Nordic Climate Forum for Construction

Efficient calculation of LCA and design optimization

Knut Ramstad, Partner and CTO

Nordic Office of Architecture

Professor at NTNU

Nordic Office of Architecture

We are Nordic

400+
people

5
offices
Oslo
Reykjavík
Copenhagen
Aarhus
Aalborg

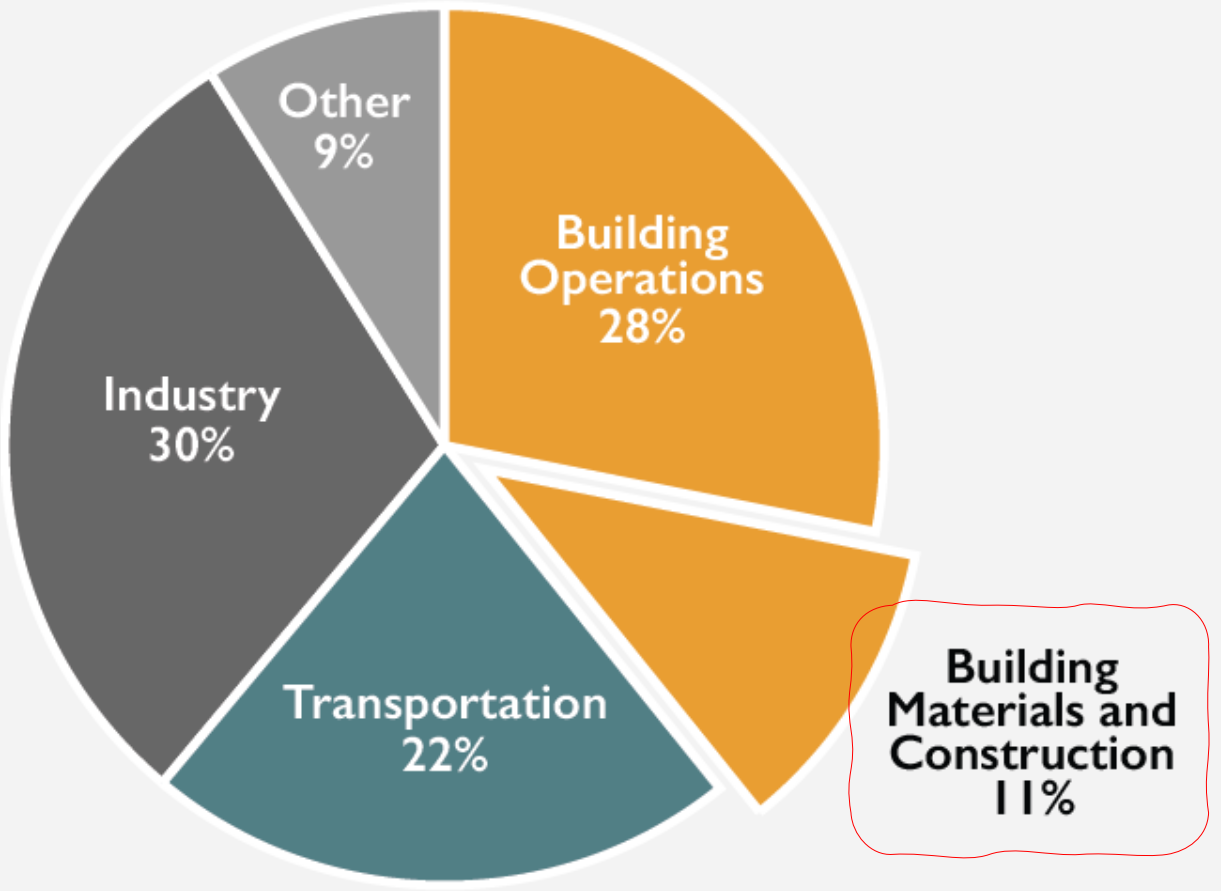
Nordic Office of Architecture

Norconsult

MANAGEMENT SYSTEM CERTIFICATION DNV ISO 9001 • ISO 14001

MANAGEMENT SYSTEM CERTIFICATION DNV ISO 9001 • ISO 14001

Global CO_2 Emission by Sector



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The Challenge:

To track the CO2 bound in materials
for our projects.

WITHOUT

The need to carry out complex, independent simulations (that require specialized expertise and software.)

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The Solution:

Should help raise awareness in our teams

Should be accessible for all our architects

Should not require specialized knowledge

Should not require separate software

Should initiate competition among market areas and projects

Should result in lower emissions!

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GOALS

OVERVIEW

APPROACH

STATUS

DeclAIre

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Create a tool that:

- Provide an **overview of CO2e** in the portfolio over time.
- Ensure **ease of use** so that everyone can access it
- Utilise **existing tools** and knowledge
- Design the system to be **expandable** and adaptable over time.
- Comply with **reporting requirements** for ISO 14001
- Create a **dashboard** that everyone can follow.
- Share positive experiences and **insights** about Nordic for all employees and visitors.

A1 - A3 Product stage
- **A1** Raw material extraction
- **A2** Transport to manufacturing site
- **A3** Manufacturing

A4 - A5 Construction stage
- **A4** Transport to construction site
- **A5** Installation / Assembly

B1 - B5 Use stage
- **B1** Use
- **B2** Maintenance
- **B3** Repair
- **B4** Replacement
- **B5** Refurbishment
- **B6** Operational energy use
- **B7** Operational water use

C1 - C4 End of life stage
- **C1** Deconstruction & demolition
- **C2** Transport
- **C3** Waste processing
- **C4** Disposal

D - Benefits and loads beyond system boundary

Reuse, recovery and/or recycling potentials, expressed as net impacts and benefits

Image: Courtesy of OneClick LCA

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Approach:

1. **Extract relevant greenhouse gas** data into Autodesk Revit and enhance the model with this data and metadata.

2. Retrieve relevant data from Revit using the **simplest method possible** (One Button).

3. Present relevant data in a format that is **easy to understand** (e.g., on a screen).

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1. Extract relevant greenhouse gas data into Revit and enhance the model with this data and metadata.

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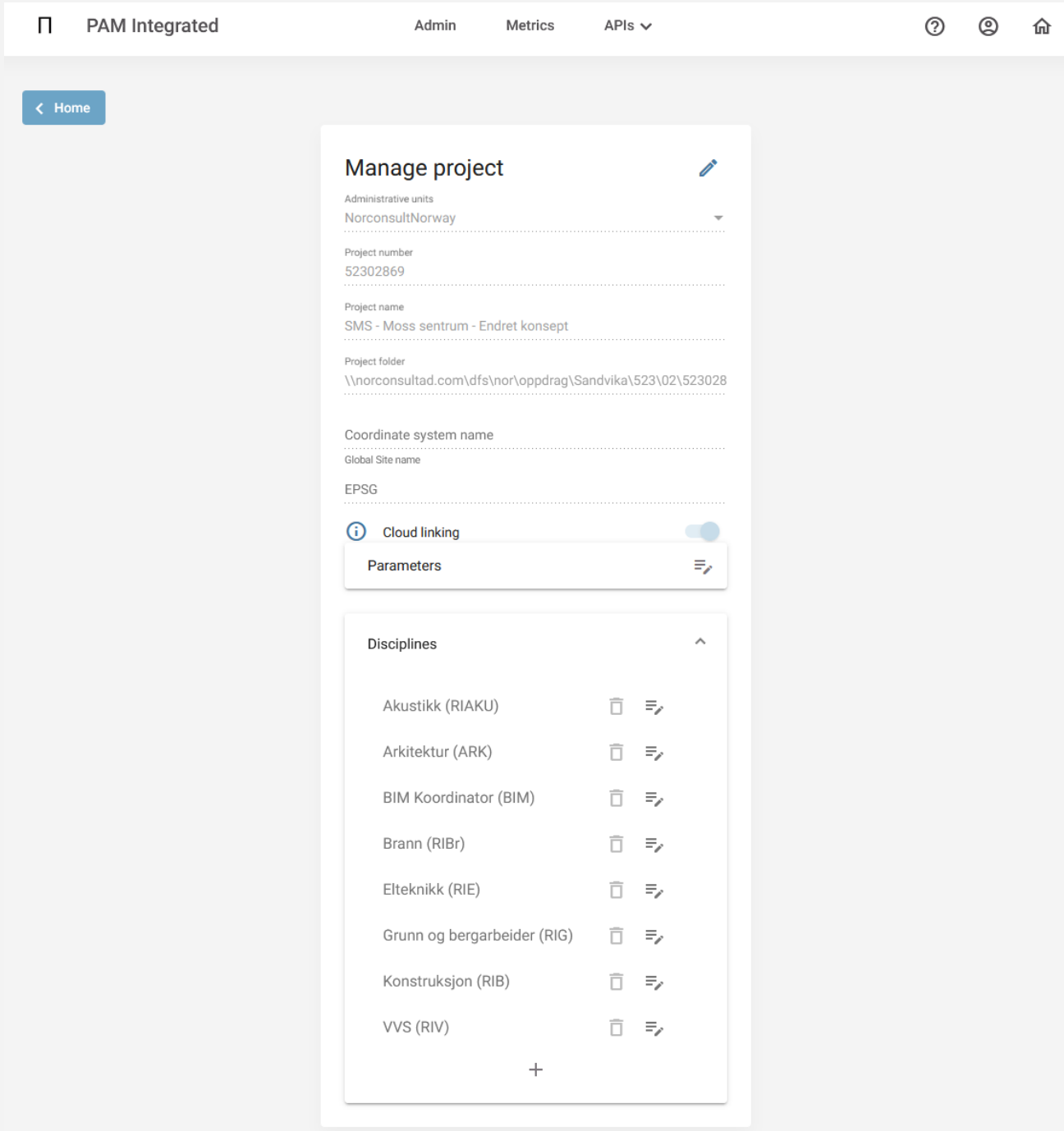

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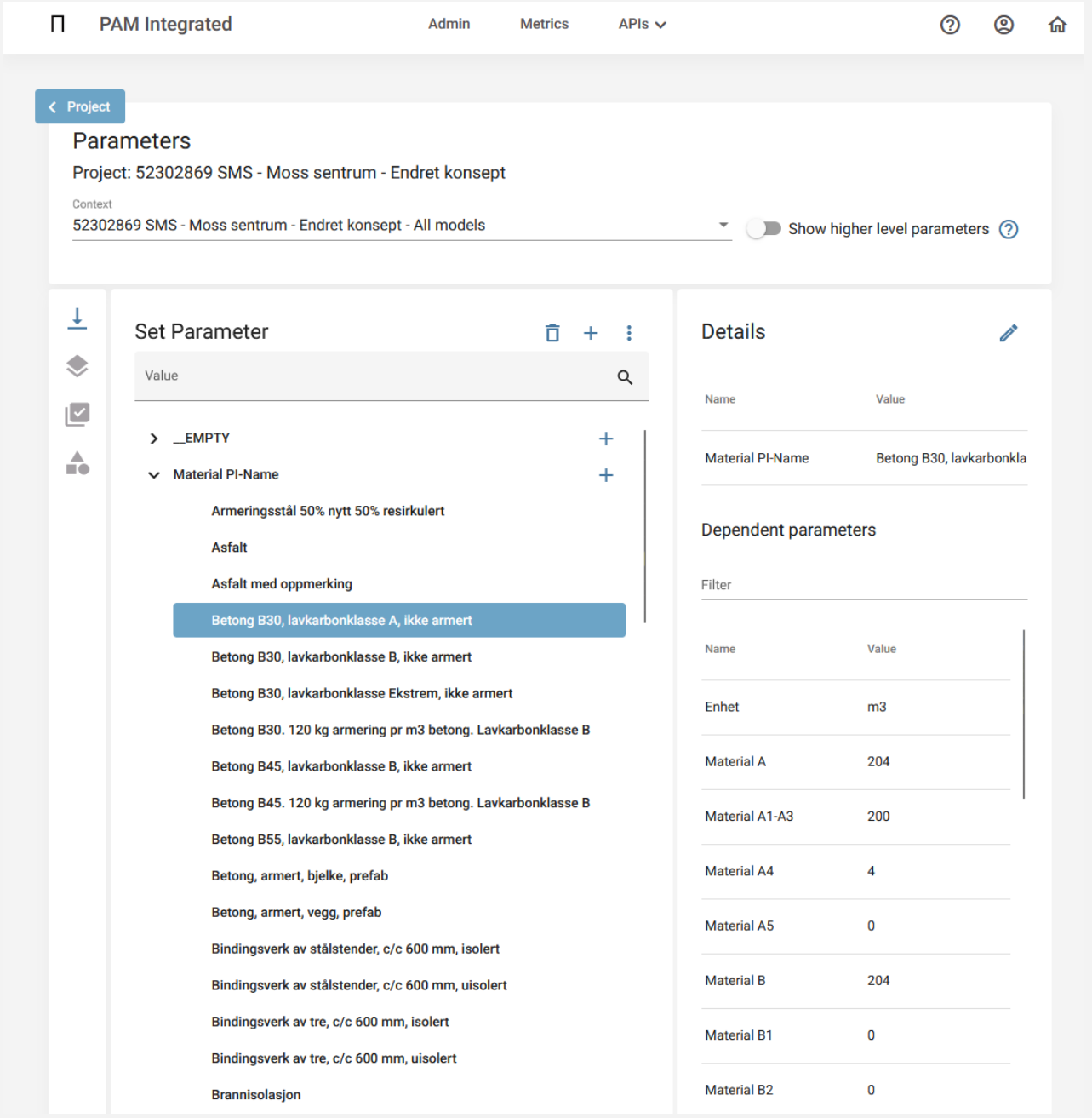

