CARBON RISK REAL ESTATE MONITOR

CRREM: ASSESS, MANAGE & AVOID CARBON RISK

15.10.2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 785058

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PROPERTY VALUES ARE INCREASINGLY
EXPOSED TO CLIMATE RISK

'CLIMATE RISK IS INVESTMENT RISK'
(BLACKROCK, 2020)

assess, manage & avoid risk with the Carbon Risk Real Estate Monitor

CRREM pathways

- Paris-aligned decarbonisation & energy reduction pathways
- Per country and building type

CRREM Tool

- Assess the carbon and energy performance of buildings and portfolios
- Benchmark against CRREM pathways and peers
- Derive indicators for risk management, reporting, disclosure

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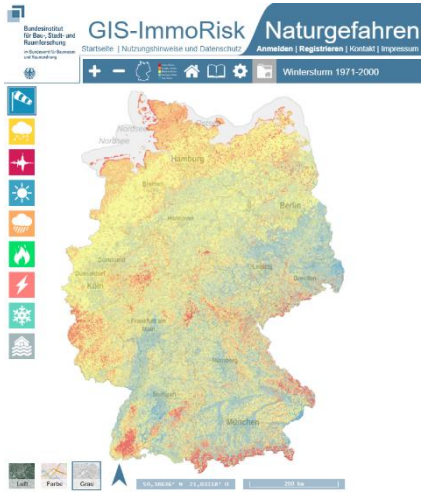
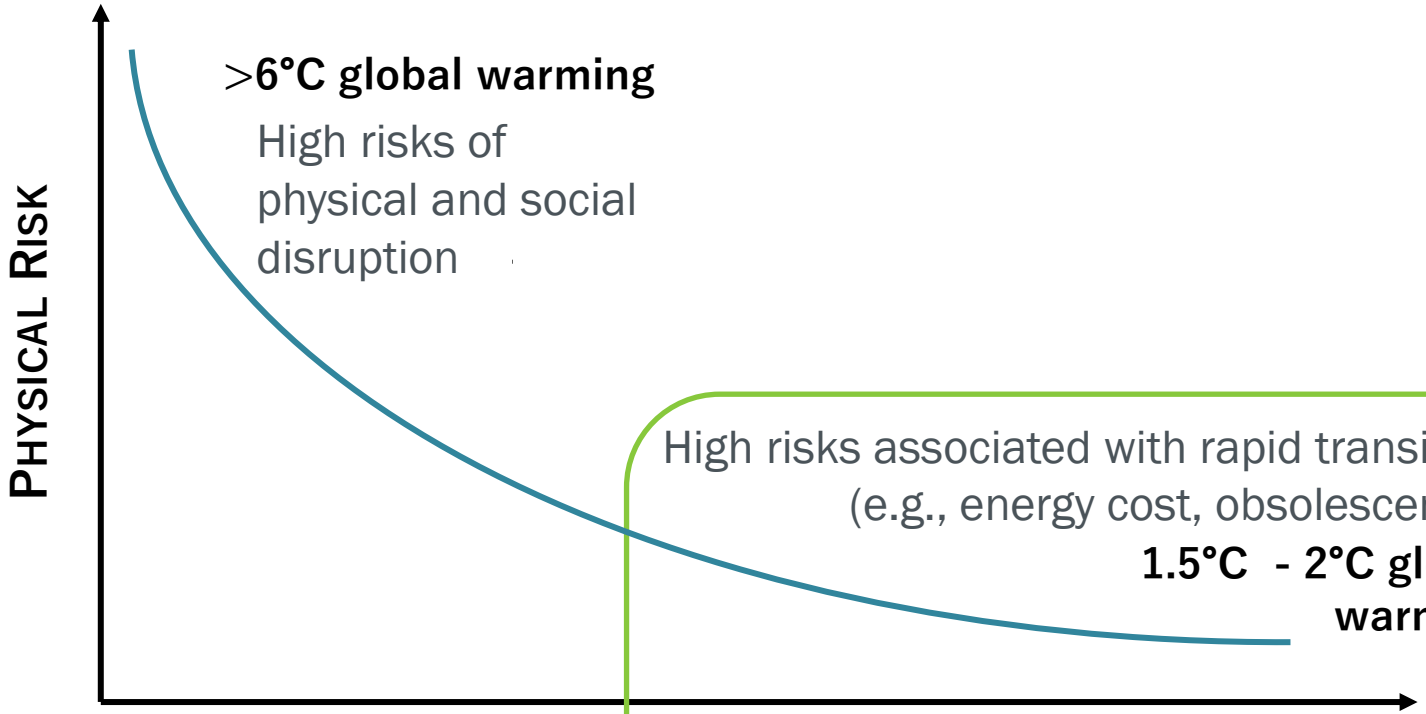
CLIMATE RISK

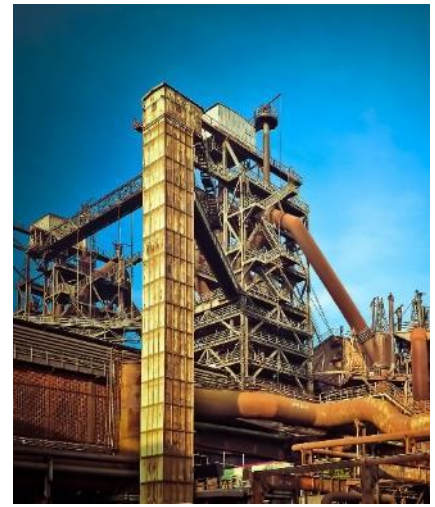


www.gisimmorisknaturgefahren.de

CLIMATE RISK =

PHYSICAL RISK + TRANSITION RISK





'**STRANDED ASSETS** are properties that will be exposed to the risk of early economic obsolescence due to climate change because they will not meet future regulatory efficiency standards or market expectations.' *(CRREM, 2019)*

Source: TCFD Technical Supplement, 2017

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Climate science

Climate impact and carbon emission budgets/pathways compatible with limiting global warming to x.x°C

↓

Paris Agreement

Commitment to limit global warming to 2°C or better 1.5°C

↓ ↓

Politics

New regulatory requirements: Emission/energy goals, reporting, (sustainable) finance

Real Estate Investors

Changed market expectations, 'Paris-proof' investments/portfolios

↓ ↓

STRANDING RISK | CARBON RISK | TRANSITION RISK

↑

assess, manage & avoid

CARBON RISK REAL ESTATE MONITOR

CRREM Pathways **CRREM Tool**

PROJECT PARTNERS

IIÖ Institut für Immobilienökonomie
Coordinator | Austria

TiasNimbas Business School
Tilburg University | Netherlands

University of Ulster | UK

University of Alicante | Spain

GRESB | The ESG Benchmark for Real Assets

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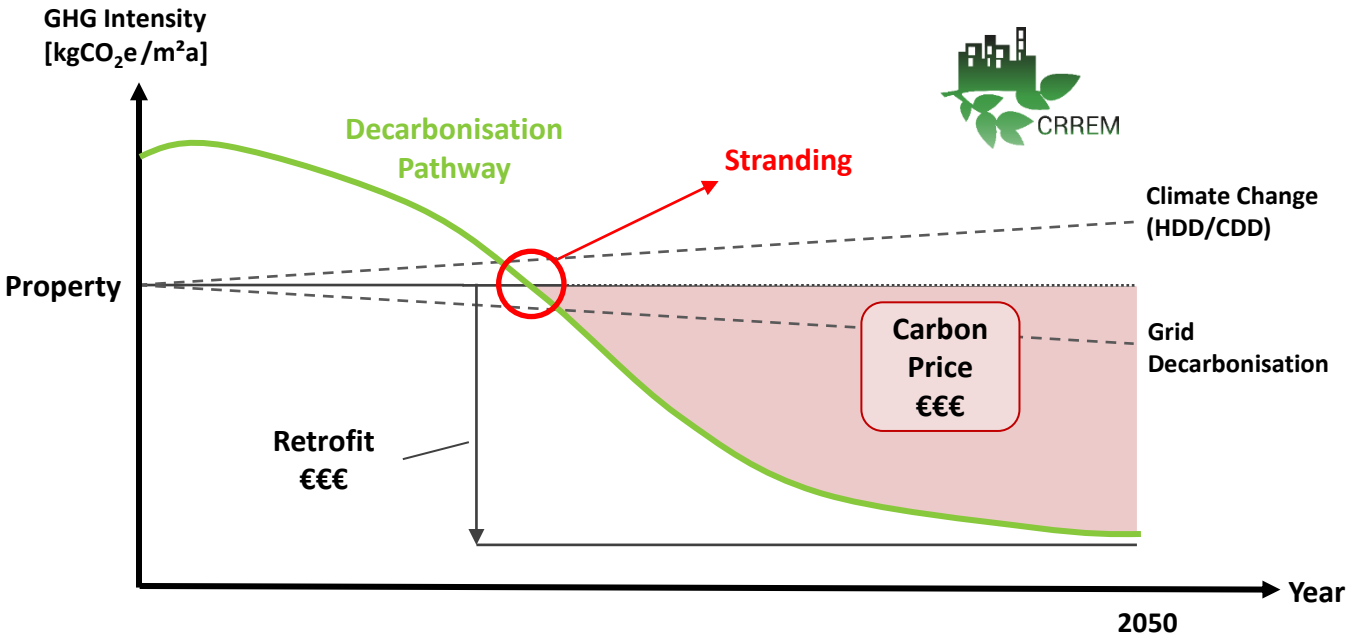
CARBON RISK ASSESSMENT & MANAGEMENT BASED ON QUANTITATIVE PERFORMANCE DATA AND TARGET SETTING

ASSET LEVEL STRANDING DIAGRAM



DECARBONISATION PATHWAYS

Aligned with 1.5°C and 2°C global warming, country- and building type specific

+

BUILDINGS' CARBON PERFORMANCE

Energy consumption, carbon emission factors, grid decarbonsation, changed heating and cooling demand, normalisation..,

=

CARBON RISK ANALYSIS

Year of stranding, excess emissions, carbon costs, energy costs, benchmarking

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ENERGY TO CO_2-EMISSIONS

WHOLE BUILDING ENERGY

Tenant electricity — kWh → Tenant controlled (pruchased & consumed)

Common area electricity — kWh → Landlord controlled (passed on to tenant)

Heating energy — kWh → Purchase by landlord

Tenant 1
Consumption
Tenant 2
Consumption
Tenant 3
consumption

$$\frac{\Sigma \text{ All consumption (kWh)}}{\text{Rented area (m²)}} =$$

INTENSITY INDICATOR 1
Energy consumption per **m²**
(kWh/**m²**)

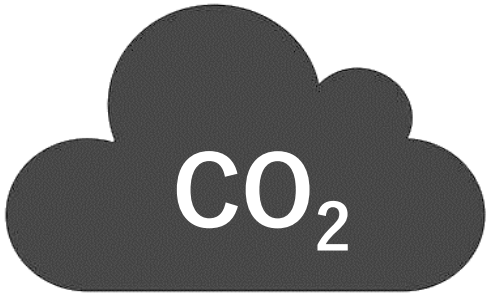
CO2 CONVERSION FACTORS

E.g. per kWh
0.475 ($kgCO_2e$)

Or 0 ($kgCO_2e$)

E.g. per kWh
0.203 ($kgCO_2e$)

BUILDING EMISSIONS



$$\frac{\Sigma \text{ All emissions } (kgCO_2e)}{\text{Rented area (m²)}} =$$

INTENSITY INDICATOR 2
CO_2 Emissions per **m²**
($kgCO_2e$/**m²**)

Source: Alstria, 2020

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1. EMISSIONS IN OPERATION

- Expand electrification, alternative types of heating (FW, WP)
- Enabling energy flexibility, eMobility and Load Management
- Renewable energies on site(production and storage)
- Reduce energy demands
- When replacing technology, focus on efficient and low-tech models

2. BUILT-IN EMISSIONS

- Continuous use of the building materials!
- In construction, use as little concrete and steel as possible!
- Simple and robust construction!
- Use low carbon (e.g. wood) and recycled building materials!

