

A low-angle, upward-looking photograph of the Eiffel Tower in Paris, France, set against a clear, bright blue sky. The tower's intricate iron lattice structure is the central focus, with its four legs converging towards the top. The lighting is bright, suggesting a sunny day.

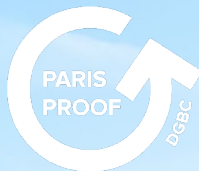
**Round 2**  
16:06 – 17:00

**Subsession 2.1:**

SBTi, CRREM and  
operational reduction  
pathways, Ramboll  
and the embodied  
carbon budget  
(English)



Dutch  
Green Building  
Council



# Welcome

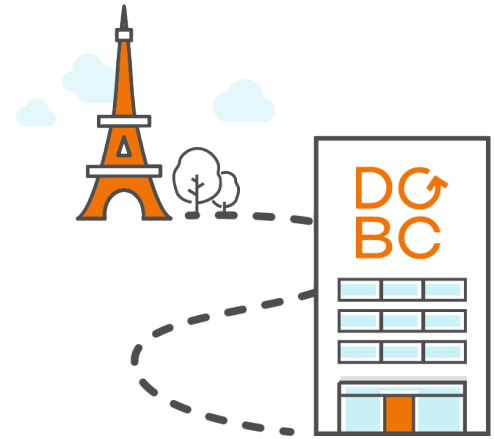
Moderator: **Laetitia Nossek** | DGBC

Presentations:

**Julia Wein** | CRREM

**Jacob Steinmann** | Ramboll

**Julie Emmrich** | WGBC



# Agenda

1 *Paris Proof operational and embodied*

2 *Operational pathways by CRREM*

3 *Embodied carbon budget by Ramboll*

4 *Discussion*

# Why Paris Proof?

## Climate Agreement Paris (COP21)



- We made an agreement that we would stay under the 1.5 degrees..

## Energy



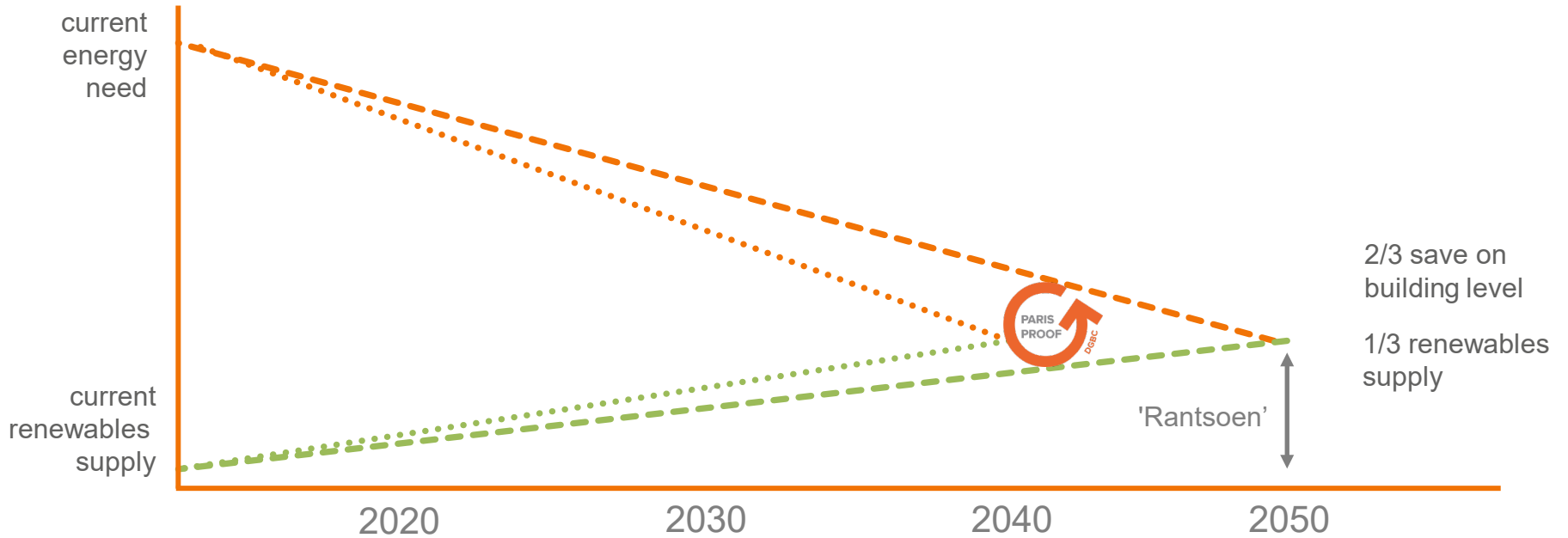
- 29% of the CO<sub>2</sub> emissions in the Netherlands come from existing buildings
- Energy labels do not always give a correct image of energy usage of a building

