

Digitalisation of LCAs and EPDs

The Stykka Case

ISC 2024 | 24 Oct. 2024



RAMBOLL

Bright ideas.
Sustainable change.

Stykka®



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Head of Circular

In the next 30 minutes we will cover:

- 1 Future demand of life-cycle-based information
- 2 Why LCA and EPD tools matter
- 3 How Stykka integrates LCA in its business
- 4 Technical realisation of Stykka's tool

Regulatory requirements increase the need for life-cycle-based information



EU regulations

- Green Claims Directive
- Battery Regulation (2028)
- Construction Products Regulation (CPR)

- Carbon footprint required for harmonised products
- Part of DoPc and Digital Product Passport
- By 2030: full EPD environmental indicator set
- More than **400.000 manufacturers** of construction products in the EU (plus imported products) affected



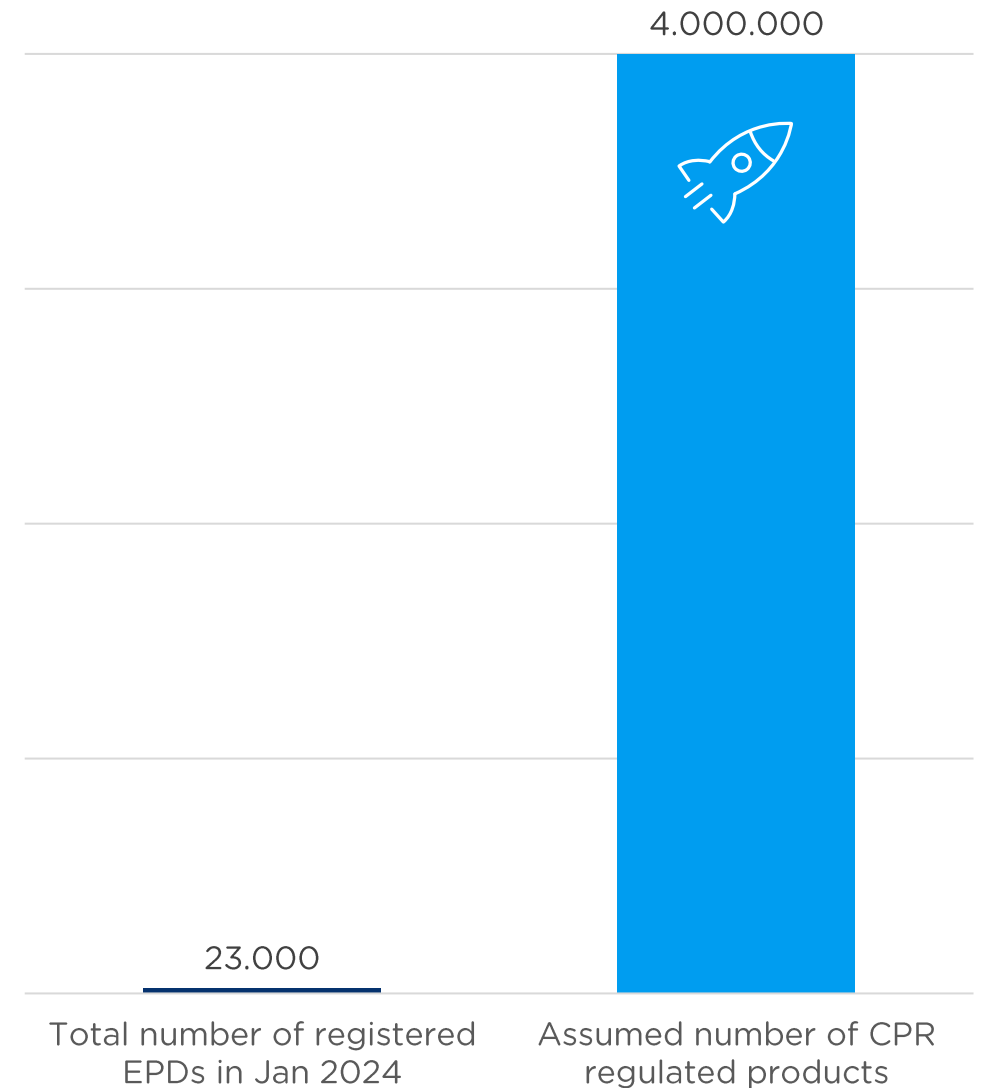
The new CPR will massively increase the need for LCA in the construction products industry alone

Thought Experiment: CPR's Potential Scale

- 400,000 manufacturers affected by CPR
- Assumption: 10 regulated products per manufacturer



- Demand of 4,000,000 LCAs by 2030
- EPDs continue to exist for unregulated product categories



The Development
leads to one question:

**How can manufacturers address the
increasing demand for LCAs?**

Stykka[®]

We make next generation
building interiors for large
scale real estate owners and
operators





DURABLE MATERIALS

DIGITALLY MANAGED



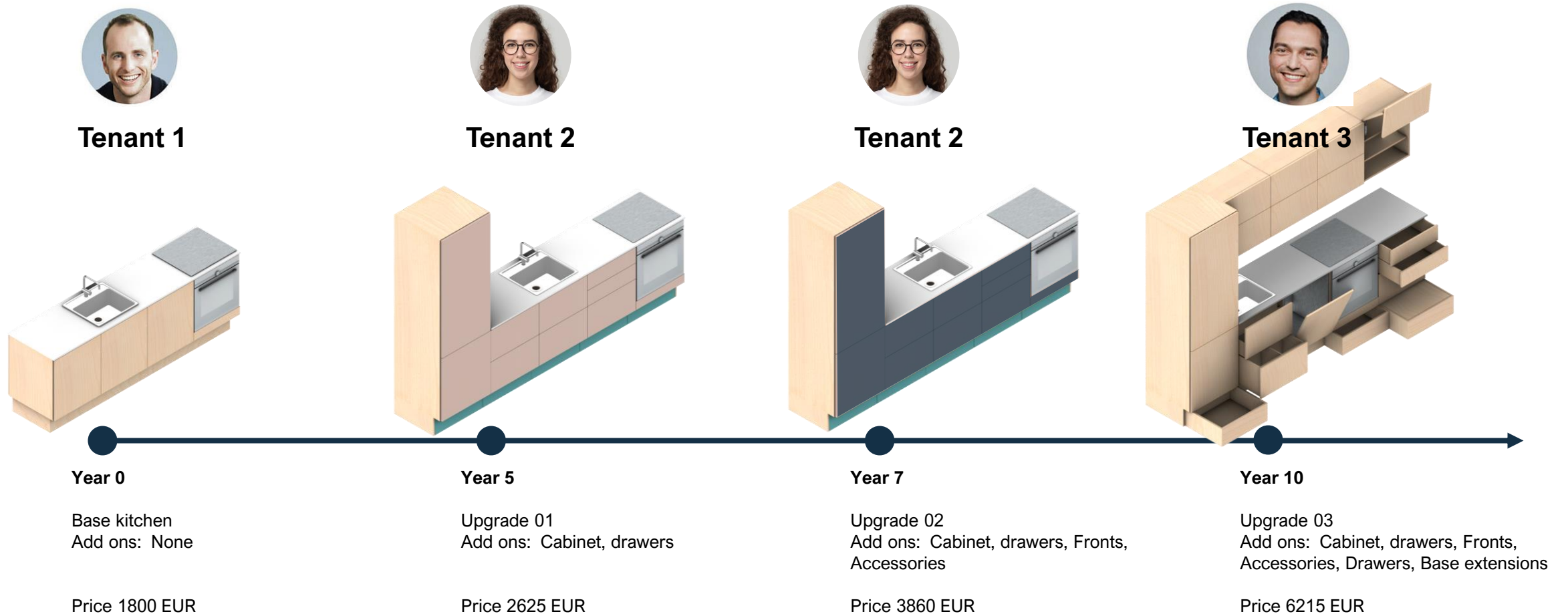


DESIGNED FOR DISASSEMBLY



Seamless Upgrades and Maintenance

The combination of our physical products and our digital twin technology allows for installed products to be repaired, upgraded, and reconfigured over time



