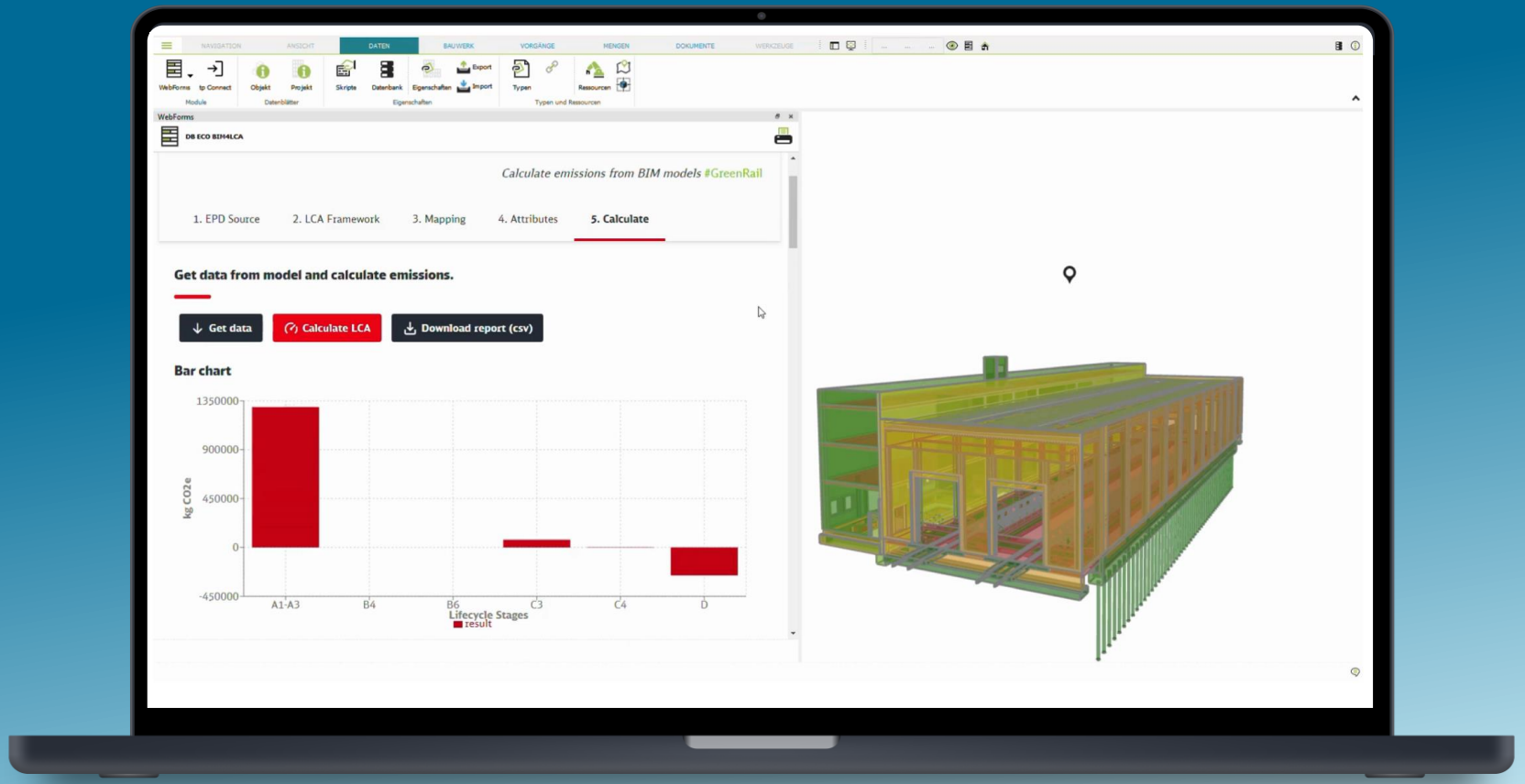
A solution by
DB E&C

BIM4LCA

Model-based lifecycle assessment



Green design and construction of railway infrastructure

Sustainability goals at DB

"Green Transformation"

Climate neutral by 2040

We at DB have committed ourselves to clear sustainability goals.

