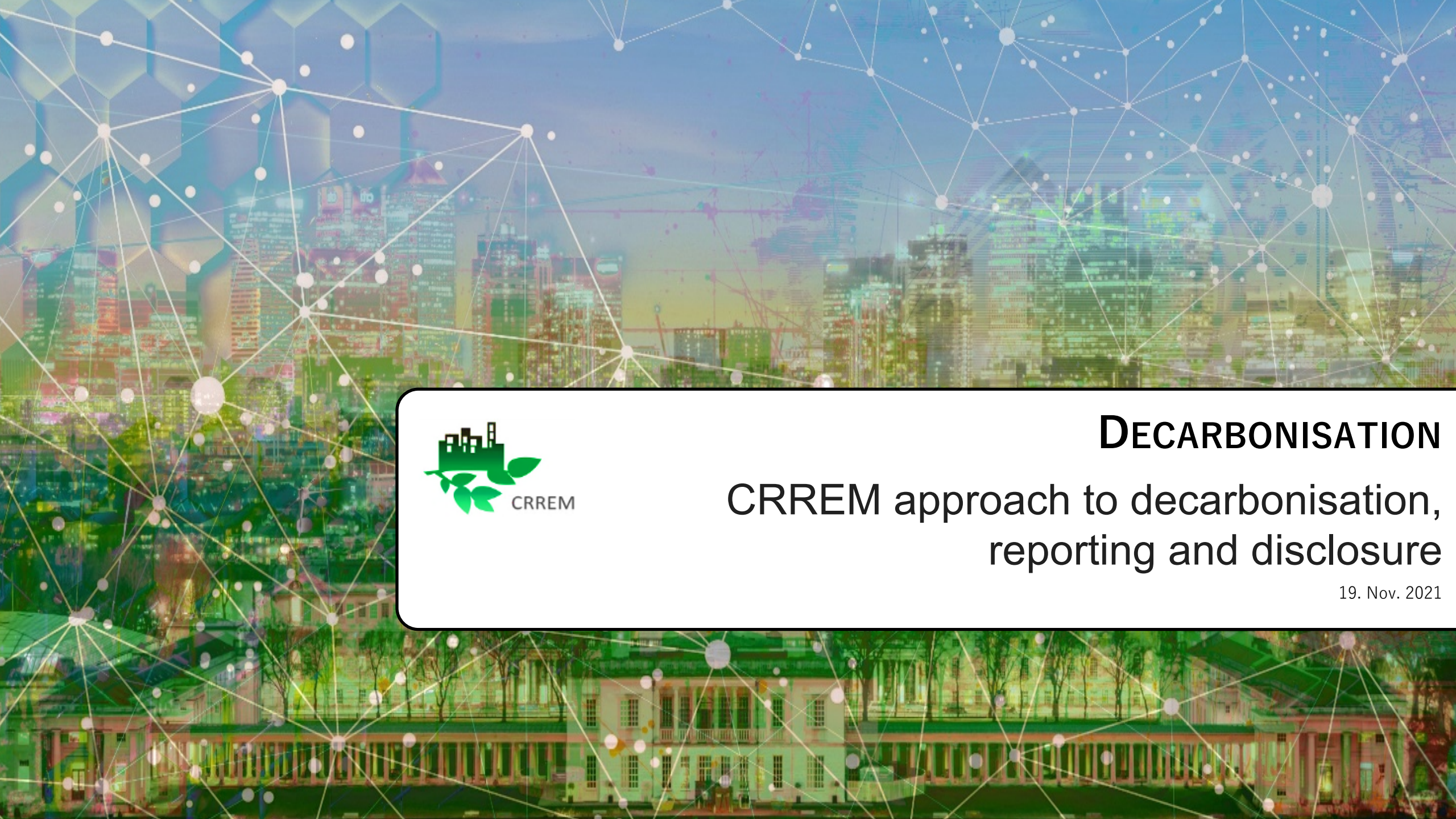


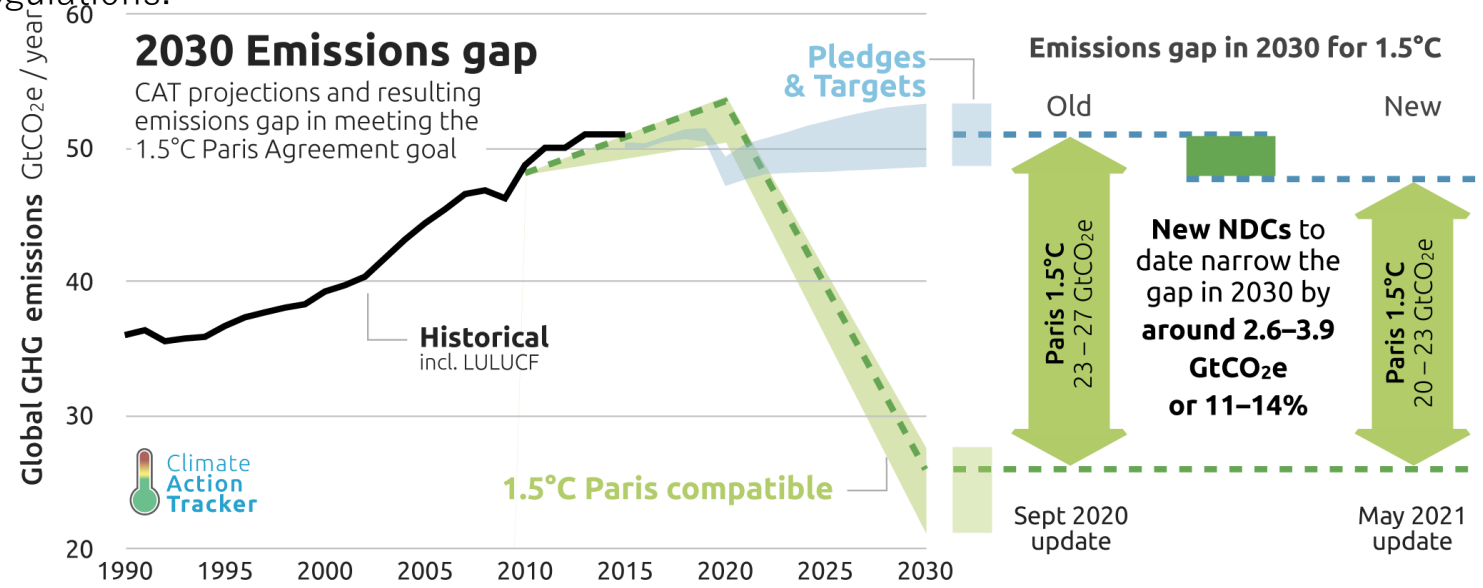
DECARBONISATION

CRREM approach to decarbonisation, reporting and disclosure

19. Nov. 2021

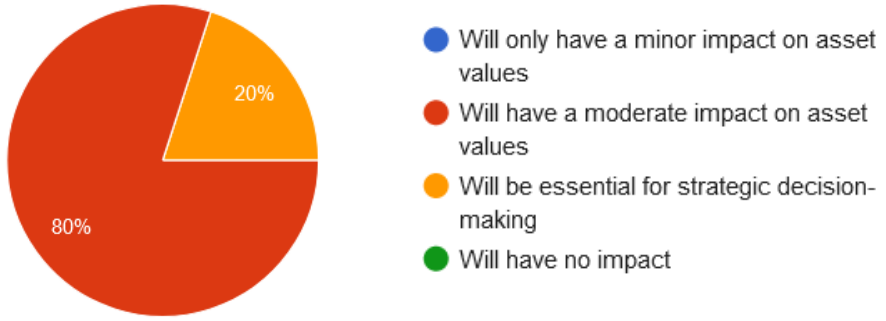
GETTING ON THE SAME PAGE: DECARBONIZATION IN TOP-PRIORITY

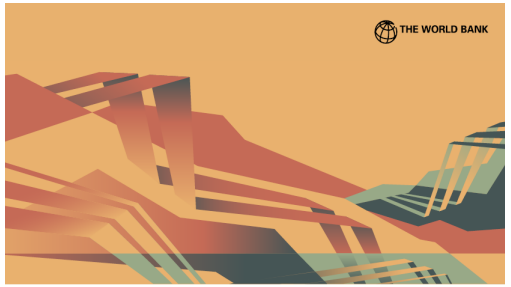
- To achieve the **Paris-aligned climate targets**, all sectors have to largely **decarbonize until 2050**, this also includes the real estate industry.
- Current emission-reduction commitments may result in global warming of more than 2.3° C, and a "business-as-usual" scenario even to a rise in temperature of more than 4.5° C by 2100 compared to the pre-industrial level.
- **Buildings no longer compliant with the "Paris-proof" decarbonisation requirements may face economic obsolescence**. This situation of increasingly rising transition risks include: decreased demand for specific assets/ portfolios (declining market attractiveness), increasing CO2 prices and energy prices, stricter regulations.
- The CRREM tool **reduces investor uncertainty** and offers a viable basis for investment decision-making with regard to **stranding risks** and strategic retrofit planning in order to meet forthcoming climate regulation and decarbonization requirements.
- It is **aligned** and **accepted** by the leading international organizations and initiatives (e.g. TCFD, SBTi, GRESB etc.).



CO2-Pricing: Not the elephant but Reality

DO YOU THINK CARBON PRICING AND /OR TAXATION FOR REAL ESTATE IN THE UPCOMING YEARS?