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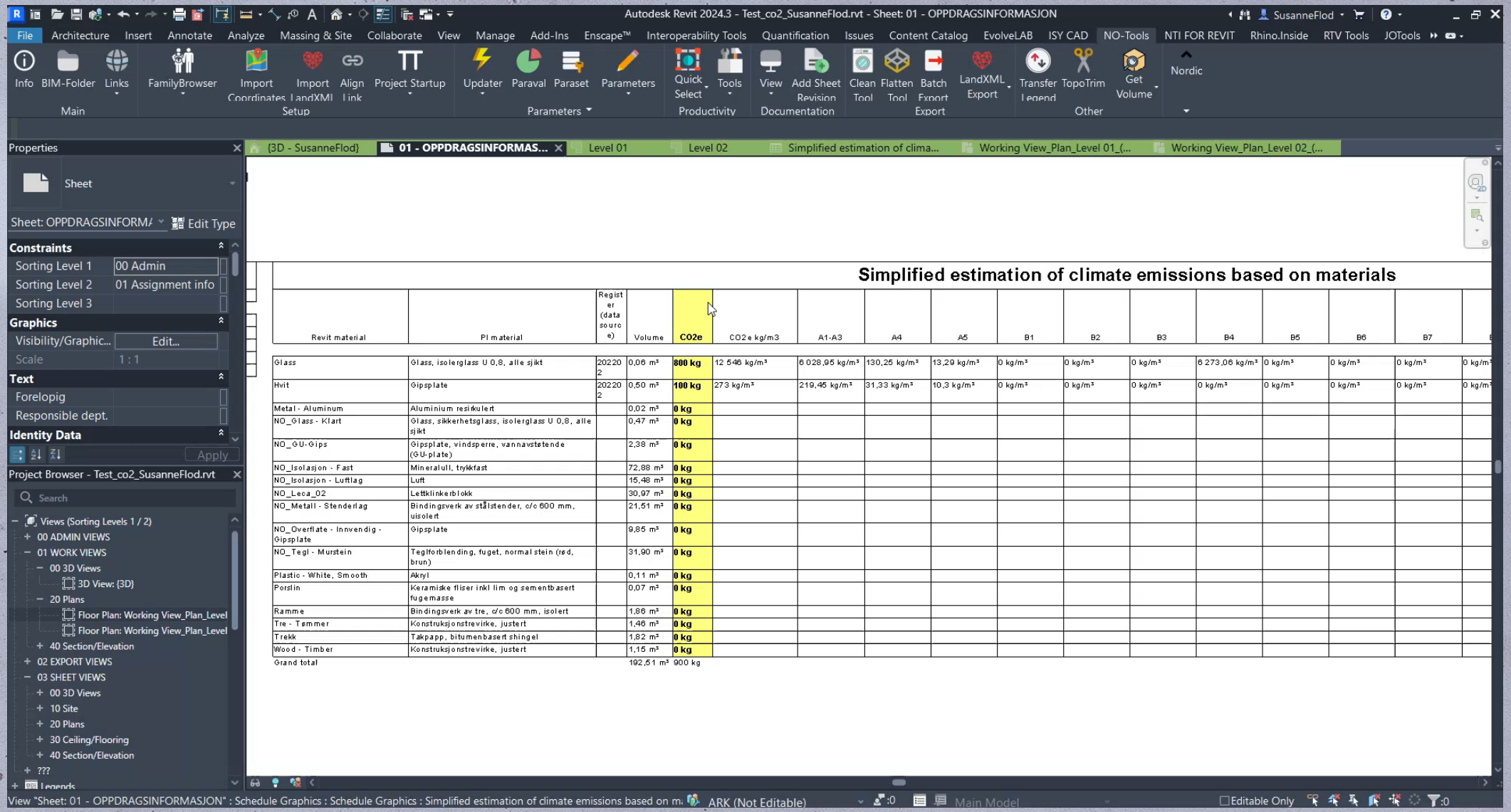

Revit material	PI material	Register (data source)	Volume	CO2e	CO2e kg/m3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7
Glass	Glass, isolerglass U 0,8, alle sjikt	20220202	0,06 m³	800 kg	12 546 kg/m³	6 028,95 kg/m³	130,25 kg/m³	13,29 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	6 273,06 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³
Hvit	Gipsplate	20220202	0,50 m³	100 kg	273 kg/m³	219,45 kg/m³	31,33 kg/m³	10,3 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³	0 kg/m³
Metal - Aluminum	Aluminium resirkulert		0,02 m³	0 kg												
NO_Glass - Klart	Glass, sikkerhetsglass, isolerglass U 0,8, alle sjikt		0,47 m³	0 kg												
NO_GU-Gips	Gipsplate, vindsperre, vannavstøtende (GU-plate)		2,38 m³	0 kg												
NO_Isolasjon - Fast	Mineralull, trykkfast		72,88 m³	0 kg												
NO_Isolasjon - Lufttag	Luft		15,48 m³	0 kg												
NO_Leca_02	Lettklinkerblokk		30,97 m³	0 kg												
NO_Metall - Stenderlag	Bindingsverk av stålstender, c/c 600 mm, uisolert		21,51 m³	0 kg												
NO_Overflate - Innvendig - Gipsplate	Gipsplate		9,85 m³	0 kg												
NO_Tegl - Murstein	Teglforblending, fuget, normal stein (rød, brun)		31,90 m³	0 kg												
Plastic - White, Smooth	Akryl		0,11 m³	0 kg												
Porslin	Keramiske fliser inkl lim og sementbasert fugemasse		0,07 m³	0 kg												
Ramme	Bindingsverk av tre, c/c 600 mm, isolert		1,86 m³	0 kg												
Tre - Tømmer	Konstruksjonstrevirke, justert		1,46 m³	0 kg												
Trekk	Takpapp, bitumenbasert shingel		1,82 m³	0 kg												
Wood - Timber	Konstruksjonstrevirke, justert		1,15 m³	0 kg												
Grand total			192,51 m³	900 kg												

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2. Retrieve relevant data from Revit using the **simplest method possible** (One Button).

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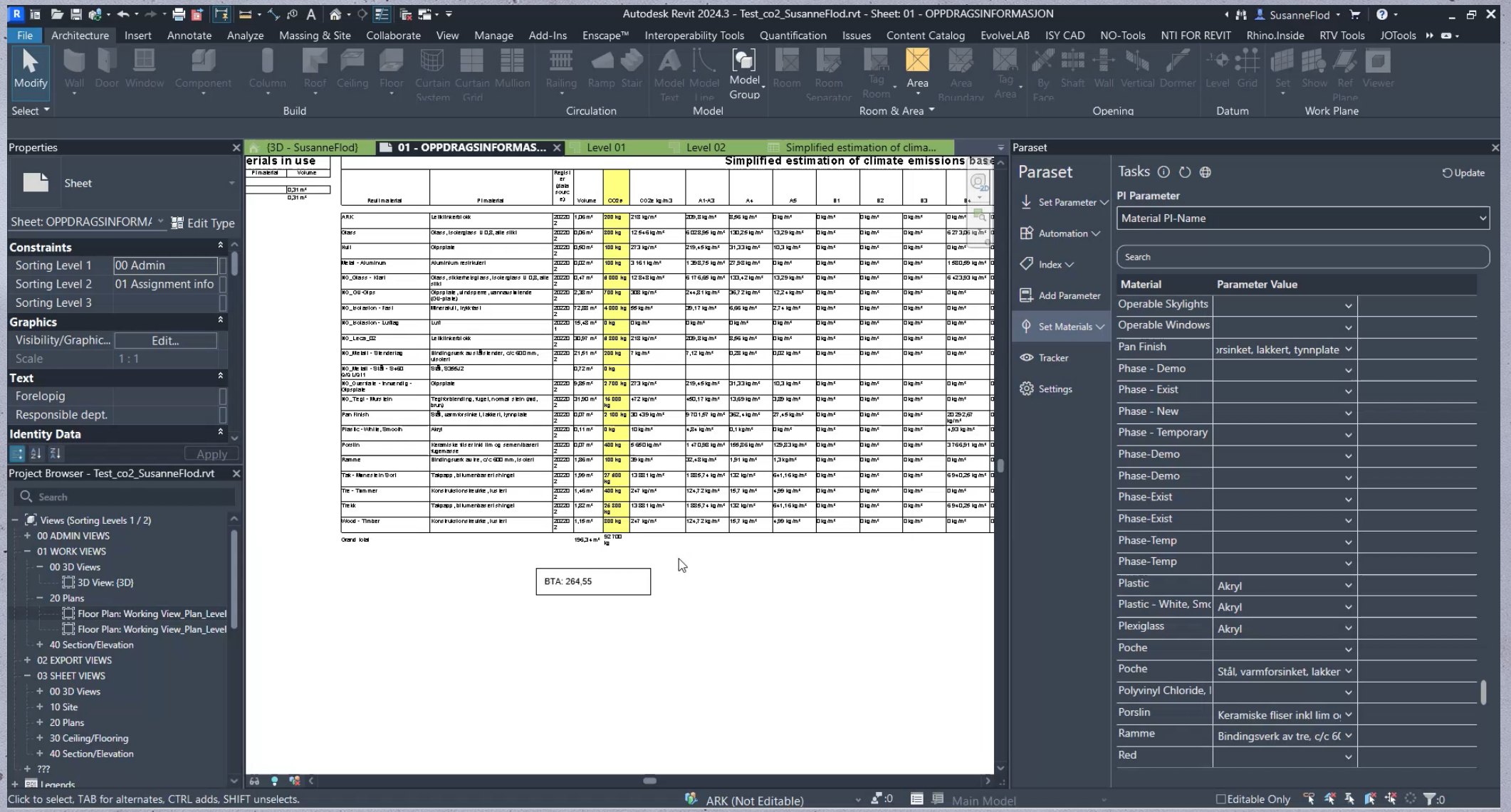

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3. Present relevant data in an easily understandable format (Screen).

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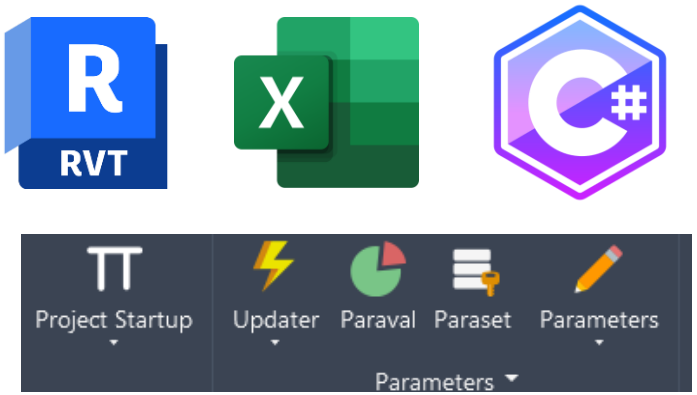
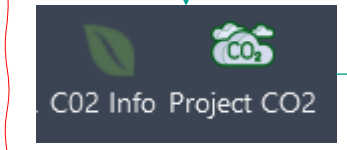
What's behind?