## Materials

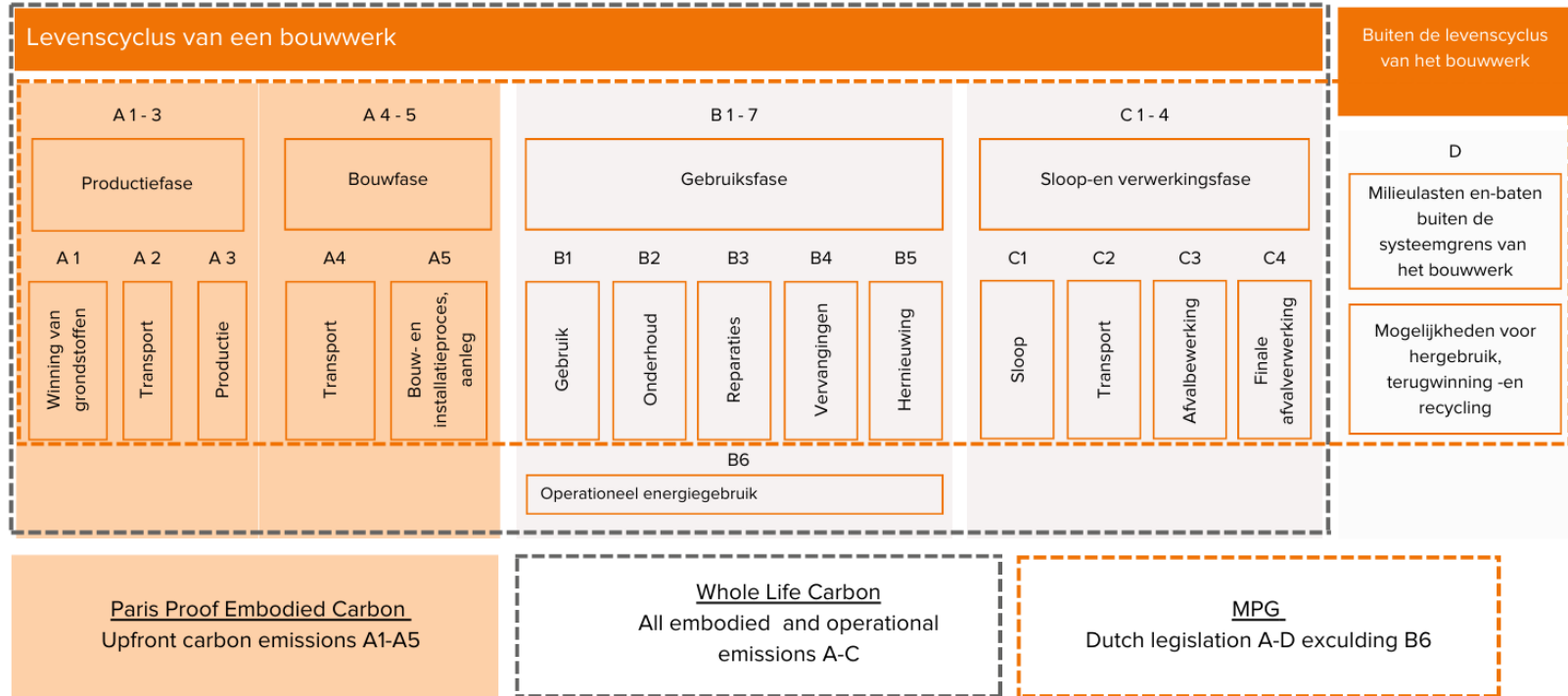


- 11% of the CO<sub>2</sub> emissions in the Netherlands come from embodied carbon
- A conventional MPG calculation steers not enough on the climate urgency short term

# Paris Proof: energy targets



# Emissions of a building over its lifecycle



# Paris Proof: Embodied carbon targets

Global budget



1.5 400 Gt



Netherlands

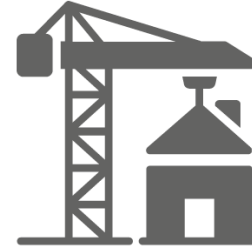


909 Mt

Inhabitants



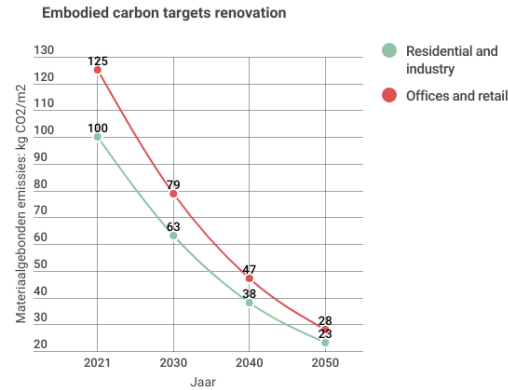
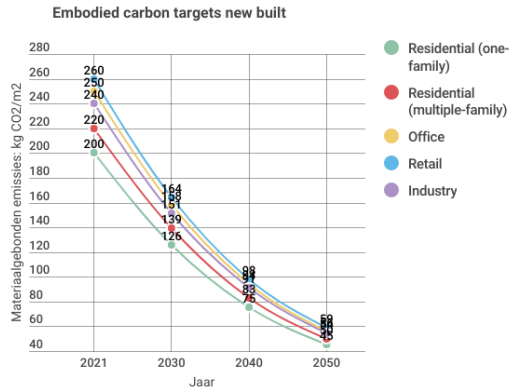
Embodied carbon  
building sector



100 Mt

Building materials industry (incl. infrastructure) is 11%  
of national emissions

# Resulting in embodied carbon targets per m<sup>2</sup>



With an own calculation protocol  
Paris Proof embodied carbon Protocol

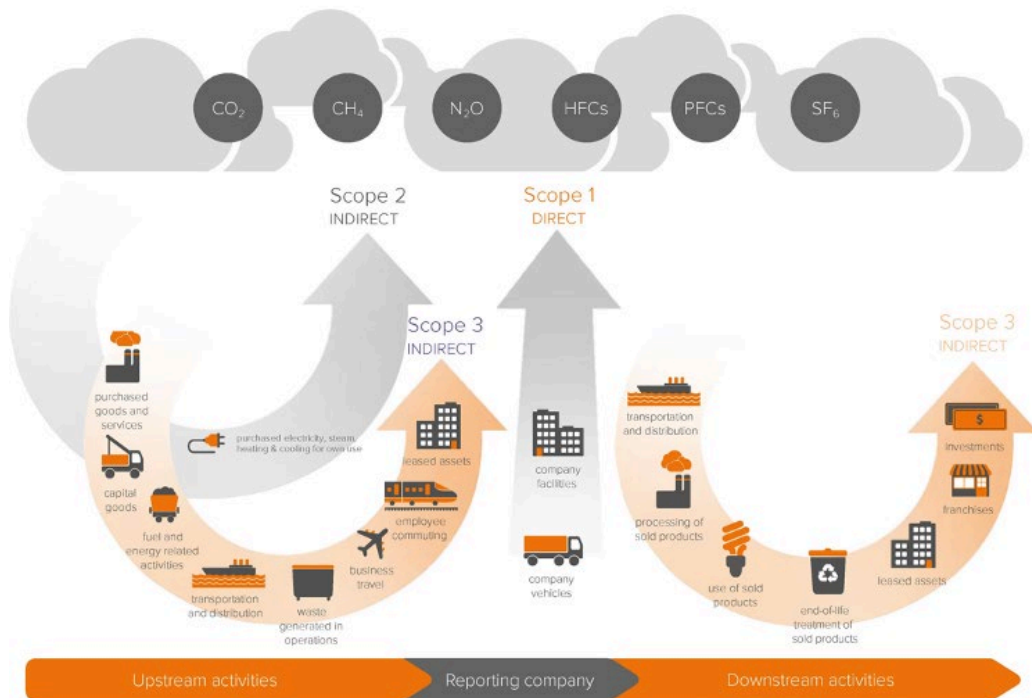
Also known as  
CO<sub>2</sub>-eis  
MPG-2  
GWPa