Benefits

Product Owner:

Convenient way to repair and upgrade the product

Extend product life span

Save resources by 'repairing, instead of replacing'

Manufacturer:

Convert unknown product owners into life-long customers

Embed a web-shop in every product

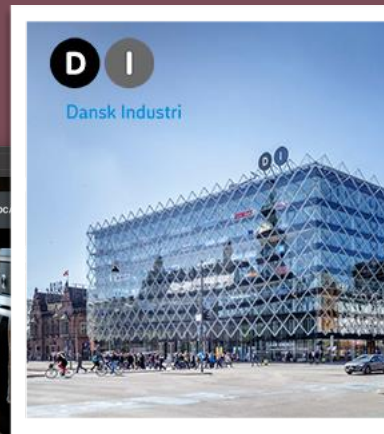
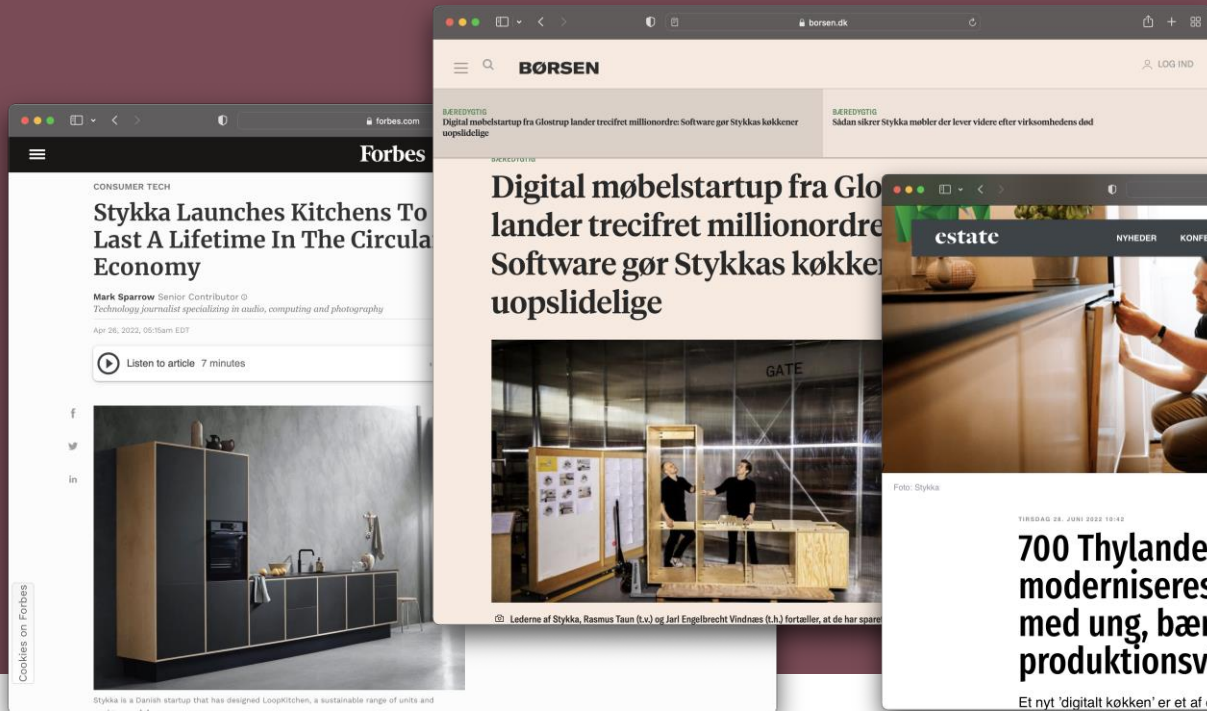
Sell spare parts and product upgrades using existing infrastructure

Improve products using actual usage data

Full compliance with future regulation: DPP, "Right to repair", LEAN, CBAM, ECO Label

Clients & Media

Stykkas™ © 2024 — Denmark



Overskud rundt 60 millioner kr. i Thylander – også 2022 tegner stærkt

PLUS, REDSKAB, INVESTERING



ONSDAG 24. FEBRUAR 2022
Thylander udvider partnerkredsen

THYLANDER

Danica Pension



Forbes

de
zeen

BØRSEN.

Home.Earth

PensionDanmark



Berlingske



estate

Heimstaden



atp=

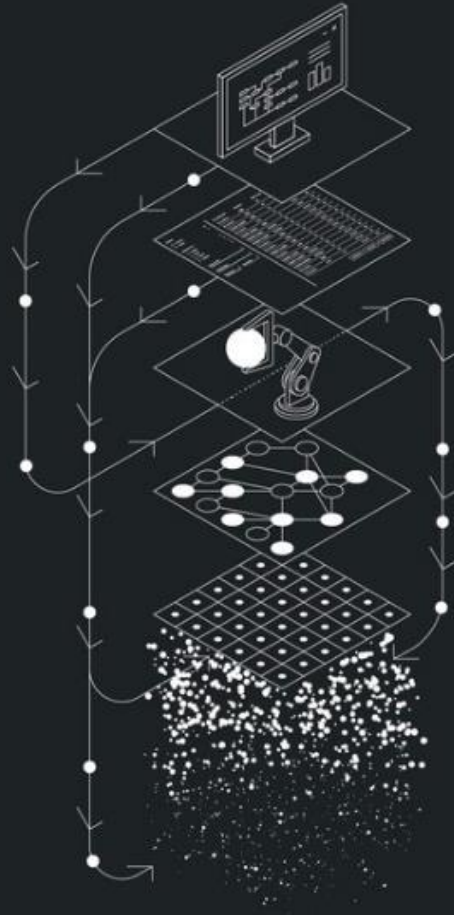


THE SUNDAY TIMES

WIRED

Stykkas®





Product Connect™

Turn any product connected, traceable and
effortlessly repairable.

