

Climate related risks and opportunities

The transition of the transport sector offers significant challenges for the Volvo Group, but it also offers a number of business opportunities.

Climate-related risks

Climate-related risks can be divided into two categories, transitional climate risks and physical climate risks. Transitional climate risks include for instance technology-related risks, policy- and legal-related risks, market risks and reputational risks. Physical climate risks include both acute physical risks, such as extreme weather events, and chronic physical risks, for instance those arising due to changing weather patterns, rising mean temperature and rising sea levels. The Volvo Group is exposed to a number of climate-related risks, as set out below.

Transitional risks

A number of climate-related transitional risks have been identified, which are incorporated in the Volvo Group Enterprise Risk Management process. Transitional risks may be material for the Volvo Group in the short, medium and long term. These risks, including their potential impact, are described in more detail on page 68–73 under the following risk categories:

- Regulations, page 69
- Transformation and technology, page 69–70
- New business models, page 70
- Suppliers and materials, page 70

Physical risks

Physical risks, including climate risks, in relation to main sites where the Group is operating are reviewed on a regular basis as part of the Group's property management and insurance programs. Longer term climate risk analysis has also been performed for selected sites, as part of the Taxonomy implementation work. Different physical risks are an inherent part of operations at all Group sites. Some of the locations may also be subject to increased risks from physical weather events in the longer term, depending e.g. on climate developments. The Group intends to continue monitoring these risks, and take actions to seek to mitigate them when considered to be appropriate. Reporting on physical risks will also be expanded, if such risks were to emerge as material from a Group perspective in the future.

Climate-related opportunities

The Volvo Group strives to lead the development of new technologies and is continuing to develop an extensive portfolio of products and services using new technologies. We aim to continue to provide high quality products and services to our customers, while at the same time enabling our customers to reduce their environmental impact.

To this end, the Volvo Group is broadening its offer of products that can be powered by renewable energy through the introduction of battery-electric vehicles as described on pages 12–16. The Group also invests in fuel cell technology with the ambition to have a heavy-duty hydrogen offer available during the second half of this decade and continues to offer products that can be powered by renewable liquid and gaseous fuels like HVO (hydrogenated vegetable oil) and biogas. In addition to new technology products, the Volvo Group has developed a range of service solutions that help to reduce the number of transports needed by optimizing fill rates, consolidating transports and choosing the most effective routing.

Customer demand for products and solutions with lower environmental impact is increasing, although the transition pace differs between business areas and regions. When using electricity as main power source in transport operations, the operational costs are in general reduced. At the same time, the capital cost increases. This rebalancing can represent an increasingly more attractive use case for fully electric vehicles in sev-

eral segments. More and more companies, with transport emissions making up a significant part of their total GHG emissions, are establishing net-zero commitment and science-based targets. This presents an opportunity for the Volvo Group in providing solutions that enable the reduction of such emissions (read more on page 12). The Volvo Group estimates that there is a potential to increase revenues by over 50% over the lifecycle when comparing an electric vehicle to a conventional version. This is primarily based on the higher sales value of an electric vehicle but also on increased revenues from autonomous solutions, new digital services and services connected energy solutions. Other factors expected to drive growth are increased service contract penetration and an increase in the duration of the contracts.

These opportunities are associated with investment costs, both in R&D as well as property plant and equipment in the short to medium term. Volvo Group also engages in partnerships and collaboration with other companies, whose core competencies are needed to develop new technology for transport and infrastructure solutions.

External dependencies and collaborations

The transition to net-zero emissions in the transport sector depends on a variety of factors, but we believe the main long-term solutions are electrification and development of other zero emission technology. Electrification depends not only on the product and service offering but also on external factors such as the existence of a functioning charging infrastructure and access to renewable energy sources to power battery electric and fuel cell electric products. Customer demand in different markets is also dependent on factors such as availability of the necessary infrastructure and energy, governmental incentives for green technologies and the price of fossil fuel. The Volvo Group strives to have products and solutions available in pace with customer demand by using a highly flexible production system.

Recognizing the need for collaboration on a system-wide basis, the Volvo Group has taken part in a number of multi-stakeholder initiatives. One such initiative is the First Movers' Coalition, which assembles cross-industry purchasing commitments to drive development of low-carbon technologies. The Volvo Group is also investing in joint ventures and strategic partnerships in adjoining sectors, such as energy, steel, charging infrastructure and energy storage, which seek to develop, or facilitate the use of, transitional technologies and products.