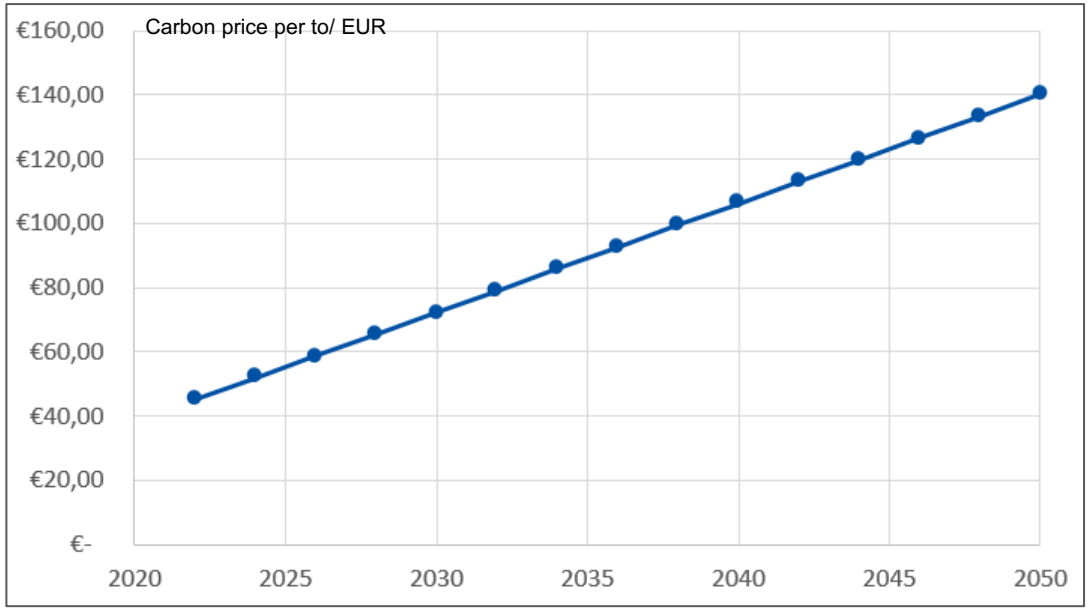




State and Trends of
Carbon Pricing 2021

PRICE INCREASE FOR EMISSIONS FORESEEABLE:

- Forecasts predict a further significant increase: Current level around 40 EUR tCO2e in Europe.
- Expected to rise to 140 EUR tCO2e by 2050 (conservative?!).
- The “Carbon risk" is underestimated: a price increase of $75 tCO2e would cause share prices worldwide to collapse by 20%.



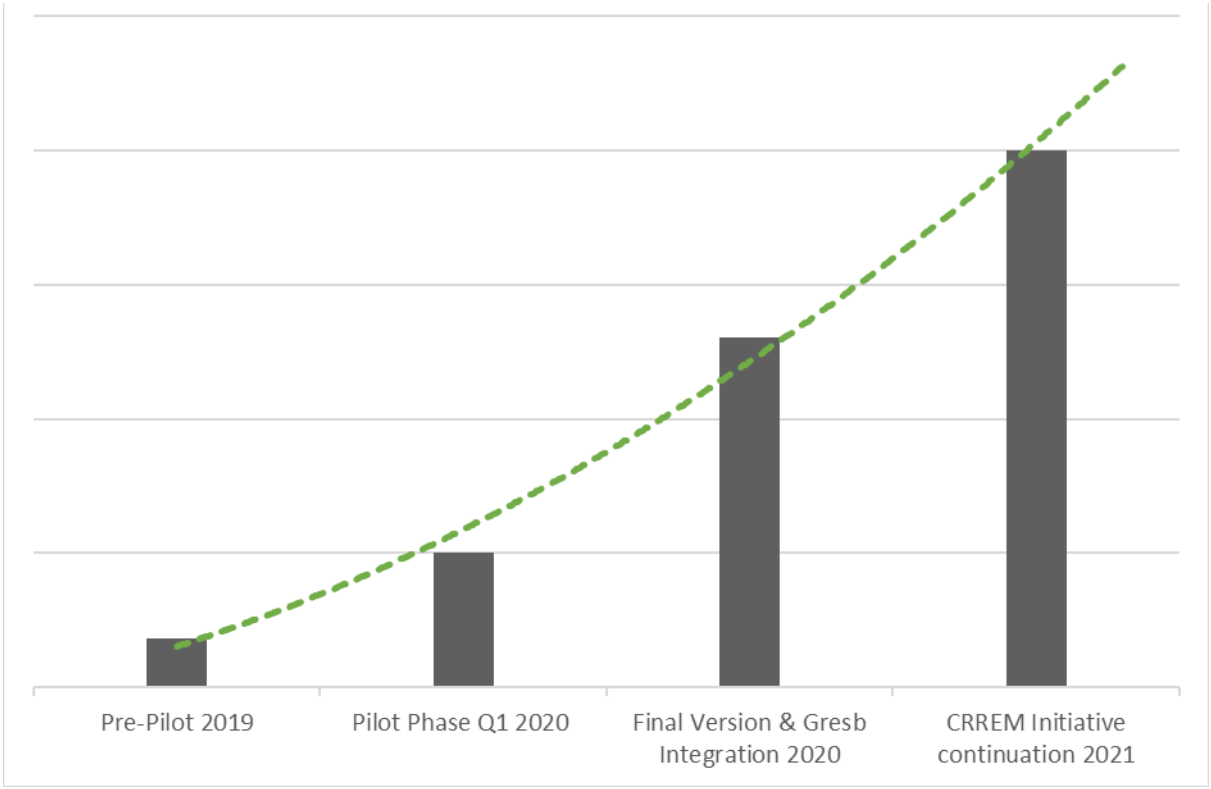
Sources: survey CRREM 10.2021 / The World Bank and CDP (2021) / Energy BrainPool (2021) / Study Kempen, Amsterdam/’s-Hertogenbosch , 30 June 2021.

