FISKER OCEAN LIFE CYCLE ASSESSMENT 2023

Sustainability is a Founding Principle at Fisker.

Our teams are dedicated on our mission to *create the world's most emotional and sustainable vehicles*. At Fisker, every function works diligently for sustainability without compromising quality and design. The results of this Life Cycle Assessment (LCA) represent our hard work and focus reducing our impact through the entire vehicle life cycle.

Fisker recognizes that customers have many good choices when deciding on personal mobility. Fisker aspires to provide the most sustainable choices, within the growing EV market. The proof of sustainability is not simple. It is a labor that must be taken seriously and conducted through science-based methodology. Fisker is a purpose-driven company that is sharply focused on clean personal mobility.

This LCA has been a natural companion to our vehicle development for guiding early production and procurement processes. This analysis also prompted environmental improvements to the design, materials sourcing, use/charging and future dismantling and reuse/recycling. This report demonstrates a technical understanding of our vehicles' carbon footprint, demonstrating how closely we pay attention to every detail to reduce our impact. In addition, the results of this LCA provide insights toward improvement as we develop PEAR, RONIN and ALASKA. When we describe the life cycle of our vehicles, we use the term "end of use" instead of "end of life." This reinforces our support of circular economy ideals and that we value the commodities that are in our vehicles.

We focus closely on the BEFORE in our actions, pausing to take a moment to understand and evaluate processes to find sustainable solutions. Products such as vehicles should always be a work-in-progress, constantly seeking sustainable innovation to improve environmental footprint. We strive to pioneer new thinking and influence our peers and all brands to be intentional about sustainability in their actions.

Henrik Fisker—Chairman and Chief Executive Officer, Fisker Inc.

Fisker Ocean Sport EU (tCO_2eq)

29.5

Fisker Ocean Extreme EU (tCO_2eq)

35.2

LCA: Driving Towards Carbon Neutral

Outpacing Competitors

Lowest published carbon footprint in the SUV market segment

Radical Transparency

From Cradle-to-Grave and from Well-to-Wheel Data shares full life cycle from raw material to dismantling and dispersing materials

A Better Choice

The carbon saved by choosing a Fisker Ocean over a gasoline car equals the carbon sequestered from 39 acres of U.S. forests.*

Data Driven

Primary data heavy, no carbon offsets, no hiding scope limitations

Fisker upends traditional OEM product development. Many auto manufacturers develop a product and some then perform an LCA to identify areas for improvement. Fisker starts with the full life cycle in mind, always seeking methods to innovate and improve.

Fisker crafts a steadfast vision of clean mobility for the future, and knows that details matter.
This LCA works as a microscope, providing clear vision into the details of the production cycle, including:

- Ensuring we extract the least possible amount of materials from the earth;
- Strategizing methods to minimize our customer's impact as they drive the Fisker Ocean.
- Evaluating how to ensure the least amount of material goes to landfill when the vehicle is no longer in use.

An LCA is a thorough study of our vehicle's impact on the planet. The LCA of the Fisker Ocean reveals the total carbon footprint, from raw materials and transportation of goods, through production and use, until the vehicle is dismantled at end of use.

* Calculating the average LCA for an internal combustion engine (ICE) vehicle in the EU: The International Energy Agency provided the reference for life cycle emissions for ICE vehicles. Odyssee-Muree provided the reference for average vehicle mileage in the EU. Europa.eu provided the reference for average vehicle emissions.

Equivalencies were created using information from the U.S. EPA Carbon Equivalency Calculator and The Climate Neutral Group.

At Fisker, we are always thinking ahead. This LCA began well before the start of production of our first vehicle, the Fisker Ocean. This is what foundational sustainability looks like:

Fisker Considers Sustainability *Before* Actions:

- Carbon neutrality is in Fisker's founding announcement
- Fisker commits to non-financial ESG reporting BEFORE going public
- Fisker implemented key sustainability performance indicators for the Fisker Ocean BEFORE the start of production
- Fisker released their inaugural ESG Impact report BEFORE starting vehicle production

Accuracy Matters

This LCA stands out among its peers because of its extensive use of primary data rather than only estimates and assumptions. Our Tier 1 suppliers share our commitment to sustainability and provide us with accurate carbon accounting.

Because we are serious about reaching carbon neutrality, we must be transparent about our processes, measurement, and impact on the earth and the atmosphere. This LCA represents our leadership with the goal of inspiring other OEMs and brands in every industry to join us on this path.

"This LCA is a critical step toward meeting our aspiration to create a climate-neutral vehicle by 2027. It represents our values and meaningful sustainability actions through measurement and transparency. "—Patrick Newsom, Head of ESG

Technical Overview

Goal
This assessment aims to determine the full carbon footprint of the Fisker Ocean Sport EU and Fisker Ocean Extreme EU in a transparent, detailed, and verifiable manner.

Scope
The scope of this evaluation is the carbon footprint over the life cycle of the vehicle, from raw material production through the end of use.

Methodology
Our process strictly followed ISO 14040, 14044, and ISO 14067 standards for life cycle assessment and carbon footprint of products as well as the standards set by the GHG protocol.

Functional Unit
The functional unit is the life cycle of the Fisker Ocean, an all-electric, four-door, five-seat SUV. For this measurement, we define the lifespan to be 200,000 km driven in Europe.

Cut-Offs
When calculating the Fisker Ocean's carbon footprint, we did not include or consider:

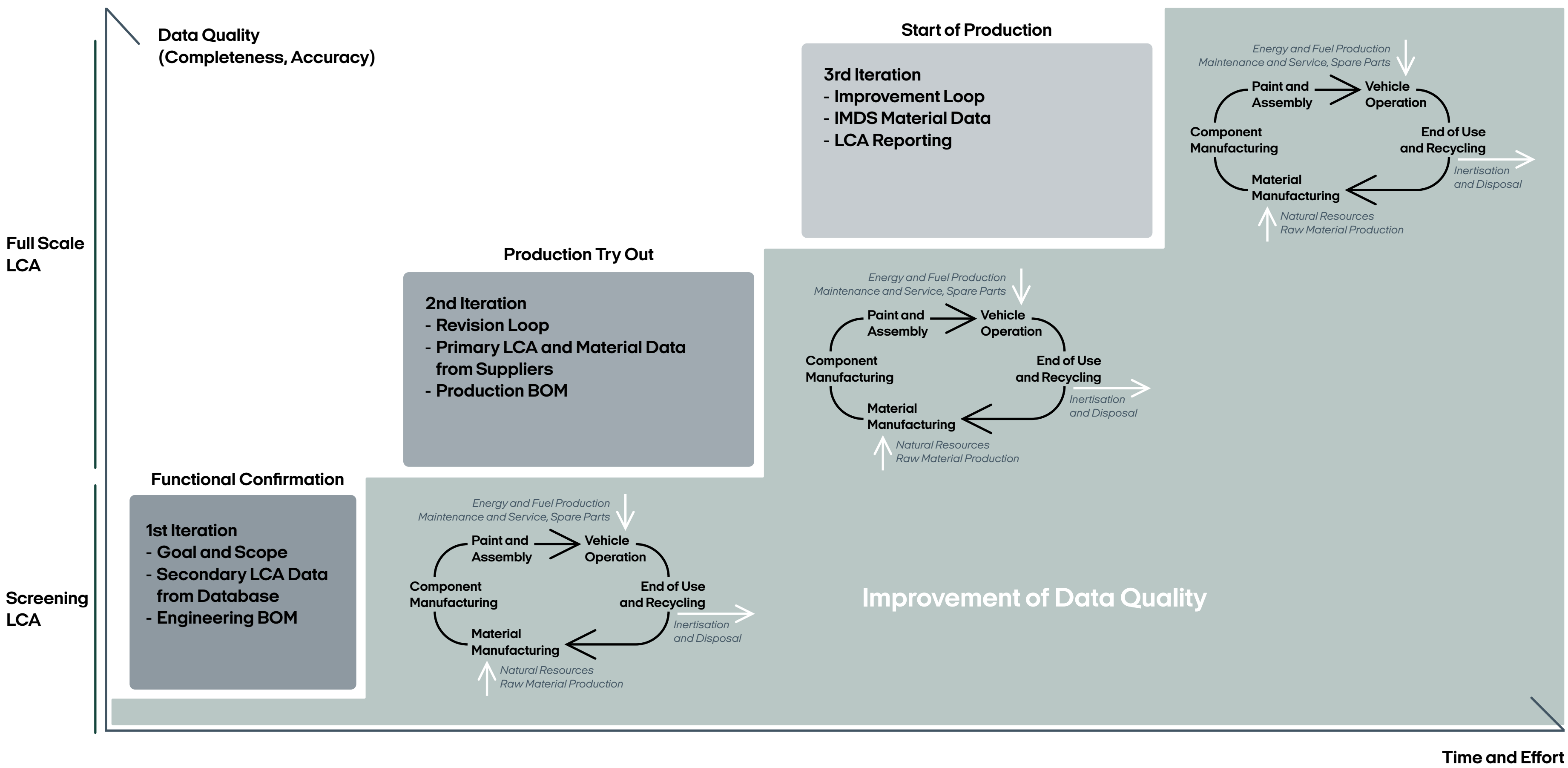
- All inbound transport activities from our sub-supply chain to Tier 1 suppliers;
- Scope 3 GHG emissions related to capital goods, business travels, employee commuting, leased assets, processing of sold products, franchises, and investments;
- Infrastructure like construction of buildings and roads, road maintenance, etc.;
- Rare events such as HV battery replacements, accidents and force majeure.

Impact Category Assessed
The selected impact category in this assessment is climate change, expressed in the characterization factor, "Global warming potential over the time horizon of 100 years." Climate change is currently the primary impact category in the automotive industry.

Iterative Process
Fisker revised this LCA several times to ensure accuracy and to properly incorporate all the data collected. There were three iterations involved in producing our final calculations.

- First iteration: We defined the scope and goal and conducted a conceptual LCA.
- Second iteration: This is our "revision loop". We revised our figures using the first primary data we received.
- Third iteration: This is our "improvement loop". We improved our assessment using all data available. This high level of accuracy coincides with the start of production of the Fisker Ocean.

Figure 01: Iterative Process of LCA



Quality Data Collection

"We expect our suppliers to commit to these same values and help us to achieve the lightest footprint on our planet."
—Fisker Responsible Supplier Policy

Fisker carefully selects like-minded suppliers to reach our vision of a carbon-neutral vehicle. We choose partners who can provide primary data, enabling us to produce what we believe is the most accurate LCA in the industry.