Solution



Add a Product ID tag to any product

Use any phone to connect with the product



Product ID — A Next Gen. DPP



Digital Twin



Product History



Impact Data + Certifications



Web Shop



Verification

Fleet Management



Platform



ESG Reporting



Operations Reporting



Repairs, Spare parts



Certifications



Insurance



Bathroom furniture

Add product info

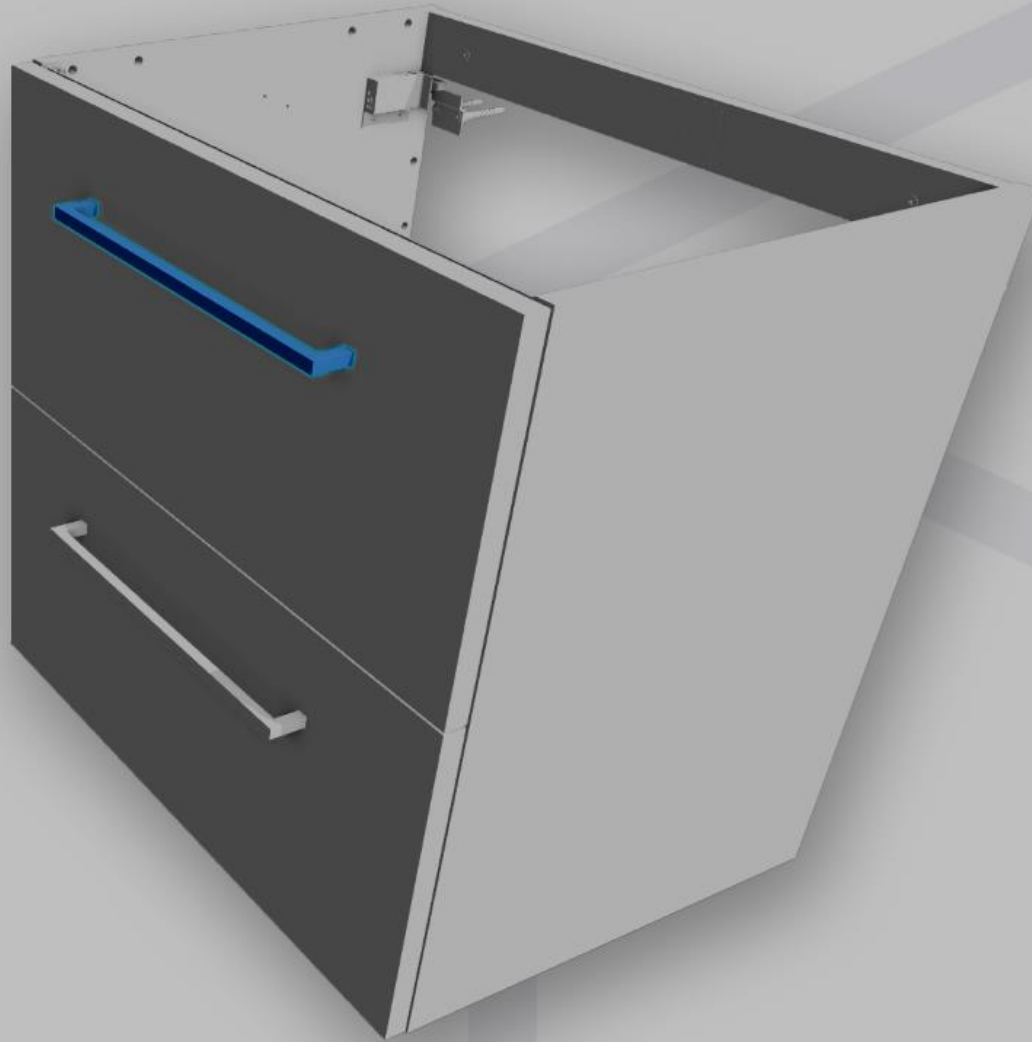
Above you can add the data that relates to the whole product and below you can add data for the individual components the product is made off.

122 Components

13.1% Done (16 of 122)

Component	Amount	Progress	Actions
 Handle handle_2x_combo-2..	2		>
 Tightening screw 16... combo16mm Cap 12...	16		... >
 - nail-23-4mm	16		>
 Existing Component 3,5-15SFØ_3,5-15S...	8	Check data	>
 - Threespin Cap 1213...	4		>
 - 5,0-60SU_5,0-60SU	16		>
 - 4,0-15SU_4,0-15SU	2		>





Handle

Spare part settings



Materials

Select one or more materials that the component 'Handle' is made of.



Metal



Plastic



Search for specific metal...

AI suggestion

☐ Steel

Metal types

☐ Aluminium

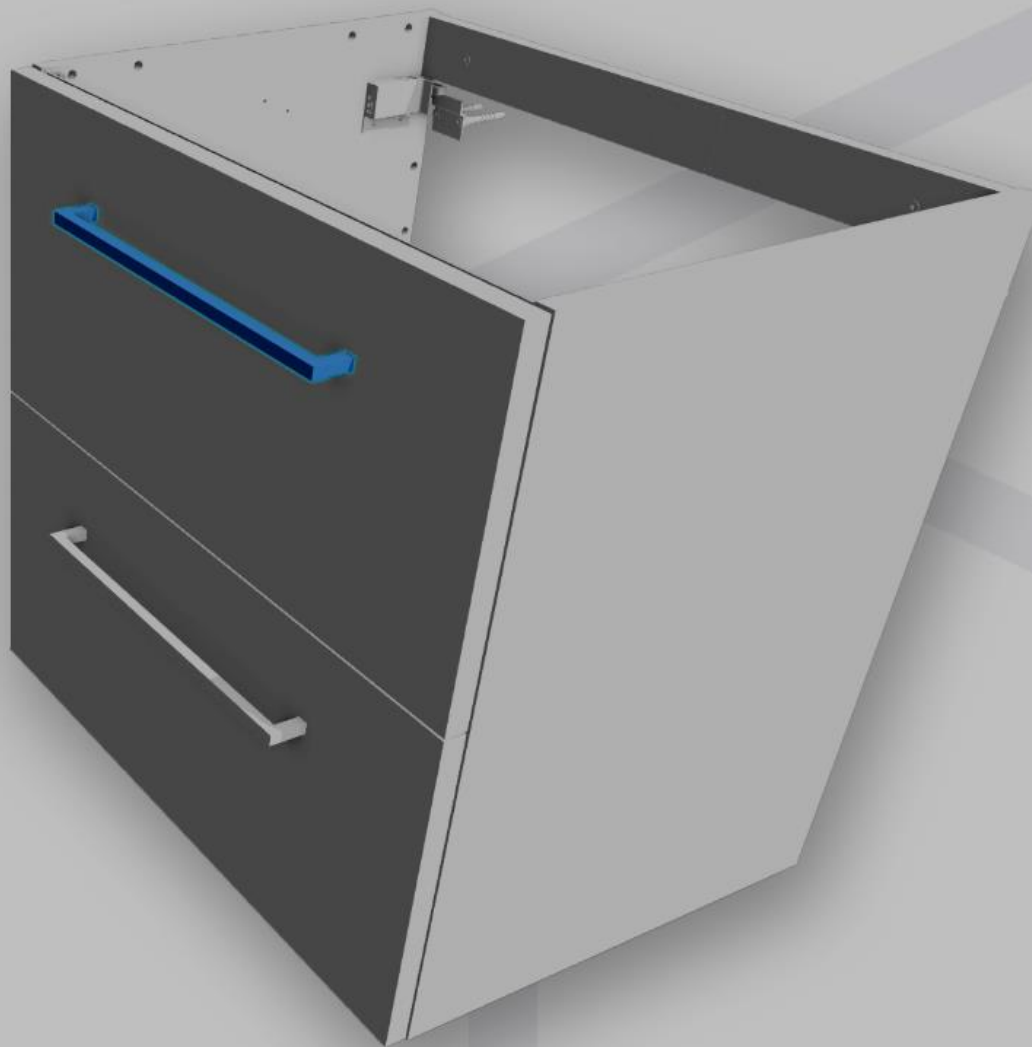
☐ Brass



Previous

Next





Handle

Spare part settings



Packaging & logistics for component

Here you inform the calculation about the efficiency of the packaging.