Transition risk is Investment Risk

Transition Risk	Impact on Real Estate
Declining market attractiveness Declining attractiveness of submarkets due to increased vulnerability and exposure to higher costs	• Lower demand (investors and tenants) • Lower competitive advantage by increasing energy costs for properties with high energy-intensities • Overall negative impact on the market environment • Decreasing market values
Increasing regulation Legislation focused on climate change - e.g., disclosure of climate risks, stricter building standards, CO2 pricing, carbon credits, etc.	• Tax increases, e.g. CO2 tax • Decrease in subsidies for certain technologies • Costs due to publication obligations • Additional investment costs to bring the real estate portfolio in line with national laws • Enforced rules that properties can only be rented if they meet a certain energy standard
Risks to reputation and market positioning Stakeholder demand for real estate companies where climate risks are included in the investment calculation	• Loss of reputation if action is too late or if no action is taken • Reputational risks for companies that do not sufficiently consider ESG topics in their strategy

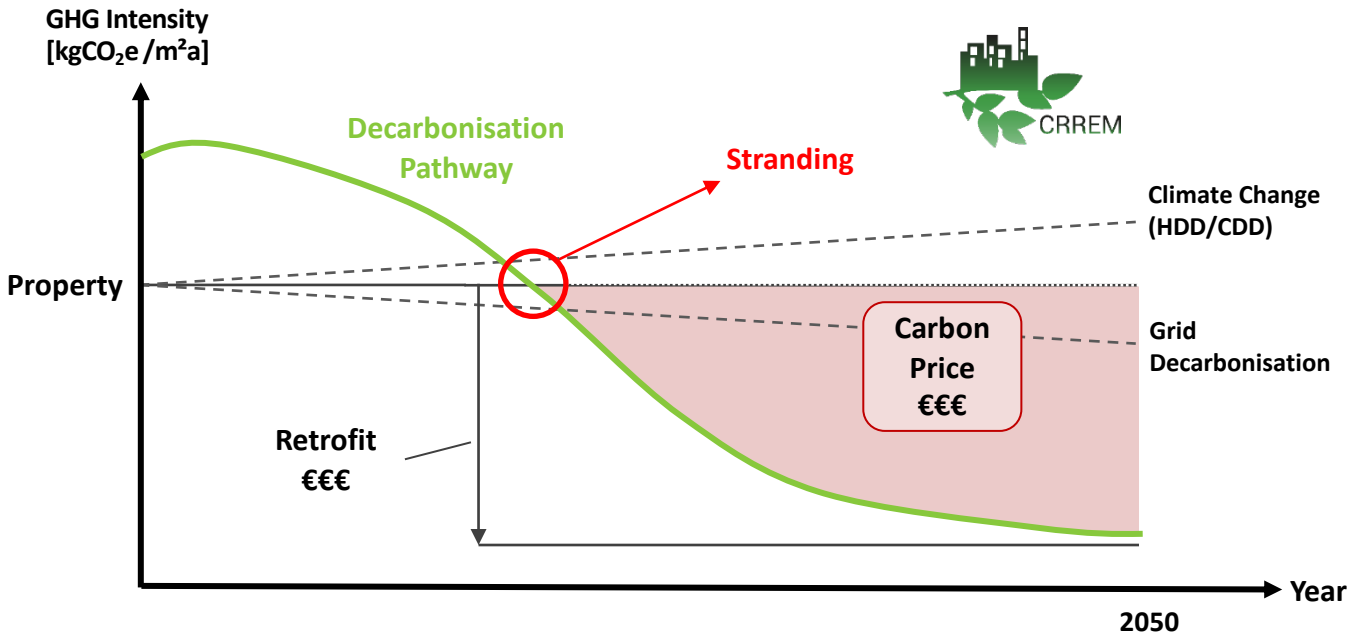
WIDE INVESTOR & STAKEHOLDER ENGAGEMENT ACHIEVED TO DATE

- Over **3.100 assets** optimized.
- Over **27 million square meters** of lettable space analysed.
- Total funds of with over **450 bn. Euro Assets under Management** used the tool.
- Lately much interest in US and Asia-Pacific
- Many industry initiatives endorsing CRREM



