CRREM | Carbon Risk Real Estate Monitor

IIÖ
INSTITUT FÜR
IMMOBILIENÖKONOMIE

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

IIÖ
INSTITUT FÜR
IMMOBILIENÖKONOMIE

Embodied carbon

Carbon accounting and reporting

Profitability/ Anyway-costs

Regulated vs. unregulated emissions

Change of emissions factors, heating/cooling load, prices

BUILDINGS and CLIMATE PROTECTION

Strategic options (Sell, Hold, Retrofit – Timing)

Scope 1,2,3

Carbon pricing

More than saving energy

Investor/Tenant/ Occupancy

GHG savings

Liability

Carbon budget downscaling

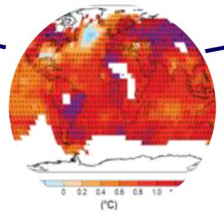
Predictability/Reliability of regulation

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

Upside „Risk“

Positive impact

Climate change = Climate risk?



Downside „Risk“

Negative impact

Positive Willingness to pay for Energy Efficiency and Sustainability

1. Portfolio level

- **diversification**
- **investment alternative with special risk-return profile**
- **Green Funds, SRI and RPI „en vogue“**

Geiger, Cajias, Bienert (2013): The Asset Allocation of Sustainable Real Estate: A Chance for a Green Contribution?

2. Corporate level

- **Sustainability as production factor**
- **Positive Impact on Yields, Tobin´s Q, Asset Turnover and risk measures**
- **CSR-strategy**

Ansari, Cajias, Bienert (2015): The Value contribution of Sustainability Reporting – an empirical evidence for real estate companies.

3. Property level

- **Sustainability is impacting rents, vacancies and values**
- **Green Building certificates**

Cajias, Fürst, Bienert (2016): Is energy efficiency priced in the German housing market? – Large sample evidence from Germany.

Intensive research with hedonic pricing (regression)

Increase of intensity and frequency of Extreme Weather Events

Direct and indirect costs of negative long-term changes in the climate system:

Impact of “creeping” climate changes like sea level rise or increased extreme weather events (drought, heat, bushfires, flood, storms…) on real estate markets

- ***Bienert (2014):*** *Extreme Weather Events and Property Values. Assessing New Investment Frameworks for the Decades Ahead.*
- ***Hirsch, Braun, Bienert (2015):*** *Assessment of Climatic Risks for Real Estate.*
- ***Bienert (2016):*** *Climate change implications for real estate portfolio allocation*

Limited Real estate research

Stranded assets and portfolios

- **Assets not meeting future regulatory requirements and future market expectations - loss of value + costs for retrofitting**
- **Not or insufficiently decarbonized real estate**
- **Real estate with high use costs and significant carbon footprint due to high energy use from non-renewable sources**

CRREM

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

Project title: **CRREM: Carbon Risk Real Estate Monitor - Framework for science based decarbonisation pathways, toolkit to identify stranded assets and push sustainable investments**

Duration: **February 2018 – January 2021**

Funding: **EU H2020 framework programme**

General objectives:

- Downscaling & transparency: Breaking down global GHG emissions budget by sector, company and property level for more transparency and capacity building
- Strategic implication of "Stranded assets": Defining areas for improvement and strategic options
- Framework, toolkits & methods: Making decarbonisation in the commercial real estate sector measurable

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

Partnership:

IIÖ Institut für Immobilienökonomie
Coordinator | Austria

TiasNimbas Business School
Tilburg University | Netherlands

University of Ulster| UK

University of Alicante | Spain

GRESB

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

European Investor Committee: Industry bodies and academics

CDP Alberto Carrillo Pineda *(Director Science Based Targets and Renewable Energy)*	***INREV*** Mathieu Elshout *(Investor Advisory Council)*
DGBC Dutch Green Building Martin Mooij *(Head of Certification and Project manager DGBC Deltaplan sustainable renovation)*	***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)*
EPRA European Public Real Estate Association Gloria Duci *(ESG Officer)*	***WGBC World Green Building Council*** Stephen Richardson *(Technical Lead - Energy Efficiency Mortgages)*
ZIA German Property Federation Philipp Matzke *(Consultant Energy and Climate Protection, Facilities Engineering)*	

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

European Investor Committee: Institutional investors & corporate partners

Aberdeen Standard Ruairi Revell *(ESG Manager, Real Estate)*	***ista International*** Hans Martin Hermann *(Senior Manager Public Affairs)*
alstria Alexander Dexne *(CFO)* Robert Kitel *(Head of Sustainability & Future Research)*	***Land Securities*** Tom Byrne *(Sustainability Manager)*
APG Asset Management Derk Welling *(Senior Responsible Investment & Governance Specialist)*	***Metro AG*** Olaf Schulze *(Director Facility, Energy & Resource Management)*
BNP Paribas Real Estate Consult Hermann Horster *(Regional Director, Head of Sustainability)*	***Nelson Group*** Carlos Morgado *(Project Manager)*
Credit Suisse Asset Management Roger Baumann *(COO & Head of Sustainability Global Real Estate)*	***PGGM*** Mathieu Elshout *(Senior Director Private Real Estate)*
ECE Projektmanagement Maria Hill *(Director Sustainability & Internal Services)*	***RE-sponsibility*** Michael Ullmann *(Managing Director)*
Grosvenor Emily Hamilton *(Sustainability Manager)*	***Savills Investment Management*** Lucy Auden *(Head of ESG)* Gerhard Lehner *(Managing Director, Head of Fund Management)*
Union Investment Jan von Mallinckrodt *(Head of Sustainability, Head of Segment Development)*	

