LCA, EPD and PCF

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Agenda

Life Cycle Assessment

LCA Overview
LCA Steps
LCA Frameworks

Environmental Product Declaration

EPD Overview
EPD: Advantages & Benefits
R<THINK

Product Carbon Footprint

PCF Overview
PCF Calculation
PCF Benefits

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Chapter 1:

Life Cycle Assessment (LCA)

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Environmental product assessments

LCA
Life Cycle Assessment

EPD
Environmental Product Declaration

PCF
Product Carbon Footprint

PEF
Product Environmental Footprint

Applicable standards

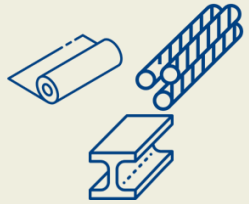
ISO 14040/44
General Life Cycle Assessment methodology

ISO 14025
Rules for type III environmental labels (EPD)

ISO 21930
Rules for construction product EPDs

EN 15804+A2
(European) rules for construction product EPDs

EN 50693
Product Category Rules for LCA of electrical and electronic products

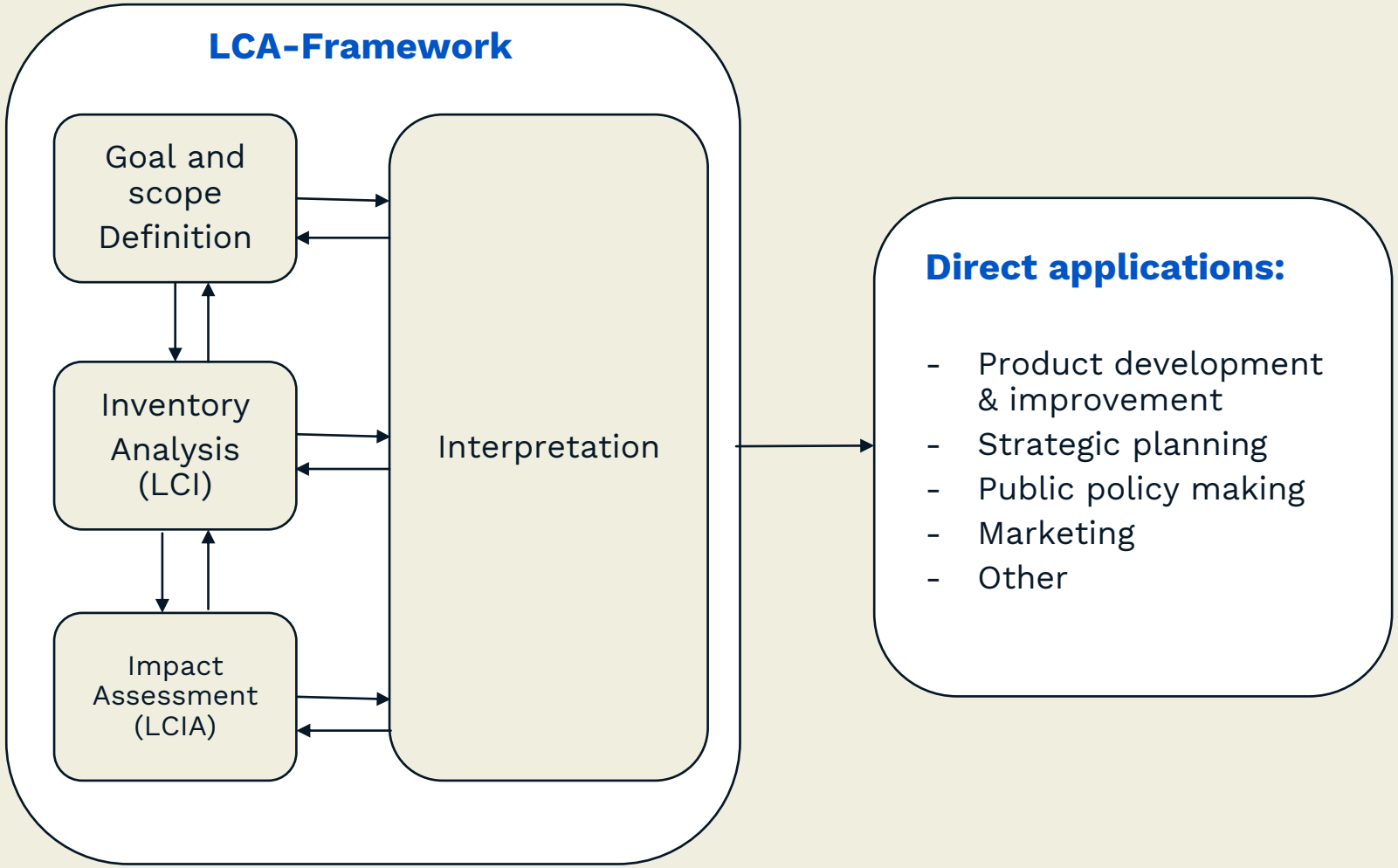


EN 15978
Environmental performance and calculations at building level

Life Cycle Assessment (LCA)

- Method for systematically estimating the environmental aspects and impacts of product systems
- Based on standards ISO 14040/44
- “Compilation and evaluation of the inputs, outputs and potential environmental impacts of a product (system/process) throughout its life cycle” (ISO 14040)
- Forms the basis for an:
  - Environmental Product Declaration (EPD)
  - Product Carbon Footprint (PCF)
  - Product Environmental Footprint (PEF)

Standardized steps of LCA



According to ISO 14040/44

LCA Procedure

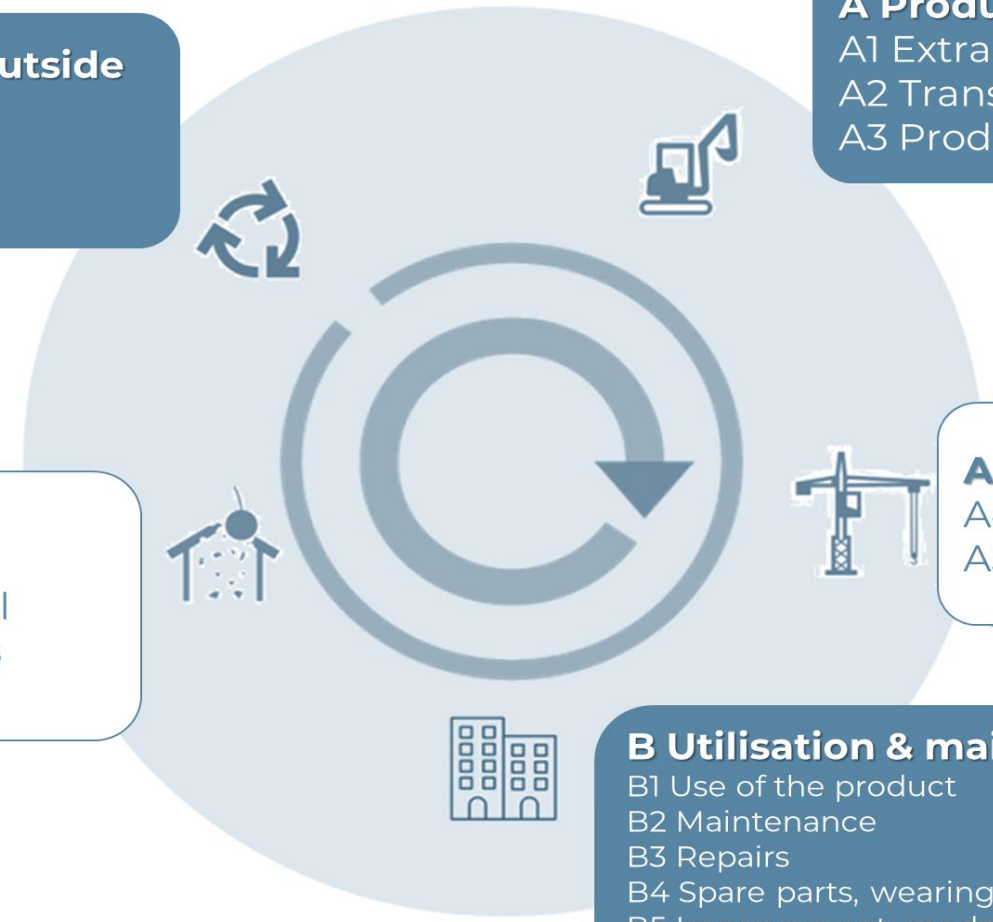
1. Goal & Scope:

- Specify the study's context, intended applications, and target audience.
- Define system boundaries (e.g. cradle-to-gate or cradle-to-grave) and functional unit (e.g. 1 kg of product).
- Outline key assumptions, data quality needs, allocation methods for multi-output processes.