Components pr. batch

pcs

Delivered on pallet

no ☐ yes

Packing material*

Choose material

Weight of packaging

g

Return pallet

no ☐ yes

Return packing

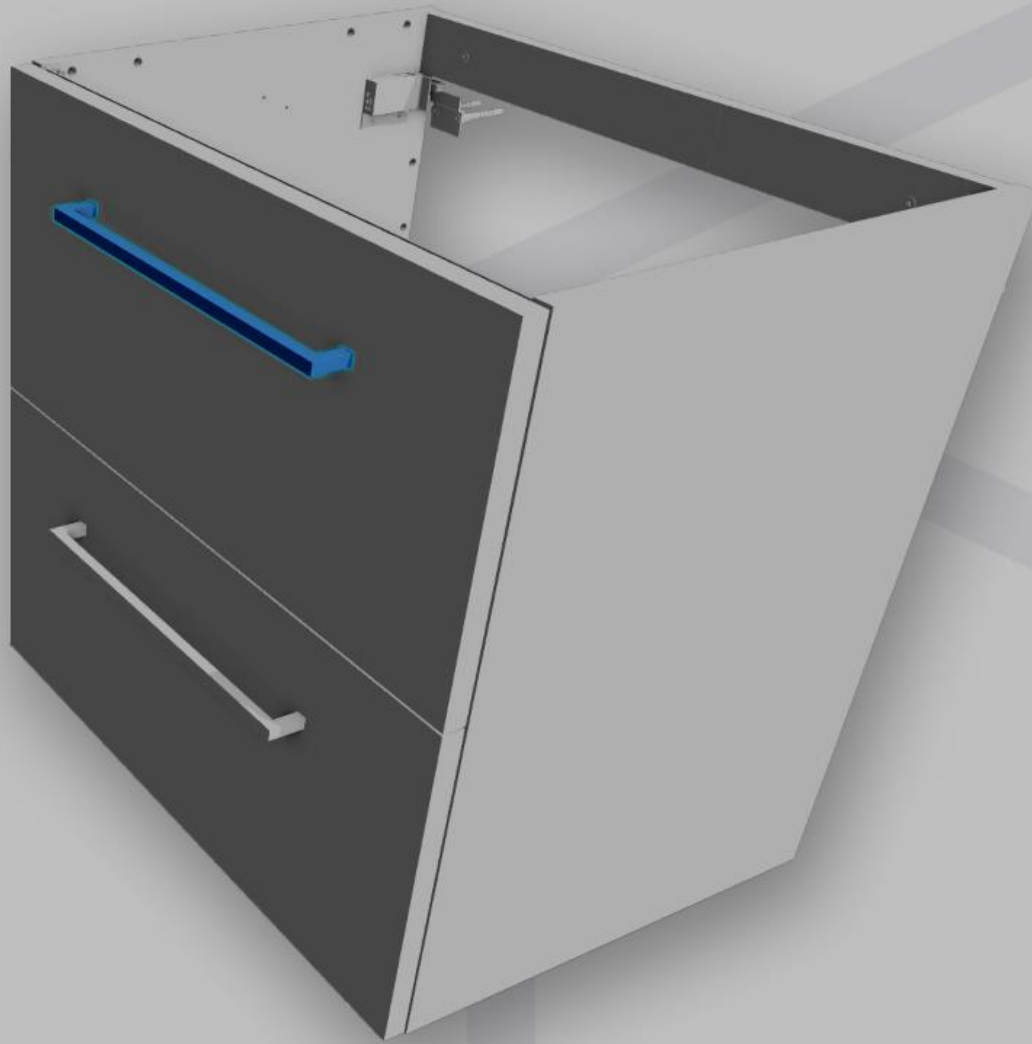
no ☐ yes

Here you inform the calculation about the efficiency of the transportation of the component to you.

Production site

Previous

Next



Handle

Spare part settings



Documentation

Any documents you have, that can verify your data can be added here.

Upload Invoice

Drop file here to upload...

Browse files

Upload other documentation (eg. FSC or PFSC certificate)

Drop file here to upload...

Browse files

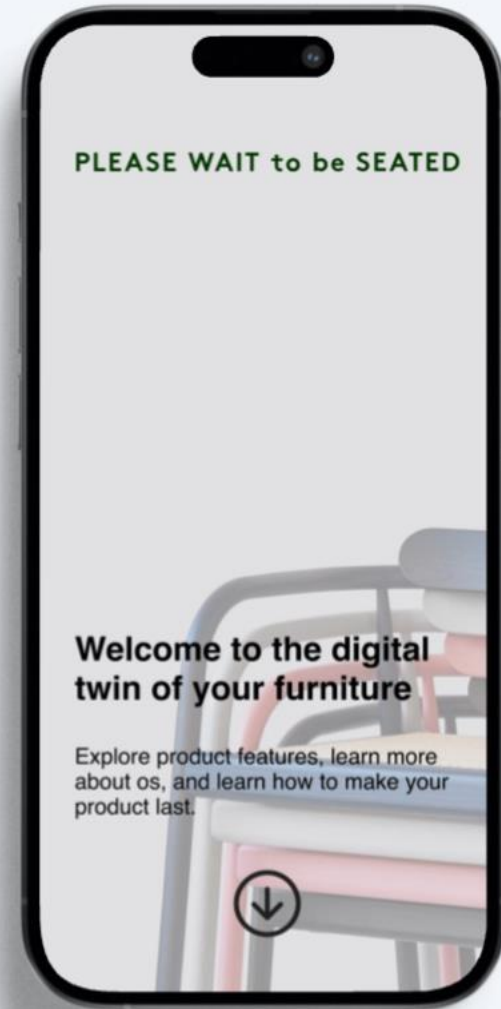
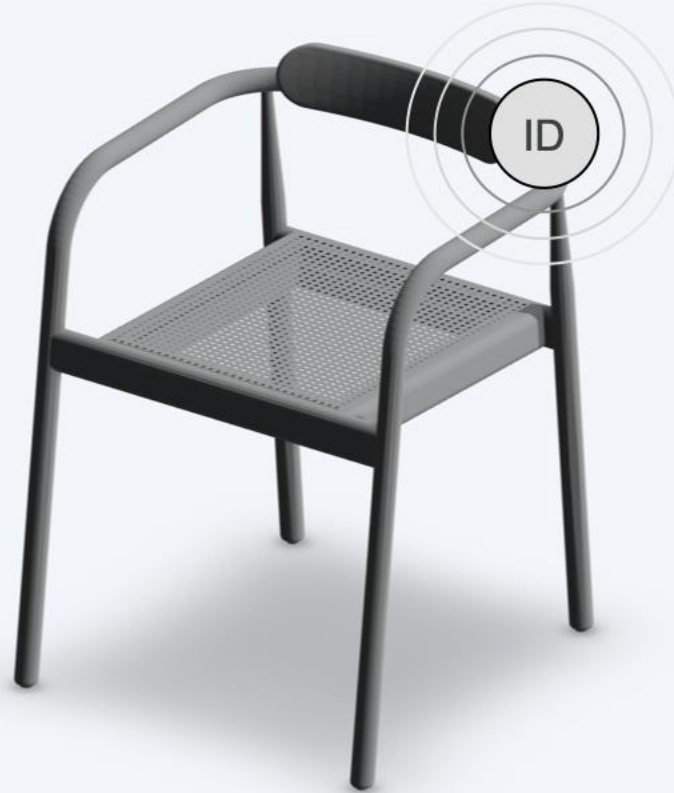
Previous

Done

User Front-end

Turn unknown product owners
into lifelong customers

Acquire new customers by turning
every product into a tool for lead-
generation.



