

# Environmental Report

## BMW i3 BEV

### Abstract

**Goal and scope:**

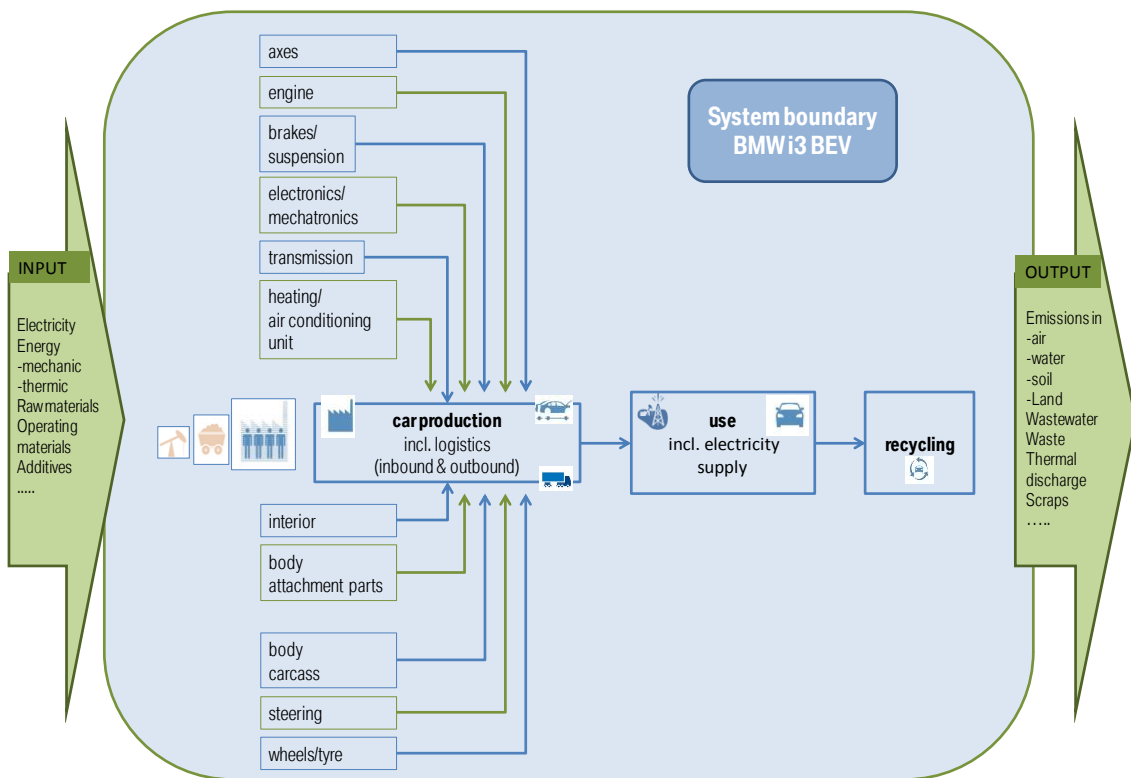
The scope of the study is the life cycle assessment of the BMW i3 BEV, Model Year 2014. Its purpose is to assess the environmental impacts of the entire vehicle and its components according to the product responsibility strategy of the BMW Group. These results are important for the further development and optimization of the next BMW i3 generation as well as for the next set of targets.

**System boundaries:**

The system boundaries consist of all material and energy flows, input and output collected according to ISO 14040 with the following level of detail:

- From sourcing and production of raw materials to production, to use phase, to recycling (incl. transport logistic).
- Use of electricity generated by renewable sources for energy-intensively produced lightweight materials and for the BMW internal production.
- Use phase: assumed mileage 150.000 km, consumption according to new European driving cycle with electricity mix EU-2010 and/or produced with renewable sources.
- Software and database GaBi 4©, ProBas (GEMIS) for current data of electricity mix.
- Material data from material balance of the BMW i3 BEV.
- The impact assessment is based on the CML-method (November 2009) developed at Leiden University in the Netherlands (Guinée and Lindeijer 2002).
- A critical review of the environmental report is done by an external auditor.
- The compilation and assessment process was verified by TÜV SÜD assessing compliance with the internal process description as well as verifying data and environmental information used (validation attached).