2. LCI:

- Compile inputs (raw materials, energy, water) and outputs (emissions, waste) across all processes within the defined system boundaries.
- Model process flows linking unit processes, creating a comprehensive inventory of environmental exchanges.

System Boundaries an LCA



A Production
A1 Extraction of raw materials
A2 Transport to the manufacturer
A3 Production

A Construction
A4 Transport to the place of use
A5 Installation at the user's location

B Utilisation & maintenance
B1 Use of the product
B2 Maintenance
B3 Repairs
B4 Spare parts, wearing parts
B5 Improvement, modernisation
B6 Operational energy consumption
B7 Operational water consumption

C End of Life
C1 Demolition
C2 Transport for waste disposal
C3 Waste treatment processes
C4 Disposal

D Loads and benefits outside the system boundary
D Resource utilisation
D Exported energy

LCA Procedure

3. LCIA:

- Aggregate collected inventory flows (e.g., emissions, resource uses) into relevant impact categories (e.g., climate change, acidification) using an impact assessment method.
- Results of the impact assessment (LCIA) are delivered as absolute values, in specific units for each category (e.g. kg CO_2 eq for climate change).
- Impact Category: Class representing key environmental concerns where LCI results are assigned.
- Commonly used Impact methods: ReCiPe 2016, EF v3.1 (Environmental Footprint), IPCC 2021 etc.

Note: ISO 14040/14044 do not define which impact categories are necessary to be included in an LCA, and the selection can be made by the practitioner.

4. Interpretation:

- Pinpoint significant impacts and data contributors.
- Test sensitivity of major elements and assess study quality.
- Provide recommendations, limitations, and transparent reporting.

Modelling Frameworks of LCA

1. Attributional LCA (aLCA)

- Assigns elementary flows and environmental impacts to a specific product system, reflecting its historical account.
- Most commonly used LCA method. (eg: for EPDs, PCFs, PEFs etc.)

2. Consequential LCA (cLCA)

- Analyzes environmental consequences of potential future changes between alternative product systems.
- It is dynamic, economic and political context specific, and marginal method.

Additional info:

LCA softwares: Simapro, GaBi, R<Think etc.

Databases: ecoinvent, GaBi/Sphera, PEF etc.

Chapter 2:

Environmental Product Declaration (EPD)

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Environmental Product Declaration (EPD)

- Based on a Life Cycle Assessment (LCA)
- Signals a manufacturer's **commitment to measure** (and reduce) the environmental impacts of its products and services and to report these impacts in a transparent manner
- Contains **quantifiable environmental information** on a harmonised scientific basis
- Contains **comparable**, **objective** and **third-party verified** data
- Can help companies to **market** their products
- Is often **required for construction projects and tenders** (e.g. green building certifications)

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Environmental Product Declaration (EPD)

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
Climate change – total	Global Warming Potential total (GWP-total)	kg CO2 eq.
Climate change – fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO2 eq.
Climate change – biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO2 eq.
Climate change – land use and land use change	Global Warming Potential land use and land use change (GWP-luluc)	kg CO2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg PO4 eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	mol N eq.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP)	kg NMVOC eq.
Depletion of abiotic resources – minerals and metals	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	kg Sb eq.
Depletion of abiotic resources – fossil fuels	Abiotic depletion potential for fossil resources (ADP-fossil)	MJ, net calorific value
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. deprived

