BMW GROUP

VEHICLE FOOTPRINT.

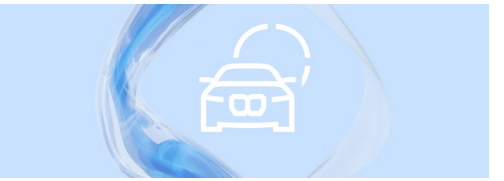
Life cycle assessment of the BMW X3 20 xDrive with a validation by TÜV Rheinland and further information on its ecological and social impact. Data for a selected vehicle at the time of start of production in August 2024. Images in this report are for illustrative purposes.

CHANGE BEGINS WITH TRANSPARENCY.

But how can I find out the environmental footprint of a vehicle? The BMW Vehicle Footprint is the answer. Four key sustainability criteria and an extensive German Technical Inspection Agency-verified life-cycle assessment (LCA) can provide you with a comprehensive picture. Clearly and transparently. Helping you to make an informed decision.

Climate impact.
Because we look at things in detail – emissions throughout the entire life-cycle.

Every vehicle leaves behind a CO_2e footprint throughout its life-cycle. This life-cycle includes the procurement, production, use and recycling or disposal of raw materials and other materials. CO_2 equivalents (CO_2e) are a unit of measurement to standardise the climate impact of different greenhouse gases, such as methane. Emissions generated along the supply chain, by transport logistics and upstream energy provision, are reported as CO_2e. Electricity produced from regenerative in-house generation systems, direct supply contracts and certified proof of origin are all taken into account when allowing for electricity from renewable energy sources.

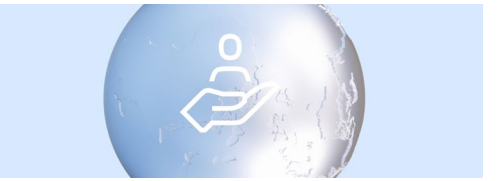


Efficiency.
Because less is more – measures with regard to consumption and range.

BMW EfficientDynamics has been synonymous with innovative consumption and range improvement solutions for generations of vehicles. Key factors affecting greater driving enjoyment coupled with lower consumption and longer range include lightweight construction through the use of an optimised material mix. Moreover, favourable aerodynamic properties increase efficiency. These factors optimise the consumption and also have a positive impact on range. But you, the driver, as ever, are also a crucial influencing factor. You can save energy through an efficient driving style, depending on the route and traffic situation.

Circularity.
Because recycling is just better – conserving resources through the use of recycled materials.

RE:THINK, RE:DUCE, RE:USE, RE:CYCLE. We adhere to these principles of circularity in order to conserve natural resources and retain high-quality materials in circulation over the long term. We therefore use secondary materials in new components. In addition, we are also increasing the recyclability of components through the design process and in product development.



Supply chain.
Because it matters to us – environmental and social requirements in the supply chain.

Social responsibility within the company and along the supply chain plays a key role for the BMW Group. For years, we have aspired to respect human rights and applicable environmental standards along the global supply chain of our vehicles. To achieve this, we rely on collaboration. In doing so, we employ on a catalogue of measures and the dovetailing of training courses, contractual agreements, certification and testing by means of questionnaires and audits. We determine specific need for action through regular risk analysis, enabling us to identify raw materials whose procurement and processing involve increased risks on people and the environment.

TABLE OF CONTENTS.

1. PRODUCT INFORMATION ON THE VEHICLE IN THE LIFE CYCLE ASSESSMENT.

Technical details of the vehicle in the life cycle assessment	**BMW X3 20 xDrive**
Powertrain type	Petrol – 48 Volt Mild-Hybrid
Transmission	8-speed, automatic
Drive type	All-wheel drive
Power in kW (hp)	153 (208)
Maximum speed in km/h	215
Fuel consumption, combined WLTP in l/100 km (mpg)[1]	7.3 (38.5)
CO_2 emissions, combined WLTP in g/km	166
Vehicle weight in kg	1,882

[1]The stated fuel consumption and CO_2 figures were determined according to the prescribed measuring procedure of the WLTP (Worldwide harmonised Light vehicles Test Procedure) cycle in accordance with Regulation (EC) No. 715/2007 and Regulation (EU) 2017/1151. The specifications always refer to a vehicle with basic equipment. Any added optional equipment that is supplied by the manufacturer to replace parts of the basic equipment may increase these values and therefore differ depending on the model and motorisation. In addition, retrofitted optional equipment and accessories can change relevant vehicle parameters such as weight, rolling resistance and aerodynamics, resulting in deviating consumption values and CO_2 emissions. Values other than the values stated here may therefore apply for the assessment of taxes and other vehicle-related duties (also) based on CO_2 emissions. The figures therefore do not refer to the specific vehicle, and do not form an integral part of the offer, but are provided solely for comparison purposes between the different types of vehicle. Further information on the WLTP measurement procedure can be found at: https://www.bmw.com/en/innovation/wltp.html

The BMW X3 20 xDrive combines sporty elegance and versatility.