All suppliers receive the Fisker Responsible Supplier Policy (RSP) and detailed questionaries regarding life cycle data. The Fisker and Magna teams conducted educational workshops to determine the feasibility, scope and goal for this assessment. Sessions explored all relevant parts of this assessment and to be as accurate, consistent, complete, and transparent as possible, following the principles of the Product Life Cycle Accounting and Reporting Standard published by the GHG protocol. Twenty-seven primary suppliers provided primary data.

Primary Data Sources:

- LCA data collection sheets
- Additional relevant LCA information direct from suppliers in other written form (presentations)
- IMDS material data sheets
- Vehicle bill of materials (BOM) information
- Magna Steyr energy and environmental management data
- Magna Steyr logistic CO_2eq. calculation tool
- Vehicle energy consumption and charging efficiency simulations and measurements
- Certificates from external partners (e.g., energy certificate of origin)

Secondary Data
Fisker seeks to limit the use of secondary data whenever possible. Because the Fisker vehicles are in limited use and were awaiting full government approvals during the LCA process, it was necessary to use secondary data for the use and end of use phases of the vehicle. Sub-supplier data is also secondary. See Technical Details for more information.

LCA Results by Phase

Five Phases of the LCA

There are five phases to the LCA*:

1. Materials and Production (Upstream Sourcing)
2. Paint and Assembly (Vehicle Manufacturing)
3. Inbound/Outbound Transit
4. Use and Maintenance
5. End of Use

*ESG Impact Report maps into this LCA under this updated list of phases.

Fisker deliberately uses the term "End of Use" for the vehicle rather than the common LCA term "End of Life" because we believe in circular production, meaning we are always looking for the next use of any materials after their first use has passed.

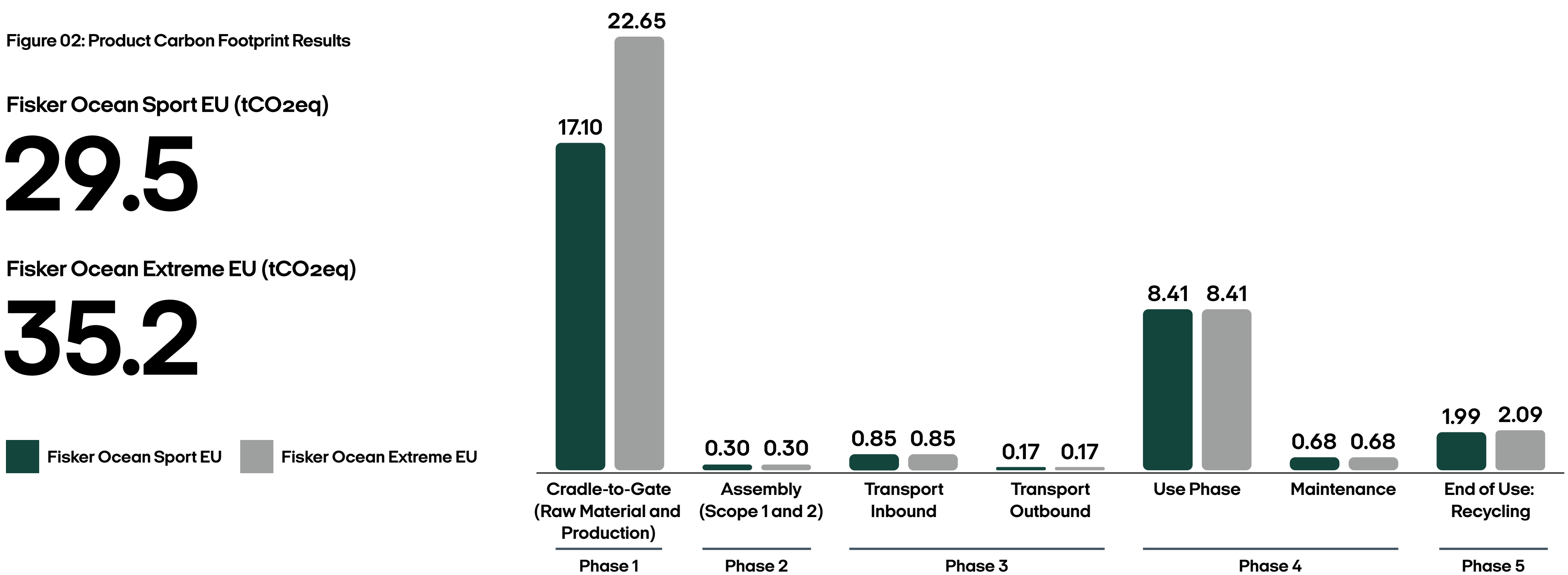
Figure 02: Product Carbon Footprint Results

Fisker Ocean Sport EU (tCO_2eq)

29.5

Fisker Ocean Extreme EU (tCO_2eq)

35.2



Phase 1: Materials and Production

How It's Made Matters

Fisker seeks to reduce the impact at every phase of production and use, starting with materials. We recognize that reducing the mass and carbon footprint of materials significantly reduces overall carbon emissions for the life cycle of a vehicle.

Fisker teams consider materials from a series of criteria: quality, recyclability, expense, contribution to carbon footprint, performance, and appearance. Materials engineers and designers analyze materials for recycled and bio-based content, recyclability and sustainable production quality.

Fisker measured the raw material and production phase, in large part from the material data sheets provided by the suppliers. Materials with a greater than 1% mass percentage of a specific part were considered. Figure 03 represents the key materials used in Fisker's EV.

Figure 04 shows the carbon footprint of specific parts of the Fisker Ocean.

Fisker Ocean Sport EU (tCO_2eq)

17.10

58% of total carbon footprint

Fisker Ocean Extreme EU (tCO_2eq)

22.65

64% of total carbon footprint

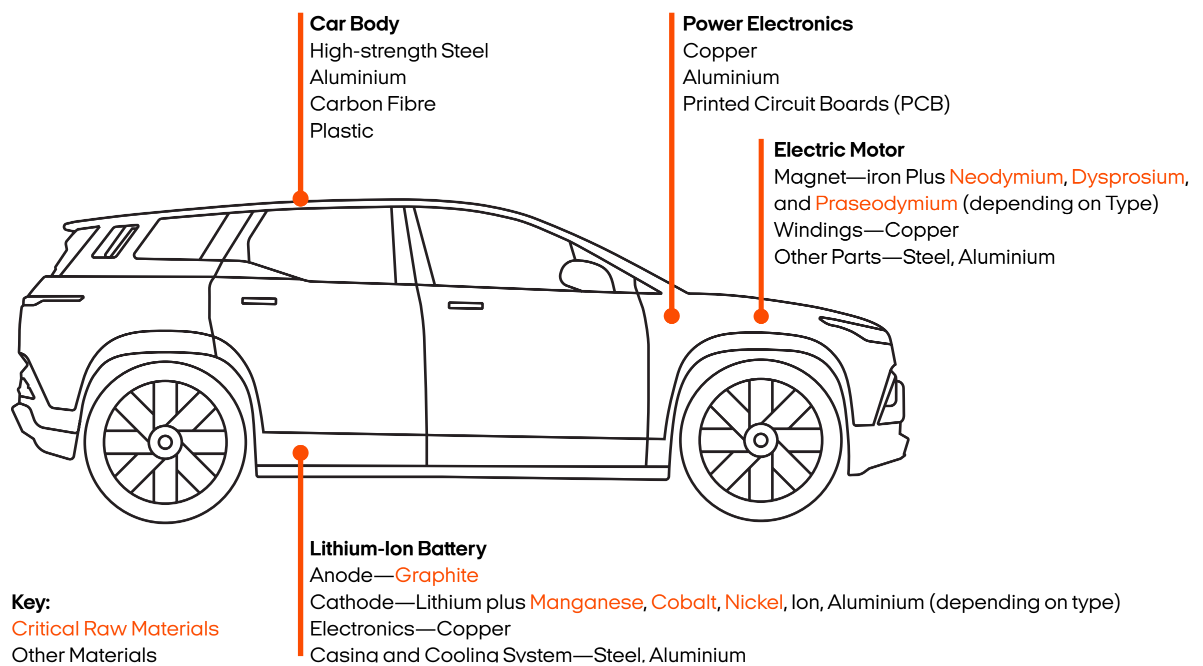


Figure 03: Key Materials Used in Fisker Ocean

Optimizing Materials

An internal engineering and sustainability attribute team conducted a materials analysis researching the perfect balance of sustainability, safety, quality, and cost. Key closure components and the "body-in-white" (manufacturing stage when the vehicle frame has been fused before paint or parts) were analyzed to find an optimal material mix, including recycled materials and mass. Results identified significant potential for reducing carbon footprint and will inform engineering for reaching our aspiration to create a climate-neutral vehicle. The Fisker Ocean has more than 50 kg of recycled polymers, biobased and other sustainable materials.

Sustainable Production Partner

Our production collaboration with Magna in Graz is a notable example of our ESG ethos. Magna provides both engineering and experienced, technical innovation, and its production facilities in Graz, Austria run on 100% renewable electricity.

Before production began, Fisker identified materially-relevant UN SDG-driven environmental key performance indicators:

- GHG Emissions
- Water Efficiency
- Waste Diversion
- Hazardous/Non-Hazardous Waste
- Energy Efficiency
- Renewable Energy
- 4Rs – Reduce, Reuse, Recycle, Recover

The production facility in Graz, Austria, tracks these indicators by production line.