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CARBON DASHBOARD

	Reducing the company's GHG emissions		Reducing other emissions		Developing carbon sinks	
	induced emissions	solution/target	avoided emissions	solution/target	negative emissions	solution/target
Inside operational control	Company vehicles	Company policy – Evs only from 2020				
	Own offices – energy consumption	Increasing efficiency, lowering demands and renewable energy procurement				
Outside operational control – Downstream leased buildings	Energy procurement for shared services in building portfolio	Framework contract for 100 % renewable energy procurement	Refurbishing & reusing existing buildings	> 60 % of embedded emissions can be saved by reusing main building parts like foundations, slabs, columns and facades (this equals to operative emissions of 25-50 years).	Carbonization of concrete	25-50 % of the carbon that was emitted during the production of concrete is absorbed during the life cycle of exposed concrete parts
	Tenant energy consumption obtained bay the company	Renewable energy procurement	Refurbishing buildings	> -25 % tenant energy consumption by lowering energy demands, increasing efficiency and electrifying buildings		
	Pilot projects	Low carbon heating systems, renewable energy generation and energy flexibility of owned buildings	Tenant and employee energy procurement	Affordable 100 % renewable energy procurement (Mieterstromportal), incetivising renewable energy		
			Green Dividend	Energy/GHG-efficient refurbishment of existing buildings without economic profit	Green Dividend	Contributing to R&D and pilot projects to develop CCS or carbon sinks in owned buildings
Outside operational control	Business travel and Employee commuting	Offering best video conference equipment to minimize travel and encouraging the use of trains instead of flying; Incentivising public transport and bicycles for commuting	Coworking business – beehive.work	Helps start-ups and small tenants to avoid emissions by energy-efficient office space close to public transport	Joshua Tree Project	R&D and pilot projects on conversion of farmland to forests; later harvesting wood for construction materials
Outside value chain	Buying low-performing and non refurbished assets	Buying non energy-efficient assets for refurbishment	Buying assets with good access to public transport	Reducing GHG from tenant transportation (business travel and employee commuting)	GHG capture projects	Contribution to projects to develop CCS or other carbon sinks via other products
			Selling refurbished assets	Selling well performing & energy efficient buildings to others to operate		
			GHG reduction projects	Contributing to compensation & offsetting projects (i.e. climate neutral natural gas procurement		
			Pilot projects	Contributions to decarbonize energy grids		

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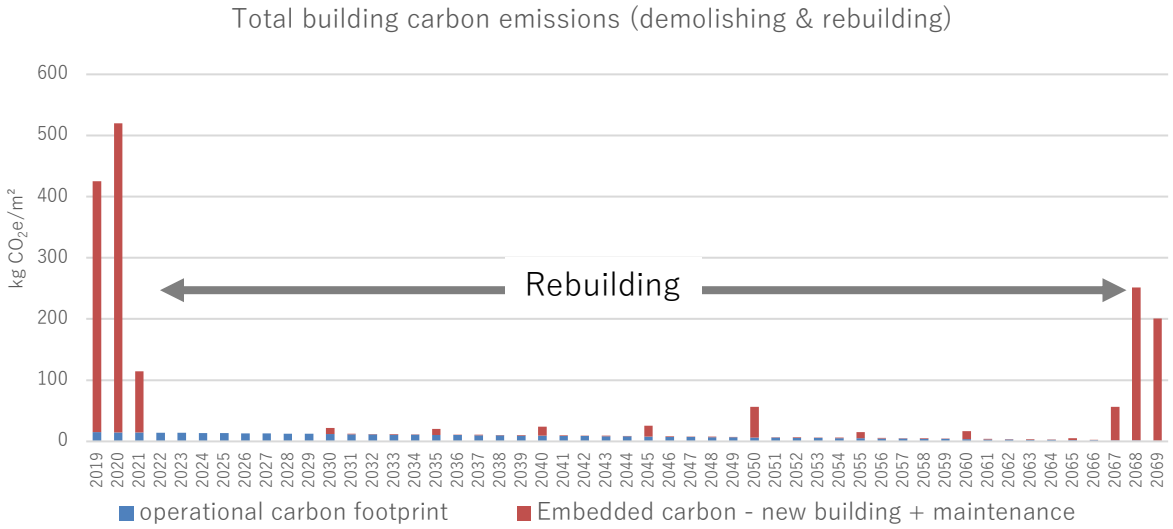
BEST IMPACT: REFURBISH & REUSE



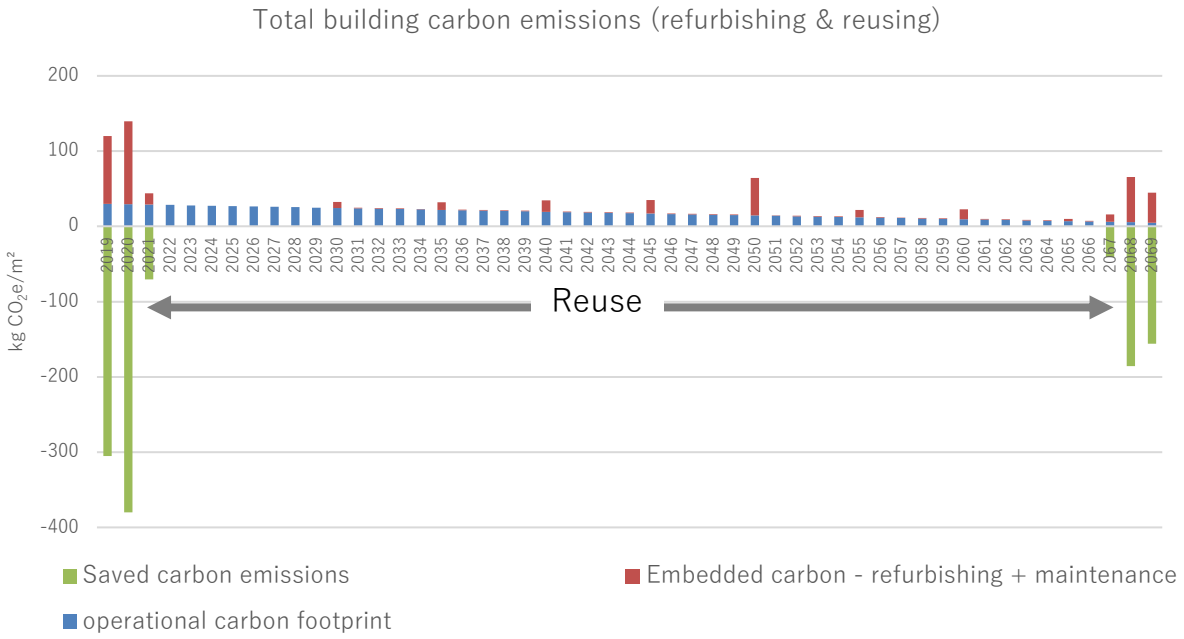
Rebuilding: approx. 1.000 kg CO_2e/m² (NGF)

operation (office): approx. 25-50 kg CO_2e/m² (NGF)

Emissions from rebuilding equal
Emissions of 25-50 years in opearation!

Refurbish & Reuse:

60 – 80 % of embedded emissions reusable
→ equals emissions of 25-35 years!



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CRREM PATHWAYS: DOWNSCALING FROM GLOBAL EMISSIONS TO CARBON INTENSITY PATHWAYS

DOWNSCALING

Global GHG budget and emissions pathway (consistent with a certain amount of global warming)

↓

Global buildings GHG emission pathway

↓

Global buildings GHG intensity pathway

↓

Country-specific residential GHG intensity pathway

↓

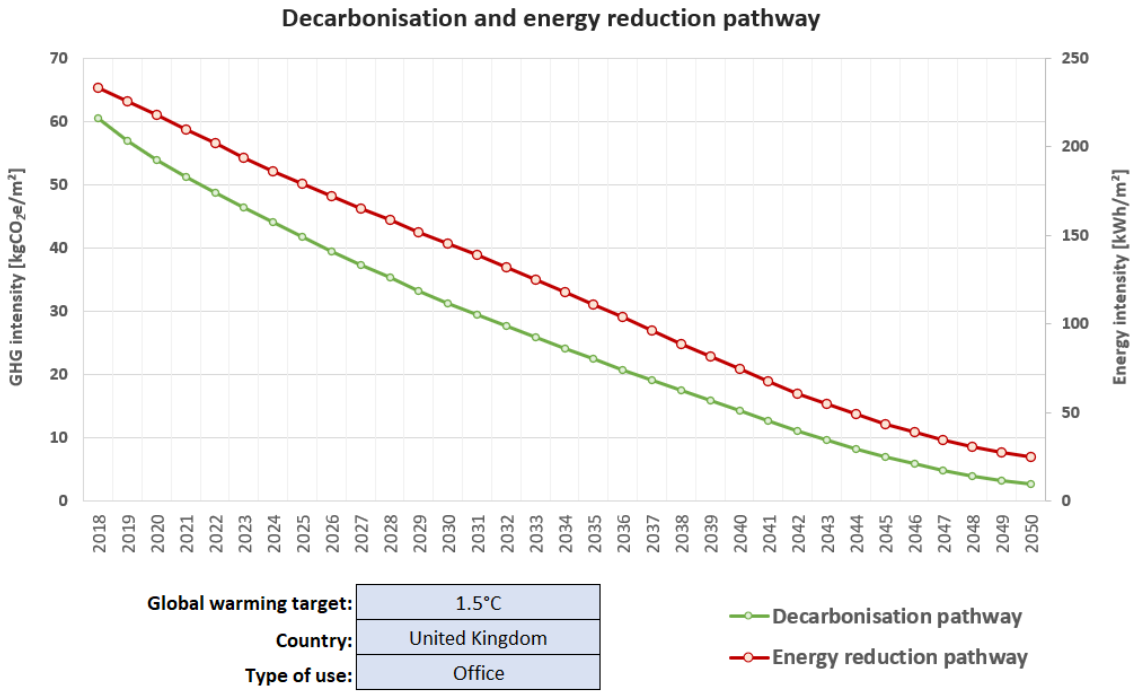
Country-specific CRE GHG intensity pathways