The way we handle resources plays a key role for the BMW Group. In this process, we wish to continue using raw materials in line with the principles of the circular economy.

The aluminium crankcase of the new BMW X3 20 xDrive, for example, consists of approx. 64 % secondary raw material. The alloy wheels are made of approx. 70 % secondary aluminium. The plastic in the engine cover contains approx. 70 % secondary raw material. Based on the overall vehicle the BMW X3 20 xDrive has a calculated secondary raw material content of approx. 25 %. These values have been calculated for the selected vehicle in the life cycle assessment at the start of production of the new vehicle generation in 2024 based on specific supplier records as well as on average industry values and also include production residues.

Modern, presence and sporting flair reach new levels: the best-seller embarks on a new era.

2. LIFE CYCLE ASSESSMENT.

Think long term and act with the customer in mind. These are the fundamental objectives of the BMW Group and firmly anchored in our corporate strategy. Part of our product responsibility includes: evaluating the environmental, economic and social impact of the BMW Group. With the help of a lifecycle assessment, we can look at the entire life cycle of a vehicle and its components.

What is a Life Cycle assessment?
A Life Cycle assessment means looking at the three elements of the car:
– production of the vehicle
– the use phase, or driving phase
– the end of life, how the car can be recycled
This transparency means that in the development phase of a vehicle for example, potential measures to reduce the environmental impact can be identified and incorporated into product development decisions at an early stage.

What Criteria are we using?
The comparable presentation of results and process applications is particular challenging for complex products such as vehicles. We are using the WLTP (Worldwide harmonised Light Vehicles Test Procedure) which gives a representation of fuel consumption, electricity consumption and CO_2 figures for comparison purposes.

For the use phase of the vehicle WLTP consumption values are used over a total nominal distance covered of 200.000 km (approx. 125.000 mls).

Then, using LCA for experts 10 Software Programme and Database from Sphera, specific supplier records are added to quantify the environmental impact of the supply chain and vehicle production. Specific supplier records include the proportion of secondary raw materials and the use of renewable energies as at the start of production of the new vehicle generation. It's an industry standard system, and unless otherwise specified, all emission factors used are taken from the software.

Who verifies this data?
External experts, TÜV Rheinland Energy & Environment GmbH, have verified compliance with the ISO 14040/44 standard.

The CML-2001 method is used for the life cycle assessment of the BMW X3 20 xDrive, and this method was developed by the Institute of Environmental Sciences at Leiden University in the Netherlands in 2001. This method of impact assessment is used in many life cycle assessments in the automotive industry. It's aim is to quantitatively map as many material and energy flows as possible between the environment and the product system in the life cycle.

VALIDATION OF THE LIFE CYCLE ASSESSMENT.

TÜVRheinland®

Validation

TÜV Rheinland Energy & Environment GmbH confirms that a critical review of the life cycle assessment (LCA) study of **BMW AG, Petuelring 130, 80788 München** for the following passenger car:

BMW X3 20 xDrive – model year 2024

was performed.

Proof has been provided that the requirements of the international standards

- ISO 14040:2006 + A1:2020: Environmental management – life cycle assessment – principles and framework
- ISO 14044:2006 + A1:2018 + A2:2020: Environmental management – life cycle assessment – requirements and guidelines
- ISO/TS 14071:2014: Environmental management – life cycle assessment – critical review processes and reviewer competencies: additional requirements and guidelines to ISO 14044

are fulfilled.

Results:

- The LCA study was carried out according to the international standards ISO 14040:2006 + A1:2020 and ISO 14044:2006 + A1:2018 + A2:2020. The methods used and the modelling of the product system correspond to the state of the art. They are suitable to fulfill the goals stated in the study. The report is comprehensive and provides a transparent description of the framework of the LCA study.
- The assumptions used in the LCA study especially energy consumption based on the current WLTP (Worldwide harmonized Light vehicles Test Procedure) were verified and discussed.
- The assessed samples of data and environmental information included in the LCA study are plausible.