In addition, Fisker set three specific key performance indicators for sourcing and engineering the Fisker Ocean:

- Carbon Footprint
- Recyclables
- Vehicle Recycling Rate

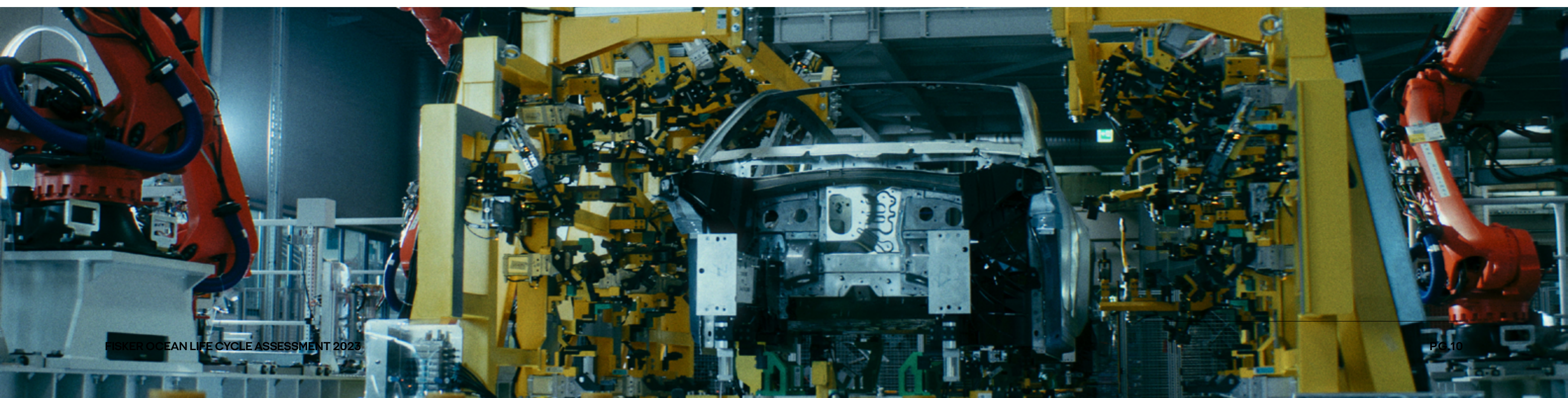
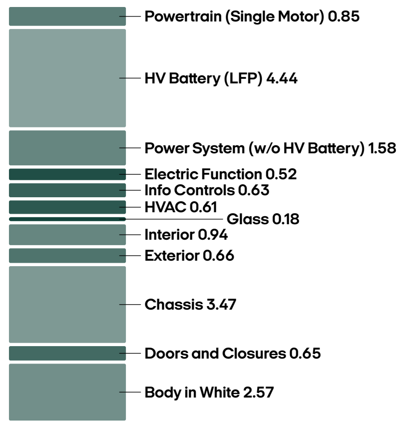
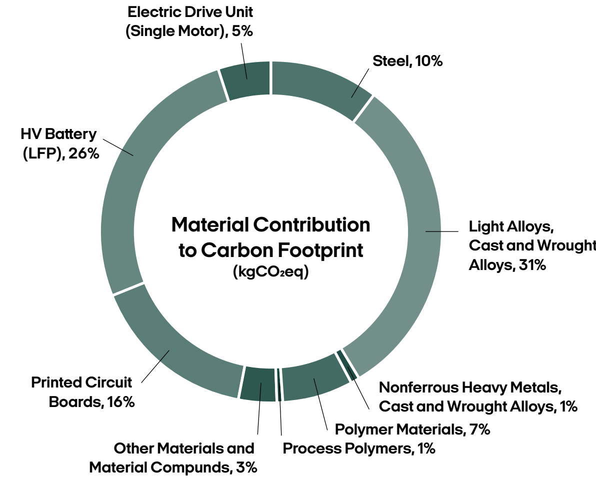


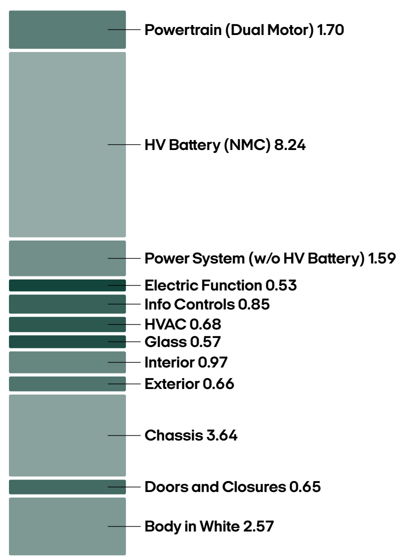
Figure 04: Carbon Footprint of Specific Parts

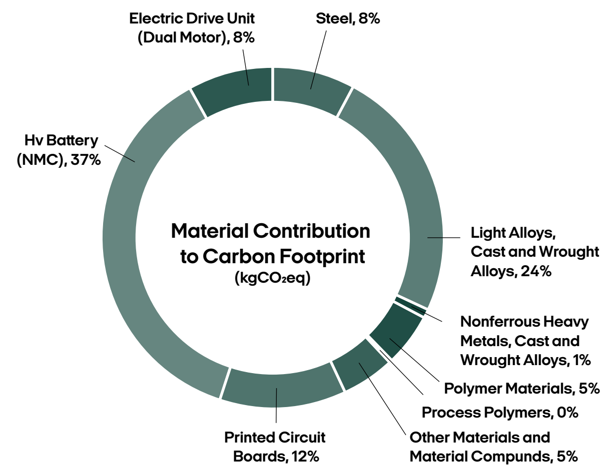
Cradle-to-Gate Carbon Footprint
Fisker Ocean Sport EU
17.10 (tCO2eq)





Cradle-to-Gate Carbon Footprint
Fisker Ocean Extreme EU
22.65 (tCO2eq)





Phase 2: Paint and Assembly

Fisker Ocean Sport EU (tCO_2eq)

0.30

1% of total carbon footprint

Fisker Ocean Extreme EU (tCO_2eq)

0.30

1% of total carbon footprint

Magna produces the Fisker Ocean Sport EU and the Fisker Ocean Extreme EU vehicles in a carbon-neutral* facility powered by electricity sourced from 100% renewable energy. This results in an extremely low impact number.

* No carbon offsets are included as given by GHG protocol Product Carbon Footprint accounting principles.

Phase 3: Inbound/Outbound Transport

Fisker Ocean Sport EU (tCO_2eq)

1.02

3% of total carbon footprint

Fisker Ocean Extreme EU (tCO_2eq)

1.02

3% of total carbon footprint

Sourcing Locally and Sustainably
Due to Fisker's logistics planning and location strategy, transport had a relatively small negative impact on the overall carbon footprint.

Fisker prioritized localization whenever possible, keeping the majority of suppliers within 1,000 km of production, allowing minimal impact from transport on our total carbon footprint. As with suppliers, Fisker challenges logistics partners to support our aspirational goal of creating a climate-neutral vehicle.

Fisker prioritizes the use of rail and electric transport, resulting in the inbound/outbound phases of the life cycle representing a very small part of the total CO2eq number.

Fisker calculated inbound transport based on Tier 1 suppliers transporting to Graz, Austria. Transport from Tier 2 suppliers and further sub-suppliers was out of scope.

For outbound transit, estimate models were based on the geographic scope of Europe, from Graz as the point of departure. Graz's central location minimizes impacts in this category.

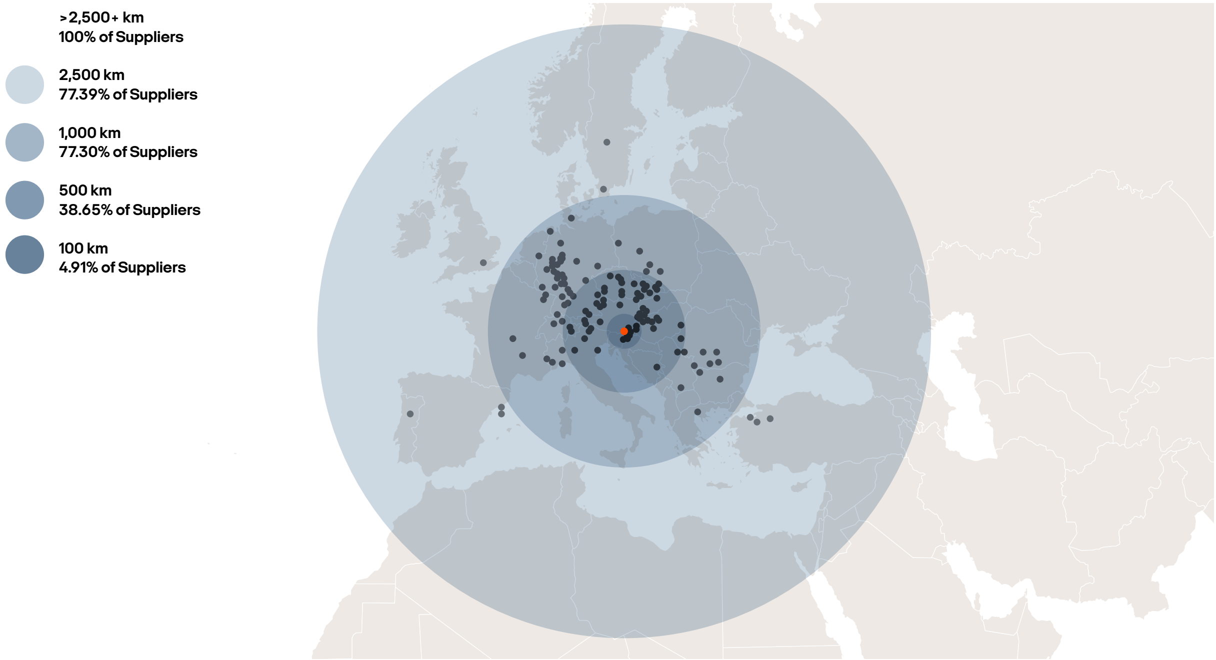


Figure 05: Supplier Proximity

Phase 4: Use and Maintenance

Fisker Ocean Sport EU (tCO_2eq)

9.09

31% of total carbon footprint

8.41 + 0.68

Use (29%) **Maintenance (2%)**

Fisker Ocean Extreme EU (tCO_2eq)

9.09

26% of total carbon footprint

8.41 + 0.68

Use (24%) **Maintenance (2%)**

The carbon saved by choosing a Fisker Ocean over a gasoline vehicle in the use phase is equivalent to 1,051 trips from Amsterdam to Paris on a high speed train.*

Service and Maintenance Designed for the Customer

Fisker saves customer time through the convenient and easy-to-use app to allow customers to schedule service and maintenance. In partnership with third-party service providers, Fisker is building a network of customer touchpoints to include physical service locations, mobile services, vehicle logistics and test drives. For the Fisker customer, delivery and service options will meet their needs at home, Center+ or Fisker Lounges.

How Its Charged Matters

Pending Fisker Ocean vehicles in the hands of retail customers, the use and maintenance phases in this report are based on scientific estimates using the most accurate data available. The most sensitive input parameters are the energy sources used, the vehicle's energy consumption, the charging efficiency, and the chosen lifetime of the vehicle.