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

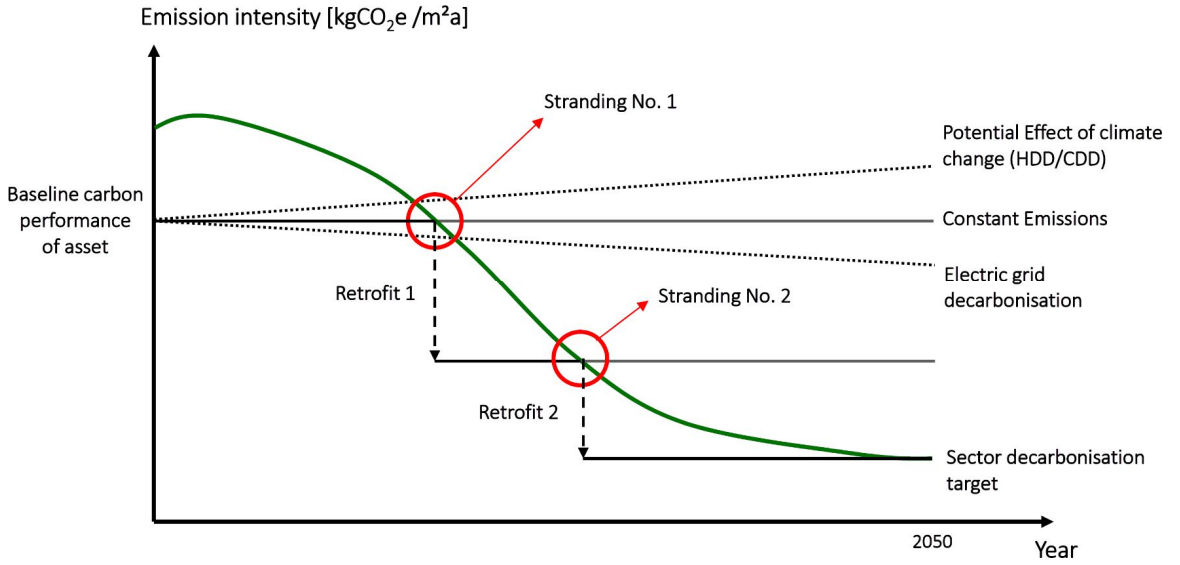
Concept ‚Stranded Asset‘

Key indicator: GHG intensity of building (Emissions per floor area [$kgCO_2e/m^2/a$])

Country and sector-specific target path

Consideration of effects of changing heating and cooling loads and electric grid decarbonisation

Stranding assets do not meet decarbonisation targets and face potential write-downs



Source: CRREM

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

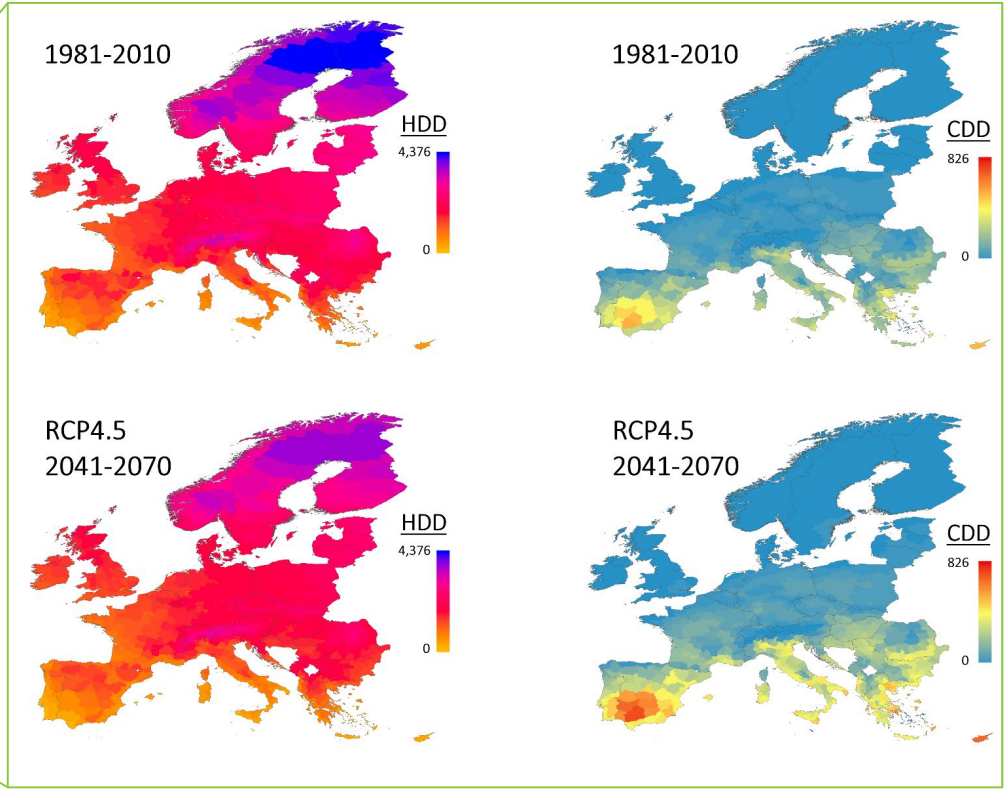
Concept ‚Stranded Asset'

Key indicator: GHG intensity of building (Emissions per floor area [$kgCO_2e/m^2/a$])

Country and sector-specific target path

Consideration of effects of changing heating and cooling loads and electric grid decarbonisation

Stranding assets do not meet decarbonisation targets and face potential write-downs



Source: Spinoni et al. (2018), own calculation and presentation.

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

Carbon Accounting and reporting

CRREM alignment to GHG Protocol:
Standards for assessment, accounting and reporting of GHG emissions (W*orld Resources Institute WRI & World Business Council for Sustainable Development WBCSD*)