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

+

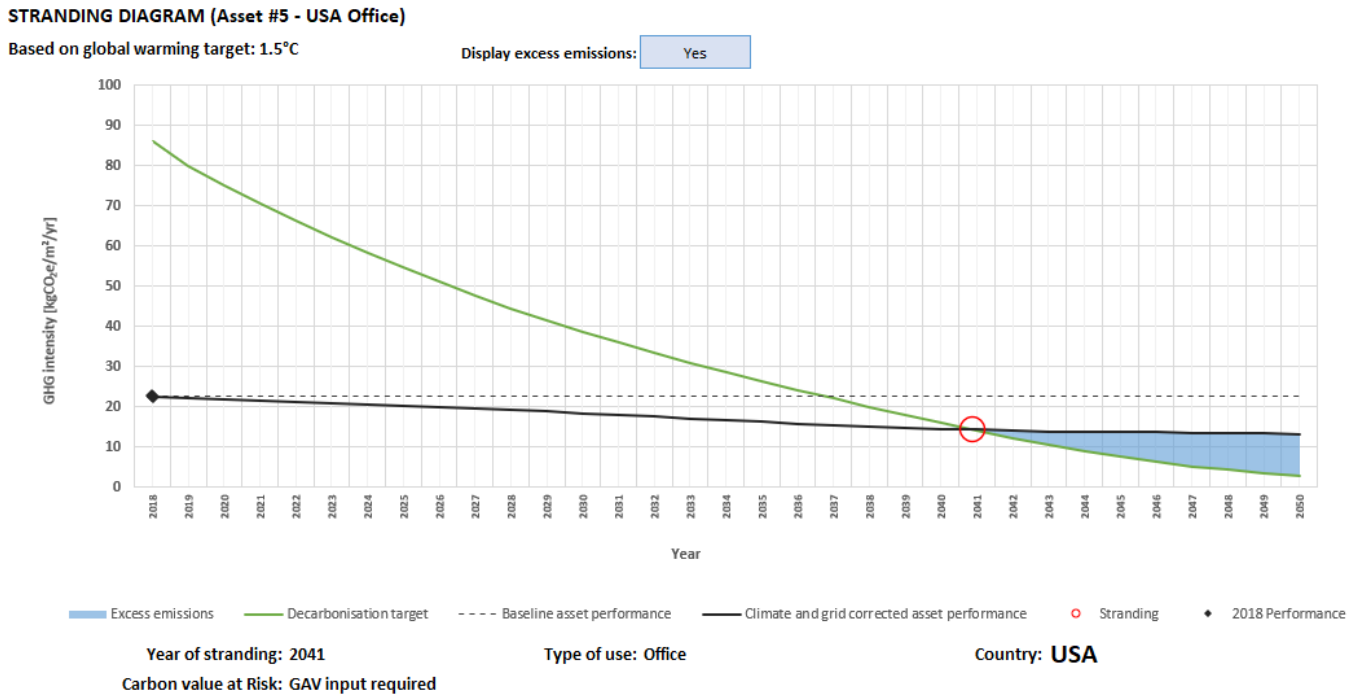
BUILDINGS' CARBON PERFORMANCE

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



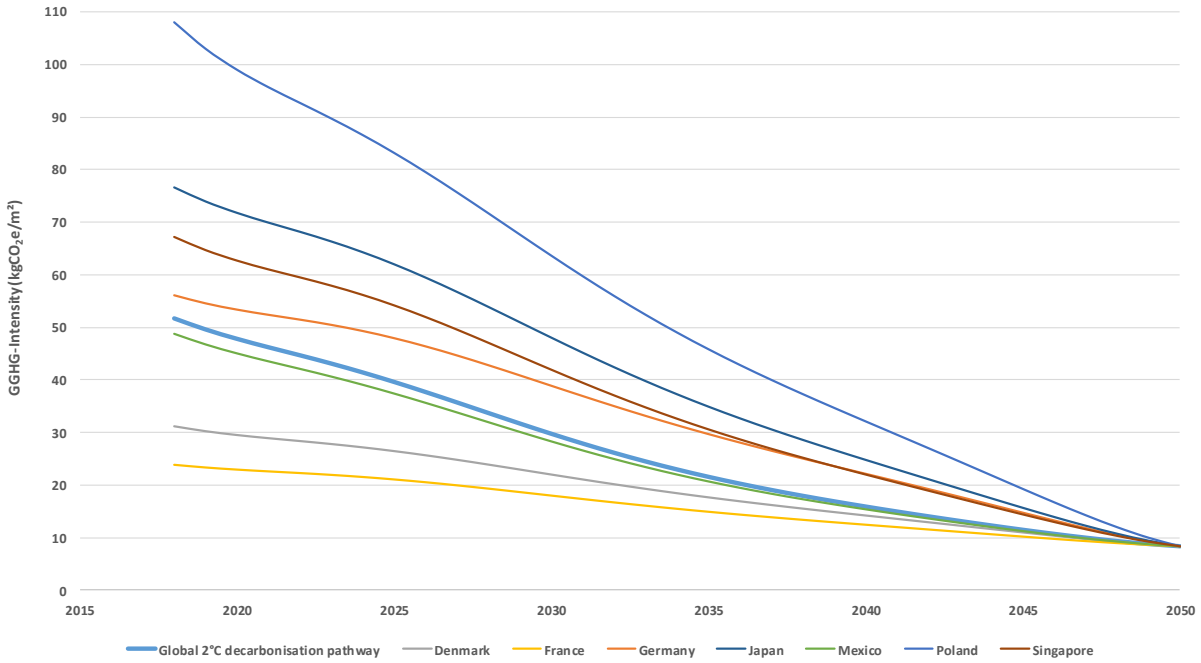
Key benefits using CRREM:

- Monetarization of transition risk for operational carbon emissions
- Identification of Paris-alignment on property level & target setting - 1,5 and 2 degree scenario
- Paris-aligned decarbonization pathways for all countries and use types derived, which can serve as a benchmark
- Scenario analysis with retrofit
- Use of default data or own assumptions
- Vast amount of background data for different metrics (EF, Carbon Price, HDD/CDD, energy mix evolvement etc.)
- Solid downscaling methodology (SDA, Sbti etc.)
- Kwh and carbon intensities available
- Aligned with many initiatives (PCAF, IIGCC, NZAOA, UNEPFI etc.)

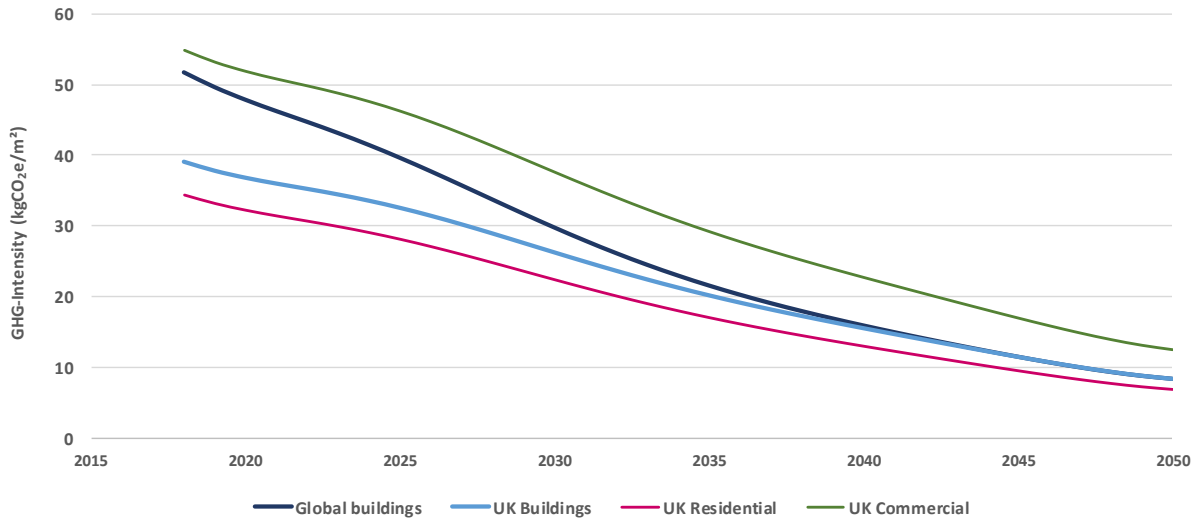
CRREM PATHWAYS: DOWNSCALING FROM GLOBAL EMISSIONS TO CARBON INTENSITY PATHWAYS

CRREM translates long-term climate goals 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



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**)

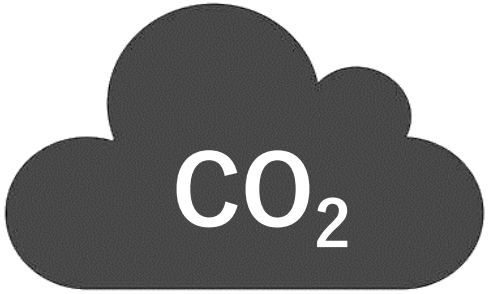
CO2 CONVERSION FACTORS

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

Or 0 ($kgCO_2e$)