↓

Country-specific CRE-subsector GHG intensity pathways

↓

Country-specific CRE-subsector energy intensity pathways



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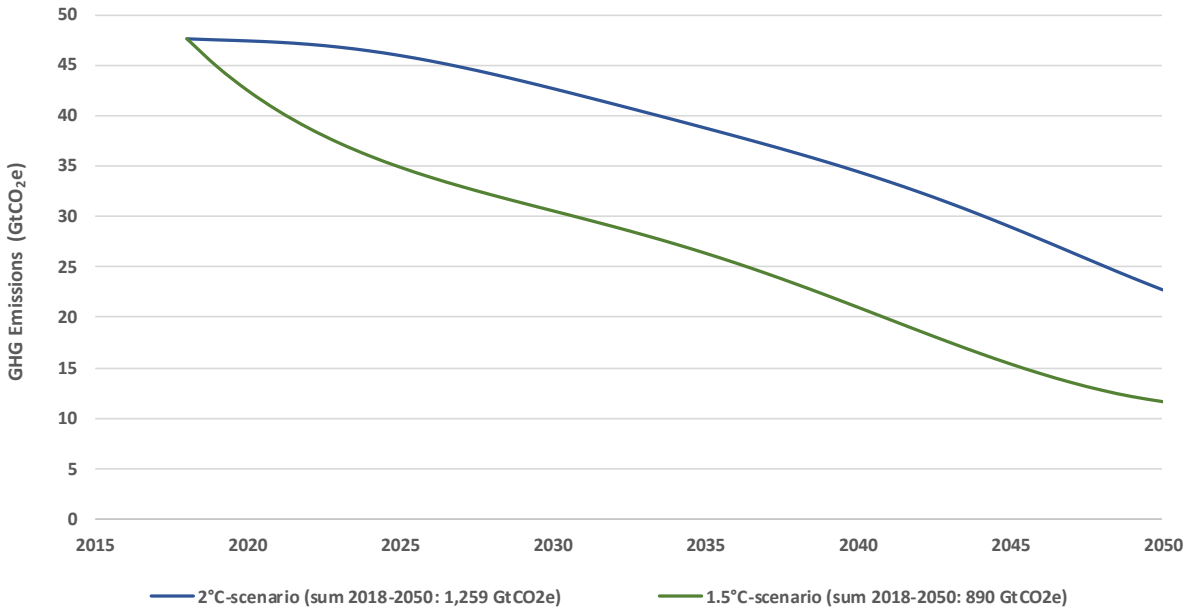
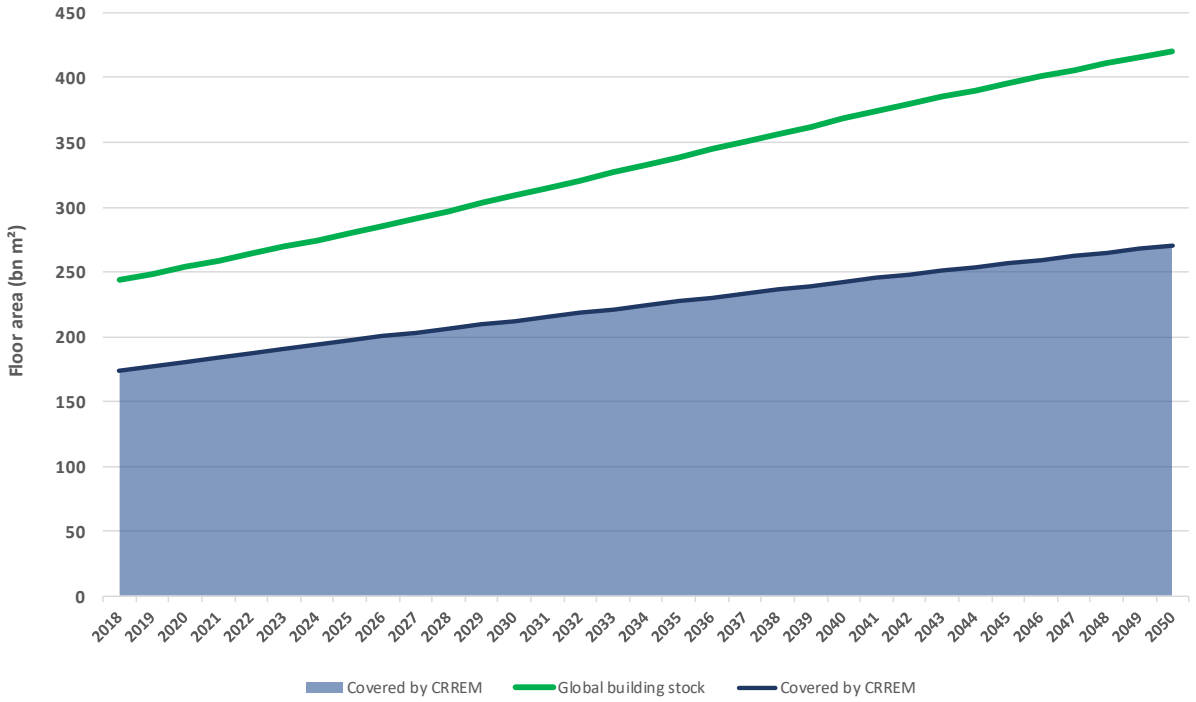
CRREM PATHWAYS: DOWNSCALING FROM GLOBAL EMISSIONS TO CARBON INTENSITY PATHWAYS

CRREM translates long-term policies (COP21) into clear science-based targets

Global carbon emission pathways (CO_2e) of 1.5°C and 2°C scenario



Evolution of global building stock (2018-2050) and part covered by CRREM



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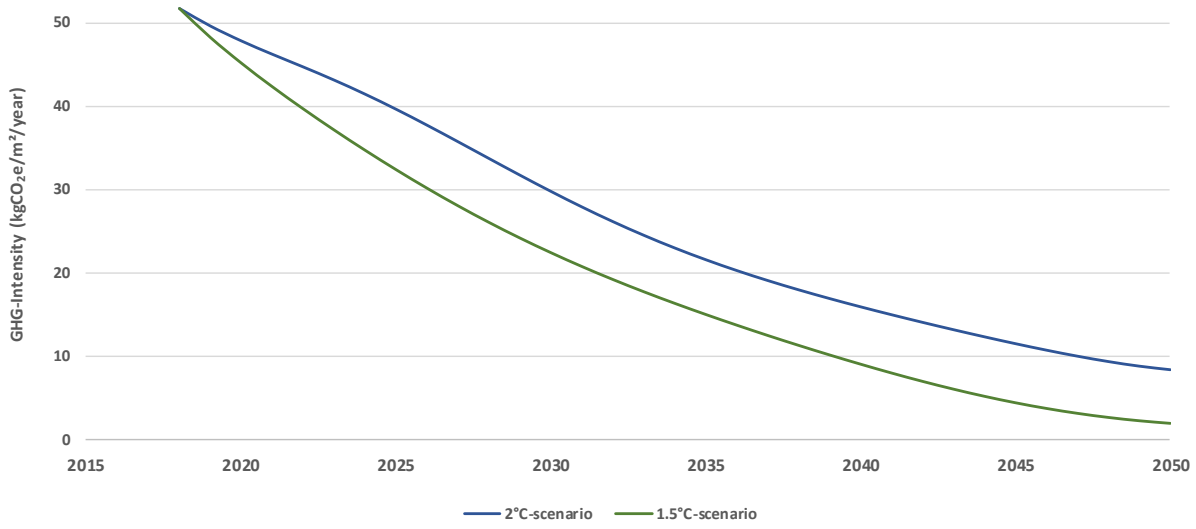
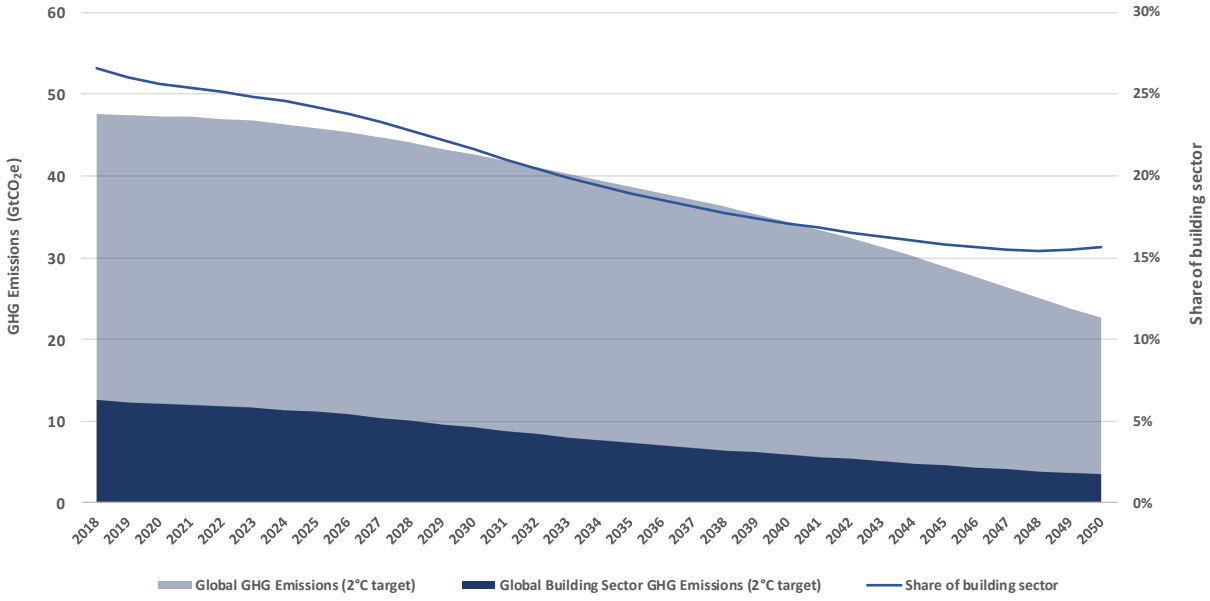
CRREM PATHWAYS: DOWNSCALING FROM GLOBAL EMISSIONS TO CARBON INTENSITY PATHWAYS