We act for the climate.

This is green.

This is green.

From roads.
To rails.
Green construction logistics.

no. 77

This is green.

Sustainably build.
Efficently operated.
Excellent office buildings.

no. 39

Our offer

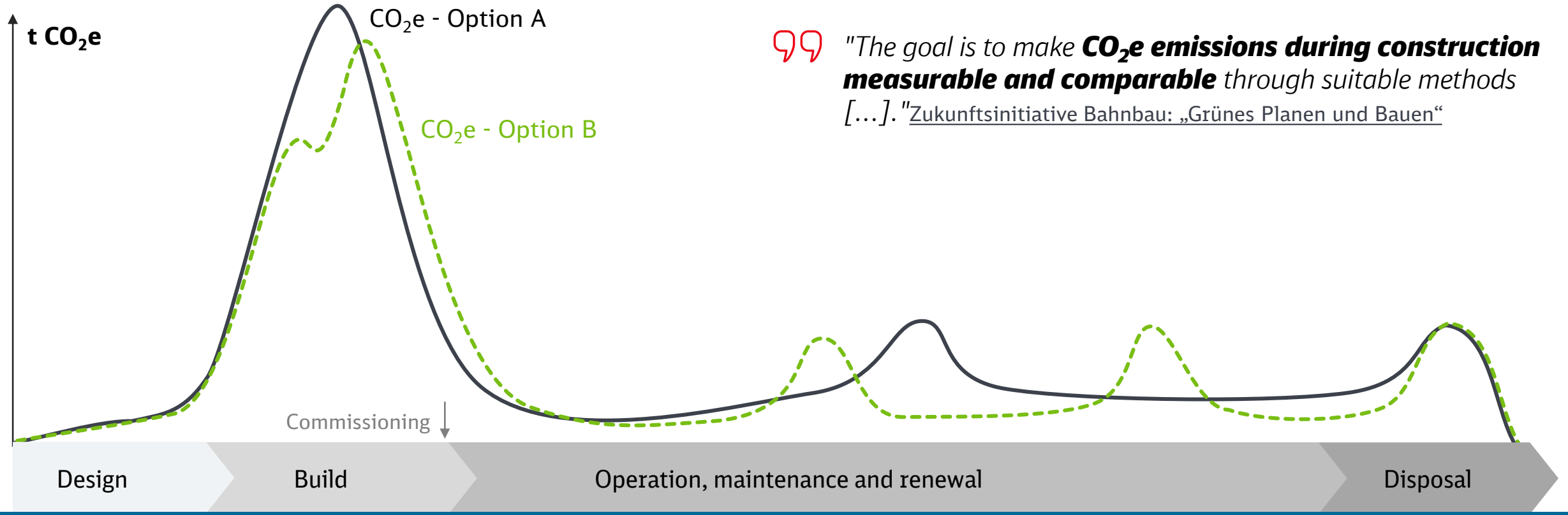
BIM model-based lifecycle assessment of infrastructure

Anchor sustainability as a **decision-making criterion** in infrastructure design.

Lifecycle assessment makes **emissions measurable** in the design.

Lifecycle assessment according to DIN EN ISO 14040 and ISO 14044

Determine and evaluate emissions and costs over the entire lifecycle



> *"The goal is to make **CO_2e emissions during construction measurable and comparable** through suitable methods […]."* Zukunftsinitiative Bahnbau: „Grünes Planen und Bauen“

Vision – Determine emissions and costs over the entire lifecycle and use them as a criterion for well-founded, holistic decisions in the design.