Review process and level of detail:

Verification of input data and environmental information as well as the check of the LCA process was performed in course of a critical data review. The data review considered the following aspects:

- Check of the applied methods and the product model,
- Inspection of technical documents (e.g. type approval documents, parts lists, supplier information, supplier information on secondary material content, measurement results, etc.) and
- Check of input data (e.g. weights, materials, secondary material content, energy consumption, emissions, etc.).

Cologne, 19th November 2024

Norbert Heidelmann
Department Manager for Carbon and Energy Services

Jocelyn Sobiech
Sustainability Expert

Responsibilities:

Sole liability for the content of the LCA rests with BMW AG. TÜV Rheinland Energy & Environment GmbH was commissioned to review said LCA study for compliance with the methodical requirements, and to verify and validate the correctness and credibility of the information included therein.

2. LIFE CYCLE ASSESSMENT.

The system boundary of the life cycle assessment (LCA) is shown in Figure 1 and ranges from the extraction of raw materials to the production of materials and components, logistics and the use phase to recycling at the end of the vehicle's service life.

Production residues from manufacturing processes are also taken into account. This includes, for example, stamping residues from the production of steel and aluminium components. The impact of the manufacture of tools and the construction of production facilities are not included in this LCA.

For the use phase, publicly available data records for european fuel mixes at the start of production of the new model generation are used for the fuel supply. The scope of the study does not include the maintenance or any service of the vehicles.

The recoverability (end-of-life) is mapped as part of the LCA using the standard processes of drainage and disassembly in accordance with the End-of-Life vehicles directive (2000/53/EC), as well as the separation of metal in the shredding process and the energy recovery of non-metallic components (shredder light fraction). No eco-credits are issued for secondary raw materials produced and energy recovery. Only the efforts and emissions of the recycling processes are taken into account.

Fig. 1: BMW X3 20 xDrive life cycle assessment system boundary

2.1. MATERIALS USED IN THE VEHICLE.

Product-related data, such as component and material specifications, piece quantities, manufacturing and logistics efforts, etc., is primary data collected by the BMW Group.

For the LCA, the weight is taken as the "mass in a drive-ready state without a driver or luggage plus artificial leather upholstery". This weight is mapped through a derivation of the vehicle's components and their material composition from a vehicle-specific parts list.

Figure 2 shows the material composition of the BMW X3 20 xDrive.

The weight of the BMW X3 20 xDrive is composed of 53 % steel and ferrous materials and 14 % light alloys, particularly aluminium. The material group of polymers also has a large share with 20 %. Other materials make up 2.8 %. Non-ferrous metals are 3.0 %. Process polymers account for 1.7 %. Operating fluids about 5.1 %. They are composed of oils, coolant and brake fluid, as well as refrigerant and washer water. Special metals such as tin have a share of well below 1 %. The specified values may contain rounding differences.