CRREM translates long-term policies (COP21) into clear science-based targets

Global building sector GHG intensity pathway (1.5°C and 2°C target)



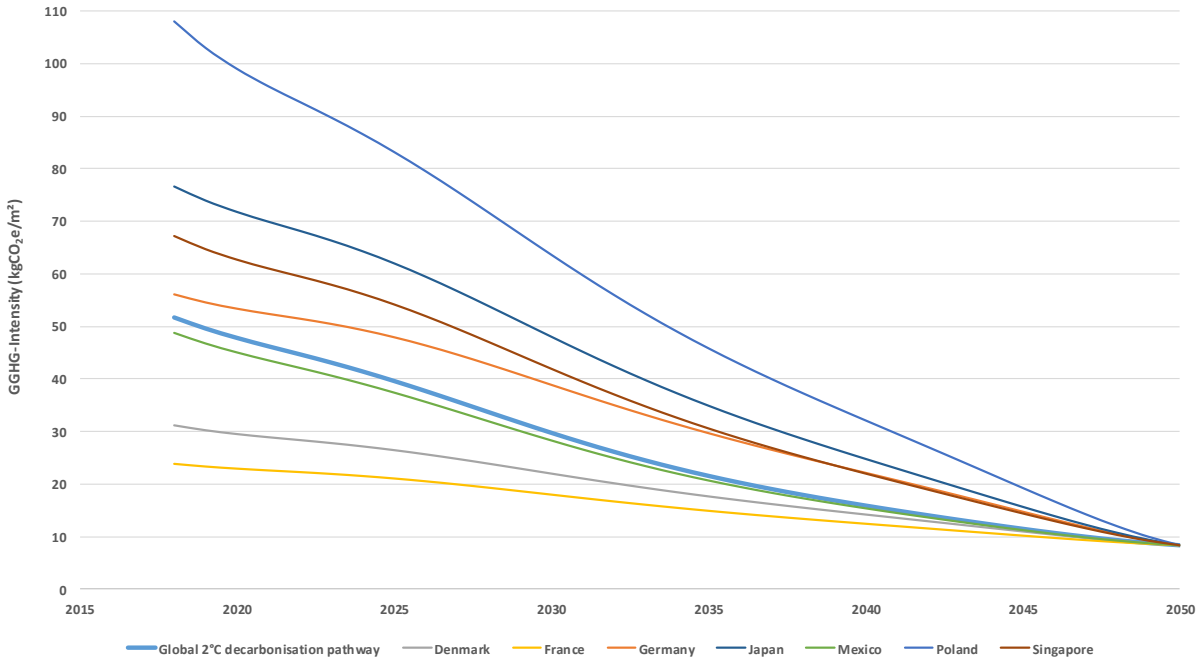
Global carbon emissions (2°C target) of all economic sectors and the building sector



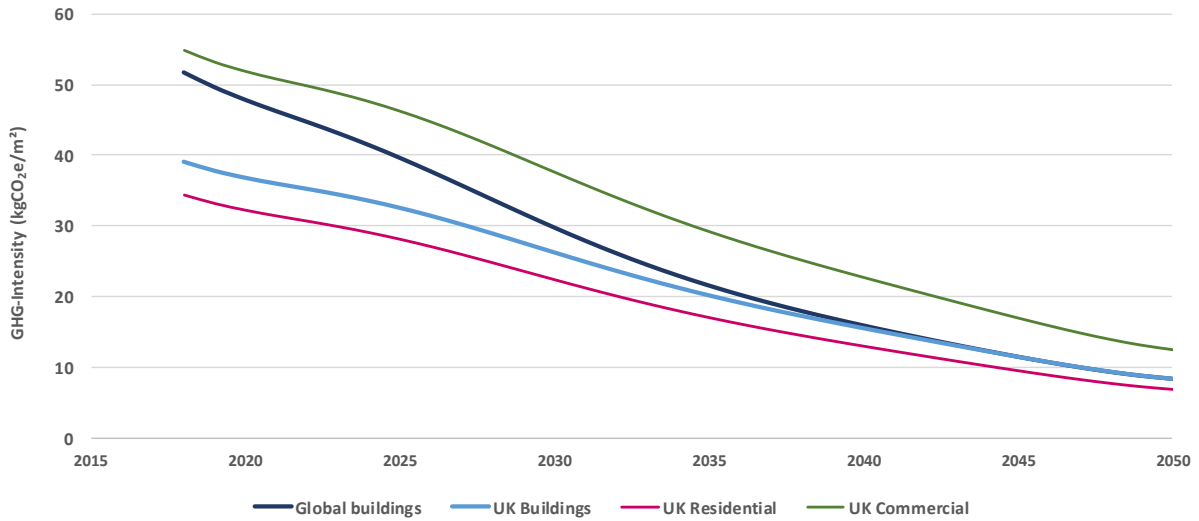
CRREM PATHWAYS: DOWNSCALING FROM GLOBAL EMISSIONS TO CARBON INTENSITY PATHWAYS

CRREM translates long-term policies (COP21) into clear science-based targets

National Pathways: Convergence of the carbon intensity pathway of the building sector in individual countries to the global pathway



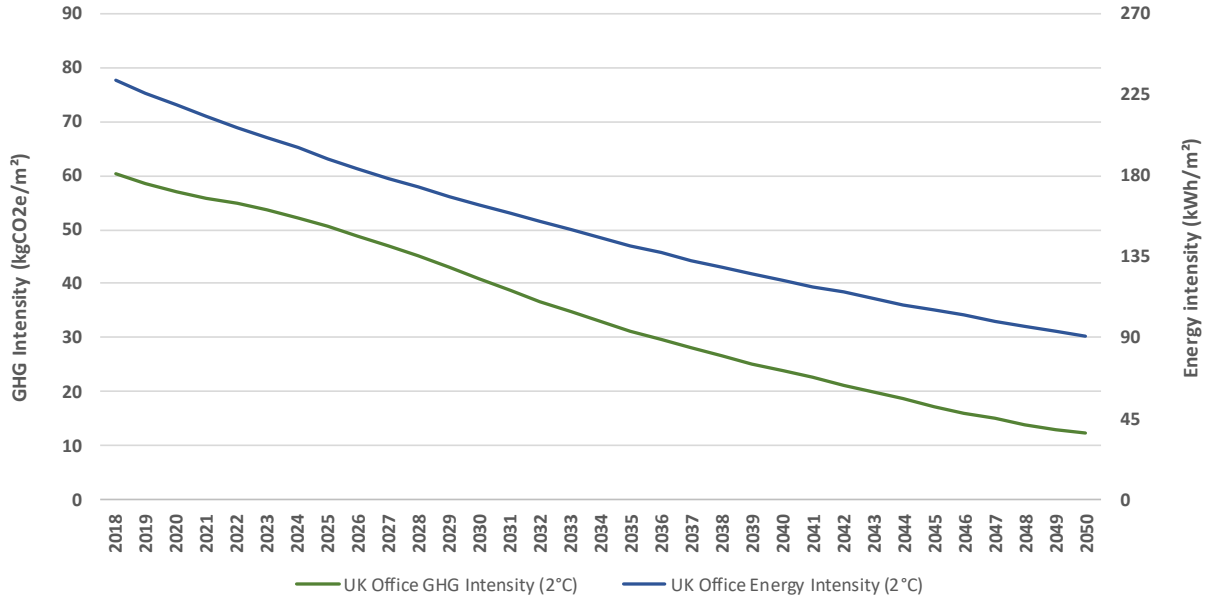
Residential and Commercial sector: Decarbonisation pathways of global buildings sector, UK buildings sector and UK residential and commercial sector



CRREM PATHWAYS: DOWNSSCALING FROM GLOBAL EMISSIONS TO CARBON INTENSITY PATHWAYS

CRREM translates long-term policies (COP21) into clear science-based targets

Subsectors of commercial real estate: Decarbonisation and energy reduction pathway for UK office buildings (2°C target)



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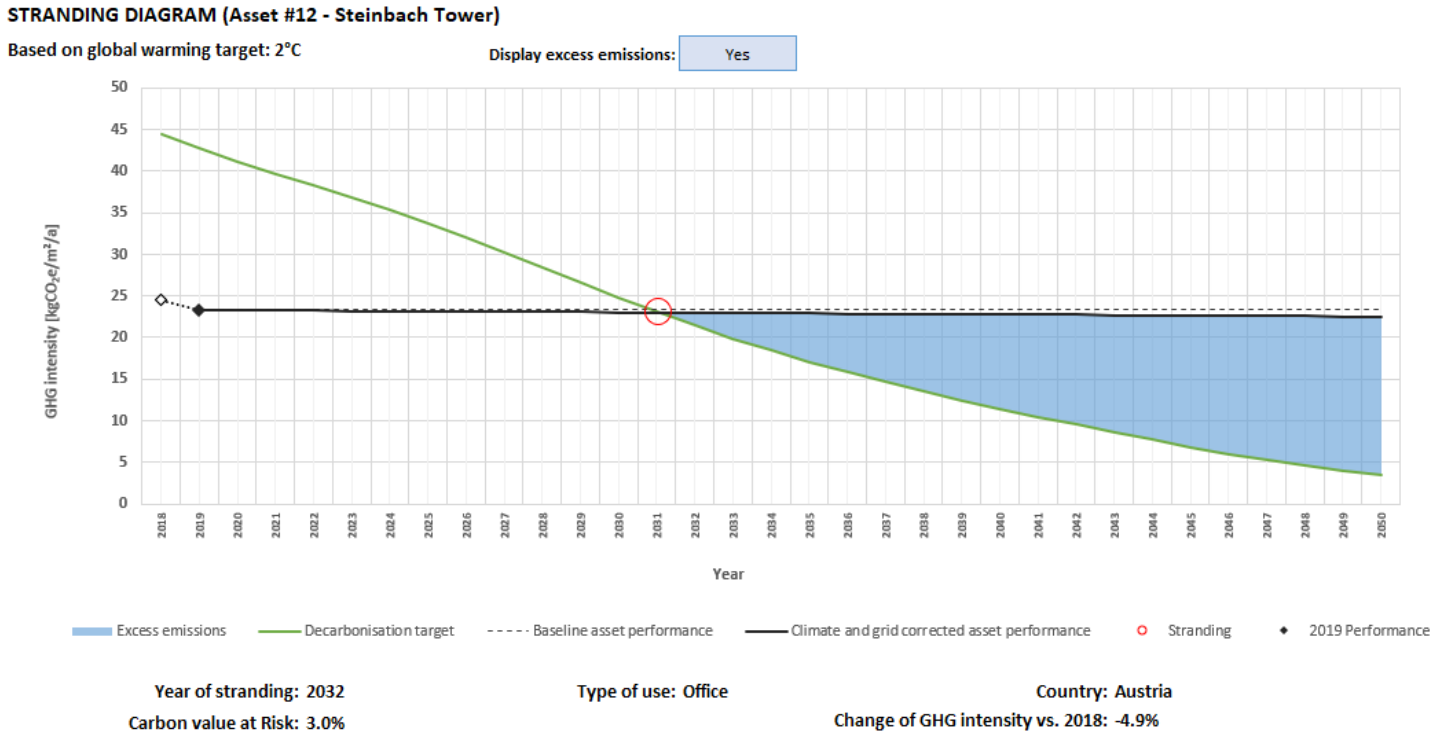
CARBON RISK ASSESSMENT & MANAGEMENT BASED ON QUANTITATIVE PERFORMANCE DATA AND TARGET SETTING