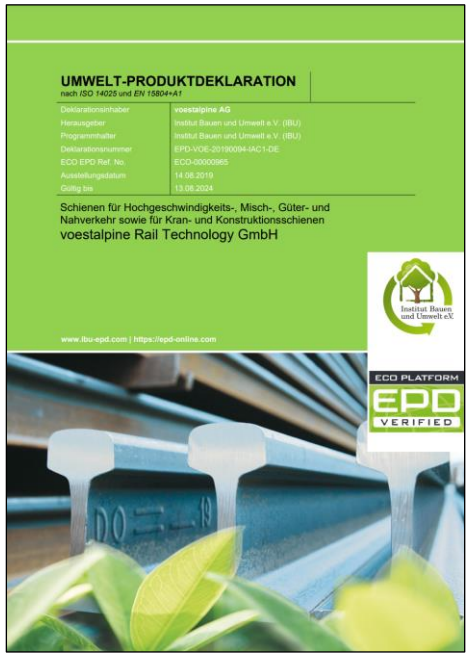
Lifecycle assessment according to DIN EN ISO 14040 and ISO 14044

Environmental Product Declarations(EPD)

The basis for a lifecycle assessment are so-called
Environmental Product Declarations (EPDs).
Norms: ISO 14025 and EN 15804

The evaluation is carried out on the basis of indicators such as
Global warming potential, eutrophication potential *or* ***hazardous waste generation to landfill.***

The quantification of the indicators is carried out according to the
lifecycle phases A-D.



"carbon footprint" →

LCA Results – Environmental influences						
Indicator		**Unit**	**A1-A3***	**C3***	**C4***	**D***
GWP	Global warming potential	kg CO_2 Eq	2.626E+03	0.000E+00	2.423E+00	-1.284E+03
ODP	Depletion potential of the stratospheric ozone layer	kg CFC11 Eq	7.183E-09	0.000E+00	6.338E-13	7.119E-06
POCP	Formation potential of tropospheric ozone	kg Ethen Eq	1.168E+00	0.000E+00	5.987E-04	-5.894E-01
AP	Acidification potential of soil and water	kg SO_2 Eq	6.734E+00	0.000E+00	6.738E-03	-2.506E+00
EP	Eutrophication potential	kg $(PO_4)^3$ Eq	7.957E-01	0.000E+00	8.538E-04	-1.872E-01
ADPE	Abiotic depletion potential for non fossil resources	kg Sb Eq	2.889E-02	0.000E+00	5.111E-07	-3.689E-03
ADPF	Abiotic depletion potential for fossil resources	MJ	2.135E+04	0.000E+00	3.469E+01	-1.239E+04