Scenario analysis

The Volvo Group has initiated work with scenario analysis to better understand potential development of climate related uncertainties. This includes exploring climate scenarios from the International Energy Agency and International Panel on Climate Change (IPCC), as well as secondary sources interpreting those scenarios specifically in relation to the transport sector. A normative scenario analysis was conducted in the establishment of the Group's science-based targets. As part of establishing strategies and plans in line with the Group's net-zero commitment, analyses have been performed to understand the level of emission reductions needed to follow the pathways aligned with the ambitions in the Paris Agreement. The analyses provide input on important factors such as modelling customer demand, regulatory requirements, infrastructure roll-out, access to renewable energy and governmental incentives for clean technologies which in turn are essential inputs to the respective Business Areas' plans.

In addition to this transition scenario, the Volvo Group analyzed physical risks for the Group's main locations based on different representative concentration pathway (RCP) scenarios developed by the IPCC. In this work, RCP 2.6, RCP 4.5 and RCP 8.5 were used.

Risk management

In accordance with the decentralized Volvo Group governance model, each Business Area and Truck Division is accountable for its own risk management. Once risks have been identified, Truck Divisions, Business Areas and Group functions report them in the ERM process using an integrated multi-disciplinary approach. The ERM process includes all types of risks for the Volvo Group, so the processes for identifying, assessing and managing climate and other sustainability related risks are fully integrated into the Volvo Group's wider risk management.

The risks identified in the ERM process undergo a materiality analysis. The Group recognizes that some externalities impact the business in several ways and climate change is a good example of this as it poses both long-term strategic risks, for instance as a result of technology shifts and increasing government regulations, and short to medium term risks, for example in relation to customer satisfaction, physical disruptions of the production system and requirements of environmental regulation. The materiality analysis is conducted with internal and external stakeholders, and the risks that are classified as material are risks which can, separately or in combination, have a material adverse effect on the Group's business, strategy, financial performance, cash flow, shareholder value or reputation. See page 68-73 for more information.

In addition to the ERM process, climate risks are also considered and managed in other Group processes, such as the scenario analysis work (see above) and in the business continuity and risk mitigation planning for the Group's operational sites.

Financial planning

The Volvo Group's investment plan includes a technology roadmap to increase zero-emission vehicles or low-emission vehicles that can enable net-zero transport solutions. These include solutions based on electric and renewable liquid and gaseous fuels.

Investments in property, plant and equipment will increase in connection with the Group building up capacity for the above activities. However, thanks to the Group's modular product architecture CAST (read more on page 18) both electric trucks and trucks with combustion engines can be produced on the same assembly lines, thus limiting the investments needed for this transition in the industrial system.

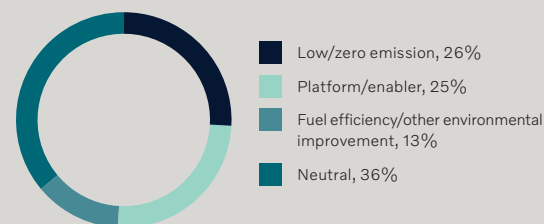
Part of the investments in R&D, as well as in property plant and equipment, is directly invested in the Group's current industrial system and tools at suppliers. Beyond this, the Volvo Group is collaborating in joint ventures and strategic partnerships where additional significant investments are made.

DISCLOSURES ON RESEARCH AND DEVELOPMENT INVESTMENTS

The Volvo Group's total investments in R&D, excluding the effects from the net of capitalized and amortized R&D, amounted to SEK 24.6 billion. The Group's R&D project portfolio has been categorized into four main categories to provide a more transparent overview of the Group's R&D investments during the year. The classification of R&D expenses in this section is based on a Group internal categorization of investments. Hence it does not align directly with the EU Taxonomy or other external standard.

- **Low- and zero-emission projects** – directly associated with products with low or zero tailpipe emissions, following the definitions of the substantial contribution criteria in the EU Taxonomy.
- **Platform and enabler projects** – associated with the development of technology common to both conventional products as well as low or zero emission vehicles based on the Group's modular architecture (CAST). This includes development of technologies such as common electrical architecture, cabs, aerodynamics, connectivity and safety features.
- **Fuel efficiency and other environmental improvement projects** – associated with the improvement of the environmental performance of internal combustion engine vehicles, e.g. fuel efficiency, emissions reduction, bio-LNG and other low-carbon fuel projects. These investments are important for the transition to lower GHG emissions in addition to electrification.
- **Neutral projects** – all the remaining projects. Some of these investments may result in certain environmental benefits, but they have not been assessed as significant, for example a quality update to an existing asset.

