ENVIRONMENTAL PRODUCT DECLARATION
IN ACCORDANCE WITH ISO 14025:2006 FOR

EPD®

TRAM FORCITY SMART ARTIC X34 TAMPERE

ŠKODA GROUP

Programme	The International EPD® System, www.environdec.com
Programme operator	EPD International AB
EPD registration number	EPD-IES-0023924:001
Publication date	4.6.2025
Valid until	3.6.2030

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at **www.environdec.com**.

Programme information

Programme	The International EPD® System
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ACCOUNTABILITIES FOR PCR, LCA AND INDEPENDENT, THIRD-PARTY VERIFICATION

Product Category Rules (PCR)	PCR: Rolling stock and parts thereof, 2009:05, Version 4.0.1, UN CPC 495 PCR review was conducted by: Claudia A. Peña, The Technical Committee of the International EPD® System. A full list of members is available at www.environdec.com.The review panel may be contacted via info@environdec.com.
Life Cycle Assessment (LCA)	LCA accountability: Ing. Eva-Žofie Bergmannová, Mgr. Kateřina Lorencová, Envitrail s.r.o.
Third-party verification	Independent third-party verification of the declaration and data, according to ISO 14025:2006/ EN ISO 14025:2010, via: ☒ EPD verification by individual verifier Third-party verifier: Dr. Jan Weinzettel, Individual EPD verifier Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third-party verifier:	☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see ISO 14025.

Company information

Owner of the EPD	Škoda Transtech Oy (member of Škoda Group), +358 88 706 900, Tutkijantie 8, 90570 Oulu, Finland
Contact	info@transtech.fi
Description of the organisation	Škoda Transtech Oy, a member of Škoda Group, is a Nordic rolling stock manufacturer specialized in production of vehicles for demanding weather conditions. The production facilities are located in Otanmäki, Finland.
Product-related or management system-related certifications	ISO 22163, ISO 9001, ISO 14001 and ISO 50001
Name and location of production site	Otanmäki production site, Kokkolantie 1791, 88200 Otanmäki, Finland

Škoda Transtech Oy as a member of Škoda Group follows the group's environmental strategy. By putting the low carbon public transport vehicles with high repairability and recyclability rate on the market, it supports the global decarbonisation goals. The ongoing research and development keep bringing smart mobility solutions that save energy on the customer's side and offer safe and accessible transportation possibilities for the end-users.

To maximise its environmentally friendly manufacturing efforts, the entire production site uses energy from a wind farm, with no additional input from non-renewable sources. The company supports the principles of the circular economy through waste management, namely the reuse of materials and strict waste sorting, as well as activities that reduce the demand for the materials and energy necessary for the manufacture of new products.

Product information

Product name	Tram FORCITY
Product identification	Smart Artic X34 Tampere
Product description	The SMART ARTIC X34 TAMPERE is an articulated tram consisting of 3 modules and 4 fully pivoting dual-axle bogies. All 8 axles have individually powered, traditional wheelsets with super-resilient wheels. The vehicle is designed from the ground up for operation over 40 years in harsh and demanding Nordic conditions, featuring extensive measures to minimize the accumulation of snow and ice as well as the condensation of water. The gauge of the vehicle is 1,435 mm while the car bodies feature an external width of 2,650 mm. Internally, the vehicle offers a brightly illuminated, appealing and full low floor passenger compartment, with low floor aisles also above the bogies. Passengers benefit not only from a state-of-the-art information system, but also from a sophisticated suspension resulting in excellent running behaviour even in demanding track conditions with low noise and vibrations. The vehicle is made of corrosion resistant materials specifically chosen to reflect also the low temperatures in the Nordics, additionally, there is no structural gluing, allowing for quick exchange of all exterior components.
UN CPC code	UN CPC 495, 2009:05, version 4.04
Geographical scope	The geographical range is global with priority use of Finnish and European processes for the production site located in Otanmäki. Operation and end-of-life treatment are based on Finnish conditions in the City of Tampere.

NOISE EMISSIONS

The noise levels for the tram were determined in accordance with ISO 3095.

	Unit	dB
Standstill noise (partial load)	$L_{pAeq,T}$	50
Acceleration noise	L_{AFmax}	75
Pass-by noise at 60 km/h	L_{Aeq}	81

LCA information

Functional unit

- Transport of 1 passenger for 1 km

Reference service life

- The operating lifetime has been set for 40 years with an average running distance of 100,000 km per year.