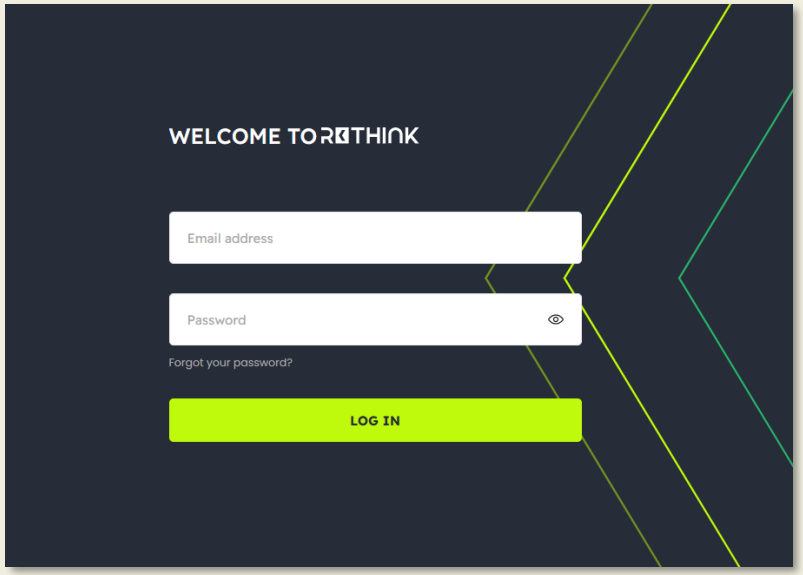
Advantages of an EPD

- Provides insight into the **environmental performance** of your product
- Supports **compliance with rules and regulations**
- Supports the **comparability** of the environmental performance of products
- Shows not only the CO2 emissions of a product, but also a variety of **other impact categories** (energy consumption, water consumption, ozone depletion, etc.)

EPDs for different product categories

	EN 15804	EN 50693
Product category	Construction products	Electronic and electrical products and systems (EEPS)
Complemented by	Product category rules (PCR)	Product-specific rules (PSR)
Life cycle stages	Shown in modules, and manufacturing stage modules (A1-A3) are also shown aggregated	Shown in stages (cannot be disaggregated into modules)
Benefits and loads outside of product system	Aggregated in module D	Provides the option to report results separately for each life cycle stage

LCA/EPD/CCF Software R<THINK



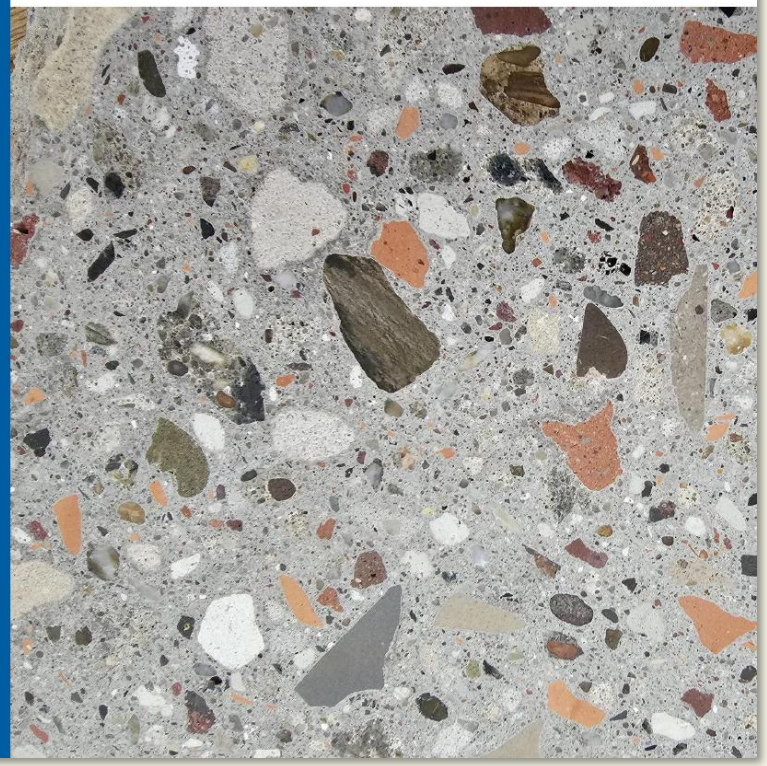
- Software to create calculations according to:
  - ISO 14040/44
  - ISO 14025/EN 15804/EN 50693
  - ISO 14067
  - ISO 14064 and GHG Protocol
- Country specific regulations (e.g. Netherlands)
- Different template options
- Integrated third-party verification
- Excel Interfaces for more efficient calculation upload
- Real time results on environmental impacts