Existing Tools

Existing Climate Database





Dashboard

Microsoft Power Platform

Power BI
Business analytics

Power Apps
App development

Power Automate
Process automation

Power Pages
External-facing websites

SharePoint

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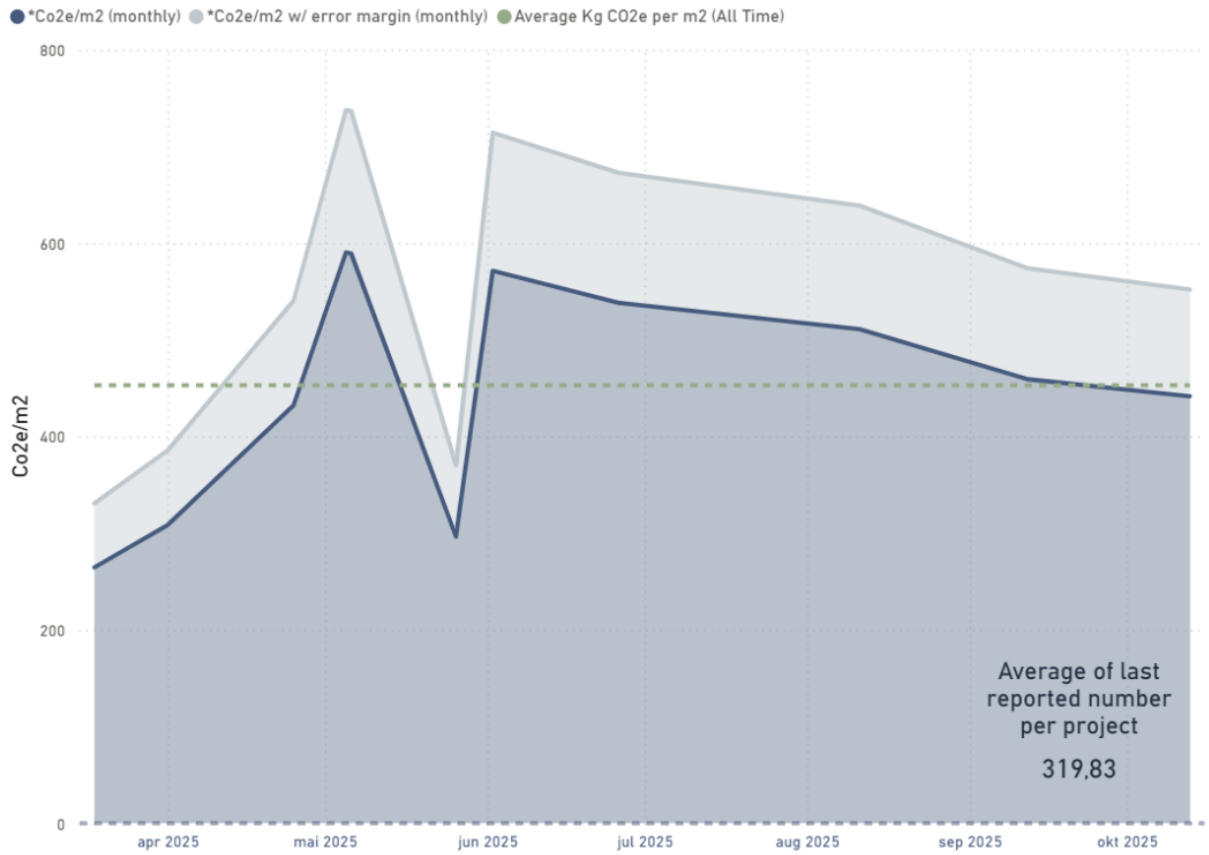
NCT - NORDIC CARBON TRACKER

MONTHLY PROJECT PROGRESS



ALL PROJECTS IN REPORT

PROJECT NUMBER	NAME	Last CO2e/m2 (per project)
320104	Sikkerhetspost Valen Sjukehus	221,54
110000	SUS 2023	441,60
110000	SUS BT2 Bygg 76	511,00
1020607	Lilleakerveien 41	296,36

NORDIC OVERALL

452,95

Average Kg CO2e per m2...

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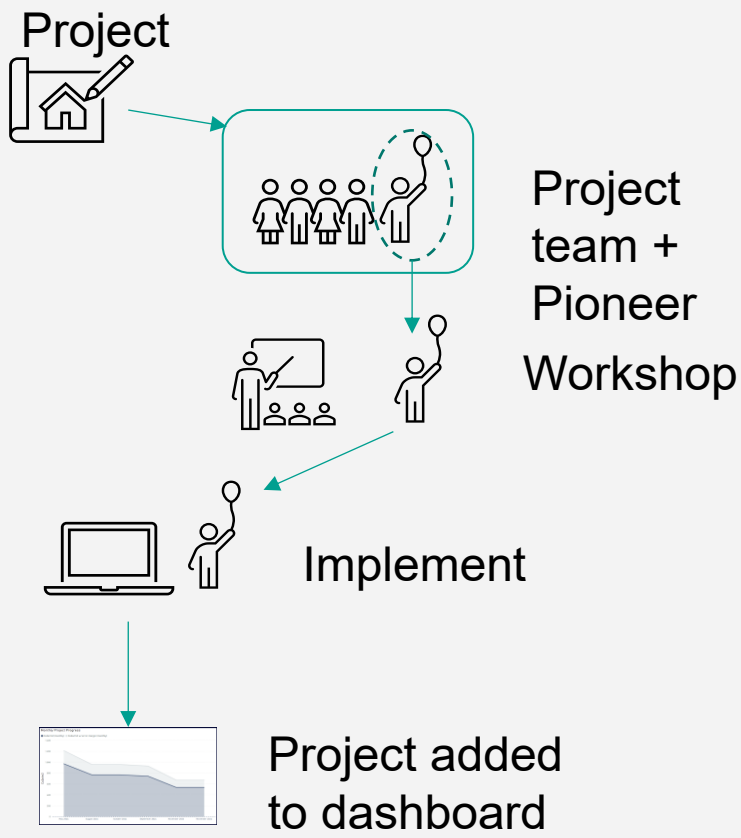
Status Q4 2025

- Training has been provided to key personnel.
- Projects are currently mapping materials.
- Final reporting is missing for some projects – SCALATION.



Prosjekter over 5000m2	Type bygg	Størrelse (ca)	Fase	PL	Ressursperson NCT (forslag)	Status rapportering	Status opplæring
Oslo Horisont, KLP	Kontor/Næring	85 000 m2	Reguleringsfase / ill.prosjekt	Jonathan	Zuzanna	Mangler	Ja
Schweigaards gt. 41-51	Kontor/Næring	23 200 m2	Reguleringsfase / ill.prosjekt	Line	Zuzanna	Mangler	Ja
Kjelsåsveien 161	Bolig/Næring	23 400 m2	Reguleringsfase / ill.prosjekt	Simon	Henriette	Mangler	Ja
Sørkedalsv. 150	Bolig	13 500 m2	Reguleringsfase / skisseprosjekt	Isaac	Isaac	Mangler	
Østensjøv. 40-44	Bolig/Næring	43 000 m2	Reguleringsfase / ill.prosjekt	Line	Isaac	Mangler	Ja
Laksevåg verft, detaljregulering	Bolig/Kontor/Næring	150 000 m2	Reguleringsfase / ill.prosjekt	Line	Isaac	Mangler	Ja
Fornebu Sør	Bolig/Næring	32 000 m2	Forprosjekt (oppstart mai/juni 25)	Geir	Anette	Mangler	Ja
Haslevangen 15	Kontor/Næring	17 400 m2	Forprosjekt (oppstart det.prosj. høsten 25)	Stijn	Kristine S	Mangler	Ja
Molobyen B6	Kontor/Næring	11 600 m2	Mulighetsstudie	Isaac	Isaac	Mangler	
Sikkerhetspost Valen Sjukehus	Sykehus	1430 m2	Forprosjekt	Anders L	Søren B	Mangler	Ja
Lilleakerveien 41	Bolig/Kontor/Næring	14800 m2	Revidert skisseprosjekt	Anette	Erik Ø	Levert	Ja
SUS2	Sykehus	101000 m2	Forprosjekt	Florian	Kristjan	Må rettes	Ja

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decIAIre

is a demonstration of how AI and machine learning can enhance the ability of designers to address increasingly complex challenges.

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The EPD* Challenge:

EPDs are **standardized** according to EN 15804, but the **presentation varies** between suppliers and databases.

Why don’t we let AI do the work?

*Environmental Product Declaration

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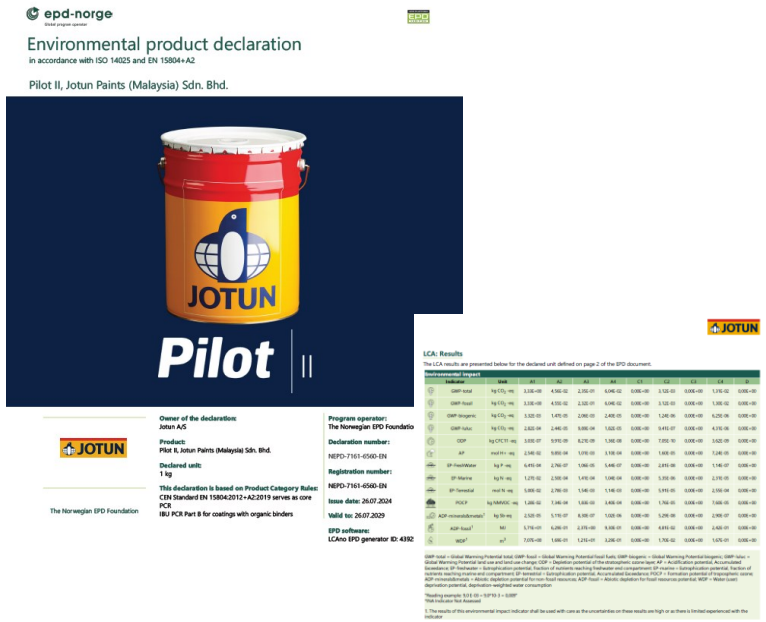


epd-norge

Environmental product declaration

in accordance with ISO 14025 and EN 15804+A2

Pilot II, Jotun Paints (Malaysia) Sdn. Bhd.

JOTUN

Pilot II

JOTUN

The Norwegian EPD Foundation

Owner of the declaration: Jotun A/S

Product: Pilot II, Jotun Paints (Malaysia) Sdn. Bhd.

Declared unit: 1 kg

This declaration is based on Product Category Rules: CEN Standard EN 15804:2012+A2:2019 serves as core PCR; IBU PCR Part B for coatings with organic binders

Program operator: The Norwegian EPD Foundation

Declaration number: NEPD-7161-6560-EN

Registration number: NEPD-7161-6560-EN

Issue date: 26.07.2024

Valid to: 26.07.2029

EPD software: LCAno EPD generator ID: 43992

JOTUN

LCA: Results

The LCA results are presented below for the declared unit defined on page 2 of the EPD document.

Environmental impact Indicator	Unit	A1	A2	A3	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	3.33E+00	4.55E-02	2.25E-01	6.04E-02	0.00E+00	1.52E-03	0.00E+00	1.37E-02	0.00E+00
GWP-fossil	kg CO_2 eq.	3.33E+00	4.55E-02	2.32E-01	6.04E-02	0.00E+00	1.52E-03	0.00E+00	1.30E-02	0.00E+00
GWP-biogenic	kg CO_2 eq.	3.32E-03	1.47E-05	2.06E-03	2.40E-05	0.00E+00	1.24E-06	0.00E+00	6.25E-04	0.00E+00
GWP-luluc	kg CO_2 eq.	2.82E-04	2.44E-05	5.80E-04	1.02E-05	0.00E+00	5.41E-07	0.00E+00	4.47E-06	0.00E+00
ODP	kg CFC11 eq.	3.03E-07	5.91E-09	8.27E-09	1.36E-08	0.00E+00	7.85E-10	0.00E+00	3.62E-09	0.00E+00
AP	mol H^+ eq.	2.54E-02	5.85E-04	1.07E-03	3.15E-04	0.00E+00	1.80E-05	0.00E+00	7.24E-05	0.00E+00
EP-FreshWater	kg P eq.	6.45E-04	2.76E-07	1.06E-05	5.44E-07	0.00E+00	2.89E-08	0.00E+00	1.14E-07	0.00E+00
EP-Marine	kg N eq.	1.27E-02	2.50E-04	1.41E-04	1.04E-04	0.00E+00	5.35E-06	0.00E+00	2.77E-05	0.00E+00
EP-Terrestrial	mol N eq.	5.80E-02	2.76E-03	1.54E-03	1.14E-03	0.00E+00	5.91E-05	0.00E+00	2.55E-04	0.00E+00
POCP	kg NMVOC eq.	1.48E-02	7.34E-04	1.68E-03	1.45E-04	0.00E+00	1.76E-05	0.00E+00	7.68E-05	0.00E+00
ADP-mineralsfossils*	kg Sb eq.	2.52E-05	5.71E-07	8.30E-07	1.02E-06	0.00E+00	1.29E-08	0.00E+00	2.90E-07	0.00E+00
ADP-fossil*	MJ	5.71E+01	6.29E-01	2.37E+00	9.30E-01	0.00E+00	4.81E-02	0.00E+00	2.42E-01	0.00E+00
WDP*	m^3	7.07E+00	1.69E-01	1.21E+01	3.29E-01	0.00E+00	1.70E-02	0.00E+00	1.67E-01	0.00E+00

GWP-total = Global Warming Potential total; GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals* = Abiotic depletion potential for non-fossil resources; ADP-fossil* = Abiotic depletion for fossil resources potential; WDP* = Water (user) deprivation potential, deprivation-weighted water consumption

*Reading example: 9.01 E5 = 9.0*10 3 = 9,000*
Not Indicator Not Assessed

1. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Remarks to environmental impacts

KNAUF INSULATION

ENVIRONMENTAL PRODUCT DECLARATION

Knauf Insulation unfaced rolls with a density of 11kg/m³ to 12.01kg/m³ and a thermal conductivity of:

- 0.042W/mK @23°C (AU)
- 0.039W/mK @15°C (NZ)

Build on us.