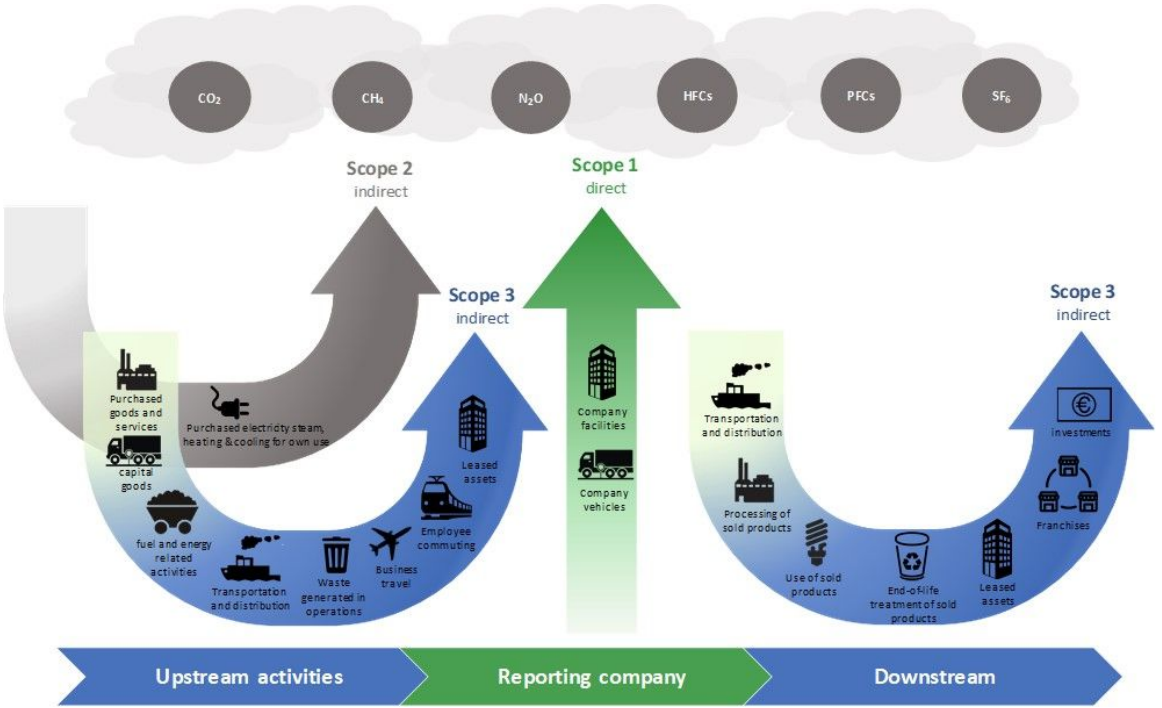
Accounting: Engery consumption (fuels, electricity), conversion to GHG with emissions factors. Challenge: lack of tenant data (esp. electricity consumption)

Reporting: Emission scopes 1, 2, 3

S1: Direct emissions from burning fuels or leakages

S2: Indirect emissions from energy consumption

S3: Indirect emissions from upstream and downstream processes



Source: GHG Protocol, 2013.

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

CRREM tool

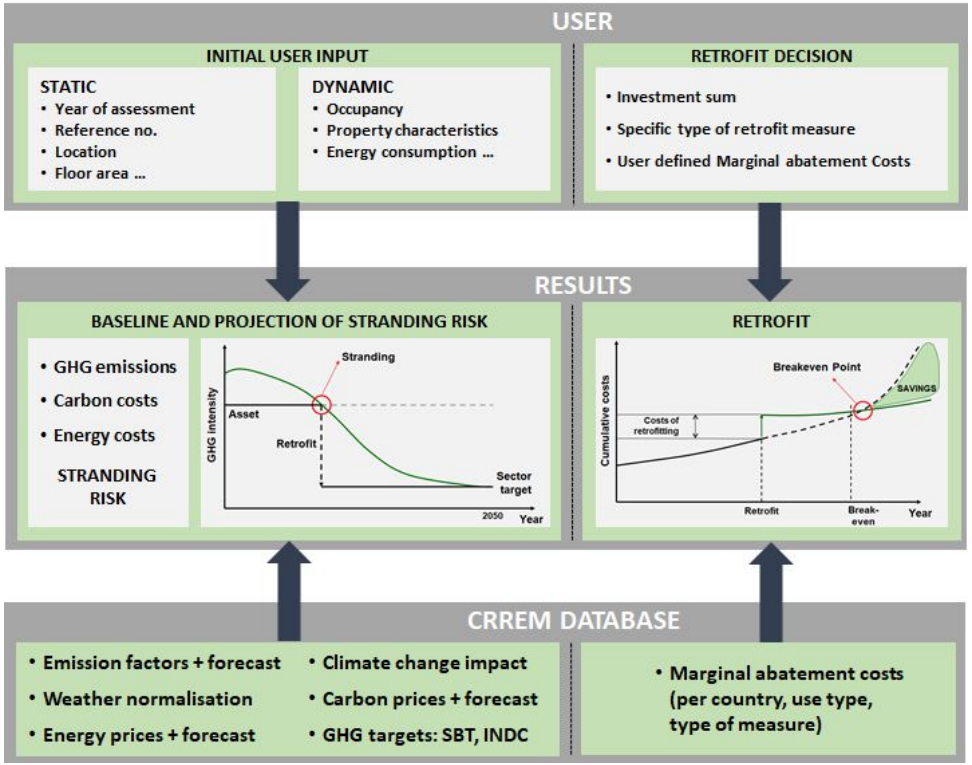
Database: GHG reduction targets, emission factors, weather normalisation, energy prices, carbon price, HDD/CDD, abatement costs, grid decarbonisation…

User input:

Property characteristics: Location, year of construction, energetic characteristics, occupancy, energy consumption

User assumptions: Discounting, carbon price, energy prices, abatement costs, own…

Result: ‚Stranding Diagramm', Stranding Risk, costs of retrofits necessary to meet targets, carbon costs…



Source: CRREM

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

IIÖ
INSTITUT FÜR
IMMOBILIENÖKONOMIE

CRREM Tool: 1) Asset level input

1. Input — Modify

CRREM-Tool v0.31 - 07.05.2019

Funded by the Horizon 2020 programme of the European Union

User-type:	Investor

	ID (internal unique identifier)	Asset name	Fund	Country	Location method (NUTS or ZIP code)	ZIP Code	NUTS-1	NUTS-2	NUTS-3	City	Address	Assessment year of reported consumption values	Type of use	Year of construction	Floor area [m²]	Whole Building [m²]	Landlord areas [m²]	Common areas [m²]	Tenant areas [m²]	Occupancy	Occupancy of whole building [%]	Occupied landlord area [%]	Occupied common area [%]	Occupied tenant area [%]	Normalize consumption data to 100% occupancy rate [yes/no]	Length of reporting period [months]	Normalize heating and cooling consumption to weather in year of consumption (yes/no)	Gas consumption [kWh]	Shared services	Common areas
Asset 1	1	Steinbach Tower	1	Austria	ZIP	6300				Wörgl	Josef-Steinbacher-Straße 1	2018	Office	2010	Individual parts		200	1,000	20,000			100%	100%	90%	Yes	12	Yes	130,200	10,000	20
Asset 2	2	Linden Paleis	2	Netherlands	NUTS		WEST-NEDERLAND	Noord-Holland	Groot-Amsterdam	Amsterdam	Rigakade 89	2018	Retail, Shopping Center	2012	Whole building	40,000					95%				Yes	12	Yes	180,150	20,000	20
Asset 3	3	Smalle Kanaal	2	Netherlands	NUTS		WEST-NEDERLAND	Noord-Holland	Groot-Amsterdam	Amsterdam	Rigakade 89	2018	Retail, Shopping Center	2012	Whole building	40,000					95%				Yes	12	Yes	180,150	20,000	20