R&D expenses



In 2022, approximately 26% of the Volvo Group's gross R&D expenses¹ were considered low- and zero-emission, an additional 38% were related to fuel efficiency and pollution prevention, or projects in shared technology projects.

¹ Excluding effects from capitalization and amortization.

ENERGY AND EMISSIONS

Connection to Agenda 2030 and reporting standards



Main connections to the UN SDGs and targets

7.3 Double rate of energy efficiency

8.4 Resource efficiency in production

11.2 Sustainable transport systems

12.2 Sustainable management of natural resources



Referenced reporting standards

GRI 302 – Energy

GRI 305 – Emissions

TCFD recommendations

The Volvo Group's Environmental Policy is the steering document addressing risks and opportunities in areas such as emissions, resource use, chemicals and residuals. Strategic priorities related to environment and climate are based on product life cycle assessments and aim to reduce emissions and other climate-related risks where they make the most impact.

Emissions metrics, targets and disclosures are based on the Greenhouse Gas (GHG) Protocol corporate standard. Emissions from use of sold products – scope 3.11 of the GHG protocol – is identified as the main material category in the baseline GHG inventory, representing over 95% of the total emission footprint. When nothing else is stated, GHG emissions are adjusted for acquisitions and divestments according to the accounting principles of the GHG protocol. The Volvo Group has reported climate-related information, targets and results since the beginning of the 2000s. The approach of managing climate-related risks has served the Volvo Group well, both in terms of reducing emissions in line with targets set and in terms of developing new technologies and business plans to meet the transition towards fossil-free transports.

Science-based targets for Scope 1, 2 and 3 emissions

The Volvo Group committed to the Science-Based Targets initiative (SBTi) "Business Ambition for 1.5 °C" in 2020 and validated its set targets in June 2021. The Volvo Group is targeting a net-zero value chain offer by 2040. Given that the average life-time of the Group's products is approximately 10 years, this should allow the Group's customers to achieve net-zero value chain greenhouse gas emissions by 2050. The pace of change is particularly important, and the Group has set ambitious milestone targets along the way.

The targets are set in different ways for the Group's different segments. What they have in common is that they are all contributing to the ambitions of the Paris Agreement.

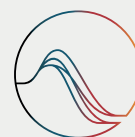
Methods and data collection

Scope 1 and 2 emissions method and data collection

Environmental impacts and greenhouse gas inventory are established according to the Greenhouse Gas Protocol's Corporate Accounting and Reporting Standard, which is a standardized framework for quantifying and reporting GHG emissions in CO₂-equivalents (CO₂e).

Part of value chain	Scope 1, 2 or 3	Approximate share based on baseline GHG inventory	2019 Baseline	2022
			Mton	
Production, technical centers, warehouses and dealerships	Scope 1 Direct emissions	<0.5%	0.250	0.243
	Scope 2 Indirect emissions from purchased energy	<0.5%	0.125	0.081
Use of sold products	Scope 3.11 use phase Indirect emissions from use of sold products	~95%	323	287
Other indirect emissions	Other Scope 3 Approximately 4% of the greenhouse gas inventory are related to purchased goods and services, transportation and distribution, waste generated in operations business travel, employee commuting etc.			

Volvo Group's Science Based Targets are set to reach net-zero value chain GHG emissions by mid-century at the latest. The ambition is to reach this already by 2040.



SCIENCE
BASED
TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

These other indirect emission are not yet included in the report. However, internal targets exists for certain areas such as goods transportation.

Less than 1% of the total emission inventory are connected to Scope 1 and 2, including production plants, engineering centers, offices and dealerships. These are under the Volvo Group's direct management and higher level of control.

Scope 3 use phase emissions method and data collection

Scope 3 emission results are reported to indicate the progress toward the net-zero SBTi targets for the Volvo Group products. The methodology for calculating emissions from use of sold products has been designed to meet the requirements provided in the relevant standards of the GHG Protocol; namely the GHG Protocol Corporate Standard, the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, and Technical Guidance for Calculating Scope 3 Emissions, which includes expected lifetime emissions from all applicable products sold in the reporting period.