Paris Proof targets	embodied carbon kg CO <sub>2</sub> -eq per m <sup>2</sup>			
	2021	2030	2040	2050
Residential (one-family)	200	126	75	45
Residential (multiple-family)	220	139	83	50
Office	240	158	94	56
Retail	260	164	98	59
Industry	240	151	91	54

Paris Proof targets	embodied carbon kg CO <sub>2</sub> -eq per m <sup>2</sup>			
	2021	2030	2040	2050
Residential (one-family)	100	63	38	23
Residential (multiple-family)	100	63	38	23
Office	125	79	47	28
Retail	125	79	47	28
Industry	100	63	38	23



# Next step: Common framework Scope 3 interpretation



**Goal: Dutch interpretation of Scope 3 for the built environment**

## Steps in process

1. First focus on builders
2. Inventory of used methods, databases, choices with expert group
3. Concept framework testing with market and accountant
4. Seeking alignment with others



# CARBON RISK REAL ESTATE MONITOR

The CRREM-SBTi aligned decarbonisation pathways for Real Estate | 30.11.2023

Julia Wein

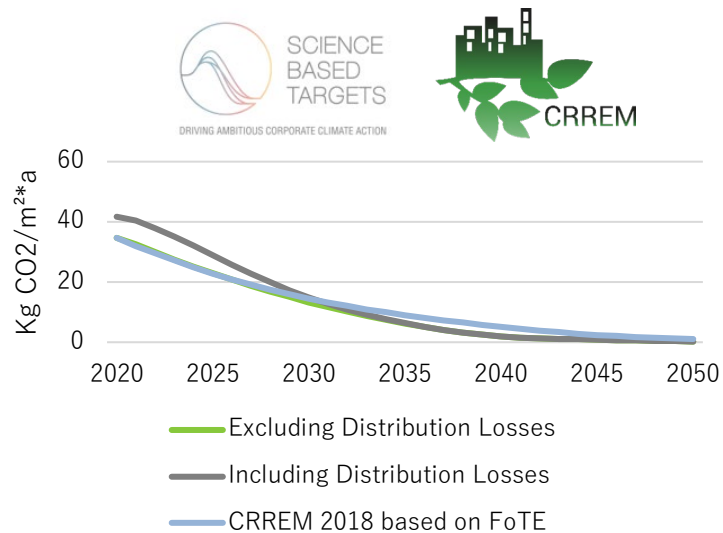
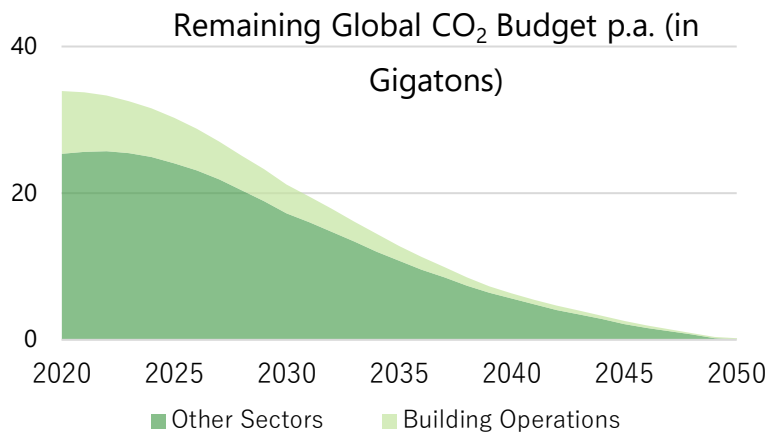
Laudes —  
— Foundation

The Carbon Risk Real Estate Monitor (CRREM) provides the real estate industry with **transparent, science-based decarbonization pathways** aligned with the Paris Climate Goals of **limiting global temperature rise to 2°C, with ambition towards 1.5°C**. CRREM considers both **operational carbon and energy intensities**.