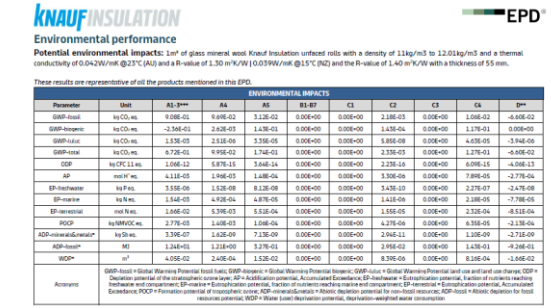
In accordance with ISO 14025, ISO 21930, EN15804+A2:2019/AC:2021

Program:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0014305
Publication date:	2024-06-18
Validity date:	2029-06-18

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

Knauf Insulation EPDs could cover one or several products (multi-products). In the case the EPD covers multiple products, the results are based on worst-case results.

EPD®



KNAUF INSULATION

EPD®

Environmental performance

Potential environmental impacts: 1m² of glass mineral wool Knauf Insulation unfaced rolls with a density of 11kg/m3 to 12.01kg/m3 and a thermal conductivity of 0.042W/mK @23°C (AU) and a R-value of 1.30 m²K/W | 0.039W/mK @15°C (NZ) and the R-value of 1.40 m²K/W with a thickness of 55 mm.

These results are representative of all the products mentioned in this EPD.

ENVIRONMENTAL IMPACTS										
Parameter	Unit	A1-3***	A4	A5	B1-B7	C1	C2	C3	C4	D**
GWP-fossil	kg CO_2 eq.	9.08E-01	9.69E-02	3.12E-02	0.00E+00	0.00E+00	2.18E-03	0.00E+00	1.06E-02	-6.60E-02
GWP-biogenic	kg CO_2 eq.	-2.56E-01	2.63E-03	1.47E-01	0.00E+00	0.00E+00	1.43E-04	0.00E+00	1.17E-01	0.00E+00
GWP-luluc	kg CO_2 eq.	1.53E-03	2.51E-06	3.35E-05	0.00E+00	0.00E+00	5.85E-08	0.00E+00	4.03E-05	-3.94E-06
GWP-total	kg CO_2 eq.	6.72E-01	9.95E-02	1.74E-01	0.00E+00	0.00E+00	2.33E-03	0.00E+00	1.27E-01	-6.60E-02
ODP	kg CFC 11 eq.	1.06E-12	5.87E-15	3.64E-14	0.00E+00	0.00E+00	2.23E-16	0.00E+00	6.09E-15	-4.08E-13
AP	mol H^+ eq.	4.11E-03	1.96E-03	1.48E-04	0.00E+00	0.00E+00	3.30E-06	0.00E+00	7.89E-05	-2.77E-04
EP-freshwater	kg P eq.	3.55E-06	1.52E-08	8.12E-08	0.00E+00	0.00E+00	3.43E-10	0.00E+00	2.27E-07	-2.47E-08
EP-marine	kg N eq.	1.54E-03	4.92E-04	4.87E-05	0.00E+00	0.00E+00	1.41E-06	0.00E+00	2.18E-05	-7.78E-05
EP-terrestrial	mol N eq.	1.66E-02	5.39E-03	5.51E-04	0.00E+00	0.00E+00	1.55E-05	0.00E+00	2.52E-04	-8.51E-04
POCP	kg NMVOC eq.	2.77E-03	1.40E-03	1.06E-04	0.00E+00	0.00E+00	4.27E-06	0.00E+00	6.35E-05	-2.13E-04
ADP-minerals&metals*	kg Sb eq.	3.39E-07	1.62E-09	7.13E-09	0.00E+00	0.00E+00	2.94E-11	0.00E+00	1.10E-09	-2.71E-09
ADP-fossil*	MJ	1.24E+01	1.21E+00	3.27E-01	0.00E+00	0.00E+00	2.95E-02	0.00E+00	1.43E-01	-9.26E-01
WDP*	m^3	4.05E-02	2.40E-04	1.52E-02	0.00E+00	0.00E+00	8.39E-06	0.00E+00	8.16E-04	-1.66E-02
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals* = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption									

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.
** (Life Cycle 2 stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately).
*** The indicator's results are calculated using a reference product, with equal weighting between plants, if this is a single plant, it means 200% for that plant.

Overlay

DAFA HiFo Intelligent

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

DAFA Vapor Barrier Tape Green/Lime/Black UV

DAFA A/S

EPD HUB, HUB-0730

Publishing date 29 September 2023, last updated until 29 September 2028

Created with One Click LCA

EPD Hub

ENVIRONMENTAL IMPACT DATA

DAFA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total*	kg CO2e	7.59E-01	7.86E-02	-5.77E-02	7.91E-01	7.20E-02	3.40E-01	MND	MND	MND	MND	MND	MND	MND	3.30E+00	2.47E-03	6.47E-01	0.00E+00	7.86E-01
GWP – fossil	kg CO2e	8.34E-01	7.84E-02	4.64E-02	8.02E-01	7.20E-02	2.35E-01	MND	MND	MND	MND	MND	MND	MND	3.30E+00	2.47E-03	7.22E-01	0.00E+00	7.86E-01
GWP – biogenic	kg CO2e	-7.28E-01	0.00E+00	-1.07E-01	-2.35E-01	0.00E+00	1.07E-01	MND	MND	MND	MND	MND	MND	MND	0.00E+00	0.00E+00	1.29E-01	0.00E+00	0.00E+00
GWP – LULUC	kg CO2e	6.99E-04	5.76E-05	2.87E-04	1.23E-03	2.88E-05	5.60E-06	MND	MND	MND	MND	MND	MND	MND	0.00E+00	6.07E-07	6.13E-06	0.00E+00	-1.69E-04
Ozone depletion pot.	kg CFC-11e	1.44E-07	1.83E-08	5.45E-08	1.99E-07	1.87E-08	8.09E-10	MND	MND	MND	MND	MND	MND	MND	0.00E+00	9.72E-13	1.58E-08	0.00E+00	-4.89E-08
Acidification potential	mol H^+e	3.71E-03	2.24E-04	2.94E-04	3.75E-03	2.06E-04	8.81E-05	MND	MND	MND	MND	MND	MND	MND	0.00E+00	7.31E-06	1.87E-04	0.00E+00	-6.13E-05
EP-freshwater*	kg Pe	4.04E-05	5.83E-07	1.74E-06	4.47E-05	1.14E-07	1.07E-07	MND	MND	MND	MND	MND	MND	MND	0.00E+00	1.78E-08	1.88E-07	0.00E+00	-4.37E-05
EP-marine	kg Ne	8.99E-04	6.47E-05	1.17E-04	1.02E-03	4.08E-06	2.38E-05	MND	MND	MND	MND	MND	MND	MND	0.00E+00	1.46E-06	7.76E-05	0.00E+00	-7.87E-04
EP-terrestrial	mol Vle	8.98E-03	6.87E-04	7.88E-04	9.69E-03	4.33E-06	3.07E-04	MND	MND	MND	MND	MND	MND	MND	0.00E+00	1.55E-05	8.00E-04	0.00E+00	-8.87E-03
POCP ("ozone")*	kg NMVOCe	3.37E-03	1.61E-04	1.85E-04	3.74E-03	1.74E-04	7.86E-05	MND	MND	MND	MND	MND	MND	MND	0.00E+00	5.07E-08	1.94E-04	0.00E+00	-2.41E-03
ADP-minerals & metals*	kg Sbe	1.16E-05	2.85E-07	3.07E-07	1.74E-05	2.85E-07	4.20E-08	MND	MND	MND	MND	MND	MND	MND	0.00E+00	0.00E+00	6.52E-06	0.00E+00	-3.21E-05
ADP-fossil resources	MJ	1.06E+01	1.17E+00	7.47E-01	1.87E+01	1.07E+00	7.85E-02	MND	MND	MND	MND	MND	MND	MND	0.00E+00	3.56E-02	1.34E-01	0.00E+00	-4.01E+02
Water-use**	m^3e depr.	8.49E-01	9.08E-03	5.26E-02	8.99E-01	3.01E-03	1.20E-02	MND	MND	MND	MND	MND	MND	MND	0.00E+00	1.72E-04	2.88E-02	0.00E+00	-1.72E-01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3.07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy**	MJ	0.00E+00	1.71E-02	7.26E-01	1.76E+00	1.68E-02	2.83E-03	MND	MND	MND	MND	MND	MND	MND	0.00E+00	5.39E-04	9.25E-03	0.00E+00	-3.24E+00
Renew. PER as material	MJ	1.17E+00	0.00E+00	8.37E-01	2.00E+00	0.00E+00	-8.37E-01	MND	MND	MND	MND	MND	MND	MND	0.00E+00	0.00E+00	1.17E+00	0.00E+00	-5.50E-01
Total use of renew. PER	MJ	4.20E+00	1.71E-02	1.59E+00	5.80E+00	1.68E-02	-8.29E-01	MND	MND	MND	MND	MND	MND	MND	0.00E+00	5.39E-04	-1.16E+00	0.00E+00	-2.69E+00
Non-re. PER as energy	MJ	0.00E+00	1.17E+00	7.13E-01	1.91E+01	1.07E+00	7.85E-02	MND	MND	MND	MND	MND	MND	MND	0.00E+00	3.56E-02	1.34E-01	0.00E+00	-4.01E+02
Non-re. PER as material	MJ	7.07E+00	0.00E+00	1.04E-02	7.11E+00	0.00E+00	-1.04E-02	MND	MND	MND	MND	MND	MND	MND	0.00E+00	0.00E+00	-7.07E+00	0.00E+00	5.50E-01
Total use of non-re. PER	MJ	1.06E+01	1.17E+00	7.47E-01	1.87E+01	1.07E+00	4.06E-02	MND	MND	MND	MND	MND	MND	MND	0.00E+00	3.56E-02	-6.94E+00	0.00E+00	-4.01E+02
Secondary materials	kg	1.05E-02	4.05E-04	4.19E-02	5.33E-02	3.95E-04	7.90E-05	MND	MND	MND	MND	MND	MND	MND	0.00E+00	1.25E-05	1.16E-04	0.00E+00	1.85E-02
Renew. secondary fuels	MJ	2.34E-03	4.40E-05	1.85E-02	1.91E-02	4.21E-05	1.54E-05	MND	MND	MND	MND	MND	MND	MND	0.00E+00	1.36E-07	4.21E-05	0.00E+00	-4.17E-06

8

Created with One Click LCA

DAFA Vapor Barrier Tape Green/Lime/Black UV

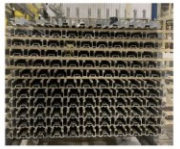
EPD PLATFORM

EPD® THE INTERNATIONAL EPD® SYSTEM

ENVIRONMENTAL PRODUCT DECLARATION (EPD) FOR

ANODISED ALUMINIUM PROFILE IMPLEMENTED WITH REDUXA BILLET

PRODUCED BY HYDRO EXTRUSION NORWAY A/S – MAGNOR SITE



Hydro

Company: Hydro Extrusion Norway A/S - Gaustadvegen 136, 2240 Magnor, Norway
Programme operator: The International EPD ® System – c/o EPD International AB, SE-11427 Stockholm Sweden - www.environdec.com
PCR: 2019:14 Construction products, version 1.3.1
Geographical scope: Europe
EPD registration number: S-P-11887
Date of publication (issue): 2024-05-14
Date of validity: 2029-02-26

