans were created in Sphera LCA FE to support the modeling. These are denoted as "plans" in Table 6.1a. Many of these plans are simple scaling functions used to normalize a process to a declared unit of 1 kg. Other plans are processes with upstream energy and operating materials (e.g., lubricants) flows connected using US data (e.g., US average electricity, US thermal energy from natural gas). These types of simple plans reflect the data in unit processes from Sphera's MLC database and are not published here.

For example, the plans for expanded polypropylene (EPP) and plastic injection are slightly more complex and cannot be found directly in Sphera's MLC database. For EPP, no data on this material are available, so an estimate was made using PP granulate and an extrusion unit process. This is a crude estimate, but is not expected to have relevant impact on the results.

6.2 Decommissioning

The carbon footprint of decommissioning the materials in an R2 is estimated using the rates of decommissioning scenarios shown in table 6.2. Materials that are not expected to be isolated during decommissioning processing are modeled as automotive shredder residue (ASR) and assumed to be landfilled.

Table 6.2
Decommissioning rates

Material Type			Source	Carbon Factor Dataset
Aluminum	% Recycled	91%	https://www.aluminum.org/sites/default/files/2021-10/Final-Report-Automotive-Aluminum-Recycling-at-End-of-Life-A-Grave-to-Gate-Analysis.pdf	-
	% Landfilled	9%		RER: Inert matter (Aluminium) on landfill Sphera
	% Incineration	0%		US: Inert waste in waste incineration plant Sphera (plan) <LC>
Steel	% Recycled	96%	https://www.steel.org/wp-content/uploads/2021/08/AISI-and-SMA-Steel-Recycling-Rates-Report-Final-07-27-2021.pdf	-
	% Landfilled	4%		RER: Inert matter (Steel) on landfill Sphera
	% Incineration	0%		US: Inert waste in waste incineration plant Sphera (plan) <LC>
Polymers	% Recycled	0%	assumption	-
	% Landfilled	100%		RER: Plastic waste on landfill Sphera
	% Incineration	0%		US: Plastic packaging in municipal waste incineration plant Sphera <p-agg> <LC>
Electronics	% Recycled	90%	estimate	-
	% Landfilled	5%		Calculated - based on polymers
	% Incineration	5%		US: Populated printed wiring board (after RoHS) in waste incineration plant Sphera <p-agg> <LC>
Other metals	% Recycled	96%	modeled as steel	-
	% Landfilled	4%		Calculated - based on steel
	% Incineration	0%		Calculated - based on steel
Battery cells	% Recycled	100%	assumption	-
	% Landfilled	0%		-
	% Incineration	0%		-
Tires	% Recycled	100%	assumption	-
	% Landfilled	0%		-
	% Incineration	0%		-
Other materials	% Recycled	0%	modeled as ASR	-
	% Landfilled	100%		Calculated - based on polymers
	% Incineration	0%		Calculated - based on polymers
Vehicle shredding				DE: Car shredder Sphera <p-agg>
Transportation to recycling facility				US: Truck - dray (EPA SmartWay) Sphera (plan) <LC>

6.3 Detailed footprint summary

Table 6.3a
Detailed breakdown R2 Performance with Launch Package (units: MT CO₂e)

		Body system	Chassis system	Interior system	Powertrain system	Other systems	Battery cells	Logistics	Onsite production	Charging	Maintenance	Decommissioning
Materials and upstream production	Aluminum	0.7	0.7	0.0	0.2	0.4						
	Steel	2.3	0.8	0.2	0.2	0.2						
	Polymers	0.4	0.4	0.5	0.1	0.5						
	Other metals	0.0	0.0	0.0	0.0	0.0						
	Other materials	0.1	0.0	0.0	0.0	0.3						
	Electronics	0.0	0.0	0.0	0.0	0.2						
	Mixed or unassigned materials	0.2	0.1	0.1	0.0	0.2						
	Battery cells						5.2					
Logistics	Inbound							0.7				
	Outbound							0.6				
Onsite production	Scope 1 and 2								2.5			
	Scope 3								0.5			
Charging and service	Charging									21.2		
	Service										2.0	
Decommissioning	Shredding											0.0
	Landfill											0.0
	Incineration											0.0
	Transportation											0.2
Total		3.8	1.9	0.9	0.6	2.0	5.2	1.3	3.0	21.2	2.0	0.3