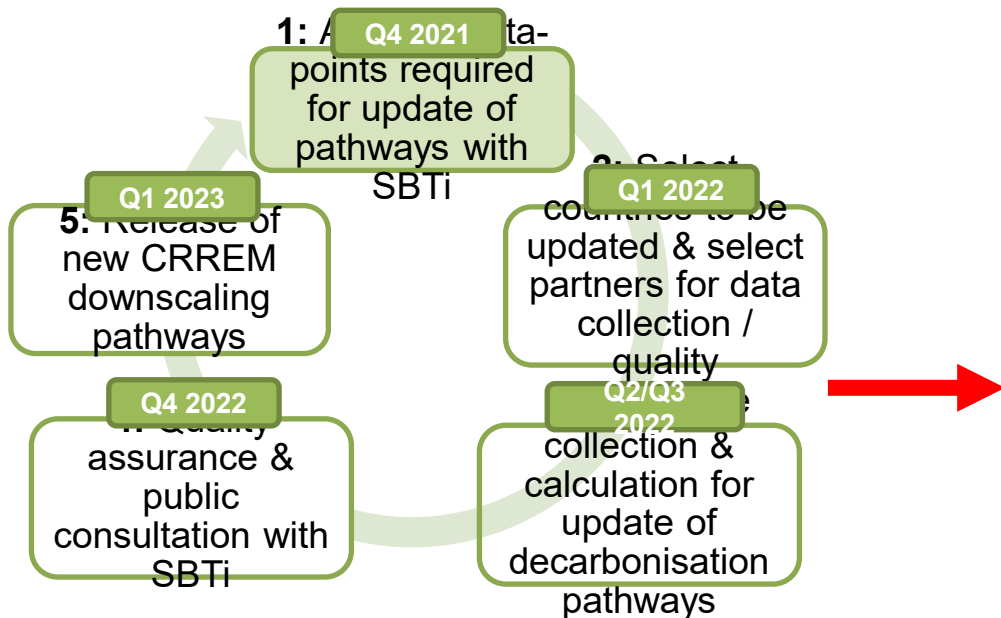
## CRREM...

- ... evaluates and tracks **operational** carbon/energy
- ... differentiates performance targets based on **use and location**
- ... provides pathways for both **carbon and energy intensity**
- ... pushes for **global alignment** with other sectors / approaches / initiatives
- ... is a **whole building** approach to holistically evaluation asset decarbonization
- ... uses straightforward **intensity KPIs** (per SqFt, SqM) for tracking

# GLOBAL CO<sub>2</sub> & kWh INTENSITY PATHWAYS



## PROCESS FOR THE UPDATE OF THE CRREM DECARBONISATION PATHWAYS WITH SBTi

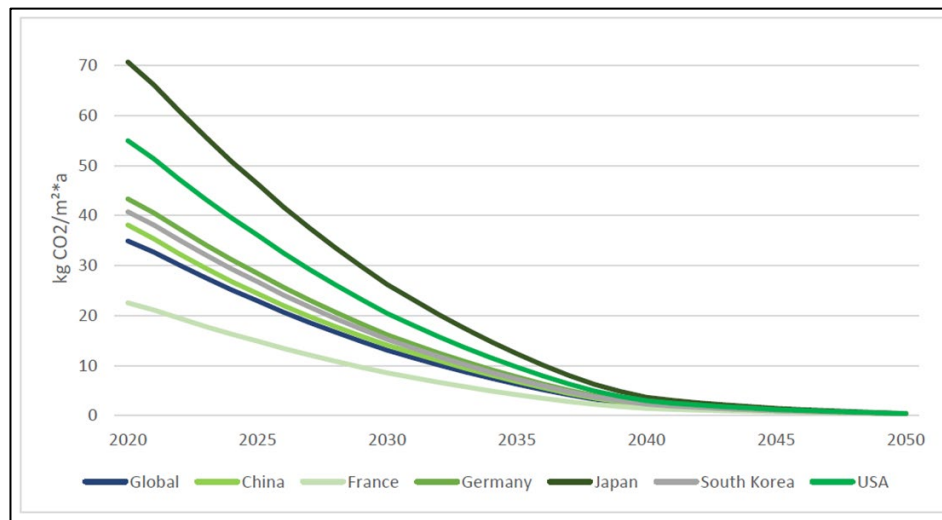


CRREM PATHWAYS: Top-down downscaling
<p><b>World Data:</b></p> <ul style="list-style-type: none"> <li>- <b>NEW</b> Global budget:                             <ul style="list-style-type: none"> <li>- IEA, IPCC</li> </ul> </li> </ul>
<p><b>Individual Country Data (Commercial):</b></p> <ul style="list-style-type: none"> <li>- <b>Energy Intensity</b> for the "whole-building" (kWh/m2/pa)</li> <li>- Country average <b>emission factors</b> (EFs)</li> <li>- <b>EF Development</b></li> <li>- <b>Energy-mix</b> &amp; Development</li> <li>- <b>Building Stock</b> (Commercial) &amp;</li> <li>- Building Stock <b>growth rate</b></li> </ul>
<p><b>Real Estate Subsectors Data:</b></p> <ul style="list-style-type: none"> <li>- Energy-intensity (kWh/m2/pa)</li> <li>- EF &amp; EF Development</li> <li>- Energy-mix &amp; Development</li> <li>- Building Stock (Residential) &amp;</li> <li>- Building Stock growth rate</li> </ul>

## NEW UPDATE

### SOME HIGHLIGHTS:

- **More Data partners:** for specific data. Partners include: CSR design, UKGBC, Australia GBC, etc.
- **Year:** New baseline year 2020 (2018 previously).
- **New property-type:** Industrial Dist. Warehouse Cooled & Industrial Dist. Warehouse Warm.
- **Further granularity on regions:** Further sub regions have been included for the USA as well as Australia (due to the country area/size).
- **New GHG-pathway:** New CO<sub>2</sub> & CO<sub>2</sub>"e" pathways for correct benchmarking



SCIENCE  
BASED  
TARGETS

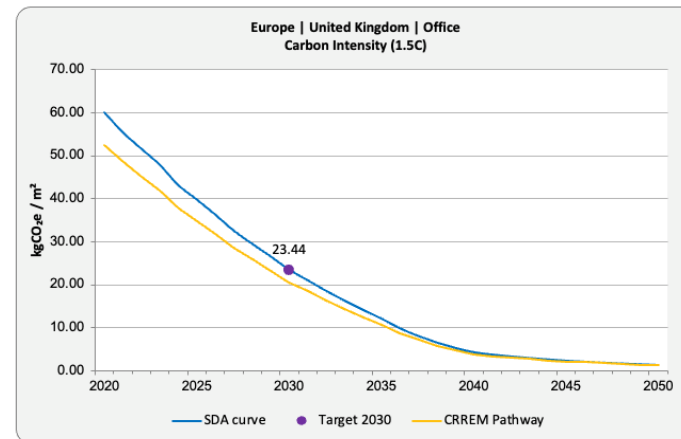
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION



CRREM

## Risk Assessment (CRREM) vs. Target Setting (SBTi)

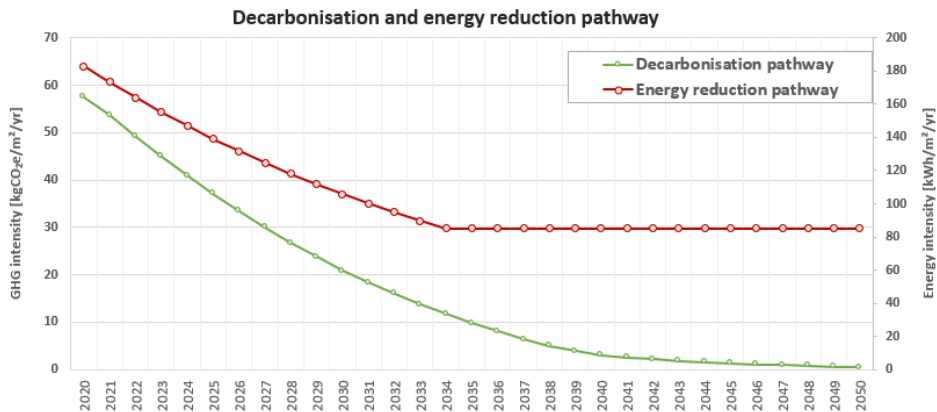
- The new 1.5° C **aligned CRREM-SBTi pathways** mean that the industry can **use the same underlying emissions scenarios and projections for limiting warming to 1.5° C by 2050** for both risk assessment and target-setting purposes.
- **CRREM:** transition risk assessment enables the evaluation of a property's relative risk compared to the median property
- **CRREM:** Guided by the logic of the market's average intensity within the CRREM pathways, not all properties will perfectly align with the benchmark in the short run; rather, some will fall below it, and some will exceed it.
- **SBTi:** The SBTi derives company-level science-based targets from sector emissions scenarios by applying a target-setting method called the sectoral decarbonization approach (SDA).
- **SBTi:** The SDA method is based on carbon intensity convergence whereby different companies in the sector are expected to converge toward an emission intensity at a certain time e.g. in 2050.





## CRREM & DGBC:

- **CRREM has aligned** all underlying datapoints with the DGBC.
- **“Whole building”** approach, however **excluding certain consumption like EV charging.**
- **Energy-intensities for property-types directly aligned with the DGBC.**
- **CRREM uses EU source for EF projections:** FF55 Scenario & EU Ref Scenario. Please note: this could be higher/ different to national projections.



Global warming target:	1.5°C
Country:	Netherlands
Type of use:	Office



## CRREM | CARBON RISK REAL ESTATE MONITOR

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**IIO**  
INSTITUTE FOR REAL ESTATE  
ECONOMICS

# A 1.5°C PATHWAY FOR THE GLOBAL BUILDINGS SECTOR'S EMBODIED EMISSIONS

Scope 1-2-3: SBTi, CRREM and operational reduction pathways, Ramboll and the embodied carbon budget

30 November 2023

**RAMBOLL**

Bright Ideas.  
Sustainable change.



# Ramboll in brief

We are an independent engineering, architecture and consultancy company founded in Denmark in 1945.

Our experts create sustainable solutions across **Buildings, Transport, Water, Environment & Health, Architecture & Landscape, Energy, and Management Consulting.**

Across the world, Ramboll combines local experience with a global knowledgebase to create sustainable cities and societies. We combine insights with the power to drive positive change to our clients, in the form of ideas that can be realized and implemented.

We call it:  
**Bright ideas. Sustainable change.**

 **300** global offices

 **18,000** employees

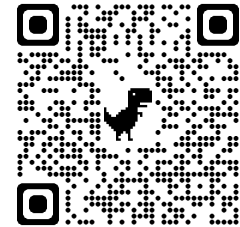


RAMBOLL



# Foundational work on developing embodied carbon benchmarks

- Report series published in March 2022
- Together with Laudes Foundation and academic partners
- **Bottom-up baseline** of embodied carbon in Europe
- **Top-down targets** based on global carbon budget