**The functional unit and the reference flow** are defined as the BMW i3 BEV vehicle with an electric motor as an ECE-basis version with a use phase of 150.000 km according to the new European driving cycle at SOP (start of production) in 2014. The BMW i3 is a passenger car with four seats and an electrical range up to 160 km. The drive components include a high voltage battery (HV-battery with lithium ions) and an electric synchronous motor with an engine power of 125 kW.



**Fig. 1:** Flowchart input / output data of the BMW i3

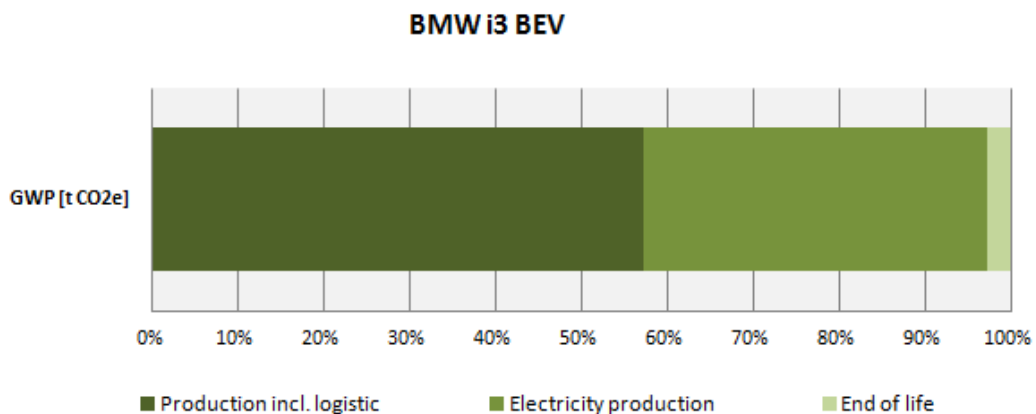
The LCA according to ISO 14040/44 refers to environmental aspects and potential environmental impacts along the life cycle of a product from the raw material extraction to the manufacturing process, to the use phase, and to the recycling at the end of the vehicle's life.

**Facts:**

The life cycle assessment (LCA) of the BMW i3 BEV shows the following environmental impacts across the whole life cycle in terms of Global Warming Potential (GWP) (fig. 2). The environmental impacts determined by the life cycle assessments are measured in different units. The GWP, for example, is stated in kilogram CO<sub>2</sub>-equivalents (kg CO<sub>2</sub>e).

Ambitious sustainability targets had been already set in the early strategic phase of the BMW i3. These targets were pursued steadily and monitored by LCA. By the BMW production energy saving targets and a complete electricity supply with renewable sources were established. For this reason four wind turbines were built at the production site of the BMW i3 in Leipzig.

The materials for the i3 were selected according to sustainability targets. For example the use of secondary aluminum and primary aluminum produced with renewable energy is kept up as high as possible. The production of the carbon fibre is obtained with 100% hydropower and consequently the global warming potential is up to 50% lower than for the conventional production of carbon fibre components.