Source: OEKOBAU.DAT

*A1: Raw material supply
A2: Transport
A3: Manufacturing / production

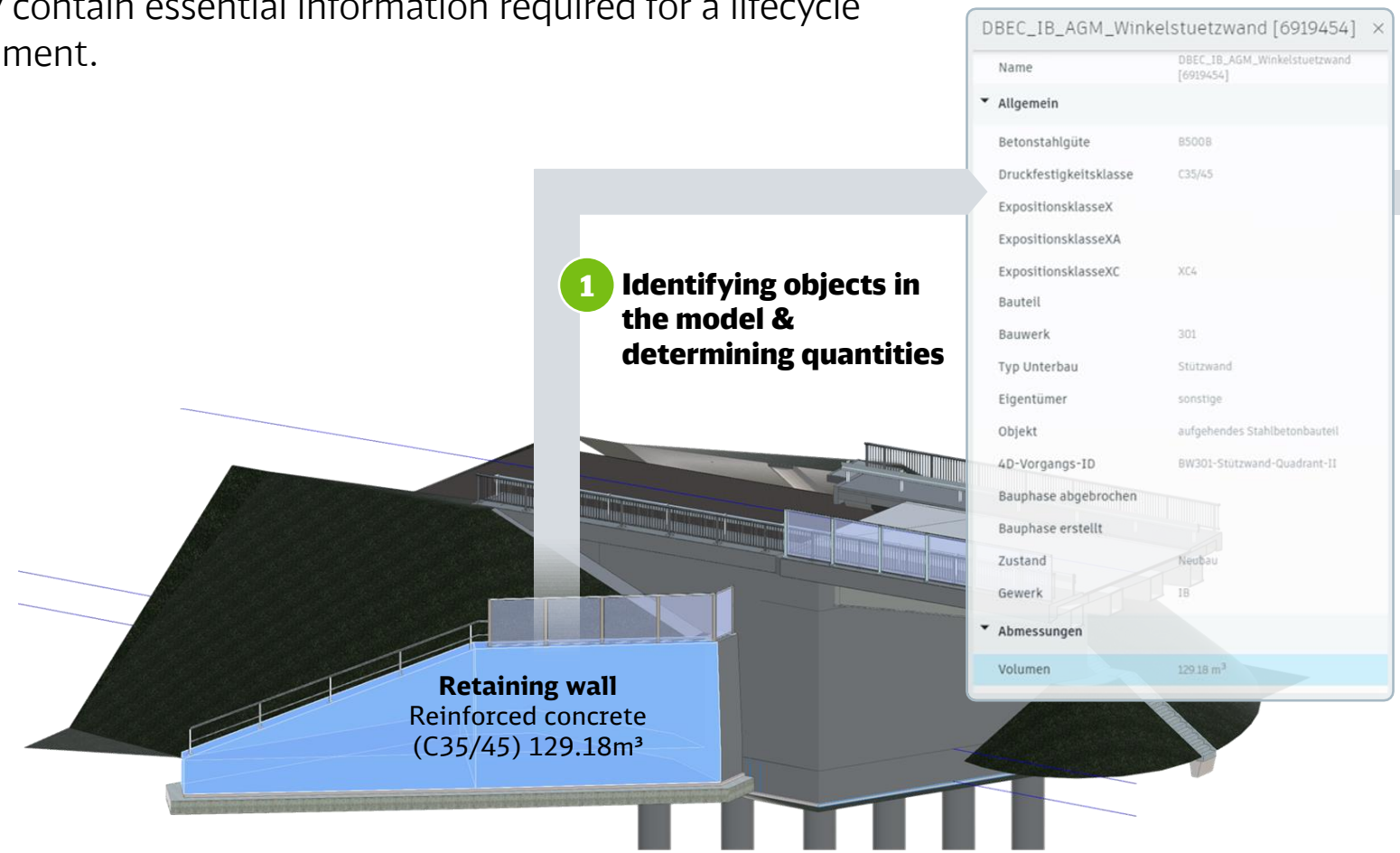
*C3: Waste treatment
C4: Disposal

*D: Reuse, recovery & recycling

Lifecycle assessment as a BIM use case

Using BIM models for lifecycle assessment

At DB E&C, **BIM models** are an **essential design component** – they contain essential information required for a lifecycle assessment.



1 Identifying objects in the model & determining quantities

2 EPD Assign

EPD
1m³ Unreinforced structural concrete C35/45 (Source: epd-online.com)

Indicator	Unit	A1-A3
GWP	kg CO_2 Eq	244.00
ODP	kg CFC11 Eq	6.81E-8
POCP	kg Ethen Eq	2.98E-2
AP	kg SO_2 Eq	3.48E-1
EP	kg $(PO_4)^3$ Eq	6.55E-2
ADPE	kg Sb Eq	8.22E-4
ADPF	MJ	1080.00