Time representativeness

- The data set will be considered valid until there are significant changes to data in the production, technology, supply chain or operational and end-of-life scenarios.

Database and LCA software used

- Ecoinvent 3.11, cutoff
- OpenLCA software 2.4.0

LCIA method

- EF 3.1

Description of system boundaries

- The system boundaries "cradle to grave" cover the whole life cycle of a tram.

Excluded lifecycle stages

None

More information

- The data related to materials and production has been sourced from Skoda Transtech Oy's internal ERP database, based on supply chain information and measurements or calculations.
- Potential environmental impacts of energy, fuel, waste and emissions were assessed based on the data from 2022–2024 and allocated according to the working hours on the project.
- During the operational phase, a normal vehicle occupancy capacity (MNO) of 208 passengers has been considered, with 80% of passengers seated and 80 % of additional 4 passengers per square meter standing, following the EN 15663 standard for operational load.
- The environmental impact of energy consumption during the operational phase (0,035 kWh/pass.km) has been evaluated based on the specific electricity mix (100 % wind power) as purchased from an electricity supplier (Lumme Energia Oy), demonstrated by a Guarantee of Origin.
- GWP of the electricity in the use phase: 0.024 kg CO_2 eq./kWh
- Data related to maintenance materials usage are based on planned preventive maintenance activities throughout the vehicle's entire lifespan, encompassing the majority of materials and spare parts (mass assumptions).
- For end-of-life treatment, the model adheres to available technology and follows the UNIFE UNI-LCA-001 method with updated FMR and FER available factors from UNIFE v.2025-04-07 guidelines for ISO 21106:2019. It is assumed that the vehicle will be dismantled and disposed within 50 km from the City of Tampere. The potential benefit from material recycling and energy recovery are not included in the calculation of the environmental impacts (polluter pays principle).

Excluded processes (cut-off)

- The LCA study follows the cut-offs for system boundary given by PCR 2009:05 for rolling stock.

LIFECYCLE PHASES

- Material & Energy Production
- Transport of Material & Parts

UPSTREAM

- Vehicle Manufacturing (including energy and auxiliary materials and waste)
- Transport of Vehicle to Use Location

CORE

- VehicleEnergy & Maintenance Materials
- Vehicle Dismantling and Disposal

DOWN-STREAM

Content declaration

VEHICLE MATERIALS

MATERIAL CONTENT IN 1 VEHICLE (%)	CARBODY	INTERIOR. WINDOWS AND DOORS	BOGIES AND RUNNING GEARS*	PROPULSION AND ELECTRIC EQUIPMENT	COMFORT SYSTEMS	TOTAL
Metals	27.95%	6.69%	30.77%	3.65%	1.47%	70.5%
Elastomers	0.11%	0.75%	1.21%	0.03%	0.02%	2.1%
Polymers	0.88%	0.56%	1.43%	0.72%	0.05%	3.6%
Composites	0.37%	5.86%	0.09%	0.17%	0.00%	6.5%
Electric and Electronic Equipment	0.16%	0.00%	0.07%	6.97%	3.02%	10.2%
Glass	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
Safety glass	0.00%	2.90%	0.00%	0.00%	0.00%	2.9%
Oil. grease and similar	0.03%	1.85%	0.18%	0.03%	0.00%	2.1%
Acids. cooling agents or similar	0.00%	0.05%	0.00%	0.67%	0.00%	0.7%
Other inorganic materials	0.04%	0.00%	0.00%	0.00%	0.00%	0.0%
Mineral wool	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
MONM. including wood	0.00%	1.15%	0.00%	0.12%	0.00%	1.3%
TOTAL	29.53%	19.80%	33.74%	12.36%	4.56%	

*Based on the material internal component classification for tram manufacturing, the engines are classified as a part of the Bogies and running gears material category, as they are part of the bogie motor module (the module was divided into 12 material categories by the manufacturer to ensure the accuracy of the study). Based on the manufacturer, it is not possible to reclassify engines to a different category.