<https://c.ramboll.com/lets-reduce-embodied-carbon>

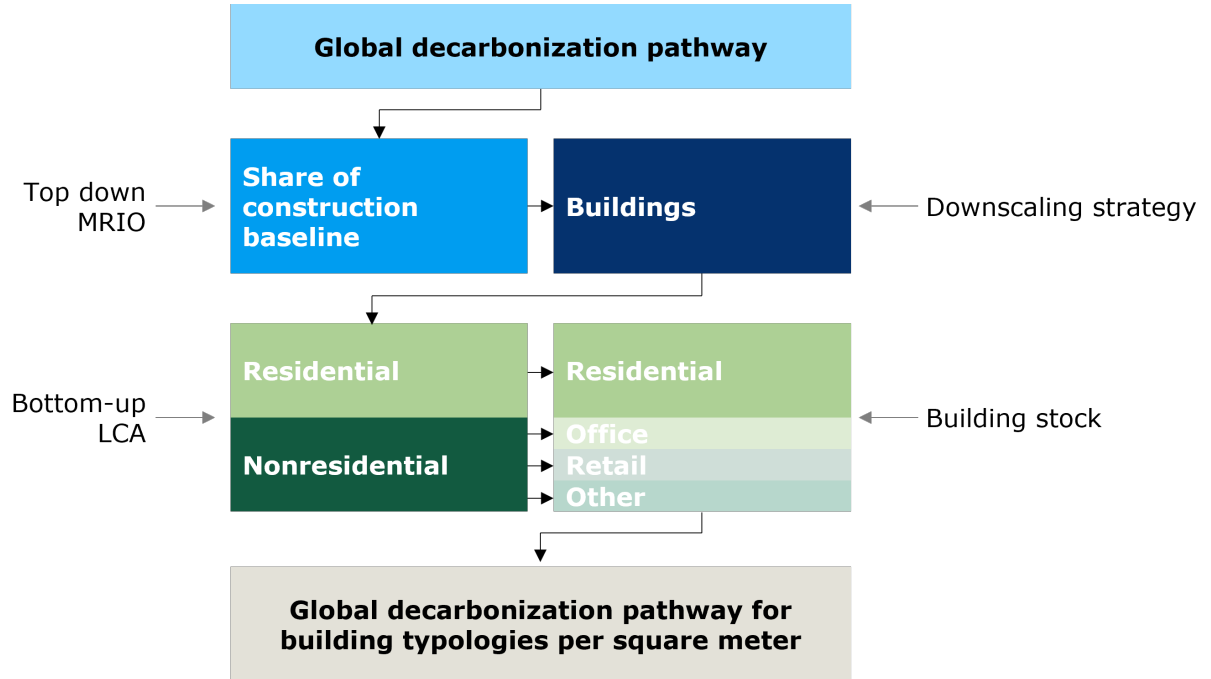
# Our approach for the SBTi pathway

We define a reference pathway:

- Aligned with SBTi fundamentals
- New construction
- Upfront emissions
- Absolute emissions pathway
- Intensity target
- Intensity metric CO<sub>2</sub>e/m<sup>2</sup>

Alternative options are also provided:

- Absolute emissions target (in % reduction of carbon footprint)
- Combined pathway for new construction and renovation



# Key elements and data sources for a science-based decarbonisation pathway for upfront embodied emissions (I)

## Global carbon budget and decarbonisation pathway

- IPCC AR6: GHG budget
- Median of pathways for 1.5°C with no or little overshoot ("C1")

## Data on construction emissions

- Exiobase version 3.8.2
- Multi-Regional Input-Output Model that provides information on the environmental impacts of economic activities across regions and sectors

## Downscaling strategy

- Identify the appropriate share of buildings' embodied emissions out of the entire global carbon budget

Downscaling approach	Allocated share for new building construction
Grandfathering	10.2%
Economic value added	6.6%
Equal per capita and utilitarian	9.2%

Source: Own calculations based on Exiobase

# Key elements and data sources for a science-based decarbonisation pathway for upfront embodied emissions (II)

## Bottom-up LCA data

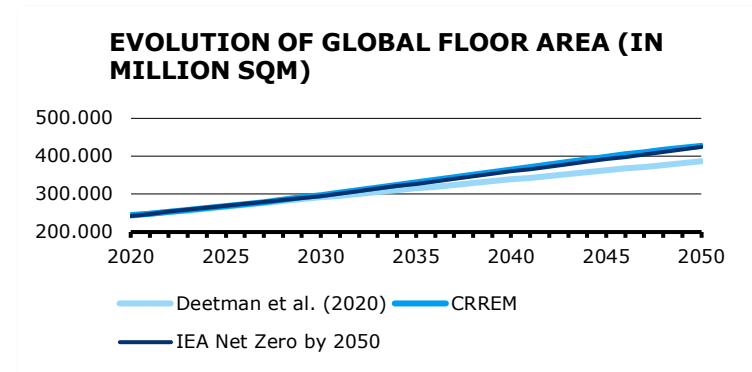
- Informs the status quo of upfront embodied carbon levels for the different building types

Average CO <sub>2</sub> eq emission	kg CO <sub>2</sub> eq / m <sup>2</sup>
Residential	407.9
Offices (an assumed representative for other non-residential typologies)	572.4

Source: Röck, M. et al. (2020). Embodied GHG emissions of buildings – The hidden challenge for effective climate change mitigation. <https://doi.org/10.1016/j.apenergy.2019.114107>.

## Building stock development

- Projected global floor area growth
- Corrected for renovation to account only for net new building construction
- Disaggregated for different building types (residential, offices, retail, other)



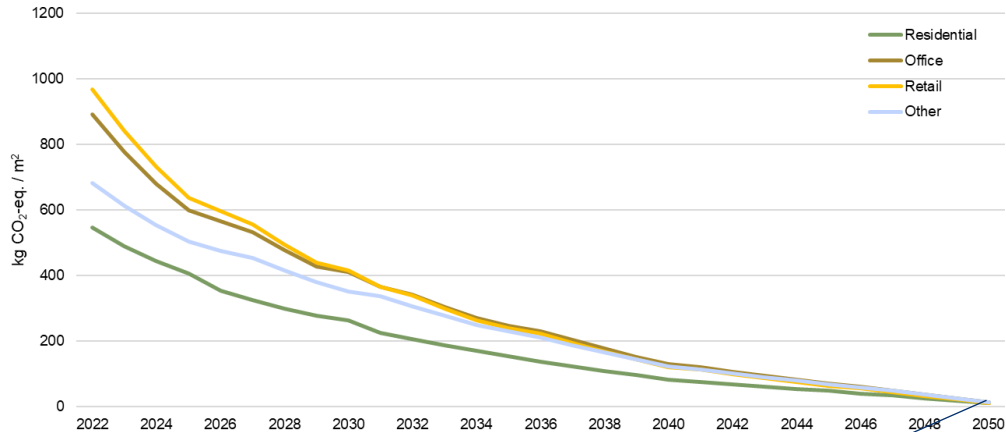
Sources: IEA (2021) [https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector\\_CORR.pdf](https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroBy2050-ARoadmapfortheGlobalEnergySector_CORR.pdf); Deetman et al (2020). Modelling global material stocks and flows for residential and service sector buildings towards 2050. <https://doi.org/10.1016/j.jclepro.2019.118658>



# Carbon intensity upfront embodied GHG emissions pathway for new buildings (SDA pathway)

All pathways and targets relate to upfront embodied carbon (A1-A5) for the entire building, including structure, floors, roof, internal and external walls, and finishes up to a CAT A fit out.

The m<sup>2</sup> relate to the gross floor area of the building.