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

BUILDING EMISSIONS

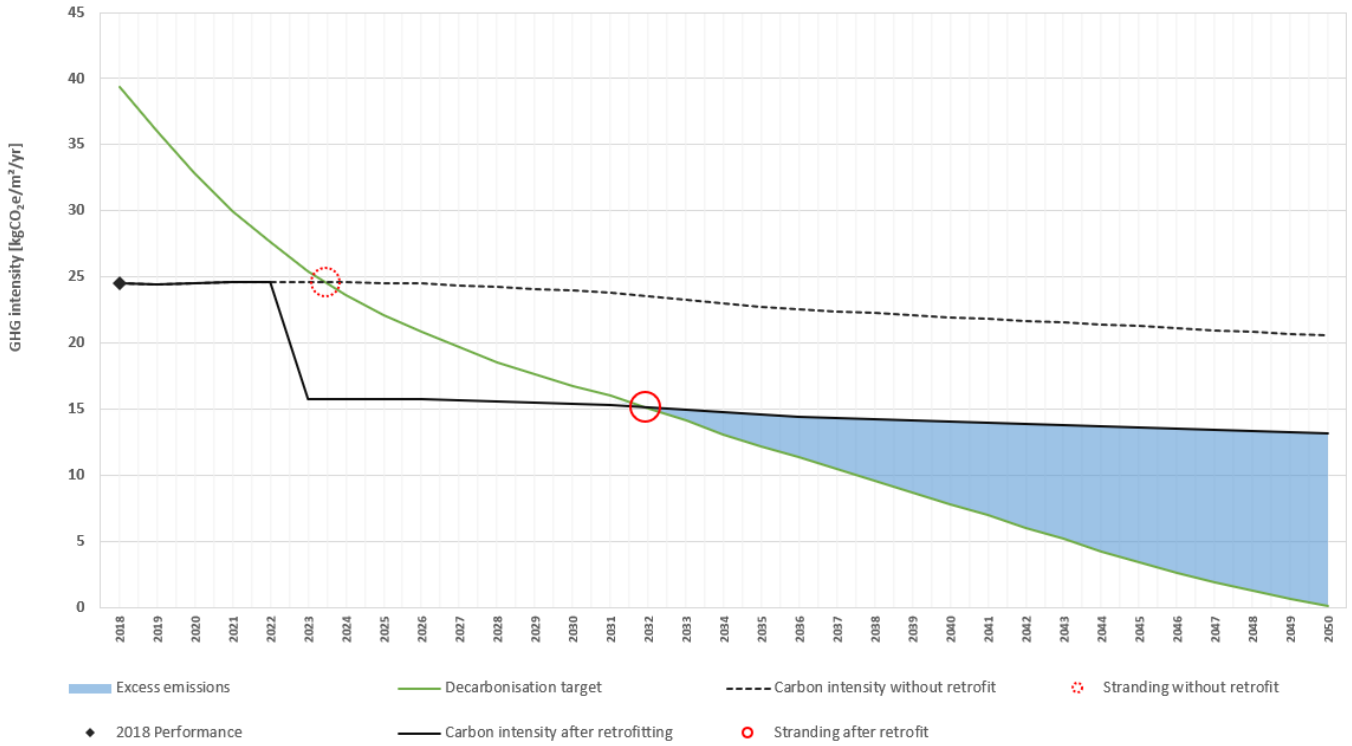


$$\frac{\Sigma \text{ All emissions } (kgCO_2e)}{\text{Rented area (m²)}} =$$

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

Source: Own illustration / Alstria, 2020

RETROFIT SIMULATION: STRANDING DIAGRAM WITH & WITHOUT RETROFIT



Strategy 1
- Energetic retrofit
- (Insul., techn. Equipement etc.)

Strategy 2
- More renewable energy on-site
- (PV, Heatpumps, Wind etc.)

Strategy 3
- Consumer behaviour
- (Green Leases, User Manuals etc.)

Strategy 4
- Building automation
- (Smart Metering etc.)

Strategy 5
- Purchase greener electricity
- („Gold“ Standard etc.)

Getting to „Net Zero“

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

WHAT WAS YOUR GREATEST CHALLENGE WHEN COLLECTING ASSET-LEVEL DATA?

- Most participants had average data quality, however, asset-level data showed some data gaps especially regarding **fugitive emissions** and **tenant specific data.**

		Data Coverage	Data on Fugitive emissions	Data on Occupancy	Full Tenant data	Data for all energy-types	Data on Renewable energy	User-defined information (e.g. on energy prices, EF's)	General Data Quality	General Data Availability/ Accuracy
Participant	A	X	X	X	X	X	X	X	X	X
Participant	B	X	X	X	X	X	X	X	X	X
Participant	C	X	X	X	X	X	X	X	X	X
Participant	D	X	X	X	X	X	X	X	X	X
Participant	E	X	X	X	X	X	X	X	X	X
Participant	F	X	X	X	X	X	X	X	X	X
Participant	G	X	X	X	X	X	X	X	X	X
Participant	H	X	X	X	X	X	X	X	X	X