2. Results — Scenario

3. Mitigate — Act

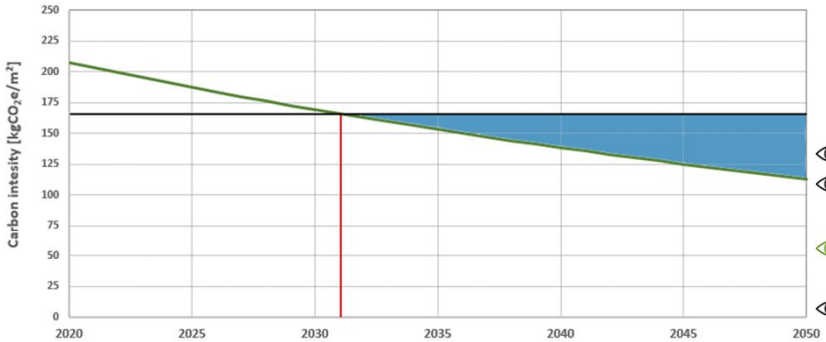
Source: CRREM

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

CRREM Tool: 2) Results – Carbon performance and targets on asset and portfolio level

1. Input — Modify

2. Results — Scenario



Main Results:

Stranding in year: 2031
Years until stranding: 12
Baseline emissions ⊕
Budget 2019 – 2050: 6,000 tCO_2e
Emissions 2019 – 2050: 5,000 tCO_2e (!)
Carbon Costs: xxx €
Excess emissions after stranding: 500 tCO_2e
Carbon Costs: xxx €
Surplus emissions before standing: 1,500 tCO_2e
Emission scope allocation ⊖
Scope 1 emissions: xxx ⊕
Scope 1 emission intensity: xxx ⊕
Scope 2 emissions: xxx ⊕
Scope 2 emission intensity: xxx ⊕
Scope 3 emissions: xxx ⊕

3. Mitigate — Act

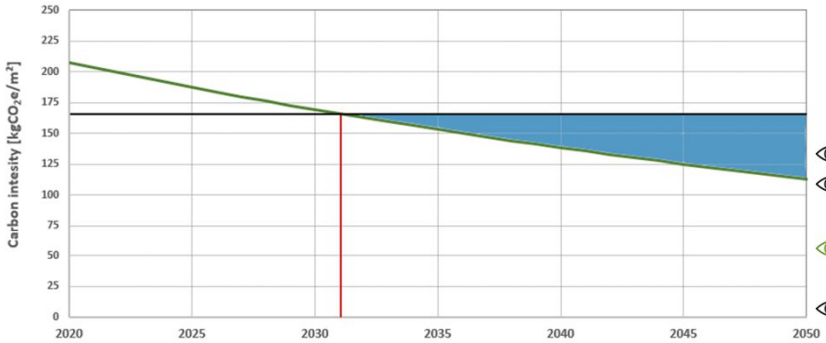
Source: CRREM

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

CRREM Tool: 2) Results - Define scenarios and evaluate their impact

1. Input — Modify

2. Results — Scenario



Main Results:
Stranding in year: 2031
Years until stranding: 12
Baseline emissions ⊕
Budget 2019 – 2050: 6,000 tCO_2e
Emissions 2019 – 2050: 5,000 tCO_2e (!)
Carbon Costs: xxx €
Excess emissions after stranding: 500 tCO_2e
Carbon Costs: xxx €
Surplus emissions before standing: 1,500 tCO_2e
Emission scope allocation ⊖
Scope 1 emissions: xxx ⊕
Scope 1 emission intensity: xxx ⊕
Scope 2 emissions: xxx ⊕
Scope 2 emission intensity: xxx ⊕
Scope 3 emissions: xxx ⊕

Define Scenarios:
Scenario 1: ⊖
Climate change effect: Yes ⊙ No ○
Climate change scenario: RCP4.5 ○ RCP8.5 ⊙
Carbon prices : Default ⊙ Edited ○
Target: 1.5°C ⊙ 2°C ○ NDC ○

Energy prices: Default ⊙ Edited ○
Grid decarbonisation: Default ⊙ Edited ○
Emissions factors: Default ⊙ Edited ○

Add Scenario

3. Mitigate — Act

Source: CRREM

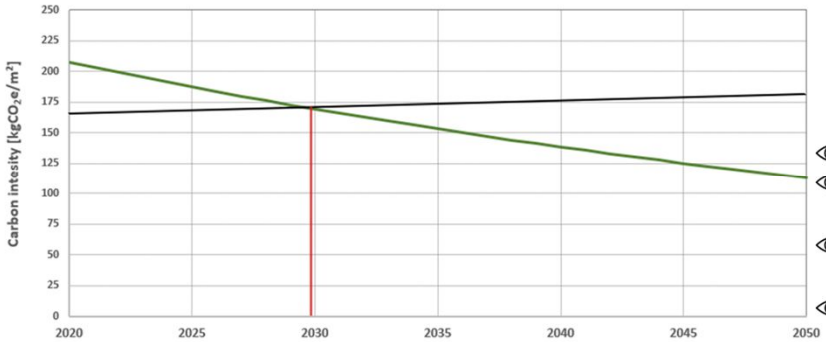
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 785058

CRREM Tool: 2) Results - Compare your assets

1. Input — Modify

2. Results — Asset | Portfolio — Scenario

Asset: *1 ('Example 1')* ⊙ *2 ('Fitzpatrick')* ○ *3 ('St. Patrick')* ○ *4 ('McDonnel')* ○



Main Results:
Stranding in year: 2030
Years until stranding: 11
Baseline emissions ⊕
Budget 2019 – 2050: 6,000 tCO_2e
Emissions 2019 – 2050: 5,500 tCO_2e (!)
Carbon Costs: xxx €
Excess emissions after stranding: 750 tCO_2e
Carbon Costs: xxx €
Surplus emissions before standing: 1,250 tCO_2e
Emission scope allocation ⊕