CRREM TOOL STRANDING DIAGRAM



DECARBONISATION PATHWAYS

Aligned with 1.5°C and 2°C global warming, country- and building type specific

+

BUILDING'S CARBON PERFORMANCE

Energy consumption, carbon emission factors, grid decarbonsation), changed heating and cooling demand, normalisation

=

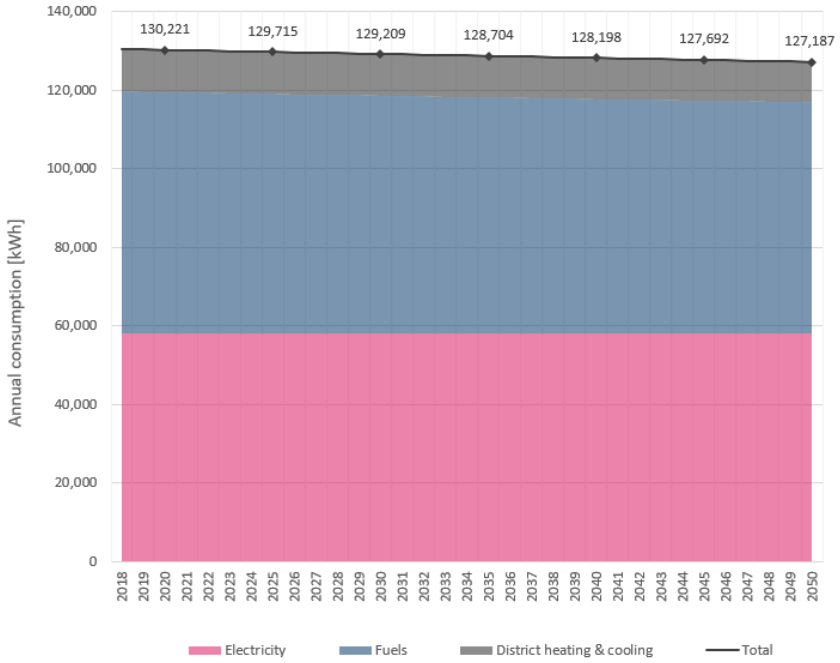
CARBON RISK ANALYSIS

Year of stranding, excess emissions, carbon costs, energy costs, benchmarking

Quantitative Carbon Performance and Risk Indicators

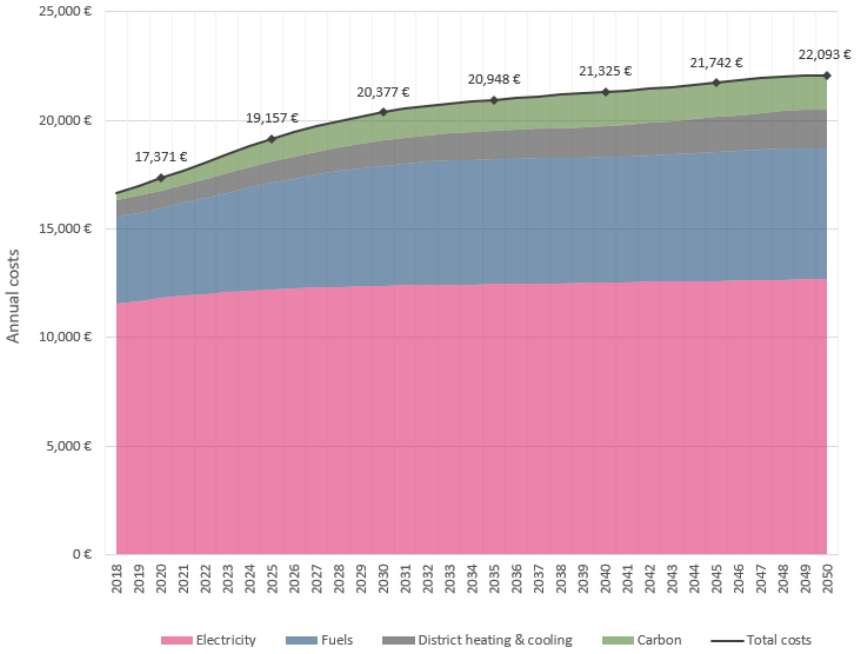
Year of Stranding, Carbon Value at Risk, Year-to-Year Improvement, Costs of Carbon...

ENERGY CONSUMPTION



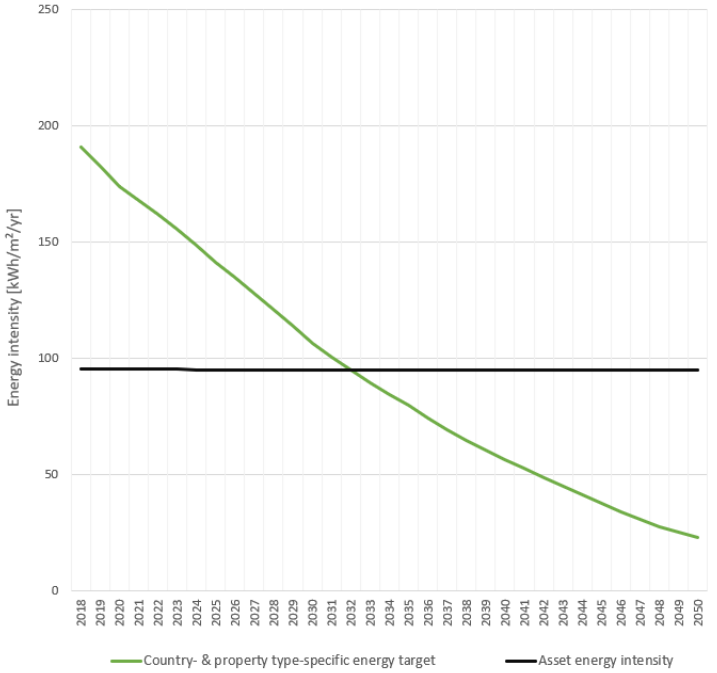
Based on (optionally) normalised baseline consumption and projected data considering changed heating and cooling demand

COSTS OF ENERGY AND CARBON



Based on energy and carbon price projections (IEA, EU etc.)

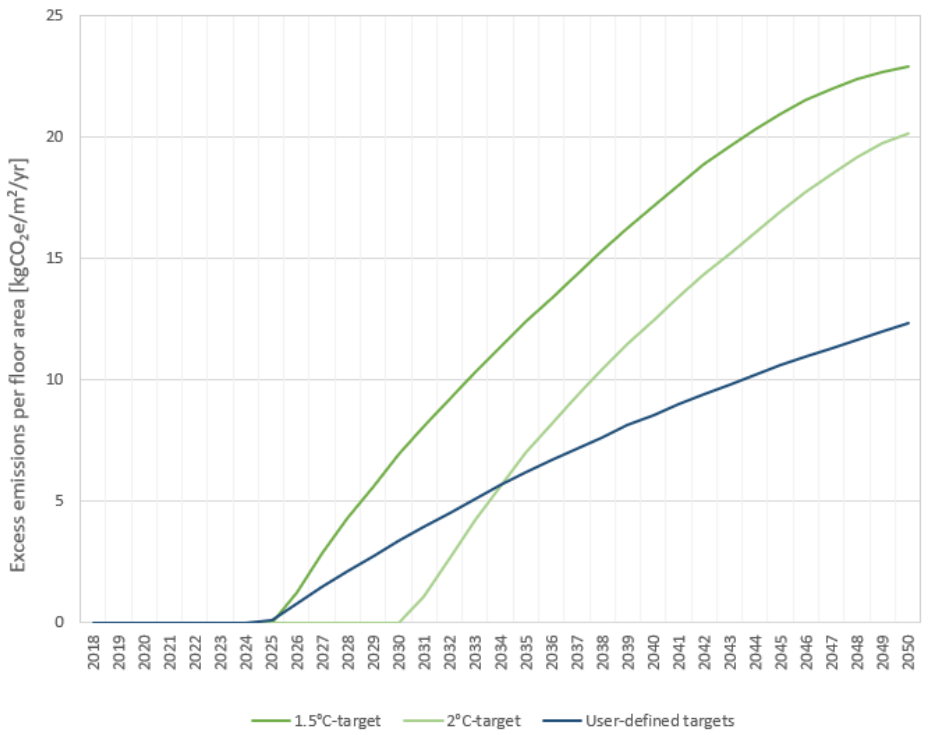
ENERGY REDUCTION PATHWAYS



Energy targets based on country-specific sector-wide emission factor reflecting energy mix and evolving grid decarbonisation