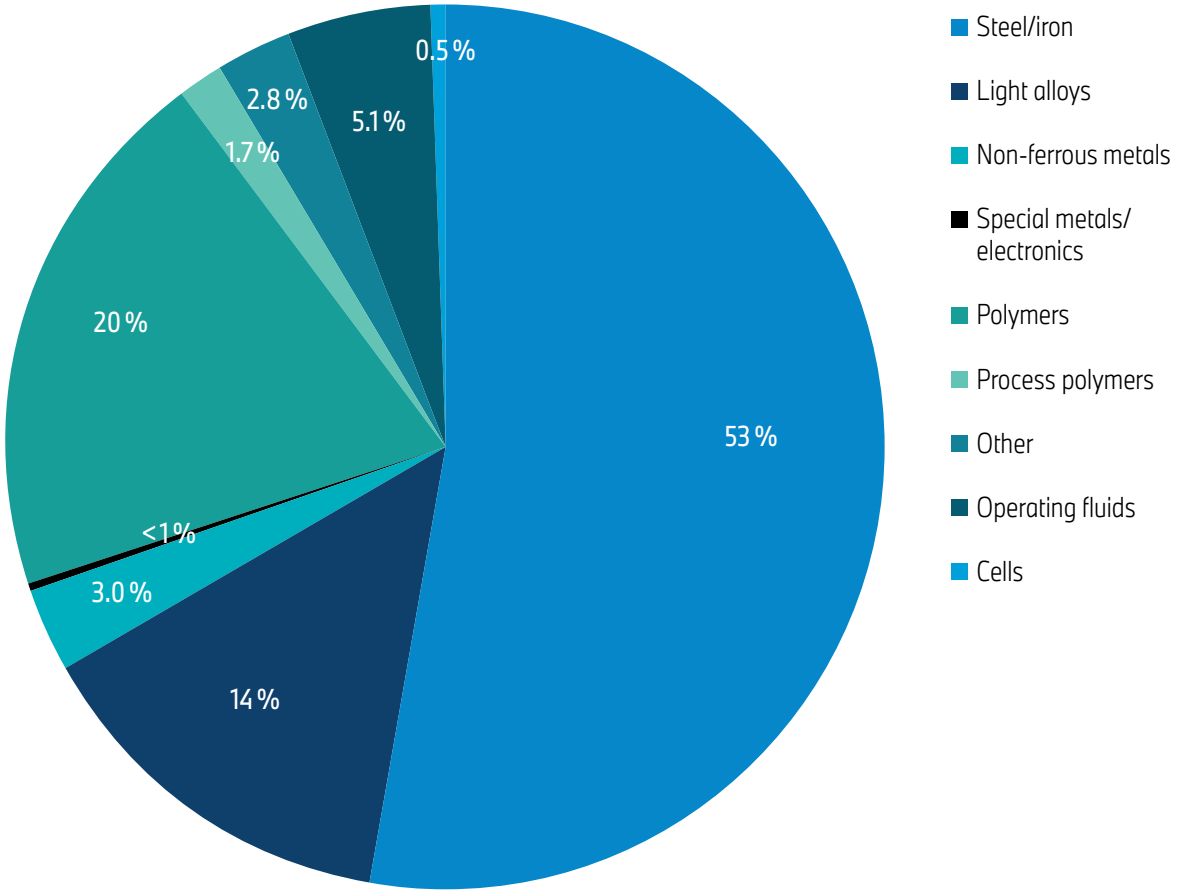


Fig. 2: Material composition of the BMW X3 20 xDrive at the start of production
The specified values may contain rounding differences

2.2. CO_2 EQUIVALENTS OVER THE LIFE CYCLE.

CO_2 equivalents [CO_2e] of the BMW X3 20 xDrive over its life cycle

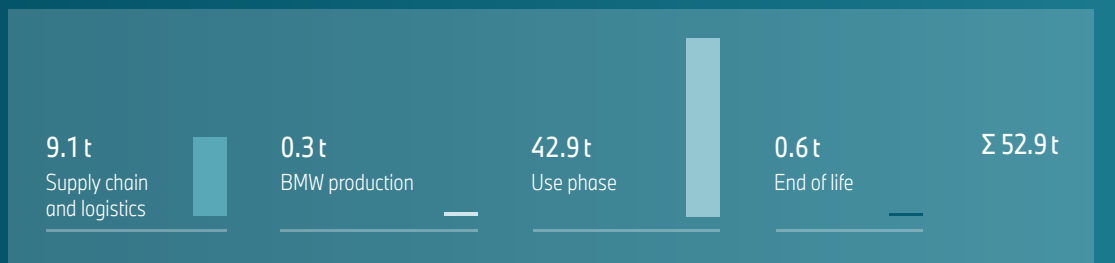


Fig. 3: The total amount of carbon dioxide (CO_2) and other greenhouse gas emissions such as methane or nitrogen oxide are taken into account. CO_2 equivalents (CO_2e) are a unit of measurement used to standardise the climate impact of different greenhouse gases. The crediting of electricity from renewable energy sources includes both electricity from renewable in-house-generation plants and direct supply contracts as well as certified guarantees of origin. Offsetting measures are not taken into account

This life cycle assessment (LCA) considers the CO_2 equivalents of a product over its entire life cycle. In order to assess the climate impact, greenhouse gas emissions associated with the raw material supply chain, transport logistics and production, the use and recycling or disposal of the product are included. The Global Warming Potential (GWP) evaluation is currently the main focus in the automotive sector.

Figure 3 shows the CO_2 equivalents of the BMW X3 20 xDrive over its entire life cycle.

The BMW X3 20 xDrive tested for this life cycle assessment is handed over to customers with 9.4 t CO_2e. Inbound and outbound logistics account for approx. 1.0 t of this. Inbound logistics includes all transportation of goods from suppliers to the production sites and intra-plant transport. The outbound transport logistics from the factory to the global markets is determined on the basis of forecasted volume plans.