EPD in accordance with ISO 14025 an
An EPD should provide current information and may be updated if conditions ch
therefore subject to the continued registration and publicatio

Hydro

3.5 PARAMETERS DESCRIBING THE ENVIRONMENTAL IMPACT ACCORDING EN15804+A2

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Table 7 Impacts of anodised profile implemented with REDUXA billet. Method EN15804+A2

Impacts of anodised profile implemented with the REDUXA billet. Method EN15804+A2							
Core Impacts indicators	A1-A3	A4	C1	C2	C3	C4	D
Climate Change – total - GWPtot [kg CO2 eq.]	6,58E+00	5,06E-02	0,00E+00	1,91E-02	1,78E-02	5,83E-04	-7,49E+00
Climate Change. fossil - GWPf [kg CO2 eq.]	6,53E+00	5,09E-02	0,00E+00	1,92E-02	1,77E-02	6,01E-04	-7,48E+00
Climate Change. biogenic - GWPb [kg CO2 eq.] (1)	3,95E-02	0,00E+00	0,00E+00	0,00E+00	1,54E-04	-2,00E-05	-1,57E-02
Climate Change. land use and land use change - GWPluc [kg CO2 eq.]	8,90E-03	4,69E-04	0,00E+00	1,77E-04	6,23E-06	1,87E-06	-1,30E-03
Ozone depletion - ODP [kg CFC-11 eq.]	4,84E-07	4,43E-15	0,00E+00	1,67E-15	3,07E-13	1,53E-15	-5,61E-11
Acidification - AP [Mole of H+ eq.]	2,85E-02	3,20E-04	0,00E+00	1,21E-04	4,18E-05	4,26E-06	-4,35E-02
Eutrophication, freshwater - Epfr [kg P eq.]*	5,62E-05	1,85E-07	0,00E+00	6,97E-08	6,42E-08	1,21E-09	-3,32E-06
Eutrophication, marine - EPmar [kg N eq.]	4,94E-03	1,57E-04	0,00E+00	5,94E-05	1,05E-05	1,10E-06	-6,26E-03
Eutrophication, terrestrial - Epter [Mole of N eq.]	5,47E-02	1,74E-03	0,00E+00	6,58E-04	1,11E-04	1,21E-05	-6,84E-02
Photochemical ozone formation, human health - POCP [kg NMVOC eq.]	1,52E-02	3,03E-04	0,00E+00	1,14E-04	2,79E-05	3,32E-06	-1,89E-02
Resource use, mineral and metals - ADPe [kg Sb eq.]**	6,18E-06	3,27E-09	0,00E+00	1,23E-09	2,61E-09	2,77E-11	-1,68E-06
Resource use, fossils - ADPf [MJ]**	7,59E+01	6,88E-01	0,00E+00	2,60E-01	3,59E-01	8,00E-03	-9,17E+01
Water use - WU [m^3 world equiv.]**	7,16E-01	5,84E-04	0,00E+00	2,20E-04	3,71E-03	6,60E-05	-1,11E+00
Indicators required by the PCR 2019:14	A1-A3	A4	C1	C2	C3	C4	D
GWP-GHG [kg CO2 eq.]***	6,54E+00	5,13E-02	0,00E+00	1,94E-02	1,77E-02	6,03E-04	-7,48E+00

* The results in kg P eq. can be obtained by dividing the results in kg PO4 eq. by a factor of 3,07.
** The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.
*** The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product.

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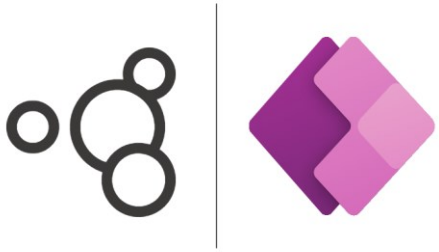
Solution: POWER AUTOMATE



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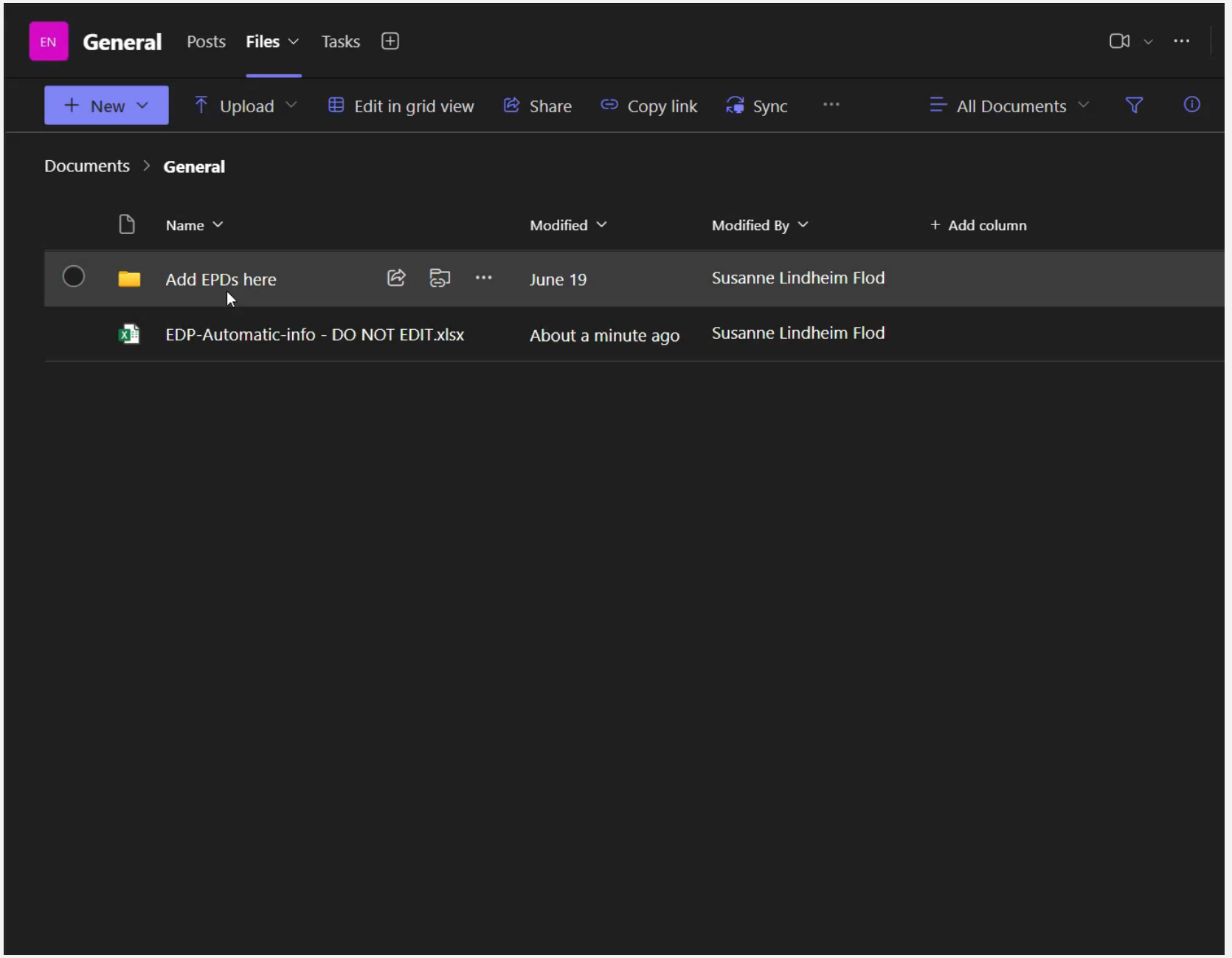

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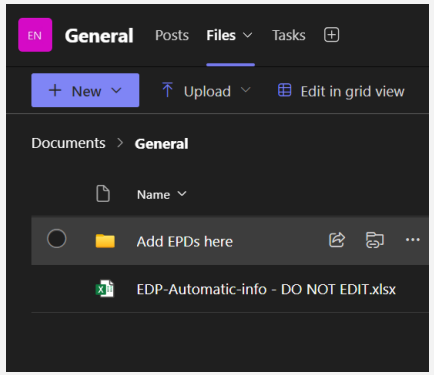
Microsoft Teams

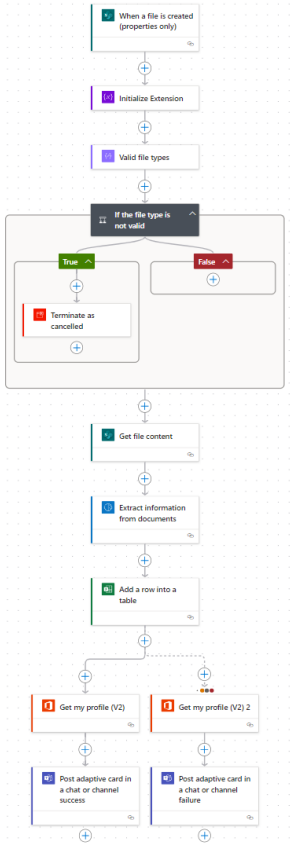
Find EPD In database

Upload EPD to project Teams folder



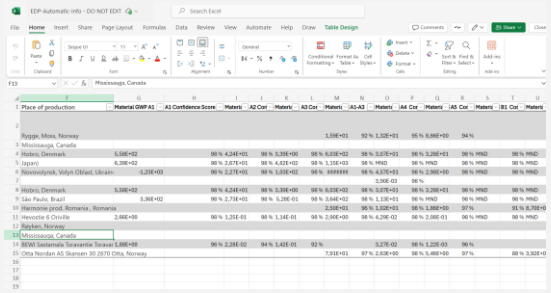
Power Automate

Power Automate flow runs with built in AI component



Microsoft Excel

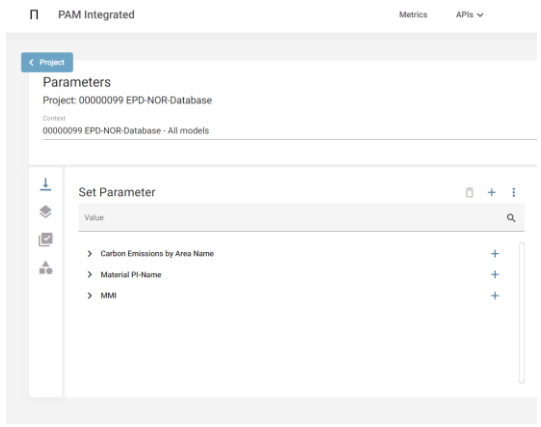
Excel is updated with data



PAM Integrated

Data can be uploaded to PAM

Use PI to make data available in Revit



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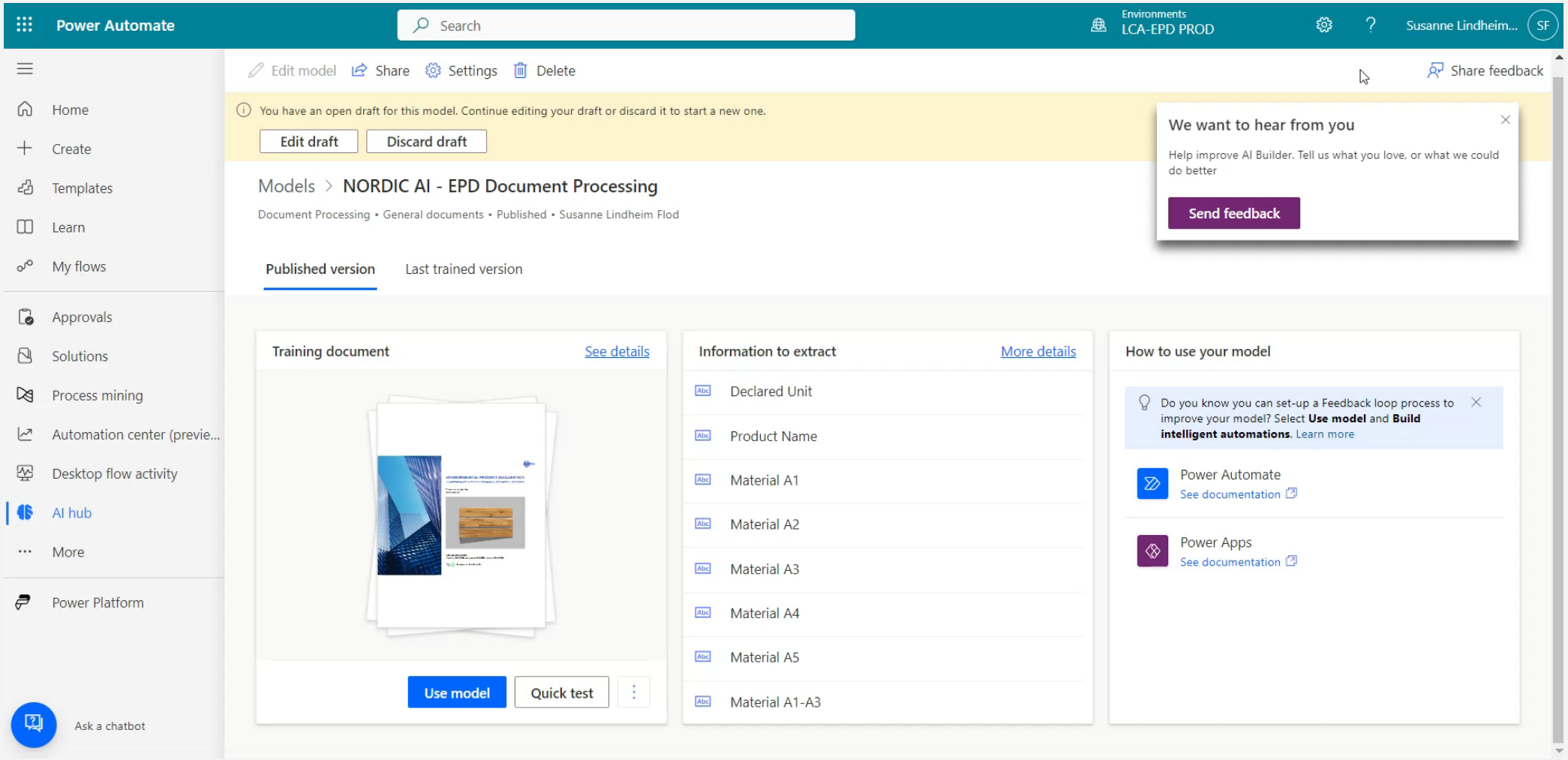