R<THINK: Web-based environmental software

Environmental Product Declaration (EPD)
According to ISO 14025 and EN 15804

EPD / product title

company logo



Registration number:	xxxxxxx
Issue date:	
Valid until:	
Declaration owner:	company name
Publisher:	Kiwa-Ecobility Experts
Program operator:	Kiwa-Ecobility Experts
Status:	verified

5 Results

For the impact assessment, the characterization factors of the LCIA method EN 15804 +A2 Method v1.0 are used. Long-term emissions (>100 years) are not considered in the impact assessment. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

5.1 ENVIRONMENTAL IMPACT INDICATORS PER CUBIC METER

CORE ENVIRONMENTAL IMPACT INDICATORS EN15804+A2

Abbr.	Unit	A1	A2	A3	A1-A3	C1	C2	C3	C4	D
AP	mol H+ eqv.	3.98E-1	2.71E-2	3.62E-4	4.26E-1	2.62E-1	5.05E-2	2.19E-2	0.00E+0	-1.64E-2
GWP-total	kg CO2 eqv.	2.21E+2	4.67E+0	1.06E-1	2.26E+2	2.51E+1	8.71E+0	3.52E+0	0.00E+0	-2.27E+0
GWP-b	kg CO2 eqv.	3.92E-1	2.16E-3	1.67E-3	3.96E-1	6.97E-3	4.02E-3	2.02E-2	0.00E+0	-1.04E-2
GWP-f	kg CO2 eqv.	2.21E+2	4.67E+0	1.04E-1	2.26E+2	2.51E+1	8.70E+0	3.50E+0	0.00E+0	-2.26E+0
GWP-luluc	kg CO2 eqv.	2.29E-2	1.71E-3	1.14E-4	2.48E-2	1.97E-3	3.19E-3	6.66E-4	0.00E+0	-2.43E-3
EP-m	kg N eqv.	1.10E-1	9.55E-3	7.48E-5	1.20E-1	1.16E-1	1.78E-2	8.72E-3	0.00E+0	-4.68E-3
EP-fw	kg P eqv.	2.57E-5	4.71E-5	7.02E-6	7.98E-5	9.12E-5	8.78E-5	1.09E-4	0.00E+0	-8.35E-5
EP-T	mol N eqv.	1.35E+0	1.05E-1	9.99E-4	1.46E+0	1.27E+0	1.96E-1	9.69E-2	0.00E+0	-5.43E-2
ODP	kg CFC 11 eqv.	3.77E-13	1.03E-6	5.59E-9	1.04E-6	5.41E-6	1.92E-6	4.53E-7	0.00E+0	-2.26E-7
POCP	kg NMVOC eqv.	3.22E-1	3.00E-2	2.27E-4	3.52E-1	3.49E-1	5.60E-2	2.64E-2	0.00E+0	-1.50E-2
ADP-f	MJ	8.03E+2	7.04E+1	1.54E+0	8.75E+2	3.45E+2	1.31E+2	4.70E+1	0.00E+0	-2.82E+1
ADP-mm	kg Sb-eqv.	0.00E+0	1.18E-4	9.41E-7	1.19E-4	3.84E-5	2.20E-4	9.86E-6	0.00E+0	-1.13E-4
WDP	m3 world eqv.	1.15E+1	2.52E-1	5.56E-3	1.17E+1	4.62E-1	4.69E-1	2.13E-1	0.00E+0	-3.24E+1

AP=Acidification (AP) | **GWP-total**=Global warming potential (GWP-total) | **GWP-b**=Global warming potential - Biogenic (GWP-b) | **GWP-f**=Global warming potential - Fossil (GWP-f) | **GWP-luluc**=Global warming potential - Land use and land use change (GWP-luluc) | **EP-m**=Eutrophication marine (EP-m) | **EP-fw**=Eutrophication, freshwater (EP-fw) | **EP-T**=Eutrophication, terrestrial (EP-T) | **ODP**=Ozone depletion (ODP) | **POCP**=Photochemical ozone formation - human health (POCP) | **ADP-f**=Resource use, fossils (ADP-f) | **ADP-mm**=Resource use, minerals and metals (ADP-mm) | **WDP**=Water use (WDP)