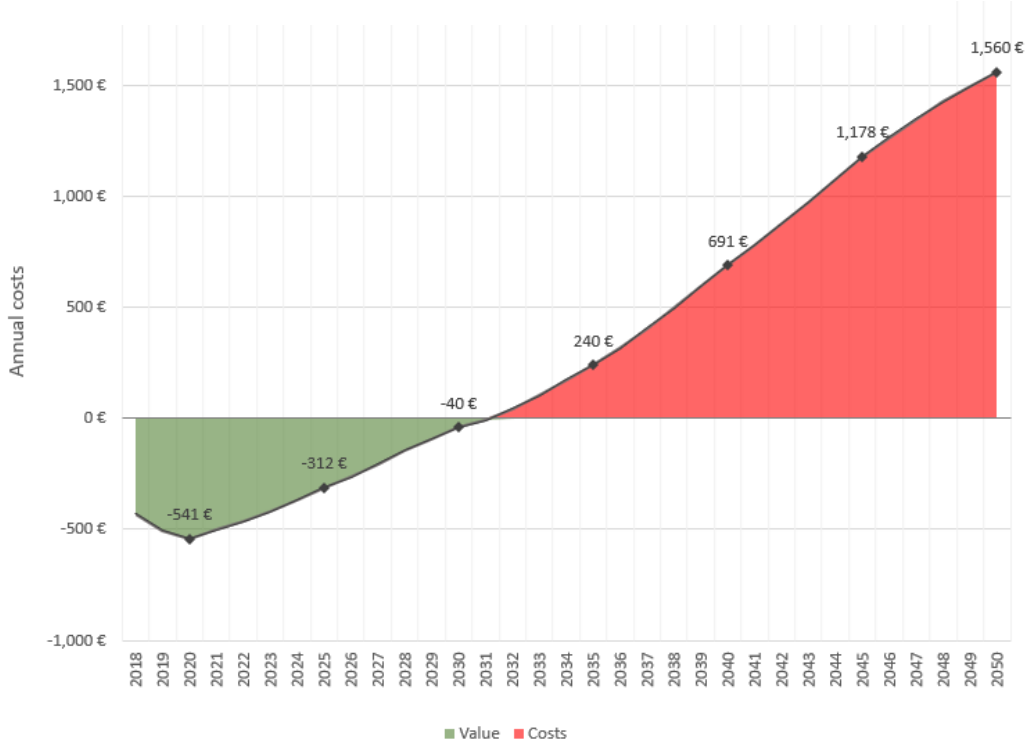
QUANTITATIVE CARBON PERFORMANCE AND RISK INDICATORS

EXCESS EMISSIONS PER FLOOR AREA



Cumulative excess emissions until 2050 [$kgCO_2e$]:	1.5°C-target	2°C-target	User-defined
	2,149,875	1,463,488	1,088,809

COSTS OF EXCESS EMISSIONS ABOVE TARGET



Analoguous to the NY City model with penalties for each ton of emission above emission limit (and possibility of trading emission credits)

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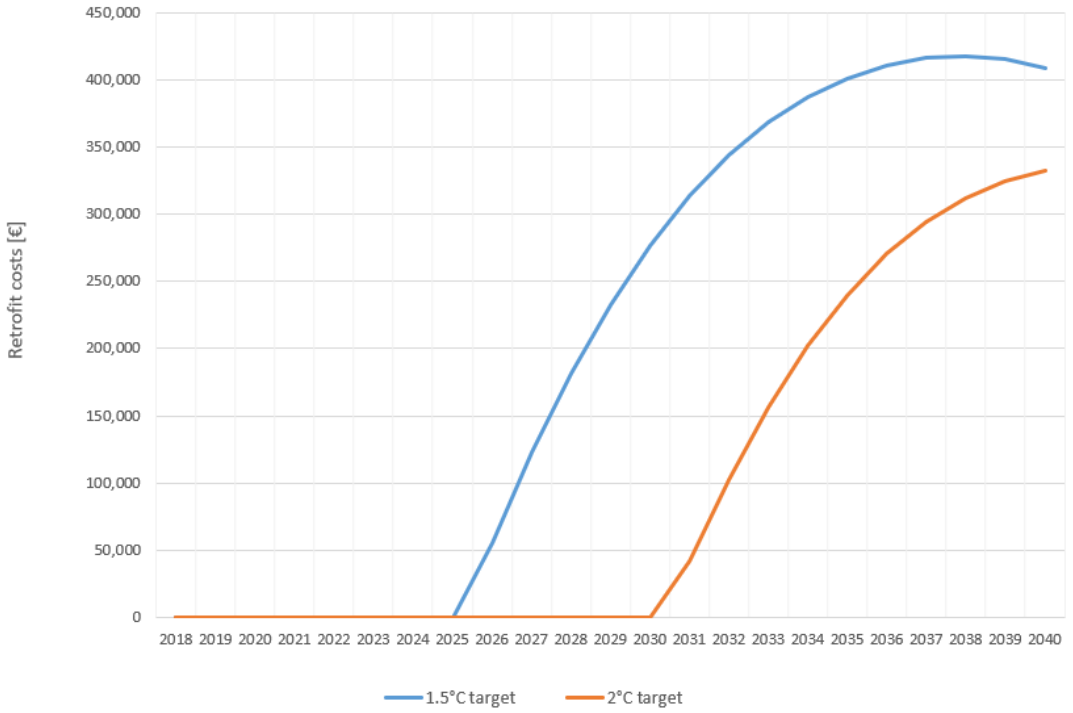
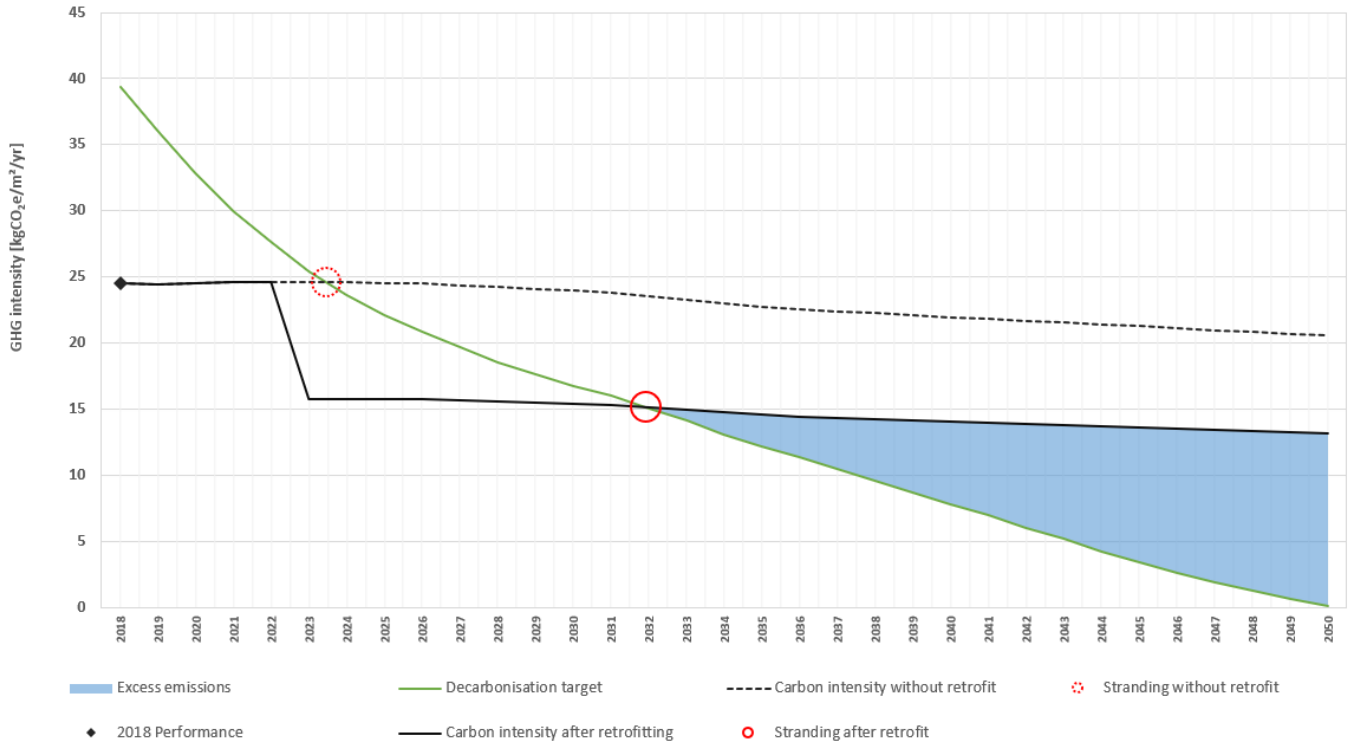
QUANTITATIVE CARBON PERFORMANCE AND RISK INDICATORS

COSTS OF RETROFITTING TO COMPLY WITH CARBON TARGETS



RETROFIT SIMULATION: STRANDING DIAGRAM WITH & WITHOUT RETROFIT



Simulation of investment in energetic retrofit and its effect on carbon risk indicators (based an marginal abatement costs)

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CARBON RISK IN REAL ESTATE PORTFOLIOS

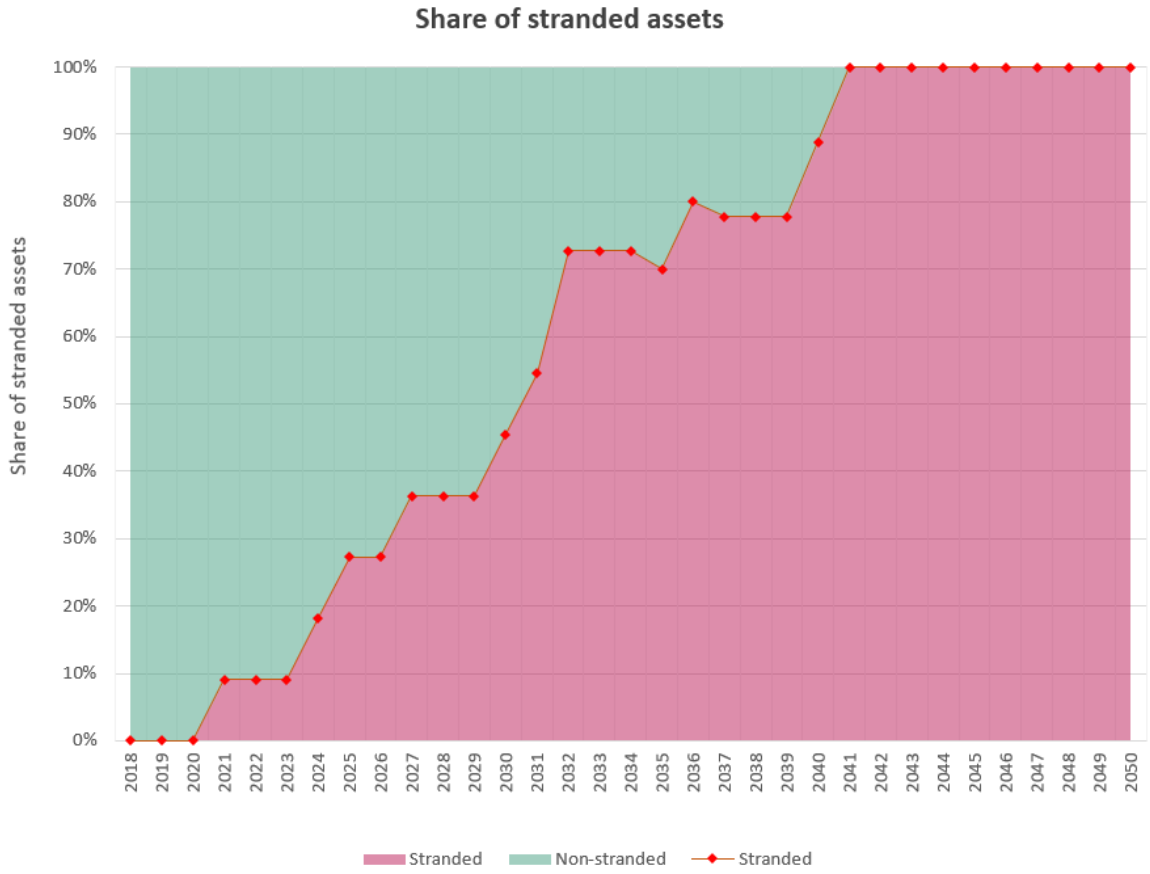
EVOLUTION OF STRANDING WITHIN PORTFOLIO

Diagrams on the right display the evolution of stranding within your portfolio. Upper graph: Relative share of stranded assets. Lower graph: Absolute figures. Choose whether to display data based on the number of buildings, gross floor area (GFA) or gross asset value (GAV). Choose whether to exclude individual assets or exclude them from a certain year on.