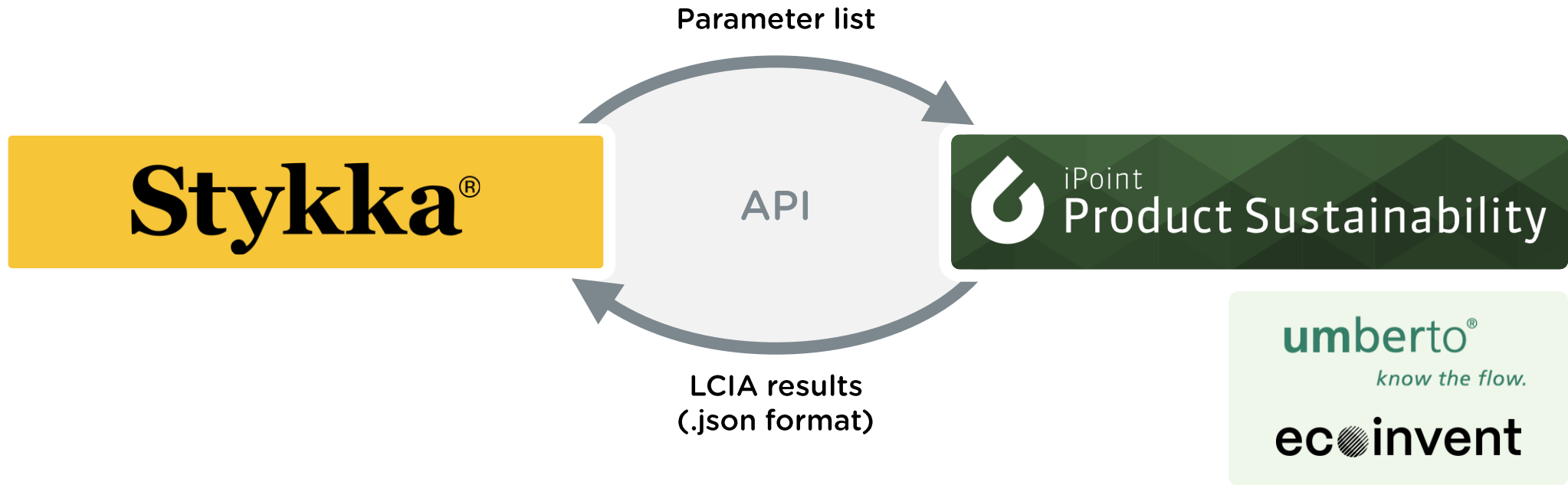
Manufacturer Back-end

Stykka™ © 2024 — Denmark

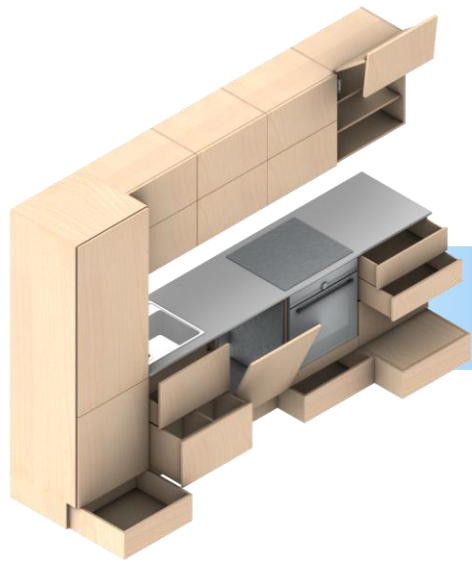


Automating LCA calculation

A list of parameter values is sent to PS Web.
Results are immediately returned via API.



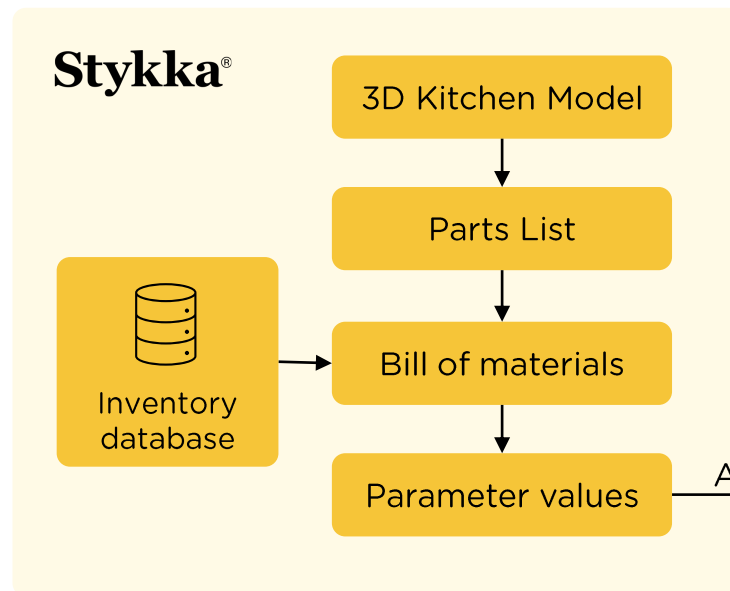
All materials, energy and transports are translated into parameter values



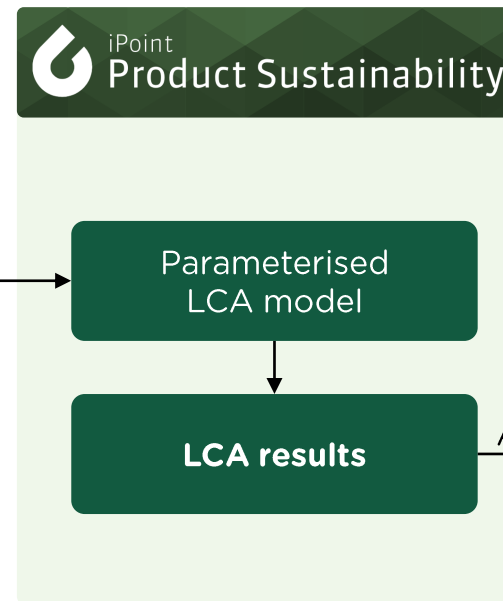
Model Parameters (71)					
Group	Name	Variable	Description	Amount	Unit
A1-A3 Wood in product	PLYBIRCH_PR P...	PLYBIRCH_PR		259.145	kg
A1-A3 Wood in product	CHIPBOARD_PR ...	CHIPBOARD_PR		59.347	kg
A1-A3 Wood in product	MDF_PR MDF i...	MDF_PR		0	kg
A1-A3 Wood in product	CORK_PR Cork ...	CORK_PR		0	kg
A1-A3 Surface materia...	LINO_PR LinoL...	LINO_PR		4.808	kg
A1-A3 Surface materia...	ADHESIVE_PR ...	ADHESIVE_PR		0.687	kg
A1-A3 Surface materia...	MELA_PR Mela...	MELA_PR		0	kg

Results may feed into diverse applications: From internal product optimisation to PCF, LCA, and EPD

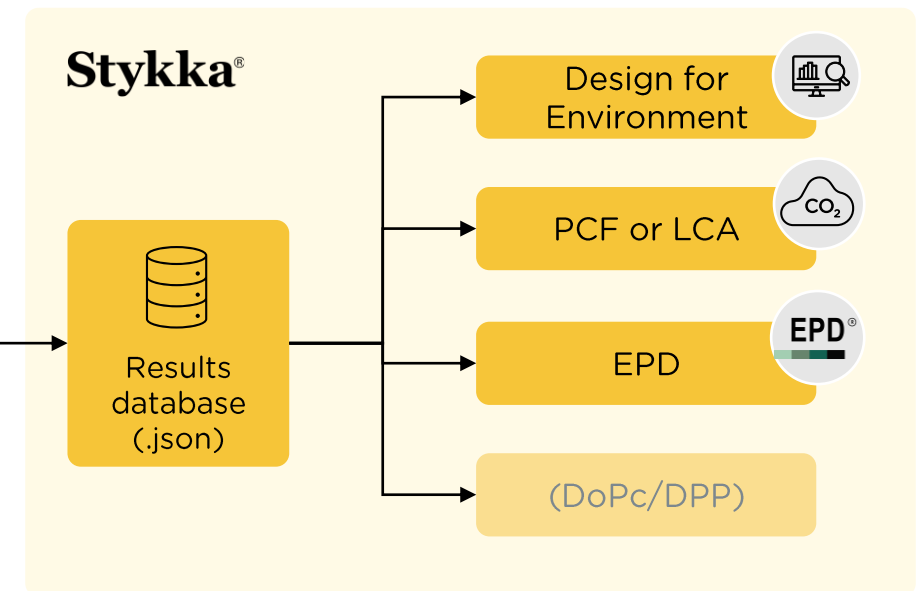
Inventory



Calculation



Further processing



The data contained in the .json is automatically processed into, for example, an EN-15804-compliant table