R<THINK: Web-based environmental software

Product 1

Reference unit: m2

In progress

- Home
- Calculation basics
- Advanced settings
- Inputs
- Information for report
- Expert functions

Weight kg / m2
200

GWP-total kg CO_2eq.
154.419

To realtime results

Material

Raw material 1 | Steel, low-alloyed, hot rolled | market for (GLO) | Kiwa Berlin | 100	124.401
Raw material 2 | Aluminium, cast alloy | market for (EU) | Kiwa Berlin | 100	23.605
Electricity use | Electricity (DE) - low voltage (max 1kV) | 10	6.413

Aditional Information

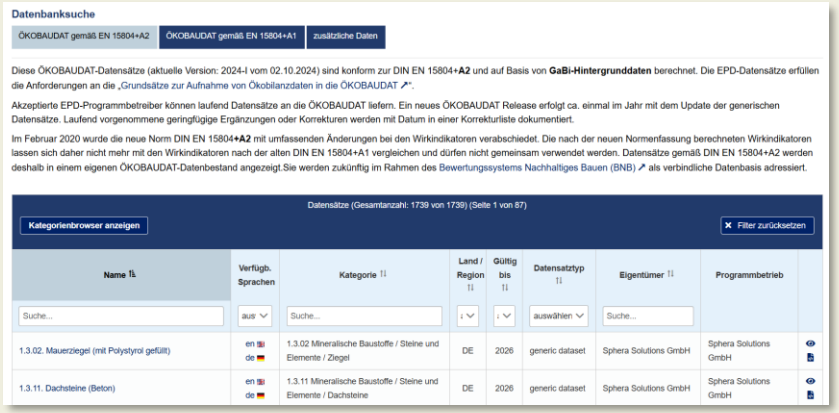
A1-A3 Production	530.122
A4-5 Construction	16.782
B1-3 Use stage	0
C1-C4 + D End-of-life	-392.485
Weight kg / m2	200

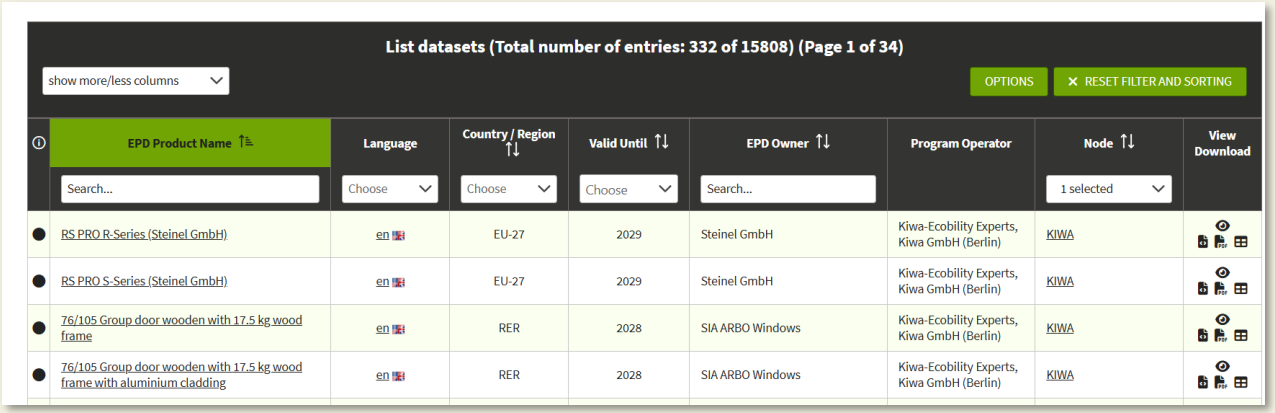
Global warming potential - total (kg CO_2eq.)	154.419