Hazardous substances

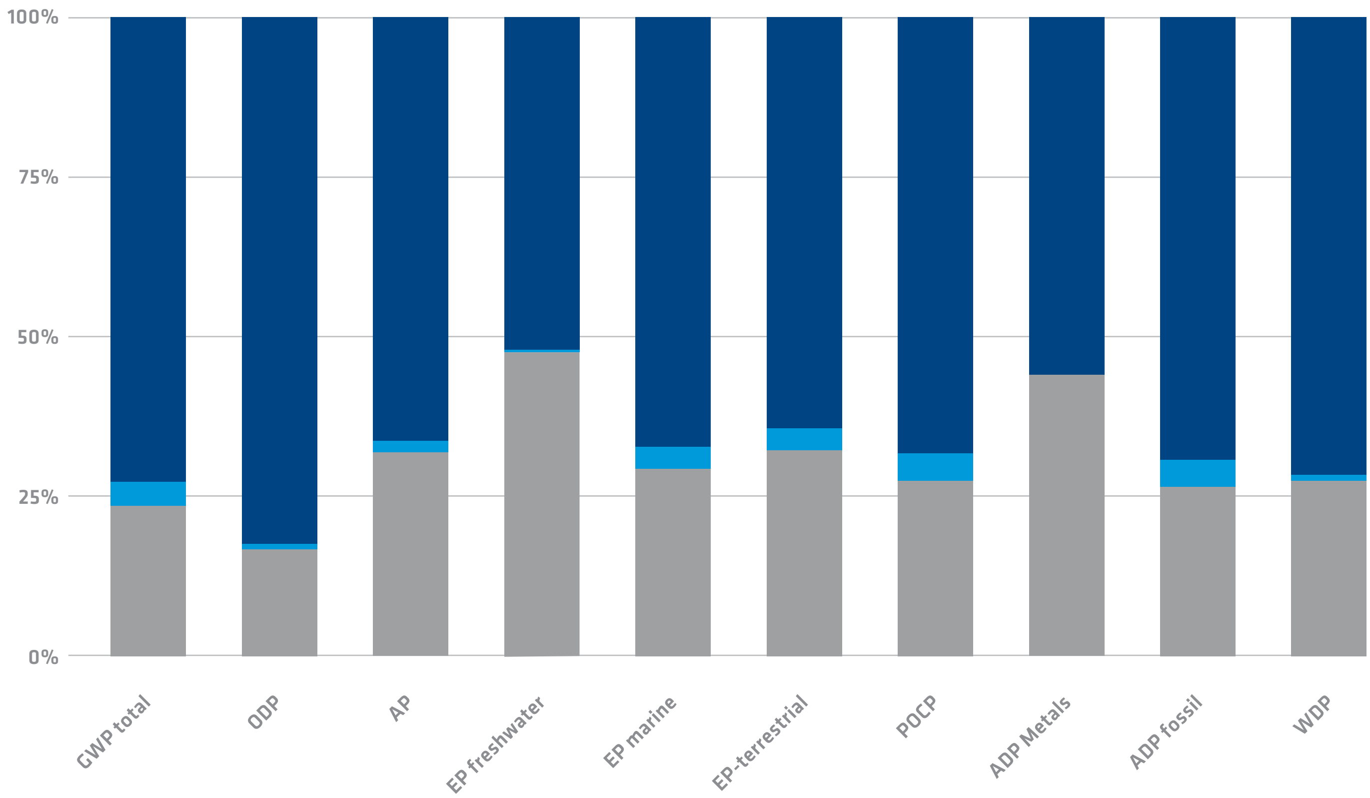
Škoda Group’s approach to managing hazardous substances complies with European regulations, including REACH, and adheres to the principles of the railway sector as set out in the RISL (Railway Industry Substances List). These considerations are integral to the design of vehicles and extend to the chemicals used for maintenance. Certain functional and safety requirements necessitate the use of hazardous substances, such as heavy metals in electronics and lubricants, as well as the refrigerant used in the HVAC system. No hazardous substances are used in any prohibited applications during manufacture.

Recyclability	93.0%
Recoverability	98.4%

Results of the environmental performance indicators

SMART ARTIC X34 ENVIRONMENTAL PROFILE

Contribution of life cycle phases on the environmental impacts



The bar chart illustrates the contribution of the three life cycle phases – Upstream, Core, and Downstream – to various environmental impact categories. The upstream and downstream phases are the primary drivers of environmental impacts.

