

Environmental Report

BMW 740Le

iPerformance

Abstract

Goal and scope:

The scope of the study is the life cycle assessment of the BMW 740Le iPerformance, Model Year 2016. 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 7series PHEV generation.

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 phase: assumed mileage 250.000 km (new European driving cycle); consumption according to EU test cycle for Plug-in-hybrid vehicles.
- Software and database GaBi 6©.
- Material data from material balance of the BMW 740Le.
- 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 740Le iPerformance vehicle as an ECE-basis version with a use phase of 250.000 km according to the new European driving cycle at SOP (start of production) in 2016. The Plug-in-hybrid power train consists of the BMW TwinPower Turbo 4-cylinder petrol engine and an eDrive electric motor as well as a high-voltage battery (lithium-ion technology).

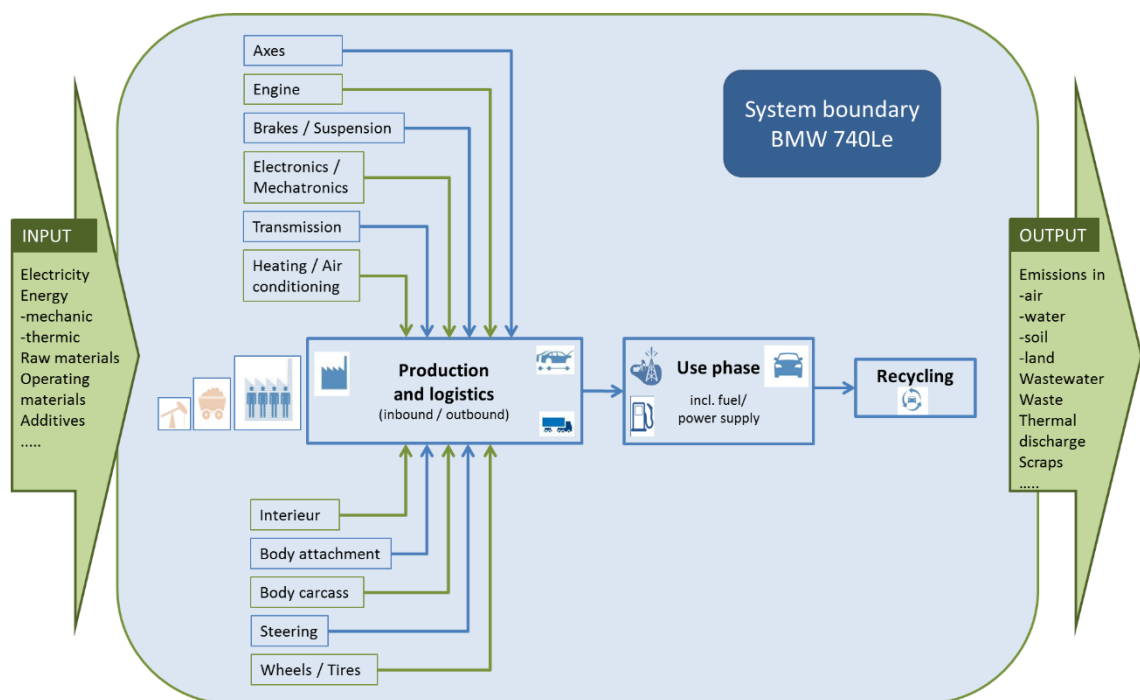
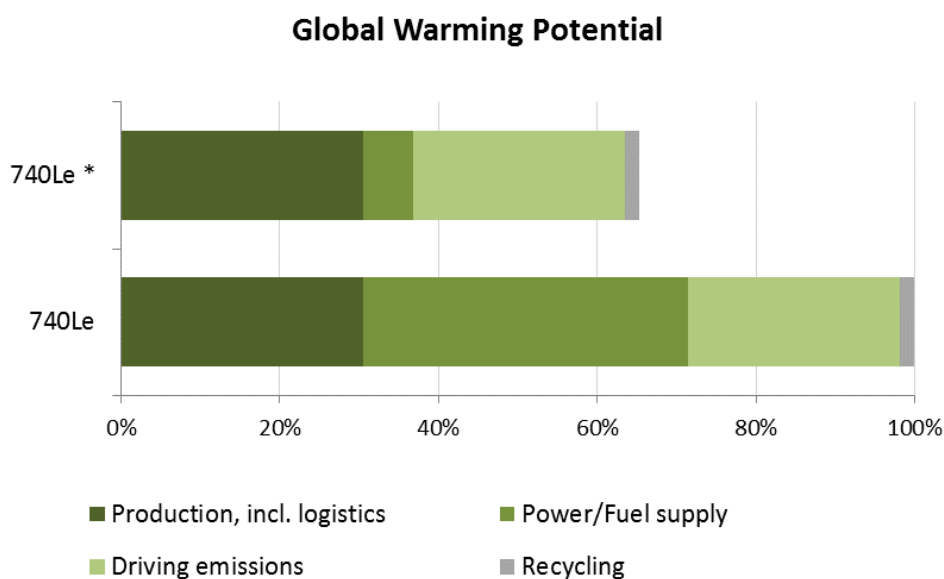


Fig. 1: Flowchart input / output data of the BMW 7series

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 740Le iPerformance 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 CO₂-equivalents (kg CO₂e).