3 Calculate emissions

$GWP_{Gew,A1-A3}$ = 129.18 m³ x 244 kgCO2e/m³
= 31.5 tCO2e

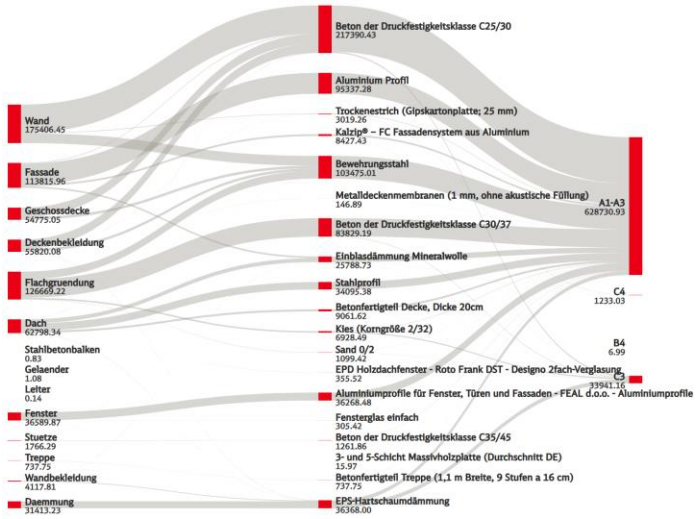
4 Rate result

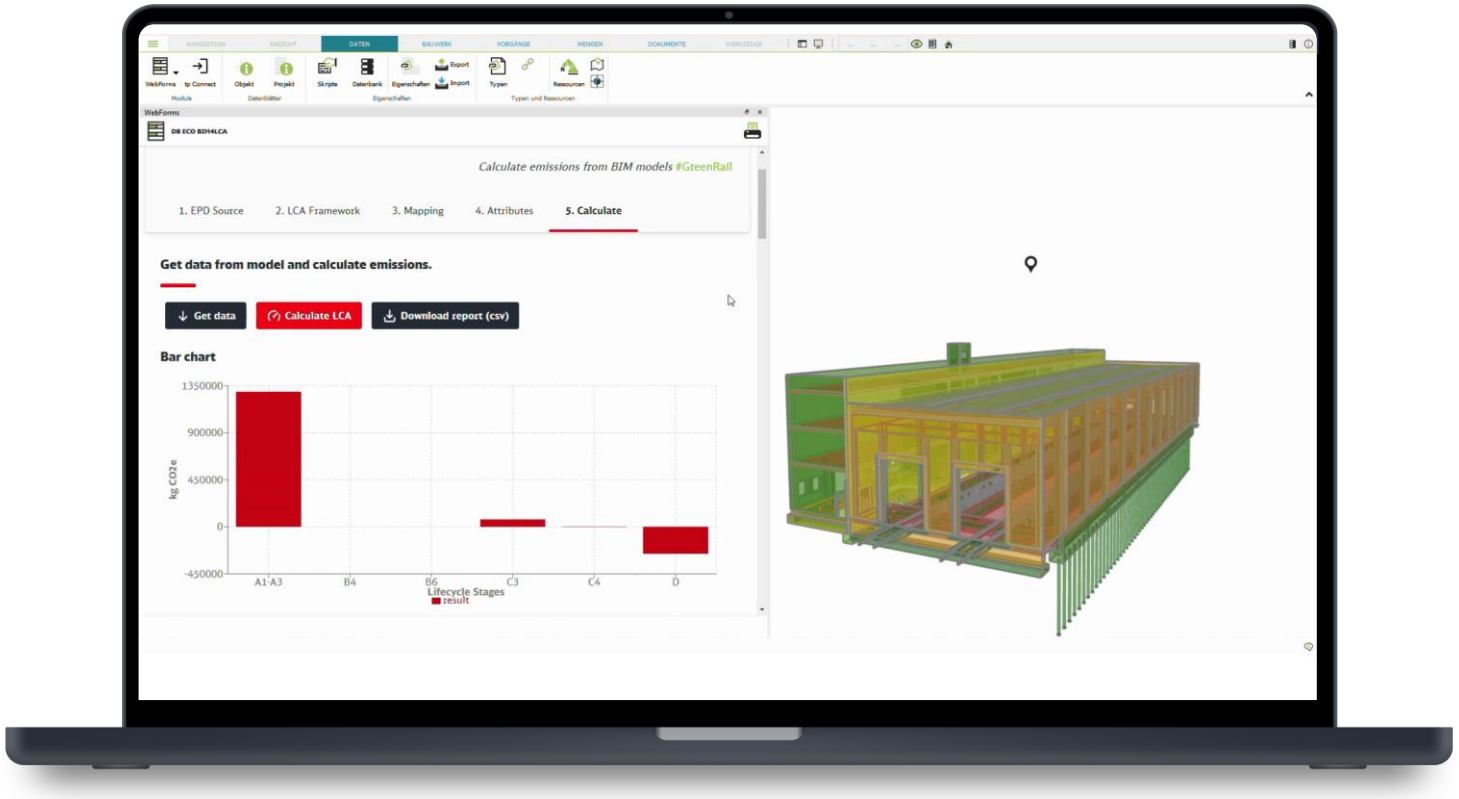
Lifecycle assessment as a BIM use case

Automating the LCA workflow with BIM4LCA

With the **BIM4LCA tool** developed at DB E&C, emissions are determined and visualized directly in the BIM model – completely model-based.