Upstream	The major potential impacts in the upstream phase are shown in the form of the freshwater eutrophication potential (EP) and the abiotic depletion potential (ADP) of metals, which are caused by the extraction of raw materials and the production of input materials and parts.
Core	Least impactful phase across all categories, typically contributing less than 5 %.
Downstream	The highest potential impacts can be found in categories of ozone depletion (ODP), GWP total, and water deprivation potential (WDP), mostly due to use-phase emissions from the electricity consumption.

IMPACT CATEGORY INDICATORS

Parameter		Unit	Upstream	Core	Downstream	TOTAL
Global warming potential (GWP)	Fossil	kg CO_2 eq.	4.61E-04	7.98E-05	1.46E-03	2.00E-03
	Biogenic	kg CO_2 eq.	1.99E-06	7.78E-08	2.02E-06	4.09E-06
	Land use and land transformation	kg CO_2 eq.	1.66E-06	5.69E-08	1.58E-06	3.30E-06
	TOTAL	kg CO_2 eq.	4.65E-04	8.00E-05	1.46E-03	2.01E-03
Ozone layer depletion (ODP)		kg CFC-11 eq.	1.53E-11	1.10E-12	7.72E-11	9.35E-11
Acidification potential (AP)		mol H^+ eq.	4.49E-06	2.74E-07	9.35E-06	1.41E-05
Eutrophication potential (EP)	Aquatic freshwater	kg P eq.	7.13E-07	9.79E-09	7.80E-07	1.50E-06
	Aquatic marine	kg N eq.	7.02E-07	7.32E-08	1.61E-06	2.38E-06
	Aquatic terrestrial	mol N eq.	7.52E-06	7.83E-07	1.51E-05	2.34E-05
Photochemical oxidant creation potential (POCP)		kg NMVOC eq.	2.25E-06	3.73E-07	5.69E-06	8.31E-06
Abiotic depletion potential (ADP)*	Metals and minerals	kg Sb eq.	6.04E-08	2.40E-10	7.65E-08	1.37E-07
	Fossil resources	MJ, net calorific value	6.15E-03	9.90E-04	1.62E-02	2.33E-02
Water deprivation potential (WDP)*		m^3 world eq. deprived	2.15E-04	1.02E-05	5.66E-04	7.91E-04

*The results of this environmental impact indicator shall be used with care as the uncertainties of the results are high and as there is limited experience with the indicator.

ENVIRONMENTAL PERFORMANCE INDICATORS

ACIDIFICATION (AP)

Acidification is the process of increasing the acidity of soils, air, or water caused by an elevated concentration of hydrogen ions. An indicator of the impact category of acidification is accumulated exceedance (AE). The result is expressed in mol.

CLIMATE CHANGE (GWP)

Climate change is divided into three parts: biogenic, fossil, land use and land use transformation. An indicator called global warming potential (GWP100) is used to measure the amount of greenhouse gases contributing to global warming. The results are quantified in kilograms of CO_2 eq.

OZONE DEPLETION (ODP)

Ozone layer depletion is the result of emissions of ozone-depleting substances, such as long-lived chlorine and bromine-containing gases (e.g., CFCs, HCFCs, Halons). It is quantified in kg CFC-11 eq., with the ozone depletion potential as its indicator.

WATER USE (WDP)

Water deprivation potential quantifies the potential of water deprivation to humans or ecosystems. It is quantified in m3 world eq. and helps evaluate the risks associated with water scarcity.

PHOTOCHEMICAL OXIDANT FORMATION (POCP)

The impact category photochemical oxidation formation aggregates substances that contribute to the formation of tropospheric ozone. Category indicator is tropospheric ozone concentration increase expressed in kg NMVOC eq.

RESOURCE USE, MINERALS AND METALS (ADP)

Resource scarcity and limitations for current and future generations includes depletion of abiotic resources - elements (ADPe), quantified in kg Sb eq. and depletion of abiotic resources - fossil fuels (ADPf), quantified in MJ.

EUTROPHICATION (EP)

Eutrophication enriches the environment with nutrients, impacting land, water, and seas leading to excess plankton and algae growth, harming the water quality. It is categorised into terrestrial (accumulated exceedance expressed in mol N eq.), freshwater (nutrient fraction reaching freshwater end expressed in kg P eq.), and marine impacts (nutrient fraction reaching marine end expressed in kg N eq.