The raw material extraction of the energy source and the energy generation from the source were measured to calculate the use phase. After extraction, the energy is transmitted to a low voltage charging station, separated into home and public charging stations, with 60% home charging and 40% public charging estimated for this assessment. The calculation is based on Fisker's european charging partner, Allego., providing 100% renewable electricity at all public charging stations.

The energy sources heavily influence the carbon footprint in this phase. The greener the source, the lower the footprint.

*Calculating the average LCA for an internal combustion engine (ICE) vehicle in the EU: The International Energy Agency provided the reference for life cycle emissions for ICE vehicles. Odyssee-Muree provided the reference for average vehicle mileage in the EU. Europa.eu provided the reference for average vehicle emissions.

Equivalencies were created using information from the U.S. EPA Carbon Equivalency Calculator and The Climate Neutral Group.

The SolarSky

The SolarSky is a rooftop solar panel on the Fisker Ocean Extreme that supplements the battery. The panel can add up to 2,400 kilometers of range annually in optimal conditions, enhancing the Fisker Ocean's kilometers per charge range.

Fisker to Educate and Influence Customers Toward Renewable Charging

Fisker's preferred charging partners are those that have a more renewable energy supply. Fisker will help guide customers to green power through the vehicles wayfinding systems. Additionally, Fisker will increase the supply of renewable energy to power vehicles and inform consumers of the importance of the critical need for renewable energy overall.

Phase 5: End of Use

Fisker Ocean Sport EU (tCO2eq)

1.99

7% of total carbon footprint

Fisker Ocean Extreme EU (tCO2eq)

2.09

6% of total carbon footprint

Fisker considered the vehicle's end of use well before production. Through meticulous consideration of materials and further refining through its engineering study, the Fisker Ocean features parts that are bio-based, mono-based, free of paint where possible, and made of clean material for recyclability, all without compromising the refined aesthetic and vehicle safety and capability.

Figure 06 shows the end of use process for the Fisker Ocean vehicles.

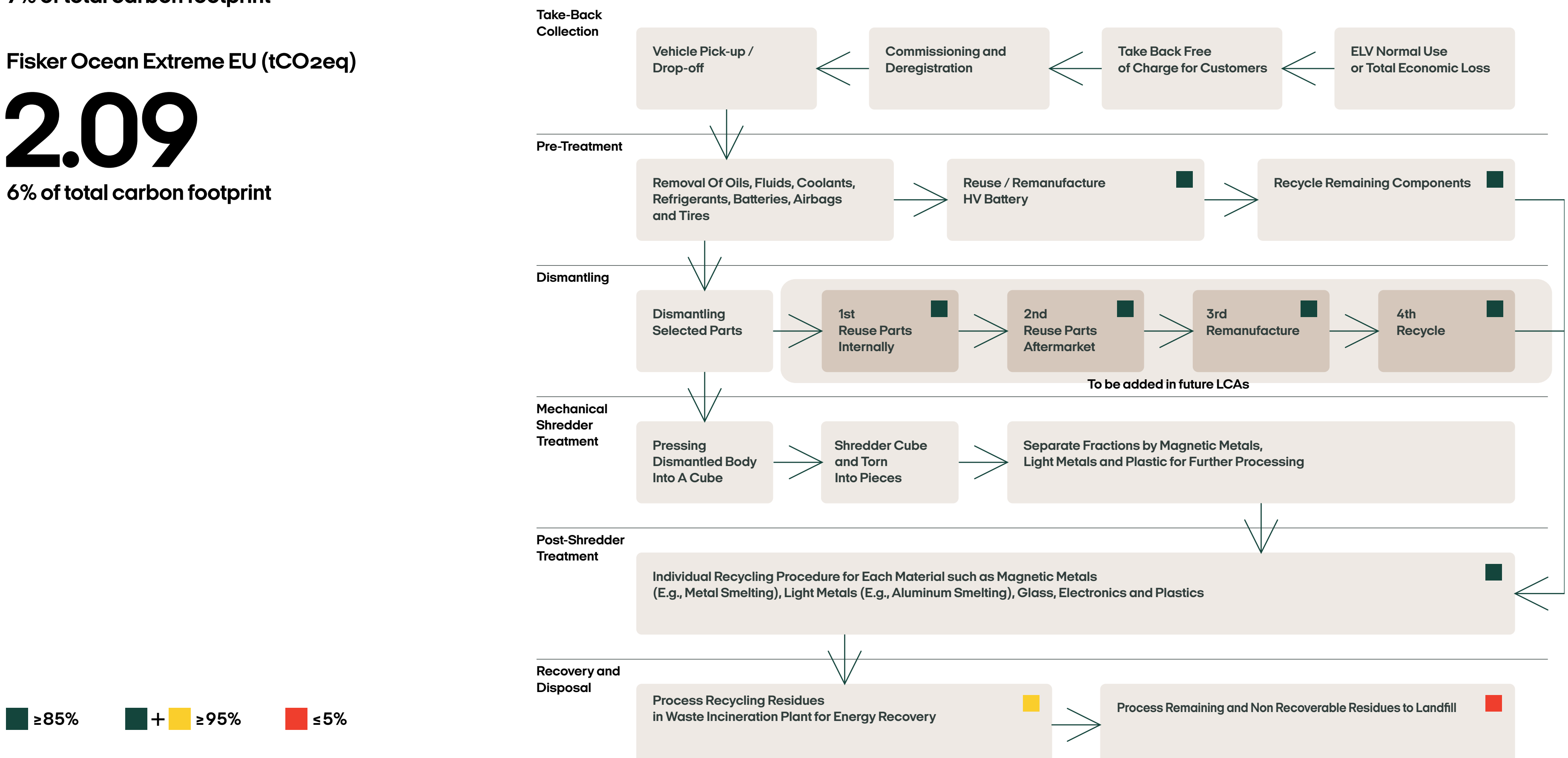


Figure 06: End of Use Process for the Fisker Ocean Vehicles

The end of use phase of the Fisker Ocean was analyzed under the assumption that the vehicle components would be re-used, remanufactured and recycled as much as possible. Carbon associated with transport to the recycling facility was not considered but is assumed to be small. Manual disassembly of certain parts, which has a low impact on the total product carbon footprint result, is the first step modeled in this assessment. Further treatments of those parts were cut-off, meaning they are not included in the scope of this assessment, except for the HV battery system. Recycling of the HV battery system is seen as an essential part of the recycling phase, accounting for the majority of the carbon footprint of this phase. For this assessment, all parts which are not disassembled would be going to a shredder process. The main recycling materials' output from the shredder process are ferrous and non-ferrous metals like steel and aluminum..

Industry Comparison

Full LCA Results

*The carbon saved by choosing a Fisker Ocean over a gasoline vehicle is equivalent to the amount of carbon sequestered from 39 acres of U.S. forests.**

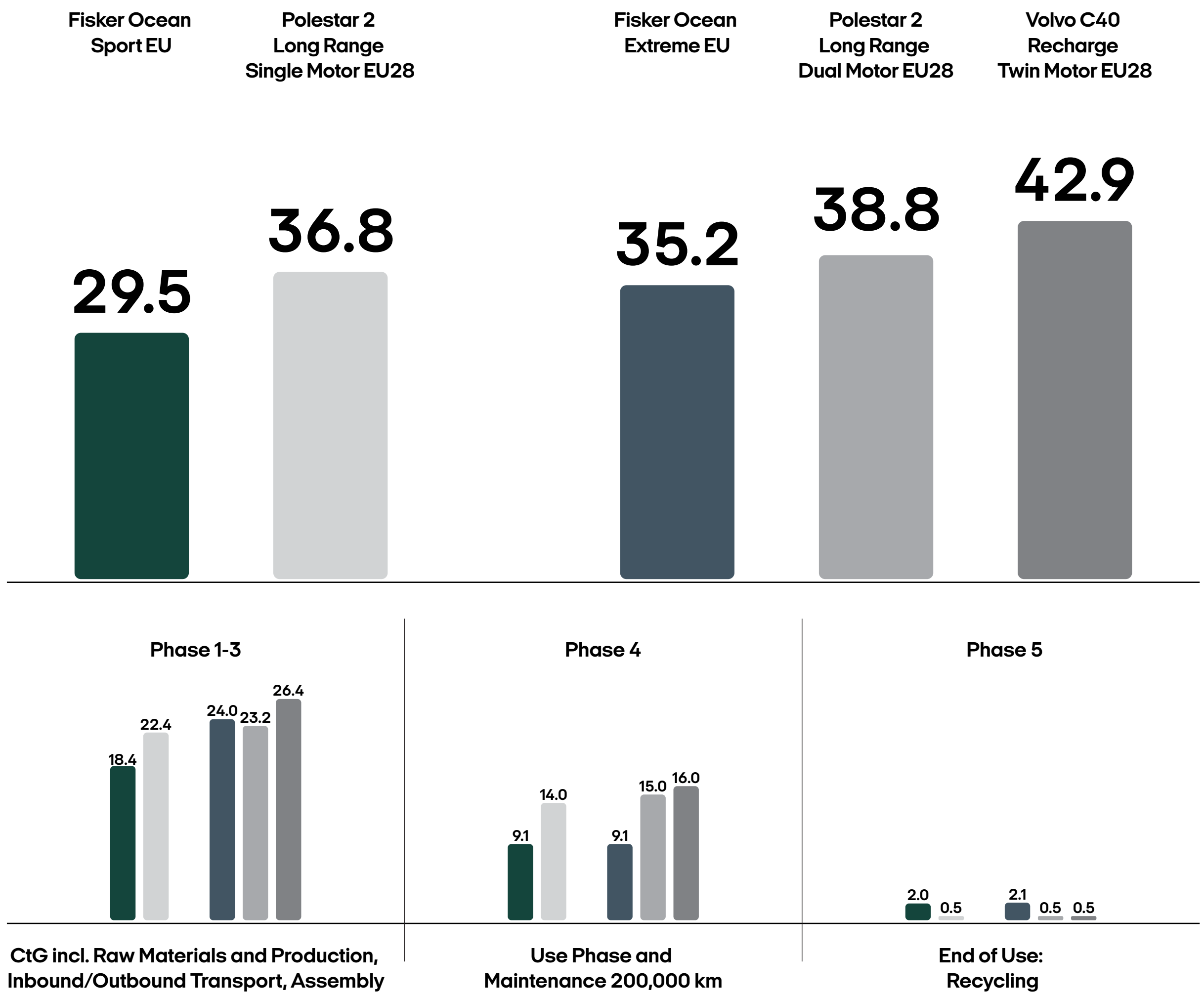


Figure 07: Fisker Ocean EU LCA Results Compared to Polestar and Volvo Specific Models**

- Fisker Ocean Sport EU
- Polestar 2 Long Range Single Motor EU28

- Fisker Ocean Extreme EU
- Polestar 2 Long Range Dual Motor EU28
- Volvo C40 Recharge Twin Motor EU28

* Calculating the average LCA for an internal combustion engine (ICE) vehicle in the EU: The International Energy Agency provided the reference for life cycle emissions for ICE vehicles. Odyssee-Muree provided the reference for average vehicle mileage in the EU. Europa.eu provided the reference for average vehicle emissions.