**97% reduction relative to 2020 absolute GHG emissions by 2050**

## Emission intensity targets kg CO<sub>2</sub>eq/m<sup>2</sup>

	2025	2030	2035	2040	2045	2050
Residential	406.8	264.0	154.1	84.2	49.0	11.3
Office	598.6	410.0	247.1	129.9	70.3	14.3
Retail	638.1	414.9	239.2	121.7	64.2	12.9
Other	504.0	350.6	230.3	124.0	69.4	14.9

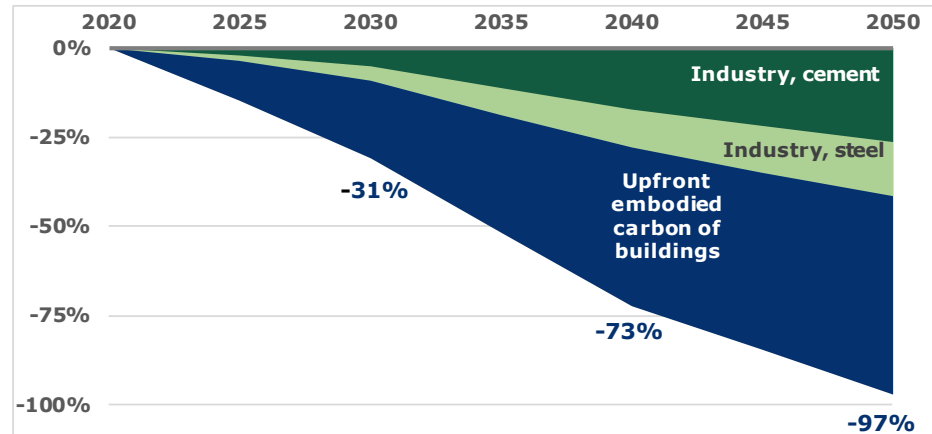
# To be aligned with a 1.5C target, emissions reductions are needed that go much beyond the decarbonization of the production of steel and cement

- Reducing upfront embodied emissions is influenced by material sectors, which reduce more slowly up to 2030

Sector	Share of total upfront GHG emissions from construction 2019	Reduction % relative to 2020 levels (SBTi absolute reduction, scope 1)	
		2030	2050
Cement	28%	-19%	-94%
Steel	17%	-24%	-91%

- Much further reduction measures are needed, including improving design for less material use and shifting to low-carbon material alternatives from reuse, recycling or sustainable bio-based sources

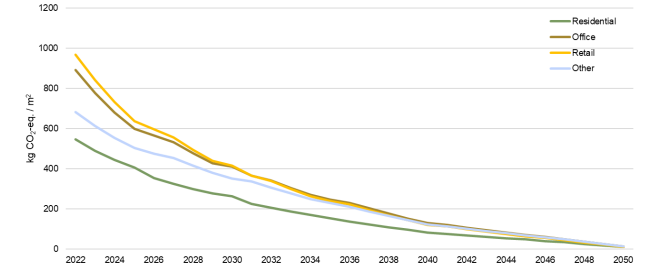
**Reduction pathway for absolute upfront embodied emissions with contribution from cement and steel industries**



# The pathways for all building construction activities including renovation is steeper than for new construction only

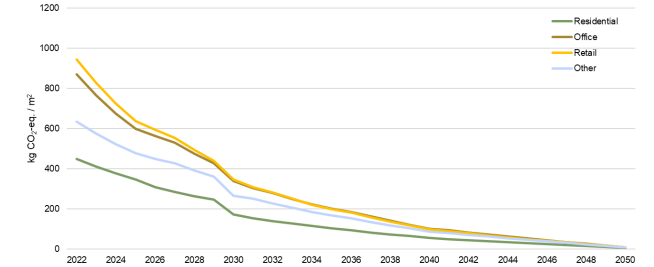
The pathways for all building construction activities project a steeper reduction in kg CO<sub>2</sub>-eq/m<sub>2</sub>, due to the additional number of m<sup>2</sup> being included for renovation, with upfront GHG emissions per m<sup>2</sup> about 50% lower for renovation than for new construction. However, the pathway for all building construction activities allow the market to focus on renovation and increase the number of m<sup>2</sup> that can be delivered for the same carbon budget.

**New buildings only**



	2025	2030	2035	2040	2045	2050
Residential	406.8	257.4	154.1	84.2	49.0	11.3
Office	598.6	385.8	247.1	129.9	70.3	14.3
Retail	638.1	390.9	239.2	121.7	64.2	12.9
Other	504.0	350.6	230.3	124.0	69.4	14.9

**All building construction activities**

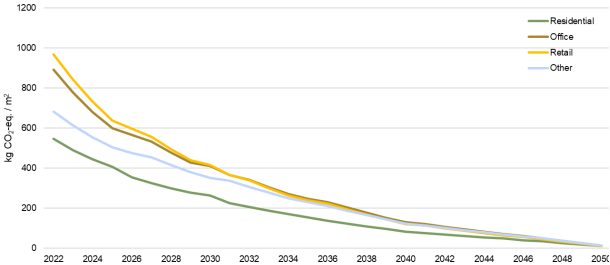


	2025	2030	2035	2040	2045	2050
Residential	348.0	171.6	105.5	56.5	31.2	6.5
Office	598.2	325.0	201.7	103.0	53.5	10.3
Retail	637.6	333.0	199.4	99.2	50.5	9.6
Other	478.8	265.4	169.3	88.7	47.4	9.4

# The pathways do not significantly change when a different downscaling approach is applied

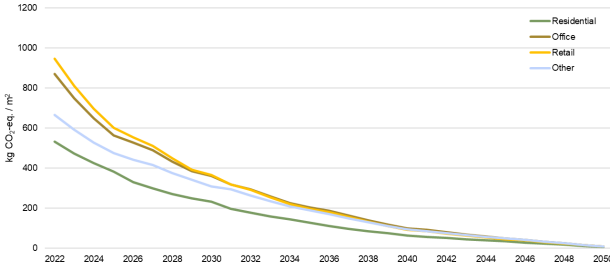
Independently of the downscaling approach applied, the upfront embodied emissions pathways project a steep reduction in kg CO<sub>2</sub>-eq/m<sub>2</sub>, due to the projected expansion in m<sup>2</sup> being built in the future, especially in developing economies