Define Scenarios:
Scenario 1: ⊕
Add Scenario

3. Mitigate — Act

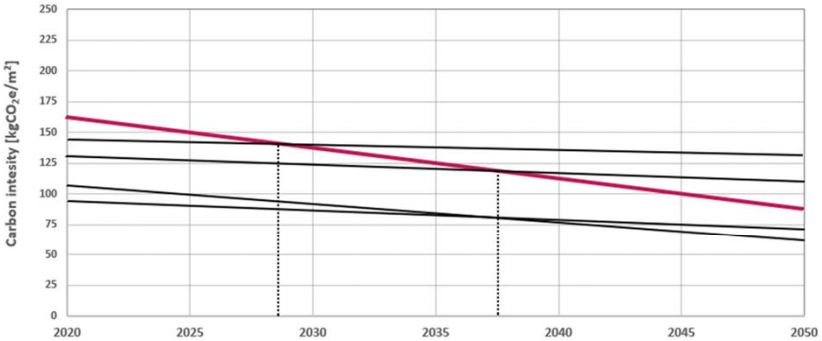
Source: CRREM

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

CRREM Tool: 2) Results - Portfolio overview

1. Input — Modify

2. Results — Asset — **Portfolio** — Scenario



Office

All ☐ 1 ☐ 2 ☐ 3 ☐

Average ☐

Shopping Centre

All ☒ 1 ☒ 2 ☒ 3 ☒ ☒

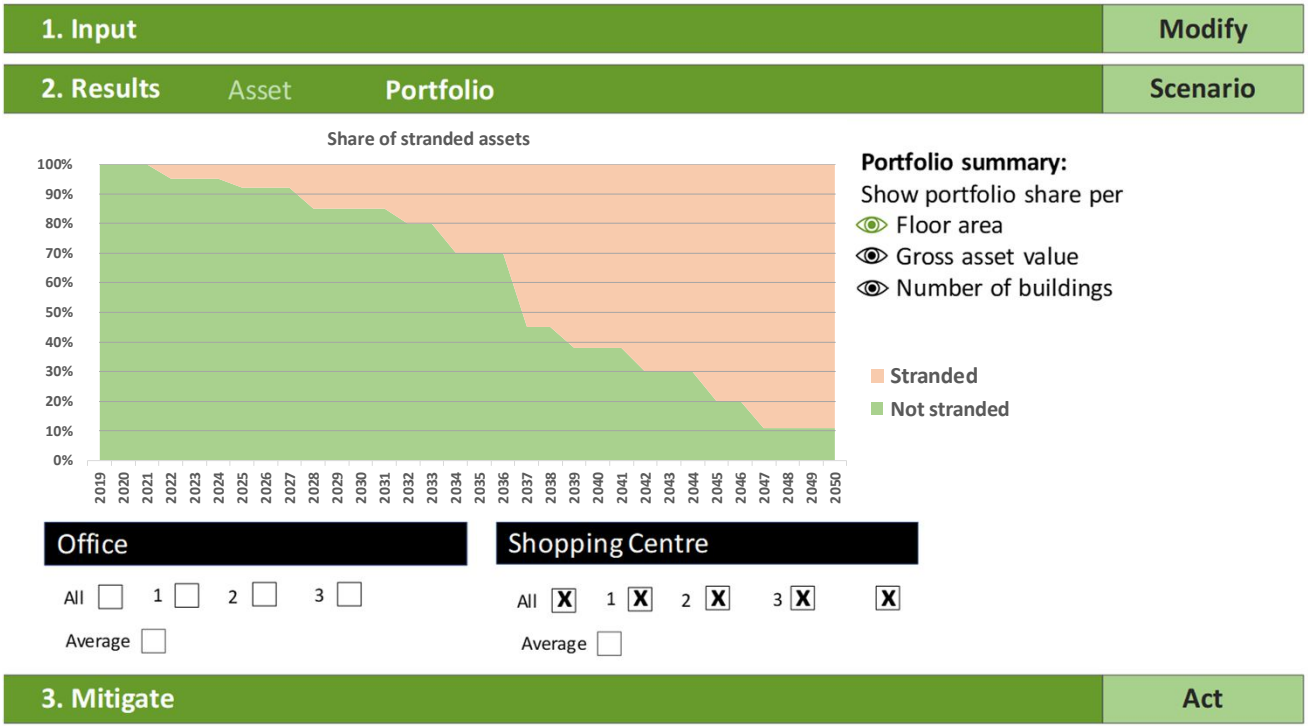
Average ☐

3. Mitigate — Act

Source: CRREM

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

CRREM Tool: 2) Results - Portfolio overview



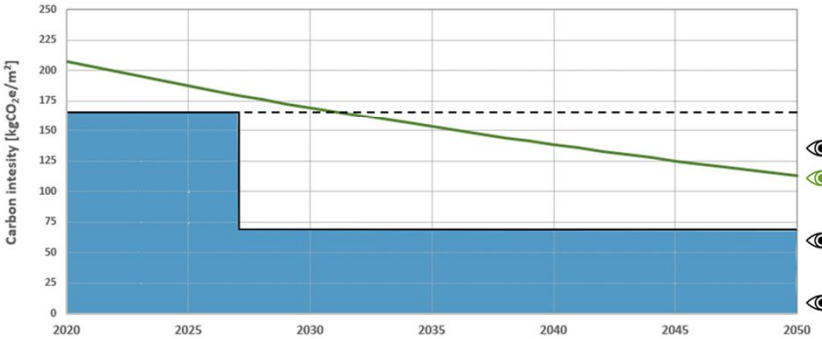
Source: CRREM

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

CRREM Tool: 3) Mitigation measures

1. Input		Modify
2. Results	Asset Portfolio	Scenario
3. Mitigate		Act

Asset: *1 ('Example 1')* ⊙ *2 ('Fitzpatrick')* ○ *3 ('St. Patrick')* ○ *4 ('McDonnel')* ○



Main Results:
Stranding in year: no stranding
Years until stranding: -
Baseline emissions ⊕
Budget 2019 – 2050: 6,000 tCO_2e
Emissions 2019 – 2050: 2,000 tCO_2e (!)
Carbon Costs: xxx €
Excess emissions after stranding: 0 tCO_2e
Carbon Costs: xxx €
Surplus emissions before standing: 3,500 tCO_2e
Emission scope allocation ⊕

Define measure:
Measure 1: ⊖
Year: 2027 Type: Cost GHG-Savings:

Add measure

Source: CRREM

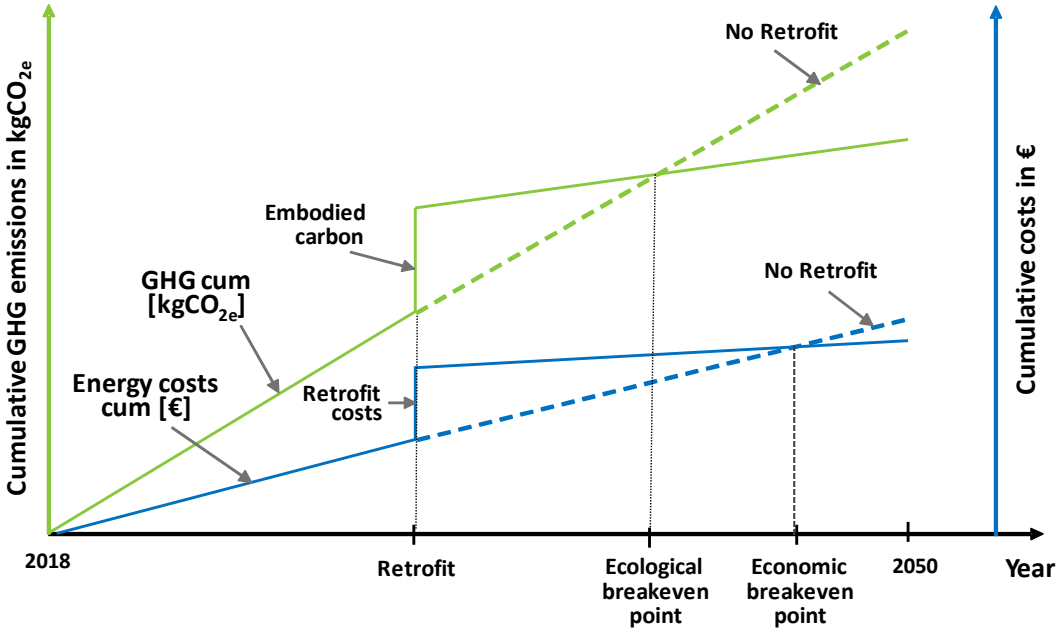
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 785058

Assessment of energetic retrofit measures

Economical: Annual energy cost savings vs. Investment costs: Assessment of net present value of energetic retrofit measure

Ecological: Annual GHG emission savings vs. embodied carbon → Supplementing the economic break-even point with an ecological one

Embodied carbon of retrofit measures is not included in corporate reporting so far



Source: CRREM

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

Derivation of country and sector-specific GHG reduction targets

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

↓

EU emission pathway (convergence of per capita emissions until 2050)

↓

EU commercial real estate (CRE) sector

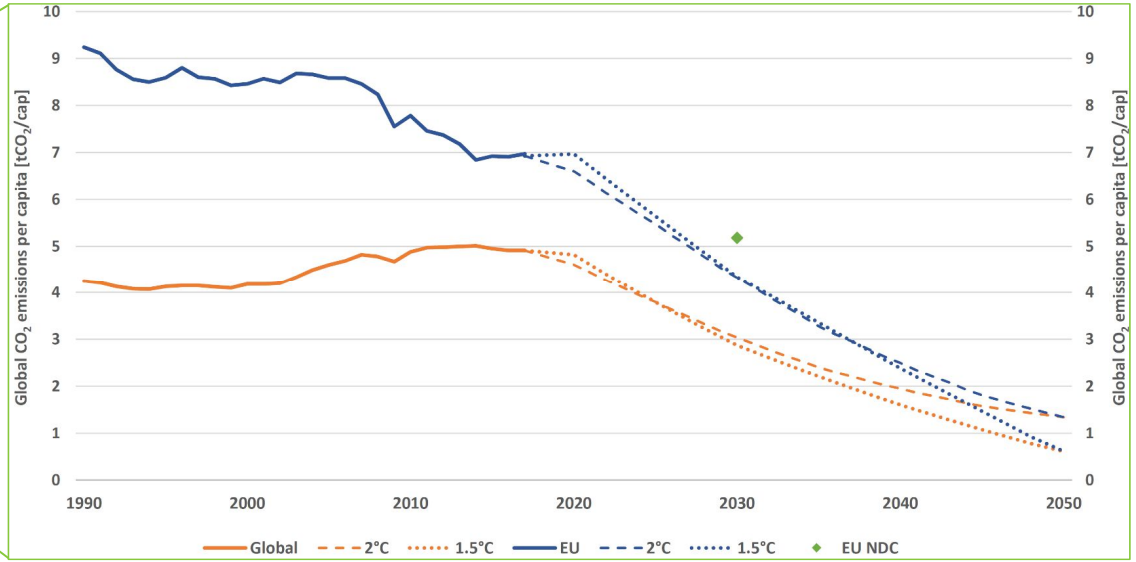
↓

Country-specific targets (convergence of GHG intensity)

↓

Sector-specific targets for each country: Intrinsic differences of GHG intensity in CRE subsectors (office, retail etc.)

Interim downscaling step: EU emission pathway



Source: Own calculations; IEA, 2017; Rockström et al.; 2017; UN DESA, 2017; PBL, 2018

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

Derivation of country and sector-specific GHG reduction targets

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

↓

EU emission pathway (convergence of per capita emissions until 2050)