Equivalencies were created using information from the U.S. EPA Carbon Equivalency Calculator and The Climate Neutral Group.

**Polestar comparison taken from Polestar-2 LCA published in 2021, with updated information from Polestar Dataset published in 2023. Volvo comparison taken from LCA published in 2021.

Comparisons by Phase

Phases 1 – 3

Material and Production, Paint and Assembly, Inbound/Outbound Transport (Cradle-to-Gate)

	Fisker Ocean Sport EU	Polestar 2 Long Range Single Motor EU28	Fisker Ocean Extreme EU	Polestar 2 Long Range Dual Motor EU28	Volvo C40 Recharge Twin Motor EU28
Result	18.4	22.3	24.0	23.3	26.4
CV Mass	2,190 kg	2,012 kg	2,427 kg	2,110 kg	2,180 kg
Battery Chemistry	LFP	NMC	NMC	NMC	NMC
Battery Capacity	75 kWh	78 kWh	113 kWh	78 kWh	78 kWh
Battery Pack Mass	523 kg	350 kg	588 kg	350 kg	350 kg
			Sliding Photov. Roof		

Phase 4

Use and Maintenance

	Fisker Ocean Sport EU	Polestar 2 Long Range Single Motor EU28	Fisker Ocean Extreme EU	Polestar 2 Long Range Dual Motor EU28	Volvo C40 Recharge Twin Motor EU28
Result	9.1	14.0	9.1	15.0	16.0
Comsuption	16.5 kWh / 100 km (Simulation based—VTS CW42)	17.1–18.3 kWh / 100 km (WLTP)	17.5 kWh / 100 km (Measurement based—VTS CW50)	19.5–20.3 kWh / 100 km (WLTP)	21.1 kWh / 100 km (WLTP)
Charging Efficiency	91%	Not mentioned	92.5%	Not mentioned	Included (no value)
Emissions Factor 40% EU Green-mix 60% EU Average	0.234 kgCO$_2$eq. / kWh 0.027 kgCO$_2$eq. / kWh 0.371 kgCO$_2$eq. / kWh	0.373–0.400 kgCO$_2$eq. / kWh (EU28)	0.234 kgCO$_2$eq. / kWh 0.027 kgCO$_2$eq. / kWh 0.371 kgCO$_2$eq. / kWh	0.373–0.400 kgCO$_2$eq. / kWh (EU28)	0.373–0.400 kgCO$_2$eq. / kWh (EU28)
	Maintenance included	Maintenance in use-phase cut-off	Maintenance included PV roof included	Maintenance in use-phase cut-off	Maintenance in use-phase cut-off

Phase 5

End of Use / Recycling

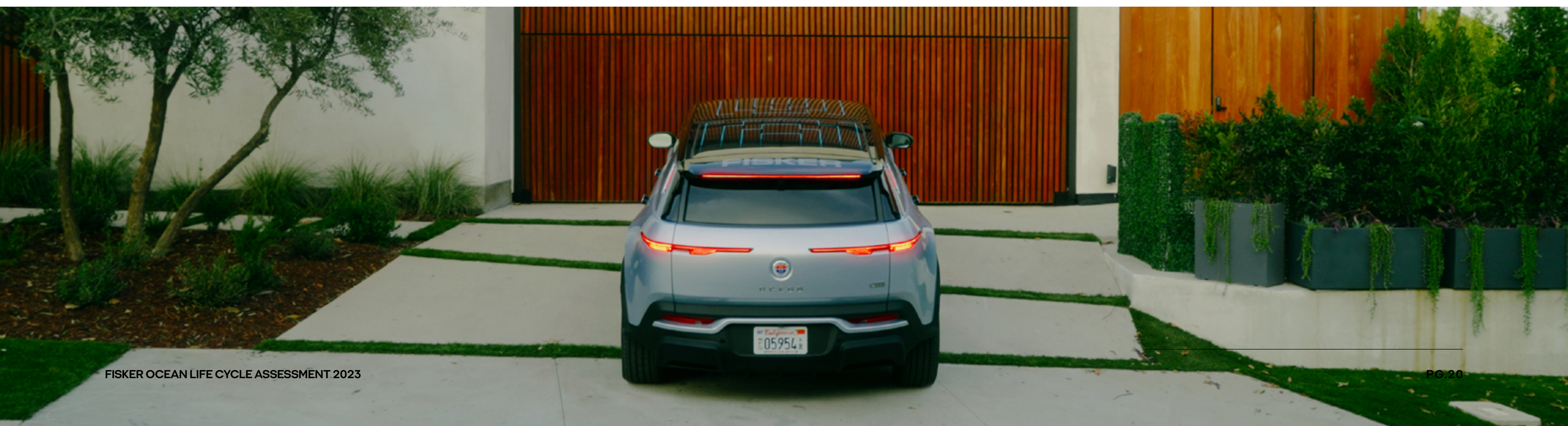
	Fisker Ocean Sport EU	Polestar 2 Long Range Single Motor EU28	Fisker Ocean Extreme EU	Polestar 2 Long Range Dual Motor EU28	Volvo C40 Recharge Twin Motor EU28
Result	2.0	0.5	2.1	0.5	0.5
	• Dismantling + Shredder + Post-shredder included • HV Battery recycling included	• The EoU recycling phase represents a global average situation • HV Battery recycling is cut-off	• Dismantling + Shredder + Post-shredder included • HV Battery recycling included	• The EoL recycling phase represents a global average situation • HV Battery recycling is cut-off	• The EoL recycling phase represents a global average situation • HV Battery recycling is cut-off

Figure 08: LCA Results Against Competitors, by Phase

Looking Forward

Fisker's LCA process and the Fisker Ocean are setting new milestones for the automotive industry and how they consider sustainability. To understand its products' true environmental impact and achieve a climate-neutral vehicle, Fisker will continuously analyze, study, measure, and innovate through all five phases of a vehicle life cycle.

This LCA will act as a living document, frequently updated for continuous improvement for future Fisker vehicles and other products.



Technical Details

This section will capture the in-depth technical information of various aspects of this life cycle assessment (LCA).

LCA Framework, Principles and Fundamentals
LCA can assist in identifying opportunities to improve the environmental performance of products at various points in their life cycle.

LCA is one of several environmental management techniques (e.g., risk assessment, environmental performance evaluation, environmental auditing, and environmental impact assessment).

LCA addresses the environmental aspects and potential environmental impacts throughout a product's life cycle from raw material acquisition through production, transportation, use, End of Use treatment, recycling and final disposal. (ISO 14040:2006)

This LCA specifically focused on providing the life cycle assessment reporting in terms of carbon footprint for each of two vehicles. The technical specifications of the two vehicles evaluated, Fisker Ocean Sport EU and the Fisker Ocean Extreme EU, are seen in Figure 09.

Standard and Guidance Documents Describing Main Principles and Fundamentals We Follow for LCA:
ISO 14040—Environmental Management; Life Cycle Assessment; Principles and Framework
ISO 14044—Environmental Management; Life Cycle Assessment; Requirements and Guidelines
ISO 14067—Greenhouse Gases; Carbon Footprint of Products; Requirements and Guidelines for Qualification
GHG Protocol—Product Life Cycle Accounting and Reporting Standard (accompanying guidance documents for Scope 2, 3 GHG)

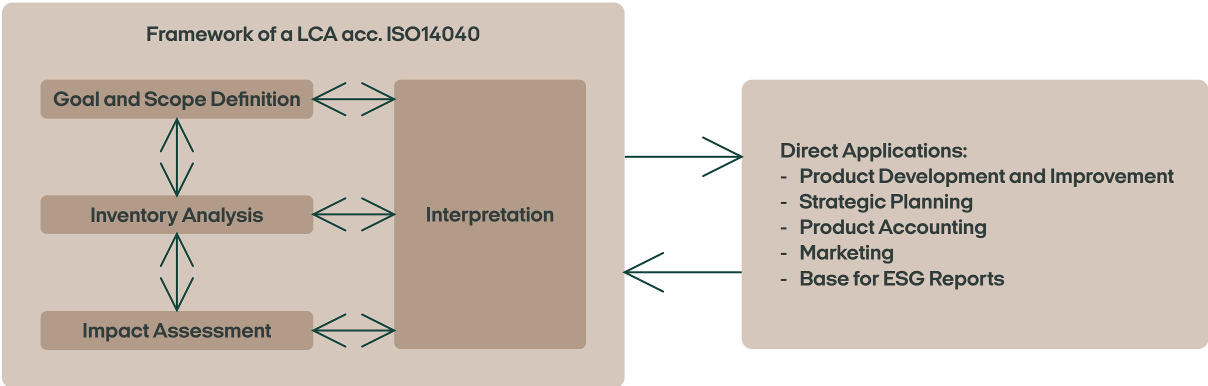


Figure 09: LCA Standards and Guidance

Target: Find out comprehensible LCA and GHG emission results in a transparent, detailed, and reliable manner for the product

Vehicle Specs/Functional Unit

	Fisker Ocean Sport EU	Fisker Ocean Extreme EU
Total Mass (kg)	**2,190 kg acc Mass Book (16.02.23)**	**2,427 kg acc Mass Book (16.02.23)**
Battery Type / Chemistry	**Lithium Iron Phosphate (LFP) Battery**	**Nickel Manganese Cobalt (NMC) Battery**
Battery Capacity	**75.3 kWh acc CATL LCA Presentation (10.12.2022)**	**113.3 kWh acc CATL LCA Presentation (10.12.2022)**
Battery Mass (kg)	**523 kg acc Mass Book (16.02.2023)**	**588 kg acc Mass Book (16.02.2023)**
Motor	**Single Motor**	**Dual Motor**
Energy Consumption (WLTP)	**16.5 kWh / 100 km (simulated—VTS CW 42)**	**17.5 kWh / 100 km (measured—VTS CW 50)**
Charging Efficiency (%)	**91% acc simulation (16.03.2022)**	**92.5% acc simulation (16.03.2022)**
Reference Year / Date	**2023, by certification date**	**2023, by certification date**
Production Plant	**Graz, Austria Magna Steyr Fahrzeugtechnik GmbH & Co KG**	**Graz, Austria Magna Steyr Fahrzeugtechnik GmbH & Co KG**
Geographical Scope	**Europe**	**Europe**

Scope

Overall Project Scope: Cradle-to-Grave, Well-to-Wheel

Figure 10 shows a simplified overview of the definitions of the different scopes: Cradle-to-Grave, Gate-to-Gate and Cradle-to-Gate.