The target methodology and boundaries are following the SBTi Transport Science Based Target setting guidance and the target setting requirements and tools from the SBTi. The methodology is based on activity data on product annual usage, years in service, energy consumption and associated well to wheel GHG emission factors for the different energy sources utilized (diesel, electricity etc.). For product annual usage, data is in six months arrear for trucks and buses to due to a time lag in obtaining logged usage data.

In absence of a standardized test procedure for trucks, as well as other Volvo Group products, manufacturers are invited to present and justify their own estimates or simulations based on fuel consumption and specific activity data. The applied expected activity data and other parameters are associated with a level of uncertainty and may be subject to change due to implementation of regulations or global, regional, or national policy changes, or improved data quality. From a sensitivity analysis perspective, changes in any of the parameters will impact outcome, but changes of assumptions of products' years in service currently have more significant impact on calculated results.

Furthermore, the calculations do not take into account all aspects of e.g. the efficiency improvements in increased load in tonnes per vehicle km

which is an important measure to increase the efficiency in the transport sector and reduce emissions of GHG. Since the calculation methodology is being developed, and e.g. different sources for emission factors and methods may be used for determining the activity data (annual usage, distance travelled etc.), the Volvo Group's emission data may not be fully comparable to that of other entities. We also expect that the Group's method to calculate the emission footprint may be developed further over time, and this may well alter results and, to ensure proper comparison, the baseline. If the calculation method is developed or assumptions used are adjusted in any material way, we intend to report on that in a transparent manner. As matters currently stand, the data is directionally useful but is subject to the limitations expressed above.

Other scope 3 emissions

The remaining part of indirect emissions based on 2019 baseline inventory account for approximately 4% of emissions in scope. These are included in the work for net-zero value chain greenhouse gas emissions, but they are not yet subject to validated science-based targets. For some areas, targets are already existing, for example freight transports.

Targets and results 2022

Own operations scope 1 and 2

The Volvo Group's total own scope 1 and 2 emissions make up less than 1% of total GHG inventory. The main ways to reduce these emissions are continuous work with energy efficiency improvements and sourcing of more renewable energy where possible. Initiatives to reduce energy use by 18 GWh were implemented during 2022 and the target is to implement saving worth of 150 GWh between 2021 and 2025.

The GHG emission from own operations were 13% lower 2022 compared to 2019. Direct emissions (scope 1) were at a similar level to previous year despite higher production volumes of trucks. The indirect emissions from own operations (scope 2) were reduced as a result of increased share of renewable energy sources, but also due to reduced volumes in regions with higher GHG intensity of purchased electricity.

Use phase, scope 3

Calculated GHG emissions from use of sold products amounted to approximately 287 million tons 2022 compared with 323 million tons in 2019. The calculated reduction in total GHG emissions is a combination of impacts from energy efficiency measures, changes in sales volumes and product mix.

Trucks

The reduction in 2022 amounted to -4% (-2%) vs 2019 baseline for the -40% intensity target. The reduction is mainly a result of products with lower greenhouse gas intensity. However volumes and product mix have somewhat decreased the overall total improvement of emissions per vehicle-kilometer.






Buses

The result for buses in 2022 was -7% (+7%) vs 2019 baseline for the -40% intensity target. The reduction is mainly due to product mix effects with more products with relatively low greenhouse gas intensity being placed on the market in both main segments, city and coach buses.

Construction equipment

For construction equipment, the result was -11% (+17%) vs 2019 baseline on the absolute emissions target. While a range of more energy efficient products have been launched, the most significant effect is explained by lower sales volumes, most notably in Asia.

SBTi approved targets, from baseline 2019

Scope 1-2 OWN OPERATIONS 	Target 2030 -50% absolute emissions	Status 2022 -13%
Scope 3 use phase TRUCKS 	Target 2030 -40% emissions per vehicle-km	Status 2022 -4%
Scope 3 use phase BUSES 	Target 2030 -40% emissions per vehicle-km	Status 2022 -7%
Scope 3 use phase CONSTRUCTION EQUIPMENT 	Target 2030 -30% absolute emissions	Status 2022 -11%
Scope 3 use phase VOLVO PENTA 	Target 2034 -37.5% absolute emissions	Status 2022 +5%