SAE Disclosure Addendum



1. DISCLOSURE ADDENDUM

1.1 Vehicle Information

Make and model	Rivian, R2
Variant(s)	Performance - Launch
Model Year	2027
Powertrain	Battery Electric Vehicle
Baseline lifetime distance (km)	321,869 km
Baseline lifetime years (yr)	10
Sales region(s)	U.S.A., CA

1.2 LCA Methodology

1.2.1 Characterization Factors

IPCC Assessment Report Vintage	AR6
Inclusion/Exclusion LUC	incl. LUC
Inclusion/Exclusion Biogenic Carbon	excl. biogenic carbon

1.2.2 LCA Scope

Materials and components

- ☒ Extraction and refining
☒ Part manufacturing
☒ Supply chain logistics
☐ Other _____

Assembly

- ☒ Upstream logistics
☒ Onsite production/assembly
☒ Downstream logistics
☐ Other _____

Maintenance

- ☒ Replacement tires
☒ Other routine maintenance
☐ Unscheduled maintenance
☐ Other _____

Traction battery

- ☒ Material extraction and refining
☒ Cell production/assembly
☒ Supply chain logistics
☐ Other _____

Operation

- ☒ Propulsion energy
☒ Passive drain (BEVs/PHEVs)
☐ Remote start/preconditioning
☐ Other _____

Decommissioning

- ☒ Logistics
☒ Vehicle dismantling/crushing
☒ Material shredding & segregation
☒ Material landfilling & incineration
☐ Other _____

1.3 Carbon Footprint Results

	Carbon footprint (g CO ₂ e/km)	Carbon footprint (MT CO ₂ e)
Materials and components	28	9.1
Traction battery cells	16	5.2
Assembly	13	4.3
Operation	66	21.1
Maintenance	6	2.0
Decommissioning	1	0.3
Total	131	42.2

Vehicle Composition

	Mass [kg]	Mass [%]	Carbon intensity [kg CO ₂ e/kg]	Recycled/bio content [%]
Steel	930	42%	4	36%
Aluminum	265	12%	7	44%
Polymers	445	20%	4	21%
Electronics	n/a	n/a	75	n/a
Other	100	5%	5	n/a
Mixed/unknown	145	7%	5	n/a
Traction battery cells	350	16%	15	n/a
Custom category: ____				
Total	2240			

1.3.1 Traction Battery Cells

Cathode chemistry	NCMA
Gross capacity (kWh)	92
Usable battery energy (kWh)	87
Carbon intensity (kg CO ₂ e/kWh installed capacity cells)	60

1.4 SAE Operation Scenario

The standardized SAE scenario is intended as a common reference benchmark for LCA comparability rather than site-specific accuracy; these values do not constitute universal defaults or represent the energy profile of any specific geographic region. Practitioner shall provide the following information on their baseline assessment alongside the SAE scenario either following the U.S. (mileage, gallons, and EPA 5-cycle) or the rest-of-world data (km, liter, and WLTP). Note, the lifetime distance changes according to the U.S. or global data selection.

Variable	Baseline	SAE Scenario
Grid description	USA with 3% year-over-year projection	50% Fossil 50% Renewable
Gasoline type	N/A	E10
Diesel type	N/A	B7
Grid carbon intensity (kg CO ₂ e/kWh)	0.32	0.4
Gasoline WTW carbon intensity (kg CO ₂ e/liter, kg CO ₂ e/gallon)	N/A	N/A
Diesel WTW carbon intensity (kg CO ₂ e/liter, kg CO ₂ e/gallon)	N/A	N/A
Lifetime distance (km, mi)	200,000 mi	200,000 mi
Lifetime age (years)	10	15
Efficiency testing protocol	EPA 5-cycle	EPA 5-cycle
Utility Factor (%)	N/A	N/A
Efficiency (MPG, Wh/km, Wh/mi)	268 Wh/mi	268 Wh/mi
Lifetime energy (MWh electricity)	67	67
Lifetime energy (gallons fuel)	N/A	N/A
Operation footprint (MT CO ₂ e)	21	27
Life cycle footprint (MT CO ₂ e)	42	48
Life cycle footprint (g CO ₂ e / km)	131	148