X	Well above/ excellent average data quality
X	Above average/ good data quality
X	Average data quality
X	Below average/ poor data quality

WE WOULD LIKE TO THANK OUR PARTNERS FOR THE FINANCIAL SUPPORT:

Laudes Foundation

Funded by the Horizon 2020 Framework Programme of the European Union

apg

NORGES BANK INVESTMENT MANAGEMENT

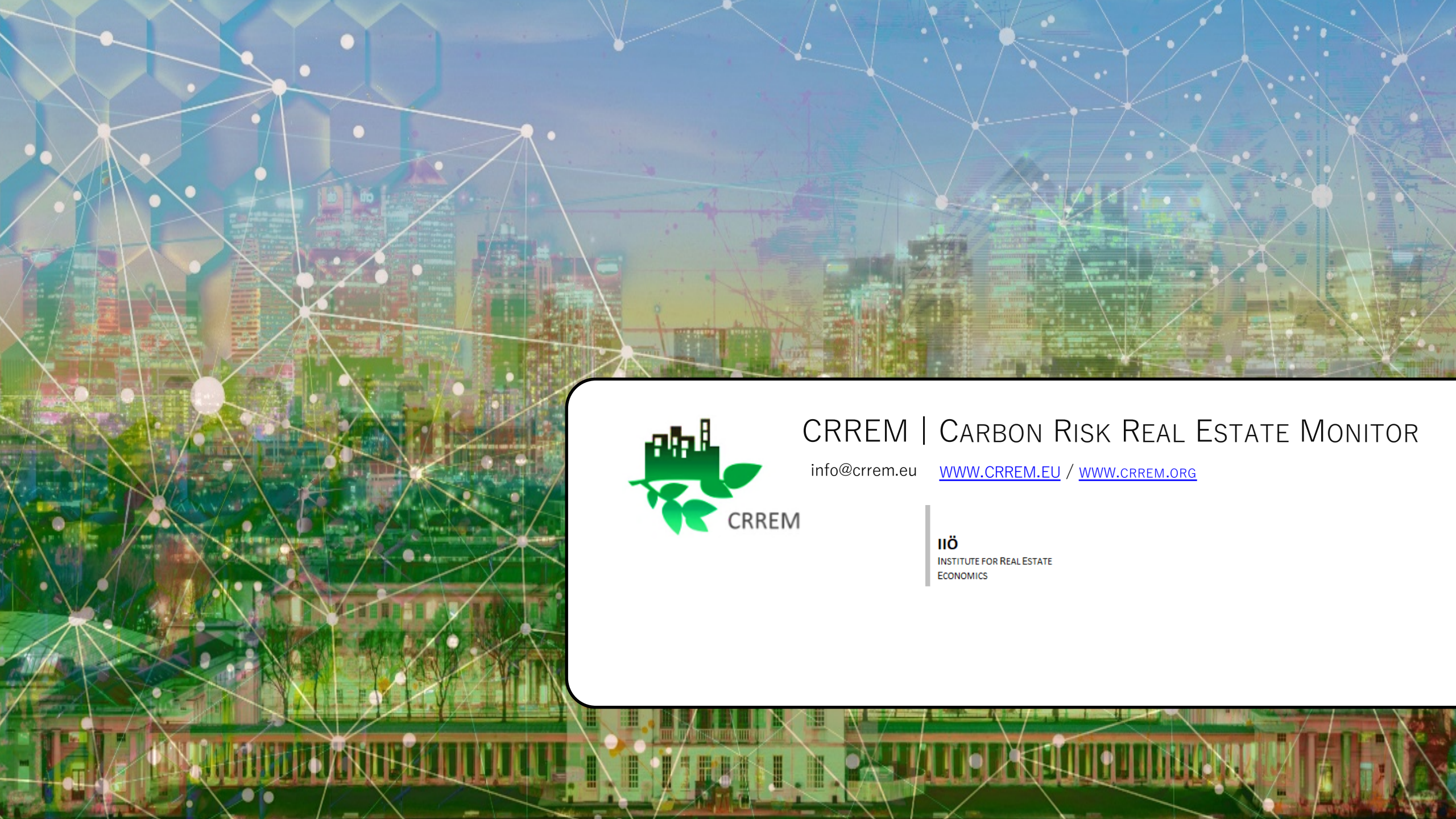
PGGM

PARTNERS (WHO HAVE ESPECIALLY ALSO SUPPORTED THE DEVELOPMENT & RELEASE OF THE GLOBAL PATHWAYS) :

Ivanhoé Cambridge

GPIF

GRESB®



CRREM | Carbon Risk Real Estate Monitor

info@crrem.eu WWW.CRREM.EU / WWW.CRREM.ORG

IIÖ
Institute for Real Estate Economics