RESOURCE USE INDICATORS

Parameter		Unit	Upstream	Core	Downstream	TOTAL
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	8.56E-04	1.31E-03	1.39E-01	1.42E-01
	Used as raw materials	MJ, net calorific value	3.98E-06	4.49E-06	2.66E-10	8.46E-06
	TOTAL	MJ, net calorific value	8.60E-04	1.31E-03	1.39E-01	1.41E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	6.15E-03	9.90E-04	1.62E-02	2.33E-02
	Used as raw materials	MJ, net calorific value	4.62E-10	4.80E-07	1.18E-10	4.81E-07
	TOTAL	MJ, net calorific value	6.15E-03	9.90E-04	1.62E-02	2.33E-02
Secondary material (optional)		kg	ND	ND	ND	ND
Renewable secondary fuels (optional)		MJ, net calorific value	ND	ND	ND	ND
Non-renewable secondary fuels (optional)		MJ, net calorific value	ND	ND	ND	ND
Net use of fresh water (optional)		m^3	4.65E-06	1.94E-07	1.24E-05	1.72E-05

WASTE INDICATORS

Parameter	Unit	Upstream	Core	Downstream	TOTAL
Hazardous waste disposed	kg	1.20E-04	2.36E-06	2.12E-04	3.34E-04
Non-hazardous waste disposed	kg	1.07E-03	1.53E-05	2.12E-04	1.29E-03
Radioactive waste disposed	kg	9.86E-09	1.21E-09	2.54E-08	3.65E-08

OUTPUT FLOW INDICATORS

Parameter	Unit	Upstream	Core	Downstream	TOTAL
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	7.69E-06	9.23E-05	1.00E-04
Materials for energy recovery	kg	0	0	0	0
Exported energy, electricity	MJ per energy carrier	0	1.48E-05	1.63E-05	3.11E-05
Exported energy, thermal	MJ per energy carrier	0	4.27E-05	4.17E-05	8.44E-05

*Zero values mean a conservative assumption due to the lack of data.

Additional environmental information

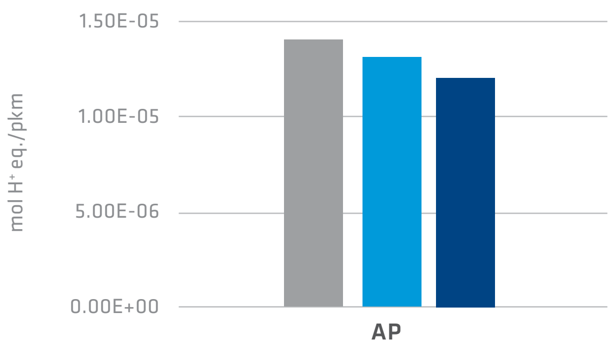
To improve the representativeness of the results, two additional operational scenarios were evaluated. Subsequent assessment of these scenarios shows that increasing the number of passengers to 261 (EL4) or 360 (EL6) would reduce the total impact (e.g. in GWP by 6 % and 12 % respectively).