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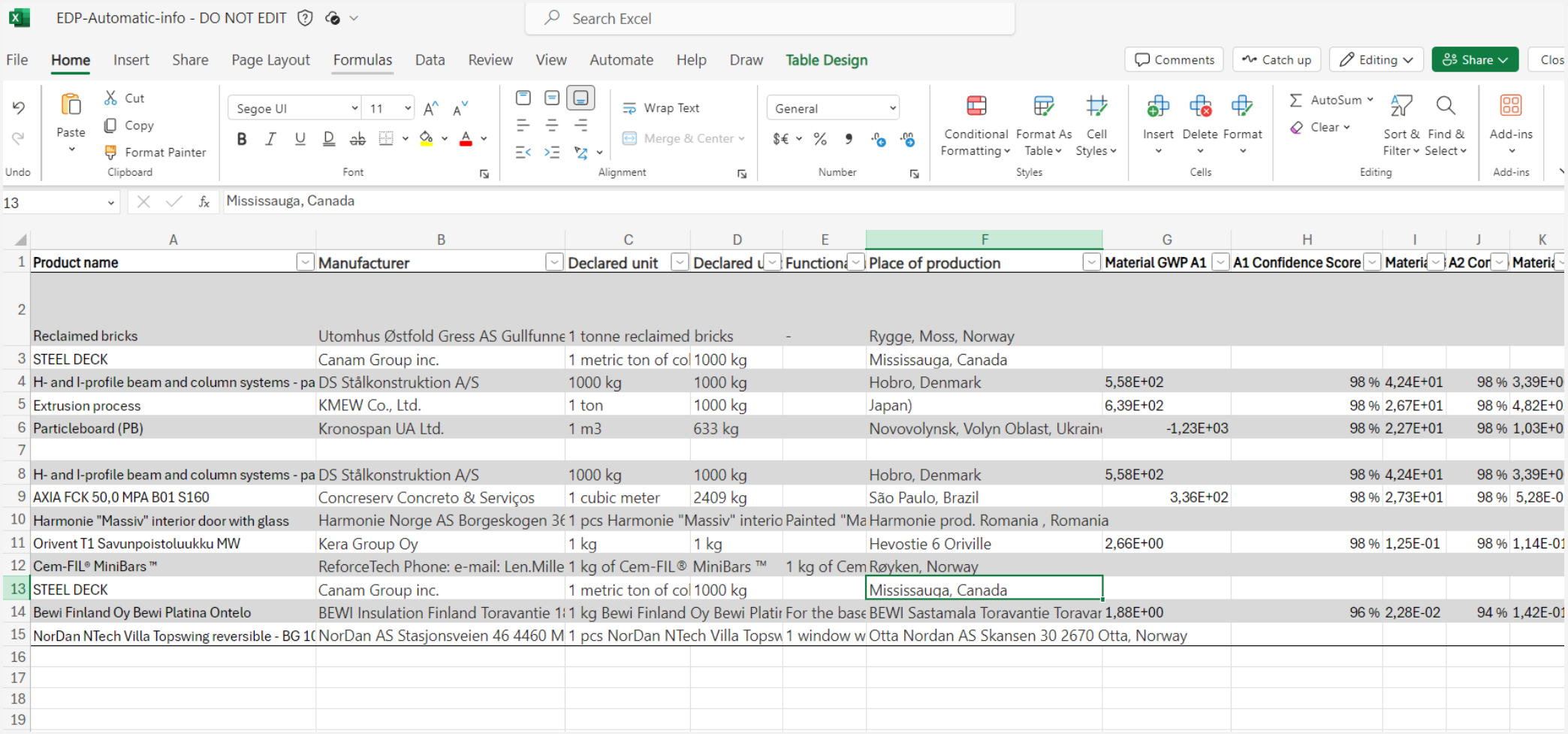

	A	B	C	D	E	F	G	H	I	J	K
1	Product name	Manufacturer	Declared unit	Declared u	Functiona	Place of production	Material GWP A1	A1 Confidence Score	Materia	A2 Cor	Materia
2	Reclaimed bricks	Utomhus Østfold Gress AS Gullfunne	1 tonne reclaimed bricks		-	Rygge, Moss, Norway					
3	STEEL DECK	Canam Group inc.	1 metric ton of col	1000 kg		Mississauga, Canada					
4	H- and I-profile beam and column systems - pa	DS Stålkonstruktion A/S	1000 kg	1000 kg		Hobro, Denmark	5,58E+02	98 %	4,24E+01	98 %	3,39E+0
5	Extrusion process	KMEW Co., Ltd.	1 ton	1000 kg		Japan)	6,39E+02	98 %	2,67E+01	98 %	4,82E+0
6	Particleboard (PB)	Kronospan UA Ltd.	1 m3	633 kg		Novovolynsk, Volyn Oblast, Ukrain	-1,23E+03	98 %	2,27E+01	98 %	1,03E+0
7											
8	H- and I-profile beam and column systems - pa	DS Stålkonstruktion A/S	1000 kg	1000 kg		Hobro, Denmark	5,58E+02	98 %	4,24E+01	98 %	3,39E+0
9	AXIA FCK 50,0 MPA B01 S160	Concreserv Concreto & Serviços	1 cubic meter	2409 kg		São Paulo, Brazil	3,36E+02	98 %	2,73E+01	98 %	5,28E-0
10	Harmonie "Massiv" interior door with glass	Harmonie Norge AS Borgeskogen 3(	1 pcs Harmonie "Massiv" interio		Painted "Ma	Harmonie prod. Romania , Romania					
11	Orivent T1 Savunpoistoluukku MW	Kera Group Oy	1 kg	1 kg		Hevostie 6 Oriville	2,66E+00	98 %	1,25E-01	98 %	1,14E-01
12	Cem-FIL® MiniBars ™	ReforceTech Phone: e-mail: Len.Mille	1 kg of Cem-FIL®	MiniBars ™	1 kg of Cem	Røyken, Norway					
13	STEEL DECK	Canam Group inc.	1 metric ton of col	1000 kg		Mississauga, Canada					
14	Bewi Finland Oy Bewi Platina Ontelo	BEWI Insulation Finland Toravantie 1	1 kg Bewi Finland Oy Bewi Platir		For the base	BEWI Sastamala Toravantie Toravar	1,88E+00	96 %	2,28E-02	94 %	1,42E-01
15	NorDan NTech Villa Topswing reversible - BG 1(	NorDan AS Stasjonsveien 46 4460 M	1 pcs NorDan NTech Villa Topsw		1 window w	Otta Nordan AS Skansen 30 2670 Otta, Norway					
16											
17											
18											
19											

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NCT is a tool designed to **raise awareness** and **assist non-experts** in **reducing material-bound carbon** in their projects **easily**

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Towards automated building LCA calculation

Tuija Pakkanen, Petr Hradil, Rita Lavikka
VTT Technical Research Centre of Finland

Nordic Climate Forum for Construction 2025

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no. 101056973

Funded by the European Union

Innovate UK

BIM-based automation of LCA calculation

Answering the question ”what is the life-cycle Global Warming Potential (GWP) of the building?”
→ Still requires manual expert work.

But what if we ask a different question:
”Is the life-cycle GWP lower than the limit?“

This answer may be obtained automatically already now.
Without large demands on the architect.

Finnish Building Act 2025: BIM-Driven LCA for Climate Compliance

- The new Finnish Building Act (2025)
  - A climate declaration and declaration of products for new buildings (2026)
  - The limits for the buildings' carbon footprint will be introduced in the following years
  - Building permits to be applied with IFC format (IFC 4.0.2.1) if the design is in BIM
- The new requirements may burden the design offices, especially the small ones, without dedicated LCA experts and access to the relevant tools
- BIM-based automation of LCA calculation
  - Enables early-stage carbon footprint checks without burdening architects
  - Reduces time and cost in design iterations
  - Enhances transparency and traceability for regulators and clients

Requirements for BIM-based LCA

- **Quantity take-off from BIM**
  - BIM shall be prepared with the sufficient detail, entities that are not part of the LCA calculation shall be either filtered out or marked
  - *BIM guidelines, templates, export filters, examples*
- **Matching products (materials) from BIM to the LCA database**
  - Products (materials) names or IDs shall be assigned to the entities and matching the identifiers from LCA the database
  - *Products (materials) classification*
  - *LCA databases*
- **Calculation, reporting, checking life-cycle GWP against the limit**
  - *LCA methodologies*
  - *LCA tools*

Building legislation in Finland

Footprint		Building	Building site
A1-3	Manufacturing	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
A4	Transport	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
A5	Construction	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
B4	Replacement	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
B6	Use of energy	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
C1	Deconstruction	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
C2	Transport	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
C3	Waste processing	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
C4	Disposal	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$
Total carbon footprint		$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$

Handprint		Building	Building site
D1-6	Carbon handprint	$kgCO_2e/m^2,a$	$kgCO_2e/m^2,a$

$kgCO_2e/m^2,a$

This value is limited

- The new **Building Act** entered into force in 2025.
- Construction permit applications shall include **a climate declaration** and a declaration of products (materials) in 2026.
- Construction permits to be applied with **IFC format** (IFC 4.0.2.1) if the design is in BIM.