↓

EU commercial real estate (CRE) sector

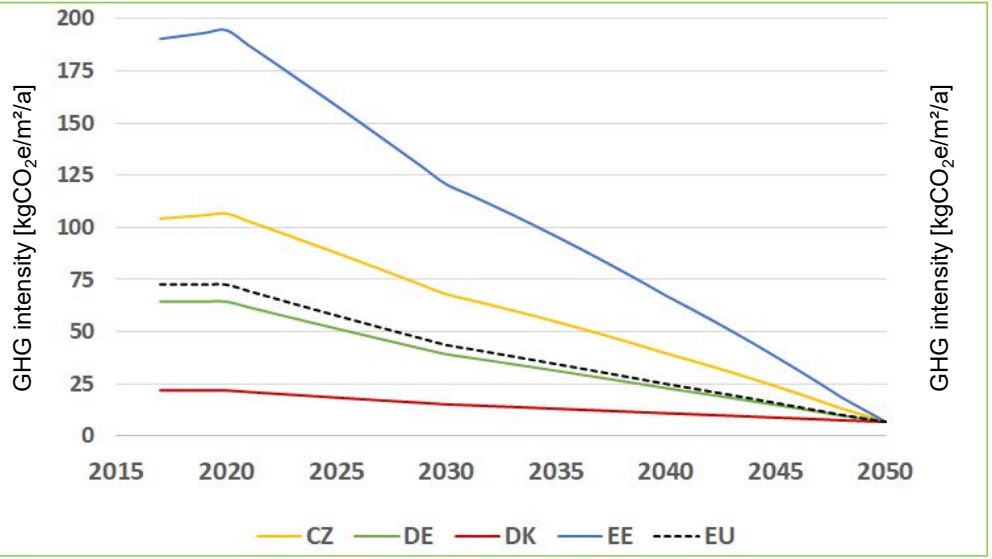
↓

Country-specific targets (convergence of GHG intensity)

↓

Sector-specific targets for each country: Intrinsic differences of GHG intensity in CRE subsectors (office, retail etc.)

Interim downscaling step: Country-specific GHG intensity targets (1.5°C target)



Source: Own calculations; IEA, 2017; Rockström et al.; 2017; UN DESA, 2017; PBL, 2018

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

Derivation of country and sector-specific GHG reduction targets

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

↓

EU emission pathway (convergence of per capita emissions until 2050)

↓

EU commercial real estate (CRE) sector

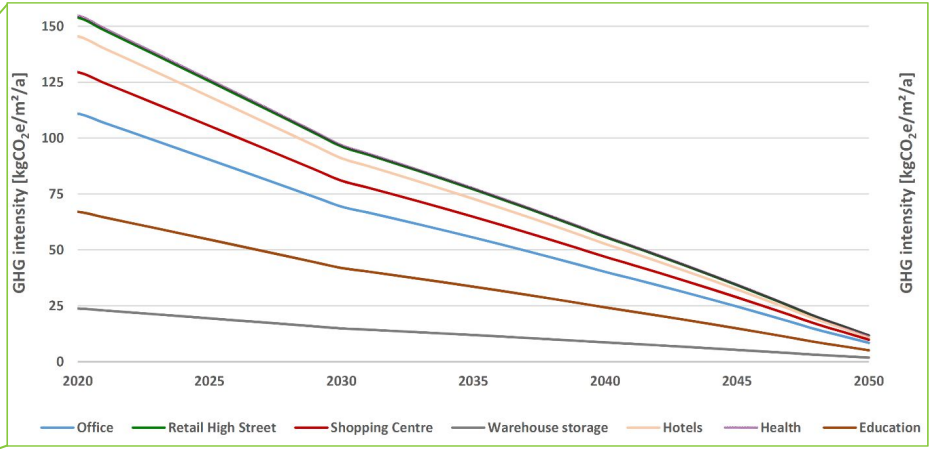
↓

Country-specific targets (convergence of GHG intensity)

↓

Sector-specific targets for each country: Intrinsic differences of GHG intensity in CRE subsectors (office, retail etc.)

Sector-specific GHG intensity targets: Germany (1.5°C target)



GRESB

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

ESD – ‚Effort Sharing Desicion‘

Objective: Compliance with EU-INDC

Non-ETS sectors: Agriculture, Buildings, Transport, (non-ETS)Industry, Waste

Only direct emissions (= Scope 1): Derivation of Scope 2 reduction targets from ETS-targets

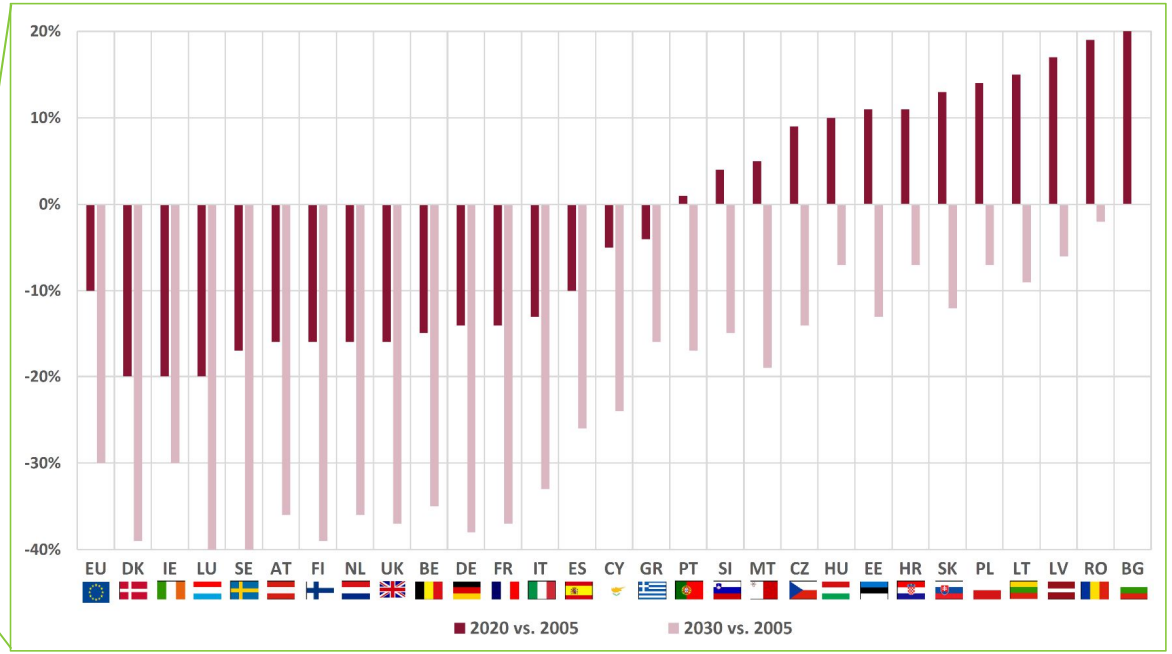
EU-wide GHG reduction targets:

- -10% until 2020 vs. 2005
- -30% until 2030 vs. 2005

Country-specific GHG reduction targets (GDP → capacity to investment in abatement measures)