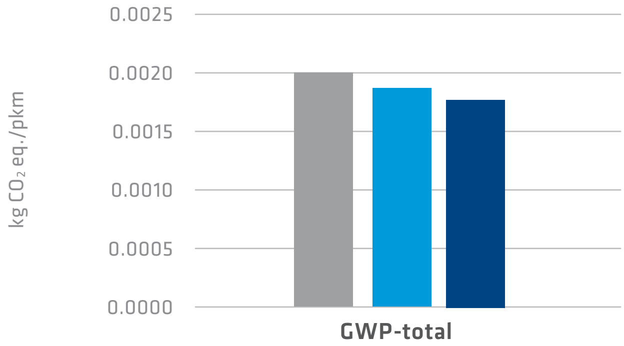
VEHICLE MATERIALS

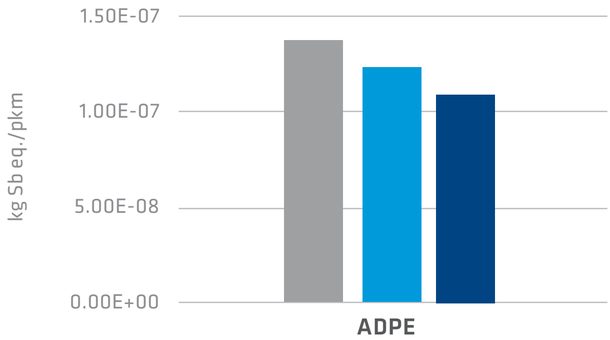
Operational phase	Main scenario - MNO	EL4	EL6
Distance traveled per year	100 000 km	100 000 km	100 000 km
Vehicle lifetime	40 years	40 years	40 years
Operational load	208	261	360
Energy consumption	0.035 kWh/pass.km	0.028 kWh/pass.km	0.022 kWh/pass.km

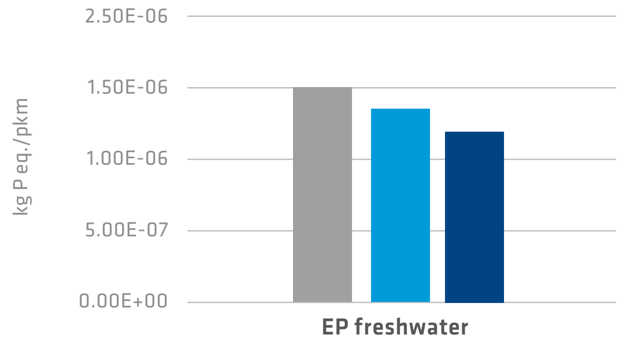
DIFFERENT SCENARIOS COMPARISON

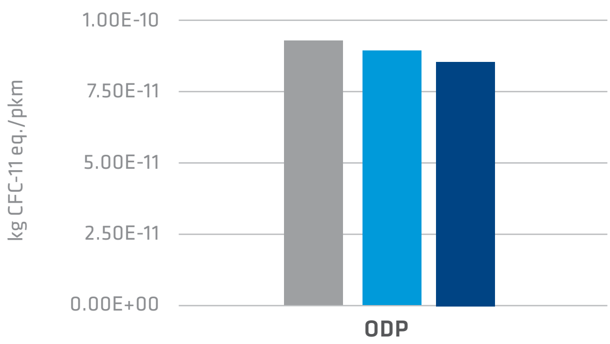
MNO EL4 EL6

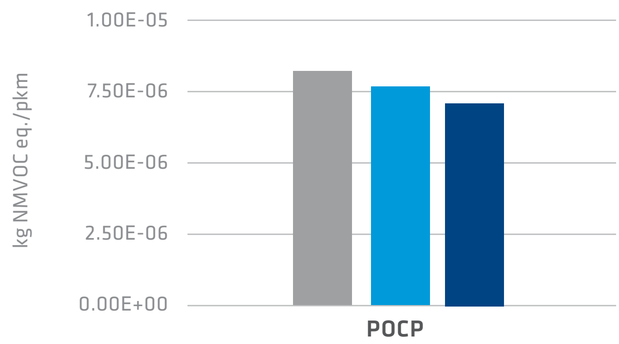












Additional social and economic information

Škoda Group is deeply committed to sustainable transportation, innovation and responsible business practices, as demonstrated by its mission, vision and values. An integral part of our business approach is to follow the principles of environmental protection systems and to prevent and minimize negative impacts resulting from our activities, while regularly assessing them. At Škoda Group, we use natural resources carefully and manage our operations in an environmentally friendly manner while producing high-quality products. We have also started to identify risks associated with environmental issues and will focus on managing these risks in the years ahead.

At Škoda Group, we value our employees and recognize the potential impact of our activities. For this reason, we guide and oversee employee-related concerns, ensuring that we prevent and minimize any negative impacts as much as possible. Prioritizing social responsibility is not just a moral obligation, but also a strategic imperative that directly impacts our long-term success and stakeholder trust. By investing in our employees' well-being, health and safety, engaging with communities and maintaining transparency, we enhance our competitiveness and secure a resilient future.

At Škoda Group, our commitment to ensuring the highest standards of safety and ease of use for all our products is driven by our deep care for our customers and end users. Business ethics is the cornerstone of our commitment to integrity and sustainable practices. Honesty, openness, respect, dignity, and setting an example of appropriate behavior are the three fundamental pillars of our professional integrity.

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