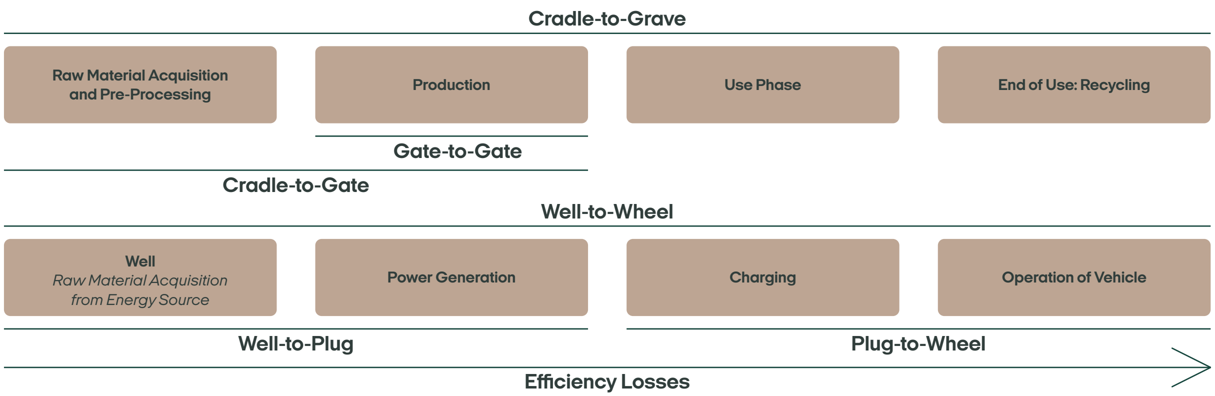


Figure 10: Cradle-to-Gate Definition

Foreground and Background

The system boundary is separated into a foreground and a background system. The foreground system in this assessment refers to activities, where Fisker and Magna, which runs Fisker's production facilities, have direct influence, financial and operative control.

Consequently, the scope 1 and 2 GHG emissions for the painted body and assembly of one Fisker Ocean are in the foreground system. Furthermore, the Tier 1 suppliers are in the foreground system, where product-specific data, or primary data, is collected and used to calculate the product's carbon footprint. Tier 1 inbound transport is included in the foreground system.

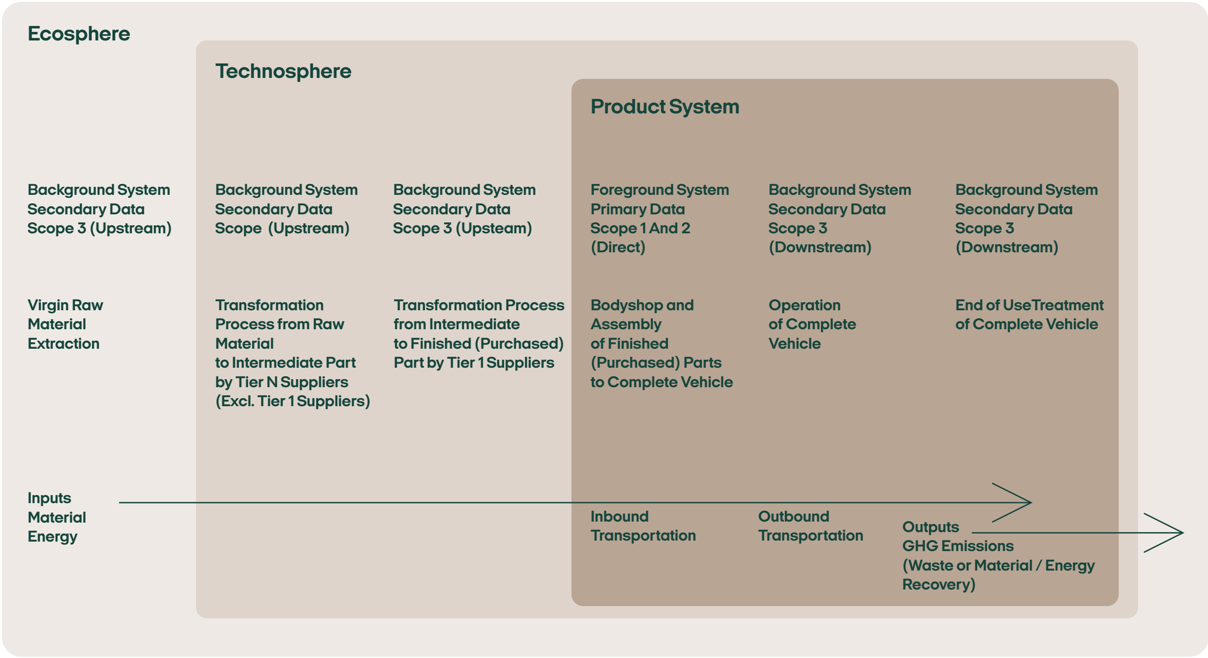
The background systems include upstream scope 3 GHG emissions from sub-suppliers, where generic data may be used, to represent, for example, steel production processes in a certain world region. This does not decrease the quality of the assessment as the technological, spatial, and temporal representativeness of reputable databases may come close to the actual state of the specific data. However, the datasets used should be carefully reviewed to ensure the most representative datasets are used.

In an ex-ante approach, real-life data for downstream scope 3 GHG emissions is not available as the assessment was conducted during the product development. However, primary product information and data have been collected from all relevant factors contributing to this assessment. Due to that results are not only based on assumptions, instead several most likely scenarios based on data from simulations, measurements, scientific studies, and external partnerships were included in the outbound transport phase, use phase, maintenance phase and end of use: recycling phase.

System Boundaries—Ecosphere / Technosphere / Product system

The ecosphere is defined as the environment surrounding the technosphere and product system. As soon as raw materials are transformed in any way these materials enter the so-called technosphere. Furthermore, as soon as transformed materials are specifically transformed for a certain product, these materials enter the so-called product system. To ensure circularity, the goal should be that the smallest number of non-renewable materials possible are extracted from the ecosphere and that the smallest number of materials possible re-enter the ecosphere by, for example, landfilling.

Figure 11: System Boundaries



The Allocation Procedure

This assessment follows an attributional process. The attributional approach includes the elementary flows and processes attributed to represent the functional unit over the complete life cycle. Furthermore, this assessment follows the recycled content, or cut-off, approach. Waste or recycling processes are the producer`s responsibility, which refers to the "polluters pay principle". As a result, at the end of use phase, the vehicle's GHG emissions or recycling processes are allocated to the total product carbon footprint result without receiving any credits or beneficiation.

Recycled materials, or secondary materials, used in the Cradle-to-Gate: Raw Material and Production phase are calculated with a reduced impact,

as only the effects of the recycling processes are attributed. Every flow and process attributed in this assessment has an environmental impact, so cannot be burden-free or attribute credits to the total product carbon footprint. Following GHG protocol, Fisker does not consider the product's offsets and avoided emissions in the product's life cycle. Furthermore, the total material input to produce the components, including scrap, is allocated to the product. This assessment does not show scenarios and sensitivity analysis regarding possible future assumptions. The reference year is 2023.

Figure 11 (Systems Boundaries) shows the system boundary in this assessment, including the different spheres and the distinction of the foreground and background systems. Starting with the raw material extraction in the Cradle-to-Gate: Raw Material & Production phase. This phase includes the extraction and transformation of materials until the complete vehicle is painted and assembled, plus the inbound transport from Tier 1 suppliers to the production facility in Graz. The use phase includes all Well-to-Wheel (WtW) activities and relevant maintenance and service activities over the lifetime of 200,000 km.

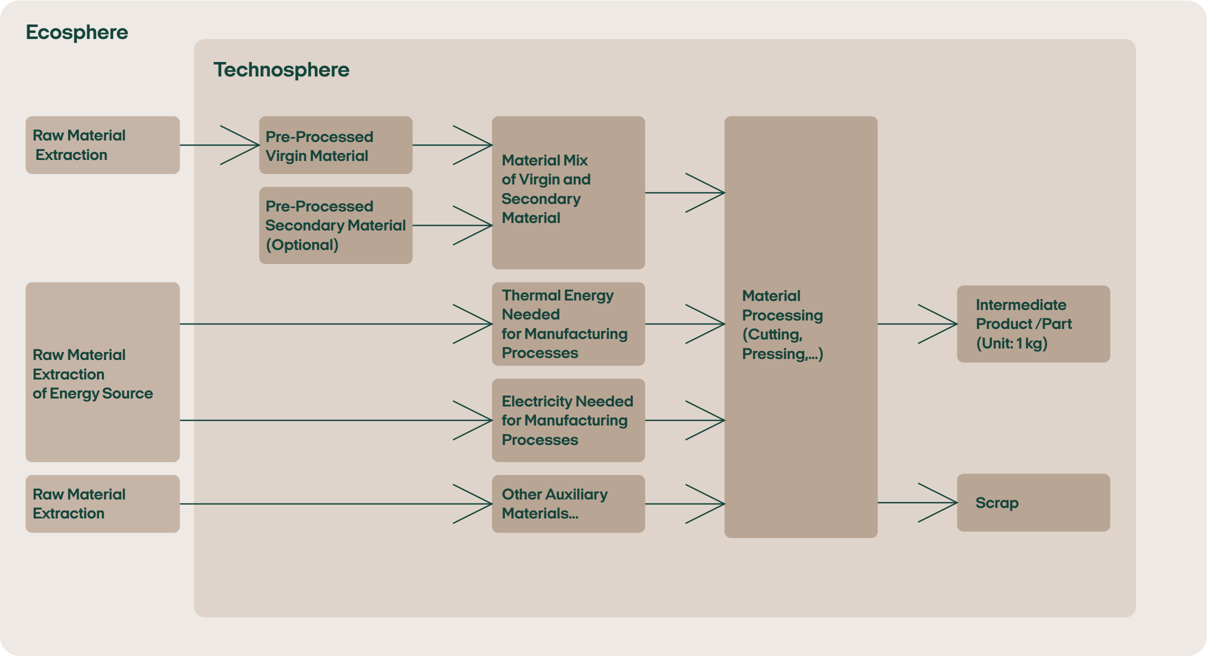
Cut-Off System for the Attributional Approach:

- The underlying philosophy is that a producer is fully responsible for the disposal of its waste and does not receive any credit for the provision of any recyclable materials.
- This system model subdivides multi-product activities by allocation, based on physical, economic, mass, or other properties. By-products of waste treatment processes are cut-off, as are all by-products classified as recyclable. Markets in this model include all activities in proportion to their current production volume.