CRREM: GHG intensity targets on property level based on ESD-targets

EU and country level ESD GHG emission reduction targets



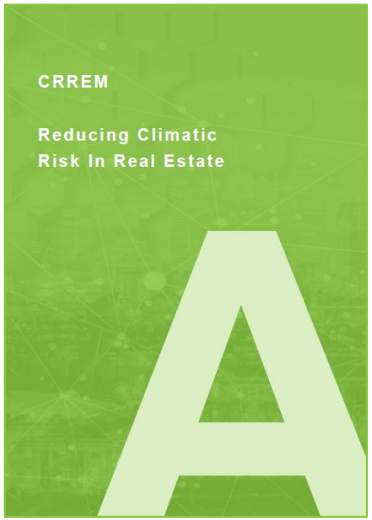
Source: European commission; own presentation

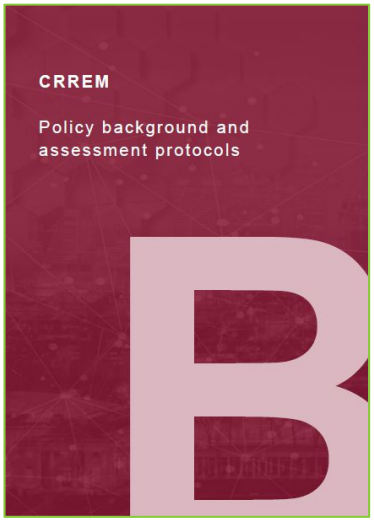
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 785058

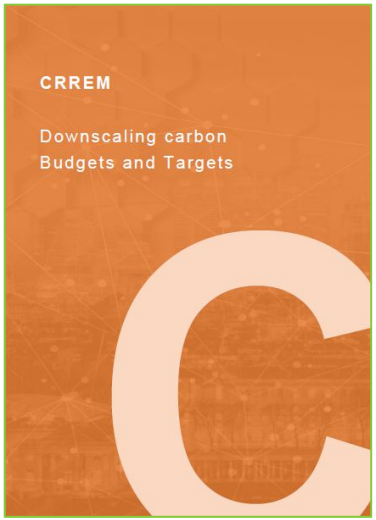
Study:

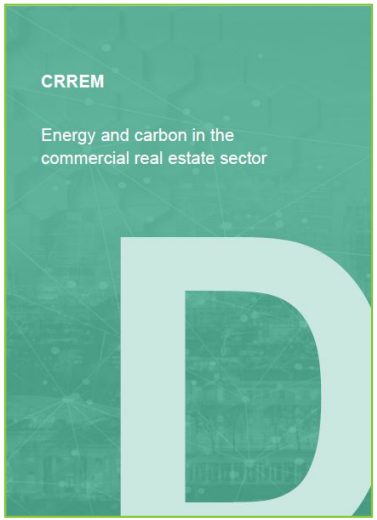
STRANDING RISKS & CARBON

Science-based decarbonising of the EU commercial real estate sector

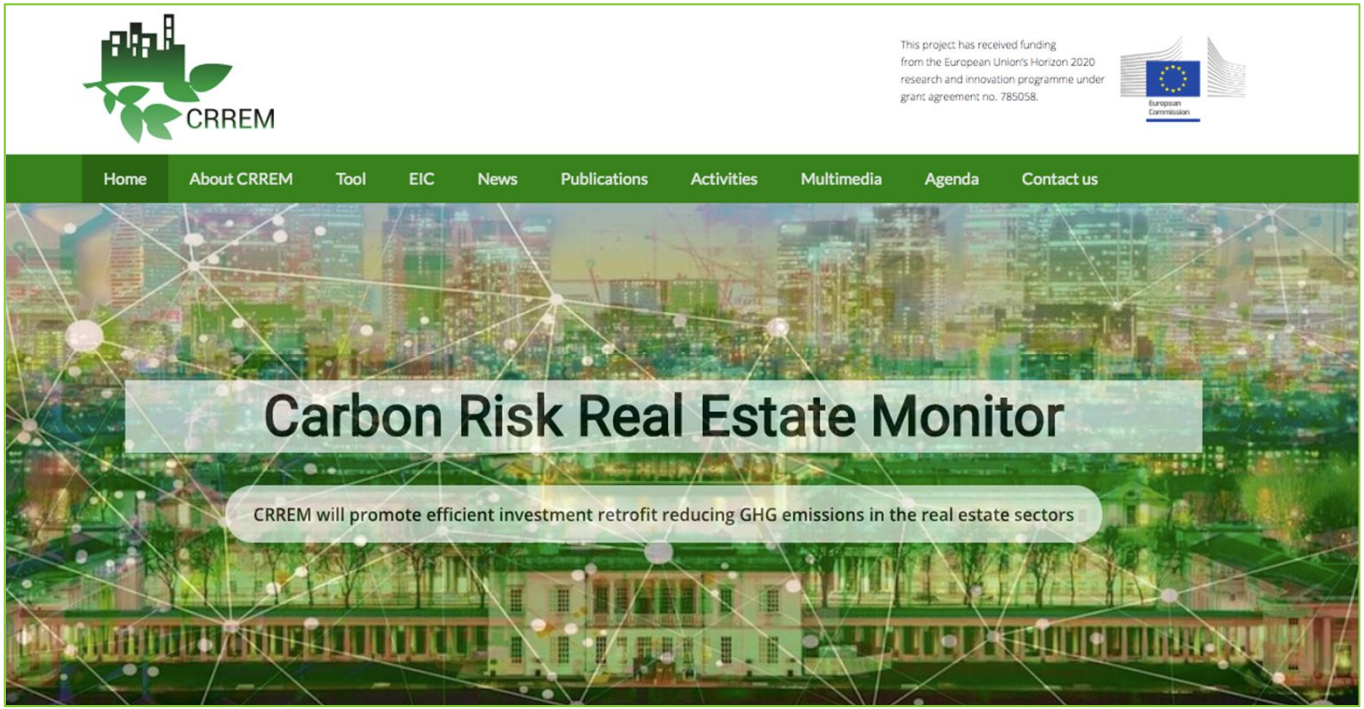








CRREM Project homepage: www.crrem.eu



Contact:

Dr. Jens Hirsch
jens.hirsch@iioe.at
+43 (5332) 239 26

Institut für Immobilienökonomie
Josef-Steinbacher-Strasse 1
A-6300 Wörgl

CRREM

IIÖ
INSTITUT FÜR
IMMOBILIENÖKONOMIE

European Commission

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