The use phase for the BMW X3 20 xDrive is based on WLTP consumption and a total distance covered of 200,000 km. (approx. 125,000 mls)

The emissions of the usage phase have a significant influence on the climate impact of the vehicle. Based on the european fuel mix (local or regional fuel mixes might differ), these amount to 42.9 t of CO_2e.

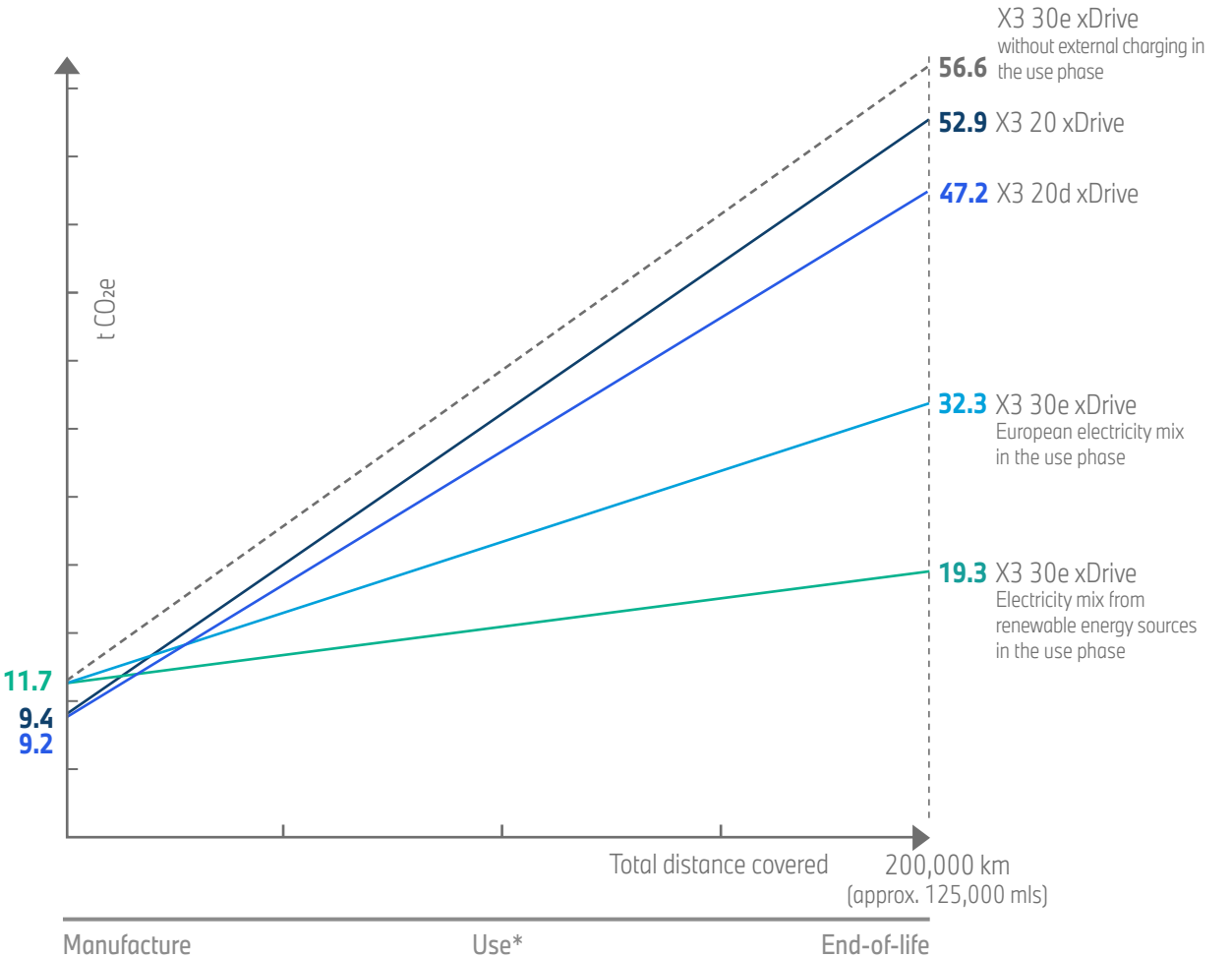
2.3. CO_2 EQUIVALENTS COMPARED FOR DIFFERENT POWERTRAINS.