Boundaries by Phase

Phase 1: Materials & Production

Figure 12: System Boundaries Cradle-to-Gate



Phase 2: Paint and Assembly

Magna in Graz produces the Fisker Ocean Sport EU and the Fisker Ocean Extreme EU vehicles in a carbon-neutral facility powered by electricity sourced from 100% renewable energy. This results in an extremely low impact number.

Phase 3: Inbound/Outbound Transport

Figure 13: Inbound Logistics Flow

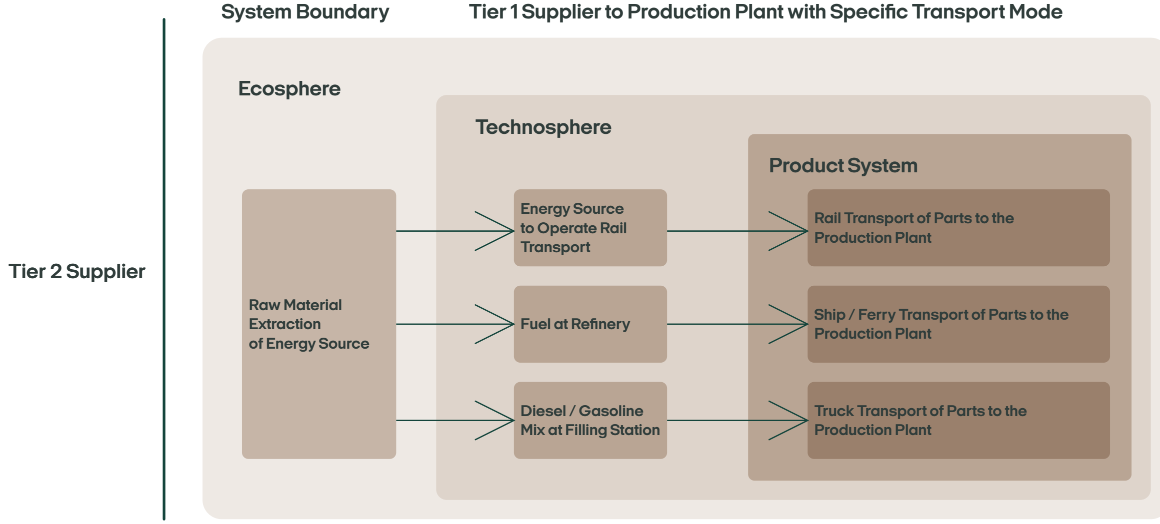


Figure 14: Outbound Logistics Flow

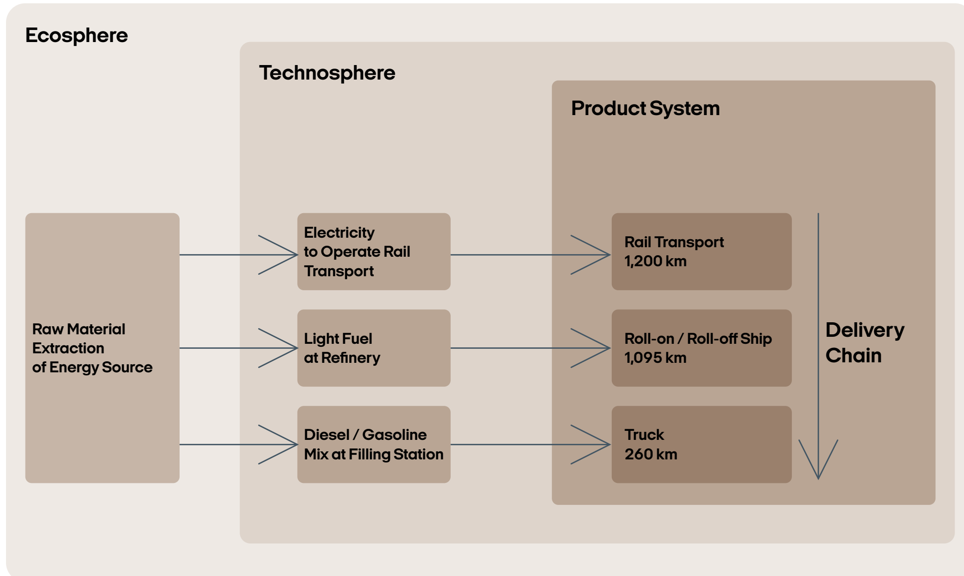


Figure 15: Use Phase Flow

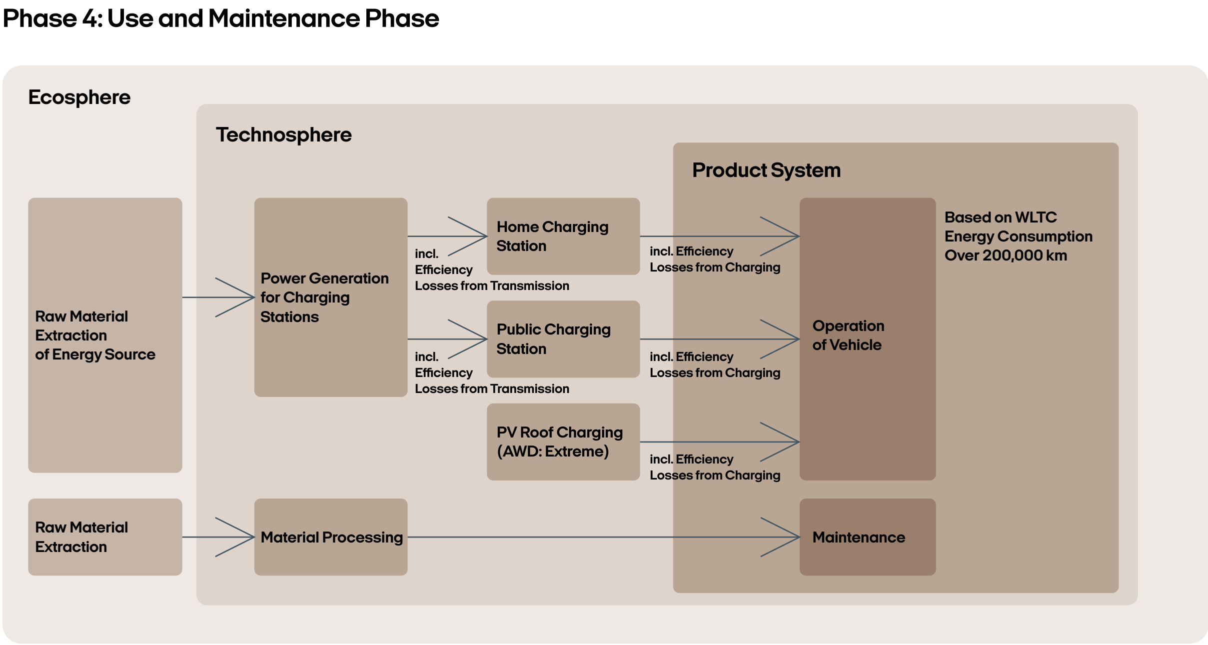
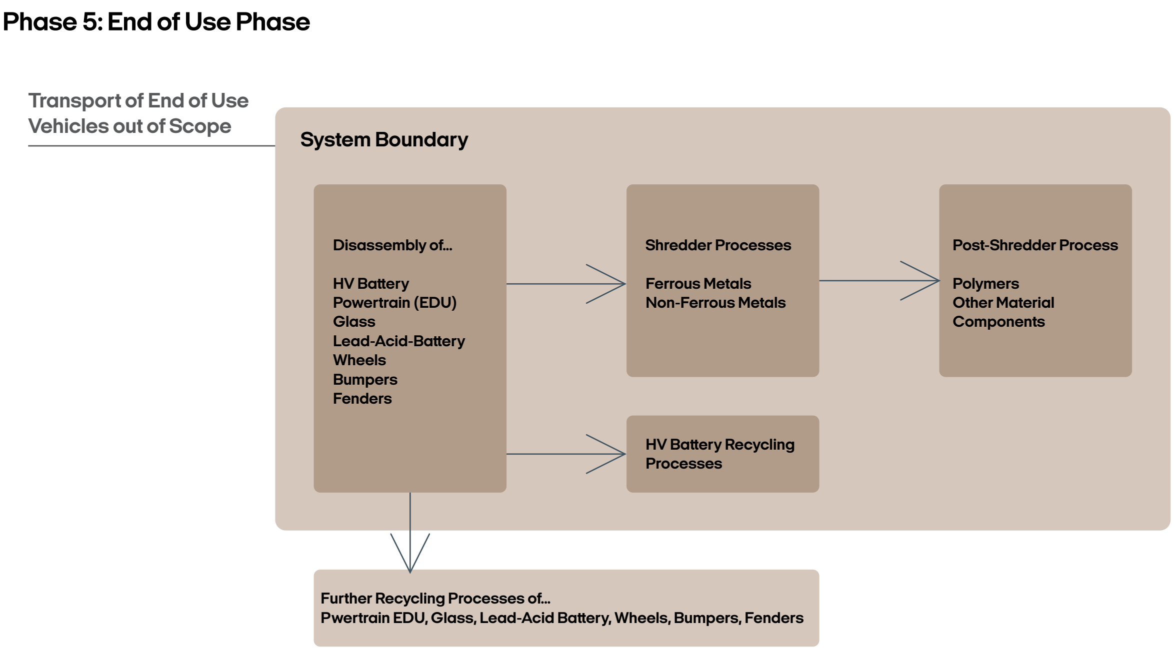


Figure 16: End of Use Phase Flow



Data Sources

Product-Specific Sources, or Primary Data
Product-specific data, or primary data, is preferred in this assessment and was used in the foreground system. Primary data sources in this assessment were IMDS material data sheets, the bill of materials (BOM) and the LCA data collection sheet information provided by suppliers in the Cradle-to-Gate: Raw Material & Production phase.