Asset ID	Include	Sell in year
1	Yes	Don't sell
2	Yes	Don't sell
3	Yes	Don't sell
4	Yes	Don't sell
5	Yes	Don't sell
6	Yes	Don't sell
7	Yes	2035
8	Yes	Don't sell
9	Yes	Don't sell
10	Yes	2037
11	Yes	Don't sell

Show shares based on: Number of buildings

Climate target: 2°C



Set filter:

Country: All

Property type: All

Entity/Fund: All

Assessment year: 2018

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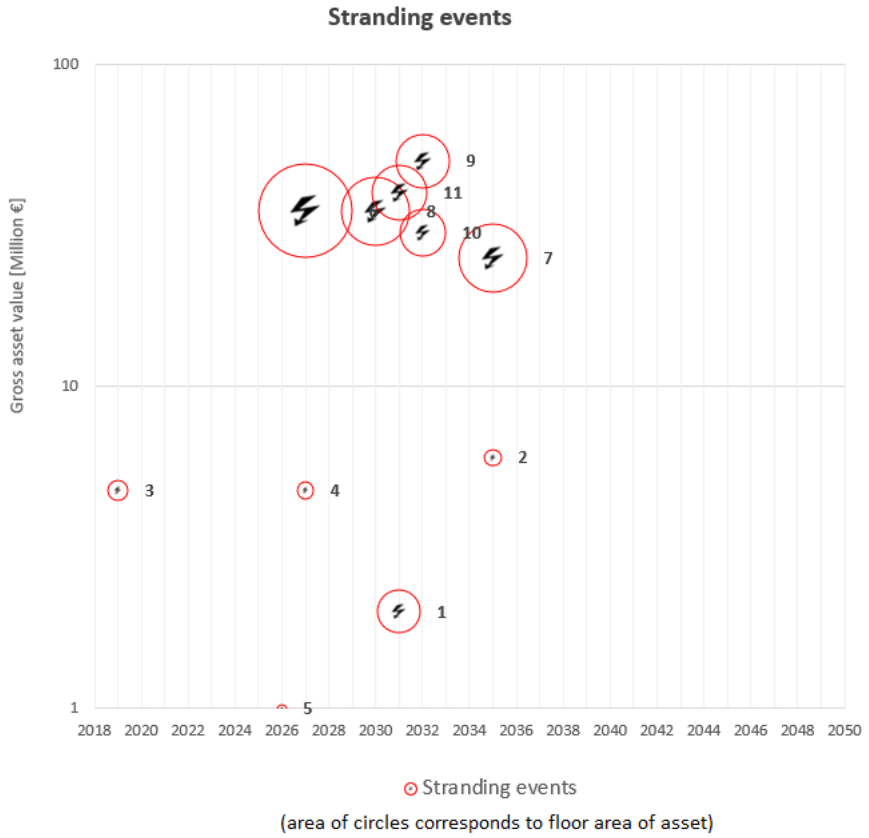
CARBON RISK IN REAL ESTATE PORTFOLIOS

STRANDING EVENTS: NEED FOR ACTION?

The graph on the right provides a summary of stranding events in the course of time. Each circle corresponds to one asset not complying with its decarbonisation pthways for the first time. Circle size (floor area) and y-axis (gross asset value) indicate the importance of an asset within the portfolio.

The area of the circles corresponds to the Gross floor area of the stranded asset. Choose below which global warming target to apply. The numbers next to the circles depict the asset ID.

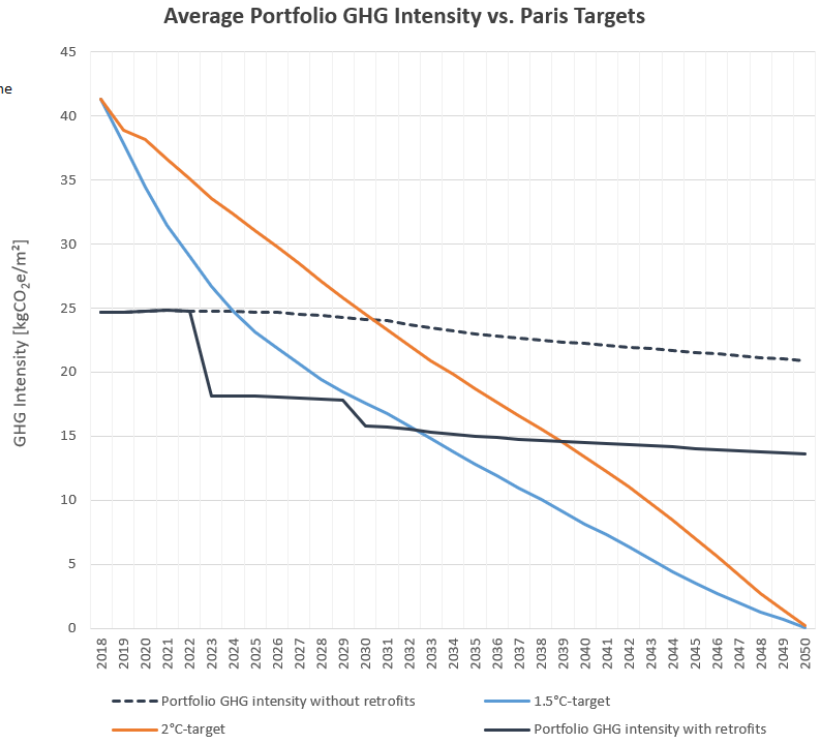
Climate target: 2°C



GHG INTENSITY OF PORTFOLIO vs. 1.5°C- & 2°C-TARGETS

The graph on the right presents the GHG intensity of the selected portfolio (black line), benchmarking it against the floor-area-weighted decarbonisation pathway (orange: 2°C, blue: 1.5°C).
Exclude individual assets by means of the table below.

Asset ID	Include
1	Yes
2	Yes
4	Yes



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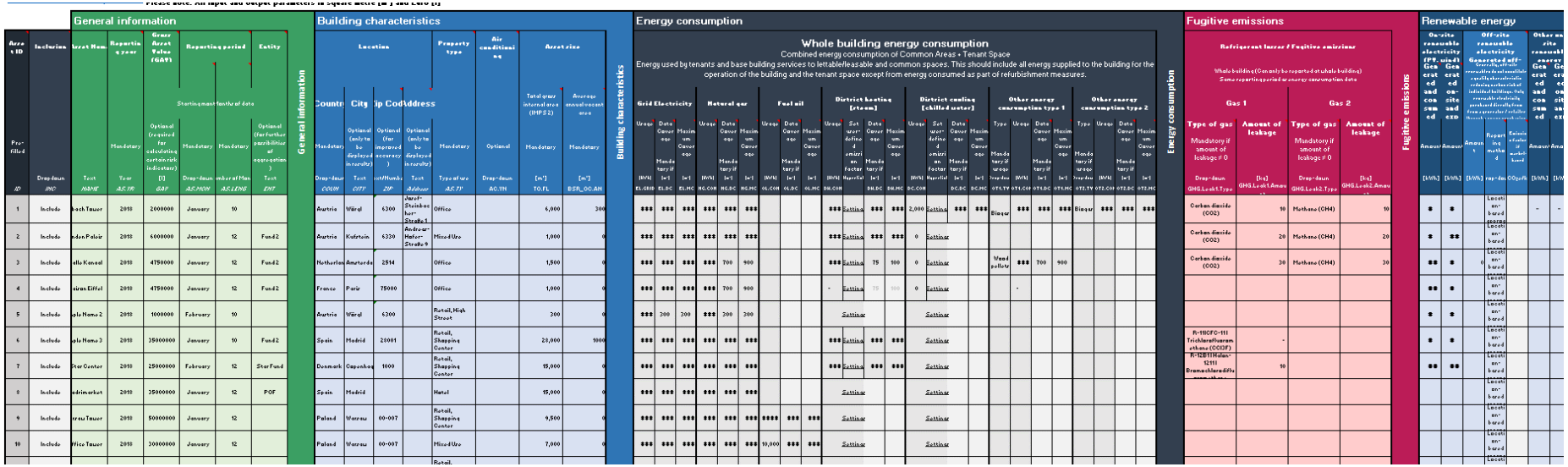
Stepwise integration of CRREM Risk Analysis and GRESB

(1) Download CRREM Risk Assessment Tool pre-filled with data company's GRESB participation

(2) GRESB participants to receive results of CRREM Risk Analysis within GRESB Portal

GRESB & CRREM

Property types and input parameters are aligned with GRESB ESG Benchmark:



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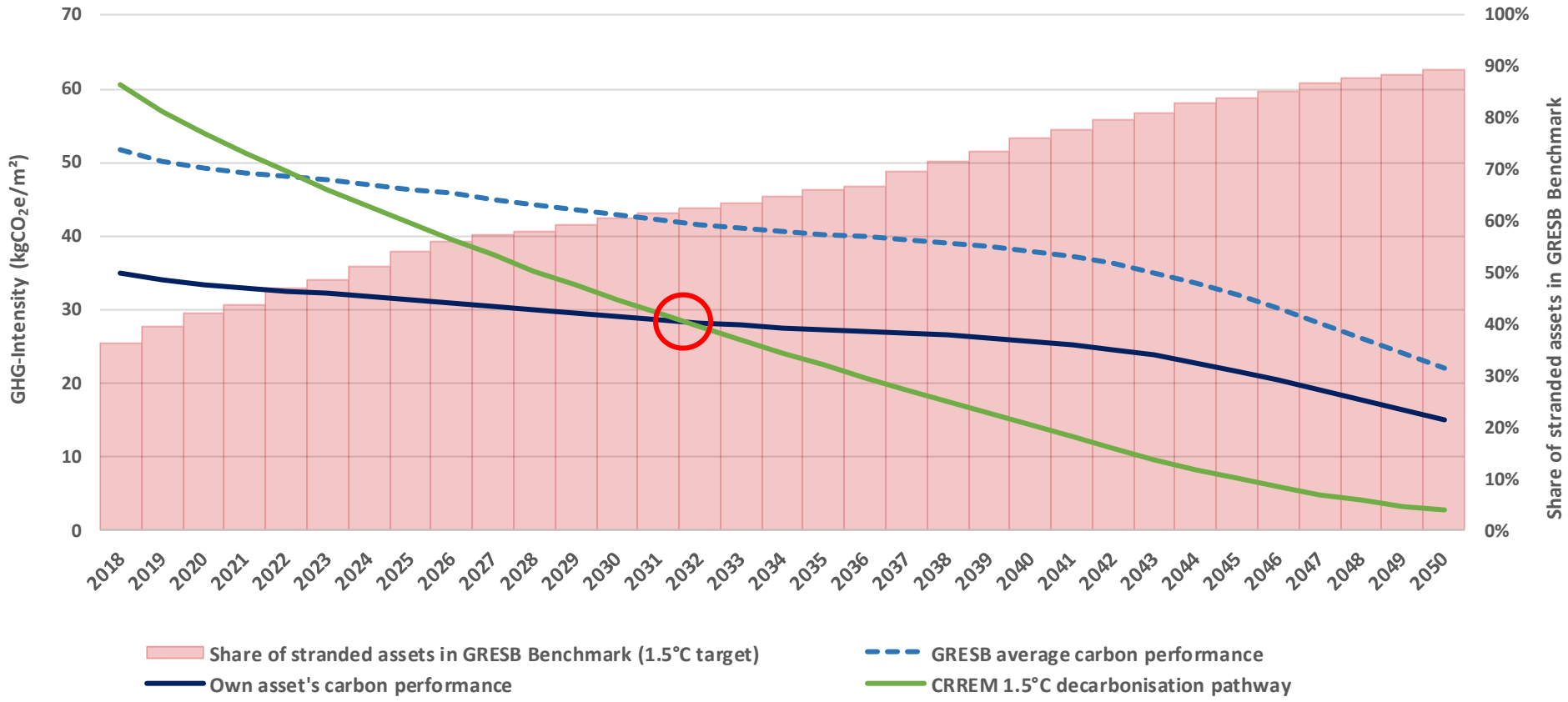
Stepwise integration of CRREM Risk Analysis and GRESB

BENCHMARK YOUR ASSET(S) AGAINST YOUR PEERS



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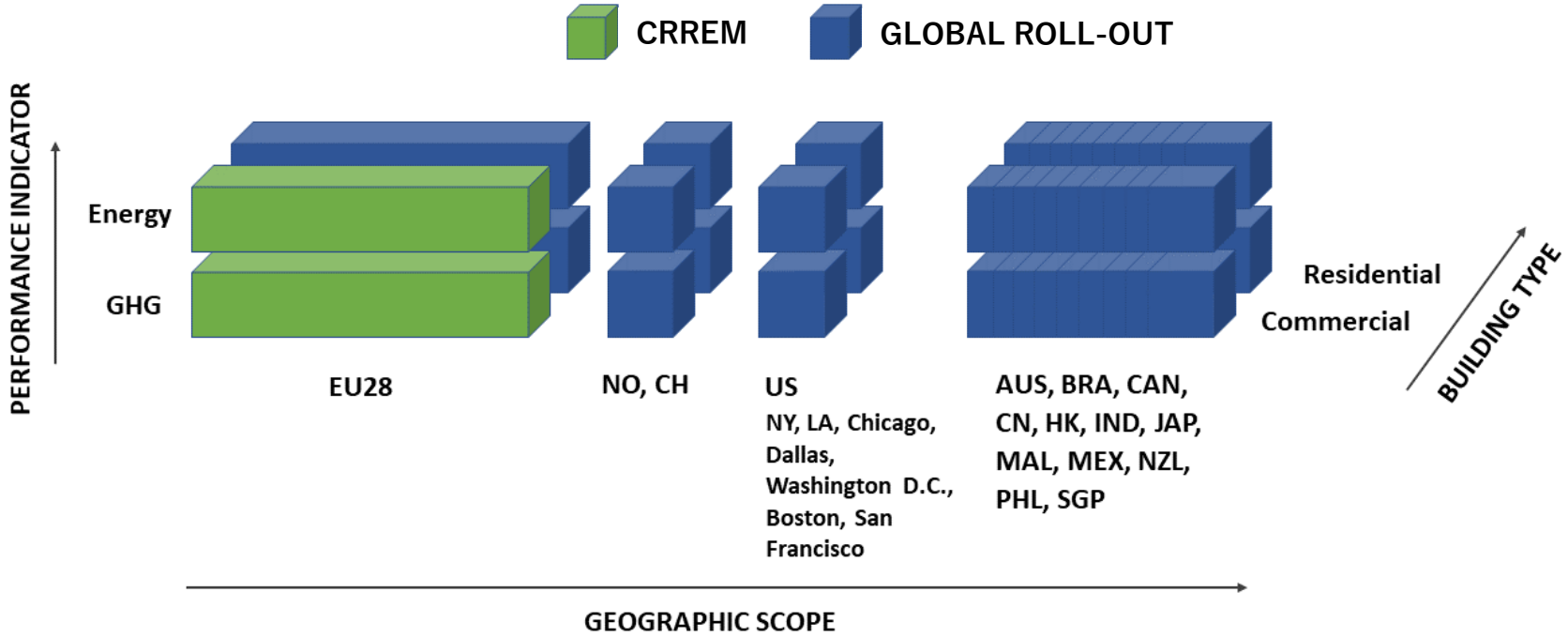
Extension of CRREM pathways: www.CRREM.org

INCLUDING RESIDENTIAL BUILDINGS & KEY GLOBAL REAL ESTATE MARKETS

(PUBLICATION OF CRREM GLOBAL PATHWAYS FOR PUBLIC CONSULTATION IN MAY 2020)



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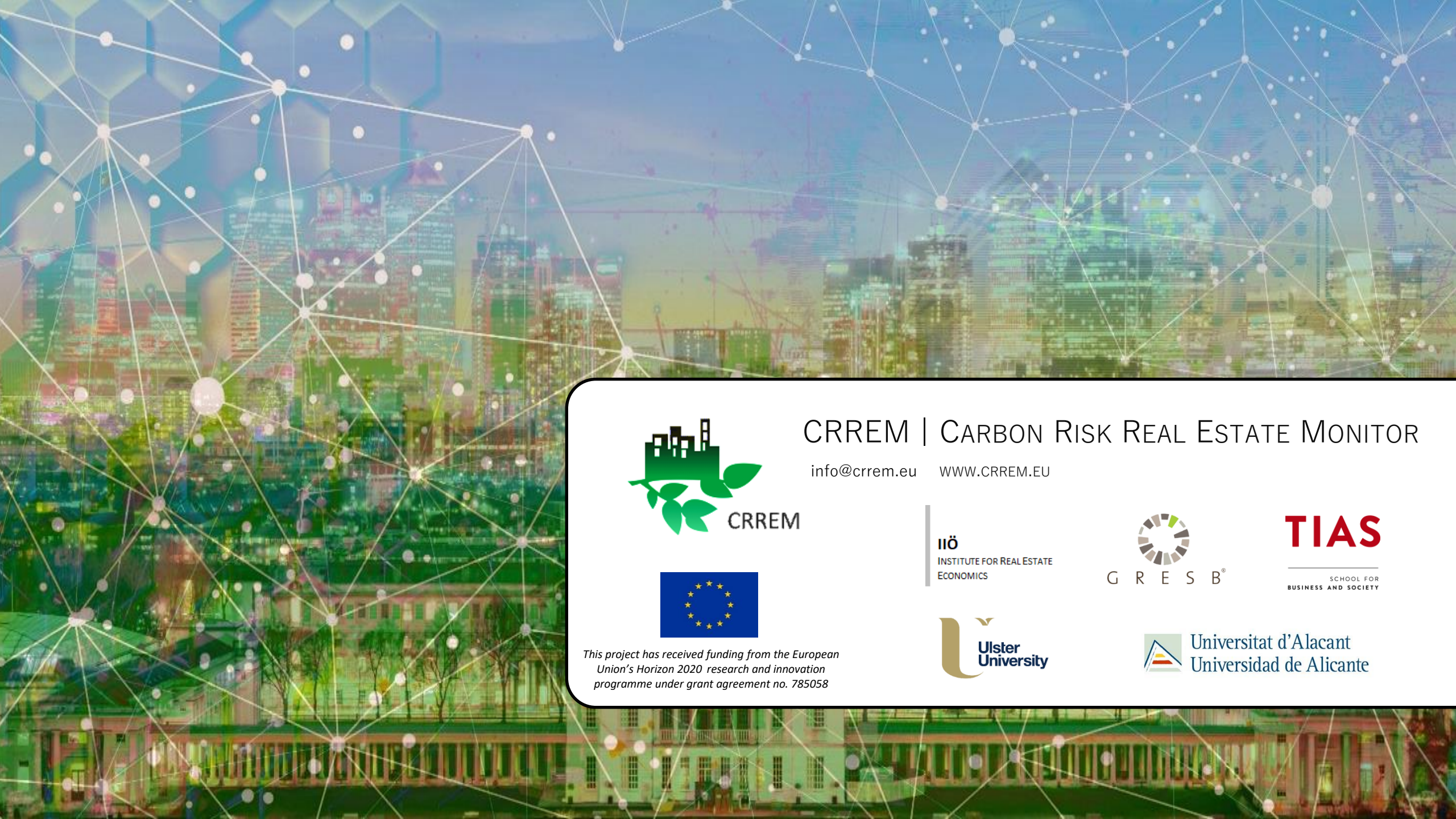
BBP Better Buildings Partnership Christopher Botten *(Programme Manager)*	***INREV European Investors in Non-Listed Real Estate*** Federica Miano *(Public Affairs Manager)*
CDP Alberto Carrillo Pineda *(Director Science Based Targets and Renewable Energy)*	***ULI Greenprint Center for Building Performance*** Marta Schantz *(Senior Vice President)*
DGNB German Sustainable Building Council Anna Braune *(Director Research and Development)*	***University of Cambridge*** Franz Fürst *(Professor of Real Estate and Urban Economics)*
DGBC Dutch Green Building Council Martin Mooij *(Head of Certification and Project manager DGBC Deltaplan sustainable renovation)*	***World Green Building Council*** Stephen Richardson *(Technical Lead - Energy Efficiency Mortgages)*
EPRA European Public Real Estate Association Gloria Duci *(ESG Officer)*	***ZIA German Property Federation*** Philipp Matzke *(Consultant Energy and Climate Protection, Facilities Engineering)*



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