Material	A1	A2	A3	A4	A5	B1	B2	B3	B6	B7	C1	C2	C3	C4	D	TOTAL
Raw material 1 | Steel, low-alloyed, hot rolled | market for (GLO) | Kiwa Berlin | 100	192.312	-	-	-	5.788	-	-	-	-	-	-	0.602	-	0.006	-74.304	**124.401**
Raw material 2 | Aluminium, cast alloy | market for (EU) | Kiwa Berlin | 100	331.584	-	-	-	10.808	-	-	-	-	-	-	0.737	27.814	0.122	-347.458	**23.605**
Electricity use | Electricity (DE) - low voltage (max 1kV) | 10	-	-	6.226	-	0.187	-	-	-	-	-	-	-	-	-	-	**6.413**
Global warming potential - total (kg CO_2eq.)	523.896	-	6.226	-	16.782	-	-	-	-	-	-	1.338	27.814	0.127	-421.763	**154.419**

Publish the verified EPD on the database

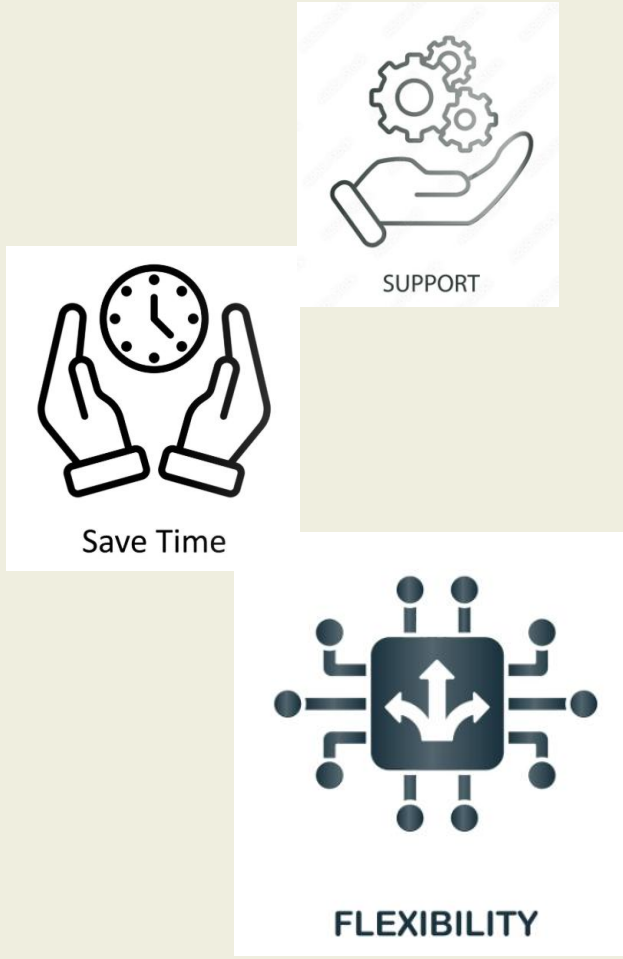
- Sign by program operator head and verifier
- Upload on database
  - KIWA Ecobility Expert database
  - ECO Portal
  - ÖKOBAUDAT (Germany)





EPD services for your products

- We prepare EPDs for a wide range of products
- We provide software licences to create your own EPDs in-house
- We offer on-boarding sessions and training for your team
- We support you throughout the EPD development process



Chapter 3:

Product Carbon Footprint (PCF)

Why PCF Is Important Today

- Climate change as global challenge
  - ISO 14067 focuses on climate change as a single impact category

- Drivers
  - EU Green Deal
  - CSRD / ESG reporting
  - Ecodesign for Sustainable Products Regulation (ESPR)
  - Supply chain decarbonization
  - Customer demand for transparency

Product Carbon Footprint (PCF)

Defines requirements and guidelines for quantifying and reporting the carbon footprint of a product

Based on Standard ISO 14067

“Sum of greenhouse gas emissions and removals in a product system, expressed as CO_2 equivalents, based on life cycle assessment” (ISO 14067:2018)

Focuses exclusively on the impact category climate change

How a PCF Is Calculated

- **Life Cycle Perspective**

– from raw material extraction, production, transport, use phase, and end-of-life