Supporting legislation and information sources

- Decree on climate declaration
- Decree on products declaration
- National CO_2 database
- National BIM requirements
- Limit values of carbon footprint

Finnish construction emissions database

		Material or product		Building
A1-3	Manufacturing	$kgCO_2e/kg$, $/m^3$, $/m^2$, /unit		$kgCO_2e/m^2$
A4	Transport	$kgCO_2e$/ton,km	or	$kgCO_2e/m^2$
A5	Construction			$kgCO_2e/m^2$
B4	Replacement	$kgCO_2e/kg$, $/m^3$, $/m^2$, /unit		$kgCO_2e/m^2$
B6	Use of energy			$kgCO_2e$/kWh
C1	Deconstruction			$kgCO_2e/m^2$
C2	Transport	$kgCO_2e$	or	$kgCO_2e/m^2$
C3	Waste processing	$kgCO_2e/kg$, $/m^3$, $/m^2$, /unit		
C4	Disposal			$kgCO_2e/m^2$

$kgCO_2e/m^2,a$

Building services

Required information

- Building floor area
- Building energy cons.
- Materials identification
- Products identification
- Relevant quantities

		Material or product	Building
D1-6	Carbon handprint	$kgCO_2e/kg$, $/m^3$, $/m^2$, /unit	

Rakentamisen päästötietokanta | CO2data.fi/rakentaminen

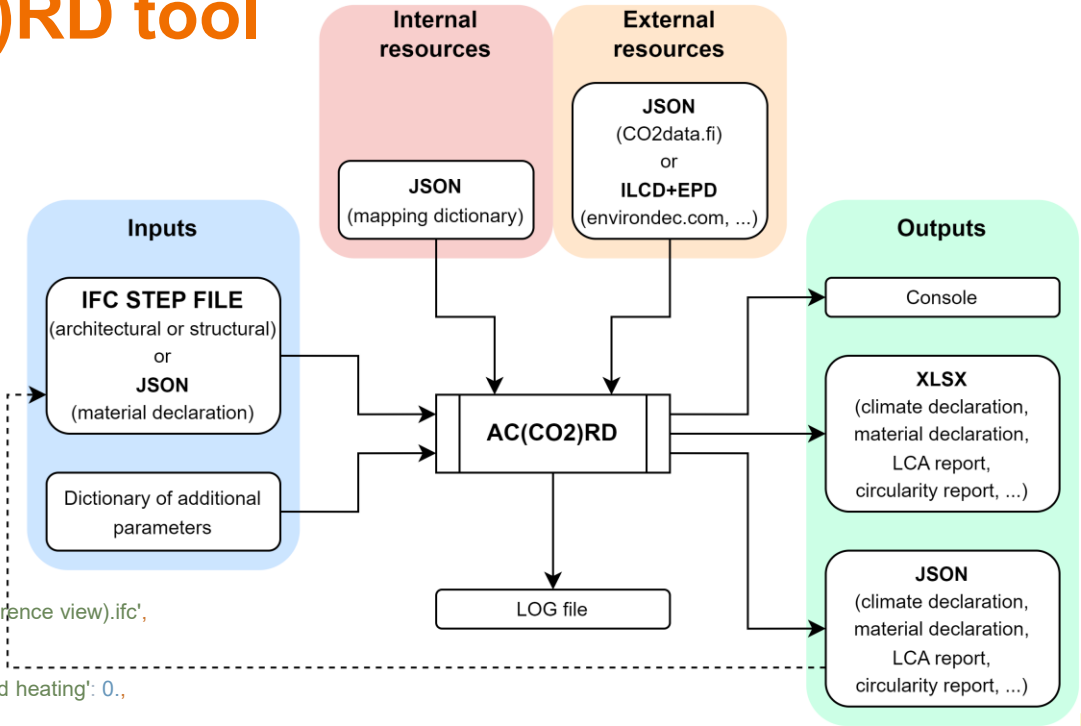
Emissions database for construction

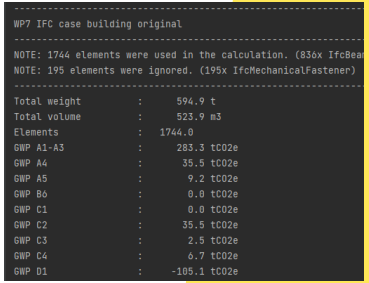
Infrarakentamisen päästötietokanta | CO2data.fi/infra

https://www.co2data.fi/rakentaminen/#en

A proof-of-concept tool to study automated conservative estimation of the environmental impact from the IFC model

AC(CO2)RD tool





```
WP7 IFC case building original
NOTE: 1744 elements were used in the calculation. (836x IfcBea
NOTE: 195 elements were ignored. (195x IfcMechanicalFastener)
Total weight          :      594.9 t
Total volume          :      523.9 m3
Elements              :   1744.0
GWP A1-A3             :      283.3 tCO2e
GWP A4                :       35.5 tCO2e
GWP A5                :        9.2 tCO2e
GWP B6                :        0.0 tCO2e
GWP C1                :        0.0 tCO2e
GWP C2                :       35.5 tCO2e
GWP C3                :        2.5 tCO2e
GWP C4                :        6.7 tCO2e
GWP D1                :     -105.1 tCO2e
```

Name	Mass	Volume
CONCRETE/Concrete_Undefined	238.365	99.31874
CONCRETE/K30-2	199.6575	83.19063
CONCRETE/K40-1	45.16389	18.81829
MISCELLANEOUS/Mineraalivilla_kova	31.22608	312.2608
STEEL/S350GD+Z	35.70369	4.548241
STEEL/S355J0	2.919739	0.371941
STEEL/S355J2	6.69243	0.852747
STEEL/S355J2H	8.342612	1.069719
STEEL/S420MH	26.79131	3.459136

```
{
  "Info": {
    "Title": "AC(CO2)RD LCA REPORT",
    "Date": "2023-06-09"
  },
  "Project": {
    "Name": "LTR Sipoo Frame (Arc reference view)",
    "DesignLife": {
      "Value": 50.0,
      "Unit": "years"
    },
    "UseCategories": [
      {
        "UseCategoryName": "school",
        "FloorArea": {
          "Value": 865.0,
          "Unit": "m2"
        },
        "HeatedFloorArea": {
          "Value": 865.0,
          "Unit": "m2"
        },
```