* renewable charging power

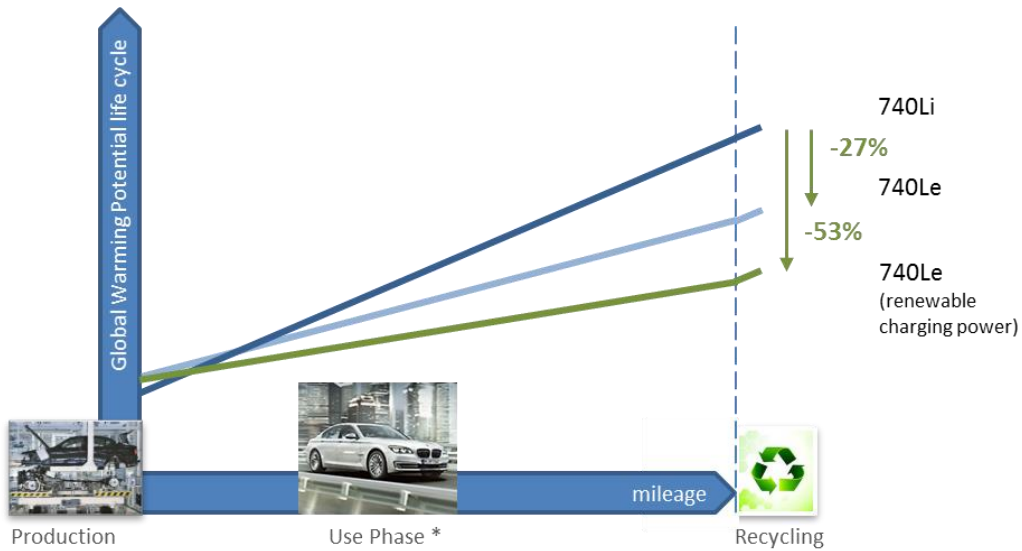
Fig. 2: Distribution of global warming potential over life cycle of BMW 740Le

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 740Le iPerformance in relation to conventional vehicle concepts.



* consumption acc. to type approval

Fig. 3: Classification of the BMW 740Le iPerformance in relation to a conventional vehicle concept (740Li)

Thanks to the consistent use of BMW EfficientDynamics eDrive technology, the Global Warming Potential of the 740Le iPerformance is about 27% lower than of the conventionally powered 740Li across the whole life cycle. If renewable energy sources are used for charging, the reduction is at about 53% (fig. 3).

Validation



Management Service

TÜV SÜD Management Service GmbH supported by an external expert in the critical review, verified the Life Cycle Assessment (LCA) study of **BMW AG, Petuelring 130, 80788 Munich** for the following passenger car:

BMW 740Le iPerformance, 2016 model year

Verification was based on the requirements of the following standards and guidance documents, in as far as applicable:

- ISO 14040/14044:2006 (Principles and general requirements – Definition of goal and scope of the LCA – Life cycle inventory analysis – Life cycle impact assessment – Interpretation – Critical review)
- ISO/TR 14062:2002 (Integration of environmental aspects into product design and development)
- ISO/TS 14071:2014 (Environmental Management – Life cycle assessment – Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006) Additional requirements and guidelines to ISO 14044:2006)
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Result:

1. The preparation of the life-cycle assessment is in compliance with ISO 14040 and ISO 14044. The methods used and the modelling of the product system correspond to the state of the art. They are suitable to fulfil the goals stated in the study. The report is comprehensive and provides a transparent description of the framework of LCA study.
2. The assumptions used in the LCA study, particularly fuel and electricity consumption based on the current NEDC (New European Driving Cycle), modelling of production processes and modelling of logistics, were verified and discussed in sensitivity analyses in terms of their variability-dependent influence on the relevant impact categories.
3. The assessed samples of data and environmental information included in the LCA study were traceable and plausible. Verification did not reveal any issues within the defined scope that compromised the validation in any way.

Verification – process and level of detail:

Verification of the LCA study included a critical review of the methodology applied and a data-oriented audit of the LCA results and their interpretation in the form of interviews, inspections of technical documents and selective checks of the data entered in the LCA database (GaBi). Random checks were performed on LCA input data (including weights, materials, fuel and electricity consumption, emissions) etc.). Within the scope of these checks, the data were traced back as far as possible to documents including official type approval documents, parts lists, supplier information (IMDS data) measurement results etc.

TÜV SÜD Management Service GmbH

Munich, 2016-08-01

A blue ink signature of Michael Brunk.

Michael Brunk

Environmental verifier

A black ink signature of Ulrich Wegner.

Dipl.-Ing. Ulrich Wegner
Head of Certification Body
Environmental verifier

Independence of verifier:

BMW Group has not placed any contracts for consultancy on product-related environmental aspects with TÜV SÜD, either in the past or at present. There are no areas of financial dependence or conflicts of interest between TÜV SÜD Management Service GmbH and BMW Group.

Responsibilities:

Sole liability for the content of the life-cycle assessment rests with BMW AG. TÜV SÜD Management Service 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.