Due to the high degree of automation, fast LCA iterations are achieved. The assessment can be carried out continuously **during the design**.

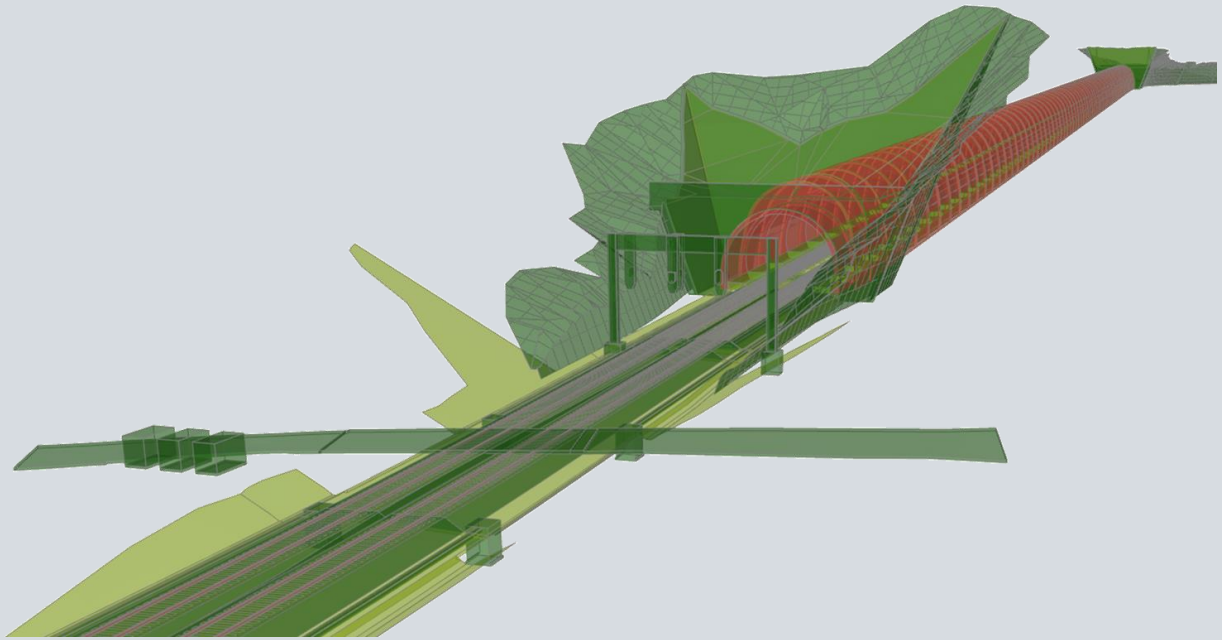




Model-based lifecycle assessment in the project

What are the advantages of lifecycle analysis using BIM4LCA?