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{'file_name': 'LTR Sipoo Frame (Arc reference view).ifc',
'use_category': 'school'
'floor_area': 865.,
'energy': {'Energy, biofuels, decentralized heating': 0.,
           'Energy, district cooling': 0.,
           'Energy, district heating': 0.,
           'Energy, electricity consumption': 68093.,
           'Energy, fossil fuels, decentralized heating': 0.},
'heated_floor_area': 920.,
'construction_year': 0, }
```

https://extgit.vtt.fi/petr.hradil/ac-co2-rd

Quality of model data

- **Missing material identification**
  - The highest CO_2 material will be selected from the database based on the element type (always conservative)
- **Missing quantities**
  - Volume of the entity bounding box will be used (always conservative)
- **Material name not matching records in the database**
  - Mapping dictionary is created and regularly updated (provisional solution)
- **Missing entities**
  - Not checked yet

Feedback to the designer

- Number of IFC entities included in the assessment
- Number of entities without quantities – calculated from the bounding box
- Number of entities without quantities – ignored
- Number of entities without materials – assumed conservative material
- List of unknown materials and ignored entities
- Model quality (not yet implemented):

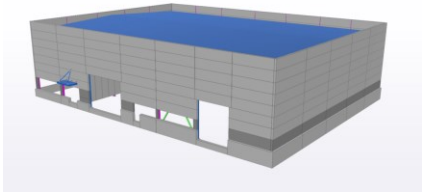
Quantities index

% of entities with quantities
+ half of entities calculated from the bounding box

Materials index

% of production CO_2 (A1-A3) of known materials

Example outputs



Carbon footprint: **13,3** **$kgCO_2e/m^2,a$**
Quantities index: 100%
Materials index: 100%
(Tekla Structures)

Carbon footprint: **27,7** **$kgCO_2e/m^2,a$**
Quantities index: 100%
Materials index: 36%
(Archicad)

Carbon footprint: **45,3** **$kgCO_2e/m^2,a$**
Quantities index: 99%
Materials index: 19%
(Revit)

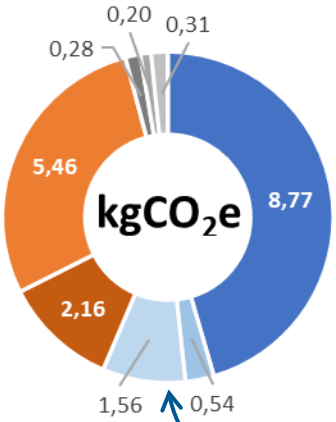
Carbon footprint: **109** **$kgCO_2e/m^2,a$**
Quantities index: 91%
Materials index: 38%
(Archicad)

Validation

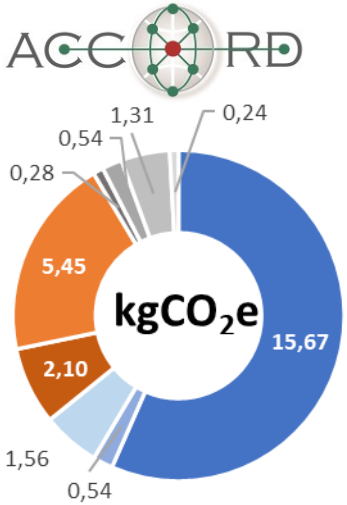
Courthouse in Pori, Finland

Net floor area:	5419 m^2
Year of construction:	2024
Assessment period:	50 years

RAKSYSTEMS

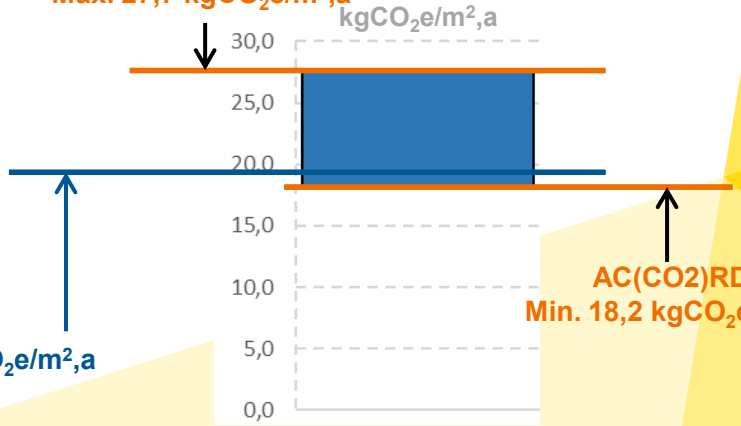


ACCORD



A1-A3 A4 A5 B4 B6 C1 C2 C3 C4

AC(CO2)RD
Max. 27,7 kgCO$_2$e/m^2,a



AC(CO2)RD
Min. 18,2 kgCO$_2$e/m^2,a

Raksystems LCA 19,3 kgCO$_2$e/m^2,a

Transferability across countries

- AC(CO_2)RD is a proof-of-concept tool to study automated conservative estimation of the environmental impact of the IFC model
- It is adjusted to the requirements of the new Finnish regulations
- Nordic countries share similar BIM maturity and regulatory ambitions
  - Differences in LCA scope and data availability across countries.
  - Need for unified BIM-LCA standards and shared databases
  - Joint Nordic initiative for harmonised digital permitting and LCA validation!?
- Plans to link this tool to the machine-readable regulation limiting the carbon footprint of the building
- Ongoing discussion on the real-world implementation of such a concept with partners of the ACCORD project: Solibri, Cloud Permit and Future Insight

BIM for LCA

Nordic Sustainable Construction

Nordic Council of Ministers

Thank you!

For more information, please contact the project coordinator

Rita.Lavikka@vtt.fi

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Funded by the European Union

Innovate UK

VTT

beyond

the obvious

Bevar mere.

Preserve More: Future homes in the existing building stock

Johanne Mose Entwistle
Head of Secretariat Bevar Mere
Partner in AART architects

Realdania DREYERSFOND LANDSBYGGEFONDEN GI GRUNDEJERNES INVESTERINGSFOND

01 The numbers

Bevar mere.

How many more people will there be in Denmark by 2040?

280.000

How many homes are needed?

100.000 - 150.000

How many homes can be created from buildings that exist today?

40.000 - 70.000

Bevar mere.

02

The initiative

Bevar mere.

Who is behind Bevar Mere/Preserve More?

GI GRUNDEJERNES INVESTERINGSFOND

DREYERSFOND

LANDSBYGGEFONDEN

Realdania

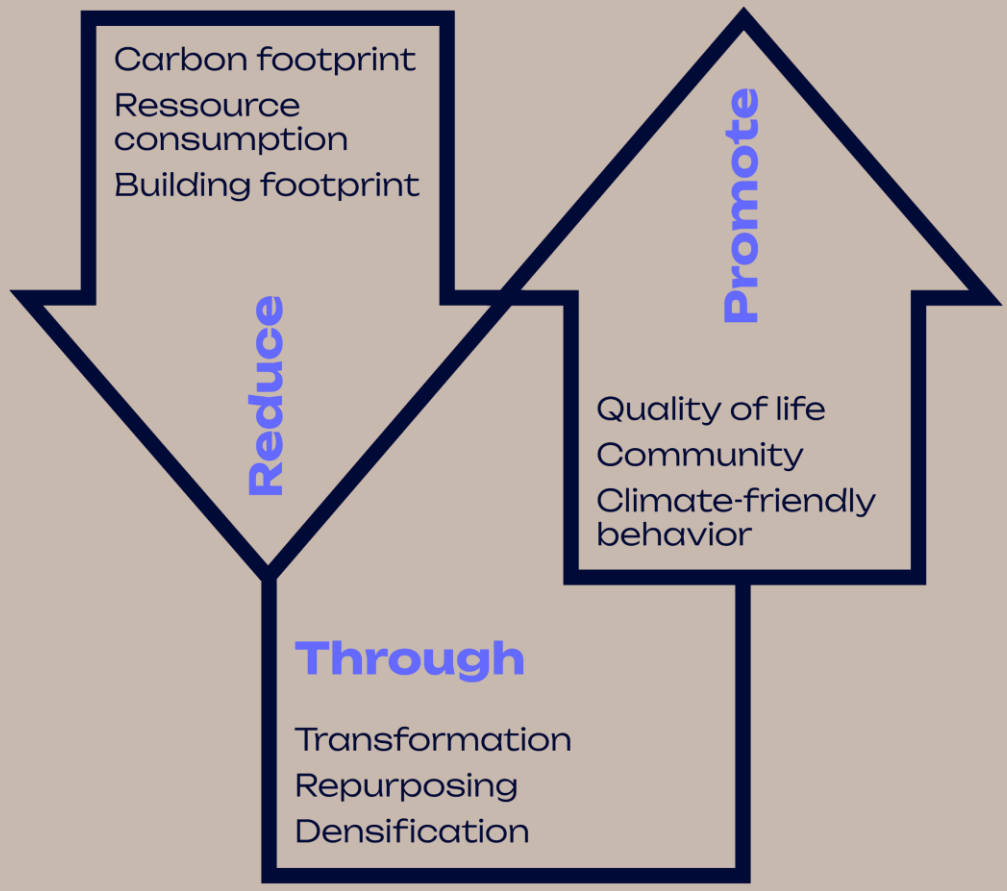
Bevar mere.

Foto: Hampus Berndtson / Pihlmann Architects / Office Kim Lenschow

Purpose and vision

How do we create the sustainable homes and housing environments of the future in the buildings we already have

We want to promote a change in behavior among professionals and the general population towards transforming and repurposing with a focus on community, quality of life, climate, and resources



Bevar mere.

Which building typologies do we focus on?

Single family houses

Roof top housing

Social housing

Commercial, office, and public service buildings

Bevar mere.

What is at the core of the initiative?

Knowledge

Tools

Involvement & communi-cation

Inspiring examples

Bevar mere.

03

Knowledge projects and tools

Bevar mere.

17

Projects

Bevar mere.

07

Tools

Opbevar // **Preserve Up**

LCA-plan // **LCA - plan**

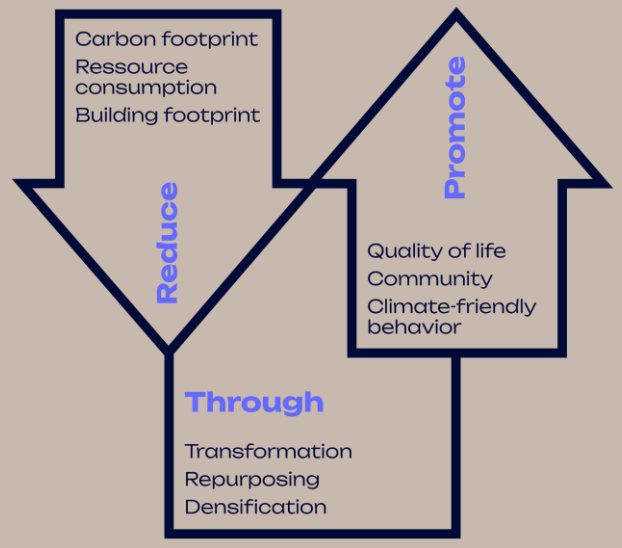
Tættere sammen // **Close together**

Bevar eller Forklar // **Preserve or explain**

Del hus i Kommunen // **Share house in the municipality**

En trin-for-trin guide // **Step-by-step guide to transformation**

Mere. Transformation. Sammen. // **More. Transformation. Together.**



10

Knowledge projects

Vi har boligerne // **We have the homes**

Mod Nye Højder // **Towards new heights**

Internationale erfaringer // **International experiences**

Udfoldning af businesscasen // **Unfolding the business case**

Empty nesters' flyttemønstre // **Empty nesters' moving patterns**

Bevar, del og bo flere sammen // **Preserve, share and live more people together**

Bæredygtig etablering af tagboliger // **Sustainable construction of rooftop dwellings**

Investeringscasen for transformation // **The investment case for transformation**

Transformation af landbrugsejendomme // **Transformation of farm properties**

Transformationskapacitet i eksisterende erhvervsejendomme // **Transformation capacity in existing commercial properties**

Bevar mere.

17 projects – five themes

Better use of the single family houses

Big potential in the existing houses - singles or couples without children occupying a part of the existing building stock

What are the architectural/structural, social, cultural, regulatory, financial etc. barriers and potentials for sharing m2 or dividing/partition of house? And how might we address them?

How might we support housing / moving chains to free up single family houses for families?

Establishing roof top housing

There is an underutilised potential in the roof space/attics in existing urban building stock.

What are the structural, regulatory and financial barriers and potentials for establishing roof top housing and how might we address them?

Future-proofing the social housing sector

Addressing the challenge of vacancy in the social housing sector.

How might we convert traditional social housing homes to co-housing communities?

Transformation of commercial, office, and public service buildings

What are the regulatory and proces-related barriers and potentials for transformation in general and how might we address them?

Cross-cutting themes

Focusing on the business / investment case of transformation as a potential barrier.

How might we elaborate and develop a more holistic business case for transformation?

Bevar mere.

Who are part of the projects?

- Building owners
- Social housing associations
- Municipalities
- Knowledge institutions
- Advisors (across disciplines)
- Contractors
- Developers and investors
- Financial institutions
- Non-profits / organisations

04 What’s next?

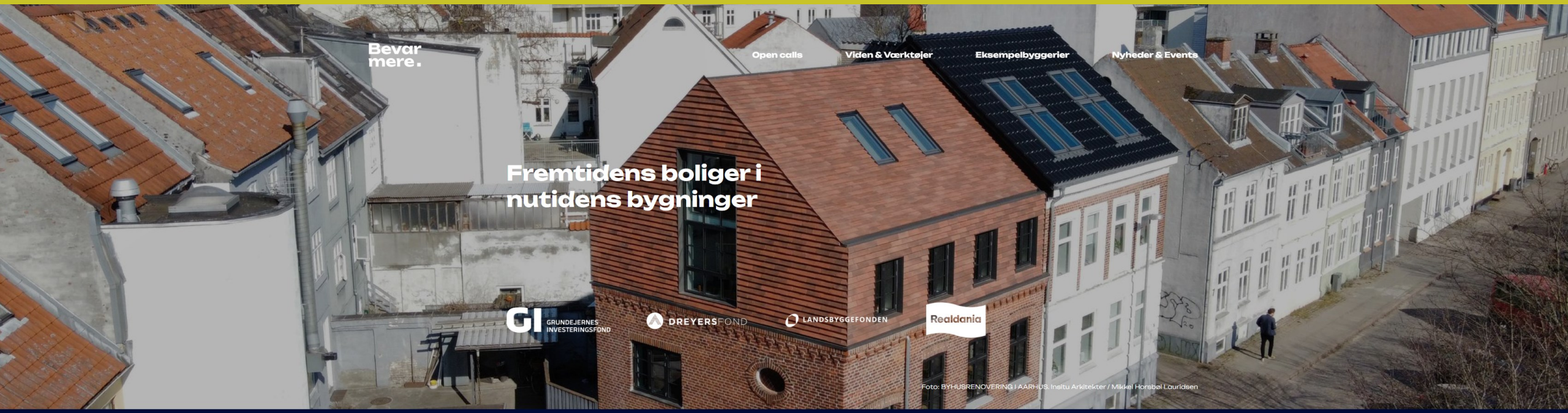
Bevar mere.

- Call for demonstration projects – inspiring examples
- Campaign and activities targeted residents/wider population
- Most knowledge projects and tools will finish in the first half of 2026

Bevar mere.

Find out more here:

→ **www.bevar-mere.dk**



Bevar Mere er en filantropisk indsats med et klart mål: At understøtte en holdnings- og praksisændring i Danmark, så transformation og ombygning af den eksisterende bygningsmasse bliver et reelt, attraktivt og kvalificeret alternativ til nybyggede boliger.

Bevar mere.

Fremtidens boliger i nutidens bygninger

Realdania · DREYERSFOND · LANDSBYGGEFONDEN · GI GRUNDEJERNES INVESTERINGSFOND

Bevar mere.

The road to net zero

Anna Denell, Chief Sustainability Officer

Vasakronan

”Future-proof cities for everyone, where people and companies thrive”

Environmental responsibility

Social responsibility

Financial responsibility

Net Zero by 2030 - throughout the whole value chain

Development

- Construction material
- Waste
- Transportation
- Energy consumption at construction sites

O&M

- Energy consumption
- Leakage of refrigerants
- Company transportation

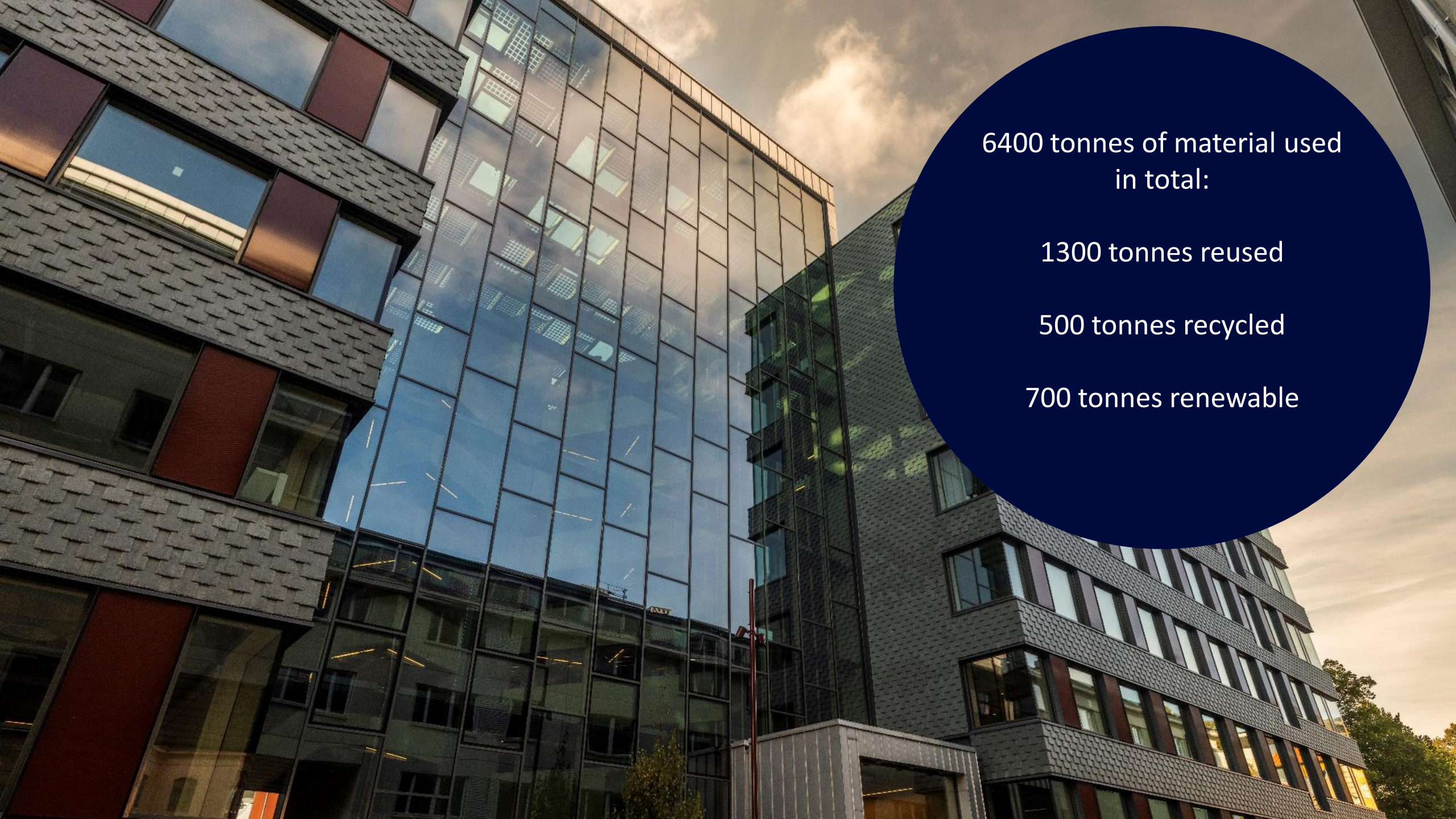
Tenants

- Electricity consumption
- Commuting
- Waste

Sergelhusen

Lumi

Sweden’s most ambitious reusing project?



6400 tonnes of material used in total:

1300 tonnes reused

500 tonnes recycled

700 tonnes renewable


Laboratorie-
byggnaden
Vita Villan
1800 nya bostäder,
ny skola med bibliotek,
ny idrottshall samt
6 förskolor.

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