The production of the BMW X3 20 xDrive causes 9.4 t of CO_2e. This is less than the BMW X3 30e xDrive with 11.7 t causes during production. The main reason is the energy-intensive production processes of the Plug-in Hybrid vehicle's High-voltage battery. At 9.2 t of CO_2e the BMW X3 20d xDrive is on a similar level as the petrol model.

However, besides production, consumption in use phase is key to their environmental impact. At a mileage of 200,000 km (approx. 125,000 mls), charged with european electricity mix in the use phase, the total emissions of the BMW X3 30e xDrive are 32.3 t of CO_2e: significantly lower than the total emissions of the compared petrol and diesel models.

Charging with electricity from renewable energy sources further reduces CO_2e in the use phase of a Plug-in Hybrid vehicle from 20.0 t to 7.0 t.

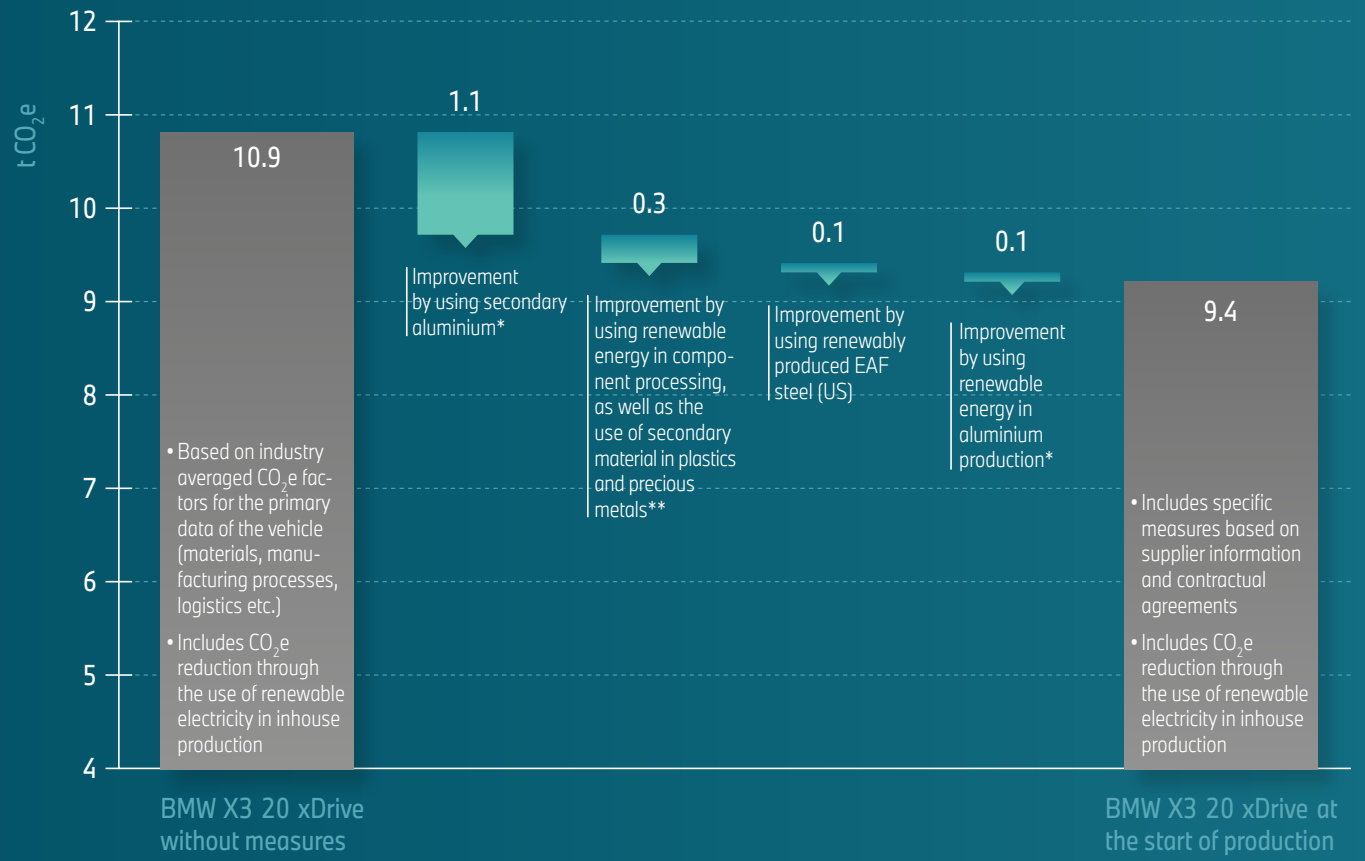
Not charging the Plug-in Hybrid over the considered use phase results in a CO_2e disadvantage of 3.7 t compared to the BMW 20 xDrive and 9.4 t compared to the BMW X3 20d xDrive.