	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Environmental Impacts									
Global warming potential - Total (GWP-total)	kg CO2-eq.	1.0E+02	1.0E+00	7.28E-02	6.40E-02	9.39E-01	2.22E+00	9.40E-01	-1.49E+01
Global warming potential - fossil fuels (GWP-fossil)	kg CO2-eq.	1.08E+02	1.0E+00	1.86E-04	6.40E-02	9.38E-01	2.22E+00	9.38E-01	-1.48E+01
Global warming potential - biogenic (GWP-biogenic)	kg CO2-eq.	1.67E+00	9.54E-04	7.26E-02	2.79E-05	8.36E-04	2.67E-04	1.07E-03	-4.90E-02
Global warming potential - land use and land use change (GWP-landuc)	kg CO2-eq.	1.12E-01	5.41E-04	9.39E-08	8.05E-06	4.63E-04	6.20E-04	4.26E-04	-3.47E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11eq.	4.82E-06	2.39E-08	4.05E-12	1.34E-09	2.04E-08	9.74E-09	2.39E-08	-3.66E-07
Acidification potential, accumulated Exceedance (AP)	mol H+eq.	8.39E-01	2.40E-03	4.07E-07	5.66E-04	2.05E-03	4.48E-03	2.58E-03	-1.04E-01
Eutrophication potential - freshwater (EP-freshwater)	kg P-eq.	3.82E-02	7.79E-05	1.32E-08	2.99E-06	6.66E-05	2.21E-04	6.35E-05	-4.00E-03
Eutrophication potential - marine (EP-marine)	kg N-eq.	1.40E-01	6.04E-04	1.03E-07	2.63E-04	5.17E-04	1.33E-03	8.14E-04	-2.03E-02
Eutrophication potential - terrestrial (EP-terrestrial)	mol N-eq.	2.08E+00	6.14E-03	1.04E-06	2.85E-03	5.25E-03	1.33E-02	8.29E-03	-2.36E-01
Photochemical ozone creation potential (POCP)	kg NM VOC eq.	5.08E-01	3.72E-03	6.32E-07	8.59E-04	3.36E-03	4.07E-03	4.23E-03	-8.65E-02
Abiotic depletion potential - non-fossil resources (ADPE)	kg Sb-eq.	1.51E-03	3.66E-06	6.22E-10	2.82E-08	3.13E-06	1.85E-05	2.84E-06	-1.64E-04
Abiotic depletion potential - fossil resources (ADPF)	MJ	1.48E+03	1.57E+01	2.66E-03	8.36E-01	1.34E+01	7.02E+00	1.48E+01	-1.48E+02
Water deprivation potential (WDP)	m³ world eq. Deprived	5.09E+01	7.79E-02	1.32E-05	2.98E-03	6.66E-02	3.78E-01	6.85E-02	-3.65E+00
Use of Resources									
Renewable primary energy as an energy carrier (PERE)	MJ	1.39E+02	2.45E-01	6.69E-01	7.48E-03	2.09E-01	7.83E-01	2.42E-01	-6.65E+00
Renewable primary energy for material use (PERM)	MJ	1.37E+00	0.00E+00	-1.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total renewable primary energy (PERT)	MJ	1.40E+02	2.45E-01	-7.02E-01	7.48E-03	2.09E-01	7.83E-01	2.42E-01	-6.65E+00
Non-renewable primary energy as an energy carrier (PENRE)	MJ	1.46E+03	1.57E+01	8.98E-01	8.36E-01	1.34E+01	3.13E+01	1.48E+01	-1.48E+02
Non-renewable primary energy for material use (PENRM)	MJ	2.65E+01	0.00E+00	-8.95E-01	0.00E+00	0.00E+00	-2.43E+01	0.00E+00	0.00E+00
Total non-renewable primary energy (PENRT)	MJ	1.49E+03	1.57E+01	2.66E-03	8.36E-01	1.34E+01	7.02E+00	1.48E+01	-1.48E+02
Use of secondary materials (SM)	kg	5.41E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E+01
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m³	8.37E-01	1.89E-03	3.22E-07	4.63E-05	1.62E-03	4.37E-03	5.01E-03	-5.17E-02
Waste Categories									
Hazardous waste disposed (HWD)	kg	8.00E+00	1.07E-02	1.81E-06	6.15E-04	9.12E-03	3.66E-02	8.83E-03	-1.33E+00
Non-hazardous waste disposed (NHWD)	kg	1.56E+02	3.24E-01	5.50E-05	1.18E-02	2.77E-01	3.14E+00	3.02E-01	-9.77E+00
Radioactive waste disposed (RWD) - Total	kg	3.64E-03	5.12E-06	8.69E-10	1.64E-07	4.38E-06	1.25E-05	4.46E-06	3.15E-05
Output Categories									
Components for Reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	2.02E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E+01	0.00E+00	0.00E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electric (EEE)	MJ	0.00E+00	0.00E+00	7.56E-02	0.00E+00	0.00E+00	2.81E+00	0.00E+00	0.00E+00
Exported energy, thermal (EET)	MJ	0.00E+00	0.00E+00	1.47E-01	0.00E+00	0.00E+00	5.49E+00	0.00E+00	0.00E+00
Additional Impact Categories and Indicators									
Particulate matter emissions potential (PM)	Incidence of disease	1.03E-05	8.17E-08	1.39E-11	1.59E-08	6.99E-08	7.38E-08	8.06E-08	-1.30E-06
Ionizing radiation potential - human health (IRP)	kBq U235-eq.	1.51E+01	2.11E-02	3.58E-06	6.85E-04	1.80E-02	4.90E-02	1.85E-02	1.16E-01
Eco-toxicity potential - freshwater (ETP-fw)	CTUeq	9.52E+02	7.70E+00	1.13E-03	3.53E-01	6.59E+00	8.25E+00	7.03E+00	-8.09E+01
Human toxicity, cancer effects (HTP-c)	CTUh	3.43E-07	5.01E-10	8.52E-14	3.09E-11	4.29E-10	8.36E-10	4.13E-10	8.00E-08
Human toxicity, non-cancer effects (HTP-nc)	CTUh	1.83E-06	1.11E-08	1.89E-12	1.61E-10	9.52E-09	2.59E-08	8.79E-09	-9.21E-08
Soil quality potential (SQP)	dimensionless	4.52E+02	9.41E+00	1.60E-03	5.67E-02	8.05E+00	1.14E+01	1.35E+01	-3.26E+01

A major part of the impact categories is calculated as usual:

Environmental indicators (e.g. GWP, AP, POCP)

PERT and PENRT

Fresh water

Waste categories

Additional impact categories

The data contained in the .json is automatically processed into, for example, an EN-15804-compliant table