The reliability of the data provided was cross-checked, adjusted, and modeled with reputable life cycle datasets from life cycle inventory databases and the LCA Software GaBi. Furthermore, Magna energy and environmental management data from the production plant and logistics department are used as a primary data source.

The background system included several simulations and measurements as well as information provided by external partners (i.e., charging network partners). However, in an ex-ante approach, the results for the outbound transport, use phase, and end of use: recycling phase are based on simulations and most likely scenarios. Suppliers provided primary data and carbon footprint results for the HV battery system and the electric drive unit.

Primary data sources in this assessment are as follows:

- LCA data collection sheets
- Relevant LCA information from suppliers in any form (presentations)
- IMDS material data sheets
- Vehicle bill of materials (BOM) information
- Magna Steyr energy and environmental management data
- Magna Steyr logistic CO2eq. calculation tool
- Vehicle energy consumption and charging efficiency simulations and measurements

Secondary Data Sources
Secondary data is mainly used in the background system if no primary data could be acquired. This does not decrease the quality of assessment as long as the multiple quality indicators are ensured. Generic data from the latest version life cycle inventory databases, i.e., GaBi, Sphera, and Ecoinvent were used to represent technological, temporal, and spatial input data. Assumptions were conservative, using worst-case scenario approximations. Scientific studies and technical literature were used to complement this assessment.

Secondary data sources in this assessment are as follows:

- LCA databases, i.e., Sphera, LCA GaBi databases and Ecoinvent
- Technical literature
- Scientific LCA studies
- Associations and organizations e.g., World Steel Association, Verband der Automobilindustrie (VDA), International Organization for Standardization (ISO), Intergovernmental Panel on Climate Change (IPCC), GHG protocol

Material Input Details

Steel

The material classification steel is divided into steel and cast iron. Steel is further separated into cold-rolled steel and hot-rolled steel as well as hot-dip galvanized steel and electro-galvanized steel. The data for steel has a high portion of primary data information included, especially regarding manufacturing processes. The recycled content, the scrap rate during manufacturing processes like cutting and pressing, the measured electricity quantities in kWh and even a specific electricity mix was modeled based on the energy provider certification for certain parts.

Light Alloys, Cast and Wrought Alloys

The material classification light alloys, cast and wrought alloys is divided in three categories, which are wrought aluminum, cast aluminum and magnesium. Wrought aluminum is furthermore divided into extrusion profiles and aluminum sheets. For die-cast aluminum and aluminum sheets a conservative approach regarding recycling was made in this assessment, where internal scrap rates of about 2% are included in the mapping process, even if there may be a portion of recycled aluminum in the vehicle. Recycled content totaling roughly 5% was included for extrusion profiles in the datasets.

Copper, Copper Alloys, Lead and Zinc

The material categories copper, copper alloys, lead and zinc contribute a minor portion to the total product carbon footprint result. These material classifications were modeled with datasets from Sphera LCA GaBi databases and Ecoinvent.

Polymers

The broadest variety of plans were modeled for polymers. This variety comes from different reinforcements and different recycled contents in polymers. For the production processes, a representative value based on the information provided by the suppliers regarding the energy quantity, scrap and recycled content and the different local based energy mixes based on the origin of the production plants were mapped to the specific polymers.

Printed Circuit Boards (PCBs)

The key indicator for electronic parts in this assessment is about the mass of printed circuit boards (PCBs) in the vehicle's distributed functions parts and components (exclusive printed circuit boards in HV battery system and electric drive unit as these PCBs are included in these modules). Printed circuit boards (PCBs) have a high impact on the total product carbon footprint result, even with a small contribution to the total mass of the vehicle. The total mass of printed circuit boards (PCBs) in the vehicle excluding the HV battery is approximately 0.4%. However, these 0.4% contribute almost 3 $tCO_2eq.$ to the total product carbon footprint result.

Other Materials and Material Compounds

The material classification of other materials and material compounds is mostly ceramics and glass parts or components. The result for glass parts (Windshield, Side, Windows, Liftgate) was calculated and modeled by the supplier in the LCA Software GaBi. The rooftop glass was separately calculated with the bill of materials (BOM) information based on primary data provided by the supplier. Furthermore, natural materials like viscose or hemp are included in this material classification.

HV Battery System
The HV battery system for the Fisker Ocean Sport EU is a lithium iron phosphate (LFP) battery. The CtG: Raw Material & Production phase carbon footprint result (without transport to the production facility in Graz) for the LFP battery was calculated and modeled with the LCA Software GaBi by the supplier. The manufacturing and assembly processes are included in the result.

The HV battery system in the Fisker Ocean Extreme EU is a NMC battery. The CtG: Raw Material and Production phase carbon footprint result (without transport to the production facility in Graz) for the NMC battery was calculated and modeled with the LCA Software GaBi by the supplier. The manufacturing and assembly processes are included in the result.

Powertrain (electric drive unit)
The Fisker Ocean Sport EU has one electric drive unit (EDU). The CtG: Raw Material & Production phase carbon footprint result (without transport to the production facility in Graz) for the electric drive unit was provided calculated and modeled with the LCA Software GaBi by the supplier. The manufacturing and assembly processes are included in the result.

Terms and Definitions

Attributional Approach
The attributional approach is defined as a method in which GHG emissions and removals are attributed to the unit of analysis of the studied product by linking together attributable processes along its life cycle (GHG protocol).

Carbon Dioxide Equivalent (CO2eq.)
Unit for comparing the radiative forcing of a GHG to that of carbon dioxide (ISO14067:2018).

Carbon Offsetting
Mechanism for compensating for all or a part of the CFP through the prevention of the release of, reduction in, or removal of an amount of GHG emissions in a process outside the product system under study. Carbon offsetting is not allowed in the quantification of a CFP and communication of carbon offsetting is outside of the scope of this document (ISO 14067:2018).

Cut-Off
Specification of the amount of material or energy flow or the level of significance of GHG emissions associated with unit processes or the product system to be excluded from a CFP study (ISO 14067:2018).

Downstream Emissions
Scope 3 emissions related to sold goods and services (GHG protocol).

Ecoinvent
Ecoinvent is a life cycle inventory database provided by the not-for-profit association Ecoinvent based in Zurich, Switzerland.

Ecosphere
The environmental surrounding of the technosphere and the product system, which includes all elementary flows without human transformations (Hauschild et al. 2018).

Functional Unit
Quantified performance of a product system for use as a reference unit (ISO14067:2018).

GaBi
GaBi is a LCA modelling software containing databases for calculating the product carbon footprint in this assessment provided by Sphera.

GHG Protocol
Greenhouse Gas Protocol provides standards, guidance, tools and training for business and government to measure and manage climate-warming emissions.

Global Warming Potential (GWP)
Index, based on radiative properties of GHGs, measuring the radiative forcing following a pulse emission of a unit mass of a given GHG in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide (ISO14067:2018). GWP100 refers to a time horizon of 100 years.

Greenhouse Gases (GHGs)
Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds (ISO14067:2018).

Intergovernmental Panel on Climate Change (IPCC)
The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

International Material Data System (IMDS)
The IMDS is an automobile industry's material data system.

ISO 14040
ISO 14040:2006 describes the principles and framework for life cycle assessment.

ISO 14067
This document specifies principles, requirements and guidelines for the quantification and reporting of the carbon footprint of a product, in a manner consistent with international standards on life cycle assessment ISO 14040 and ISO 14044.

Life Cycle Assessment (LCA)
LCA can assist in identifying opportunities to improve the environmental performance of products at various points in their life cycle. LCA is one of several environmental management techniques (e.g., risk assessment, environmental performance evaluation, environmental auditing, and environmental impact assessment). LCA addresses the environmental aspects and potential environmental impacts throughout a product's life cycle from raw material acquisition through production, use, end of use treatment, recycling and final disposal. (ISO 14040:2006).

Life Cycle Inventory (LCI)
Phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle (ISO 14067:2018).

Primary Data
Quantified value of a process or an activity obtained from a direct measurement, or a calculation based on direct measurements. Primary data need not necessarily originate from the product system under study because primary data might relate to a different but comparable product system to that being studied (ISO 14067:2018).

Process
Set of interrelated or interacting activities that transform inputs into outputs (ISO 14067:2018).

Product Carbon Footprint (PCF)
Sum of GHG emissions and GHG removals in a product system, expressed as carbon dioxide equivalents (CO2eq.) and based on a life cycle assessment using the single impact category of climate change (ISO 14067:2018).

Product System
The collection of processes and elementary flows of a specific product performing a defined function (ISO 14067:2018).

Scope 1 Emissions
Direct emissions—direct emissions from owned or controlled sources (GHG protocol)

Scope 2 Emissions
Indirect emissions - indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company (GHG protocol).

Scope 3 Emissions
Indirect emissions - includes all other indirect emissions that occur in a company's value chain (GHG Protocol).

Secondary Data
Data which does not fulfil the requirements for primary data. Secondary data can include data from databases and published literature, default emission factors from national inventories, calculated data, estimates or other representative data, validated by competent authorities. Secondary data can include data obtained from proxy processes or estimates (ISO 14067:2018).

Sensitivity Study
Systematic procedures for estimating the effects of the choices made regarding methods and data on the outcome of a CFP study (ISO 14067:2018).

System Boundary
Boundary based on a set of criteria representing which unit processes are a part of the system under study (ISO14067:2018).

Technosphere
Elementary flows from the ecosphere enter the technosphere, if transformations are made e.g., by processing raw materials (Hauschild et al. 2018).

Transparency
All relevant issues are addressed and documented in an open, comprehensive and understandable presentation of information (ISO 14067:2018).

Upstream emissions
Scope 3 emissions, related to purchased or acquired goods and services (GHG protocol).

Report Preparation

Magna Steyr conducted the life cycle assessment on the Fisker Ocean and provided the subsequent LCA technical report. Magna Steyr used data provided by Fisker and its Tier 1 Suppliers. Data used for production model 2023 Fisker Ocean EU.

This publication was adapted from the LCA technical report by Riveron Consulting.

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