*Consumption data according to type test (mean value of the WLTP range)

Fig. 4: Comparison of the CO_2 equivalents of the BMW X3 20 xDrive in relation to plug-in hybrid and diesel models

2.4. MEASURES FOR REDUCING CO_2 EQUIVALENTS.



* Drive bearings, wheels, body, engine and transmission components etc.

** Catalytic coating in the exhaust system

Fig. 5: Influence of development targets on the CO_2 equivalents in the manufacturing phase of the BMW X3 20 xDrive

In order to achieve internal sustainability targets, various measures were implemented during the production phase of the BMW X3 20 xDrive.

Figure 5 shows the measures that contribute to reducing CO_2 equivalents in the manufacturing phase by around 15 % compared to the industry averages according to LCA for Experts 10 Software and Database. The use of renewable energy sources in in-house production was not reported separately as a measure and is already included in the 10.9 t of CO_2e.

The inclusion of the measures result in a CO_2e value of 9.4 t when the vehicle is handed over to the customer.

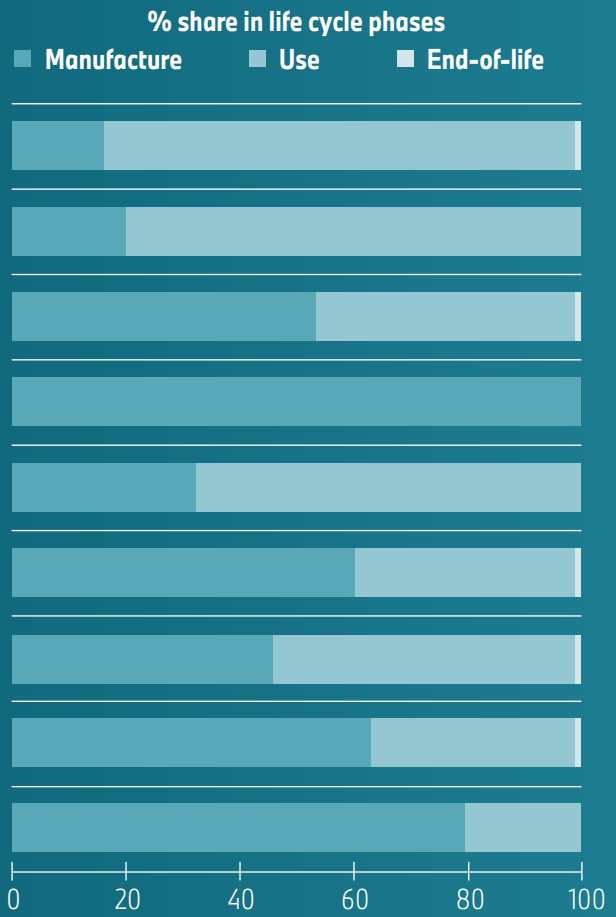
The specified values may contain rounding differences.

2.5. FURTHER ENVIRONMENTAL IMPACT CATEGORIES.

Table 1 shows the CO_2 equivalents of the BMW X3 20 xDrive, which is expressed in CO_2e as well as other significant environmental impact categories with percentage contributions in the life cycle phases:

- The primary energy demand from renewable and non-renewable resources. In other words, the primary energy (e. g. coal, solar radiation) required to generate usable energy and to produce materials.
- Abiotic – i.e. non-living – resource consumption measures the scarcity of resources. The scarcer an element and the higher the consumption, the higher the contribution to Abiotic depletion potential (ADPelem.).
- The photochemical ozone creation potential (POCP) measures ground-level ozone formation (e. g. summer smog) by emissions.
- The acidification potential (AP) quantifies and evaluates the acidifying effect of specific emissions.
- The eutrophication potential (EP) describes the undesirable introduction of nutrients into water bodies or soils (eutrophication).
- Nitrogen oxides (NO_x) contribute, among other things, to the formation of particulate matter and ozone. NO_2, for example, is an irritant gas.
- Emitted particles combine particles of different sizes.