- **Important ISO 14067 Rules**

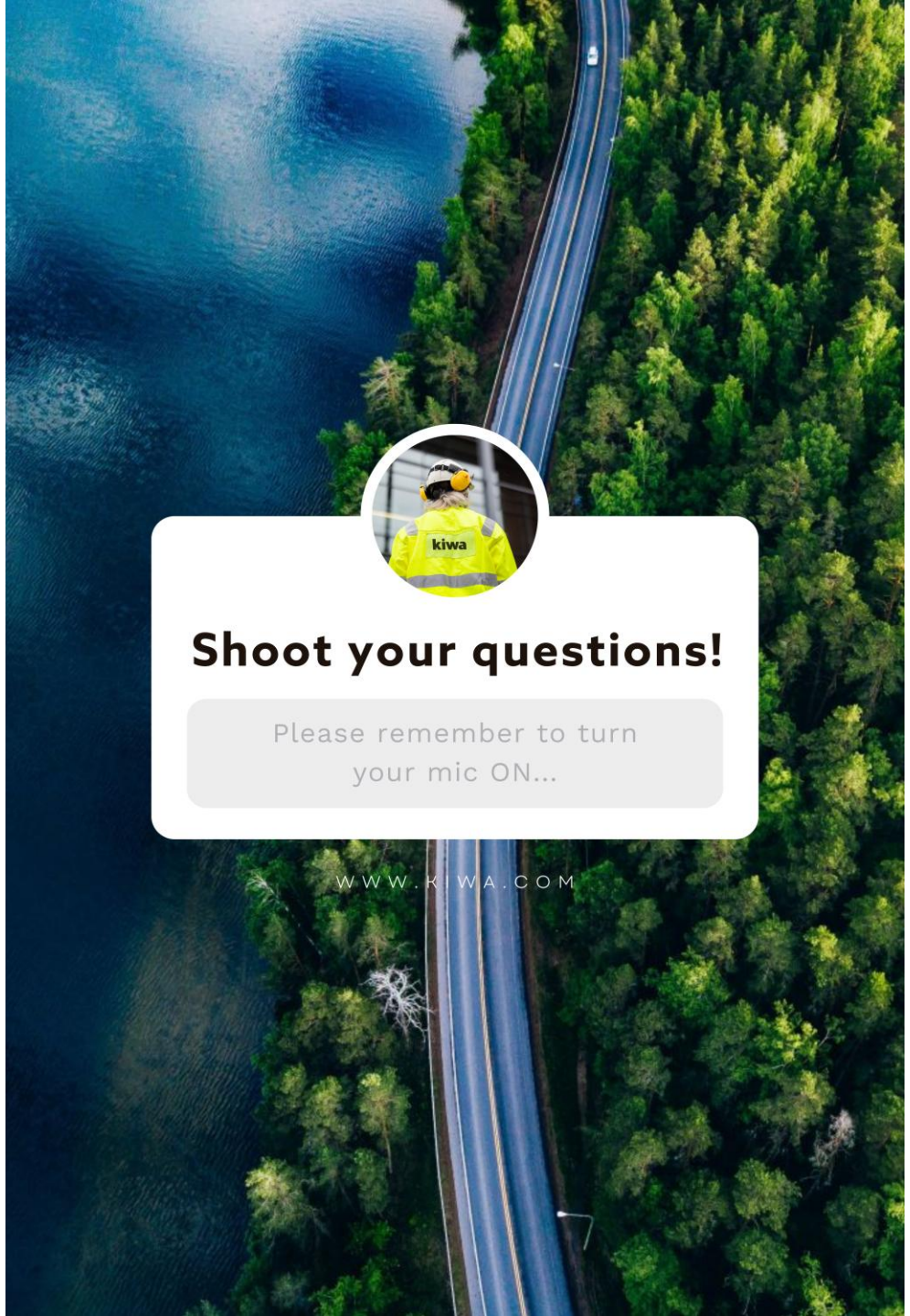
– Only evaluating climate change as an impact category.

– Carbon offsetting is not allowed in the calculation.

– Transparency and documentation are required, and a third-party review can increase credibility.

Benefits of Conducting a PCF

- Identifies GHG emission hotspots across the product life cycle
- Enables cost-effective CO_2 reduction measures
- Supports Scope 3 reporting and ESG compliance
- Prepares for regulatory and customer requirements
- Strengthens competitive advantage and sustainable market positioning



Thank you for attending!

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