BIM4LCA *as a green component for the digital and sustainable design of tomorrow's railway infrastructure.*



Determining emission and cost hotspots
Consultation on design alternatives, particularly in early stages

Speed through automation
Quick LCA iterations along the entire design process

Lifecycle Analysis
BIM4LCA addresses the whole infrastructure lifecycle

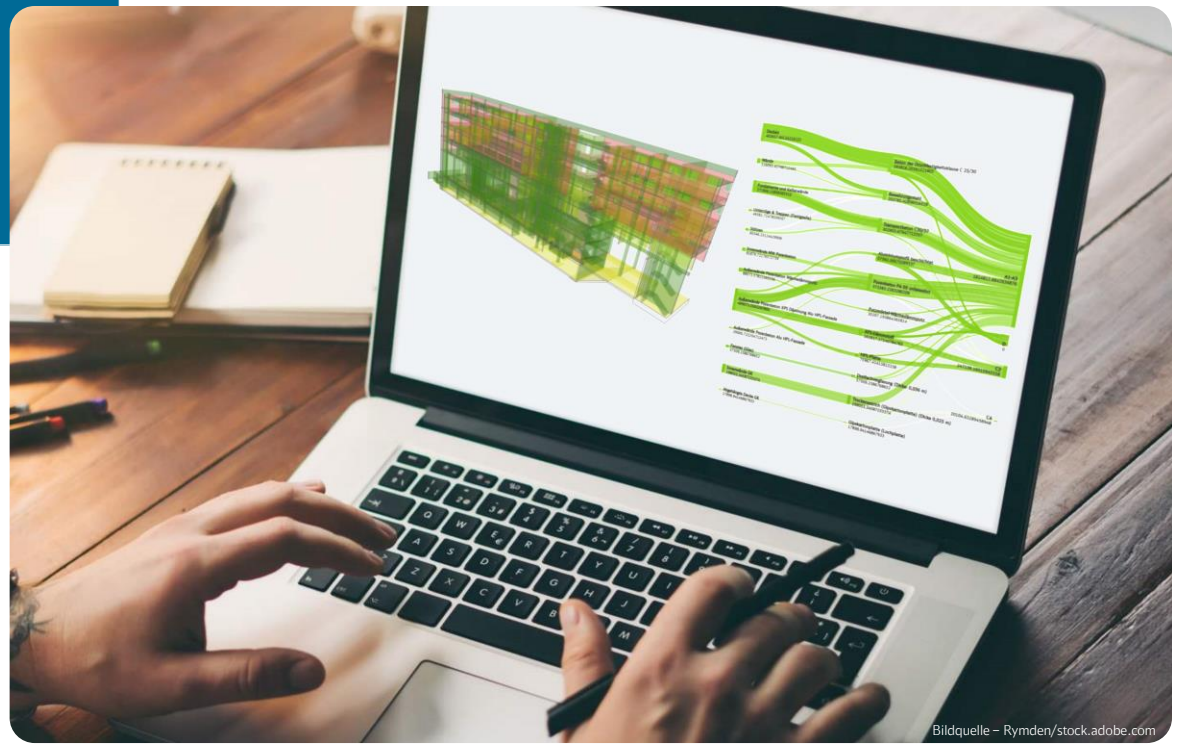
Making sustainability measurable
Quantifying emissions as a decision criterion

Quick comparison of design variants
LCA data can support the decision for a preferred design

High degree of standardization
Lifecycle assessment according to ISO 14040 & ISO 14044

DB E&C as your partner for digital and sustainable design.

Digital design methods combined with expertise in sustainability assessment
for a sustainable and lifecycle-oriented infrastructure design.



Contact us today.

BIM4LCA
Model-based lifecycle assessment

e-mail