Influencing variable	Unit	Value
Global warming potential (GWP)	t CO_2e	52.9
Primary energy demand from non-renewable resources	GJ	702.5
Primary energy demand from renewable resources	GJ	89.5
Abiotic depletion potential (ADPelem.)	kg Sbe	0.6
Photochemical ozone creation potential (POCP)	kg C_2H_4e	14.3
Acidification potential (AP)	kg SO_2e	73.9
Eutrophication potential (EP)	kg PO_4e	11.7
Nitrogen oxide (NO_x)	kg	52.6
Particles	kg	7.4



Tab. 1: Environmental impact categories with percentage contributions in the life cycle phases of the BMW X3 20 xDrive

3. PRODUCTION AND WATER DEMAND.

For the BMW X3 20 xDrive, the relevant production sites are Spartanburg in North America, Steyr, Landshut and Berlin. The assembly of the complete vehicle as well as the assembly of the drive components takes place at the plant in Spartanburg, while the diesel engine is manufactured at the Austrian plant in Steyr. Individual add-on parts of the body are delivered from the Landshut plant; the brake discs from the Berlin plant.

All four sites obtain their entire external electricity requirements from renewable energy sources, for example using guarantees of origin. The BMW Group only purchases certificates of renewable energy for which the production is not subsidised. This excludes the possibility of double counting. In addition, electricity is also generated from renewable energy sources on the factory premises. The heat demand is covered by natural gas, heating oil and heat from combined heat and power (CHP) plants.

Many production processes, such as painting the vehicles, require a lot of water. The average potable water consumption in 2023 across all global production sites was 1.78 m^3* per new vehicle.

*Source: https://www.bmwgroup.com/en/report/2023/index.html
The specifications regarding water demand do not form part of the LCA.

4. RECYCLING OPTIONS AT THE END OF THE LIFE CYCLE.

BMW considers the impact on the environment over the entire life cycle of a new vehicle. From production to use, servicing and recycling. Efficient recycling is planned as early as in the development and production stages. "Design for recycling" is applied and ensures efficient recycling of end-of-life vehicles. One example is the complete and simple removal of the operating fluids (e.g. refrigerant).

It goes without saying that BMW automobiles worldwide meet the legal requirements for the recycling of end-of-life vehicles, components and materials. In relation to the entire vehicle, at least 85 % of materials are recycled and, including thermal utilisation, at least 95 % as stipulated by legal requirements (European End-of-Life Vehicles Directive ELV 2000/53/EC).

End-of-life vehicles are recycled in recognised disassembly facilities. The BMW Group and its national sales companies have established a network recycling at more than 2,800 collection points in 30 countries worldwide. The four stages of recycling include controlled return, pre-treatment, disassembly and recycling of the remaining vehicle.

The statements and specifications on this page do not form part of the LCA.

5. SOCIAL RESPONSIBILITY IN THE SUPPLY CHAIN.

Compliance with environmental and social standards in the supplier network is the declared goal of the BMW Group. This includes respect for human rights and diligence in the extraction of raw materials.

We source components, materials and services from many manufacturing and delivery locations worldwide. We pass on social and environmental due diligence obligations as part of contractually binding sustainability standards. We counter identified risks in the network with prevention, enabling and remedial measures. They are systematically embedded in our processes.

In critical supply chains, corporate due diligence is a particular challenge. This is due to the complex tracing of raw material sources to ensure the necessary transparency. That is why, for example, we have been actively involved in the Aluminium Stewardship Initiative since 2012 in the development and implementation of a certification standard to minimise the risk of negative environmental impacts and possible human rights violations in the extraction of aluminium. Since 2019, we have had the BMW light metal foundry in Landshut certified according to this Chain of Custody Standard. In this way, the origin and extraction methods of the raw materials are fully traced. Environmental and social standards become more transparent.

Further information on auditing and improving environmental and social standards in the extraction and processing of raw materials can be found here:
https://www.bmwgroup.com/en/sustainability/our-focus/environmental-and-social-standards/supply-chain.html

The statements and specifications on this page do not form part of the LCA.

6. EVALUATION AND CONCLUSION.

Boasting sporting appeal, visual impact and versatility the BMW X3 20 xDrive assumes the mantle of talented all-rounder for everyday use, leisure activities and trips.

The independent TÜV Rheinland Energy & Environment GmbH validated a life cycle assessment of the BMW X3 20 xDrive showing the measures taken to reduce its environmental impact.