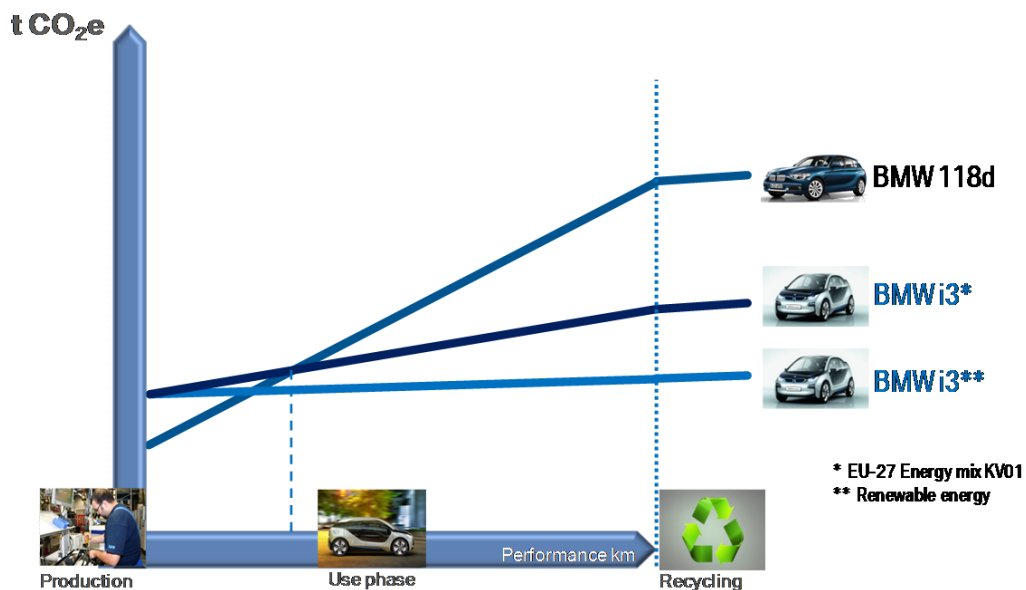
**Fig. 2:** Distribution of global warming potential over life cycle of BMW i3

**Sensitivity analysis:**

A sensitivity analysis of different scenarios was carried out for estimating the effect of the choices made regarding methods and data on the results of the study.

Examples of the scenarios considered in the sensitivity analysis are:

- Influence of the data robustness on the life cycle assessment results.
- Influence of the different consumption and electricity availability scenarios during use phase.
- Classification of the BMW i3 BEV in relation to conventional vehicle concepts.
- Influence of the environmental impact of the high-voltage battery cells and the battery's lifespan.



**Fig. 3:** Classification of the BMW i3 in relation to a conventional vehicle concept (118d)

Thanks these sustainability actions over the whole value chain and the ongoing monitoring the resulted global warming potential of the BMW i3 BEV is about 30% up to 50% (renewable source for charging power) less compared to a conventional vehicle (Green Car of the Year 2008) (fig. 3).



Management Service

# Validation

TÜV SÜD Management Service GmbH has verified the Life Cycle Assessment (LCA) study for the following passenger vehicle type

**BMW i3 BEV  
Modelljahr 2014**

of

**BMW AG  
Petuelring 130  
80788 München**

and herewith, **declares it valid.**

**Basis of verification:**

- **The standards ISO 14040:2006 / ISO 14044:2006** for the statements to LCA study in the version of 2013-09-30 (principles and general requirements, definition of goal and scope as well as inventory analysis, life cycle impact assessment, interpretation, critical review)
- **Requirements of the TÜV SÜD MS-methodology for the evaluation of the quality of (process and product) modelling and data for inventory analysis and impact assessment as parts of a life cycle assessment according to ISO 14040:2006/ISO 14044:2006**

**Scope of verification:**

- **External critical review of LCA study regarding compliance with requirements of ISO 14040/14044**
- **Review of compliance of the specific LCA process with the related BMW process instruction**
- **Verification of LCA input data and other relevant environmental information**

**Results of verification in detail:**

- **This LCA study meets the requirements of above mentioned standards. The applied methodology is consistent with the scientific state of technology.**
- **The LCA study was prepared in line with the related BMW process instruction. The used input data and other environmental information therein are correct. (TMS-Report no: 707014506 from 14.10.2013)**

**TÜV SÜD Management Service GmbH**

Munich, 2013-10-15

Michael Brunk  
Environmental Verifier

Dipl.-Ing. Ulrich Wegner  
Head of certification body

**Independence and objectivity of verifier:**

TÜV SÜD Group has not advised product-related environmental aspects with BMW Group neither in the past nor at present. TÜV SÜD Management Service GmbH is not economically dependent or otherwise involved in any way with BMW AG.

**Responsibilities:**

BMW AG has full responsibility for the content of the LCA study. TÜV SÜD Management Service GmbH had been assigned to review the fulfilment of the methodical requirements regarding LCA realisation as well as to verify and validate the available information for correctness and credibility.