**Grandfathering**  
(allocated share of emission budget = 10.2%)



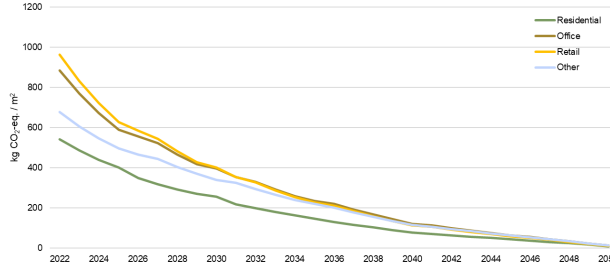
	2025	2030	2035	2040	2045	2050
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Retail	638.1	390.9	239.2	121.7	64.2	12.9
Other	504.0	350.6	230.3	124.0	69.4	14.9

**Economic value added**  
(allocated share of emission budget = 6.6%)



	2025	2030	2035	2040	2045	2050
Residential	383.1	227.4	127.2	64.6	34.7	7.3
Office	563.7	340.8	203.9	99.6	49.8	9.3
Retail	600.9	345.4	197.4	93.3	45.5	8.4
Other	474.6	309.7	190.0	95.1	49.2	9.7

**Equal-per-capita and utilitarian**  
(allocated share of emission budget = 9.2%)



	2025	2030	2035	2040	2045	2050
Residential	400.7	249.6	147.2	79.1	45.3	10.3
Office	589.6	374.2	236.0	122.1	65.0	13.0
Retail	628.5	379.1	228.4	114.3	59.4	11.8
Other	496.4	340.0	219.9	116.5	64.2	13.5

# Thank you!

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# Downscaling approaches

Attribution principles	Description	Underlying principle of distributive justice
<b>Grandfathering</b>	The GHG budget is allocated and spread over time based on past or current emission levels. Current high emitters also have relatively higher carbon budgets.	<i>Acquired rights:</i> No theoretical justification, as the share, is based on historical data on how large a share the system/country has previously acquired.
<b>Equal per capita</b>	All individuals in the world have an equal right to emit GHGs. The individual carbon budget is the same for all, which allows to establish national carbon budgets.	<i>Egalitarianism:</i> All individuals should be equal in terms of welfare or resources.
<b>Economic capability</b>	A larger share of the remaining budget is allocated to those who have fewer means, for instance by allocating a lower reduction target to a country with a low GDP. The individual carbon budget differs and favours poorer and less developed economies.	<i>Prioritarianism:</i> A benefit has a greater moral value the worse the situation of the individual to whom it accrues.
<b>Economic value added</b>	Determines the total gross value added from each industry sector based on total economic activity in the World. The approach considers value added it does not consider the need or utility that the industries provide to the final consumers	<i>Financial merit:</i> Industry sectors with a relatively large value added are allocated a proportionally large share of the emission budget.
<b>Utilitarian</b>	The carbon budget is split by assigning individual shares which are proportional to the final consumption expenditure of an economy.	<i>Utilitarianism:</i> Maximising the sum of welfare should be the priority.
<b>Historic responsibility</b>	Emissions since the industrial revolution have caused global warming and depleted carbon budget to the current levels. Therefore, emitters of the past should be held accountable and emit less in the future.	<i>Responsibility:</i> Historic action is the reason for the situation the world is facing today.

# Downscaling approaches have different advantages and disadvantages

## Grandfathering

### Advantages

- Mature and widespread principle
- Commonly used because it can be substantiated with comparable and high-quality data

### Disadvantages

- Prolonges historical emission patterns into the future without considerations of equity or ability to decarbonise



## Equal-per-capita combined with Utilitarian

### Advantages

- Avoids replicating current and historical emissions patterns
- Maximises total welfare based on final consumption expenditure

### Disadvantages

- Empirical data is limited. Modelled data is needed at the global level
- Requires adaptation to be applicable to scope 3 emissions







SUSTAINABLE  
FINANCE



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# SUSTAINABLE FINANCE

Unlocking impactful finance flows into the transition  
towards a sustainable built environment

30 November 2023  
DEN HAAG

FOUNDING  
MEMBERS

**SKANSKA**

The logo icon for Saint-Gobain, featuring a stylized building or graph structure with red and blue lines.  
**SAINT-GOBAIN**

# Sustainable Finance Taskforce members



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# 28

Green Building Councils

FOUNDING  
MEMBERS

SKANSKA



# Sustainable finance lens



SUSTAINABLE  
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# 3 x

more investments needed in energy efficiency in buildings alone

# 2/3

of our global net worth comes from the real estate sector, subject to **substantive physical and transition risks** from climate change



SUSTAINABLE  
FINANCE



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**Insured losses from natural catastrophes  
have increased  
250%  
in the last 30 years.**

**It is becoming increasingly difficult to ensure any building  
in areas prone to natural disasters, such as Florida.**



SUSTAINABLE  
FINANCE



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We need to decrease energy intensity of  
our buildings to  
**85-120**  
kWh/m<sup>2</sup> by 2030.

Energy intensive buildings are at risk of economic  
obsolescence due to a changing regulatory  
environment and a shift in market expectations.

To unlock impactful finance flows we need

**Alignment.**

**Transparency**

**Accountability.**

**Contextualisation.**



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Transition risk operational pathways



WLC reporting framework



Criteria of green economic activities



Setting of corporate climate targets

Climate Bonds  
INITIATIVE

Criteria for green buildings for bonds



X

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**Thank you for your  
attention! The  
conference continues  
on the 3rd floor**

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