	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Environmental Impacts									
Global warming potential - Total (GWP-total)	kg CO2-eq.	1.0E+02	1.0E+00	7.28E-02	6.40E-02	9.39E-01	2.22E+00	9.40E-01	-1.49E+01
Global warming potential - fossil fuels (GWP-fossil)	kg CO2-eq.	1.08E+02	1.0E+00	1.86E-04	6.40E-02	9.38E-01	2.22E+00	9.38E-01	-1.48E+01
Global warming potential - biogenic (GWP-biogenic)	kg CO2-eq.	1.67E+00	9.54E-04	7.26E-02	2.79E-05	8.36E-04	2.67E-04	1.07E-03	-4.90E-02
Global warming potential - land use and land use change (GWP-landuc)	kg CO2-eq.	1.12E-01	5.41E-04	9.39E-08	8.05E-06	4.63E-04	6.20E-04	4.26E-04	-3.47E-03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11eq.	4.82E-06	2.39E-08	4.05E-12	1.34E-09	2.04E-08	9.74E-09	2.39E-08	-3.66E-07
Acidification potential, accumulated Exceedance (AP)	mol H+eq.	8.39E-01	2.40E-03	4.07E-07	5.66E-04	2.05E-03	4.48E-03	2.58E-03	-1.04E-01
Eutrophication potential - freshwater (EP-freshwater)	kg P-eq.	3.82E-02	7.79E-05	1.32E-08	2.99E-06	6.66E-05	2.21E-04	6.35E-05	-4.00E-03
Eutrophication potential - marine (EP-marine)	kg N-eq.	1.40E-01	6.04E-04	1.03E-07	2.63E-04	5.17E-04	1.33E-03	8.14E-04	-2.03E-02
Eutrophication potential - terrestrial (EP-terrestrial)	mol N-eq.	2.08E+00	6.14E-03	1.04E-06	2.85E-03	5.25E-03	1.33E-02	8.29E-03	-2.36E-01
Photochemical ozone creation potential (POCP)	kg NM VOC eq.	5.08E-01	3.72E-03	6.32E-07	8.59E-04	3.36E-03	4.07E-03	4.23E-03	-8.65E-02
Abiotic depletion potential - non-fossil resources (ADPE)	kg Sb-eq.	1.51E-03	3.66E-06	6.22E-10	2.82E-08	3.13E-06	1.85E-05	2.84E-06	-1.64E-04
Abiotic depletion potential - fossil resources (ADPF)	MJ	1.48E+03	1.57E+01	2.66E-03	8.36E-01	1.34E+01	7.02E+00	1.48E+01	-1.48E+02
Water deprivation potential (WDP)	m³ world eq. Deprived	5.09E+01	7.79E-02	1.32E-05	2.98E-03	6.66E-02	3.78E-01	6.85E-02	-3.65E+00
Use of Resources									
Renewable primary energy as an energy carrier (PERE)	MJ	1.39E+02	2.45E-01	6.69E-01	7.48E-03	2.09E-01	7.83E-01	2.42E-01	-6.65E+00
Renewable primary energy for material use (PERM)	MJ	1.37E+00	0.00E+00	-1.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total renewable primary energy (PERT)	MJ	1.40E+02	2.45E-01	-7.02E-01	7.48E-03	2.09E-01	7.83E-01	2.42E-01	-6.65E+00
Non-renewable primary energy as an energy carrier (PENRE)	MJ	1.46E+03	1.57E+01	8.98E-01	8.36E-01	1.34E+01	3.13E+01	1.48E+01	-1.48E+02
Non-renewable primary energy for material use (PENRM)	MJ	2.65E+01	0.00E+00	-8.95E-01	0.00E+00	0.00E+00	-2.43E+01	0.00E+00	0.00E+00
Total non-renewable primary energy (PENRT)	MJ	1.49E+03	1.57E+01	2.66E-03	8.36E-01	1.34E+01	7.02E+00	1.48E+01	-1.48E+02
Use of secondary materials (SM)	kg	5.41E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E+01
Use of renewable secondary fuels (RSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels (NRSF)	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (FW)	m³	8.37E-01	1.89E-03	3.22E-07	4.63E-05	1.62E-03	4.37E-03	5.01E-03	-5.17E-02
Waste Categories									
Hazardous waste disposed (HWD)	kg	8.00E+00	1.07E-02	1.81E-06	6.15E-04	9.12E-03	3.66E-02	8.83E-03	-1.33E+00
Non-hazardous waste disposed (NHWd)	kg	1.56E+02	3.24E-01	5.50E-05	1.18E-02	2.77E-01	3.14E+00	3.02E-01	-9.77E+00
Radioactive waste disposed (RWD) - Total	kg	3.64E-03	5.12E-06	8.69E-10	1.64E-07	4.38E-06	1.25E-05	4.46E-06	3.15E-05
Output Categories									
Components for Reuse (CRU)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	kg	2.02E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E+01	0.00E+00	0.00E+00
Materials for energy recovery (MER)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electric (EEE)	MJ	0.00E+00	0.00E+00	7.56E-02	0.00E+00	0.00E+00	2.81E+00	0.00E+00	0.00E+00
Exported energy, thermal (EET)	MJ	0.00E+00	0.00E+00	1.47E-01	0.00E+00	0.00E+00	5.49E+00	0.00E+00	0.00E+00
Additional Impact Categories and Indicators									
Particulate matter emissions potential (PM)	Incidence of disease	1.03E-05	8.17E-08	1.39E-11	1.59E-08	6.99E-08	7.38E-08	8.06E-08	-1.30E-06
Ionizing radiation potential - human health (IRP)	kBq U235-eq.	1.51E+01	2.11E-02	3.58E-06	6.85E-04	1.80E-02	4.90E-02	1.85E-02	1.16E-01
Eco-toxicity potential - freshwater (ETP-fw)	CTUe	9.52E+02	7.70E+00	1.13E-03	3.53E-01	6.59E+00	8.25E+00	7.03E+00	-8.09E+01
Human toxicity, cancer effects (HTP-c)	CTUh	3.43E-07	5.01E-10	8.52E-14	3.09E-11	4.29E-10	8.36E-10	4.13E-10	8.00E-08
Human toxicity, non-cancer effects (HTP-nc)	CTUh	1.83E-06	1.11E-08	1.89E-12	1.61E-10	9.52E-09	2.59E-08	8.79E-09	-9.21E-08
Soil quality potential (SQP)	dimensionless	4.52E+02	9.41E+00	1.60E-03	5.67E-02	8.05E+00	1.14E+01	1.35E+01	-3.26E+01

...others can only be evaluated when modelling is in compliance with certain rules

PERE, PERM
PENRE, PENRM

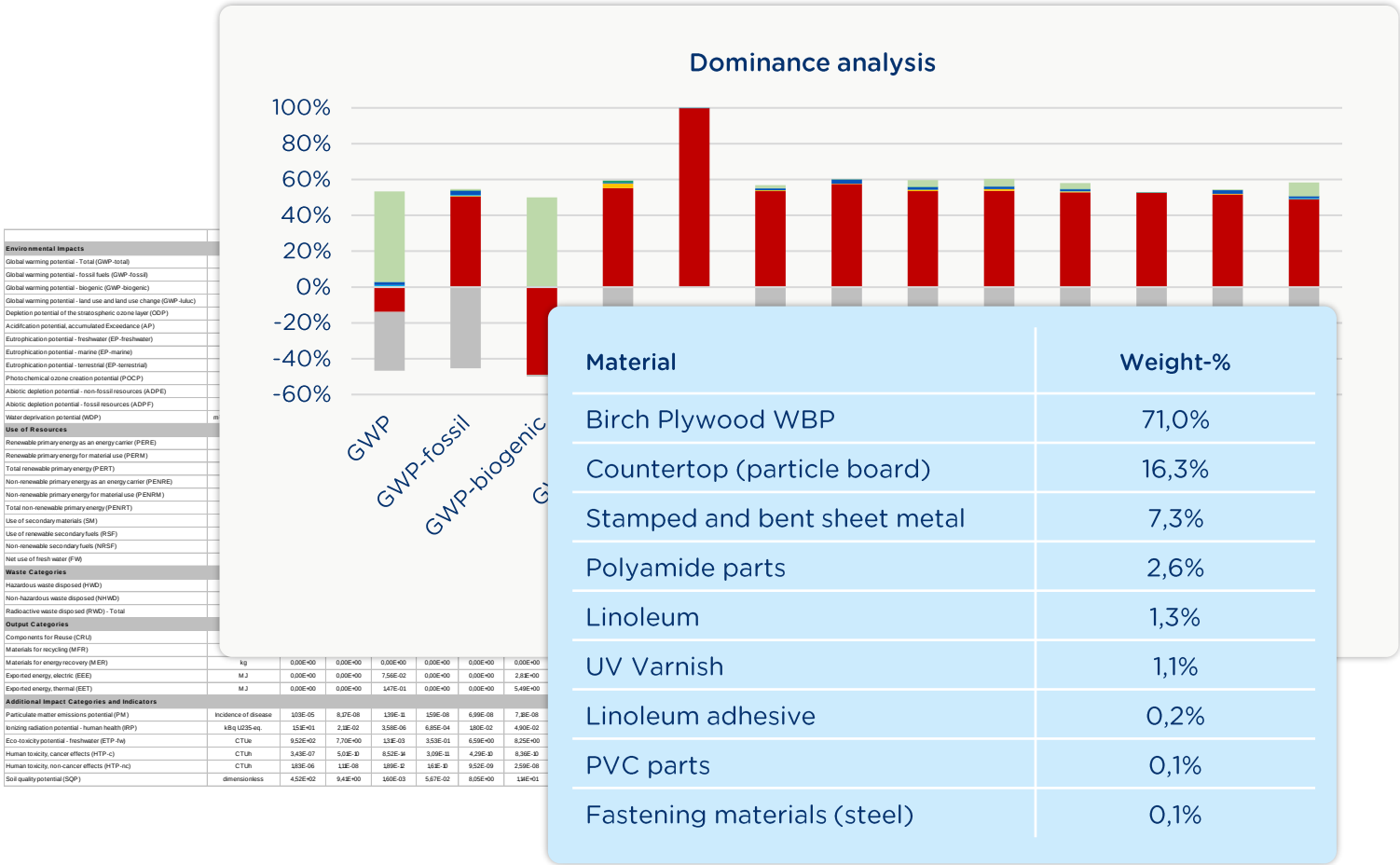
SM, RSF, NRSF

Output categories

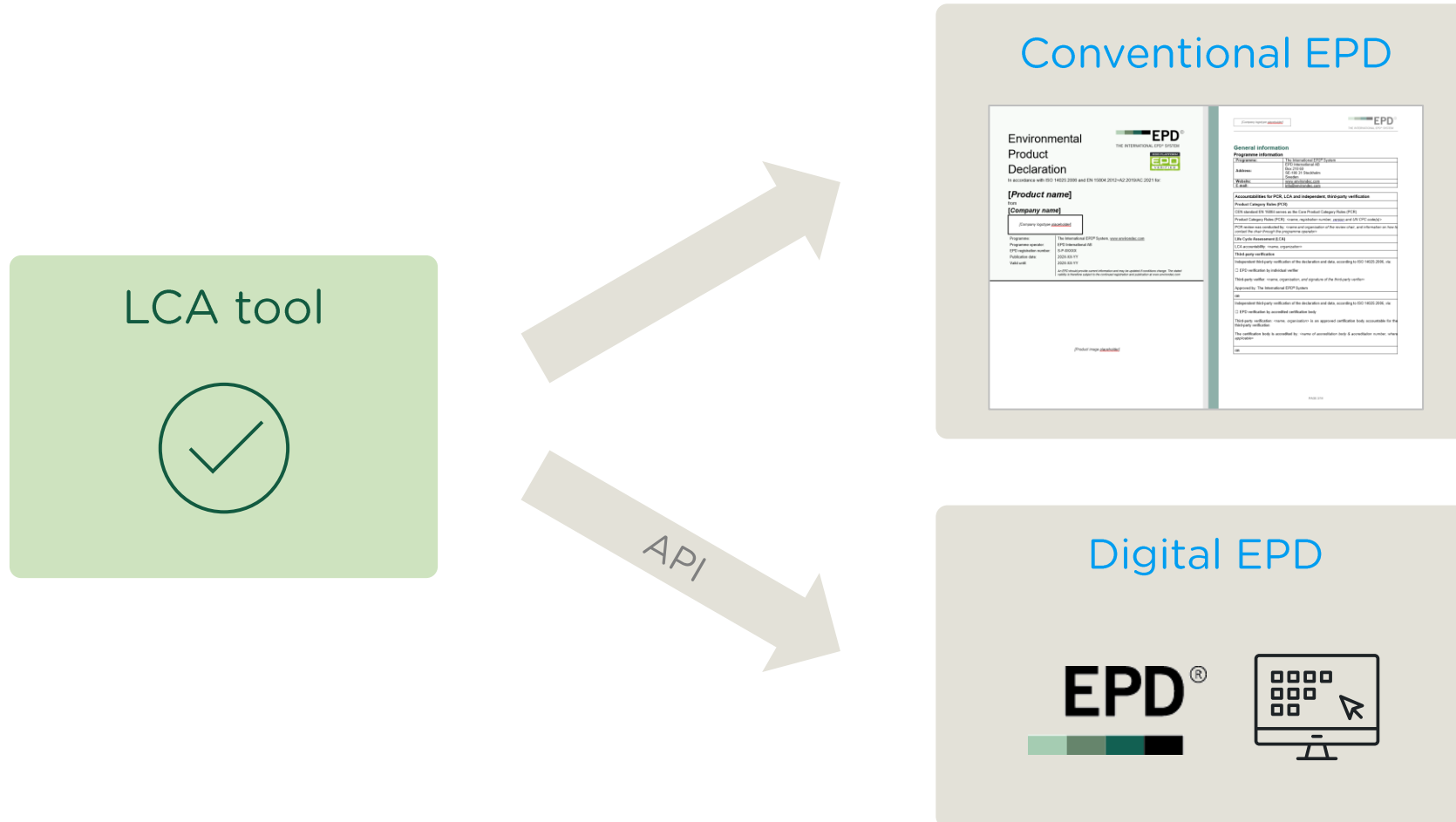
The JSON file also allows further analyses such as export of inventory data and graphics

Examples for automated reporting features:

- Life Cycle Inventory table
- Ready-to-use graphics
- Comparison of inventory items vs. impacts
- Dataset mapping table



The Final Steps Towards Full Integration



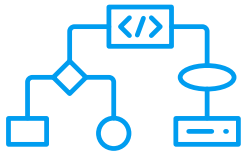
Thank you!

Bright
ideas.
Sustainable
change.

RAMBOLL

How can we make mass creation of LCAs faster, more efficient and more affordable?

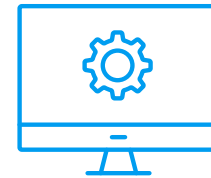
Key Considerations



LCA models covering a maximum of products



Empowering Non-Experts



Integration with software systems (e.g., CAD, ERP)